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RCRA Facility Investigation Phase I Environmental Monitoring Reports Solid Waste Management Units #15/06, #14/00, and #16/16 Naval Surface Warfare Center, Crane Division

Crane, IN

Northern Division Naval Facilities Engineering Command

Contract No. N62472–90–D–1298
Contract Task Order 0015

November 1992

HALLIBURTON NUS
Environmental Corporation

SEC DONOHUE
Environment & Infrastructure

November 23, 1992
DNSB/92-0015

Ms. Adrienne Wilson
Department of the Navy
Southern Division, Naval Facilities Engineering Command
2155 Eagle Drive, Code 186ND
Charleston, SC 29411-0068

Re: Contract No. N62472-90-D-1298 "CLEAN"
Final Phase I Environmental Monitoring Report
CTO #0015, Naval Weapons Support Center, Crane, Indiana
SEC Donohue Project No. 20602

Dear Ms. Wilson:

Enclosed for your review are four copies of the Final RCRA Facility Investigation Phase I Environmental Monitoring Report for Solid Waste Management Units #14/00, #15/06, and #16/16 for Naval Surface Warfare Center, Crane Division, Indiana. Copies of this document have been distributed to all other Technical Review Committee members according to the enclosed Distribution List.

Sincerely,

Jeffrey D. Maletzke
Project Manager

enc: As Noted

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RCRA FACILITY INVESTIGATION PHASE I
ENVIRONMENTAL MONITORING REPORTS
SOLID WASTE MANAGEMENT UNITS
#15/06, #14/00, AND #16/16
NAVAL SURFACE WARFARE CENTER, CRANE DIVISION
CRANE, INDIANA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

Submitted to:
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Contract Task Order No. 0015

NOVEMBER 1992

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PREFACE

This preface is to inform the reader of a name change which occurred at the Naval Weapons Support Center Crane (NWSCC) during the preparation of this report. SEC Donohue was notified of the name change in late January 1992. The new name for the Facility is Naval Surface Warfare Center, Crane Division (NAVSURFWARCENDIV).

To eliminate potential errors involving the referencing of sources and to maintain clarity in the report, the former facility title of NWSCC has been retained in the report text. The facility name on the cover of this report, however, has been changed to NAVSURFWARCENDIV to acknowledge that the name change has occurred.

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RP/15EMRF/AE3

LIST OF ACRONYMS/ABBREVIATIONS

ALPEC	Ammunition Loading and Production Engineering Center
APE	Ammunition Peculiar Equipment
CAAA	Crane Army Ammunition Activity
CASCO	Central Ammunition Supply Control Office
CEC	Caution Exchange Capacity
CSF	Central Storage Facility
CLEAN	Comprehensive Long-Term Environmental Action Navy
CMS	Corrective Measures Study
CTO	Contract Task Order
EMR	Environmental Monitoring Report
HMTC	Hazardous Material Technical Center
HMX	Cyclotetramethylene Tetranitramine
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
IDEM	Indiana Department of Environmental Management
IRP	Installation Restoration Program
ISBH	Indiana State Bureau of Health
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
NACIP	Navy Assessment and Control of Installation Pollutants
NAD	Naval Ammunition Depot
NAVFAC	Navy Facilities Engineering Command
NEESA	Naval Energy and Environmental Support Activity
NORTHDIV	Naval Facilities Engineering Command Northern Division
NPDES	National Pollutant Discharge Elimination System
NWSCC	Naval Weapons Support Center, Crane
PAH	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylene Trinitramine = Hexahydro-1,3,5-trinitro-1,3, 5-triazine
RFI	RCRA Facility Investigation
SCS	Soil Conservation Service

LIST OF ACRONYMS/ABBREVIATIONS (Continued)

SMCL	Secondary Maximum Contaminant Level
SWMU	Solid Waste Management Unit
TNT	2,4,6-Trinitrotoluene
TRPH	Total Recoverable Petroleum Hydrocarbons
TSD	Treatment, Storage, or Disposal
USACE	United States Army Corps of Engineers
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
WWII	World War II

RP/15EMRF/AE3

EXECUTIVE SUMMARY

This Environmental Monitoring Report (EMR) was completed as part of the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) being conducted for Solid Waste Management Units (SWMUs) #15/06, #14/00, and #16/16 at the Naval Weapons Support Center, Crane Indiana, (NWSCC). This EMR is submitted to the Northern Division, Naval Facilities Engineering Command (NAVFAC) in response to Contract Task Order (CTO) No. 0015 under Comprehensive Long-Term Environmental Action Navy (CLEAN) Prime Contract No. N62472-90-D-1298 and Subcontract No. GCPP-91-001-1298.

NWSCC is located in southwestern Indiana and provides naval support for equipment, shipboard weapons systems, and ordnance. In addition, NWSCC supports the Crane Army Ammunition Activity (CAAA), including production and renovation of conventional ammunition, storage, shipment, and demilitarization and disposal of conventional ammunition. Promulgation of the United States Environmental Protection Agency's (USEPA) Resource Conservation and Recovery Act (RCRA) hazardous waste regulatory program provided the impetus to identify and control environmental contamination from past practices at NWSCC. Corrective actions programs established as part of the RCRA Hazardous and Solid Waste Amendments (HWSA) required NWSCC to address past releases of hazardous waste or hazardous constituents at SWMUs. In order to identify and assess SWMUs posing potential threat to human health or the environment, this EMR has been prepared to address three designated SWMUs including the Roads and Grounds Area (SWMU #15/06), Sanitary Landfill and Lithium Battery (SWMU #14/00), and Cast High Explosive Fill/Incinerator Building 146 (SWMU #16/16).

At the Roads and Grounds Area past operations have included asphalt production at a former batch plant, steam generation at a boiler house, waste oil storage in an aboveground storage tank, pesticide container and applicator washout at a washrack, and materials storage at four different buildings. In addition, a ravine along the SWMU perimeter has been used for indiscriminate dumping. Navy records indicate construction of the boiler house and storage buildings as 1956 and 1953, respectively. An operations startup date for the former asphalt batch plant is unknown; however, its demolition is recorded as 1979. Potential contaminants associated with operational practices at the Roads and Grounds Area include waste oils, fuel oil, gasoline, asphalt, and pesticide and herbicide residues. Based on waste characteristics, operational practices, and locational characteristics, there is potential for release to groundwater. Direct visual observations, including stained soils, accumulations of asphalt materials, and oily sheens on surface water suggest that releases to soil and surface water have occurred.

The Sanitary Landfill consists of approximately 65 acres which utilized trench and fill methods for disposal of paper, wood, metal, and putrescible materials beginning in 1972. In addition, certain portions of the trench and fill area were designated as "hot beds" necessitating materials isolation from burnable refuse because they were subject to spontaneous combustion. Other portions of the landfill have been used for lithium and thermal battery disposal. The Sanitary Landfill has also received a wide variety of special wastes consisting primarily of asbestos materials. Potential releases to groundwater, soil, and subsurface gas are likely to have occurred. Potential releases to these media primarily reflect trench and fill operational practices which resulted in waste emplacement at or below the water table, within or directly above fractured bedrock, coupled with a lack of engineered controls to prevent contaminant migration. Reported overflow of leachate ponds, as well as analytical records, indicate that releases to surface water have occurred.

Building 146 was constructed in 1943 and was the site of melt-pouring of TNT, RDX, and HBX explosives into projectiles (cast loading). In addition, demilitarization operations at Building 146 included high pressure water washout of 5-inch projectiles filled with Composition A, steamout of Army ammunition and rockets containing TNT and Composition B, and incineration of small-arms ammunition. A startup date for incineration is not known; however, Navy drawings for the first incinerator at Building 146 are dated 1960. The incinerators were disassembled in 1987. Explosives residuals, contaminated wastewaters, and incinerator ash and residues serve as potential contaminants. Based on operational history, locational characteristics, waste characteristics, and visual evidence indicative of possible contaminant leaching from soil, potential releases to groundwater are likely. Releases to surface water and soil have occurred as evidenced by visual observations and analytical data. Operational practices, as well as unit design, have contributed to contaminant releases to surface water and soil.

Potential releases to environmental media have been identified. These releases pose a potential threat to environmental and human receptors and indicate the need for continuing RCRA Facility Investigation (RFI) Corrective Actions at each of the three SWMUs. At the Roads and Grounds Area (SWMU #15/06), RFI Phase II Release Assessments are recommended for groundwater, surface water, and soil. At the Sanitary Landfill and Lithium Battery (SWMU #14/00), RFI Phase II Release Assessments are recommended for groundwater, surface water, soil, and subsurface gas. At Building 146 (SWMU #16/16), RFI Phase II Release Assessments are recommended for groundwater, surface water, and soil.

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

This Environmental Monitoring Report (EMR) was completed as part of the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) being conducted for Solid Waste Management Units (SWMUs) #15/06, #14/00, and #16/16 at the Naval Weapons Support Center, Crane Indiana, (NWSCC). This EMR is submitted to the Northern Division, Naval Facilities Engineering Command (NAVFAC) in response to Contract Task Order (CTO) No. 0015 under Comprehensive Long-Term Environmental Action Navy (CLEAN) Prime Contract No. N62472-90-D-1298 and Subcontract No. GCPP-91-001-1298.

The purpose of this report is to identify and assess Installation Restoration Program (IRP) Corrective Action SWMUs posing potential threat to human health or the environment due to contamination from past hazardous material operations. In response to CTO #0015, this EMR addresses the following SWMUs at NWSCC:

- SWMU #15/06: Roads and Grounds Area
- SWMU #14/00: Sanitary Landfill and Lithium Battery
- SWMU #16/16: Cast High Explosive Fill/Incinerator Building 146

To perform this work, Donohue acquired, reviewed, and evaluated background data relevant to the NWSCC facility and to the designated SWMUs. Donohue conducted site reconnaissance to identify the SWMUs, observe significant physical features, collect visual evidence of potential releases, assess conditions relevant to future sampling or remedial activities, record site features on maps, and assess the need for additional sampling visits.

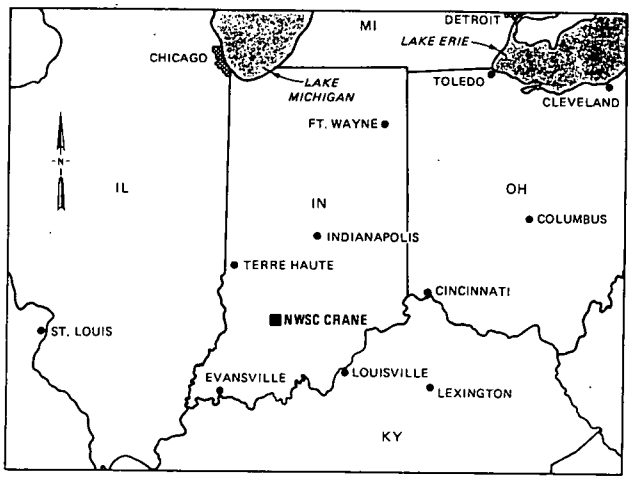
1.2 FACILITY BACKGROUND

1.2.1 Facility Location and Description

NWSCC is located in southwestern Indiana and occupies the northern half of Martin County (Figure 1-1). The site encompasses more than 100 square miles (62,463 acres) including 800-acre Lake Greenwood. NWSCC provides Naval support for equipment, shipboard weapons systems, and ordnance. In addition, NWSCC supports the CAAA including production and renovation of conventional ammunition, and storage, shipment, demilitarization, and disposal of conventional ammunition.

CLEAN CTO #0015

EPA ID NO. IN5 170 023 498
NAVSURFWARCENDIV EMR
NOVEMBER 1992



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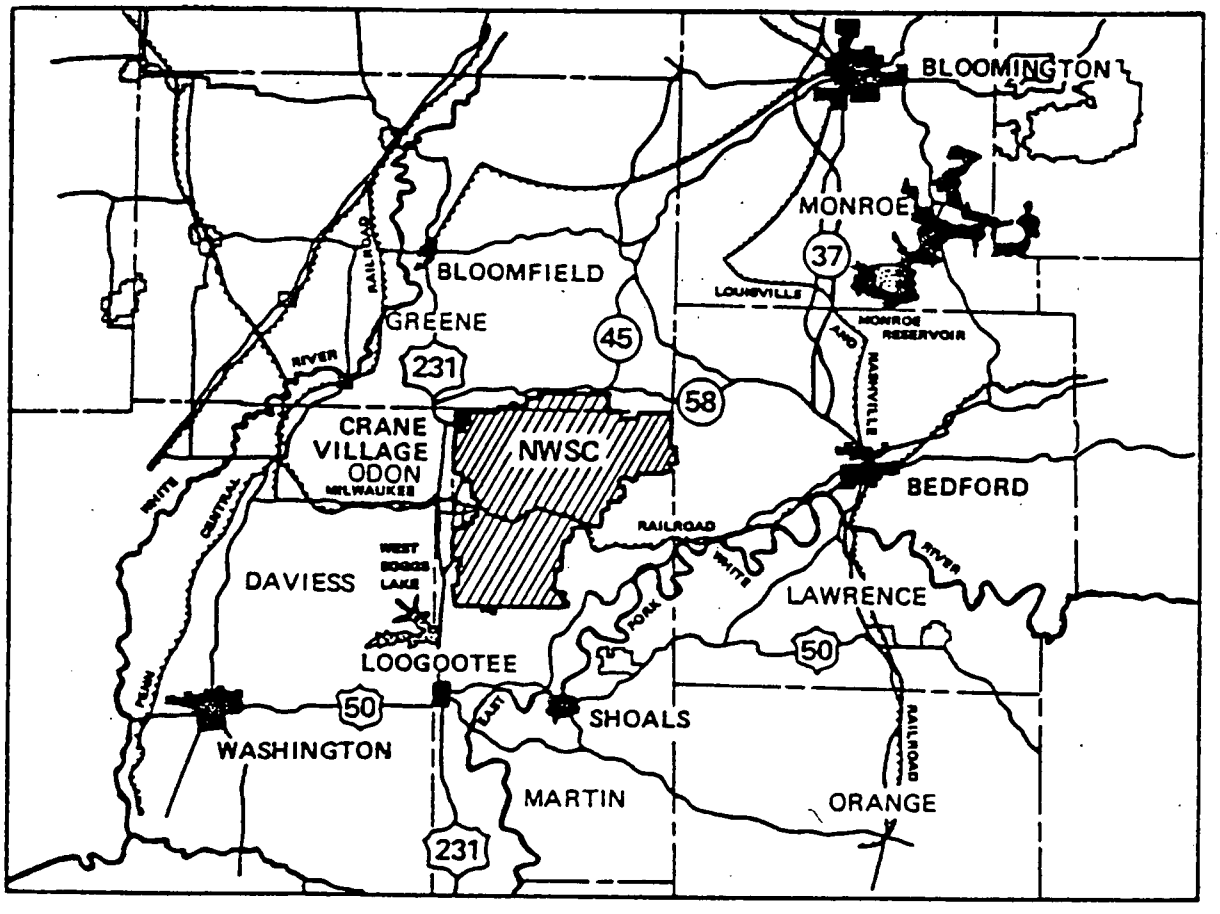

SOURCES: CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND, 1979 AND NAVAL ENERGY AND ENVIRONMENTAL SUPPORT AGENCY, 1983.

NOVEMBER 1992

FIGURE 1-1

GENERAL LOCATION MAP NWSCC

ENVIRONMENTAL MONITORING REPORT
NAVSURFWARCENDIV
CRANE, INDIANA

20602

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1.2.1.1 Legal Description

NWSCC occupies portions of Townships 4 North, 5 North, and 6 North and portions of Ranges 2 West, 3 West, and 4 West, Martin County, Indiana. Legal descriptions for each of the three SWMUs covered in this report are given in subsequent SWMU-specific sections.

1.2.1.2 Contiguous Property

The Department of the Navy formerly owned Crane Village which is located just outside the northwest corner of the facility. Crane Village was sold in 1984. Crane Village houses civil service employees.

1.2.2 Facility History and Activities

1.2.2.1 History of Ownership and Operation

In 1940, Congress authorized construction of a Naval Ammunition Depot (NAD) in southern Indiana, and in late 1941 the Burns City Ammunition Depot was commissioned. In 1943, NAD Burns City was renamed NAD Crane, and the Town of Crane was built to house the rapidly growing number of civil service employees. NAD Crane's overall mission was to load, prepare, renovate, receive, store, and issue ammunition to the fleet.

During World War II (WWII), NAD Crane's mission expanded to include pyrotechnics production, mine filling, rocket assembly, field storage, torpedo storage, and ordnance spare parts and mobile equipment storage. During the 1950s, several new departments were created, the Ammunition Loading and Production Engineering Center (ALPEC) was transferred to Crane, and the Central Ammunition Supply Control Office (CASCO) was established. NAD Crane supplied ammunition to the fleet during the Korean and Vietnam conflicts. During the Southeast Asia crisis, the number of full-time employees at NAD Crane grew to 6,800.

In 1976, NAD Crane was designated NWSCC. Its new mission was to provide support for ships and crafts equipment, shipboard weapons systems and assigned ordnance items, and to perform additional functions as directed.

In 1977, the Single Manager Concept was implemented. The CAAA was created, and the Army assumed ordnance production, storage, and related responsibilities as a tenant organization. Other functions remained Navy, and currently the Navy retains ownership of all real estate and facilities at NWSCC. Responsibility for overall station safety, security, and environmental protection remains with the Commanding Officer, NWSCC.

Until the late 1970s and early 1980s, a variety of liquid wastes from both ordnance and non-ordnance activities were disposed on-site without treatment. For example, ordnance-contaminated wastewaters were discharged into unlined ponds or into storm drains and ditches; wastewaters generated from cleaning operations were discharged into an unlined pond; oily waters, battery acids, paint thinner, acetone, boiler blowdown, and solvents were dumped behind buildings or into ravines; and waste hydraulics oil was spread on dirt roads. Since that time, treatment plants have been built, wastewater streams have been connected to the sanitary sewer, and oils and solvents have been collected, segregated, and either recycled, sold, or properly disposed.

Air pollution control devices were not installed until the late 1970s. Therefore, ventilation systems at bomb loading facilities and the incinerator had no scrubber systems until the 1970s. Waste management activities included the burning of solid wastes and subsequent disposal of ash in unlined pits or gullies. Also, dye and dye-contaminated materials have been disposed in on-site trenches.

Operations at NWSCC also included radiological activities and some radioactive materials were disposed on-site during the early 1950s. Known burial grounds were excavated, decontaminated, and released for unrestricted use in 1974.

1.2.2.2 History of Regulatory Actions

Following promulgation of the USEPA's RCRA hazardous waste regulatory program, NWSCC filed notification and application to operate as a treatment, storage, or disposal (TSD) facility in October 1980. Interim status was granted subject to operating requirements and applicable technical standards found in Title 40 Code of Federal Regulations, Part 265 (40 CFR, Part 265).

In April 1981, the Navy implemented the Navy Assessment and Control of Installation Pollutants (NACIP), subsequently known as the Installation Restoration Program (IRP). The purpose of the NWSCC IRP was to identify and control environmental contamination from past practices. As part of the IRP, an Initial Assessment Study (IAS) was conducted in April and May 1981, by a team from the Naval Energy and Environmental Support Activity (NEESA), the Ordnance Environmental Support Office, and the Army Corps of Engineers. Based on information from historical records, aerial photographs, field inspections, and personnel interviews, the IAS identified 17 potentially contaminated sites at NWSCC. Fourteen of the 17 sites were recommended for confirmation studies to include sampling and monitoring. Of the 14 sites identified in the IAS as warranting further investigation under NACIP, two are evaluated in this EMR (SWMU #15/06 and #16/16). Prior to publication of the IAS in May 1983, confirmation studies were reportedly initiated by NWSCC (NEESA, 1983).

Pursuant to the RCRA regulations and the IRP, hydrogeologic investigations, including groundwater monitoring, were initiated at 10 sites in 1981. Eight of these 10 sites were later identified as warranting further investigation in the IAS.

In November 1984, the Naval Facilities Engineering Command - Northern Division (NORTHDIV) contracted the Hazardous Material Technical Center (HMTC) to perform confirmation studies at several sites at NWSCC.

Corrective actions programs established as part of the RCRA HSWA required NWSCC to address past releases of hazardous waste or hazardous constituents at SWMUs. Accordingly, NWSCC submitted a Hazardous Waste Management Report to the USEPA in January 1985. The report listed the IAS-identified hazardous waste sites as SWMUs. Following the Hazardous Waste Management Report, a RCRA Facility Assessment (A.T. Kearney, Inc., 1987) was conducted to characterize the potential for releases of hazardous waste or constituents from 100 SWMUs.

On December 23, 1989, the USEPA issued the federal portion of the Final RCRA Permit for NWSCC to the U.S. Navy. This permit established the HSWA Corrective Action Requirements and Compliance Schedules obligating the U.S. Navy to perform RFIs at 30 SWMUs, to conduct Corrective Measures Studies (CMSs) and implement corrective measures if needed. The Federal RCRA permit for NWSCC requires that RFI Phase I EMRs be submitted for many of the SWMUs at NWSCC.

1.3 ORGANIZATION OF REPORT

Subsequent sections of this EMR document the results of data review and evaluation and reconnaissance performed for the three designated SWMUs. Section 2 presents general facility conditions at the NWSCC facility, including physical features and site permits. Sections 3 through 5 present background information, assess existing data, and describe unit and waste characteristics pertinent to each of the three designated SWMUs. Section 6 presents recommendations for either continuing RFI Corrective Actions or ceasing RFI Corrective Actions at each SWMU.

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2.0 GENERAL FACILITY CONDITIONS

2.1 PHYSICAL CHARACTERISTICS

This section describes the climate, topography, hydrology, soils, geology, hydrogeology, and biology of the NWSCC facility. Subsequent sections of this report present SWMU-specific information.

2.1.1 Climate

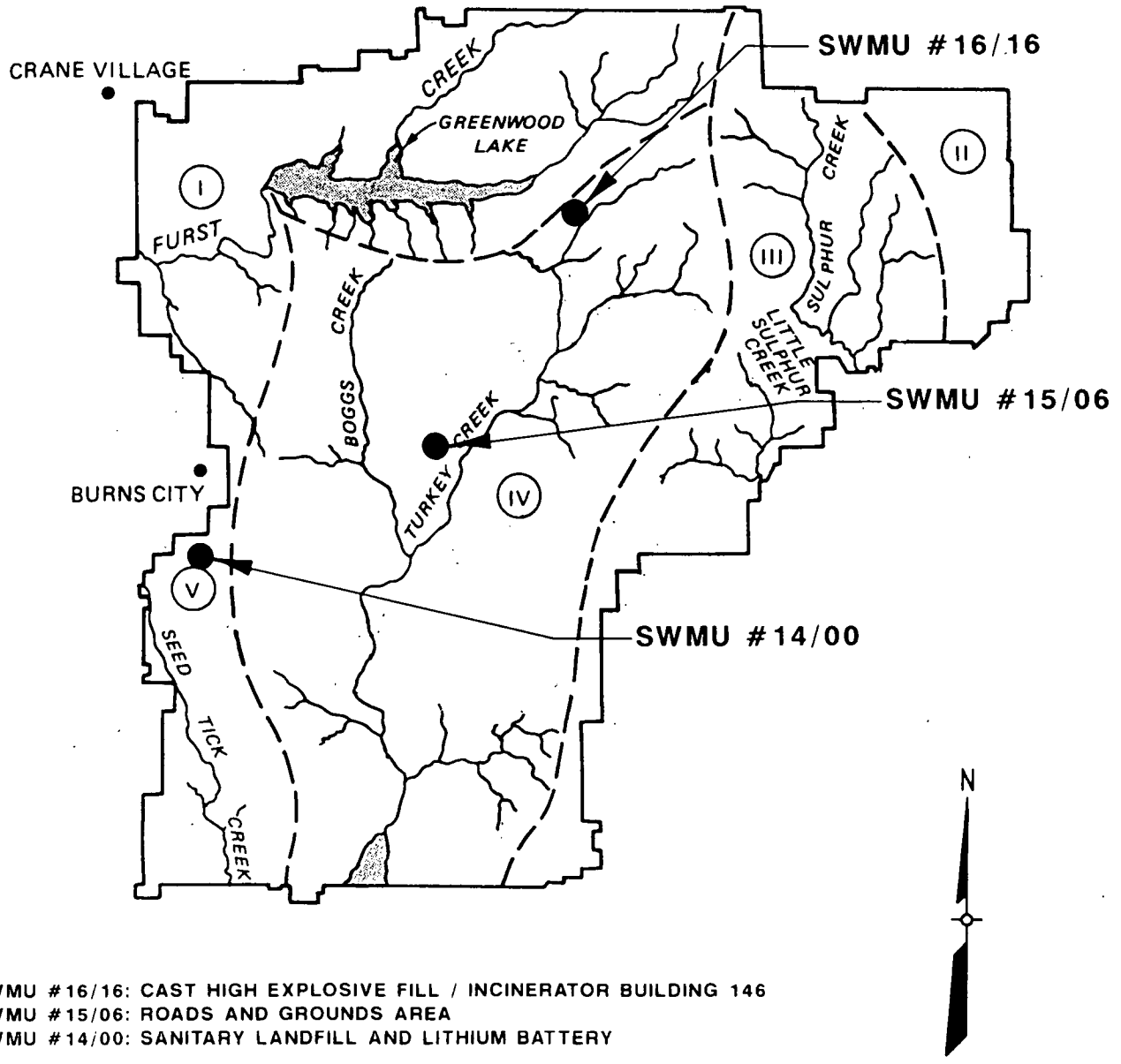
NWSCC is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The mean minimum temperature in January is 26°F, and the mean maximum temperature in July is 89°F. The area receives an average of 44 inches of precipitation annually, with 42 inches of rainfall and 15 inches of snowfall (NEESA, 1983).

2.1.2 Topography

The topography at NWSCC consists of undulating terrain dissected by many small drainageways. The elevation of the site ranges from 470 feet above Mean Sea Level (MSL) at a southern drainageway to 860 feet MSL on a ridge in the west-central portion of the site. V-shaped drainageways in the north progress to 2,000-foot-wide floodplains in the south and rise to approximately 150 to 200 feet to the ridgelines (NEESA, 1983).

2.1.3 Hydrology

Six creeks accept drainage in five separate drainage basins at NWSCC (Figure 2-1). The six creeks are: Furst Creek, Sulphur Creek, Little Sulphur Creek, Boggs Creek, Turkey Creek, and Seed Tick. Drainage in the north and northwest drainage (Basin I) eventually empties into Furst Creek, which flows off the site in a westerly direction. Basin II, in the extreme eastern part of NWSCC, consists of several small drainageways. Basin III occupies the eastern portion of the facility and contains Sulphur Creek and Little Sulphur Creek which flow toward the south. In the central portion of the site (Basin IV), Boggs Creek and Turkey Creek receive the surface water drainage and flow in a general southerly direction. Turkey Creek merges with Boggs Creek which exits the south-central boundary of the NWSCC. Basin V, in the extreme southwestern portion of NWSCC, contains Seed Tick Creek which flows south and exits the facility's southern



SWMU #16/16: CAST HIGH EXPLOSIVE FILL / INCINERATOR BUILDING 146
SWMU #15/06: ROADS AND GROUNDS AREA
SWMU #14/00: SANITARY LANDFILL AND LITHIUM BATTERY

SCALE

2 0 2 4 MI

SOURCE: CHESAPEAKE DIVISION NAVAL FACILITIES COMMAND, 1979

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FIGURE 2-1
SURFACE DRAINAGE BASINS
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boundary. All surface drainage from NWSCC eventually empties into the east fork of the White River, south of the NWSCC. Situated within Crane are Lake Greenwood and several ponds. Lake Greenwood water is the main source of water at NWSCC and is also used for recreation (NEESA, 1983).

2.1.4 Soil

Four soil units have been mapped at NWSCC in the Soil Survey of Martin County, Indiana (McElrath, 1988). Soil units are summarized individually below.

2.1.4.1 Wellston-Gilpin Soils

Wellston-Gilpin soils are deep and moderately deep, gently sloping to very steep, well-drained soils formed in loess and material weathered from underlying sandstone, siltstone, and shale in upland areas. This unit is commonly found along ridgetops and sideslopes in the upland areas. These areas are generally large and are separated by long, narrow bottom land and ridges.

This soil unit is composed of 50 percent Wellston soils, 15 percent Gilpin soils, and 35 percent minor-extent soils. Wellston soils are deep, gently-sloping to very steep silt loam. Gilpin soils are moderately deep and are strongly sloping to very steep. Gilpin soils are described as channery silt loam, channery loam, and loam. Channery soils contain, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist (McElrath, 1988).

2.1.4.2 Wellston-Berks-Gilpin Soils

This soil unit is composed of deep and moderately deep, gently sloping to very steep, well-drained soils formed in loess and material weathered from underlying sandstone, siltstone, and shales in upland areas. This soil unit is on ridgetops and sideslope in upland areas. Areas mapped with this unit are large and are separated by long, narrow bottom land and ridges. Of the NWSCC areas mapped with this soil unit, 43 percent are Wellston soils, 15 percent are Berks soils, 10 percent are Gilpin soils, and 32 percent comprise other minor soil series.

Wellston and Gilpin soils are described above. Berks soils are moderately deep, and are moderately steep to very steep. The surface layer and subsoil in areas mapped as Berks soils consist of channery and channery loam. Friable sandstone bedrock is commonly encountered at an average depth of 38 inches in areas mapped as Berks soil (McElrath, 1988).

2.1.4.3 Wellston-Berks-Ebal Soils

The Wellston-Berks-Ebal Unit is composed of deep and moderately deep, gently-sloping to very steep, well-drained and moderately well-drained soils formed in loess and material weathered from underlying sandstone, siltstone, and shale bedrock in upland areas. Areas mapped with this unit are large and are separated by long narrow bottom land and ridges. Of the area covered with this unit, the distribution of soil types is 35 percent Wellston, 30 percent Berks and similar soils, 15 percent Ebal, and 20 percent minor soil types.

Wellston and Berks soil types have been described in preceding paragraphs. Ebal soils are deep, moderately to strongly sloping, and moderately well- drained. The surface soil layer and subsoil in areas of Ebal soils consist of silt loam, channery silty clay, channery clay, mottled clay, and shaley clay (McElrath, 1988).

2.1.4.4 Wakeland-Wilbur-Haymond Soils

Soils in this unit are described as deep, nearly level, somewhat poorly-drained to well-drained soils formed in alluvium on stream flood plains. Areas mapped with this unit are broad bottom land along meandering streams which generally vary in size and shape. The soil types in areas mapped as this unit include 39 percent Wakeland soils, 13 percent Wilbur soils, 12 percent Haymond soils, and 36 percent miscellaneous soil types of minor extent.

Wakeland soils are poorly-drained soils located on broad flats and narrow floodplains along streams. Typically, these soils are silt loam, which formed from alluvial parent material. Wilbur soils are moderately well-drained, and are found along streams at slightly higher elevations than Wakeland soils. Wilbur soils are typically silt loam and formed in alluvial parent material washed from loess-covered uplands. Haymond soils are well-drained and are commonly found along streams on the landscape above Wilbur soils. Haymond soils are formed in parent materials similar to Wakeland and Wilbur soils and are classified as silt loam (McElrath, 1988).

2.1.5 Geology

NWSCC is located in the eastern flank Illinois Basin. Beneath unconsolidated colluvial and alluvial deposits, Paleozoic age sedimentary rocks underlying NWSCC have been deformed to yield a gentle dip of 50 feet per mile towards the west-southwest. Rock units in the basin are reported to exceed a thickness of 13,000 feet in some areas (Murphy et al., 1990). The distribution of the unconsolidated surficial deposits and bedrock units at NWSCC is presented in Figure 2-2.

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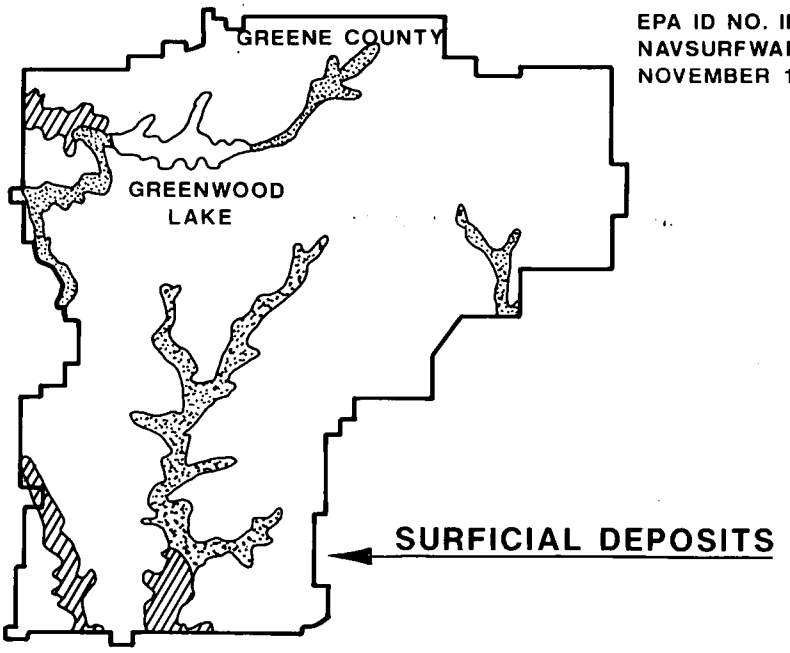

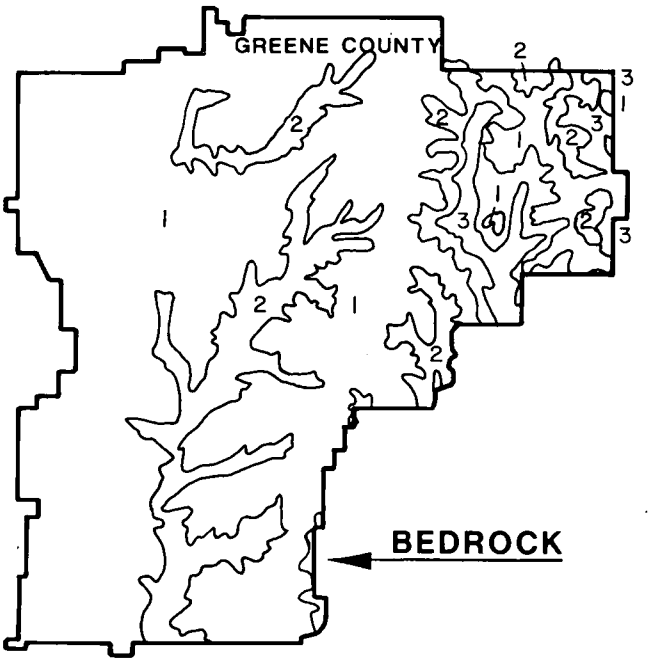

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LEGEND

- QUARTERNARY SILT, SAND, AND GRAVEL MOSTLY ALLUVIUM BUT INCLUDES SOME COLLUVIAL AND PALUDAL DEPOSITS.
- QUATERNARY CLAY, SILT AND SAND. LACUSTRINE DEPOSITS.
- RESIDUAL CLAYS AND SILT FROM PENNSYLVANIAN RACCOON CREEK GROUP AND MISSISSIPPIAN STEPHENSPORT AND WEST BADEN GROUPS.

1. RACCOON CREEK GROUP
2. STEPHENSPORT GROUP
3. WEST BADEN GROUP

SOURCE: NAVAL ENERGY AND ENVIRONMENTAL SUPPORT AGENCY, 1983.

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FIGURE 2-2

SURFICIAL AND BEDROCK GEOLOGIC MAPS

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The bedrock surface at NWSCC is made up of lower Pennsylvanian and upper Mississippian age sandstones, limestones, and shales. A generalized stratigraphic column of bedrock units in the NWSCC area is shown in Figure 2-3.

In general, Mississippian age Chester Series sandstones, shales, and limestones are exposed in the valley walls of eastern portions of NWSCC and in the lower elevations of deep valleys in the western portions. Pennsylvanian age Mansfield Formation sandstone, siltstones, claystones, and shale are found at the crests

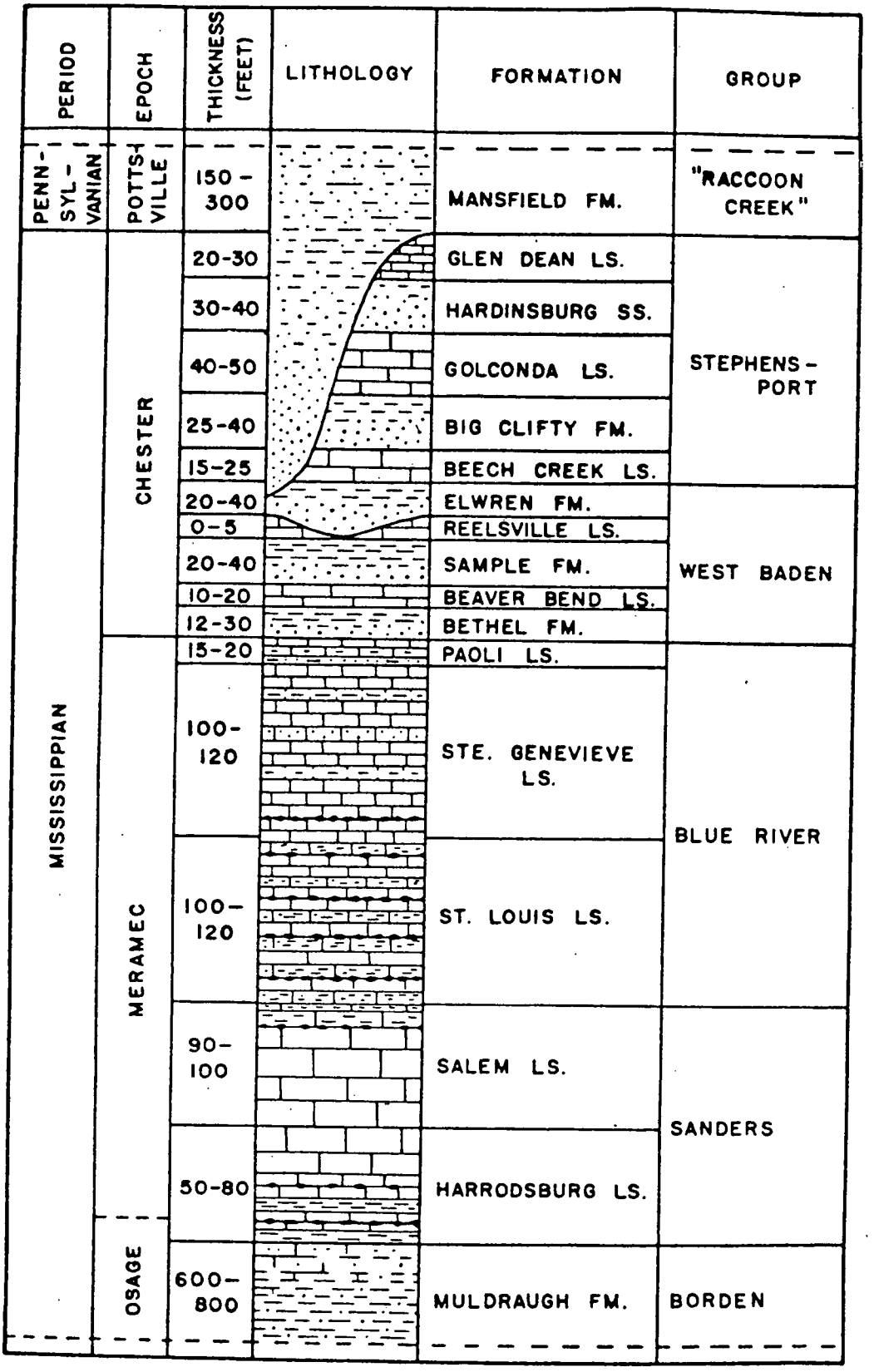
of hills and ridges in eastern portions of NWSCC and as the surficial bedrock unit further west. The contact between the Mississippian units and overlying Pennsylvanian units is an unconformity formed by long-term erosion of the Mississippian surface (Murphy et al., 1990). In the following subsections, stratigraphic units are described from youngest to oldest in order to provide information potentially significant in evaluating the role these units may play on the fate of potential contaminants.

2.1.5.1 Surficial Geology

Unconsolidated units beneath NWSCC are composed of alluvial and colluvial deposits. These deposits consist predominantly of silty and sandy clay and range in thickness from 1 to 15 feet. Alluvial and colluvial deposits on the floors of valleys at NWSCC contain occasional to numerous weathered sandstone fragments, cobbles, and boulders. Valley deposits at NWSCC are generally thicker than the thin residual and colluvial silty clay deposits which cover the valley slopes. Valley slope deposits are commonly less than 5 feet thick (Hunt, 1988). Residual deposits were derived from the weathering of the underlying Pennsylvanian and Mississippian bedrock (NEESA, 1983).

2.1.5.2 Mansfield Formation (Raccoon Creek Group)

The Pennsylvanian age Mansfield Formation generally caps hills in the eastern portions of NWSCC and makes up the bedrock surface farther west. The unit generally consists of interfingered sandstones, siltstones, claystones, and shale with occasional coal beds deposited in cyclic seas and swamps. Individual strata pinch out laterally. Overall thickness of the Mansfield Formation at locations within the eastern portion of NWSCC is reported to range from 0 to 65 feet (Murphy et al., 1990).



SOURCE: PALMER, 1969

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FIGURE 2-3
BEDROCK STRATIGRAPHIC COLUMN
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2.1.5.3 Hardinsburg Formation

This Mississippian age unit is encountered directly below the unconformity present between Pennsylvanian and Mississippian units. The formation consists of thick, laterally varying beds of fine-grained, friable sandstone, thickly bedded sandstone and shale, and carbonaceous shale. The maximum reported thickness of the Hardinsburg Formation in borings completed at NWSCC is approximately 47 feet (Murphy et al., 1990).

2.1.5.4 Haney (Formerly Golconda) Formation

This formation underlies the Hardinsburg Formation or may directly underlie the Pennsylvanian/Mississippian unconformity where the former is absent. The Haney Formation consists of medium to thickly bedded, hard, crystalline limestone interbedded with shaley limestone. The Haney Formation is considered the uppermost aquifer in studies completed within the eastern portion of NWSCC (Hunt, 1988; Murphy et al., 1990).

2.1.5.5 Big Clifty Formation

The Big Clifty Formation is divided into two lithologic members. The upper member is the Indian Springs Shale which consists of 20 feet of dark gray carbonaceous shale. The Indian Springs is considered to act as an aquiclude at the base of the Haney Formation in portions of NWSCC, but is absent in others. The lower member of the Big Clifty Formation consists of up to 40 feet of tan, massive, fine-grained sandstone. This sandstone is considered highly friable and is transcended by abundant intersecting joints. The lower member of the Big Clifty Formation and the underlying Beech Creek Limestone form the Middle Aquifer in the eastern portion of NWSCC (Murphy et al., 1990).

2.1.5.6 Beech Creek Formation

This formation is a very hard, dense, fossiliferous limestone ranging in thickness from 18 to 22 feet in areas studied at NWSCC. The Beech Creek Formation may be thinner where dissolution resulting from groundwater movement has removed upper portions of the formation. Core borings completed in earlier investigations at NWSCC (Hunt, 1988) encountered voids in the unit interpreted as solution cavities producing buried karst conditions. The lower portion of this limestone formation contains occasional to numerous shale partings. Rounded shale inclusions from the underlying Elwren Shale are often found in the extreme lower portions of the formation. The Beech Creek Formation and overlying portions of the Big Clifty Formation comprise the Middle Aquifer previously reported at NWSCC (Hunt, 1988).

2.1.5.7 Elwren Formation

The Elwren Formation is included in the Mississippi West Baden Group. The Elwren Formation consists of massive to thinly bedded, dark, gray-green shale interbedded with red-brown claystone. The average reported thickness of the formation in the eastern part of NWSCC is 20 feet. The Elwren is considered relatively impervious and is reported to be an effective aquiclude at the base of the overlying Beech Creek Limestone (Hunt, 1988; Murphy et al., 1990).

2.1.5.8 Reelsville Formation

The Reelsville Formation consists of several zones. The upper zone consists of 1 to 3 feet of hard, sandy limestone which may grade laterally into calcareous sandstone. The middle zone consists of massive to thinly bedded, dark gray to gray-green shale. The lower zone consists of 1 to 3 feet of fine-grained, locally calcareous sandstone. The Reelsville Formation averages 10 feet in thickness in investigated areas of NWSCC (Hunt, 1988; Murphy et al., 1990).

2.1.5.9 Sample Formation

This formation consists of dark gray to black, thinly bedded, platey to fissile shale with occasional thin to thick beds of light gray, massive, friable, fine-grained sandstone. During a previous investigation at NWSCC, the average thickness of the Sample Formation was found to be 40 to 45 feet and, at the surface, outcrop was observed to consist of 25 to 30 feet of sandstone (Hunt, 1988; Murphy et al., 1990).

2.1.5.10 Beaver Bend Formation

The Beaver Bend Formation consists of medium gray-brown fossiliferous, medium to coarsely crystalline, very hard and dense limestone. The formation ranges from 10 to 12 feet thick in eastern portions of NWSCC and is reported to contain numerous intersecting joints. The Beaver Bend Formation is the lowest aquifer included in previous investigations at the facility (Hunt, 1988; Murphy et al., 1990).

2.1.5.11 Bethel Formation

The Bethel Formation was only partially penetrated in a limited number of borings during previous investigations at the NWSCC. The upper portion of the formation consists of black, thinly bedded shale with occasional light gray sandstone and sandstone with shale lenses (Hunt, 1988; Murphy et al., 1990).

2.1.6 Hydrogeology

Hunt (1988) discussed regional groundwater trends pertaining to the unglaciated southwest portion of Indiana. In general, groundwater is contained in joint openings of limestone and sandstone aquifers. Based on studies conducted in the eastern portion of NWSCC (Hunt, 1988; Murphy et al., 1990), rock units considered to be aquifers and aquicludes are presented in Figure 2-4. Although unit thicknesses may vary, the distribution of bedrock units at NWSCC (Figure 2-2) suggests similar aquifer characteristics throughout NWSCC. Surficial unconsolidated aquifers are thin and have limited potential as water supplies.

In the Crawford Uplands area where NWSCC is located, aquifers are considered to be vertically isolated from each other by interlayered shale beds which act as aquicludes. Groundwater recharge occurs where aquifer units outcrop. After entering an aquifer outcrop, groundwater flows by gravity down the dip of the aquifer unit. Since the regional dip of rock units is to the southwest, regional groundwater flow in all aquifers is directed towards the southwest.

Local variations in bedding, dip, aquifer and aquitard, incision by surface drainage, and karstic conditions cause local groundwater movement at NWSCC to differ from regional trends. Where erosion resulting from surface drainage has cut through aquifer units, springs and seeps are produced which locally complicate groundwater flow. Springs and seeps are prevalent at contacts between aquicludes and overlying aquifers. Groundwater flowing from springs and seeps into surface water can potentially re-enter the groundwater system as recharge to a lower aquifer outcropping downstream.

Karstic conditions are produced when the movement of groundwater results in dissolution of materials along the preferred flow pathway. As dissolution continues, large interconnected conduits and caverns are created. Substantial dissolution in underlying rock units can cause instability resulting in the collapse of overlying materials. In the eastern portion of NWSCC, Hunt (1988) hypothesized that karstic conditions are present primarily in major drainage valleys where erosion has cut into permeable sandstones overlying easily dissolved limestone units. Rapid infiltration within the Big Clifty sandstone units has caused dissolution and weathering of the underlying Beech Creek Limestone. The result of this occurrence has been the creation of karst and collapse conditions along major drainageways within the eastern part of NWSCC. Similar conditions may exist elsewhere at NWSCC where similar bedrock conditions exist (Figure 2-3). In addition, karstic conditions have been documented in geographic regions adjacent to the Crawford Uplands region (Palmer et al., 1975; Palmer, 1984).

GEOLOGIC UNIT	THICKNESS (FEET)	HYDROGEOLOGIC UNIT TYPE
Golconda/Haney Formation	Few – 14	Upper Aquifer
Big Clifty Formation – Indian Springs Shale	20	Aquiclude–Aquitard
Big Clifty Formation – Lower Member Beech Creek Formation	40 18 – 22	Middle Aquifer
Elwren Formation Reelsville Formation Sample Formation	20 10 40 – 45	Aquitard
Beaver Bend Formation	10 – 12	Lower Aquifer

ADAPTED FROM: MURPHY ET AL. 1990 AND HUNT, 1988.

NOTE: REPORTED UNIT THICKNESS AND TYPE ARE BASED ON STUDIES COMPLETED IN THE EASTERN PORTION OF NWSCC. THE DISTRIBUTION OF BEDROCK UNITS AT NWSCC SUGGESTS SIMILAR AQUIFER CHARACTERISTICS THROUGHOUT NWSCC.

FIGURE 2-4
HYDROSTRATIGRAPHIC UNITS
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2.1.7 Biology

The source of the NWSCC biological characterization presented in this section is the IAS (NEESA, 1983). Eighty percent of NWSCC is classified as Central Hardwoods Forest. Also, some old agricultural fields are in various stages of succession. Although no threatened or endangered plant species are known to exist on-site, some local species are listed as rare by the Biological Survey Committee of the Indiana Academy of Sciences. Trees are commercially harvested on-site as a source of income for NWSCC.

A great variety of animal life is present at NWSCC. Deer, beaver, groundhogs, and hawks are among the vertebrates which inhabit the site. Two species listed by the Federal Government, the Indiana bat (Myotis sodalis) and the peregrine falcon (Falco peregrinus), may potentially inhabit the area. A single Indiana bat was caught on site in 1987 (IDNR, 1987). Also, a pair of Bald Eagles have nested at Lake Greenwood for the past year. Thus far, no eggs have been produced (NWSCC, 1991a).

An aquatic study performed at NWSCC (Department of Army, 1979) indicated that although stream water quality near potential pollutant sources was fair to poor, site stream exit points were of good quality. The 1979 study identified three sediment sites contaminated by PCBs above USEPA criteria for protection of freshwater biota for water samples and five stream water sites with cadmium above USEPA criteria for protection of freshwater biota. Samples collected by NWSCC personnel and analyzed by a state certified lab in 1981 did not demonstrate elevated levels of these contaminants (NEESA, 1983).

Listings of plants and animals found at NWSCC are included in Appendix A.

2.2 IDENTIFICATION AND SUMMARY OF PERMITS

NWSCC currently operates under a series of environmental permits. These permits limit releases to the air and surface water. Permits identified and reviewed for the NWSCC include:

- A RCRA permit.
- A National Pollutant Discharge Elimination System (NPDES) permit.
- A Clean Air Act permit.

Individual permits are discussed in detail below.

2.2.1 RCRA Permit

A RCRA permit was issued to the NWSCC on December 20, 1989. A copy of the Final RCRA Permit transmittal letter, title page, and signature page are included as Appendix B. This permit will remain in effect for 5 years, after which it must be renewed. The Federal portion of the RCRA permit allows NWSCC to manage hazardous waste in accordance with the conditions of the permit. The state portion allows NWSCC to store and manage hazardous wastes.

As part of the conditions of the Federal portion of the RCRA permit, individual SWMUs within the facility boundaries must satisfy detailed Corrective Action Requirements. NWSCC is obligated under the conditions of the permit to complete these Corrective Action Requirements. A total of 30 SWMUs are listed in the RCRA permit as requiring corrective action. Those SWMUs specifically addressed in this report are:

- SWMU #15/06: Roads and Grounds Area.
- SWMU #14/00: Sanitary Landfill and Lithium Battery.
- SWMU #16/16: Cast High Explosive Fill/Incinerator Building 146.

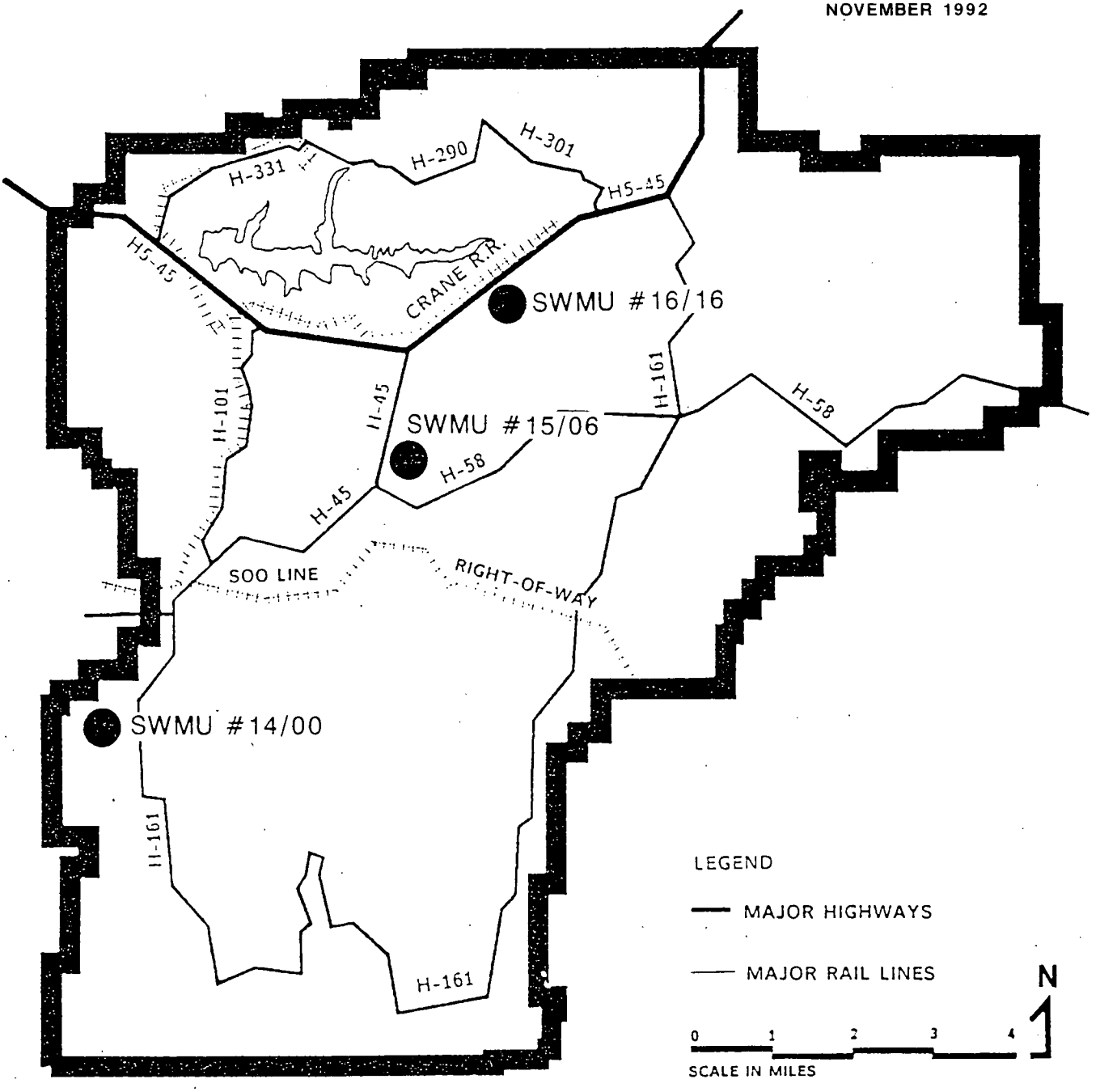
The locations of these three SWMUs are indicated on Figure 2-5.

The first required corrective action activity for all three SWMUs is completion of an RFI Phase I EMR. The purpose of an EMR is to document past and present monitoring requirements under Federal, State, and local authorities, known releases of hazardous waste or hazardous constituents, and corrective measures taken, and to recommend whether corrective measures should be continued at each SWMU. This report has been prepared to satisfy the EMR requirements for the three SWMUs listed above.

2.2.2 NPDES Permit

A NPDES permit (Permit No. IN 0021539) was issued to NWSCC effective November 1, 1989, and will remain in effect until August 31, 1994. A portion of this permit was amended effective January 1, 1990.

The NPDES permit issued to the NWSCC authorizes discharges from the facility to Turkey Creek and Boggs Creek. Discharges are required to be consistent with the terms and conditions of the permit. The permit specifies discharge requirements for 12 outfalls. Outfalls addressed in the permit and their locations are listed in Table 2-1. Of the permitted outfalls in Table 2-1, none are located in a SWMU undergoing investigation as part of this EMR.



SWMU #16/16: CAST HIGH EXPLOSIVE FILL/INCINERATOR BLDG. 146
SWMU #15/06: ROADS AND GROUNDS AREA
SWMU #14/00: SANITARY LANDFILL AND LITHIUM BATTERY

SOURCE: NORTHERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND, NWSCC MASTER PLAN, 1986

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FIGURE 2-5
SWMU - LOCATION MAP

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TABLE 2-1

OUTFALLS TO BE MONITORED
IN ACCORDANCE WITH NPDES PERMIT NO. IN0021539*
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Outfall Number	General Location
001	Sewage Treatment Plant
002	Demolition Ground Sedimentation Ponds
003	Demolition Ground Sedimentation Ponds
004	Demolition Ground Sedimentation Ponds
008	Demolition Ground Sedimentation Ponds
009	Scrapyard Oil/Water Separator
101	Building 3064
107	Building 3044 (Rockeye Bomblet)
201	Building 3074
301	Building 3110 (Demilitarization)
401	Building 38
501	Building 2521

*Effective November 1, 1989, through August 31, 1994.

RP/15EMRF/AA3

2.2.3 Clean Air Act Permit

NWSCC currently operates under four air pollution variances and six Air Pollution Operation Permits. Air permit and variance information specific to the SWMUs discussed in this report are presented in the SWMU-specific sections. The variances and operation permits are described below.

2.2.3.1 Air Pollution Variances

- Variance APC-4811

This variance covers the burning of explosive contaminated waste, waste explosives, pyrotechnics-contaminated waste, and waste pyrotechnics at the Ammunition Burning Ground.

- Variance APC-4812

This variance covers the burning of explosive-contaminated materials at the Old Rifle Range.

- Variance APC-4813

This variance covers the burning of explosives, lithium batteries, ordnance items, and gas cylinders at the Demolition Range.

- Variance APC-4654

This variance covers the testing of munition items at the Ordnance Test Area.

2.2.3.2 Air Pollution Operation Permits

The Indiana Air Pollution Control Board has issued the following six Operation Permits to NWSCC:

- No. 51-05-88-0028
- No. 51-05-88-0029
- No. 51-05-88-0030
- No. 51-05-88-0031
- No. 51-05-88-0032
- No. 51-05-88-0033

These permits authorize various surface coating and degreasing operations, rotary deactivation furnaces, grit blasting operations, and boiler operations. The Operation Permits expired May 1, 1988. NWSCC submitted renewal applications in 1988. Because the State has not acted upon the new applications, the specified operations are allowed to continue operation under the existing permits.

RP/15EMRF/AA1

3.0 SWMU #15/06: ROADS AND GROUNDS AREA

3.1 BACKGROUND

3.1.1 Location and Description

The Roads and Grounds Area is located in the northern half of NWSCC (Figure 2-5). This SWMU includes Building 2801 and an aboveground waste oil storage tank, Buildings 2716, 2717, 2718, 2774, an area occupied by a former asphalt batch plant, and a vegetated hillside south of Building 2801. Buildings 2716, 2717, and 2718 are described as General Warehouses, while Building 2774 is listed as a Paint Locker (NAVFAC Drawing No. 610328, 1962). The hillside area to the south of Building 2801 is characterized by assorted debris and a small intermittent stream at the base of the hill. These buildings are currently considered inert storage (NWSCC, 1991b). The Roads and Grounds Area is accessed via Highway H-468. Figure 3-1 shows the Roads and Grounds Area.

3.1.2 Legal Description

The Roads and Grounds Area is located in the SE 1/4 of Section 14, Township 5 North, Range 4 West, Martin County, Indiana.

3.1.3 Contiguous Property

A parking area and the Pyrotechnics Production Area lie to the west of the Roads and Grounds Area. The Booster Area is situated to the south, instrument calibration and repair buildings are situated to the north, and inert and open storage areas are located to the east of the Roads and Grounds Area.

3.1.4 Ownership and Operation

Past operations conducted at the Navy-owned Roads and Grounds Area reportedly included asphalt production, steam generation (Building 2801), and inert storage (Buildings 2716, 2717, 2718, and 2774). Building 2801 was built in 1956 as a permanent building for use as a boiler house. Buildings 2716, 2717, and 2718 were constructed in 1953 as semipermanent storage buildings (NWSCC, 1992). An operations startup date for the former asphalt batch plant is unknown, but Navy records indicate construction of an asphalt pump house (Building 1834) in 1946 and its demolition in 1979 (NWSCC, 1992).

B-1833 STORAGE BUILDING

B-2693 OFFICE

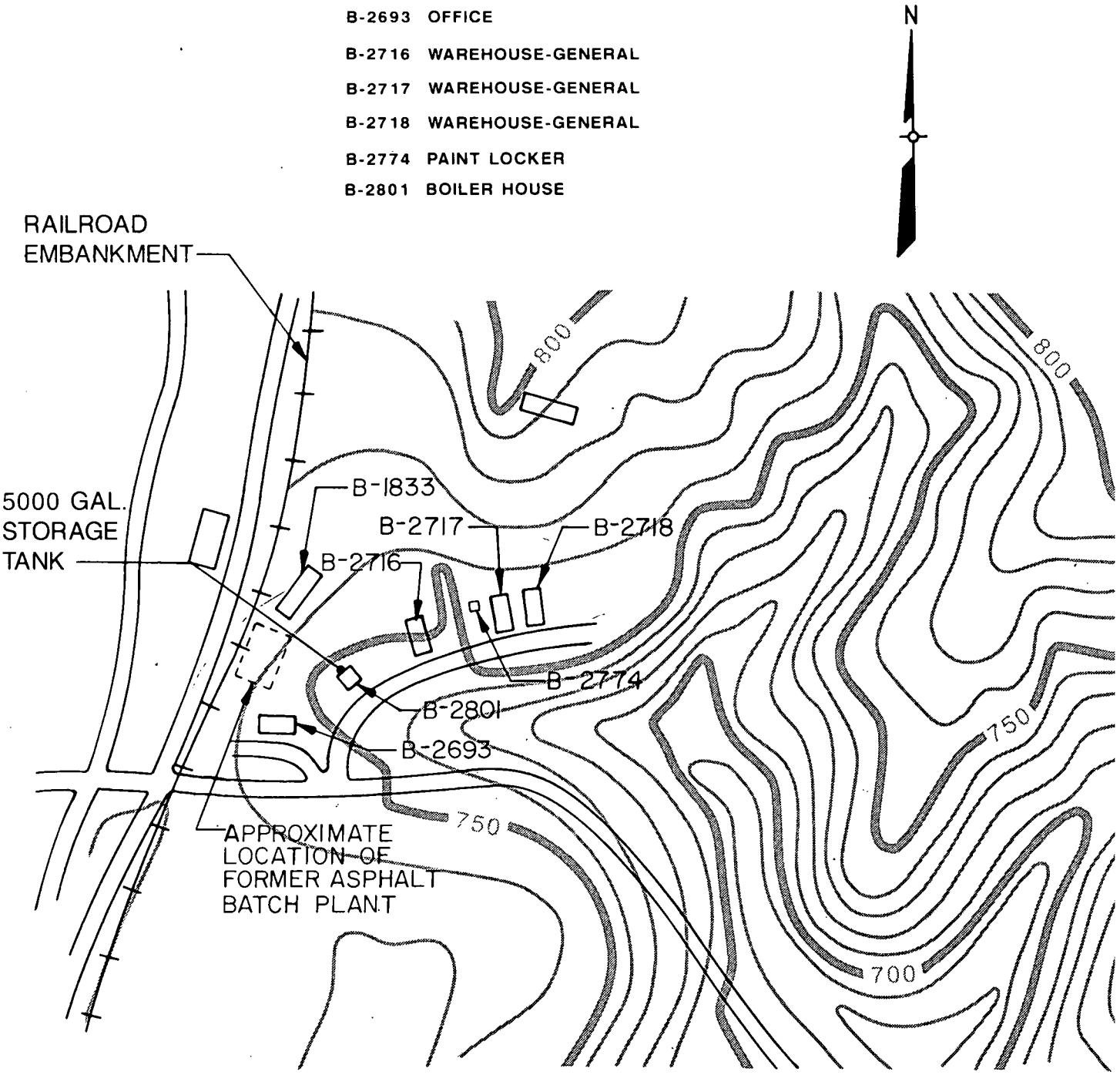
B-2716 WAREHOUSE-GENERAL

B-2717 WAREHOUSE-GENERAL

B-2718 WAREHOUSE-GENERAL

B-2774 PAINT LOCKER

B-2801 BOILER HOUSE



SOURCE: U.S.G.S., 1978, INDIANA SPRINGS, INDIANA, 7.5 MIN. TOPOGRAPHIC QUADRANGLE.

APPROXIMATE SCALE: 1" = 400'
CONTOUR INTERVAL = 10'

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FIGURE 3-1
SWMU #15/06 :
ROADS AND GROUNDS AREA
ENVIRONMENTAL MONITORING REPORT
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3.2 PHYSICAL CHARACTERISTICS

3.2.1 Topography

The Roads and Grounds Area occupies an upland area south of Lake Greenwood. Elevations in the general area range from approximately 760 feet MSL to approximately 745 feet MSL. Topography adjacent to the Roads and Grounds Area drops off sharply southeast of the Roads and Grounds Area. The base of the valley southeast of the Roads and Grounds Area is at an approximate elevation of 700 feet MSL. The topographic high (elevation 800 feet MSL) in the vicinity of the Roads and Grounds Area is approximately 1,000 feet north of Building 2693.

3.2.2 Physiography and Hydrology

Surface drainage from the Roads and Grounds Area enters intermittent drainageways to the south and southeast. These intermittent drainageways converge into a single intermittent drainageway which continues to flow towards the south-southeast under Highway 99. Surface flow continues towards the south while gaining volume from other intermittent sources until it enters Turkey Creek. Turkey Creek flows south-southwest to merge with Boggs Creek. Boggs Creek continues to flow south, exiting the southern boundary of NWSCC. South of NWSCC, Boggs Creek eventually flows into the east fork of the White River.

3.2.3 Geology

The regional geology of NWSCC, which includes SWMU #15/06, was presented previously in Section 2, General Facility Conditions. The following geologic information deals specifically with the Roads and Grounds Area.

3.2.3.1 Soil

Soil information discussed below for the Roads and Grounds Area was obtained from the Soil Survey of Martin County, Indiana, which was published by the Soil Conservation Service (SCS) (McElrath, 1988).

Detailed soil mapping by the United States Department of Agriculture (USDA) shows soils in the Roads and Grounds Area to be of the Wellston-Gilpin complex (Figure 3-2). An index of soil map units is presented in Table 3-1. In the vicinity of the Roads and Grounds Area, these soils are strongly to steeply sloping (12 to 30 percent). Wellston-Gilpin soils are considered well-drained and are commonly found on hillsides in the upland areas. Wellston soil is generally considered to be deep where bedrock is generally present at depths greater than 5 feet. Gilpin soil is described as moderately deep, and bedrock is commonly found at a depth of 39 inches. Unified Soil

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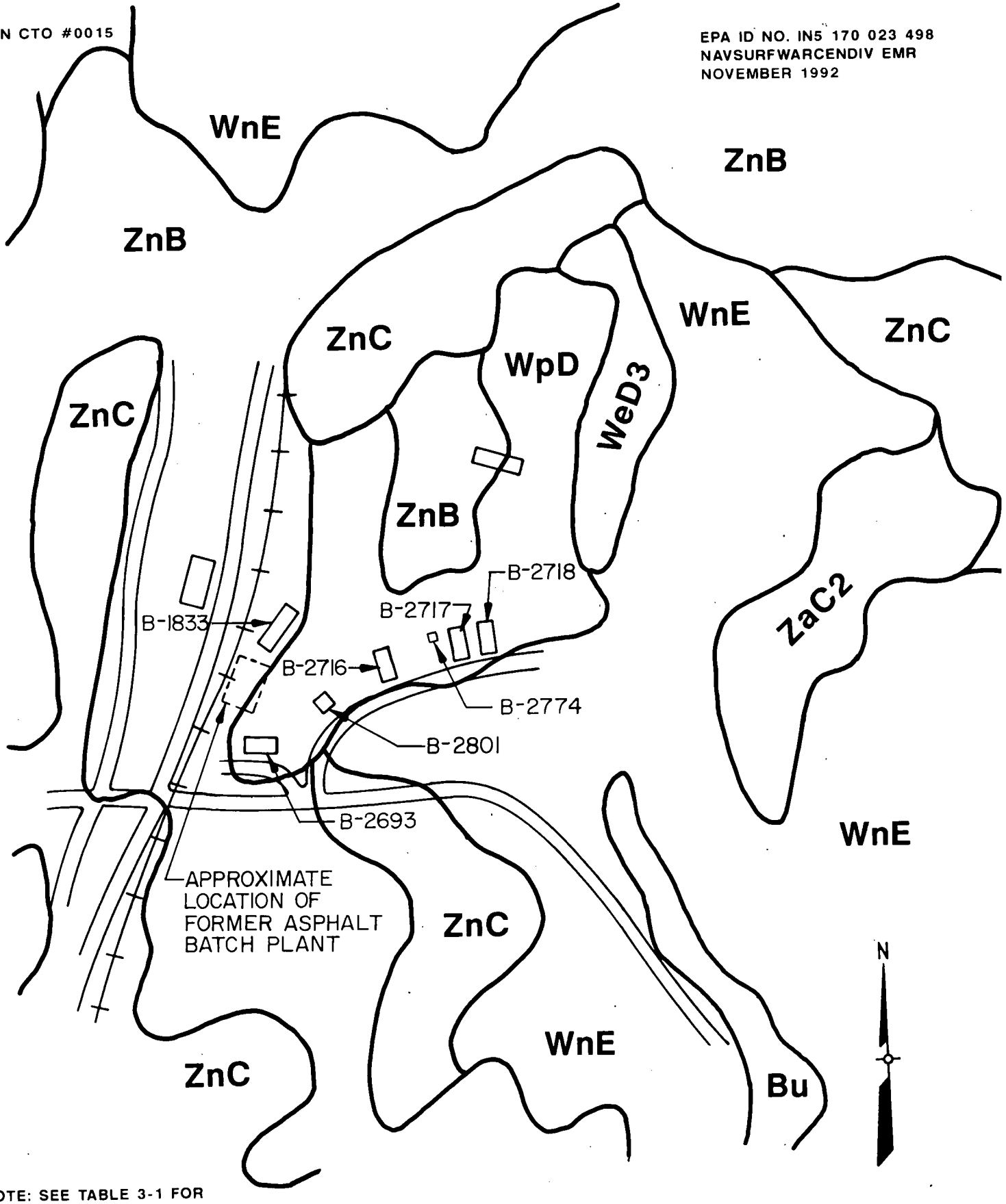

NOTE: SEE TABLE 3-1 FOR
INDEX TO SOIL MAP UNITS.

SOURCE: McELRATH, 1988

APPROXIMATE SCALE: 1" = 400'

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FIGURE 3-2
SOIL MAP FOR SWMU #15/06 :
ROADS AND GROUNDS AREA
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TABLE 3-1

INDEX TO SOIL MAP UNITS*
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Bu	-	Burnside loam, occasionally flooded.
HoB	-	Hosmer silt loam.
UhD	-	Udorthents, silty, 6 to 14 percent slopes.
WeC2	-	Wellston silt loam, 6 to 12 percent slopes, eroded.
WeD2	-	Wellston silt loam, 12 to 18 percent slopes, eroded.
WeD3	-	Wellston silt loam, 12 to 18 percent slopes, severely eroded.
WnE	-	Wellston-Gilpin complex, 12 to 30 percent slopes.
WpD	-	Wellston-Udorthents complex, 12 to 18 percent slopes.
ZaB	-	Zanesville silt loam, 2 to 6 percent slopes.
ZaC2	-	Zanesville silt loam, 6 to 12 percent slopes, eroded.
ZaC3	-	Zanesville silt loam, 6 to 12 percent slopes, severely eroded.
ZnB	-	Zanesville-Udorthents complex, 2 to 6 percent slopes.
ZnC	-	Zanesville-Udorthents complex, 6 to 12 percent slopes.

*To be used with Figures 3-2, 4-3, and 5-2.

Source: McElrath, 1988

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Classification System (USCS) classifications of Wellston soil are silt (ML), clay (CL), clayey silt (CL-ML), at depth sandy clay (SC) and silty sand (SM). USCS classifications of Gilpin soil include gravelly clay (GC), sandy clay (SC), clay (CL), and clayey silt (CL-ML).

Hydraulic conductivity for both soils is considered moderate. Hydraulic conductivities reported by the USDA for the Wellston-Gilpin complex range from 4.2×10^{-4} cm/sec to 1.4×10^{-3} cm/sec. Surface runoff is medium for both soil types. The organic matter content of the surface layer is moderate, ranging from 1 to 4 percent. Soil pH ranges from 3.6 to 6.5 in Wellston-Gilpin soils.

3.2.3.2 Bedrock

The bedrock surface beneath the Roads and Grounds Area is composed of sandstone, shale, and limestone of the Pennsylvanian Age Raccoon Group (Department of the Army, 1978).

A lineation study (U.S. Army Corps of Engineers, undated) shows a north-south trending lineation to terminate just north of the Roads and Grounds Area. Lineations were interpreted from aerial photographs and indicate the potential presence of structural geologic controls. Structural geologic controls include features such as faults, joints, foliation, and bedding planes. Lineations mapped during the study were not field verified.

3.2.4 Hydrogeology

The general hydrogeologic setting of NWSCC was described in Section 2. This regional hydrogeologic setting is considered representative of the hydrogeology in the Roads and Grounds Area. SWMU-specific hydrogeologic information for the Roads and Grounds Area is not presented due to the absence of soil borings and monitoring wells.

3.3 PERMITS

3.3.1 Air

No air permits have been issued or are required for the Roads and Grounds Area (NWSCC, 1991b).

3.3.2 Groundwater

NWSCC does not have or require groundwater permits for the Roads and Grounds Area (NWSCC, 1991b).

3.3.3 Surface Water

NWSCC is covered by NPDES Permit No. IN0021539, which currently covers 12 outfalls. None of the covered outfalls are in this SWMU.

3.3.4 Soil

No soil permits have been issued or are required for the Roads and Grounds Area (NWSCC, 1991b).

3.4 SWMU #15/06 EVALUATION

This section describes operations and maintenance, existing data, reconnaissance, and waste characteristics associated with the Roads and Grounds Area.

3.4.1 Operations and Maintenance

3.4.1.1 Operations

Building 2801 was previously used as a boiler house. A 5,000-gallon aboveground storage tank is located on the north side of this building. Approximately 10,000 gallons of waste oil are removed annually from this tank (NWSCC, 1992). Building 2801 is currently used for general storage. No specific information concerning historical operations at Building 2801 was available. However, NWSCC staff indicated that Building 2801 operated as a boiler house for at least the last 18 years (NWSCC, 1991a).

An operations startup date for the former asphalt batch plant (Figure 3-3) is not known, but is thought to have occurred early in NWSCC history. NWSCC staff stated that the batch plant was removed in 1972 or 1973 (NWSCC, 1991a). NWSCC staff (1991a) reported that during batching operations, tar was heated to a liquid and stored in tanks using steam-heated coils. Gravity fed liquid tar stored in underground storage tanks (USTs) to smaller aboveground storage tanks. Valves in the aboveground tanks allowed tar to be recovered for incorporation into the batching process (NWSCC, 1991a).

Operation information was not available for the storage buildings in this SWMU (Buildings 2716, 2717, 2718, and 2774).

3.4.1.2 Maintenance

No information was available concerning maintenance activities for the buildings in the Roads and Grounds Area.

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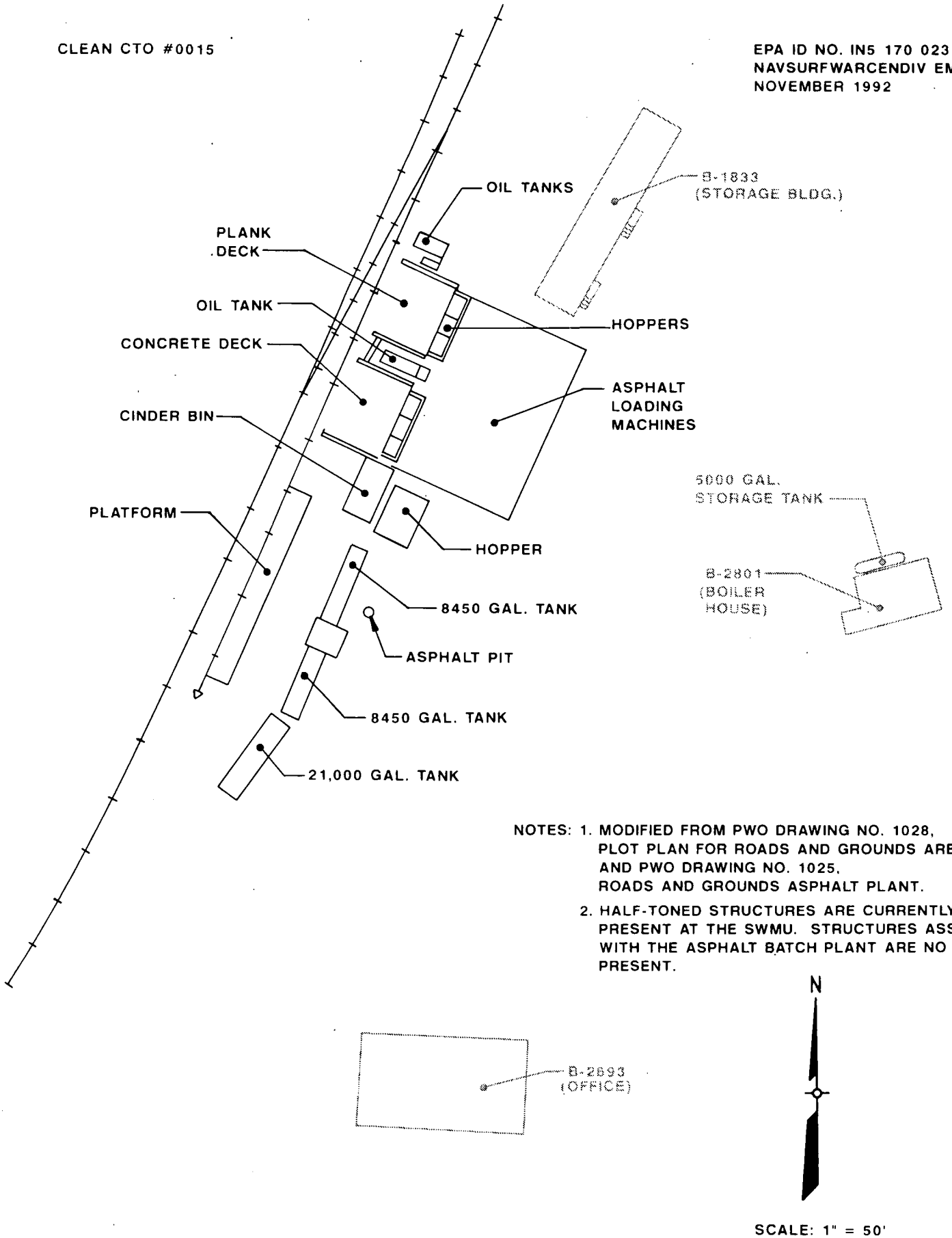

NOTES: 1. MODIFIED FROM PWO DRAWING NO. 1028, PLOT PLAN FOR ROADS AND GROUNDS AREA, AND PWO DRAWING NO. 1025, ROADS AND GROUNDS ASPHALT PLANT.

2. HALF-TONED STRUCTURES ARE CURRENTLY PRESENT AT THE SWMU. STRUCTURES ASSOCIATED WITH THE ASPHALT BATCH PLANT ARE NO LONGER PRESENT.

SCALE: 1" = 50'

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FIGURE 3-3

FORMER ASPHALT BATCH PLANT AT SWMU #15/06: ROADS AND GROUNDS AREA

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3.4.2 Existing Data Assessment

This section reports monitoring devices, analytical data, types and volumes of waste, spills or releases, and potential migration pathways for SWMU #15/106.

3.4.2.1 Monitoring Devices

No known monitoring devices are located in the Roads and Grounds Area.

3.4.2.2 Analytical Data

Limited analytical data are available for the Roads and Grounds Area. The IAS (NEESA, 1983) recommended that four soil and sediment samples be collected near debris deposited at the bottom of the hill south of Building 2716 and analyzed by the EP Toxicity test for heavy metals and pesticides. Accordingly, in 1985 four samples were collected and analyzed for the recommended parameters. The sample locations are not known. Analytical results for the four samples are presented in Table 3-2. Detectable levels of metals and pesticides were absent.

A Pilot Test Program (Kent et al., 1973) was conducted by the Navy to provide input for the development of a Navy-wide database. NWSCC was selected as the site of one of three such programs. The NWSCC tests were used to establish environmental baseline conditions at a typical naval ordnance activity and to provide data for pollution abatement projects. The test program included sampling ambient stations (wells, streams, and lakes), industrial discharges, and sewage treatment plant discharges over a 7-1/2-month period in 1972.

During the Pilot Test (Kent et al., 1973), a sample was collected in Turkey Creek downstream of the Roads and Grounds Area. The exact location of the sample is unknown, however, Kent et al (1973) describe the location as 1,500 feet downstream from a sample collected from a plating shop (Building 1884) discharge pipe. The purpose of this sampling point was to assess the effects of discharge from the plating shop on the creek. The plating shop is located approximately 500 feet northwest of the Roads and Grounds Area. Analytical results are presented in Table 3-3. The information presented in Table 3-3 reveals that the average concentrations of chromium, cadmium, lead, and cyanide present in the creek exceed drinking water MCLs. In addition, concentrations of these same metals and copper detected during the pilot study exceed available Ambient Water Quality Criteria for the protection of Aquatic Life (USEPA, Clean Water Act). Parameters considered appropriate to the Roads and Grounds Area such as pesticides, oil and grease, Polyaromatic Hydrocarbons (PAHs), and Total Recoverable Petroleum Hydrocarbons (TRPHs) were not analyzed.

TABLE 3-2

EP TOXICITY RESULTS
ROADS AND GROUNDS AREA
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Units: mg/l

	EP Toxicity Action Levels	Sample 1	Sample 2	Sample 3	Sample 4
Arsenic	5.0	< 0.004	< 0.004	< 0.004	< 0.004
Barium	100.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	1.0	< 0.01	< 0.01	< 0.01	< 0.01
Chromium	5.0	< 0.15	< 0.10	< 0.10	< 0.10
Lead	5.0	< 0.10	< 0.10	0.10	< 0.10
Mercury	0.2	< 0.003	< 0.003	< 0.003	< 0.003
Selenium	1.0	< 0.004	< 0.004	< 0.004	< 0.004
Silver	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Endrin	0.02	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Lindane	0.4	< 0.00008	< 0.00008	< 0.00008	< 0.00008
Methoxychlor	10.0	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Toxaphene	0.5	< 0.0002	< 0.0002	< 0.0002	< 0.0002
2,4-D	10.0	< 0.0001	< 0.0001	< 0.0001	< 0.0001
2,4,5-TP Silvex	1.0	< 0.00005	< 0.00005	< 0.0005	< 0.00005

Source: 1985 Analytical Reports received from NWSCC (no accompanying text provided).

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TABLE 3-3

STREAM ANALYTICAL RESULTS
ROADS AND GROUNDS AREA*
NWSCC
CRANE, INDIANA
NOVEMBER 1992

	Count[1]	Minimum[2]	Maximum[2]	Average[2]	MCL[3] (mg/l except where noted)	Ambient Water Quality Criteria (For protection of Aquatic Life)[5] mg/l Chronic
Temperature (°C)	6.000	14.900	20.800	17.450		
Dissolved Oxygen	6.000	7.900	9.500	8.733		
PHF	5.000	3.000	7.300	6.040		
PHL	6.000	2.100	7.500	6.333		
Turbidity (lbs/day)	6.000	3.200	16.500	8.667	0.5-1.0 NTU	
Dissolved Oxygen (Lab)	6.000	7.900	9.500	8.733		
BOD	4.000	0.000	8.000	3.750		
COD	6.000	19.000	45.000	32.833		
Total Suspended Solids	6.000	8.000	18.000	14.500		
Total Dissolved Solids	6.000	247.000	4001.000	1274.667		
Nitro Ammonia	6.000	.440	2.940	1.088		
Nitro Nitrate	6.000	0.000	.280	.107		
Nitro Nitrite	6.000	.010	.030	.022		
Total Phosphates	6.000	.047	8.472	1.667		
Chloride	6.000	76.000	1164.000	397.833		
Copper	6.000	0.000	.800	.267	1.3[4]	6.5×10^{-3}
Zinc	6.000	.500	9.500	3.383		0.047
Magnesium	6.000	3.400	21.000	8.633		
Potassium	6.000	1.300	2.000	1.667		
Chromium	6.000	0.000	1.500	.450	0.1	0.011
Total Coliform	1.000	430000.000	430000.000	430000.000		
Fecal Coliform	1.000	430000.000	430000.000	430000.000		
Calcium	6.000	30.000	500.000	127.167		

TABLE 3-3 (Continued)

STREAM ANALYTICAL RESULTS
ROADS AND GROUNDS AREA*
NWSCC
CRANE, INDIANA
NOVEMBER 1992

	Count[1]	Minimum[2]	Maximum[2]	Average[2]	MCL[3] (mg/l except where noted)	Ambient Water Quality Criteria (For protection of Aquatic Life)[5] mg/l Chronic
Iron	6.000	0.000	25.000	4.950		
Cadmium	6.000	.600	18.000	4.067	.005	6.6×10^{-4}
Manganese	6.000	.400	3.500	1.333		
Sodium	6.000	49.000	420.000	141.667		
Lead	6.000	0.000	3.000	.500	.005[4]	1.3×10^{-3}
Cyanide	4.000	1.080	2.000	1.322	0.2[4]	5.2×10^{-3}

* Sample located 1,500 feet downstream of Building 1884. (Building 1884 is located approximately 500 feet west of the Roads and Grounds Area)
1 Count = number of samples collected and analyzed.
2 Units are parts per million (ppm) unless otherwise denoted.
3 Maximum Contaminant Level, (MCL), USEPA 1991
4 Proposed MCL
5 Ambient Water Quality Criteria, USEPA Clean Water Act

Sources: Kent et al., 1973.
U.S. EPA, 1991.

RP/15EMRF/AD8

3.4.2.3 Types and Volumes of Waste

Types of wastes present at the Roads and Grounds Area have reportedly included waste oils, fuel oil, gasoline, asphalt, and pesticide and herbicide residues. Drums labelled waste oil, anti-freeze, and hydraulic fluid were observed during the site visit. Herbicides, pesticides, solvents, paints, and lubricants were also stored in the Roads and Grounds Area. General refuse such as drums, containers, and construction debris have been dumped on the hillside south of inert storage buildings (B-2716, 2717, 2718) in the area (Figure 3-1).

No information concerning the volume of waste generated, stored, or disposed at the Roads and Grounds Area was available.

3.4.2.4 Spills or Releases

A review of spill response records maintained by the Environmental Protection Division at NWSCC concluded that no spills or releases have been documented in the Roads and Grounds Area (Buildings 2693, 2801, 2716, 2717, and 2718) since October 5, 1987. No spills or releases prior to October 1987 were noted in other records reviewed for the Roads and Grounds Area. However, pesticide residues have reportedly been released to soils and surface (NEESA, 1983; A.T. Kearney, 1987).

During the site inspection of the Roads and Grounds Area, a NWSCC Roads and Grounds Area employee stated that tar spills occurred at the asphalt batch plant formerly located in the Roads and Grounds Area (NWSCC, 1991a). Spills were attributed to boilovers and accidental discharge associated with the molten tar storage tanks at the batch plant. It was stated that one spill occurred as a result of a molten tar storage tank drain valve being left open overnight. The following morning tar was said to have flowed approximately 150 yards south down the drainageway between Buildings 2693 and 2801.

3.4.2.5 Potential Migration Pathways

The primary potential migration pathways existing at the Roads and Grounds Area are surface water and groundwater. Reportedly, pesticides, drums, and other debris have been dumped on the hillside south of Buildings 2716, 2717, and 2718 (NEESA, 1983; A.T. Kearney, 1987). Depending upon the volume of pesticide and drum residues released down the hillside, compounds may have either directly entered the stream or infiltrated the surface soils. Compounds sorbed onto surface soils may be transported in suspension or solution down the hillside and into the stream by storm events. Also, as previously mentioned, tar has been released from storage tanks at the former asphalt batch plant. Tar spills flowed into drainageways in the Roads and Grounds Area and continued to flow into the stream.

Groundwater is the other potential migration pathway. Waste oils were observed to have been released to soil in the Roads and Grounds Area. In addition, pesticide residues were reportedly released to soils and surface water (NEESA, 1983; A.T. Kearney, 1987). Other chemicals may have also been released from drums stored in the area or dumped down the hillside. Compounds released to soils may percolate through the vadose zone by gravity or leaching and eventually the groundwater system. Chemicals entering surface waterways may eventually merge with surface water bodies outside NWSCC.

3.4.3 SWMU Reconnaissance

A visual reconnaissance of the Roads and Grounds Area was conducted on October 22 and 23, 1991. NWSCC staff from several different departments were interviewed to gather information on past and current practices in the SWMU, materials stored or used there, and other pertinent details. The following sections present information specific to Building 2801, the former asphalt batch plant, Building 2716, Building 2774, Building 2717, and Building 2718.

3.4.3.1 Building 2801

Building 2801, described as a boiler house (General Development Maps), is no longer used for this purpose; however, boiler equipment remains inside. The building is currently used for general storage by the NWSCC Public Works Department. NWSCC staff indicated that Building 2801 operated as a boiler house for at least the last 18 years (NWSCC, 1991a).

A large aboveground storage tank is located on the north side of Building 2801. The tank is estimated to have a capacity of 5,000 gallons (A.T. Kearney, Inc., 1987). NWSCC staff indicated that the tank has been present in this location for at least 10 years; however, the exact date of tank installation is unknown (NWSCC, 1991a). A 3-foot high concrete block containment wall exists around the tank. The containment wall has been in place for 5 to 10 years according to NWSCC (1991a). The presence of a floor in the containment area is uncertain and no concrete pad was visible during the SWMU walkover. NWSCC staff indicated that no pad was present (NWSCC, 1991a), however, previous reports indicate that a gravel pad is present beneath the tank (A.T. Kearney, Inc., 1987).

A drain line and valve are located on the west end of the tank. These fittings are used to transfer stored waste oils to tanker trucks for reprocessing outside NWSCC. Information on the schedule for emptying the tank was not available; however, previous reports state that 4,000 to 6,000 gallons of waste oil are removed annually from the tank (A.T. Kearney, Inc., 1987). Staining was observed throughout the containment area. In addition, oil was observed to be dripping from the valve (Appendix C, Photo No. 1).

A UST was stated to have existed within the containment area east of the aboveground waste oil tank. Tank size was estimated to be 6 feet by 15 feet. This UST is thought to have held fuel oil. The tank was stated to have been removed within the last 5 years (1991a). To facilitate removal of the tank, a portion of the containment wall was dismantled because the wall was built over a portion of the tank. The base of the tank is considered to have extended to a depth of 7 to 8 feet below grade. Soil excavated during tank removal was reportedly used to backfill the excavation (NWSCC, 1991a). No information was available on containment testing completed in association with the tank removal, and NWSCC staff (1991a, 1991c) suggest that no sampling occurred.

Twenty-one 55-gallon steel storage drums were present in and outside of the waste oil tank containment area. Several drums were labeled as containing waste oil, anti-freeze, and hydraulic fluid (Appendix C, Photo No. 2). Fourteen drums outside the containment area (Appendix C, Photo No. 3) were upright and appeared empty to partially full. Several drums outside the containment area were placed on plastic sheeting; however, dark staining was observed in the vicinity of other drums. It was stated that it was uncommon for so many drums to be present outside the containment area, rather it is common for one or two drums to be stored outside the containment area (NWSCC, 1991a). Drums inside the containment area (Appendix C, Photo No. 4) were upright, tilted, and up-ended.

Construction materials, plastic piping, metal conduit, and wooden pallets are stored at the northeast corner of Building 2801.

A UST and service pump (Appendix C, Photo No. 5) were installed west of Building 2801 on October 2, 1991, (NWSCC, 1992). This UST is used to store gasoline used by the Roads and Grounds Department at NWSCC. A UST was reportedly removed to facilitate the installation of the new 5,000-gallon tank (NWSCC, 1991b). Detailed information on the tank removal was not available; however, NWSCC Environmental Protection Division staff indicated that no sampling was conducted (NWSCC, 1991c).

Utility line excavation in the vicinity of the newly installed UST encountered "heavy petroleum type" materials (NWSCC, 1991b). The exact location of excavation work was not determined. Samples were not collected of the material encountered.

3.4.3.2 Former Asphalt Batch Plant

The former NWSCC asphalt batch plant was located in the Roads and Grounds Area approximately 200 feet northwest of Building 2801 (Figure 3-3). No structures related to the former NWSCC asphalt batch plant were observed to exist during the SWMU reconnaissance. NWSCC staff (1991a) provided a brief overview of batching operations. Tar was heated to a liquid and stored in tanks using steam-heated coils. One or two

large UST(s) were located near the railroad embankment north of Buildings 2801 and 2693. Gravity fed liquid tar stored in these USTs to smaller (approximately 1,000-gallon) aboveground storage tanks to the south. Valves in the aboveground tanks allowed tar to be recovered for incorporation into the batching process (NWSCC, 1991a).

Southwest of Building 1833 (Figure 3-3), heavy soil staining was observed in the railroad embankment. Wooden railroad ties used as a retaining wall in this area were irregularly stained. A dark orange liquid possessing a petroleum odor was observed seeping from the retaining wall at one location. Runoff from this area is collected in the drainageway between Buildings 2801 and 2693.

According to NWSCC staff (1991a), it was fairly common for spills to occur in the tar storage tank area as a result of boilover or unsecured drain valves. Spills in the area impacted soils in the vicinity of the tanks and at times flowed into drainageways. NWSCC staff (NWSCC, 1991a) recalled a tar spill resulting after a drain valve on a southern tank was inadvertently left open overnight. The next day, tar was observed to have extended through drainageways as far as 150 yards down the stream bed south of the Roads and Grounds Area which parallels Highway 99.

Tar "flows" were observed in the base of the drainage ditch flowing south-southeast between Buildings 2801 and 2693 (Appendix C, Photo No. 6). The drainageway continues to route flow along the base of the slope south of the Roads and Grounds Area, eventually flowing under Highway 99. Asphalt was observed in the stream bed as far as 100 yards north of the intersection with Highway 99. An oily sheen was observed on the surface of the water at the head of this drainageway. NWSCC staff commented that waste oil may have been used as fuel or co-burned with other fuels at the batch plant. Boilers at the batch plant were stated to be capable of burning a wide variety of fuels (NWSCC, 1991a).

3.4.3.3 Building 2716

Building 2716 is a corrugated metal barn with a concrete floor. A concrete loading ramp is located at the south end of the building. This building is currently considered as inert storage. Eight hundred pounds of the granular herbicide ureabor (or urealor) was stored in 50-pound paper bags in Building 2716 prior to 1973-74. The remaining ureabor was moved to Building 2189 (outside of this SWMU) and used extensively from 1974 to 1976. Several bags of ureabor are reported to remain today (NWSCC, 1991d).

Pesticide containers and applicators were reportedly washed out in the vicinity of a washrack near Building 2716 (NEESA, 1983). NWSCC staff, however, professed no knowledge of this practice (NWSCC, 1991d). Two wash facilities were observed near Building 2716. The first consists of a steel grate and pipe fence straddling a concrete

basin which intersects an underground corrugated pipe drainageway. The function of this facility was not known to NWSCC staff. The bottom of the corrugated pipes entering and exiting the basin are covered with a layer of dark asphalt-like material (Appendix C, Photo No. 7). The concrete in the bottom of the basin is stained dark red-brown to brown. Liquids flowing through the drainageway during the reconnaissance were a rusty brown color. Drainage exiting the washrack is discharged to the ravine south of the Roads and Grounds Area.

A second wash facility is located east of Building 2716 and southwest of Building 2774. This facility consists of a concrete pad sloped to collect and divert runoff to a concrete channel which flows into the facility described in the preceding paragraph. Running water and a hose are available for rinsing purposes and two uncovered garbage cans were present. This facility is reportedly used by NWSCC Public Works Department to wash equipment and vehicles. In the past, the facility was used daily to wash 35 dump trucks operated by Public Works (NWSCC, 1991a).

3.4.3.4 Building 2774

Building 2774 is listed as a paint locker in the General Development Maps for NWSCC. NWSCC staff stated that the building is currently used as inert storage (NWSCC, 1991a). The Building 2774 placard indicates storage of hazardous materials. Materials stored in the building in the past included paints, solvents, pesticides, herbicides, and lubricants used by the Roads and Grounds staff (NWSCC, 1991a). Pesticides and herbicides used at NWSCC are listed in Table 3-4. Building 2774 was stated to have a concrete floor (NWSCC, 1991a). It is not known if any floor drains are present.

3.4.3.5 Building 2717

Building 2717 is located between Buildings 2716 and 2718 in the Roads and Grounds Area. This building is a corrugated steel building with a concrete floor, listed as a General Warehouse in the NWSCC General Development Maps (NAVFAC Drawing No. 610328, 1962). This building is currently used for inert storage (NWSCC, 1991a).

Miscellaneous materials including wood, barricades, displays, old phone booths, and other objects are stored outside Building 2717. Fuel line connections for an oil burning heater thought to have existed inside Building 2717 were observed on the northeast corner of the building. An aboveground fuel storage tank is thought to have existed at this location according to NWSCC staff (NWSCC, 1991a). A similar setup exists at the northeast corner of Building 2718. The aboveground fuel storage tank is still present at this location. Staining was not observed in the vicinity of the former storage tank.

TABLE 3-4

PESTICIDES USED ON-SITE
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Current

Krovar (Diuron - Bromacil)
Ureabor
Oust: 75% Sulfometuran Methyl (Methyl z-[[[[4,6-Dimethyl-2-Pyrimidinyl)-Amino]Carbonyl] Amino] Sulfonyl] Benzoate
Roundup (Mono(Isopropylamine) salt of Glyphosate)
Malathion
Diazinon

Reported

Chlordane
Dieldrin
DDT
2,4-D (Tordon)
2,4,5-T
MH30 (maleic hydrazide, and diethanolamine salt of 6-Hydroxy-3-(2H) Pyridazinone)
Telvar (80% Monuron (3-(p-chlorophenyl)-1,1-dimethylurea))
Pentaur*
Benomyl
Dyrene (Anilazine)
Prometone
Diuron
MBC (Carbendazim)*
Baygon (Propoxur)
Dursban (Chloropyrifos)
Pyrethrum
Carbaryl
Methyl Bromide*
Lindane

Sources: NWSCC, 1991d.
NEESA, 1983.
Department of the Army, 1978.

* Reported in Installation Assessment (Dept. of Army, 1978), however Navy personnel (NWSCC, 1991d) report as never used on-site.

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The ravine south of Building 2717 has been used for indiscriminate dumping in the past (NWSCC, 1991a, 1991b). The northern slope of the ravine is littered with debris including rusted metal containers, ammunition storage containers, construction debris, plumbing fixtures, and general refuse (Appendix C, Photo No. 8). Several 55-gallon storage drums are scattered along the slope. These drums appear empty to partially full. Drums have deteriorated and, in some instances, their contents appeared to have spilled onto the ground.

3.4.3.6 Building 2718

Building 2718 is the easternmost general warehouse in the Roads and Grounds Area. During interviews with NWSCC personnel, it was determined that the building has been used for inert storage (NWSCC, 1991a).

Construction materials and miscellaneous equipment are stored outside Building 2718. An aboveground fuel storage tank is located on the northeast corner of the building. The tank is considered to have been used as a fuel supply for the heating unit inside the building. Limited staining was observed around the tank.

During an interview with NWSCC staff, it was discovered that the ravine east and southeast of the road east of Building 2718 had been extensively filled. Fill is stated to have included all types of material including two railroad box cars (NWSCC, 1991a). At the time of the SWMU reconnaissance, the filled area was at the same elevation as the Roads and Grounds Area. Based on discussions with NWSCC (NWSCC, 1991a), it is estimated that filling has shifted the crest of the slope as much as 50 yards south, southeast of its original location.

The ravine south of Building 2718 has been used for indiscriminate dumping in the past (NWSCC, 1991a and 1991b). The northern slope of the ravine is littered with debris. Debris observed on this slope included rusted metal containers, discarded ammunition storage containers, construction debris, plumbing fixtures, and general refuse. Several 55-gallon storage drums are scattered along the slope. These drums appear empty to partially full. Drums have deteriorated and, in some instances, their contents appear to have spilled onto the ground (Appendix C, Photo No. 9). Runoff from the Roads and Grounds Area flows down channels in the ravine slope. Several of these channels intersect the debris.

3.4.4 Waste Characteristics

3.4.4.1 Physical and Chemical Characteristics

The main compounds of concern identified in the IAS (NEESA, 1983) are pesticides and herbicides. The types of pesticides and herbicides used at NWSCC are listed in Table 3-4 (Section 3.4.3.4). The physical and chemical characteristics of most of these compounds are summarized in Table 3-5. The table also indicates herbicide and pesticide toxicity. Although not toxic to humans, the compounds listed in Table 3-4 are most certainly toxic to their targeted organisms and as such may be considered an environmental threat. No information was found for the following compounds or their constituents: Pentaur, Prometone, and Ureabor.

The former asphalt plant also released compounds of potential concern. Asphalt is a dark-brown to black cementitious material in which the predominating constituents are bitumens. It is a mixture of paraffinic and aromatic hydrocarbons and heterocyclic compounds containing sulfur, nitrogen, and oxygen (Sax and Lewis, 1987). Gasoline, waste oil, and fuel oil are similar in composition. These three wastes are derived primarily from petroleum. Petroleum is a highly complex mixture of paraffinic, cycloparaffinic and aromatic hydrocarbons containing a low percentage of sulfur and trace amounts of nitrogen and oxygen (Sax and Lewis, 1987). Petroleum is a moderate fire risk. It is toxic to humans by ingestion and is a local skin irritant (Sax and Lewis, 1987). The properties of petroleum-derived products vary depending upon the hydrocarbon weight, chain configuration, and degree of saturation. For example, hydrocarbon mixtures can be liquid or solid, volatile or nonvolatile, and may be slightly soluble or insoluble in water. Some hydrocarbons, particularly aromatic compounds, are carcinogenic. Waste oils may also contain barium, chromium, and lead. These compounds are included in Table 3-5.

The IAS (NEESA, 1983) also identified inorganic waste salts as a waste of concern. The rationale behind this is not explained in the text, and no specific compounds are identified. In general, metallic salts may be a concern due to the presence of heavy metals. Barium, chromium, and lead are included in Table 3-5. Characteristics of other heavy metals are discussed in detail in Section 5, SWMU #16/16, Building 146.

3.4.4.2 Hazardous Classification

Hazardous wastes which may have been stored or disposed at the Roads and Grounds Area are listed in Table 3-6.

TABLE 3-5

PHYSICAL AND CHEMICAL PROPERTIES
ROADS AND GROUNDS AREA
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Chemicals (CAS No.)	Physical Form	General Chemical Class	Molecular Weight (g/mole)	Density (g/cm^3)	Solubility in Water (mg/l)*	Melting Point (°C)	Vapor Pressure (mmHg)*	Henry's Law Constant (atm m^3/mole)*	LOG Kow	LOG Koc	Biodegradability	Bio-concentration Factor	Hydrolysis Rate	Photolysis Rate	Toxic
Barium (7440-39-3)	Silver-white[3]	Heavy metal	137.33	3.6[3]	Reacts[3] with water	710[3]	NA	NA	NA	3.2** [4]	NA	4[4]	NA	NA	X
Benomyl (17804-35-2)	NA	Fungicide[1]	290.36[1]	NA	2.8-3.8[1]	NA	NA	NA	2.12-3.11[1]	3.3[1]	Moderate[1]	Low to[1] moderate	High[1]	Moderate[1]	X
Bromacil (314-40-9)	White[5] crystalline solid	Herbicide[5]	NA		815[5] @ 20	NA	8×10^{-5} @ 100	NA	NA	NA	NA	NA	NA	NA	X
Carbaryl (63-25-2)	Solid[3]	Molluscicide,[1] insecticide, acaricide	201.22[1]	1.23[3]	32 @ 20° [1]	142[1]	1.36×10^{-6} [1]	1.28×10^{-8} [1] @ 20°	2.36[1]	2.0-2.6[1]	High[1]	Low[1]	Moderate[1] to high	Very high[1]	
Chlordane (technical) (12789 03-6)	Colorless viscous liquid[3]	Insecticide[1]	409.80[1]	1.57-1.67[3]	0.1[1]	103-131 [1] (depends on isomer)	4.6×10^{-4} [1]	4.85×10^{-5}	5.54[1]	4.2-4.4[1]	Low[1]	High[1]	Low[1]	Low[1]	X
Chromium (7440-47-3)	Hard-brittle, [3] semi-grey	Heavy metal	51.996	7.1[3]	Insoluble[3]	1900[3]	NA	NA	NA	NA	NA	NA	NA	NA	X
Diazinon (331-41-5)	Colorless liquid[3]	Insecticide[1]	304.3[1]	NA	68.8 @ 20 [1]	>120 [1] (decomp)	8.4×10^{-5} [1] @ 20°C	1.13×10^{-7} [1]	3.81[1]	1.6-2.6[1]	High[1]	Low[1]	Moderate[1]	High[1]	X
Dieldrin (6-57-1)	Light tan flaked[1] solid	Insecticide[1]	380.93[1]	1.75[2]	0.17 [1] @ 20°C	175-176[1]	3.75×10^{-6} [1] @ 20	5.8×10^{-5} [1]	4.32[1]	3.87- [1] 4.08	Very low[1]	Moderate to[1] very high	Very low[1]	Low[1]	X
Diuron (350-54-1)	White crystalline[1] solid	Herbicide[1]	233.10[1]	NA	37.3[1]	158-159[1]	2.7×10^{-6} [1] @ 20	2.7×10^{-6} [1]	2.77[1]	1.9- [1] 2.9	Moderate[1]	Low[1]	NA	High[1]	X
DDT (50-29-3)	Colorless cry- [3] stals or white/ off-white powder	Insecticide[3]	354.5[2]	NA	0.0031- [2] 0.0034	108[2]	1.9×10^{-7} [2] @ 20°	NA	6.19[2]	NA	Low[1]	High[2]	NA	Very low[2]	X
Dursban (2921-88-2)	NA	Insecticide[3]	350.59[1]	NA	1.121[1] @ 24	41-42[1]	1.19×10^{-5} [1]	7.8×10^{-5} [1]	4.96[1]	3.6-4.1[1]	Moderate[1]	316-3470[1]	Moderate[1]	Moderate[1] - low	X

TABLE 3-5 (Continued)

PHYSICAL AND CHEMICAL PROPERTIES
ROADS AND GROUNDS AREA
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Chemicals (CAS No.)	Physical Form	General Chemical Class	Molecular Weight (g/mole)	Density (g/cm^3)	Solubility in Water (mg/l)*	Melting Point (°C)	Vapor Pressure (mmHg)*	Henry's Law Constant (atm m^3/mole)*	LOG Kow	LOG Koc	Biodegrada-bility	Bio-concentration Factor	Hydrolysis Rate	Photolysis Rate	Toxic
(Dyrene) Anilazine (101-05-3)	White to tan[5] crystals	Fungicide[5]	275.51[5]	NA	Insoluble[5]	159-160[5]	NA	NA	NA	NA	NA	NA	NA	NA	X
Glyphosphate (1071-83-6)	White[5] solid	Herbicide[5]	169.07[5]	NA	12000[5]	230	NA	NA	NA	NA	NA	NA	NA	NA	X
Lead (7439-92-1)	Heavy, soft grey[3] solid	Heavy metal	207.12	11.35[3]	Insoluble[3]	327.4[3]	NA	NA	NA	3.1** [4]	NA	300[4]	NA	NA	X
Lindane (58-89-9)	White/yellowish[3] powder or flakes	Insecticide[1]	290.85[1]	1.87[3]	7.3[1]	112.5[1]	5.57×10^{-5} [1]	2.92×10^{-6} [1]	3.61[1]	3.03[1]	High[1] (anaerobic)	Low [1]	Moderate[1] to high	Low[1]	X
Malathion (121-75-5)	Yellow liquids	Insecticide,[1] acaricide	330.36[1]	1.23[3]	143 @ 20°	2.9[1]	7.9×10^{-6} @ 20°	2×10^{-8} [1]	2.36[1]	2.4-3.3[1]	High[1]	Low[1]	High[1]	Moderate[1]	
Maleic Hydrazide (123-33-1)	Crystals[3]	Systemic[3] herbicide	112.10[1]		6000[1]	296-298[1]	Essentially[1] zero	NA	-0.84[1]	1.6-2.5[1]	Moderate[1] - high	5[1]	Low[1]	High[1]	X
MBC (Carbendazim) (10605-21-7)	Light[5] gray powder	Degradation product of benomyl	191.18[5]		8[5] @ 24°	302-307[5]	NA	NA	NA	NA	NA	NA	NA	NA	X
Methyl Bromide (74-83-9)	Colorless gas or[3] liquid	Soil fumigant[1]	94.95[1]	1.732 [3] @ 0°C	17500 [1] @ 20°	-93.66[1]	1633[1]	6.24×10^{-3} [1]	1.19[1]	2.2[1]	Low[1]	Low[1]	High[1]	Low[1]	X
Monuron (150-68-5)	White crystalline[3] solid	Herbicide[3]	NA	NA	Very low[3]	175[3]	NA	NA	NA	NA	NA	NA	NA	NA	
Oust (74222-97-2)	Off-white[6] solid	Herbicide[6]	NA	1.46[6]	Dispersible[6]	NA	NA	NA	NA	NA	NA	NA	NA	NA	X
Propoxur (114-26-1)	White[3] crystalline powder	Insecticide,[1] molluscicide	209.24[1]	NA	1750 @ 20[1]	91.5[1]	3×10^{-6} @ 20[1]	4.44×10^{-10} [1]	1.52[1]	1.9[1]	High[1]	Low[1]	High[1]	High[1]	X

TABLE 3-5 (Continued)

PHYSICAL AND CHEMICAL PROPERTIES
ROADS AND GROUNDS AREA
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Chemicals (CAS No.)	Physical Form	General Chemical Class	Molecular Weight (g/mole)	Density (g/cm^3)	Solubility in Water (mg/l)*	Melting Point (°C)	Vapor Pressure (mmHg)*	Henry's Law Constant (atm m^3/mole)*	LOG Kow	LOG Koc	Biodegrada-bility	Bio-concentration Factor	Hydrolysis Rate	Photolysis Rate	Toxic
Pyrethrum	Viscus liquid[3] mixture of cinering and pyrethrins	Natural insecticide[3]	NA	NA	Insoluble[3]	NA	Low[3]	NA	NA	NA	NA	NA	NA	NA	X
2,4-D (94-75-7)	White to yellow[3] crystalline powder	Herbicide[1]	221.04[1]	NA	682[1]	140.5[1]	1.05×10^{-2} [1]	1.37×10^{-10} [1]	2.81[1]	1.2-2.0[1]	High[1]	Very low[1]	Very low[1]	Moderate[1]	
2,4,5-T (93-76-5)	Light tan solid[3]	Herbicide[1]	255.49[1]	NA	278[1]	153[1]	$<7.5 \times 10^{-7}$ [1] @ 20°C	8.68×10^{-9} [5]	3.13[1]	1.9-2.4[1]	Moderate[1] to high	Low[1]	Low[1]	Moderate[1]	

Notes:

* - Value measured or estimated for 25°C unless otherwise noted.
1 - Howard, 1991.
2 - Verschueren, 1983.
3 - Sax and Lewis, 1987.
4 - Layton et al., 1986.
5 - Windholz, 1983.
6 - DuPont, 1992.
** - Log kd.
NA - Information not available or applicable.

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TABLE 3-6

POTENTIAL HAZARDOUS WASTES
ROADS AND GROUNDS AREA
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Waste	Hazard Constituent	Hazardous Waste Numbers	Hazard Code
Waste Oils (some of which may be ignitable)		D001	I
	Barium	D005	T
	Chromium	D007	T
	Lead	D008	T
Metallic Salt Contaminated Wastes	Arsenic	D004	T
	Barium	D005	T
	Cadmium	D006	T
	Chromium	D007	T
	Lead	D008	T
	Mercury	D009	T
	Selenium	D010	T
	Silver	D011	T

Notes: I = Ignitable
T = Toxic

Adapted from NWSCC RCRA Permit IN5 170023498.

RP/15EMRF/AA3

3.4.4.3 Migration and Dispersal Characteristics

In general, pesticides and herbicides exhibit low potential subsurface mobility attributable to relatively low water solubilities, low vapor pressures, moderate Henry's Law constants, and high partition coefficient values. Some compounds, however, are mobile and environmental fate and transport will vary from compound to compound. The following paragraphs present transport and removal characteristics for several of the pesticides and herbicides used at NWSCC. The discussions are based upon information from the Handbook of Environmental Fate and Exposure Data for Organic Chemicals (Howard, 1991).

When released to water, lindane is not expected to volatilize significantly. Hydrolysis in basic water may be significant. Lindane hydrolysis in acidic or neutral water is expected to be less significant. Release of lindane to soil will most likely result in volatilization and slow leaching to groundwater. Lindane may slowly biodegrade in aerobic media and will rapidly degrade under anaerobic conditions. Lindane has been reported to photodegrade in water despite lack of a photoreactive center.

If released on land, 2,4-D will biodegrade. It is not expected to appreciably adsorb to soils. Leaching to groundwater will likely be a significant process in coarse-grained sandy soils with low organic content or with very basic soils. If released to water, 2,4-D will be lost primarily via biodegradation. It will not bioconcentrate in aquatic organisms or appreciably adsorb to sediments, especially at basic pHs.

The compound 2,4,5-T has a high acid dissociation constant and will consequently be found in the dissociated form in all environmental media. If released to soil, it will biodegrade, limiting the extent of leaching to groundwater. Trichlorophenol and 2,4,5-trichloroanisol are the primary biodegradation products of 2,4,5-T. Degradation under aerobic conditions occurs more rapidly than under anaerobic conditions. When 2,4,5-T is released to water, it will be removed by photochemical decomposition, volatilization, and biodegradation.

If malathion is released to soil, it should moderately bind to soil, and will be subject to significant biodegradation and hydrolysis. In water, malathion should be subject to biodegradation and possibly photodegradation at the water surface. Hydrolysis in water may also be an important fate mechanism.

Chlordane tends to be persistent and immobile in soils. It can volatilize significantly from soil surfaces on which it has been sprayed; however, shallow incorporation into soil will greatly restrict volatile losses. In water, chlordane is not expected to undergo significant hydrolysis, oxidation, or direct photolysis. Although chlordane may rapidly volatilize from surface waters, adsorption to sediment significantly attenuates the importance of volatilization. Bioconcentration is also expected to be important.

Release of carbaryl to soil will result in photolysis at the soil surface at a rate dependent upon soil water content. Hydrolysis is expected to be rapid in neutral and basic soil. Carbaryl biodegradation has also been shown to be significant. Carbaryl may leach into groundwater because its soil adsorption coefficient is only moderate. In water, carbaryl will rapidly hydrolyze if the pH is neutral or basic. Photolysis will also be significant. Biodegradation of carbaryl may be significant at lower pH values.

Diazinon will exhibit moderate mobility in soil. Hydrolysis, photolysis, and biodegradation are all major fate processes for diazinon in soil. In surface water, it should moderately sorb to sediments, but should not significantly bioaccumulate in aquatic organisms. Photolysis, biodegradation, and hydrolysis may be important fate processes for diazinon released to natural waters. Volatilization may also be a very important transport mechanism.

Dieldrin released to soil will persist for long periods of time. It may enter the atmosphere either through evaporation or adsorption on dust particles and subsequent suspension in air. In water, dieldrin will adsorb strongly to sediments, bioconcentrate in fish, and slowly photodegrade.

Diuron is a highly adsorbed, highly persistent chemical in soil. In water, it will adsorb to sediment and slowly biodegrade after acclimation. In clear layers of surface water, diuron will degrade by sunlight irradiation in a matter of days.

Benomyl released to soil will not tend to leach, but volatilization may be significant. Hydrolysis of benomyl in soil is probably the most significant removal process, but biodegradation may also be significant. In water, benomyl will have a low to moderate tendency to sorb to sediments and will not significantly bioconcentrate. Hydrolysis will probably be the most significant removal process for benomyl in water, but biodegradation and photolysis may also be important.

Dursban released to soil can degrade by a combination of chemical hydrolysis and microbial degradation. The chemical hydrolysis is clay catalyzed. Volatilization is also expected to contribute to Dursban's loss from soil. It is tightly sorbed to soil and is not expected to leach significantly. Dursban will partition to sediments and will be susceptible to hydrolysis when released to water. Sorption to sediments does not effect hydrolysis in acidic or neutral water. The hydrolysis rate increases rapidly at high pH. Photolysis at the water surface may be significant during the midsummer. Significant bioconcentration may occur in aquatic organisms.

Maleic hydrazide may be removed from soil by microbial degradation and by leaching. It can generally be expected to be mobile in soils with low clay content and relatively immobile in soils with high clay content. Biodegradation and leaching will limit the significance of photolysis. If released to water, maleic hydrazide may undergo rapid photochemical decomposition. It may also biodegrade in natural waters. Hydrolysis, bioconcentration, adsorption, and volatilization should not be significant removal or transport mechanisms.

Propoxur released to soil is expected to leach to groundwater. However, it is highly persistent in soil. In alkaline soils, hydrolysis may be an important transformation mechanism. Propoxur in surface layers of water will photolyze relatively rapidly. Biodegradation will also occur, and increases with temperature, high microbial populations, the presence of mud and biota, and increasing pH. Volatilization, adsorption, and bioconcentration are not important fate processes.

The migration and dispersal characteristics of asphalt and the petroleum-derived wastes at the Roads and Grounds Area will vary with the hydrocarbon structure. For example, straight chain hydrocarbons tend to be more biodegradable than corresponding branched hydrocarbons, more soluble hydrocarbons tend to be more biodegradable and more volatile than insoluble hydrocarbons, and unsaturated hydrocarbons are more quickly biodegraded than corresponding saturated compounds. The heavier hydrocarbon wastes such as carbon black, bituminous asphalt, and bituminous oil are practically insoluble and nonvolatile. These wastes should not migrate or transform appreciably.

Potential subsurface mobility of heavy metals in waste oils ranges from low (chromium III, lead) to high (chromium VI). Some inorganic compounds may be present as volatile species which enhances their mobility. Dowdy and Volk (1983) reviewed research data related to metal transport. In soil materials, metals occur on exchange sites, are incorporated into or on the surface of crystalline or noncrystalline inorganic precipitates, are incorporated into organic compounds, and are present in solution. Movement of metals in natural soils is generally considered minimal because of low solubilities. Metals are often chelated or complexed with organic materials. The chelated compounds may be more soluble than inorganic precipitates. Metal movement will more likely occur for sandy, acid, low organic matter soils which receive high rainfall. Even under these conditions, however, the extent of metal movement will be limited. Most movement will occur through open channels where the soil has little opportunity for metal attenuation. More specific information for some of the metals is presented below. No further migration or dispersal characteristics for barium was found.

Chromium may occur in more than one oxidation state in subsurface matrices. Trivalent form (chromium III) is dominant under pH and redox conditions generally present in the subsurface. Chromium III may be converted to the more mobile and toxic hexavalent form (chromium VI) under oxidizing conditions. Chromium III is readily adsorbed in the subsurface while chromium VI is not (USEPA, 1990).

Dominant species of lead in aqueous solution are Pb^{2+} under acidic conditions and Pb^{2+}-carbonate complexes under alkaline conditions. Adsorption behavior correlates with cation exchange capacity (CEC) of soil and aquifer material. Adsorption/precipitation increases with increasing pH, with most Pb precipitating out at pH>6. Volatile alkylated-Pb compounds may be present or may form under reducing conditions (USEPA, 1990).

3.5 CONCLUSIONS AND RECOMMENDATIONS

Background data and site observations were reviewed to determine the likelihood of releases posing a potential threat to human health or the environment. Data and observations pertinent to the Roads and Grounds Area were reviewed to assess the potential for contaminant releases to groundwater, surface water, air, subsurface gas, and soil. Data were interpreted and release determinations were made according to the approach described in RCRA Facility Assessment Guidance (USEPA, 1986). Based upon the information and conclusions presented, medium-specific recommendations are made concerning the need for continuing RFI corrective actions.

At the Roads and Grounds Area, potential releases to groundwater may have occurred based on unit type and design (open land and underground and aboveground storage tanks), lack of engineered structures to prevent releases, unit age, and locational characteristics including soil conductivity. Characteristics of some of the waste constituents (such as some waste oil compounds and some pesticides) suggest susceptibility for leaching to groundwater. Visual evidence of tar releases and waste oil stains also indicate the potential for releases to groundwater.

Direct releases to groundwater may occur if leaking underground storage tanks are positioned at depths near to or intercepting the water table. Indirect releases to groundwater may occur when chemical desorption from contaminated soil infiltrates through the vadose to the unsaturated zone. Phase II Release Assessments to verify the presence or absence of groundwater contamination are recommended in relation to present or former underground storage tanks at the following locations:

- Building 2801 containment area.
- Service pump west of Building 2801.
- Former asphalt batch plant.

A Phase II investigation to assess groundwater contamination occurring secondarily following contaminant release from impacted soil may not be warranted until after the nature of impacts to soil has been determined. However, additional groundwater studies may be required as part of a Phase III Release Characterization based on results of a Phase II Release Assessment for soils in the Roads and Grounds Area.

Releases to surface water were determined to have occurred based on the lack of engineered features to control runoff, the slope of the terrain, and the proximity of surface water. Direct evidence of release to surface water included observations of oily residues as surface water sheen and asphalt materials in drainageways.

A Phase II Release Assessment of surface water and sediment are recommended at the following locations within this SWMU:

- Drainageway between Buildings 2801 and 2693.
- Drainageways at former asphalt batch plant.
- Drainageway/stream bed parallel to Highway 99 south of Roads and Grounds Area.
- Drainageway flowing south-southeast between Buildings 2801 and 2693 and under Highway 99.
- Stream bed north of intersection with Highway 99.

Releases to soil were identified based on unit characteristics including unit type (land based) and lack of engineered structures to prevent release, unit operating procedures, and unit age. Runon and runoff to and from this area are uncontrolled, and stained soils were observed in conjunction with the aboveground waste oil storage tank and the embankment southwest of Building 1833.

Within the Roads and Grounds Area, Phase II Release Assessment sampling activities to verify the presence or absence of hazardous constituents in soils are recommended at the following locations or areas:

- Building 2801 aboveground storage tank.
- Building 2801 underground storage tank.
- Building 2801 drum storage area (waste oil tank containment area).
- Building 2801 UST and service pump.
- Former Asphalt Batch Plant area surface soils.
- Former Asphalt Batch Plant UST areas.
- Railroad embankment southwest of Building 1833.
- Retaining wall near Building 1833.
- Tar storage tank area.

- Building 2716 loading ramp.
- Washout rack area near Building 2716.
- Ravine south of Roads and Grounds Area.
- Equipment/vehicle wash facility.
- Aboveground fuel storage tank area for Building 2717.
- Aboveground fuel storage tank area for Building 2718.
- Ravine south of Building 2717 (debris area).
- Ravine near Building 2818 (filled area).
- Ravine south of Building 2718 (debris area).

Phase II or III investigations to determine the presence or absence of underground storage tanks or buried railroad box cars, or to evaluate soil or groundwater impacts in these areas, may involve indirect (geophysical) methods or direct methods (boring or monitoring well installation and soil or groundwater sampling).

Drum sampling is recommended for drums of unknown contents or origin, for example, in the debris areas south of Building 2717 and 2718.

Based on the information available, it is unlikely that releases to air and subsurface gas at the Roads and Grounds Area constitute a potential threat to human health or the environment.

Potential releases at the Roads and Grounds Area are summarized on Table 3-7.

RP/15EMRF/AA7

TABLE 3-7

POTENTIAL RELEASES
ROADS AND GROUNDS AREA
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Media	Release	Suspected Contaminants[3]
Groundwater	Potential[2]	Pesticides, Hydrocarbons
Surface Water	Occurred[1,2] Potential[2]	Asphalt Pesticides
Soil	Occurred[1,2] Potential[2]	Asphalt, Hydrocarbons Pesticides
Air	Unlikely	--
Subsurface Gas	Unlikely	--

NOTES:

1 Observed.
2 Reported.
3 See Table 3-4 for individual compounds.

RP/15EMRF/AA3

4.0 SWMU #14/00: SANITARY LANDFILL AND LITHIUM BATTERY

4.1 BACKGROUND

4.1.1 Location and Description

The Sanitary Landfill is located near the western boundary of NWSCC (Figure 2-5). The Sanitary Landfill is an active 65-acre landfill which began operations in 1972 and replaced the Old Burn Pit. The landfill currently receives trash and garbage from production operations and residential and food preparation areas. Special approval was granted by the Indiana State Bureau of Health (ISBH) in 1981-82 to bury neutralized lithium batteries in the landfill. Figure 4-1 shows the Sanitary Landfill.

4.1.2 Legal Description

The legal description of the Sanitary Landfill includes the southern 1/2 of the NE 1/4 and part of the northern 1/2 of the SE 1/4 of Section 6, part of the SW 1/4 of the SW 1/4 of the NW 1/4, and part of the western 1/2 of the NW 1/4 of the SW 1/4 Section 5, Township 4 North, Range 4 West, Martin County, Indiana.

4.1.3 Contiguous Property

The western boundary of NWSCC lies to the west of the Sanitary Landfill. Electric transmission lines, a conservation dam, and high explosive magazines are located south of the Sanitary Landfill. To the east lie Williams Cemetery and more high explosives magazines, and to the north lies the NWSCC Golf Course. In addition, an area approximately 1/4-mile north of the Sanitary Landfill was identified in the Installation Assessment Relook Program (Fox-Dial, 1985) as a trench-method landfill. According to the Relook study, the landfill was operated from 1953 to 1958. NWSCC personnel, however, reported that this area was a coal mine operated by the Navy from 1942 to 1950 (NWSCC, 1992b).

4.1.4 Ownership and Operation

The Navy-owned and operated Sanitary Landfill began accepting paper, wood, metal, and putrescible wastes in 1972. Landfilling was accomplished by the trench and fill method utilizing 23 disposal cells (Figure 4-2). Area fill waste disposal is currently employed in an area to the southeast of the filled trenches.

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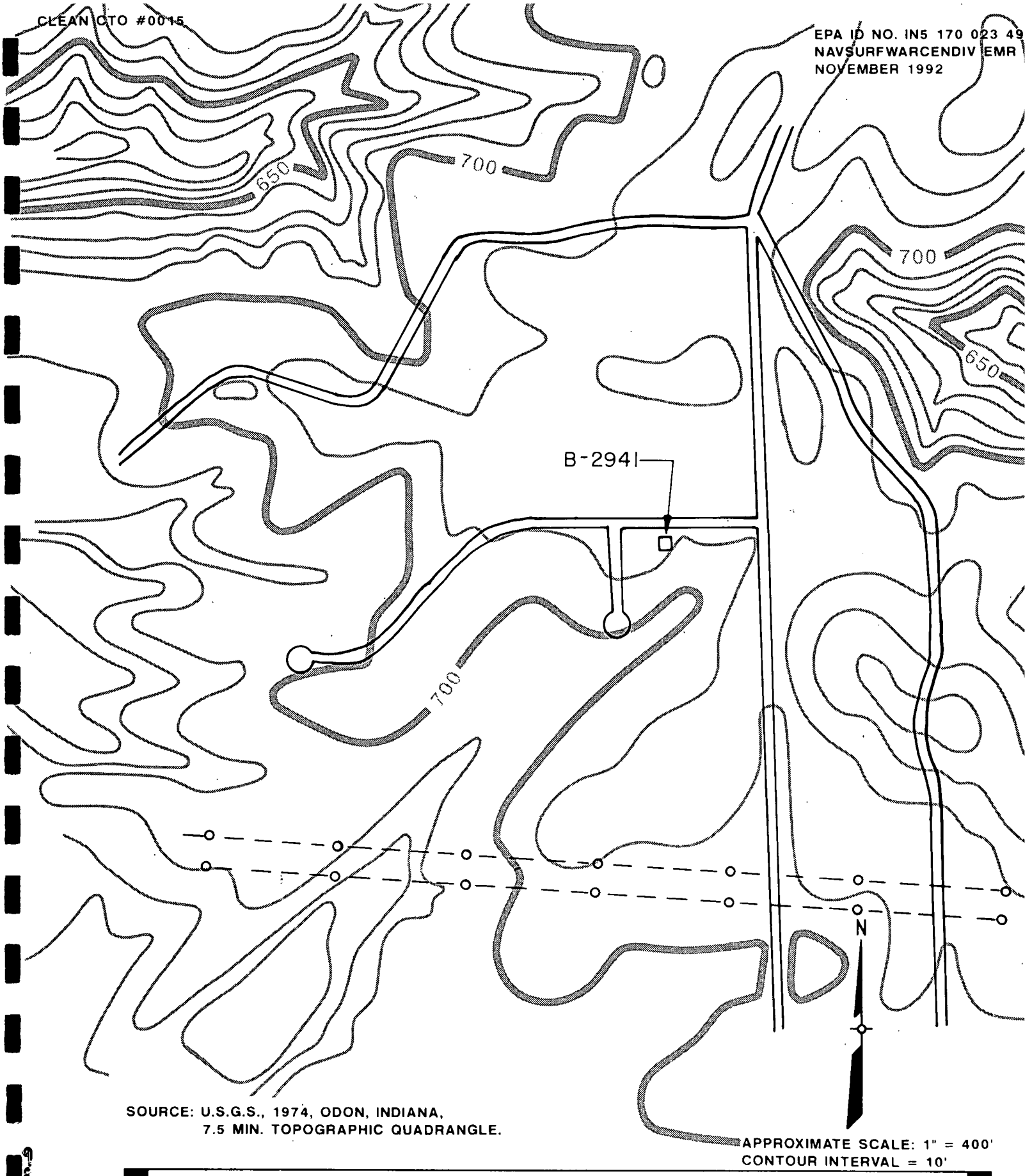
NOVEMBER 1992



SOURCE: U.S.G.S., 1974, ODON, INDIANA,
7.5 MIN. TOPOGRAPHIC QUADRANGLE.

APPROXIMATE SCALE: 1" = 400'
CONTOUR INTERVAL = 10'

NOVEMBER 1992

FIGURE 4-1
SWMU #14/00 :
SANITARY LANDFILL AND LITHIUM BATTERY
ENVIRONMENTAL MONITORING REPORT

NAVSURFWARCENDIV
CRANE, INDIANA

20602

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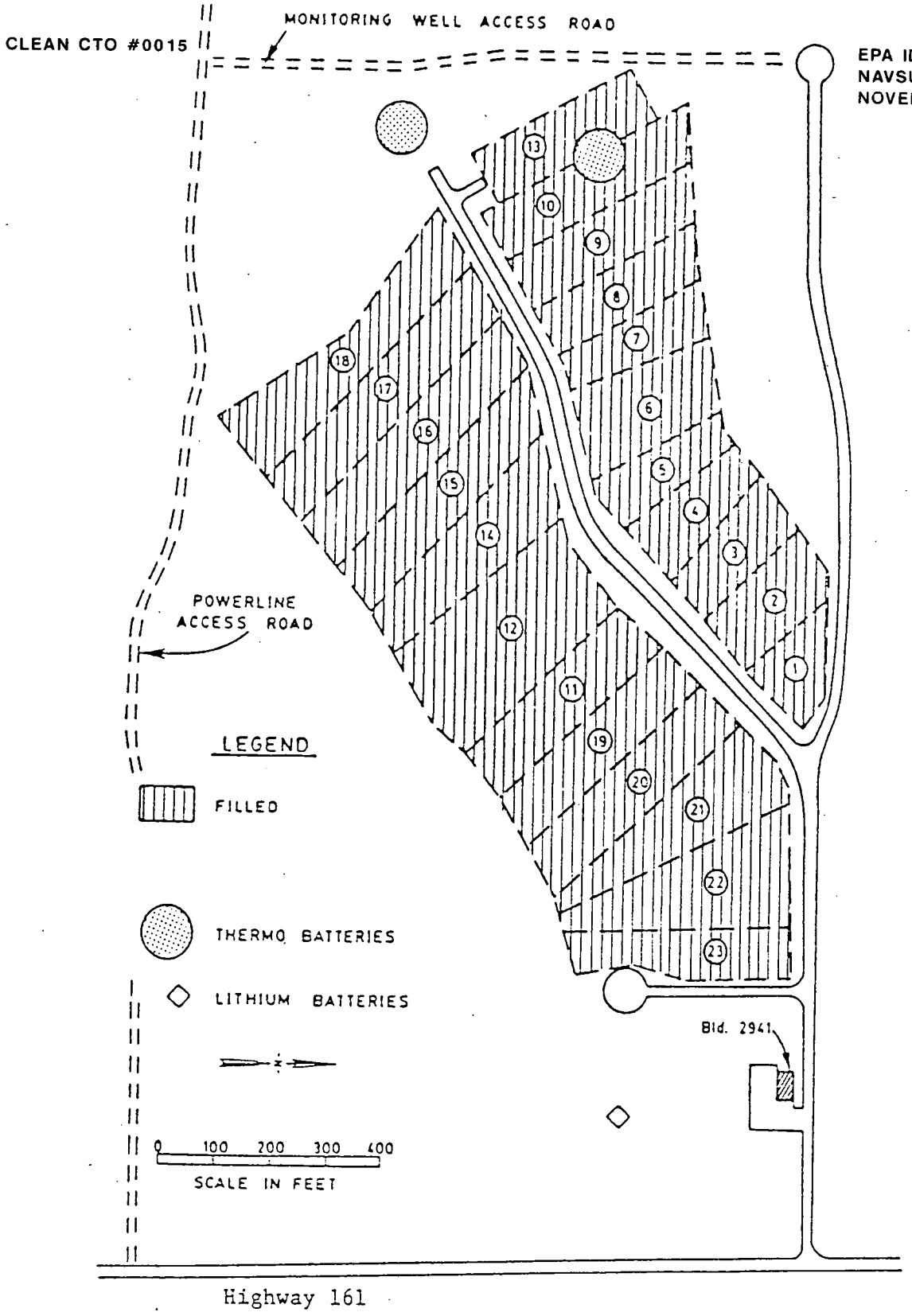
L-10985

14/00



SOURCE: DUNBAR, APRIL 1984

NOVEMBER 1992

FIGURE 4-2

SANITARY LANDFILL WASTE DISPOSAL CELLS

ENVIRONMENTAL MONITORING REPORT

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CRANE, INDIANA

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4.2 PHYSICAL CHARACTERISTICS

4.2.1 Topography

The Sanitary Landfill is located in an upland area in the west-central section of NWSCC adjacent to its western boundary. According to topographic contours reported on a plan sheet (PWO Drawing No. 5316), the maximum elevation at the Sanitary Landfill is 716.3 feet MSL. Elevations for future construction proposed on the same plan sheet specify a maximum finished grade elevation of 722 feet MSL. The Sanitary Landfill is characterized by relatively gentle topographic relief with existing elevations ranging from approximately 702 to 716 feet MSL. Figure 4-1 presents the Sanitary Landfill with topography superimposed from the United States Geological Survey (USGS) Odon, Indiana 7.5-minute quadrangle.

4.2.2 Physiography and Hydrology

Surface runoff at the Sanitary Landfill is almost exclusively to the west, southwest, and to a lesser extent the northwest. Surface runoff from the Sanitary Landfill is diverted to intermittent drainageways in these directions. A manmade surface water impoundment is located approximately 600 feet southwest of the Sanitary Landfill. The area of this impoundment was calculated to be approximately 0.85 acres according to the topographic quadrangle (USGS, 1974).

Surface runoff collected in intermittent drainageways, and flowing out of the surface water impoundment enters Seed Tick Creek 3,000 to 5,000 feet from the landfill boundaries. Seed Tick Creek flows in a south-southeasterly direction exiting the southern boundary of NWSCC. Seed Tick Creek eventually merges with Boggs Creek south of NWSCC. Boggs Creek continues to flow south to merge with the east fork of the White River.

4.2.3 Geology

4.2.3.1 Soil

Detailed soil mapping in the vicinity of the Sanitary Landfill indicates the presence of four soil units (Figure 4-3). These soil units, in descending order of percent coverage, include Hosmer silt loam, Wellston silt loam, Udorthents (silty), and Zanesville silt loam. The active landfill area is mapped as covered by Udorthents.

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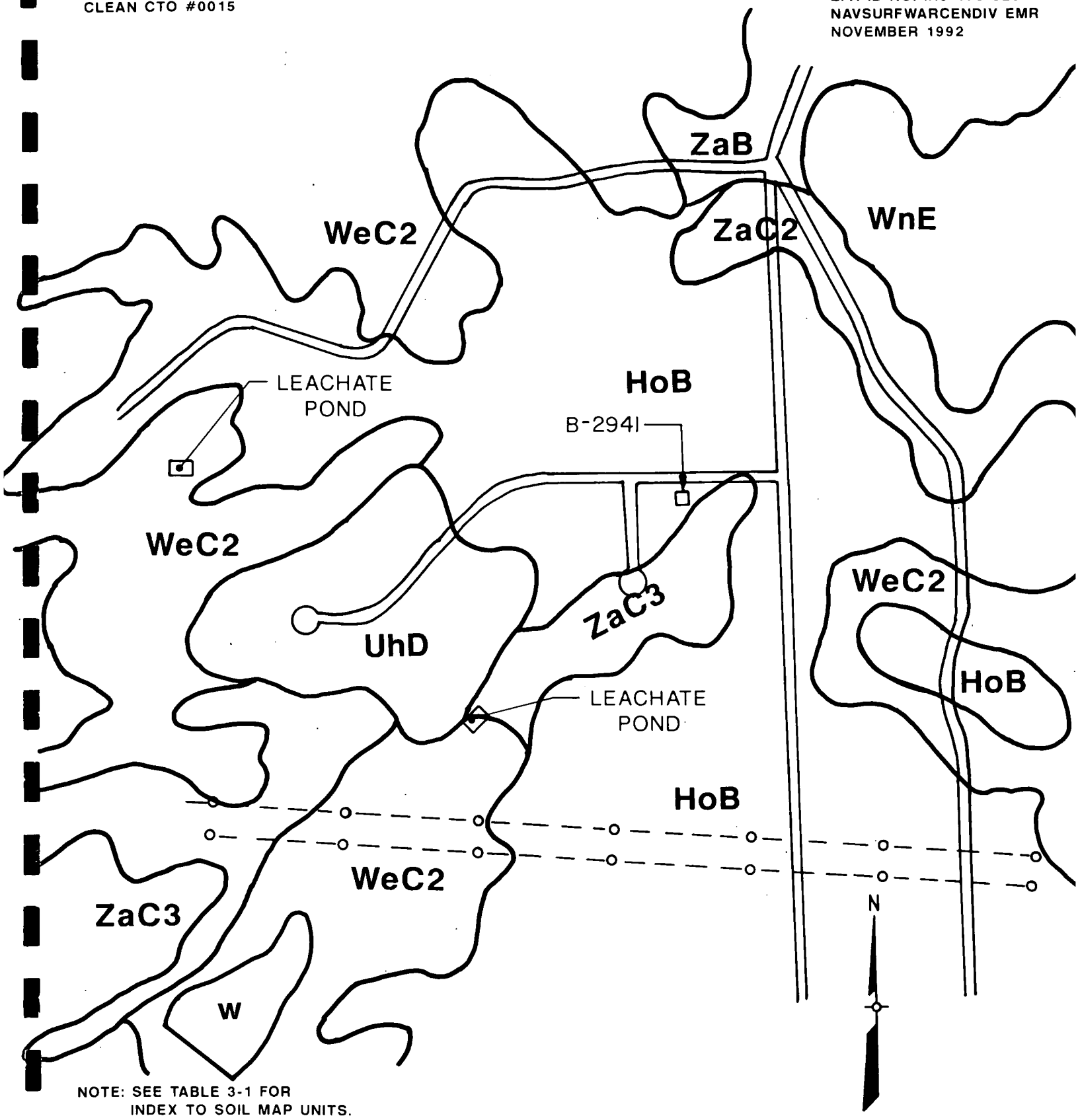

NOTE: SEE TABLE 3-1 FOR INDEX TO SOIL MAP UNITS.

SOURCE: McELRATH, 1988

APPROXIMATE SCALE: 1" = 400'

NOVEMBER 1992

FIGURE 4-3
SOIL MAP FOR SWMU #14/00 : SANITARY LANDFILL
ENVIRONMENTAL MONITORING REPORT
NAVSURFWARCENDIV
CRANE, INDIANA

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The Hosmer silt loam in the vicinity of the Sanitary Landfill is described as gently sloping (2 to 6 percent slopes). These soils are commonly found on upland ridgetops and loess-capped lake plains. Bedrock in areas mapped as covered with Hosmer silt loam generally occurs at depths greater than 6.5 feet. USCS classifications for the Hosmer silt loam include silt (ML), clayey silt (CL-ML), and clay (CL).

Hydraulic conductivities reported for the Hosmer silt loam vary with depth due to the presence of a fragipan zone occurring at a depth of 23 to 27 inches. Hydraulic conductivity above the fragipan is described as moderate and ranges from 4.2×10^{-5} cm/sec to 1.4×10^{-3} cm/sec. Surface runoff is medium. The organic matter content of the upper layer is moderate, ranging from 1 to 3 percent. Soil pH in the Hosmer silt loam commonly ranges from 4.0 to 7.3.

The second most abundant soil in the vicinity of the landfill is the Wellston silt loam. In the vicinity of the landfill, Wellston soil is moderately sloping (6 to 12 percent) and is commonly found along ridgetops and sideslopes along drainageways in upland areas. Wellston soil is generally considered deep, having a thickness of greater than 5 feet. USCS classifications for Wellston soil include silt (ML), clay (CL), clayey silt (CL-ML), sandy clay (SC), and silty sand (SM).

The range of hydraulic conductivity reported for the Wellston soils is 4.2×10^{-4} cm/sec to 1.4×10^{-3} cm/sec. Due to the slope and hydraulic conductivity, surface runoff is rapid and the soil is considered well drained. The organic matter content in the surface layer of Wellston soil is moderate (1 to 3 percent). Soil pH in the Wellston soil commonly ranges from 4.5 to 6.5 (McElrath, 1988).

Soils mapped as silty Udorthent is found almost exclusively in areas used as landfill. As an Udorthent, this soil type is the result of excavation activities. Excavation activities have produced a moderately to strongly sloping soil surface. The thickness of this soil type and depth to bedrock are variable due to the excavation activities that produced them.

Hydraulic conductivity in Udorthents is considered to be moderate and range from 4.2×10^{-4} cm/sec to 1.4×10^{-3} cm/sec. Surface runoff is commonly rapid due to slope. A trace to no organic matter is found in the surface layer of Udorthent soils (McElrath, 1988).

The final soil type found in the vicinity of the Sanitary Landfill is the Zanesville silt loam. This soil unit is moderately sloping (6 to 12 percent slopes) and is commonly found on ridgetops and the upper sideslopes within natural drainageways in the uplands. Zanesville silt loam soil is considered to be deep, and bedrock is generally encountered at depths of 6 feet or more. The soil unit can be vertically divided into several zones, due

to the presence of a fragipan commonly occurring at an average depth of 23 to 31 inches. USCS classifications for Zanesville silt loam soil include clayey silt (CL-ML), clay (CL), silt (ML), sandy clay (SC), silty sand (SM), and silty gravel (GM).

Hydraulic conductivities within the Zanesville silt loam soil unit vary due to vertical variations in the soil. Hydraulic conductivity above the fragipan is reported as moderate and varies from 4.2×10^{-4} cm/sec to 1.4×10^{-3} cm/sec. Hydraulic conductivity within the fragipan zone ranges from 4.2×10^{-5} cm/sec to 1.4×10^{-4} cm/sec. Hydraulic conductivity beneath the fragipan increases slightly, ranging from 1.4×10^{-4} cm/sec to 4.2×10^{-4} cm/sec. Surface water runoff is reported to be rapid. The organic matter in the surface layer is low ranging from 0.5 to 1.0 percent. Soil pH in the Zanesville silt loam ranges from 4.5 to 5.5.

4.2.3.2 Bedrock

The bedrock surface beneath the Sanitary Landfill is composed of sandstone, shale, and limestone of the Pennsylvanian Age Raccoon Group (Department of the Army, 1978). Subsurface exploration at the landfill has included monitoring well installation and auger and split-spoon borings. Landfill area borings (Appendix D) indicate approximately 4 to 16 feet of surficial soils comprised of silt, clay and sandy clay, overlying sandstone and shale bedrock with occasional stringers of coal (NEESA, 1983).

4.2.4 Hydrogeology

Based on information reported by the Geotechnical Laboratory of the U.S. Army Engineer Waterways Experiment Station (Dunbar, 1984a), groundwater occurs between approximately 4 and 24 feet beneath the Sanitary Landfill at elevations between approximately 674 feet MSL and 707 feet MSL. Historical groundwater levels are presented in Appendix E.

Groundwater flow within the surficial soils and the shallow bedrock is primarily to the west and southwest (Figure 4-4). Based on the groundwater contour map presented on Figure 4-4, horizontal hydraulic gradients average approximately 0.020 ft/ft. Based on groundwater elevations presented in Table 4-1, calculations (by the HALLIBURTON NUS Team) of vertical hydraulic gradients between nested pairs of monitoring wells around the perimeter of the filled trenches indicate relatively strong downward gradients ranging between approximately 0.320 ft/ft and 0.890 ft/ft.

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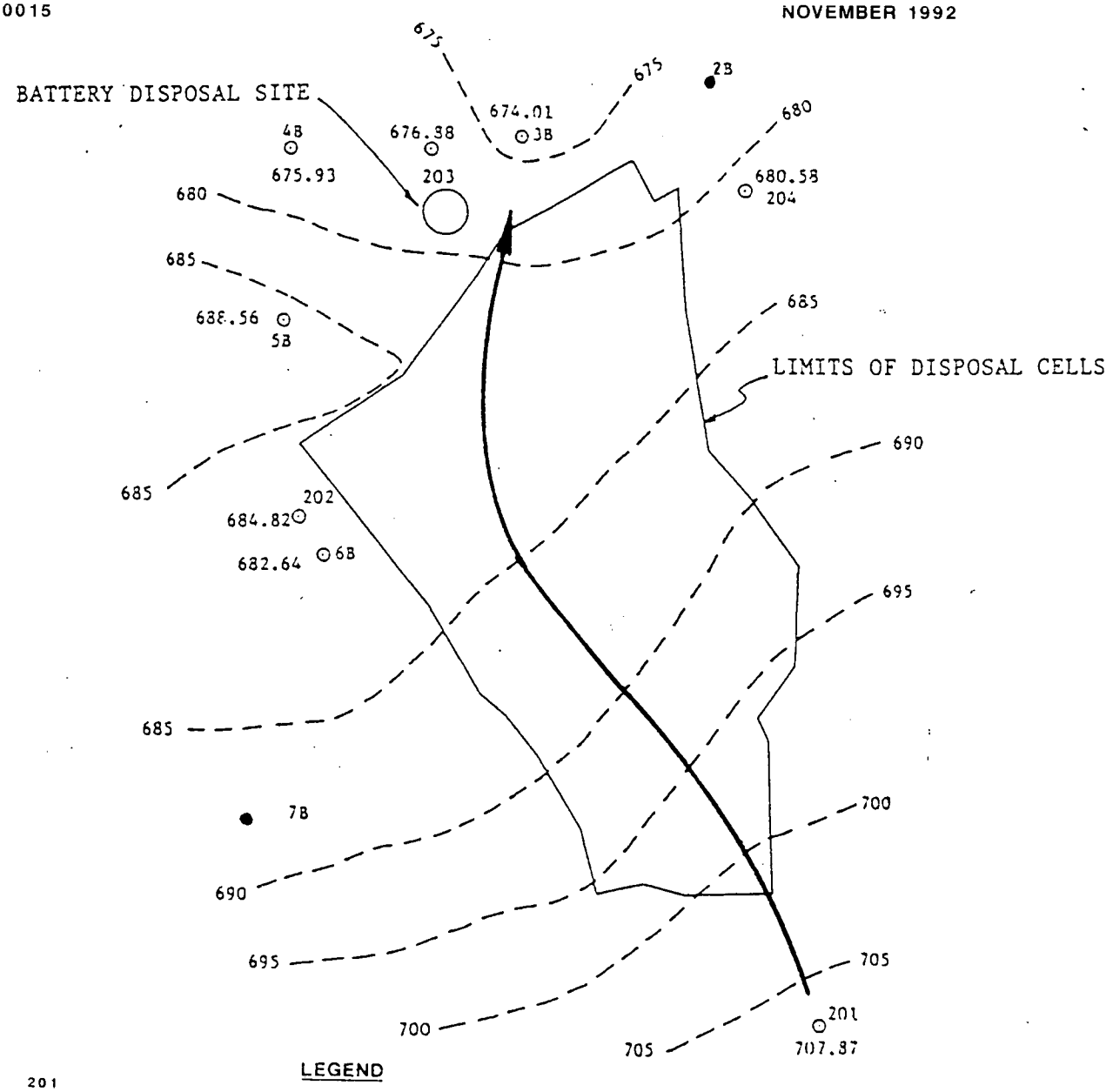

LEGEND

201
707.87 ⊙ MONITORING WELL WITHGROUNDWATER ELEVATION IN FEET MSL (WATER LEVELS MEASURED 11 JUNE 1982)

7B ● DRY MONITORING WELL

695 — — GROUNDWATER CONTOUR IN FEET MSL

GROUNDWATER FLOW DIRECTION

0 200 400 FT
SCALE

SOURCE: DUNBAR, APRIL 1984

NOVEMBER 1992

FIGURE 4-4
SANITARY LANDFILL GROUNDWATER CONTOUR MAP
ENVIRONMENTAL MONITORING REPORT
NAVSURFWARCENDIV
CRANE, INDIANA

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TABLE 4-1

MONITORING WELL INSTALLATION SUMMARY
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Well No.	Top of Pipe Elevation (ft MSL)	Bottom of Screen[1] (ft MSL)	Depth to Water	Water Elevation[2] (ft MSL)
1A	713.57	672.32	27.33	686.24
1B	713.62	694.32	19.50	694.12
2A	671.56	629.86	25.10	646.46
2B	671.78	657.68	14.80	656.98
3A	677.64	631.39	35.50	642.14
3B	677.91	667.11	3.90	674.01
4A	687.95	640.45	18.70	669.25
4B	687.93	661.03	12.0	675.93
5A	693.69	651.69	19.10	674.59
5B	693.66	675.86	5.10	688.56
6A	688.51	646.21	6.90	681.61
6B	688.64	673.74	6.0	682.64
7A	711.04	669.04	29.50	681.54
7B	711.11	681.31	24.30	686.81
201	714.82	704.12	7.0	707.82
202	688.72	680.62	4.50	684.22
203	684.38	672.38	7.50	676.88
204	686.38	676.38	5.80	680.58

1 Wells designated as "A" reportedly were constructed with 1- to 2-foot screens. Wells designated as "B" were constructed with 3-foot screens. Wells 201 through 204 reportedly have 1- to 2-foot screens.

2 Water levels measured June 11, 1982.

Source: Dunbar, 1984a.

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4.3 PERMITS

4.3.1 Air

The Sanitary Landfill, according to the Navy, does not require any air permits (NWSCC, 1991b).

4.3.2 Groundwater

No permits specific to groundwater are required for the Sanitary Landfill (NWSCC, 1991b). Under the NWSCC's Operating Permit for Sanitary Landfill Operation (see Section 4.3.4), however, groundwater monitoring wells are required to be sampled on a quarterly basis.

4.3.3 Surface Water

No outfalls in the immediate vicinity of the Sanitary Landfill are monitored under NWSCC's NPDES permit. No other surface water permits are required (NWSCC, 1991b).

4.3.4 Soil

The Sanitary Landfill is authorized to operate by Operating Permit No. 51-2 issued by the ISBH. A copy of the 1988-1990 permit is presented as Appendix F. A more recent copy was not available during review of Navy files. A summary of available correspondence concerning this permit is presented in Table 4-2.

4.4 SWMU #14/00 EVALUATION

This section describes operations and maintenance, existing data, reconnaissance, and waste characteristics associated with the Sanitary Landfill.

4.4.1 Operations and Maintenance

4.4.1.1 Operations

As previously mentioned, the Sanitary Landfill was opened in 1972 for disposal of paper, wood, metal, and putrescible materials. Landfilling progressed by trench and fill methods with each trench or cell having approximate dimensions of 100 feet wide, 300 to 500 feet long, and 8 feet deep. Within the bottom of each trench a shallow trench was dug, and a 4- to 6-inch perforated plastic pipe was buried and backfilled with fine gravel

TABLE 4-2

SUMMARY OF PERMIT CORRESPONDENCE
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Source	Date	Requested/Denied/Received
	10-24-80	Construction Plan Permit issued (SW 239).
Part B RCRA Permit Application	2-28-83	Sanitary Landfill Operating Permit No. 51-2 for NWSCC's sanitary landfill was renewed by the Indiana State Board of Health on 2-28-83.
Indiana State Board of Health (ISBH)	12-3-84	Letter notifying expiration of 2-year Operating Permit No. 51-2. Expires 4-1-85. Application forms enclosed.
Indiana Department of Environmental Management (IDEM)	9-6-85	Renewal of Operating permit granted. Expires 9-1-87.
NWSCC	8-26-87	Application for Construction/Operating permit for Solid Waste Management facilities.
IDEM	5-5-88	Granted amendment to Construction Plan Permit SW-239 and renewal of Operating Permit No. 51-2. Approved the amended plans and specifications submitted 8-31-87.
NWSCC	1-31-90	Application for renewal of Operating Permit for Sanitary Landfill. Due to expire 6-90.

Source: NWSCC Environmental Protection Division Reference File 5090/LF1.1.

RP/15EMRF/AA3

(Snell Environmental Group, Inc., 1977). The purpose of this drain was to remove rain water during cell excavation, and subsequently serve as a leachate drain. Leachate is conveyed to two fenced-in ponds at the northwest and south ends of the landfill. Each leachate collection pond is approximately 40 feet by 60 feet by 5 feet deep, with an estimated storage capacity of 40,000 to 50,000 gallons (Dames & Moore, 1992). Perforated laterals connect each cell to 8-inch collection pipes at a series of manholes. The leachate pond outfall was connected to the sanitary sewer in 1981 (NWSCC, 1992b).

The sequence of trench construction and filling is not entirely clear. The Installation Assessment Relook Program (Fox-Dial, 1985), identified the presence of 3 large trenches in 1974 as well as what appeared to be the western leachate collection pond. At the time of preparation of the Landfill Operational Plan (Snell Environmental Group, Inc., 1977), the first nine cells had been constructed, Cell No. 1 was being used as a hot pit (isolated burial of spontaneously combustible materials), and Cell No. 7 was being filled (Figure 4-2). The Crane Sanitary Landfill consolidated profiles (PWO Drawing No. 4638) indicate that the first 12 trenches were completed prior to 1980. PWO Drawing No. 4638 also indicates initiation dates for filling of Trench Nos. 13, 14, 15, and 17 as March 1980, March 1982, January 1985, and July 1983, respectively. Dunbar (1984a) reports filling of Trench Nos. 1 through 15, and Trench No. 17 as complete.

A 1987 Permit Amendment Application for the landfill (Reid, Quebe, Allison, Welcox & Associates, Inc., 1987) outlined plans to shift to area fill methods at the completion of trench and fill methods. Area fill was to be over the original landfill trenches (Nos. 1 through 9, 11, 12, 14, and 15 through 23).

It is not known if area fill was developed over the completed trench and fill area. Currently, area fill methods are employed in an approximately 37-acre area to the southeast of the completed trenches, with current fill encompassing approximately 10 acres (NWSCC, 1991c). It is believed that area fill was not placed over the completed trenches, but rather initiated in the area encompassing current operations.

4.4.1.2 Maintenance

There is no known regular leachate sampling or regularly scheduled leachate collection system clean-out. The Sanitary Landfill is periodically inspected by the Indiana Department of Environmental Management (IDEM). Inspection reports are summarized in Table 4-3.

TABLE 4-3

SUMMARY OF SANITARY LANDFILL INSPECTION REPORTS
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Inspection Date	Violations
7-10-91 to 9-30-91	No violation
4-25-91	Problems with cover soil
9-14-90	Require slope improvements, cover exposed solid waste, no violations
6-30-89 to 3-5-90	No violation
5-30-89	Violations: #5, surface drainage; #8, leachate surfacing just below work area; #31, weekly cover; and #16, roll bars & fire extinguishers not installed on operating equipment
1-25-85 to 5-30-89	No violation
9-18-84	Violations: #23, final cover; and #24, final grading & seeding (north slope)
6-21-84	Violation: #24, final cover
5-1-84	Violation: #24, final cover
3-6-84	Violations: #5, surface wet; and #24, final grading wet
1-24-84	Violations: #22, daily cover not being applied; #24, final grading (north slope); and #29, operating equipment deficiencies
12-9-83	Violation: #24, final grading and seeding
7-26-83 to 9-19-83	No violation
4-5-83	Violations: #5, surface water (standing water over top past filled between trenches 10 & 13); and #23 & 24, final cover & final grading (north end)
1-4-83	Violations: #5, surface water (standing water over top past filled between trenches 10 & 13); and #23 & 24, final cover & final grading (north end)

TABLE 4-3 (Continued)

SUMMARY OF SANITARY LANDFILL INSPECTION REPORTS
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Inspection Date	Violations
11-3-82	Violations: #5, surface drainage (standing water between trench 12 & 13); #14, salvage materials; and #23 & 24, final cover and final grading
6-28-82 to 8-11-82	No violation
4-15-82	Violation: #23, erosion of final cover
11-12-81 to 2-5-82	No violation
7-24-81	Violation: #23, final cover
6-10-81	Violations: #5, surface drainage and #8, leachate off-site
1-30-81	No violation
9-29-80	Violations: #24, final cover; and #30, absence of approved permit plans
6-10-80	Violation: #30, absence of approved permit plans
3-11-80	Violations: #30, absence of approved permit plans; and #5, surface drainage
12-17-79	Violations: #5, surface drainage; #7, leachate seeping; #23, final cover; 24, final grading; and #30 absence of approved permit plans
10-11-79	Violations: #10, blowing litter; #22, daily cover (operational problem); and #30, absence of approved permit plans
7-19-79	No violation (Note: Installation of methane gas vents)
3-16-79	No violation

No information is available for inspections prior to March 1979 (NWSCC, 1991c).

Source: NWSCC Environmental Protection Division Reference File 5090/LF2.0.

RP/15EMRF/AA3

A Basis of Design Report prepared by Dames & Moore (1992) details the proposed replacement of the existing leachate collection ponds by two new lined ponds with increased capacities on the order of 40 to 60 percent. Additional IDEM design requirements include leak detection systems and emergency storage capacity (Dames & Moore, 1992).

4.4.2 Existing Data Assessment

This section reports monitoring devices, analytical data, types and volumes of waste, spills or releases, and potential migration pathways for SWMU #14/00.

4.4.2.1 Monitoring Devices

A total of 18 groundwater monitoring wells have been installed at the Sanitary Landfill (Dunbar, 1984a). Eleven of the wells intersect the water table at depths generally less than 20 feet, and seven wells are completed within bedrock at depths of more than 40 feet. Well construction reportedly consists of 4-inch diameter PVC with 1- to 2-foot screens (Dunbar, 1984a). Well construction is summarized in Table 4-3 and well construction diagrams are included in Appendix G. Quarterly groundwater quality monitoring is performed.

4.4.2.2 Analytical Data

Some special wastes have been analyzed for hazardous characteristics prior to disposal in the Sanitary Landfill. These wastes are defined under 329 IAC 2-21 and require a state approval prior to disposal. These wastes were previously defined as hazardous under 330 IAC-4. Regulation 330 IAC-4 has since been repealed. Special waste analyses are summarized in Table 4-4. None of the analyses indicate that the special wastes are RCRA characteristic hazardous wastes as defined under 40 CFR 261.

Fuel-oil and gasoline contaminated soils have also been disposed as special wastes. Table 4-5 presents soil analytical data collected during UST excavations at NWSCC. It is assumed that these soils were disposed in the Sanitary Landfill. One of the excavated tanks was located at the Maintenance Building near the landfill (B-2941).

Surface runoff and stream contamination from the Sanitary Landfill were evaluated as part of a 1979 study (Mason & Hanger, Silas Mason Company (MHSM), 1979). Seven areas were sampled. These locations are shown on Figure 4-5 and described below.

- L1: Northwest leachate pond.
- L2: Surface drainage from the northwest portion of the landfill, including overflow from the northwest leachate pond

TABLE 4-4

SPECIAL WASTE ANALYSES
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Units: ppm

	RCRA EP Toxicity Guidelines	Inert Filler #1* 1985	Inert Filler #2** 1985	Sandblast/Paintchip Residue-1987 #1	#2	#3	#4
EP Tox-Arsenic	5.0	0.007	<0.004	<0.02	<0.02	<0.02	<0.02
EP Tox-Barium	100.0	<1.0	<3.0	<0.14	<0.14	<0.14	<0.14
EP Tox-Cadmium	1.0	<0.01	0.05	<0.01	<0.01	<0.01	<0.01
EP Tox-Chromium	5.0	<0.10	<0.10	<0.09	<0.09	<0.09	<0.09
EP Tox-Lead	5.0	<0.10	<0.14	0.14	<0.06	<0.06	0.23
EP Tox-Mercury	0.2	<0.003	<0.003	<0.01	<0.01	<0.01	<0.01
EP Tox-Selenium	1.0	<0.02	<0.16	<0.02	<0.02	<0.02	<0.02
EP Tox-Silver	5.0	<0.10	0.07	<0.01	<0.01	<0.01	<0.01
pH	$2 \geq pH \geq 12.5$	--	8.7	5.71	5.67	5.81	5.70
Sulfide	--	ND	ND	--	--	--	--
Cyanide	--	ND	ND	--	--	--	--

Units: ppm

	B-155 Wax from Electrostatic Precipitator 1989	B-190 Flare Ash 1986	B-190+ Flare Ash 1987	B-69 Phosphoric Acid Filters 1990	Paint Booth Filters (Dry) 1990	Grit Blast Residue 1990
EP Tox-Arsenic	<0.01	<0.001	<0.001	0.23	<0.02	<0.02
EP Tox-Barium	<0.01	2.6	1.5	<0.2	<0.02	0.8
EP Tox-Cadmium	<0.01	<0.01	0.02	0.16	0.36	0.08
EP Tox-Chromium	<0.05	0.08	0.13	<0.06	0.58	<0.06
EP Tox-Lead	<0.05	0.0	0.1	<0.1	0.7	<0.1
EP Tox-Mercury	<0.01	<0.0002	<0.0002	<0.002	<0.002	<0.002
EP Tox-Selenum	<0.01	<0.001	<0.005	<0.05	<0.05	<0.05

TABLE 4-4 (Continued)

SPECIAL WASTE ANALYSES
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Units: ppm

	B-155 Wax from Electrostatic Precipitator 1989	B-190 Flare Ash 1986	B-190+ Flare Ash 1987	B-69 Phosphoric Acid Filters 1990	Paint Booth Filters (Dry) 1990	Grit Blast Residue 1990
EP Tox-Silver	<0.05	0.18	0.01	<0.05	<0.05	<0.05
pH	4.5	--	10.6	2.13	3.35	6.92
Sulfide	--	<1	<1	<1	<1	<1
Cyanide	--	--	2	<1	10	4

* Inert Filler #1 = 50% Gypsum, 25% Stearic Acid, 20% Barium Sulfate, 5% Wood Rosin.
** Inert Filler #2 = 75% Magnesium Sulfate, 25% Barium Sulfate.
\+ Sample also analyzed for pesticides. None were detected. 1990 samples also analyzed for volatile organic compounds. Paint booth sample contained 0.4 ppm Toluene.

Sources: NWSCC Environmental Protection Division Reference File 5090/W4.0; Aquatech Environmental Consultants, Inc., 1985, Tank Industry Consultants, 1988.

RP/15EMRF/AD8

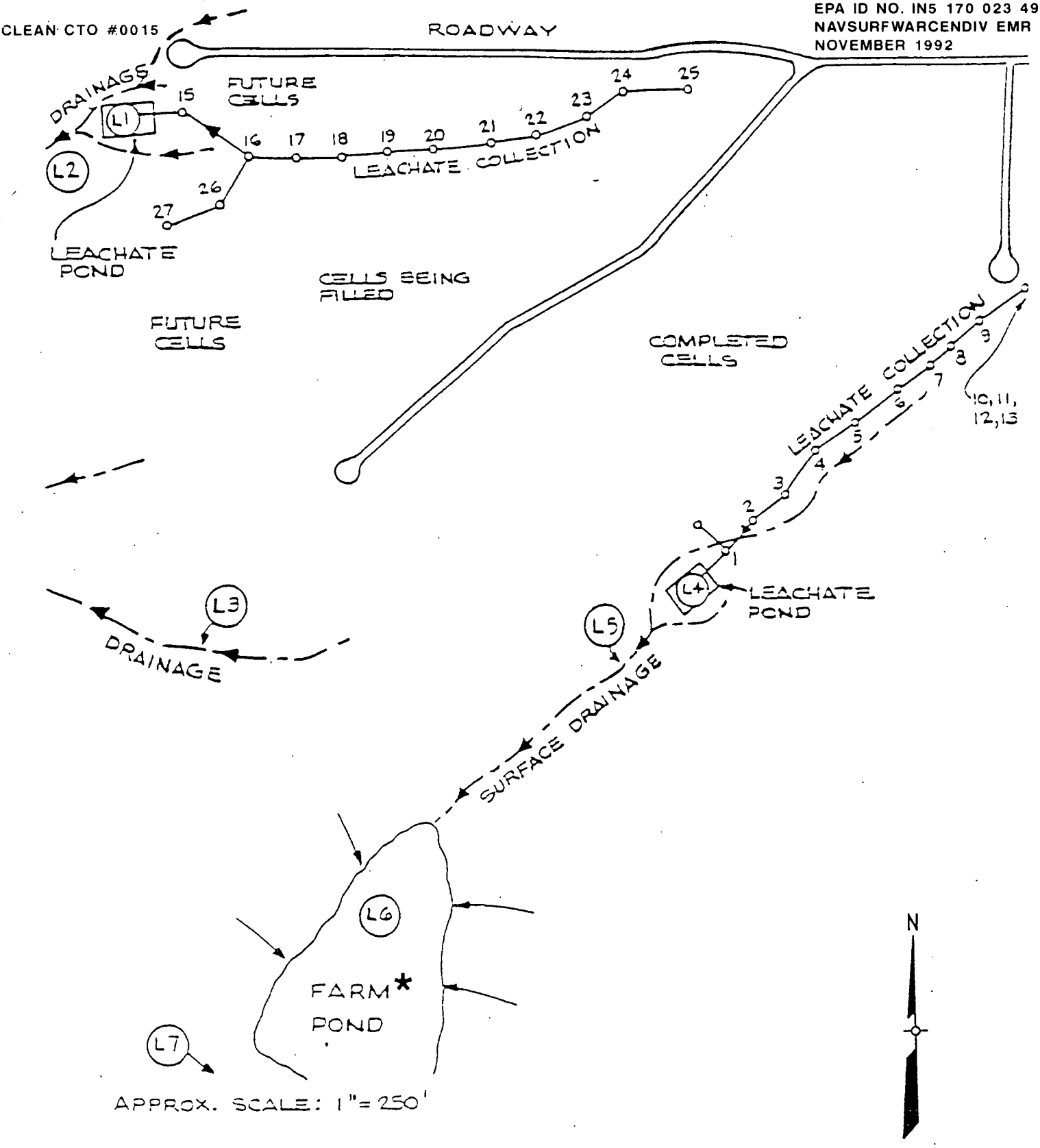
TABLE 4-5

UST EXCAVATION SOIL SAMPLE RESULTS
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

	Total Petroleum Hydrocarbons (ppm)
B-2941 (April 1990)	
Bottom of tank, right	<50
Down gradient	<50
Down gradient (further)	<50
Bottom of tank, left	<50
B-2693 (September 1991)	
Bottom of tank	<10
Sidewall "A"	20.2
Sidewall "B"	<10

Source: NWSCC letters to IDEM May 31, 1990 and October 4, 1991 (NWSCC Environmental Protection Division Reference File 5090/ST1.0).

RP/15EMRF/AA3



* NAVY OWNED CONSERVATION POND ON NAVY PROPERTY.

SOURCE: MASON & HANGER, SILAS MASON COMPANY, 1979.

NOVEMBER 1992

FIGURE 4-5
SANITARY LANDFILL ROADS, LEACHATE FIELD AND SAMPLE POINTS

ENVIRONMENTAL MONITORING REPORT
NAVSURFWARCENDIV
CRANE, INDIANA

20602

Donohue ENGINEERS ARCHITECTS SCIENTISTS

L-10981

- L3: Surface drainage from the landfill
- L4: Southern leachate pond
- L5: Surface drainage from the southern portion of the landfill, including overflow from the southern leachate pond
- L6: Farm pond (receives drainage from southern portion of the landfill and woodland areas)
- L7: Farm pond outfall

During sampling, the northwest leachate pond was black colored and had a hydrogen sulfide odor. The southern leachate pond was reddish-coffee colored from algae growth (MHSM, 1979). One surface water sample and several sediment samples were collected from each of the locations shown on Figure 4-5. The analytical results of the water and sediment sampling are presented in Tables 4-6 and 4-7, respectively.

Detection limits for the analyses performed on leachate and surface runoff samples in Table 4-6 were not available. Information in Table 4-6, however, suggests that detection levels for most analytes were above MCLs and as a result comparisons of analytical data for all samples to MCLs was not possible. Nevertheless, detected concentrations of lead and cyanide in leachate samples are above MCLs. The concentration of mercury in runoff sample L2 is above the MCL. In addition, detected concentrations of copper, lead, mercury, zinc, and cyanide exceed available ambient water quality criteria for the protection of aquatic life. MHSM (1979) recommended that the leachate pond overflow be connected to the sanitary sewer and that the entire landfill area be fenced.

Quarterly groundwater quality monitoring is required under the Sanitary Landfill's Operating Permit (IDEM Correspondence to NWSCC, 1988). Analytical results from June 1981 through September 1991 were made available by the Navy and are summarized in Table 4-8. The analytes listed in Table 4-8 represent the analytes being monitored at the sanitary landfill. However, not all the monitoring wells have been monitored for all the listed parameters during every sampling round. In addition, dry wells and fluctuating water levels have prevented sample collection in a number of wells. Wells 1B, 2B, and 7B are consistently dry. Wells 4B, 201, 202, 203, and 204 often contain insufficient quantities of water and cannot be sampled. The 1985 analytical reports also indicate that well 202 was damaged and sealed, thereby not permitting further sampling. Monitoring parameters including manganese, sodium, boron, zinc, sulfate, ammonia, arsenic, barium, cadmium, chromium, mercury, selenium, silver, fluorine, and nitrate were monitored in all wells with sufficient water volume during the March 1991 sampling round and in two wells (1A and 7A) during the September 1991 sampling round. The concentration ranges of these parameters depicted in Table 4-8 reflect only information obtained during the March and September 1991 sampling efforts. Rigorous statistical analysis of the groundwater data is beyond the scope of this EMR, rather the concentration ranges are reported to assess the need for further investigation.

TABLE 4-6

LEACHATE POND WATER AND SURFACE RUNOFF ANALYTICAL RESULTS
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Sample Site:	L1 (leachate)	L2 (runoff)	L3 (runoff)	L4 (leachate)	L5 (runoff)	L6 (farm pond)	L7 (farm pond)	Maximum Contaminant Level (MCL)[1] (mg/l)	Ambient Water Quality Criteria (for Protection of Aquatic Life)[3] (mg/l) Chronic
Flow Rate, GPM	1.5	1.6	0.5	0.8	1.6	Pond	13		
Temperature, °C	13	15	16	14	12.5	19	18.5		
Dissolved Oxygen, mg/l	1	6.3	--	0.6	2.5	8.2	6.7		
pH (on site)	7.3	7.4	5.6	6.6	5.9	6.5	6.2		
Total Alkalinity, mg/l	413	237	25	435	69	29	31		
Sulfate, mg/l	26	28	25	26	15	15	15	400/500[2]	
Chloride, mg/l	53.7	32.4	2.0	662	43	11	123		
Iron, mg/l	6.4	3.67	2.30	23.5	8.7	1.39	1.86		
Copper, mg/l	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.3[2]	6.5×10^{-3}
Lead, mg/l	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	.005[2]	1.3×10^{-3}
Mercury, mg/l	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	.002	1.2×10^{-5}
Zinc, mg/l	0.46	0.21	0.04	0.11	<0.05	<0.05	<0.05		.047
Nickel, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	.01[2]	0.056
Cadmium, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	.005	6.6×10^{-4}
TKN, mg/l as N	1.70	1.13	0.40	1.50	0.65	0.33	0.28		
Nitrate, mg/l as N	6.15	0.49	0.10	2.25	0.29	0.18	0.29		
Nitrite, mg/l as N	<0.01	<0.01	<0.01	0.04	<0.01	0.02	<0.01	1.	
Ammonia, mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10		
Cyanide, mg/l	0.33	--	--	0.25	--	--	--	.2[2]	5.2×10^{-3}
BOD_5, mg/l	473.1	243	43	996	53	303	80		
TNT, mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		
RDX, mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01		
Phosphate, mg/l as P	0.11	0.06	0.13	0.15	0.17	0.23	0.05		

TABLE 4-6 (Continued)

LEACHATE POND WATER AND SURFACE RUNOFF ANALYTICAL RESULTS
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Sample Site:	L1 (leachate)	L2 (runoff)	L3 (runoff)	L4 (leachate)	L5 (runoff)	L6 (farm pond)	L7 (farm pond)	Maximum Contaminant Level (MCL)[1] (mg/l)	Ambient Water Quality Criteria (for Protection of Aquatic Life)[3] (mg/l) Chronic
Flow Rate, GPM	1.5	1.6	0.5	0.8	1.6	Pond	13		
Fluoride, mg/l	0.20	0.14	0.05	0.12	0.10	0.06	0.08	4.	
Total Solids, mg/l	824	564	333	2730	774	97	86		
Suspended Solids, mg/l	49	138	163	561	485	16	12		
Dissolved Solids, mg/l	775	426	170	2169	289	81	74		
Phenol, mg/l	0.10	--	--	0.20	--	--	--		
Appearance	black	turbid	turbid	brown	turbid	murky	murky		

Source: MHSM, 1979

Notes:

Grab Samples collected on April 18, 1979, Analyzed at Crane AAA.

Sample points coincide to locations indicated on Figure 4-5.

1 USEPA, 1991
2 Proposed
3 USEPA, Clean Water Act

RP/15EMRF/AE6

TABLE 4-7

LEACHATE POND AND FARM POND SEDIMENT ANALYTICAL RESULTS
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Sample Date:	18 April	18 April	18 April	26 April	26 April	4 May	4 May	9 May	9 May
Site Location:	L1 (Pond)	L4 (Pond)	L6 (Farm Pond)	L1	L4	L1	L4	L1	L4
Weight Loss at 105°C	78.3%	41.3%	40.8%	73.6%	41.7%	26.1%	39.8%	41.6%	34.7%
Weight Loss 105° to 550°C	13.0%	3.5%	7.5%	3.2%	3.6%	3.2%	4.6%	3.8%	0.84%
Lead, mg/gram	0.186	0.0100	0.0137	0.0054	0.0073	0.0054	0.0127	0.0041	0.0059
Copper, mg/gram	0.0023	0.0013	0.0030	0.0005	0.0010	0.0004	0.0021	0.0012	0.00059
Iron, mg/gram	4.6558	5.0801	4.8065	1.1563	1.8067	0.4052	6.9508	5.6310	2.3175
Mercury, mg/gram	0.10	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TNT, mg/gram	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

mg/gram: Milligrams per gram of sample dried at 105°C (except mercury which is expressed as Micrograms per gram of sample dried at 60°C; TNT sample dried at 40°C).

Source: MHSM, 1979.

Sample points coincide to locations indicated on Figure 4-5.

RP/15EMRF/AD8

TABLE 4-8

BACKGROUND AND MCL/SMCL[1] COMPARISON OF COMPOUNDS DETECTED IN GROUNDWATER SANITARY LANDFILL NWSCC CRANE, INDIANA NOVEMBER 1992

Parameter	Range of Concentrations[2] Groundwater (mg/l)	Upgradient[3] (mg/l)	MCL[1] (mg/l)	SMCL[1] (mg/l)
Specific Conductance (micro mohs/cm)	117-2120	280-610	--	
pH (su)	5.2-8.8	6.95-7.2		6.5-8.5
Total Lead	ND-0.21	ND-0.16	0.005 (proposed)	
Total Copper	ND-0.06	ND-0.012	1.3 (proposed)	1.0
Total Organic Carbon	ND-28	ND-8	--	
Total Dissolved Solids	42-3196	200-569		500
Chloride	1.0-420	0.5-203		250
Iron	ND-63	ND-9.8		0.3
Chemical Oxygen Demand	ND-388	ND-95	--	
Hardness	32-2560	100-270	--	
Cyanide	ND-0.03	ND-0.01	0.2 (proposed)	
Phenol	ND-0.02	ND-0.03	--	
Methylene Chloride	ND-0.0019	--	--	
Manganese	ND-4.67	ND	--	
Sodium	5-96	10	--	
Boron	ND-0.09	ND	--	
Zinc	ND-0.36	ND	--	
Sulfate	1.0-780	SB	400/500 (proposed)	
Ammonia	ND-0.80	ND	--	
Arsenic	ND	ND	0.05	
Barium	ND-0.19	0.09	2.0 (proposed)	
Cadmium	ND	ND	0.01	
Chromium	ND	ND	0.05	

TABLE 4-8 (Continued)

BACKGROUND AND MCL/SMCL[1] COMPARISON OF COMPOUNDS DETECTED IN GROUNDWATER SANITARY LANDFILL NWSCC CRANE, INDIANA NOVEMBER 1992

Parameter	Range of Concentrations[2] Groundwater (mg/l)	Upgradient[3] (mg/l)	MCL[1] (mg/l)	SMCL[1] (mg/l)
Mercury	ND	ND	0.002	
Selenium	ND	ND	0.01	
Silver	ND	ND	0.05	
Fluoride	ND	ND	4.0	
Nitrate	ND-2.35	0.11	10	

Notes:

1 Drinking Water Regulations and Health Advisories, EPA, 1991.
2 Obtained from NWSCC Landfill Well Analyses submittals to IDEM (June 1981 through September 1991).
3 Upgradient conditions represented at Well 201 (Dunbar, 1984a).
SMCL = Secondary Maximum Contaminant Level.
MCL = Maximum Contaminant Level.
ND Not detected.

RP/15EMRF/AA3

According to the groundwater contour map shown in Figure 4-4 (Dunbar, 1984a) Well 201 is located upgradient of the sanitary landfill. Landfill monitoring well analytical results are compared to both upgradient groundwater concentrations (Well 201) and Secondary Maximum Contaminant Levels (SMCLs) or Maximum Contaminant Levels (MCLs) in Table 4-8. As Table 4-8 indicates, the SMCLs or MCLs for lead, total dissolved solids, chloride, iron, and pH were exceeded in landfill groundwater samples. However, iron and total dissolved solids SMCLs were also exceeded in upgradient samples, suggesting that there may be a high background level of these analytes.

The highest value of lead was detected at Well 5B located in the southwest portion of the landfill. It should be noted that as reported on the analytical data sheets, the detection limits of 0.01 and .05 mg/l for lead exceed the proposed MCL. Therefore, it is possible that all samples exceeded the proposed lead MCL. Most samples from Wells 1A, 2A, 3A, 3B, and 4A exceeded the SMCL for total dissolved solids. In general, deep wells contained more total dissolved solids than shallow wells.

The chloride SMCL was exceeded in two samples. Both of these samples were collected from Well 6A, located south of the limits of the disposal cells (Figure 4-4).

The highest concentration of iron was detected in Well 204, located in the northwestern portion of the landfill. The iron SMCL was regularly exceeded in Wells 3A, 5A, and 5B.

With the exception of one sample collected at Well 1A, all pH values outside the SMCL range were below 6.5. The most acidic pHs were consistently detected at Well 2A, located downgradient of the limits of the disposal cells.

The March and September 1991 samples were also analyzed for volatile organic compounds. Methylene chloride was the only volatile organic compound detected. It was detected in Wells 203 and 7A during the September sampling event at concentrations of 0.0007 and 0.0019 mg/l respectively. There is no MCL for methylene chloride.

No SMCLs or MCLs exist for total organic carbon, chemical oxygen demand, hardness, or specific conductance. The maximum detected levels for these parameters, however, are at least an order of magnitude greater than the upgradient levels. The monitoring data, therefore, indicate that the landfill may be impacting groundwater quality.

4.4.2.3 Types and Volumes of Waste

The landfill primarily receives trash and garbage from NWSCC production operations, residential areas, and food preparation areas. Estimates of material disposed daily are as follows:

- 1979: 40,000 lbs/day ("Land Disposal Site Information" memorandum).
- 1987: 35 cubic yards/day (compacted) (NWSCC Environmental Protection Division Reference File 5090/LF1.1).
- 1990: 28 cubic yards/day (NWSCC Environmental Protection Division Reference File 5090/LF1.0).

In addition to trash and garbage, other wastes have been buried in the Sanitary Landfill. In 1976, fire debris from a chemical warehouse fire were sent to the landfill (RCRA Facility Permit No. IN5170023498). The fire itself destroyed 70,000 pounds of pentachlorophenol, 50,000 gallons of paint, 500 pounds of fluorescence dye, 500 gallons of solvents, and other items (NEESA, 1983). In 1981-82, special approval was granted by the ISBH to bury neutralized lithium batteries in the Sanitary Landfill. A plan map (PWO Drawing 4638, 1985; NAVFAC Code ID No. 80091) shows an approximate 25-foot square area in the northeast portion of the landfill used for lithium battery disposal. The same map also indicates two circular areas, where approximately 2,100 thermo batteries have been buried and a rectangular asbestos material disposal area. However, asbestos burial was reportedly not confined to specific areas of the landfill (NWSCC, 1992a). The two circular thermo battery areas and the rectangular asbestos area are in the western portion of the landfill and were added to the base map in 1983.

The lithium batteries shown as buried in the northeast portion of the landfill (PWO Drawing 4638, 1985) are reportedly a type of thermo battery consisting of Li-Fe/FeS_2 cells separated by a pyrotechnic heat paper (NWSCC, 1992a). The cells are solid at room temperature. Activation of the batteries was accomplished by igniting the heat paper and melting the cells. Temperatures of between 500 and 600° C were reached during this process (NWSCC, 1992a).

The thermo battery disposal areas designated in the western portion of the landfill (PWO Drawing 4638, 1985) are thought to consist of calcium chromate thermo batteries (NWSCC, 1992a). These thermo batteries consisted of $Ca/CaCrO_4 \cdot 2H_2O$ cells with asbestos insulators, and their use apparently preceded the lithium cells described above (NWSCC, 1992a).

According to the Installation Assessment of NWSCC (Department of the Army, 1978), certain areas of the Sanitary Landfill have been designated as "hot beds." Toxic or hazardous waste was placed in these hot bed areas within the trenches and a neutralizing agent was added before placement of the final cover. The quantities of contaminated wastes placed in these areas have been very small (Department of the Army, 1978). These materials were isolated from burnable papers because they were subject to spontaneous combustion (Snell Environmental Group, 1977). According to the Landfill Operational Plan, 16 of these "hot beds" existed in 1977 (Snell Environmental Group, 1977).

The Sanitary Landfill has also received special wastes that have been approved for disposal by the State. The majority of special waste is asbestos materials. Table 4-9 summarizes special waste disposal requests, approvals, expiration dates, and case numbers. Monthly disposal summaries for special wastes are included as Appendix H.

Other miscellaneous wastes that have reportedly been disposed in the Sanitary Landfill include a 30-gallon trash can containing rags contaminated with grease and Petroleum Naptha (Environmental Protection Division File LF1.1), magnetic computer tapes stored in cardboard boxes, Purple K fire extinguishing fluid (NWSCC Telephone Record, 1983), 30,000 pounds of styrofoam packing material (NWSCC Environmental Protection Division File 5090/W4.0), fluorescent lamps (NWSCC Memorandum, 1982), 200 size "X" and 193 size "D" batteries (Environmental Protection Division File 11346/LF1.1), and empty containers utilized for shipping and handling bulk explosives (Allen, 1974).

4.4.2.4 Spills or Releases

A review of spill response records maintained by the Environmental Protection Division at NWSCC determined that no spills or releases have been documented at the Sanitary Landfill since October 5, 1987. No information on spills or releases prior to October 1987 was available in other records reviewed for the Sanitary Landfill.

However, a report on surface runoff control (MHSM, 1979) indicated that the leachate ponds were overflowing at the rate of approximately 0.5 gallons per minute to the surrounding drainage areas, subsequently as surface runoff, on March 6, 1979.

TABLE 4-9

SPECIAL WASTES REQUESTS AND APPROVALS
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Material	Quantity	Date Requested	Date Approved	Date Expired	Case Number
Asbestos	6,000 lbs	-	04-23-81	Voided by State in Nov. 1984 (retroactive to 12-31-81)	-
	6,000 cf	-	-	05-30-86	-
	400 cy	-	05-19-88	05-31-89	80110
	400 cy	-	04-05-89	04-30-90	90195
	400 cy	-	-	04-30-91	0097
	400 cy	-	-	04-03-92	01014
	400 cy	-	01-17-92	04-30-93	11277
Magnesium/Barium Sulfate (Inert Filler?)	5 drums/wk	-	01-28-82	-	-
Magnesium/Barium Sulfate Inert Filler	40 tons	-	03-16-90	04-30-92	00222
Inert Filler #1	40 55-gal drums/yr	-	09-13-85	12-31-85	-
	100 cy	11-19-85	-	-	-
Inert Filler #2	40 55-gal drums/yr	-	09-13-85	12-31-85	-
	100 cy	11-19-85	-	-	-
Thermal Batteries	~932	12-09-85	Denied		
Oil-Saturated Soils	100 cy	-	09-13-85	10-31-86	-

TABLE 4-9 (Continued)

SPECIAL WASTES REQUESTS AND APPROVALS
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Material	Quantity	Date Requested	Date Approved	Date Expired	Case Number
Plastic Coated Ferrous Powder	5 cy	-	09-13-85	10-31-86	-
Chlorinated Rubber		1986	Denied		
Discharged Underwater Mine Batteries		02-06-86	Denied (went to DRMO)		
Sandblast and Paint Chip Residue	500 cy	-	05-11-88	08-31-88	80231
Fuel Oil Contaminated Soil and Gravel	500 cy 500 cy	- 10-11-90	04-05-89 -	04-30-90 04-30-91	90199 80110/0097?
Fuel Oil Contaminated Sand and Gravel	500 cy	-	01-17-92	04-30-93	11277
Wax From Electro-static Precipitator	40 55-gal drums 40 55-gal drums 40 55-gal drums	09-25-89 06-22-90 -	- - 01-06-92	10-30-90 10-31-91 01-31-93	90738 00627 11301
Phosphoric Acid Filters	20 cy	05-10-90 07-19-91 (extension) -	- - 08-07-91	06-30-91 - 09-30-92	00489 - 10703
Paint Booth Filters	20 cy 20 cy	05-10-90 07-19-91 (extension) -	- - 08-07-91	06-30-91 - 09-30-92	00489 - 10703

TABLE 4-9 (Continued)

SPECIAL WASTES REQUESTS AND APPROVALS
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Material	Quantity	Date Requested	Date Approved	Date Expired	Case Number
Grit Blast Residue	50 tons	05-10-90	-	06-30-91	00489
		07-19-91 (extension)	-	-	-
	50 tons	-	08-07-91	09-30-92	10703
Carbon Black	1,995 50-lb bags	-	-	-	00322
		08-29-90 (extension)	-	04-30-91	00868
Soil, Sand, and Rocks Contaminated with Leaded Gasoline	50 cy	09-12-90	-	06-30-91	00909
	500 cy (correction to original est.)	04-09-91 (extension)	-	-	-
Flare Ash	40,000 lbs	09-25-90	-	-	00538
	10,000 lbs	07-19-91	-	-	-
Flare Ash and Baghouse Dust	5 tons	-	08-07-91	09-30-92	10703
	89,000 lbs	-	10-23-90	07-31-92	00958
Filter Media	110 cy	-	-	02-29-89	-
Pentachlorophenol Treated Scrap Wood	-	10-02-91	-	-	-
Wastewater Treatment Plant Grit	-	-	05-04-90	04-30-95	00336

NOTE: "-" means information was not available.
Source: NWSCC Environmental Protection Division Reference File 5090/W4.0

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4.4.2.5 Potential Migration Pathways

Potential migration pathways at the Sanitary Landfill include subsurface gas, groundwater, surface water, and air. Gases such as methane and volatilized chemicals can migrate vertically or horizontally within the landfill and will either be released to the atmosphere or will build up in the subsurface. The Permit Amendment Application (RQAW, 1987) stated that gas control was to be provided by constructing cells in a manner to allow upward migration of gases to installed gas vents. This report also stated that the initial operation each day was to break a small hole in the previously placed daily cover to allow migration of methane to the atmosphere.

Groundwater provides another potential migration pathway. Water leaching through the landfill will migrate to groundwater if it is not intercepted by the leachate collection system. The collection system was not installed until 1981 (NWSCC, 1992a). Wastes may have been placed directly on fractured bedrock (NEESA, 1983), increasing the potential for materials to enter groundwater. Finally, the Sanitary Landfill has no bottom liner, making it more difficult to collect all the leachate.

Surface water may also act as a migration pathway. Dirt and debris may have been washed away from active cells during rain events. The 1979 study (MHSM, 1979) indicated that during heavy rains, leachate ponds were overflowing in excess of 1 gallon per minute. The proposed upgrade of the leachate ponds (Dames & Moore, 1992) does not exclude consideration of this migration pathway.

Air is a potential migration pathway for gases and particulate matter. Methane vented to the atmosphere is not flared. Particulate matter, especially from past trench and fill operations, may have been dispersed by wind. Dust control measures, such as wetting, were employed to mitigate particulate migration.

4.4.3 SWMU Reconnaissance

Visual reconnaissance of the Sanitary Landfill was performed on October 21, 1991. A representative of the Environmental Protection Division accompanied Donohue during the reconnaissance.

The approximate limits of the landfill are defined by Highway 161 to the east, a powerline access road to the south, a gravel access road to the north, and a monitoring well access road to the west.

The former trench and fill area is characterized by slightly mounded conditions. This area has been graded and seeded, and is bisected by several gravel access roads. Leachate collection system manholes are prominent in two distinctive lines as shown on Figure 4-5. Leachate is conveyed to two fenced-in leachate ponds at the northwest and southern ends of the landfill. Although reported as cement-lined (MHSM, 1979), direct observation of the leachate ponds could not confirm this. A 1987 visual site inspection report (A.T. Kearney, Inc., 1987) reports that the leachate ponds are unlined with continuous feed to the sanitary sewer system.

At the time of the reconnaissance, the southern leachate pond (Appendix F, Photo No. 10) was dry with large desiccation cracks. It had apparently been dry since July 1991 (NWSCC, 1991c). This leachate pond has reportedly overflowed in the past (MHSM, 1979) with surface drainage to a Navy-owned conservation pond (farm pond) southwest of the leachate pond (Figure 4-5). The northwest leachate pond (Appendix F, Photo No. 11) contained some liquid. Discharge from this pond to the sanitary sewer is controlled by a float-activated sump pump housed directly west of the pond. The float has experienced operational problems, estimated at approximately 12 times in the past 3 years (NWSCC, 1991c).

The vegetation within the fenced perimeter of the northwest leachate pond was severely stressed. The drainage slope in the northwest corner (north of the northwest leachate pond) is frequently washed out and eroded during heavy rains. NWSCC staff have indicated difficulty in keeping the slope seeded (NWSCC, 1991c).

The landfill operations office (B-2941) is located near the eastern border of the site. Transformer storage and draining of PCB-contaminated oils has occurred in Building 2941 in the past (NWSCC, 1991c). Drainage and storage of PCB-contaminated oils in Building 2941 continues today (NWSCC, 1991b).

In April 1990, a 3,000-gallon UST was removed at the southeast corner of Building 2941 (NWSCC, 1991c). The tank apparently contained gasoline for fueling of landfill operational vehicles. Three soil samples were collected at the time of the tank excavation. Analytical results reportedly did not indicate elevated levels of petroleum hydrocarbons (see Section 4.4.2.2). The excavation was backfilled and notification of closure was filed.

The lithium battery disposal area located southeast of Building 2941 (Figure 4-2) was noticeably visible due to stressed and dead vegetation. Some portions of the burial area lacked vegetation.

4.4.4 Waste Characteristics

4.4.4.1 Physical and Chemical Characteristics

The majority of wastes placed in the landfill consist of municipal type refuse such as wood debris, organic food matter, plastics, paper, cardboard, and metals. Paper is usually low in moisture content, and increased amounts of paper in refuse have resulted in decreased rates of refuse breakdown (Chen and Bowerman, 1974). Conversely, food wastes may be extremely wet. The individual characteristics of such wastes are difficult to identify.

Other materials disposed of in the Sanitary Landfill include a variety of special wastes. Analytical data for several of these wastes were presented in Section 4.4.2.2. Additional characteristics of large quantity wastes are listed in Table 4-8. Several of the compounds are derived from petroleum. Gasoline and fuel-oil contaminated soils have also been buried in the landfill. Petroleum is a highly complex mixture of paraffinic, cycloparaffinic and aromatic hydrocarbons containing a low percentage of sulfur and trace amounts of nitrogen and oxygen (Sax and Lewis, 1987). Petroleum is a moderate fire risk. It is toxic to humans by ingestion and is a local skin irritant (Sax and Lewis, 1987). The properties of petroleum-derived products vary depending upon the hydrocarbon weight, chain configuration, and degree of saturation. For example, hydrocarbon mixtures can be liquid or solid, volatile or non-volatile, and may be slightly soluble or insoluble in water. Some hydrocarbons, particularly aromatic compounds, are carcinogenic.

Carbon black particulate dust can be an irritant to the upper respiratory tract, eyes, and skin (NWSCC Environmental Protection Division Reference File 5090/W4.0). Decomposition products of bituminous asphalt include hydrogen sulfide and other hazardous vapors. Hydrogen sulfide is extremely flammable and highly toxic (NWSCC Environmental Protection Division Reference File 5090/W4.0). Fumes from bituminous oil may cause eye, nose, and respiratory irritation (NWSCC Environmental Protection Division Reference File 5090/W4.0).

Asbestos is composed of magnesium silicate minerals. It is a carcinogen and is highly toxic by inhalation of airborne fibers (Sax and Lewis, 1987).

Lithium ignites in air near its melting point. It is a dangerous fire and explosion risk when exposed to water, acids, or oxidizing agents. Lithium in solution is toxic to the central nervous system (Sax and Lewis, 1987).

4.4.4.2 Hazardous Classification

The special wastes disposed in the Sanitary Landfill are, by current definition under 329 IAC 2-21, any solid waste not otherwise excluded by 329 IAC 2-5 from a nonresidential source. Special wastes include the following:

- A waste containing free liquid until September 1, 1989, when such wastes are regulated by 329 IAC 2-9-4(2).
- A sludge waste.
- An industrial process waste.
- A pollution control waste.
- Contaminated soil, residue, debris, and articles from the cleanup of a spill or release of materials listed above.

The analytical data presented in Section 4.4.2.2 indicate that the inert fillers, sandblast residue and paint chip residue, waste wax, phosphoric acid filters, paint booth filters, and grit blast residue are not RCRA characteristic hazardous wastes. In NWSCC's RCRA Facility Permit, grit blast residue is listed as a toxicity characteristic hazardous waste for cadmium (D006), chromium (D007), lead (D008), and barium (D005). Asbestos is not regulated under RCRA. The grit blast residue listed in the RCRA permit, however, is derived from paint removal activities whereas the landfilled material is generated by metal preparation operations. The grit blast residue disposed of in the landfill is not classified as RCRA hazardous waste (NWSCC, 1992a).

4.4.4.3 Migration and Dispersal Characteristics

Many of the materials disposed in the Sanitary Landfill, such as wood, paper, and food wastes are highly biodegradable. Landfills generally produce anaerobic conditions. Ultimate anaerobic biodegradation products include methane, nitrates, and cell mass. Methane is a gas and will migrate either vertically or horizontally within the landfill until vented. Nitrates are highly soluble and will percolate through the landfill. Partially decomposed materials and intermediate compounds may also migrate through the landfill. This may be reflected by leachate with a high BOD or a low pH.

The migration and dispersal characteristics of the petroleum-derived wastes in the Sanitary Landfill will vary with the hydrocarbon structure. For example, straight chain hydrocarbons tend to be more biodegradable than corresponding branched hydrocarbons, more soluble hydrocarbons tend to be more biodegradable and more volatile than insoluble hydrocarbons and unsaturated hydrocarbons are more quickly biodegraded than corresponding saturated compounds. The heavier hydrocarbon

wastes such as carbon black, bituminous asphalt, and bituminous oil are practically insoluble and nonvolatile. These wastes should not migrate or transform appreciably within the landfill.

Magnesium sulfate is highly soluble and will likely migrate with leachate. The remaining compounds in Table 4-10 are not highly soluble. Although no additional information was obtained, it is likely that these compounds will not be mobile and will persist within the landfill.

4.5 CONCLUSIONS AND RECOMMENDATIONS

Background data and site observations were reviewed to determine the likelihood of releases posing potential threat to human health or the environment. Data and observations pertinent to SWMU #14/00, Sanitary Landfill and Lithium Battery, were reviewed to assess the potential for contaminant releases to groundwater, surface water, air, subsurface gas, and soil. Data were interpreted and release determinations were made according to the approach described in RCRA Facility Assessment Guidance (USEPA, 1986). Based upon the information and conclusions presented, medium-specific recommendations are made concerning the need for continuing corrective actions in subsequent RFI Phases.

At the Sanitary Landfill, potential releases to groundwater may have occurred based on unit characteristics and operations including unit type (trench and area fill landfill) and unit design (absence of bottom liner, periods without leachate collection system, and unlined leachate ponds). Locational characteristics contributing to the potential for releases to groundwater include a shallow water table, strong downward vertical gradients, and the presence of fractured bedrock.

Statistical analyses of the existing quarterly groundwater monitoring data are recommended as the next phase for this medium at SWMU #14/00. The objectives of this review include assessing seasonal groundwater quality trends as well as comparing downgradient sample results to background levels. If the results of the statistical analyses verify impacts to groundwater from this SWMU or if results of Phase II Release Assessments for other media indicate groundwater impacts are occurring, additional groundwater quality or flow characterization may be required in a subsequent RFI phase.

Releases to surface water occurred at the southern and northwest leachate ponds and the Farm Pond. Engineered features have not consistently controlled overflow from the

TABLE 4-10

PHYSICAL AND CHEMICAL PROPERTIES (OF LARGE QUANTITY WASTES)
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Chemicals (Case No.)	Physical Form	General Chemical Class	Molecular Weight (g/mole)	Density (g/cm^3)	Solubility in Water (mg/l)*	Melting Point (°C)	Vapor Pressure* (mm Hg)
Carbon Black (1333-86-4)	Dark grey powder [1] or pellets	Petroleum product	NA	1.80 [1]	Negligible [1]	NA	Negligible [1]
N-N' ethylene bis-stearamide * (275 wax) (110-30-5)	Off-white to light [1] tan solid, powder, or flakes	Wax	NA	0.885 [1]	Negligible [1]	140 [1]	Negligible [1]
Bituminous Asphalt * (64741-45-3 and 64741-56-6)	Dark or black [1] high viscosity liquid	Petroleum product	600-1000 [1]	0.95-1.05 [1]	Insoluble [1]	NA	<10 [1]
Bituminous 0.1 * (microcrystalline wax)	Brown to black [1] solid	Petroleum product	NA	0.93 [1]	None [1]	NA	None [1]
Magnesium Sulfate o (7587-88-9)	Colorless crystals [3]	Inorganic Salt	NA	2.65 [2]	High [2]	NA	NA
Barium Sulfate o	White or yellowish [3] powder	Inorganic Salt	NA	4.25-4.5 [2]	NA	1580 [2]	NA
Gypsum-Calcium Sulfate o (10101-41-4)	White powder or [3] crystals	Inorganic Salt	NA	2.32 [2]	Slight [2]	NA	NA
Stearic Acid (57-11-4)	Colorless, wax-like [3] solid	Organic	284.47 [3]	0.839 [2]	340 [3]	69.6 [2]	NA
Asbestos (13321)	White, gray, green [3] brown	Inorganic	NA	2.5 [2]	Insoluble [2]	NA	NA
Lithium (7439-93-2)	Soft silvery metal [3]	Metal	6.939 [2]	0.534 [2]	NA	179 [2]	NA

1 NWSCC Environmental Protection Division Reference File 5090/W40.
2 Sax and Lewis, 1987.
3 Verschueren, 1983.
* Components of B-155 electric precipitator wax.
o Components of inert fillers.

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leachate ponds. Release migration potential is increased by the slope and lack of runoff control to the downgradient Farm Pond. Evidence of surface water release was provided by discoloration of pond water and stressed vegetation. Proposed upgrades to the leachate ponds (Dames & Moore, 1992) do not impact consideration of past releases.

Phase II Release Assessment sampling of leachate ponds and farm pond surface water and sediment is recommended to verify the presence or absence of hazardous materials or constituents because visual evidence of environmental impact is apparent in 1992, and available analytical data are over 10 years old.

Potential releases to soil were identified to be likely based on unit type and design, lack of engineered structures to prevent contaminant migration, unit age, past operating procedures, and run on and runoff potential. Potentially impacted soil includes soil beneath and directly adjacent to the trench and fill disposal area, the lithium battery disposal area, leachate drainageways, and leachate ponds. Releases to soil may result from the adsorption of contaminants to soil from contaminated groundwater or surface water, and from leachate percolating through landfill cells. Sorption can occur due to both chemical and physical reactions between contaminants and soil. Potentially impacted soil includes soil beneath and directly adjacent to the landfill, leachate drainageways, and leachate ponds.

Based on the information available, it is unlikely that direct releases of volatile or particulate emissions to air at the Sanitary Landfill pose a potential threat to human health and the environment. Potential for subsurface gas release from the Sanitary Landfill is high because the unit contains decomposable refuse which generates subsurface gas. Subsurface gas releases from landfills can reach explosive levels at the source area or in facility structures or off-site; the primary constituent of concern is methane due to its explosive properties. Other volatile constituents generated from decomposable refuse may also be carried by methane and vent as surface emissions or migrate laterally. Barriers or collection and venting systems were not confirmed to control subsurface gas migration.

As part of a Phase II Release Assessment, installation and sampling of gas probes are recommended in order to identify areas containing high concentrations of explosive or toxic landfill gas.

Potential releases at SWMU #14/00 are summarized on Table 4-11.

TABLE 4-11

POTENTIAL RELEASES
SANITARY LANDFILL
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Media	Release	Suspected Contaminants*
Groundwater	Likely	Leachate Constituents
Surface Water	Occurred[2,3]	Leachate Constituents
Soil	Likely	Leachate Constituents
Air	Unlikely	--
Subsurface Gas	Likely	Methane

NOTES:

1 Observed.
2 Reported.
3 Analytical Records.
* See Table 4-10 for individual compounds.

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5.0 SWMU #16/16: CAST HIGH EXPLOSIVE FILL/INCINERATOR BUILDING 146

5.1 BACKGROUND

5.1.1 Location and Description

Building 146 is located in the north central part of NWSCC (Figure 2-5). Building 146 is situated along H-307 and is also accessed by R-170. Building 146 was an explosive fill and pressure washout facility. Two oil-fed rotary kiln incinerators were also located at Building 146. The site is currently active and is used for renovation/rework and breakdown of munitions. Figure 5-1 shows Building 146 and nearby structures.

5.1.2 Legal Description

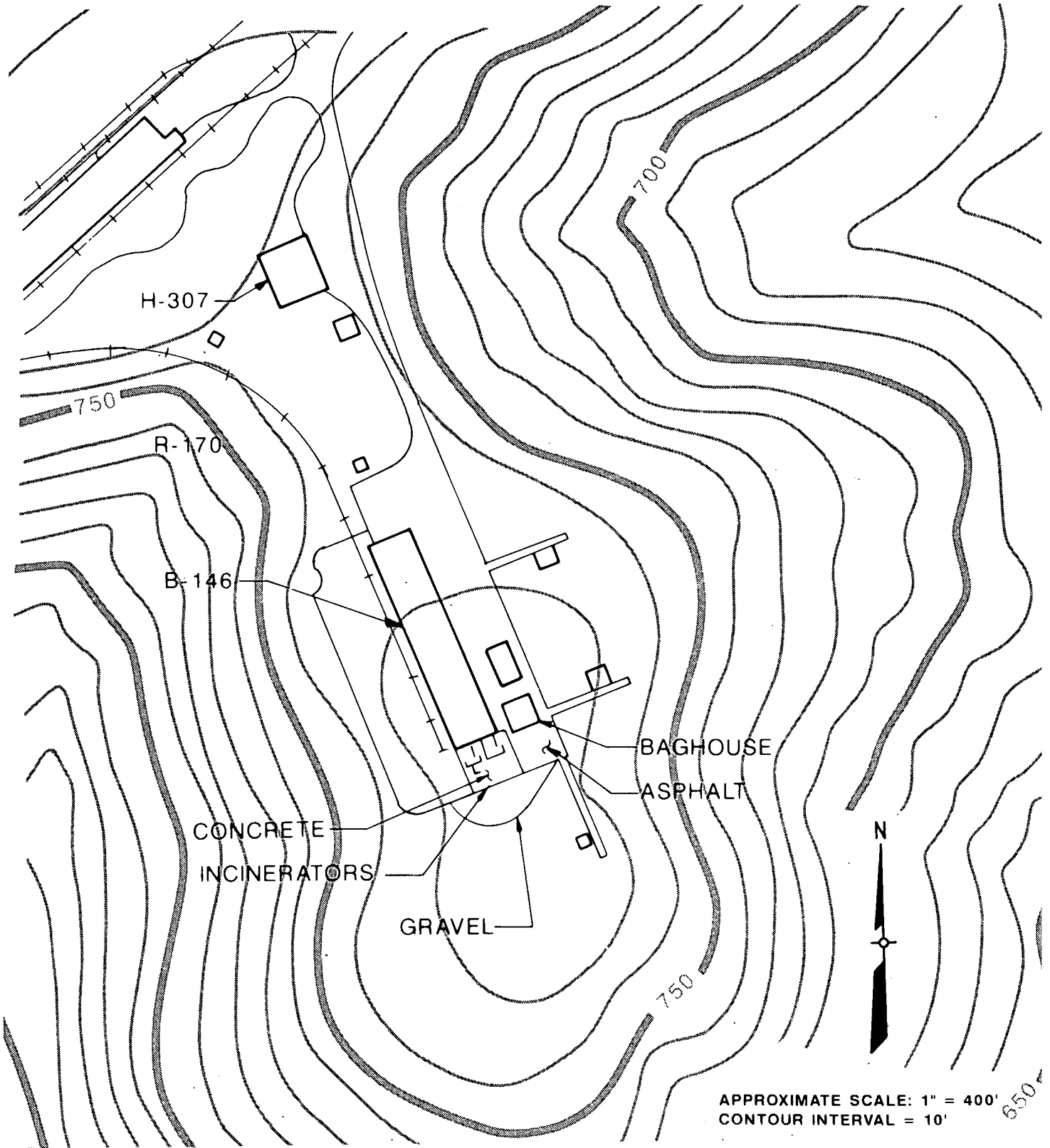
Building 146 is located in the NW 1/4 of the NE 1/4, Section 5, Township 5 North, Range 4 West, Martin County, Indiana.

5.1.3 Contiguous Property

Nearby facilities include case filling, case preparation, lunch and locker, and sewage pumping station buildings to the immediate north and fuse and detonator magazines to the south. Magazines and storage buildings are situated to the west of Building 146. Magazines for fuses, detonators, and high explosives lie to the east of this SWMU. Buildings within the immediate vicinity of Building 146 which have housed significant quantities of explosives include Building 145, the case filling plant, and Building 148, the small arms repacking building. Both buildings primarily housed smokeless powder.

5.1.4 Ownership and Operation

Building 146 was constructed in 1943 (NWSCC, 1992a). During World War II operations, Building 146 was used for 40-millimeter projectile loading. Subsequent to 40-millimeter production, two types of demilitarization operations were conducted in Building 146 including incineration and high pressure water washout of projectiles. A startup date for incineration is not known, however, Navy drawings for the first incinerator at Building 146 are dated 1960 (NSWCC, 1992a).



SOURCE: FIGURE B-4, SITE PLAN,
CENTRAL STORAGE FACILITY; INCINERATORS, 1984

NOVEMBER 1992

FIGURE 5-1
SWMU #16/16 : CAST HIGH
EXPLOSIVE FILL / INCINERATOR BLDG. 146
ENVIRONMENTAL MONITORING REPORT
NAVSURFWARCENDIV
CRANE, INDIANA

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5.2 PHYSICAL CHARACTERISTICS

5.2.1 Topography

Building 146 occupies an upland area at NWSCC. The topography of the upland area is essentially level at an approximate elevation of 763 feet MSL. The relatively level area in the vicinity of Building 146 is in sharp contrast to the steep slopes east, south, and west of the building. Elevation changes on the adjacent slopes average 150 feet vertical difference per 1,000 feet in the horizontal direction. Bottom elevations in the ravines adjacent to the Building 146 area are approximately 595 to 600 feet MSL.

5.2.2 Physiography and Hydrology

Surface drainage from the upland area around Building 146 drains to the ravines to the west, south, and east. One drainage ditch near the southwest corner of Building 146 collects drainage from the gravel-covered storage area along the west side of the building. This ditch collects and diverts surface drainage over the western slope.

Surface runoff from the Building 146 area descends the adjacent slopes to enter intermittent drainageways in the bottoms of ravines west and east of Building 146. These intermittent ravine drainageways converge at a point south of Building 146 to form one of the more upstream fingers of Turkey Creek. Turkey Creek flows south-southwest to merge with Boggs Creek. Boggs Creek continues to flow south eventually exiting the southern boundary of NWSCC. After exiting NWSCC, Boggs Creek continues to flow south and flows into the east fork of the White River.

5.2.3 Geology

5.2.3.1 Soil

Detailed soil mapping near Building 146 by the USDA and SCS (McElrath, 1988) shows the area to be covered by Zanesville-Udorthents complex soils (Figure 5-2). Zanesville soils are commonly found on ridge tops in upland areas. NWSCC udorthents occur in areas which have been affected by earth moving activities. In general, the Zanesville soil and Udorthents are so intricately intermixed that separating them is impractical. The soil near Building 146 is moderately sloping (6 to 12 percent slopes). Soil of the Zanesville-Udorthents complex is characteristically well drained to moderately well drained.

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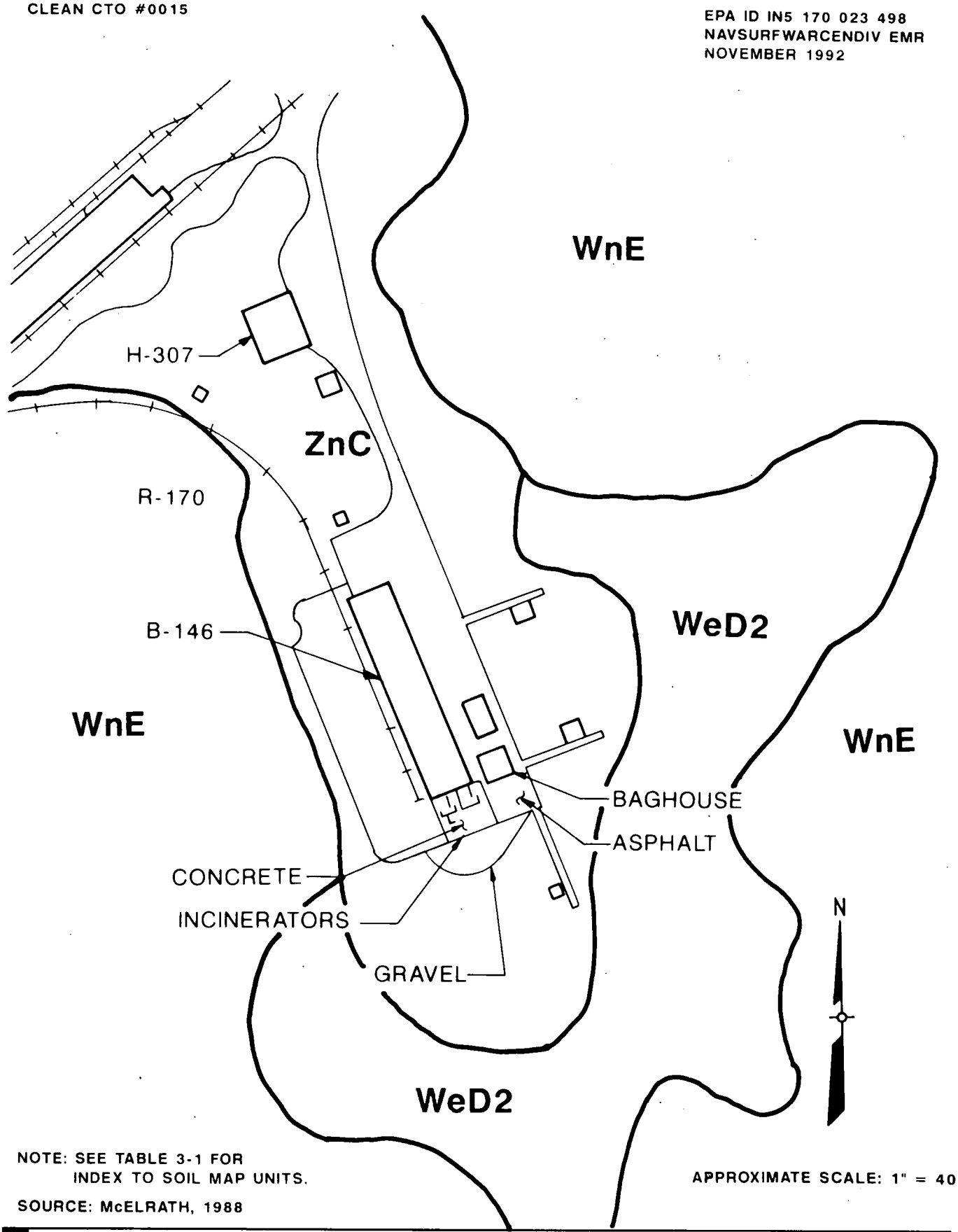

NOTE: SEE TABLE 3-1 FOR INDEX TO SOIL MAP UNITS.

SOURCE: McELRATH, 1988

APPROXIMATE SCALE: 1" = 400'

NOVEMBER 1992

FIGURE 5-2

SOIL MAP FOR SWMU #16/16 : CAST HIGH EXPLOSIVE FILL / INCINERATOR BLDG. 146

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CRANE, INDIANA

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USCS classifications for the upper portions of the Zanesville-Udorthents complex soils are clay (CL), silt (ML), and silty clay (ML-CL). At depth, USCS classifications include clay (CL), sandy clay (SC), silty sand (SM), and silty gravel (GM).

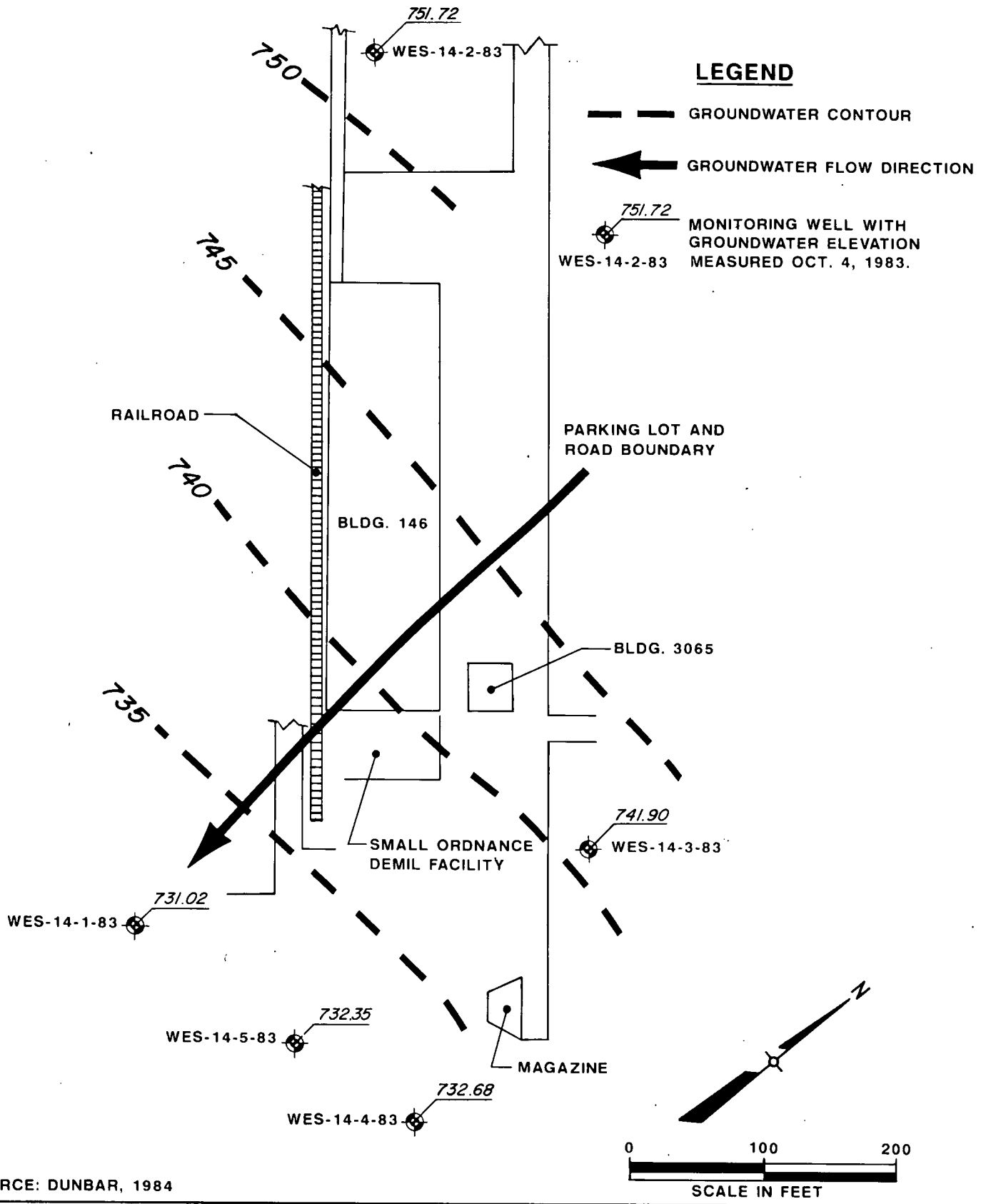
Permeability in the Zanesville-Udorthents complex varies with depth. Zanesville soils exhibit moderate hydraulic conductivity above the fragipan (generally found at a depth of 2.5 to 4.0 feet). Hydraulic conductivities in this zone range from 4.2×10^{-4} to 1.4×10^{-3} cm/sec. Within the fragipan, hydraulic conductivity is low, reportedly ranging from 4.2×10^{-5} to 1.4×10^{-4} cm/sec. Below the fragipan, hydraulic conductivity increases to the range found above the fragipan. Hydraulic conductivities in Udorthents are considered moderate and similar to those found above the fragipan in Zanesville soils. Surface runoff is described as medium by the USDA for soils in the Building 146 area. Erosion and runoff are considered significant environmental concerns at Building 146.

Depth to bedrock, in areas covered by Zanesville and Udorthent soils, generally ranges from 48 to greater than 55 inches. Depth to bedrock is often at the lower end of this range when earth moving activities have occurred. Organic matter content in the surface soil layer is low, ranging from 1 to 3 percent in Zanesville soils to absent in Udorthents (McElrath, 1988).

5.2.3.2 Bedrock

The bedrock surface beneath Building 146 was reported by the Department of the Army (1978) to be composed of sandstone, shale, and limestone of the Pennsylvanian Age Raccoon Group. Borings were reportedly completed by the Army Corps of Engineers in conjunction with monitoring well installation and subsurface investigation. Subsequent investigation of the Building 146 area by the U.S. Army Corps of Engineers (USACE) included borings completed in conjunction with monitoring well installations.

Five borings were completed during the USACE investigation to allow for the installation of groundwater monitoring wells (Figure 5-3). Three to 6 feet of clayey soil overlies bedrock in these borings. The surficial bedrock was interpreted as the Pennsylvanian Age Raccoon Creek Group. Shale and sandstone of the Raccoon Creek Group are the predominate rock types encountered. Shale thickness varies from 10 to 20 feet, to alternating or interlayered shale and sandstone beds less than 1 inch thick. Sandstone units are reported to be as thick as 10 to 20 feet when not interlayered with shales. Coal seams were encountered during coring at Building 146. Coal seams are reported as discontinuous but thicknesses of up to 4 feet were encountered. Bedrock is exposed on the slopes of adjacent uplands supporting Building 146 and the Demilitarization incinerators (Dunbar, 1984b). Boring logs for USACE well installations are presented in Appendix J.



SOURCE: DUNBAR, 1984

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FIGURE 5-3

B-146 GROUNDWATER CONTOUR MAP

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5.2.4 Hydrogeology

The general hydrogeologic setting of NWSCC was described in Section 2. Information on the hydrogeology of the Building 146 area was obtained from Dunbar (1984b).

Within the five monitoring wells in the vicinity of Building 146, groundwater is reportedly encountered 15 to 38 feet below the ground surface. Well construction is summarized in Table 5-1 and well construction diagrams are included in Appendix K. Groundwater flow beneath the Building 146 incinerators is towards the south. Figure 5-3 includes a groundwater contour and flow map, as well as monitoring well locations at Building 146 (Dunbar, 1984b).

The groundwater elevation information shown in Figure 5-3 indicates a horizontal hydraulic gradient of 0.048. Historical water level measurements for the Building 146 wells are presented in Appendix L.

Hydraulic conductivity of the clay soil near Building 146 was determined to be 4.25×10^{-6} cm/sec through laboratory testing (Dunbar, 1984b). Hydraulic conductivities of bedrock units at Building 146 were not available.

5.3 PERMITS

5.3.1 Air

NWSCC has no permits regulating the CAAA Building 146 incinerators because they have been dismantled. NWSCC is currently awaiting IDEM closure approval for the dismantled incinerators before installing two new Ammunition Peculiar Equipment (APE) 1236 furnaces. The following paragraphs summarize the air permit and closure information reviewed during the site visit.

In 1984, NWSCC submitted its RCRA permit application. When RCRA Permit No. IN170023498 was issued to NWSCC in 1985, it did not contain any open burning/open detonation permits. The Building 146 incinerators were allowed to continue operation under interim status.

On January 15, 1985, the Indiana Air Pollution Control Board issued Operation Permits 51-05-88-029, 51-05-88-0030, and 51-05-88-0031. These permits authorized operation of the three Building 146 incinerators until May 1, 1988. A cyclone and a baghouse with 99 percent control efficiency for particulate matter emissions was required for each furnace. Also, emissions were to be at a level acceptable to 325 IAC 6-3.

TABLE 5-1

MONITORING WELL INSTALLATION SUMMARY
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Well No.	Top of Pipe Elevation (ft MSL)	Top of Screen (ft MSL)	Bottom of Screen (ft MSL)	Depth to Water*	Water Elevation (ft MSL)*
WES-14-1-83	767.37	728.57	719.12	36.35	731.02
WES-14-2-83	767.31	752.96	743.92	15.59	751.72
WES-14-3-83	764.65	740.77	731.66	22.75	741.90
WES-14-4-83	763.73	729.35	720.26	31.05	732.68
WES-14-5-83	770.10	731.60	722.35	37.75	732.35

*Water levels measured October 4, 1983.

Source: Dunbar, 1984b.

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During September and October of 1987, the Building 146 incinerators were disassembled by employees of the Tooele Army Depot. During disassembly, it became apparent that extensive replacement, rather than routine maintenance of components, would be necessary. Consequently, in August 1988, NWSCC withdrew its RCRA Part B Permit Application for CAAA Building 146 incinerators. The next month, NWSCC sent a letter to IDEM stating the intent for temporary closure before starting reconstruction of the incinerators.

In March 1989, NWSCC submitted a closure plan for the incinerators. IDEM issued a Notice of Deficiency in May 1989, and NWSCC resubmitted the closure plan in August 1989. In 1990, NWSCC requested an extension for closure. In October of the same year, IDEM granted a 180-day extension. As stated previously, NWSCC is still waiting to complete closure of the Building 146 incinerators.

5.3.2 Groundwater

No permit information regarding groundwater monitoring at Building 146 was available.

5.3.3 Surface Water

No outfalls monitored for current or past NPDES permits are located near Building 146.

5.3.4 Soil

No permits pertaining to soil have been issued or required at Building 146 (NWSCC, 1991b). Soil sampling, however, was required by IDEM for closure of the incinerators. Soil sampling conducted in conjunction with closure activities is discussed in Section 5.4.2.2.

5.4 SWMU #16/16 EVALUATION

5.4.1 Operations and Maintenance

This section reports operations and maintenance, existing data assessment, types and volumes of waste, spills or releases, and potential migration pathways for SWMU #16/16.

5.4.1.1 Operations

Cast Loading

Building 146 was the site of melt-pouring of TNT, RDX, and HBX explosives into projectiles (cast loading). Between December 1943 and the end of World War II, over 2.5 million 3-inch (40-millimeter) projectiles were loaded in Building 146 (NEESA, 1983).

Demilitarization - Incineration

Beginning in approximately 1967, demilitarization of small-arms ammunition was accomplished in three incinerators located adjacent to Building 146. The incinerators included two rotary kiln incinerators designed as APE 1236s, and a smaller prototype incinerator.

Small-arms ammunition including 20-millimeter, 50-caliber, 30-caliber, shotgun shells, fuses, detonators, boosters, tracers, flare candles, and smoke flares were fed to the incinerators on input conveyor belts and corresponding feed chutes. Upon entering the furnaces, the munitions were propelled through rotary kilns toward fuel-oil burners. As the munitions approached the flame and were heated, they either burned or detonated. Each of the fuel-oil burners was supplied by an aboveground storage tank.

Exhaust gases from the furnace were directed through an air pollution control system consisting of a cyclone and baghouse. The cyclone served as a particulate removal device for the larger particles in the exhaust gases, whereas the baghouse was designed for the removal of smaller particles. In order to remove collected dust and dirt from the bags, a surge of high pressure air was induced to reverse air flow through the bags. The dust then settled into hoppers and was exhausted through motor-driven double discharge gates into collector barrels under the hoppers (RCRA Part B Permit Application, 1984).

Demilitarization - High Pressure Water Washout

High pressure water washout of 5-inch projectiles filled with Composition A was conducted at Building 146. In addition, steamout of Army ammunition and rockets containing TNT and Composition B was reportedly conducted between 1954 and 1956 (NEESA, 1983).

The washout demilitarization was accomplished by first drilling out and recovering approximately 5 pounds of powder from each projectile. An additional 3 pounds of powder was then washed out, collected, and disposed of at the burning ground (NEESA, 1983). Prior to 1978, the generated wastewater was discharged to a storm

drain with release to a ditch and ultimate transport to Boggs Creek. Subsequent to 1978, wastewater was collected in sumps and transported to the Rockeye area for treatment (A.T. Kearney, Inc., 1987).

5.4.1.2 Maintenance

Information regarding routine inspection or maintenance activities associated with washout demilitarization and munitions loading at Building 146 was not available. It is anticipated that munitions loading and demilitarization areas were rinsed with water daily to minimize ignition of explosive dust.

Throughout the operating history of the incinerators, maintenance has consisted of upgrade and replacement of air pollution control system equipment and subsequent dismantlement of the incinerators. It is anticipated that inspections conducted at the Building 146 incinerators included daily operations inspections and, potentially, quarterly facility inspections.

5.4.2 Existing Data Assessment

5.4.2.1 Monitoring Devices

There are five groundwater monitoring wells located around the southeast perimeter of the SWMU. Well construction is summarized in Table 5-1 and well construction diagrams are included in Appendix K.

5.4.2.2 Analytical Data

Table 5-2 presents analytical data for two demilitarization ash pile samples collected in 1982. The results show that the ash from the rotary kiln furnaces was a RCRA toxicity characteristic hazardous waste.

The Weapons Quality Engineering Center performed source emission testing of the Building 146 rotary furnaces in 1980 and 1981. The purposes of the testing were to determine if emissions would comply with Indiana State emission standards with only treatment by cyclone separation and to determine gaseous emissions from different types of ammunition (Burch and Schwenk, 1982). Table 5-3 presents the types of ammunition tested by item nomenclature, production weights, and explosive composition. Particulate and gaseous emission results from the 1980 tests are summarized in Table 5-4. The emission rates determined from the source emission testing exceeded the allowable rate of emission set forth under Regulation APC-5 of the

TABLE 5-2

DEMIL ASH ANALYTICAL RESULTS
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Units: ppm

	EP Toxicity 8-5-82	As Received 8-23-82	IEPA Leachate 8-23-82	EP Toxicity 9-30-87	EP Toxicity Action Levels
Arsenic	<0.010	0.45	--	0.12	5
Barium	340	16,000	11,500	4.7	100
Cadmium	0.33	474	--	18	1.0
Chromium	<0.05	39.5	--	<0.01	5.0
Lead	11.2	14,100	11.5	330	5.0
Mercury	<0.0010	0.408	--	0.0137	0.2
Selenium	<0.005	<0.50	--	<0.010	1.0
Silver	<0.05	10.8	--	<0.01	5.0
TNT	<0.001	--	--	--	--
RDX	0.008	--	--	--	--
HMX	0.22	--	--	--	--
pH	--	11.8	--	6.7	12.5≤pH≤2
Flash Point	--	>212° F	--	--	--
Copper	--	15,900	--	--	--
Nickel	--	46.9	0.76	--	--
Zinc	--	123,000	11.0	--	--
Dissolved Sulfides	--	<2.0	--	--	--
Phenols	--	<5.0	--	--	--
Cyanides	--	<10.0	--	130	--
Total Sulfides	--	--	--	<1	--
PCBs	--	--	--	11	--

Note: "--" means not analyzed.

Sources: EIS, Inc., 1982; CWM, 1982.

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TABLE 5-3

ROTARY FURNACE TEST ITEMS
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Item	Explosive Content (Grains)	Item Weight Total (Lbs)	Items/ Min	Process Weight Total Lbs/Hr
30 Cal	50 smokeless power 5.5 primer	0.058	300	1,044
50 Cal API	235 smokeless power 11.5 incendiary 5.0 primer	0.26	150	2,520
Det Cord Initiators Mark 2-0	15 tetryl	0.589	10 30	352 1,060
Electric Blasting Caps, M109	20.0 PETN	0.10	25	150
Nonelectric Blasting Caps, M13	18.5 PETN	0.10	25	150
20mm HE	623 smokeless powder 168 tetryl	0.57	20	684

Source: Burch and Schwenk, 1981.

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TABLE 5-4

1980 EMISSION DATA
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Particulate Results

Item	Furnace	Date	Rate (Items/Min)	gr/scf	Corrected to 12% CO_2 gr/scf	lbs/hr
30 Cal	2	7-30-80	300	0.26	5.23	7.25
30 Cal	2	7-31-80	300	0.45	9.05	12.43
30 Cal	1	7-30-80	300	0.26	3.35	7.32
30 Cal	1	7-31-80	300	0.22	4.88	8.27
50 Cal Inc.	2	9-11-80	150	0.74	13.38	29.94
50 Cal Inc.	2	9-12-80	150	0.50	11.38	21.17

Gaseous Results

Item	Furnace	Date	Rate	Sulfur Dioxide ppm	Sulfur Dioxide lbs/hr	Nitrogen Oxides ppm	Nitrogen Oxides lbs/hr
30 Cal	2	7-30-80	300	--	--	3,332	51.6
30 Cal	2	7-31-80	300	1.0	0.03	1,049	23.9
30 Cal	1	7-30-80	300	--	--	1,594	36.7
30 Cal	1	7-30-80	300	1.0	0.03	389	12.0
50 Cal Inc.	2	9-11-80	150	1.0	0.03	3,955	131.9
50 Cal Inc.	2	9-12-80	150	1.0	0.03	2,276	79.6

Note: Furnaces sampled in horizontal duct preceding emission control equipment (cyclone separation only).

Source: Burch and Schwenk, 1981.

RP/15EMRF/AA3

Air Pollution Control Board of the State of Indiana (Burch and Schwenk, 1981). Opacity testing in 1980 determined that the visible emissions for both the 50 and 30 cal ammunition exceeded standards set forth under Regulation APC-3 (Burch and Schwenk, 1981). These results show that furnace could not comply with Indiana standards without the baghouses on-line.

The gaseous analysis results obtained in 1981 are presented in Table 5-5. The sulfur dioxide standard at that time (APC-13) applied only to sulfur dioxide emissions exceeding 10 lbs/hr. The tested emissions were well below this level and the study concludes that sulfur dioxide emissions should not present a problem as long as No. 2 fuel oil is used to fire the furnace burners. No nitrogen oxides emission standards from stationary sources were in-place in Indiana during 1980-1981. The 1980 results for 50 cal ammunition were particularly high. The prescribed sample method, however, may not give true indication of actual oxides of nitrogen emission rates (Burch and Schwenk, 1981). In general, the 1981 nitrogen oxides emission rates were significantly lower.

Surface soil/sediment samples have been collected around Building 146 in 1982 and 1985. Results for samples collected in 1982 from the south surface water drainage ditch are presented in Table 5-6. A sample location map for the 1982 soil samples was not available, however a hand-drawn sketch of the 1985 soil sampling locations is included in Appendix M (Figure M-1). The 1982 samples exceed EP toxicity action levels for cadmium and lead. These samples also contained trace levels of explosives and a high oil and grease content. One of the 1985 samples (No. 4) exceeded the EP toxicity action level for lead. None of the 1985 samples contained detectable levels of explosives. The detection levels, however, were relatively high.

Table 5-7 summarizes analytical data for samples collected from the north ditch during the Water Quality Engineering Special Study (Department of the Army, 1980). These sediment samples were collected from drainageways where the Building 146 floor drains presumably discharge. Sample locations are shown in Appendix M (Figure M-2). Sample point No. 1, located to the west of Building 146, was sampled twice. Both times the sediment was high in TNT, RDX, and HMX. Sample point No. 2 contained a low level of HMX.

Water analytical results are summarized in Table 5-8. The 1979 samples were collected near settling basins or sumps where the Building 146 floor drains discharge (from the same areas that the sediment samples were collected). The sample locations are shown in Appendix M (Figure M-2). It is not known whether the 1972 sample was collected from the east or west sump. The 1972 sample contained detectable levels of RDX and HMX.

TABLE 5-5

1981 GASEOUS EMISSION RESULTS
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Date	Item	Feed Rate Items/Min.	Furnace #	Sulfur Dioxide ppm	Sulfur Dioxide lb/hr	Oxides of Nitrogen ppm	Oxides of Nitrogen lb/hr
5-12-81	Det Cord Initiators	10	2	2.7	0.089	21.3	0.370
5-13-81	Det Cord Initiators	30	2	<0.1	<0.2	99.9	1.780
5-19-81	Blasting Caps Non Electric	25	2	4.1	0.115	30.0	0.444
5-20-81	Blasting Caps Electric	25	1	0.5	0.012	19.0	0.223
5-21-81	30 Cal. Ball	300	1	0.75	0.018	1,880	23.89
5-21-81	30 Cal. Ball, Carbine	300	2	<0.1	<0.001	840	12.42
5-26-81	30 Cal.	300	1	<0.1	<0.001	750	9.069
5-27-81	30 Cal.	300	2	0.18	0.006	388	6.548
6-16-81	20mm Dummy, A.P.I.	20	2	0.13	0.005	326	6.270
6-17-81	20mm, HEI	20	1	2.3	0.062	461	6.574
6-17-81	20mm, (Primers only)	20	3	3.8	0.076	2	0.022
6-18-81	20mm	20	1	2.0	0.068	212	3.774

Source: Burch and Schwenk, 1981.

RP/15EMRF/AA3

TABLE 5-6

SOIL ANALYTICAL RESULTS
BUILDING 146 - SOUTH DITCH
NWSCC
CRANE, INDIANA
NOVEMBER 1992

	EP Toxicity Action Levels	EP Toxicity* 8-5-82	EP Toxicity* No. 1 (East) 8-22-85	EP Toxicity* No. 2 (East) 8-22-85	EP Toxicity* No. 3 (West) 8-22-85	EP Toxicity* No. 4 (West) 8-22-85
Arsenic	5.0	<0.010	<0.004	<0.004	<0.004	0.004
Barium	100.0	49	4.10	4.35	34.9	25.9
Cadmium	1.0	11.0	0.05	0.05	0.15	0.15
Chromium	5.0	<0.05	<0.10	<0.10	<0.10	<0.10
Lead	5.0	11.1	0.55	0.50	2.50	5.80
Mercury	0.2	<0.0010	<0.003	<0.003	<0.003	<0.003
Selenium	1.0	<0.005	<0.004	<0.004	<0.004	<0.004
Silver	5.0	<0.05	<0.01	<0.01	<0.01	<0.01
TNT	--	<0.001	<3.6	<3.6	<3.6	<3.6
RDX	--	0.013	<5.0	<5.0	<5.0	<5.0
HMX	--	0.022	<7.2	<7.2	<7.2	<7.2
Oil and Grease*	--	42,400	--	--	--	--

* With the exception of oil and grease, samples were extracted and analyzed using the EP Toxicity test procedure according to RCRA.

Note: Metals concentrations reported as mg/l, explosives concentrations reported as mg/kg, and oil and grease concentrations reported as mg/kg (dry).

1985 Sample Locations are shown in Appendix M (Figure M-1).

Sources: EIS, Inc., 1982.
1985 Analytical Reports received from NWSCC (no accompanying text provided).

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TABLE 5-7

SOIL ANALYTICAL RESULTS
BUILDING 146 - NORTH DITCH
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Units: mg/kg

	No. 1 (West) 4-9-79	No. 2 (East) 4-9-79	No. 1 (West) 6-8-79
TNT	109	<0.5	382
RDX	31	<2	44
HMX	7	1.0	10.2

Source: Department of the Army, 1980.

Note: Sample locations are shown in Appendix M (Figure M-2).

RP/15EMRF/AA3

TABLE 5-8

WATER ANALYTICAL RESULTS
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Units: mg/l except where noted

	Settling Basin 7-1-72	No. 1 (West) 4-9-79	No. 2 (East) 4-9-79	No. 1 (West) 6-8-79
COD	782	--	--	--
TSS	1,662	8	68	--
TDS	90.6	--	--	--
TOC	--	2.7	5.7	--
Chloride	--	3.0	12	--
Sulfate	--	8	19	--
Total Nitrogen	5.1	--	--	--
Total Phosphorus	0.05	0.02	0.18	--
Oil and Grease	229	--	--	--
Copper	0.30	--	--	--
Zinc	2.0	--	--	--
Magnesium	14	--	--	--
Potassium	0.50	--	--	--
Chromium	0.0	--	--	--
Calcium	10.0	--	--	--
Iron	0.30	--	--	--
Cadmium	0.0	--	--	--
Manganese	0.0	--	--	--
Sodium	1.8	--	--	--
Lead	10.0	--	--	--
TNT	0.0	0.011	<0.005	0.003
Cyanide	0.0	--	--	--
RDX	6.75	0.03	0.02	<0.01
HMX	1.95	<0.01	<0.01	<0.01
pH (SU)	8.9	6.1	7.0	5.4
Turbidity (JTU)	19	--	--	--

Notes: JTU = Jackson Turbidity Units
SU = Standard Units
1979 Sample locations are shown in Appendix M (Figure M-2).

Sources: Department of the Army, 1980.
Kent et al., 1973.

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Sample point No. 1 contained trace levels of TNT both times it was sampled in 1979 and a low level of RDX during the first sampling event. Sample point No. 2 contained a low level of RDX in 1979. None of the 1979 samples contained detectable levels of HMX. No measurable concentrations nor related detrimental effects were found in the Building 146 receiving stream, Turkey Creek (Department of the Army, 1980).

Soil samples have been collected from within the Building 146 incinerator bays as part of closure activities (NWSCC Environmental Protection Division Reference File 5090/H3.0). Between October and December 1989, 133 soil samples were collected from 34 locations from depths between 0 and 2 feet below the surface. The samples were analyzed for total metals and PCBs. The sampling locations analytical results and analytical methods are presented in Appendix N-1. In March 1990, an additional 16 samples were collected from four locations to represent background conditions. Background sampling locations and analytical results are included as Appendix N-2. Upon review of the analytical data from the sampling efforts and the sampling data documentation, the IDEM determined that the Quality Assurance/Quality Control (QA/QC) data for the PCB parameters were inadequate (IDEM, 1990). The IDEM directed NWSCC to resample at six locations between 0 and 2 feet below the surface. The six locations and the corresponding PCB analytical data are presented in Appendix N-3.

Soil analytical results in Appendix N-1 and N-2 show detectable levels of arsenic, barium, cadmium, chromium, lead, selenium and silver for almost every sample from beneath the incinerator bays and background soil locations. Table 5-9 summarizes the concentration ranges of detected metals for Building 146 and average concentrations found in soil as presented by Dragun (1988). Comparison of analytical results reveals that the concentrations of arsenic, cadmium, chromium, selenium, and silver detected beneath the incinerator bays exceed background conditions. Exceedances involving selenium and silver are considered significant. Comparison of detected concentrations of metal to the ranges commonly found in soil indicate that elevated levels of cadmium and silver are present in soil at Building 146. The PCB analytical data presented in Appendix N-3 indicates that detectable levels of PCBs were not present at Building 146 sampling locations.

Four monitoring wells (WES-14-1-83 through WES-14-4-83) were installed near Building 146 in July 1983. During well installation, soil and groundwater samples were collected and analyzed for metals and select organic compounds. An additional well (WES-14-5-83) was installed in September 1983, but was not sampled. The analytical data are presented in Tables 5-10 and 5-11 for soil and groundwater, respectively. Table 5-10 also lists average U.S. soil concentrations of metals for comparison. Based on the average concentrations, the soils around Building 146 appear to contain elevated

TABLE 5-9

SUMMARY OF METALS DETECTED IN SOIL BENEATH B-146 INCINERATOR BAYS NWSCC CRANE, INDIANA NOVEMBER 1992

	Range of Concentrations		
Compound	Soil Beneath B-146 Incinerator Bays (mg/kg)	B-146 Background Soil[1] (mg/l)	Average Soil[2] (ppm)
Arsenic	<0.05 - 9.05	<0.05 - 5.45	1.0 - 40.0
Barium	8.10 - 424.75	10.50 - 989.5	100 - 3500
Cadmium	<0.10 - 11.55	<0.10 - 8.0	0.01 - 7.0
Chromium	1.00 - 49.60	6.0 - 32.0	5.0 - 3000
Lead	<0.10 - 415.5	<0.25 - 3518	2.0 - 200
Selenium	<0.10 - 1.85	<0.10	0.1 - 2.0
Silver	<0.50 - 57.90	<0.5	0.1 - 5.0

[1]Analytical and Consulting Laboratories (Anacon, Inc.). The units (mg/l) are as provided on sample analysis results reported by Anacon, Inc. It is suspected that these values are mg/kg.
[2]Dragun, 1988.

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TABLE 5-10

SOIL ANALYTICAL RESULTS
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Units: mg/kg unless otherwise indicated.

	Well No. 1 0 - 2.8 ft	Well No. 2 0 - 5 ft	Well No. 2 5 - 8.7 ft.	Well No. 3 0 - 5.2 ft.	Well No.4 0 - 3.8 ft.	Average U.S. Soil Concentrations[3]
PCB 1260 (ug/l)	ND	NA	NA	NA	NA	--
Lead, Total	26	9.3	8.4	22	58	10
Chromium, Total	37	27	30	30	44	100
Copper, Total	24	11	7.2	15	32	30
Nickel, Total	ND	13	16	15	32	100
Silver, Total	ND	ND	ND	ND	ND	0.05
Cadmium, Total	ND	ND	ND	ND	ND	0.06
Mercury, Total	ND	ND	ND	ND	ND	0.03
Zinc, Total	160	33	19	86	280	50
Arsenic, Total	7.0	5.8	5.0	6.4	3.1	10
Barium, Total	30	27	27	27	93	430
Selenium, Total[1]	<2	<2	<2	<2	<2	0.50
Trichloroethylene	ND	ND	ND	ND	ND	--
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	--
Methylene Chloride[2]	ND	ND	ND	ND	ND	--

Notes:
1 Higher detection limit due to matrix interference.
2 Elevated detection limit due to presence of compound in blank.
3 New Lyme Landfill RI/FS, CH_2M Hill, 1986.

ND Not Detected
NA Not Analyzed
-- No information available.

Source: ERG, 1983.

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TABLE 5-11

GROUNDWATER ANALYTICAL RESULTS
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Units: mg/l unless otherwise indicated.

	Well No. 1	Well No. 2	Well No. 3	Well No.4	MCL/SMCL[2]
Lead, Total	0.05	0.06	0.20	0.11	0.005 (proposed)
Chromium, Total	0.050	0.086	0.16	0.038	0.1
Copper, Total	0.036	0.052	0.12	0.052	1.3 (proposed)
Nickel, Total	0.30	0.16	0.55	0.36	0.1 (proposed)
Silver, Total	ND	ND	ND	ND	0.10
Cadmium, Total	ND	ND	ND	0.006	0.005
Mercury, Total	0.0007	0.0010	0.0036	0.0026	0.002
Zinc, Total	0.28	0.26	0.94	1.6	5
Arsenic, Total	0.006	0.005	0.030	0.031	0.05 (under review)
Barium, Total	ND	ND	ND	ND	2 (proposed)
Selenium, Total	ND	ND	ND	ND	0.05
Trichloroethylene (ug/l)	6.9	ND	27	2.7	5
1,1,1-Trichloroethane (ug/l)	ND	ND	ND	ND	200
Methylene Chloride (ug/l)[1]	ND	ND	ND	ND	5 (proposed)

Notes:

1 Elevated detection limit due to presence of compound in blank.
2 MCL = Maximum Contaminant Level; SMCL = Secondary Maximum Contaminant Level; Drinking Water Regulations and Health Advisories, EPA, 1991.

Source: ERG, 1983.

RP/15EMRF/AD8

levels of lead and zinc. The detected concentrations of lead and zinc in samples from downgradient wells WES-14-1-83 and WES-14-4-83 (Figure 5-3) were an order of magnitude greater than in samples from wells WES-14-2-83 and WES-14-3-83. No organic compounds were detected in the soil samples.

As shown in Table 5-11, groundwater samples collected from the wells around Building 146 exceeded drinking water regulations for lead, chromium, nickel, cadmium, mercury, and trichloroethylene. The concentrations of chromium, copper, and trichloroethylene detected in WES-14-3-83 were an order of magnitude greater than detected concentrations in the other three wells. Trichloroethylene, detected in three of the wells, was the only organic compound detected.

5.4.2.3 Types and Volumes of Waste

Wastes historically generated at Building 146 include those resulting from cast high explosive filling, washout demilitarization, and incineration demilitarization. Loading activities produced TNT, RDX, HBX, ammonium picrate residuals, and contaminated wastewater. These were probably originally washed down from within the building into the floor drains, if the drains were in place at that time. The floor drains discharge to settling basins or sumps which subsequently discharge to natural surface drainage. After the Rockeye Treatment Facility was installed, wastewaters generated at Building 146 have been transported to that facility for treatment (Department of the Army, 1978).

Washout activities included demilitarization of 5-inch munitions containing Composition A. Items containing TNT and Composition B were also briefly washed out in Building 146 (Department of the Army, 1979). Until 1975 or 1976, explosive material not reclaimed for resale was washed out directly into a storm drain that discharged into the Boggs Creek Watershed (Department of the Army, 1978). Three to 3-1/2 pounds of unreclaimed material from each 5-inch munition were washed out in this manner (Department of the Army, 1978). No information regarding flow rates generated by the filling or washout activities was obtained. Sediment and surface water data for samples collected near the settling basin areas were presented in Section 5.4.2.2.

No information concerning actual feed items and rates for Building 146 demilitarization was available. Treated wastes consisted primarily of military energetic materials and ordnance that had exceeded the "shelf-life", off-spec versions of these items, or various waste components from the manufacturing processes that could not be recycled or otherwise disposed safely (RCRA Part B Application, 1990). In addition, there are indications that possible incineration of PCB-contaminated fuels or materials has occurred (Memorandum to File, December 1987). These fuel blending procedures were

reportedly not intended to incinerate PCBs, but rather to minimize waste oil generation and to supplement fuel requirements (NWSCC, 1992a). Lists of incinerator design capacity or munitions which may be treated, however, have been compiled at various times. Table 5-12 is a 1983 list of munitions potentially fed into deactivation furnaces at NWSCC (Department of the Army, 1983). A more recent list of munitions which may be treated was found in the 1990 RCRA Part B Application and is included as Appendix O. The more recent listing contains munitions which are not on Table 5-12. It is assumed that these additional munition items were not yet regarded off-spec or obsolete in 1983. It is also assumed that the earlier list is more representative of munitions actually treated while the incinerators were still active. Further characterization of the munitions in Table 5-12 are included in Appendix P.

Data regarding the quantity of ash or particulate and gaseous emissions generated by the incinerators was not provided and cannot be estimated without actual feed item and rate information. The 1990 list of munitions which may be treated (Appendix O) provides an indication of the amount of ash and emissions which may have been released. The source emission testing data presented in Section 5.4.2.2 provides further information concerning potential particulate and gaseous releases, particularly those occurring prior to baghouse installation. Initially, incinerator ash was piled near Building 146. Later, ash and residue from burning and baghouse dust was collected in 55-gallon drums and transferred to the Central Storage Facility at NWSCC (RCRA Part B Application, 1990). Waste oils were also reportedly run through the Building 146 incinerators (NWSCC, 1991e). This was done to minimize waste oil generation and to supplement fuel requirements (NWSCC, 1992a).

5.4.2.4 Spills or Releases

A review of spill response records maintained by the Environmental Protection Division at NWSCC determined that no spills or releases have been documented in the Building 146 area since October 5, 1987. No information on spills or releases prior to October 1987 was found in other records reviewed for Building 146.

5.4.2.5 Potential Migration Pathways

Potential migration pathways at Building 146 include air, surface water, and groundwater. Particulate and gaseous emissions were directly released to the atmosphere from the deactivation furnaces prior to baghouse installation and during air pollution control system failure. Also, incinerator ash was previously stored in piles near Building 146. There is no known specific ash pile location (NWSCC, 1992a). Ash was likely dispersed and blown to other portions of NWSCC, most notably to the southeast, south, southwest, and west of the incinerator bays. Air should no longer be a migration pathway because the furnaces and ash piles have been removed.

TABLE 5-12

MUNITION ITEMS POTENTIALLY FED INTO DEACTIVATION FURNACES
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Munition Item	Model Number
50 Cal API	T49
45 Cal Ball	M1911
Fuze/Mine Combination	M605
Fuze	Mk 72, Mods 1-13
Fuze, Aux. Detonator	Mk 52, Mod 3
Fuze	Mk 91, Mod 1
Fuze, Point Detonating	M519
Fuze, Point Detonating	M51A5
Fuze, Aux. Detonating	Mk 52, Mod 0
Detonator	Mk 29, Mod 0
Booster	M21A4
Fuze, Point Detonating	Mk 30, Mods 0-3
Fuze, Point Detonating	Mk 30, Mod 5
Fuze, Mechanical Time	Mk 50, Mods 0-8
Fuze, Point Detonating	Mk 29, Mod 3
Fuze, Aux. Detonating	Mk 54, Mods 0-2
50 Cal Spotter-Tracer	M48
Fuze	Mk 74, Mods 0 and 1
Fuze, Aux. Detonating	Mk 28, Mod 0
Fuze, Base Detonating	Mk 31, Mod 2
Fuze, Base Detonating	Mk 20, Mod 2
Fuze, Base Detonating	Mk 21, Mod 1
Fuze, Mechanical Time	Mk 61, Mod 0
Detonator	Mk 35, Mod 3
Detonator	Mk 59, Mod 0
Squib	Mk 1, Mod 0
Fuzing System Bomb	Mk 1, Mod 0
Delay	M9
Fuze Bomb	M116
Booster	Mk 39, Mod 0
7.62 mm Tracer	M62
22 Cal Ball	M24
5.56 mm Grenade	M195
7.62 mm Blank	--
7.62 mm Ball	M80
5.56 mm Tracer	M196
50 Cal Spotter-Tracer	M48A1
50 Cal API	M8
30 Cal Carbine Tracer	M27
30 Cal Blank	M1909

TABLE 5-12 (Continued)

MUNITION ITEMS POTENTIALLY FED INTO DEACTIVATION FURNACES
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Munition Item	Model Number
30 Cal Carbine Ball	M1
30 Cal API	M2
20 mm High Explosive	H97A2
20 mm APT	M95
Ignition Cartridge	M2
Booster	M21A4
38 Cal Ball	M41
Fuze	M78
30 Cal Ball Match	M72
Impulse Cartridge	Mk 152, Mod 0
Initiation Cartridge	M125
Squib	Mk 13
Impulse Cartridge	Mk 125, Mod 0
Initiation Cartridge	Mk 11
Impulse Cartridge	M19
Squib	572
Impulse Cartridge	291A
Fuze, Aux. Detonating	Mk 395, Mod 1
Fuze, Aux. Detonating	Mk 396, Mod 1
Fuze, Prox.	Mk 7K2
Fuze, Mechanical Time	Mk 67, Mod 2
Fuze, Mechanical Time	Mk 68, Mod 0
Fuze, Point Detonating	--
Fuze, Base Detonating	--
Fuze, Area Detonating	Mk 54, Mod 1
Primer	Mk 14, Mod 1
Delay, Plunger Assembly	Mk 1
Delay, Plunger	--
Fuze, Area Detonating	Mk 384, Mod 0
Safety Device	Mk 18, Mod 6
Fuze, Mechanical	Mk 395, Mod 0
Fuze, Area Detonating	Mk 395, Mod 0
Fuze, Area Detonating	Mk 379, Mod 1
Fuze, Point Detonating	--

TABLE 5-12 (Continued)

MUNITION ITEMS POTENTIALLY FED INTO DEACTIVATION FURNACES
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Munition Item	Model Number
Fuze, Base Detonating	Mk 85, Mod 0
Booster Assembly	Mk 384, Mod 0
Primer, Percussion	--
Fuze, Area Detonating	Mk 64, Mod 2
Fuze, Prox.	--
Detonator	Mk 19, Mod 0
Booster	Mk 395, Mod 0
Fuze, Mechanical Time	Mk 58
Primer	M52AH
Fuze	--
Sealing Cup	Mk 43
Dyralin Wad	--
Distress Signal	--
Squib Assembly	--
Blasting Cap	--
Detonator Assembly	--
Primer	--
7.62 mm Cartridge	--
20 mm Target Practice Cartridge	--
Fuze, Mechanical Time	Mk 349
Fuze, Mechanical Time	Mk 342, Mod 0
20 mm HEI Cartridge	--
20 mm HEI Cartridge	--
20 mm HEI Cartridge	Mk 106
20 mm Target Practice Cartridge	Mk 105, Mod 1
30 Cal Cartridge	--
50 Cal Cartridge	M1
12 Gauge Cartridge	--
Ignition Cartridge	M2 85
Signal Cartridge	Mk 43
Primer, Detonating Fuze	M14
Primer, Detonating Fuze	M14
Base Booster Assembly	--
Base Booster Assembly	--
Sensory Element (Fuze)	--
Grenade Adapter	M1A1

TABLE 5-12 (Continued)

MUNITION ITEMS POTENTIALLY FED INTO DEACTIVATION FURNACES
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Munition Item	Model Number
Grenade Adapter	M1A1
Practice Hand Grenade	--
Grenade Cartridge Asst.	--
Practice Rifle Grenade, AT	M11A3
Grenade Cartridge	M30
Warhead Booster	Mk 35
Warhead Initiator Assembly	--
Rocket Motor Initiator	Mk 282
Booster Cup	Mk 30
Rocket Igniter	M127
Rocket Motor Igniter	Mk 6, Mod 0
Fuze, Mine	M10 Series
Primer, Igniter	--
Squib, Time Delay	--
Arming Device	Mk 2, Mod 1
Shutter Housing	Mk 1, Mod 0
Primer	Mk 250
Primer	Mk 25, Mod 1
Impulse Cartridge	Mk 33, Mod 1
Fuze Assembly	Mk 362, Mod 0
Blasting Cap	M6
Ignition Cylinder	--
Cutter Cartridge	--
Impulse Cartridge	--
Detonator Initiator	--
Life Raft Cartridge	--
Impulse Cartridge	--
Squib	--
Impulse Cartridge	Mk 2, Mod 1

Notes:

API: Armor Piercing Incendiary.
APT: Armor Piercing Tracer.
HEI: High Explosive Incendiary.

Source: Department of the Army, 1983.

RP/15EMRF/AA3

Surface water provides another migration pathway. Historically, contaminated washdown and washout wastewaters have been discharged via floor drains to sumps which empty to the Boggs Creek watershed. Although wastewaters are not currently generated at Building 146, surface water may continue to act as a migration pathway. Contaminants may desorb from sediments, or contaminated sediments may be resuspended and washed from the area.

Contaminants sorbed to drainageway sediments or nearby soils could slowly desorb and percolate through the vadose zone to groundwater. Also, precipitation passing through ash piles could mobilize contaminants. Solubilized or suspended contaminants could then either resorb onto underlying soils or migrate to groundwater. Although the ash piles have been removed, contaminants may continue to leach into groundwater from the soils in this area.

5.4.3 SWMU Reconnaissance

The Building 146 Cast High Explosives Fill/Incinerator area visual reconnaissance was conducted on October 22, 1991. An NWSCC environmental specialist accompanied Donohue during the reconnaissance and provided answers to questions raised during the walkover.

The Building 146 SWMU can be divided into two separate areas based on operational process; however, Building 146 exists as one continuous structure. The northern two-thirds of Building 146 have historically been used primarily for the production of 40-millimeter rounds. The southern third of Building 146 is the area which contains the remnants of three incineration furnaces used to demilitarize small arms ammunition.

The incineration operation at the south end of Building 146 appears to be a recent addition in comparison to the remainder of the building. Demilitarization using the incinerators at Building 146 is reported to have started in 1967 (A.T. Kearney, Inc., 1987). At the time of the reconnaissance, the incinerators were inactive, inoperable, and in various stages of dismantlement.

Incineration furnaces were housed in separate bays with walls constructed of concrete block (8 to 10 feet high) and poured concrete floors. At the time of this reconnaissance, the bays were uncovered and it is not certain if the bays were previously covered. Parts of the disassembled furnaces were present in all bays. The east and west bays are each reported to have contained an 87.4 ft^3 oil-fed, rotary kiln, type APE 1236, incinerator. The central bay is reported to have housed a prototype 46.1 ft^3 capacity incinerator. Miscellaneous equipment and incinerator components were present in all bays; however, the smaller prototype incinerator bay was nearly empty (Appendix Q, Photo

No. 12). A retort (used to contain and rotate ammunition during demilitarization) removed during dismantling was stored on the floor in the east bay (Appendix Q, Photo No. 13). Incineration demilitarization processes were stated to have stopped in 1986-1987 and dismantling to have been initiated in 1988 (NWSCC, 1991e).

The floors in the incinerator bays were stained red brown and/or dark gray near steel structures and platforms previously supporting incineration equipment. Equipment platforms were stained with oily residues.

Sections of dismantled retorts and cyclones, as well as equipment to be used for the assembly of new incinerators, are stored on the ground southwest of Building 146. The ground surface in the storage area is covered with gravel. The interiors of several of the dismantled retort sections were coated with a slag resulting from ammunition demilitarization (Appendix Q, Photo No. 14). This slag is composed of ammunition components possessing low melting points (NWSCC, 1991e). Fragments of slag were also noted on the ground near the stored retort sections (Appendix Q, Photo No. 15). Runoff from this area drains south to an east-west trending ditch which diverts drainage beneath the fence surrounding the Building 146 complex to the ravine running parallel to the western side of Building 146. Small piles of ash residue were observed adjacent to the ditch inside and outside of the fence. NWSCC staff (1991e) stated that the fence was recently erected and should not be interpreted to delineate the extent of past activities (NWSCC, 1991e). Several open rusted 55-gallon steel storage drums were noted on the banks of the ravine outside of the fence west of Building 146.

Three aboveground storage tanks are present south of the incinerator bays. These tanks stored No. 2 fuel-oil used to fire the incinerators. Tanks supplying fuel to the larger incinerators in the exterior east and west bays have an approximate capacity of 1,750 to 2,000 gallons. The tank supplying fuel to the prototype incinerator in the center bay is considerably smaller having an estimated capacity of 300 to 500 gallons. The ground surface in the vicinity of the tanks is covered with gravel. Staining is evident on the ground surface in the vicinity of the tanks (Appendix Q, Photo No. 16). Waste oil was likely burned as fuel in the incinerators at Building 146, according to NWSCC Environmental Division staff (NWSCC, 1991e).

During a review of files on Building 146, a memorandum was found which requested that oil-contaminated ground beneath fuel tanks at Building 146 be cleaned up and fresh gravel placed beneath the tanks. In addition, this memorandum recommended that action be taken to combine the three fuel tanks into one tank (NWSCC, 1984). Another memorandum, dated 1986, identifies the need to remove fuel-oil from incinerator fuel-oil tanks during retrofitting/dismantling and reports that one fuel tank is partially filled with water (SMCCN-EDP, 1986).

Areas south and southeast of Building 146 and the incinerator fuel storage tanks were observed to have been disturbed, with noticeably less vegetation than surrounding areas. NWSCC staff stated that these areas had been used to stockpile ash from incineration demilitarization operations. It was also stated that during the late 1970s, removal of stockpiled ash and potentially contaminated soil took place. Materials removed from the site were thought to have been disposed of at a Chemical Waste Management facility outside NWSCC (NWSCC, 1991e). Nevertheless, cartridge fragments and small quantities of ash were observed in the area.

Five monitoring wells were present outside of the fenced area, north, south, southeast, and southwest of the former Building 146 incinerators (Figure 5-3). Monitoring wells were installed by the USACE in July through September 1983 (Dunbar, 1984). The current status of these wells is not known.

Rock cores stored in core boxes were found at three locations on the concrete pad supporting the incinerators. Cores were reportedly recovered by the USACE at four locations during early closure work for the incinerators. Core holes are reported to have been grouted after drilling (NWSCC, 1991b).

An asphalt-covered area east and northeast of the incinerator bays was stated to have been the location of baghouses for the incinerator particle emission elimination system (NWSCC, 1991e). The baghouses are no longer present. Concrete footings used to support such structures, however, are still present. Larger concrete pads in the area and just west of Building 3065 were stated to have supported fiberglass columns used in the particle elimination/emission scrubber system during demilitarization of select ordnance. Red brown staining and dark discoloration was noted on the blacktop in the vicinity of the former baghouses and treatment columns (Appendix Q, Photo No. 17).

Piping extending from the west side of Building 3065, the Air Pollution Control Building, is considered to have connected to the treatment columns formerly located there. Liquids decanted from the columns were stored inside a stainless steel tank inside Building 3065 (NWSCC, 1991e). These columns were thought to have been used when demilitarizing ordnance containing ammonium picrate or Yellow D. Liquids contained in the tank were transferred to transport tankers through a conduit outside the southern wall of the building. After transfer to tankers, waste liquids were transported to the Rockeye Wastewater Treatment Facility (NWSCC, 1991e). Red-brown and dark brown staining was observed on the blacktop beneath the liquid transfer conduit on the south side of the building. Surface runoff from the asphalt area is collected in a north-south trending ditch east of the area and diverted towards the south. This ditch turns east, south of the incineration area, and flows into the ravine east of Building 146. A monitoring well is located just south of the ditch.

According to NWSCC staff (NWSCC, 1991e), wastes generated from the incineration process included ash or heavy residues in the kiln and dust-size particles "knocked out" in the cyclones and baghouses included as emission control measures. Materials knocked out in the cyclones and baghouses were reportedly deposited in 55-gallon steel storage drums at the outfall of these devices and considered hazardous wastes. During full operation, 10 to 12 drums of cyclone/baghouse dust were reportedly generated every 2 days. These drums were temporarily stored in an enclosed steel hazardous waste facility prior to transportation to the Central Storage Facility (CSF) at NWSCC. Materials at the CSF were disposed of as hazardous waste along with other hazardous wastes off base. Chemical Waste Management, Inc., collected hazardous waste at the CSF as often as twice per week. The need to empty and dispose of the contents of the incinerator kiln were dependent on the ordnance undergoing demilitarization.

Inspections conducted at the Building 146 incinerators include daily operations inspections (similar to a hazardous waste inspection) conducted by the Army, and potentially a quarterly facility inspection by the Navy.

Reconnaissance of the remaining two-thirds of Building 146 produced several potentially significant observations. Foremost is the presence of two settling basins near the northeast and northwest corners of Building 146. These settling basins are thought to accept discharge from floor drains inside Building 146 (NWSCC, 1991e). Activities occurring in Building 146 have been previously discussed in detail and include ordnance production and demilitarization.

Wastewater entering the settling basins is routed through a series of alternating concrete baffles presumably to slow the velocity of the wastewater to promote the drop-out of suspended particles. After moving through the basin, wastewater flows to surface drainageways flowing into the ravines on the east and west sides of Building 146. Settling basins are constructed with concrete walls and covered with wooden boards (Appendix I, Photo No. 18). No information regarding the type of bottom in the settling basins was available.

Building 147, a pump house, is located just east of Building 146. A compressor type filter protrudes from the east wall of Building 147. Two containers holding hydraulic oil-type fluids were located beneath and adjacent to the filter (Appendix Q, Photo No. 19). Staining was present on the building wall and on the concrete beneath the filter.

Two compressor motors are located on the concrete loading dock on the east side of Building 146 (Appendix Q, Photo No. 20). The concrete in the vicinity of the compressor motors is visibly stained. The configuration of staining suggests that the fluids causing

the staining ran down the loading dock to the asphalt area below. Surface runoff from the area is collected in ditches and diverted to the ravine east of Building 146 near the southeast corner of the Building 146 complex.

Fragments of pipe insulation were noted on the ground east of Building 146 (Appendix Q, Photo No. 21). Insulation and building materials containing asbestos have historically been used at NWSCC (NWSCC, 1985).

5.4.4 Waste Characteristics

5.4.4.1 Physical and Chemical Characteristics

The major contaminants resulting from Building 146 loading and washout activities were TNT, RDX, HBX, Composition A, Composition B, and ammonium picrate. HBX is a mixture of RDX, TNT, aluminum, and wax. Composition A contains RDX and beeswax. Composition B is composed of RDX, TNT, and wax. The main compounds of concern in the incinerator ash are the heavy metals lead, barium, cadmium, chromium, and mercury. Potential contamination from PCB oxidation products has also been reported (Memorandum to File, December 1987). Physical and chemical characteristics of these compounds are summarized in Table 5-13. Polyaromatic hydrocarbons (PAHs) and undetonated explosives have also been detected in ash from APE-1236 incinerators (Layton et al., 1986). The toxicity and hazards of some of these chemicals are briefly discussed below.

TNT is a dangerous fire risk. TNT is very reactive and will ignite upon contact with strong oxidizers. Contact with ammonia or strong alkalies may increase sensitivity to shock (U.S. Department of Labor, 1978). TNT is toxic by ingestion, inhalation, and skin absorption (Sax and Lewis, 1987). The most notable effects of TNT in humans are aplastic anemia and toxic dermatitis (Burrows et al., 1989).

RDX is toxic by inhalation and skin contact (Sax and Lewis, 1987). Toxic effects by inhalation and ingestion attack the central nervous system and include nausea, irritability, convulsions, unconsciousness, and amnesia (USEPA, 1988).

Ammonium picrate is a high explosive when dry and is flammable when wet (Sax and Lewis, 1987). At high doses, it causes effects similar to TNT (Burrows et al., 1989).

Aluminum can ignite violently in powder form. Fire powder forms flammable and explosive mixtures in air (Sax and Lewis, 1987). Cadmium is also flammable in powder form. It is toxic by inhalation of dust or fume and is considered a carcinogen. Soluble

TABLE 5-13

PHYSICAL AND CHEMICAL PROPERTIES
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Chemicals (CAS No.)	Physical Form	General Chemical Class	Molecular Weight (g/mole)	Density (g/cm^3)	Solubility in Water (mg/l)*	Melting Point (°C)	Vapor Pressure (mmHg)*	Henry's Law Constant (atm m^3mole)*	LOG Kow	LOG Koc	Biodegradability	Fish Bioconcentration Factor	Hydrolysis Rate	Photolysis Rate
TNT (118-96-7)	Yellow[1] crystalline solid	Secondary Explosive	227.13	1.654[1]	150[2]	80-81[1]	$3.7x10^{-6}$ [2] $8.02x10^{-6}$ Torr+	$1.10x10^{-8}$ [2]	1.86-2.00[2]	2.72[2]	Low*[2]	8.95[2]	None[3]	Moderate[2] to high
RDX (121-82-4)	White solid[1]	Secondary Explosive	222.13	1.806[1]	50 @ 20°C[1]	202-203[1]	$4.03x10^{-9}$ [2] Torr+	$1.96x10^{-11}$ [2]	0.81-0.87[2]	2.00[2]	Low[2]	1.50[2]	Slow[3]	Moderate[2]
Calcium Chloride (10043-52-4)	White, deli-[4] quesent crystals, granules, lumps, or flakes	Inorganic Compound	110.99	2.15[4]	High[4]	772[4]	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum Powder	Silvery[4] white, cryst-alline solid	Metal	26.98	2.708[4]	NA	660[4]	NA	NA	NA	NA	NA	NA	NA	NA
Ammonium Picrate (131-74-8)	Yellow to[1] orange solid	Secondary Explosive	246	1.63-[1] 1.717	10,200 @[1] 20°C	280[1] w/decomp	NA	NA	1.90[5]	2.3[5]	NA	16[5]	NA	NA
Cadmium (7440-43-9)	Soft, blue-[4] white male-able metal or grey-white powder	Heavy Metal	112.41	8.642[4]	NA	320.9[4]	NA	NA	NA	3.3**[5]	NA	200[5]	NA	NA
Lead (7439-92-1)	Heavy, soft[4] grey solid	Heavy Metal	207.12	11.35[4]	Insoluble[4]	327.4[4]	NA	NA	NA	3.1**[5]	NA	300[5]	NA	NA
Mercury (7439-97-6)	Silvery,[4] heavy liquid	Heavy Metal	200.59	13.59[4]	Insoluble[4]	NA	NA	NA	NA	3.5**[5]	NA	63,000	NA	NA
Barium (7440-39-3)	Silver-white[4]	Heavy Metal	137.33	3.6[4]	Reacts[4] w/water	710[4]	NA	NA	NA	3.2**[5]	NA	4[5]	NA	NA
Chromium (7440-47-3)	Hard,[4] brittle, semi-grey	Heavy Metal	51.996	7.1[4]	Insoluble[4]	1,900[4]	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor 1242 (PCB)	Colorless[4] Liquid	Coolant/ Lubricant	NA	1.385[6]	0.45[6]	-19[6]	$4.06x10^{-4}$ [6]	$3.4x10^{-4}$ [6]	5.58[6]	5[6]	Insig-[6] nificant	NA	NA	NA
Aroclor 1254 (PCB)	Colorless[4] Liquid	Coolant/ Lubricant	NA	1.538[6]	0.012[6] @ 20	10[6]	$7.71x10^{-5}$ [6]	$2.8x10^{-4}$ [6]	6.03[6]	NA	Insig-nificant[6]		NA	NA
Aroclor 1260 (PCB)	Colorless[4] Liquid	Coolant/ Lubricant	NA	1.44[6]	0.0027 @[6] 20	NA	$4.05x10^{-5}$	$3.4x10^{-4}$	7.15[6]	NA	Insig-nificant[6]		NA	NA

Notes:

1 Department of the Army, 1984.
2 Burrows et al., 1989.
3 Spanggord et al., 1980.
4 Sax and Lewis, 1987.
5 Layton et al., 1986.
6 USEPA, 1990.
+ 1Torr = 1 mm Hg at 0°C.
* Biotransformed, but not degraded.
** Log Kd.
NA - Not available or not applicable.

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compounds of cadmium are highly toxic (Sax and Lewis, 1987). Lead is toxic by ingestion or inhalation (Sax and Lewis, 1987). Hexavalent chromium compounds are carcinogenic and corrosive to human tissue (Sax and Lewis, 1987). Mercury is highly toxic by skin absorption and inhalation (Sax and Lewis, 1987).

PCBs are highly toxic and suspected human carcinogens. Some PAH compounds are carcinogenic.

Finally, the potential exists that small quantities of munition components may have passed through the Building 146 incinerators without undergoing complete combustion. A list of munition components which were likely fed through the incinerators is presented in Table 5-14. Information concerning the likelihood of this occurring, or the exact characterization of partial combustion products, was not available.

5.4.4.2 Hazardous Classification

The ash generated by Building 146 deactivation furnaces was found through analyses to be a RCRA hazardous waste. Other specific information was not found. However, ammonium picrate and wastewaters generated at the facility may have also been considered hazardous. Hazardous wastes which may have been generated at Building 146 are listed in Table 5-15.

5.4.4.3 Migration and Dispersal Characteristics

Overall, adsorption to soils will not effectively prevent mobility of secondary explosive compounds through surface soils. Adsorption of TNT onto soils is most closely correlated not with organic content but with extractable iron, cation exchange capacity, and percent clay. Also, adsorption and desorption appear to occur to the same extent, suggesting that continued desorption, and subsequently leaching, may remove TNT from soils unless more strongly adsorbed products are formed (Pennington, 1990). The explosive compounds of concern released from Building 146, therefore, will not be immobilized by surface soils. Contaminants in soil will be slowly solubilized by precipitation or surface runoff and will percolate into the groundwater.

In general, two processes can significantly affect the fate and distribution of TNT in the environment, namely microbial transformations and photochemical transformations. Physical transport from aqueous systems is expected to be insignificant because of volatilization and sediment partitioning. There is no evidence for other important chemical transformation processes, such as hydrolysis or oxidation, under environmental conditions (Burrows et al., 1989). The predominant changes are the reduction of nitro side groups into amino groups and the coupling of rings to produce azoxy compounds (Pennington, 1990). The final reduced product is

TABLE 5-14

MUNITION COMPONENTS
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Aluminum powder
Amatol
Ammonium nitrate
Antimony sulfide
Antimony trisulfide
Barium nitrate
Barium peroxide
Black powder
Black powder
Boron
Calcium carbonate
Calcium chloride
Calcium resinate
Calcium silicide
Carbon black, charcoal, graphite, acetylene black
Carborundum
Commercial rimfire
Composition-A3
Composition-A4
Composition-B
Composition-C4
Composition-D2 wax
Cryolite
DDNP
Dibutyl phthalate
Diethyl phthalate
2,4-Dinitrotoluene
Diphenylamine
Ethyl centralite
Explosive-A4
Explosive-D
Graphite
Ground glass
Gum arabic
H6
Haleite (EDNA)
HBX-1
HBX-3
HBX-6 (H6)
HMX
Lead
Lead azide
Lead carbonate
Lead oxide
Lead stearate
Lead styphnate
Lead sulfocyanate
Lead thiocyanate
M10 propellant
M30 propellant
M6 propellant
M96 propellant
Magnesium
Military dynamite MV
Nitrocellulose 13.45%N
2-Nitrodiphenylamine
Nitroglycerin
Nitroguanidine
Nitroguanidine picrate
Octol
Parlon-chlorinated rubber
PBX-0280
Pentolite 10/90
Pentolite 50/50
PETN
Photoflash
Picratol
Plasticizer for C-4
Polyvinyl chloride
Potassium chlorate
Potassium nitrate
Potassium nitrate
Potassium perchlorate
Potassium sulfate
Rareox
RDX
Red phosphorus
Selenium
Sodium sulfate
Strontium nitrate
Strontium oxalate

TABLE 5-14 (Continued)

MUNITION COMPONENTS
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Strontium peroxide
Sulfur
Tetracene
Tetryl
Tetrytol
Tin
TNT
Torpex
TPA = triethylaluminum
Tritonal
Wax see Composition-D2
Zinc stearate
Zirconium
Zirconium-nickel alloy

Sources: NWSCC, 1990; Department of the Army, 1983.

RP/15EMRF/AA3

TABLE 5-15

POTENTIAL HAZARDOUS WASTES
BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Waste	Hazardous Constituent	Hazardous Waste Number	Hazard Code
Incinerator ash, Baghouse dust		D003	R
	Barium	D005	T
	Cadmium	D006	T
	Chromium	D007	T
	Lead	D008	T
	Mercury	D009	T
Pinkwater	TNT	K047/D003	R
Yellow D contaminated water, very dilute solution	Ammonium Picrate	D003	R

Notes: R = Reactive.
T = Toxic.

Sources: RCRA Facility Permit IN5 170023498.
EIS, 1982.
NWSCC, 1990.

RP/15EMRF/AA3

2,4,6-triaminotoluene. Hydroxylamine intermediates can also couple to form tetranitroazoxytoluenes. The product which predominates depends on the nature of the microbial preparation, microbial species, and conditions under which nitro group reduction takes place (Burrows et al., 1989).

Photochemical transformation of TNT in environmental waters are more important than microbial transformations because the rates are significantly higher. The photolysis of dilute aqueous solutions gives rise to complex mixtures because primary photoproducts undergo further reaction. The major primary photoproduct is 2,4,6-trinitrobenzaldehyde which is converted to azoxydicarboxylic acid. Smaller amounts of azodicarboxylic acid, decarboxylated azoxy compound, and amide are also formed. Two other photoproducts are 2-amino-4, 6-dinitrobenzoic acid and 4,6-dinitro-1,2-benzisoxazole (Burrows et al., 1989).

The primary transformation products (both biotic and abiotic) of TNT are 4-amino-2,6,-dinitrotoluene (4ADNT) and 2-amino-4,6-dinitrotoluene (2ADNT). These compounds tend to be more persistent in soils, with 4ADNT more resistant than 2ADNT (Pennington, 1990).

Unlike TNT, the ring structure of RDX completely breaks down with anaerobic biodegradation during composting (Doyle, 1986). Aerobic biodegradation of RDX is not known to occur (U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 1988). Aerobic biotransformation of RDX in environmental surface water appears to be insignificant and the significance of anaerobes in removing it from soils and standing water zones or bottom sediments is not know (Burrows et al., 1989).

RDX is readily degraded photochemically. Several pathways may be operative. Photolysis in water leads to the formation of nitrate, formaldehyde, and methylene dinitramine. Methylene dinitramine decomposes in water to form formaldehyde and nitrous oxide (Burrows et al., undated). Formaldehyde is biodegradable both aerobically and anaerobically (Howard, 1991). Volatilization, sediment sorption, and hydrolysis are not expected to be significant environmental fate processes (Spanggord et al., 1980).

Specific information concerning the fate and migration of ammonium picrate was not found. Its partition coefficients are similar to TNT. Ammonium picrate, however, is much more soluble than both TNT and RDX. This suggests that it may be more readily transported by groundwater or surface water.

Potential subsurface mobility of the inorganic compounds ranges from low (cadmium, chromium III, lead, mercury) to high (chromium VI). Some inorganic compounds may be present in volatile form which enhances their mobility. Dowdy and Volk (1983) reviewed research data related to metal transport. In soil materials, metals occur on exchange sites, are incorporated into or on the surface of crystalline or noncrystalline inorganic precipitates, are incorporated into organic compounds, and are present in solution. Movement of metals in natural soils is generally considered minimal because of low solubilities. Metals are often chelated or complexed with organic materials. The chelated compounds may be more soluble than inorganic precipitates. Metal movement will more likely occur for sandy, acid, low organic matter soils which receive high rainfall. Even under these conditions, however, the extent of metal movement will be limited. Most movement will occur through open channels where the soil has little opportunity for metal attenuation. More specific information for some of the metals is presented below. No further migration or dispersal characteristics for aluminum or barium was found.

Cadmium occurs only in divalent form in aqueous solutions (e.g. Cd^{2+}, $CdC1^{+}$, $CdSO_4$). Adsorption behavior correlates with CEC of soil and aquifer material. Adsorption/ precipitation increases with increasing pH with most cadmium precipitating at pH>6.

Mercury may occur in more than one oxidation state. It may occur in subsurface in mercuric form (Hg^{2+}), mercurous form (Hg_2^{2+}), elemental form, and alkylated form (e.g. methyl and ethyl mercury). Hg_2^{2+} and Hg^{2+} are more stable under oxidizing conditions and are strongly adsorbed by soils. Elemental mercury and alkylated forms are more stable under reducing conditions. Conversion to alkylated forms may occur under reducing conditions. Elemental mercury and alkylated-Hg forms are volatile, toxic, and may not be as strongly adsorbed by soils (USEPA, 1990).

Chromium may occur in more than one oxidation state in the subsurface. The trivalent form (Chromium III) is dominant under pH and redox conditions generally present in the subsurface. Chromium III may be converted to the more mobile and toxic hexavalent form (Chromium VI) under oxidizing conditions. Chromium III is readily adsorbed in the subsurface while Chromium VI is not (USEPA, 1990).

Dominant species of lead in aqueous solution are Pb^{2+} under acidic conditions and Pb^{2+}-carbonate complexes under alkaline conditions. Adsorption behavior correlates with CEC of soil and aquifer material. Adsorption/precipitation increases with increasing pH with most Pb precipitating at pH>6. Volatile alkylated-Pb compounds may be present or may form under reducing conditions (USEPA, 1990).

PCBs exhibit low potential for subsurface mobility due to relatively low water solubility, low vapor pressure, moderate Henry's Law constants, and high Kow and Koc values (see Table 5-13). PCBs, which exist as mixtures of isomers, are virtually chemically inert. Most PCBs are virtually insoluble in water and are highly resistant to biodegradation. No information is available on photodecomposition of PCBs. PCBs sorb strongly to soil organic matter and tend to be highly persistent.

PAHs, in general, exhibit low potential subsurface mobility because of low water solubility, low vapor pressure, high Kow and Koc values, and moderate biodegradability. PAHs are also resistant to hydrolysis (Lyman, 1981).

5.5 CONCLUSIONS AND RECOMMENDATIONS

Background data and site observations were reviewed to determine the likelihood of releases posing a potential threat to human health or the environment. Data and observations pertinent to SWMU #16/16, Cast High Explosive Fill/Incinerator Building 146 were reviewed to assess the potential for contaminant releases to groundwater, surface water, air, and soil. Data were interpreted and release determinations were made according to the approach described in RCRA Facility Assessment Guidance (USEPA, 1986). Based upon the information and conclusions presented, medium-specific recommendations are made concerning the need for continuing corrective actions in subsequent RFI phases.

At Building 146, potential releases to groundwater are likely to have occurred based on unit characteristics including unit type and design (landbased storage of incinerator ash), lack of engineered structures to prevent releases to groundwater, and unit operation (loading washout demilitarization processes). Locational characteristics contributing to potential releases to groundwater include moderately permeable soil. Visual evidence of potential for release to groundwater by leaching includes ash residue and surface staining near aboveground fuel storage tanks. A Phase II Release Assessment is recommended to verify the presence or absence of groundwater contamination. Phase II activities should include water level measurements and groundwater sampling at the existing monitoring wells in order to assess changes in groundwater quality since the 1983 samples were collected. Based on verification of groundwater contamination by these results or results of Phase II sampling of other media, additional activities may be required in a Phase III Release Characterization to determine the nature and extent of groundwater contamination.

Releases to surface water were determined to have occurred based on unit design and physical condition, lack of runoff control systems, and operation history. For example, wastewater generated within Building 146 was discharged to surface drainage. Release migration potential to surface water is high due to the slope of the facility and the intervening terrain. The potential for groundwater discharge to Turkey Creek also may contribute to surface water impact. Evidence of contaminant release to surface water is provided by analytical data. A Phase II Release Assessment is recommended to evaluate surface water and sediment contamination in ravines, ditches, drainageways, Turkey Creek and settling basins and sumps. While some analytical data exist for some of these areas, the data are almost 20 years old and do not reflect existing conditions.

Potential releases to soil were determined to have occurred based on unit type and operations (landbased storage and discharge). Evidence of contaminant release to soil include observation of ash residue on the soil surface, staining, and soil and sediment analytical results. Phase II soil sampling is recommended for areas potentially impacted by spills or leaks, discharges runoff and erosion, and particulate emissions. Again, available analytical data do not accurately represent current conditions.

Releases to air probably occurred in the past due to air pollution control system failures, but are no longer considered to pose a threat to human health or the environment. However, entrainment of ash and residual explosives particulates from demilitarization and loading operations could contribute to releases via the air pathway which could impact soil.

Releases to subsurface gas are unlikely at this SWMU. Potential releases to subsurface gas, as well as other media at at SWMU #16/16 are summarized on Table 5-16.

RP/15EMRF/AA5

TABLE 5-16

POTENTIAL RELEASES
SWMU #16/16: BUILDING 146
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Media	Release	Suspected Contaminants *
Groundwater	Likely	Explosives, metals
Surface Water	Occurred[2,3]	Explosives, metals
Soil	Occurred[2]	Explosives, PCBs, metals
Air	Unlikely	--
Subsurface Gas	Unlikely	--

NOTES:

1 Observed.
2 Reported.
3 Analytical Records.
* See Table 5-9 for individual compounds.

RP/15EMRF/AA3

6.0 RECOMMENDATIONS

Based upon the information and conclusions presented in Sections 3, 4, and 5, the following recommendations are made concerning the need for continuing RFI Corrective Actions at the three SWMUs discussed in this report.

6.1 SWMU #15/06: ROADS AND GROUNDS AREA

At the Roads and Grounds Area, RFI Phase II Release Assessments for groundwater, surface water, and soil are recommended as summarized in Table 6-1. This recommendation is based on potential and observed releases to these media and the corresponding potential threat to human health and the environment.

6.2 SWMU #14/00: SANITARY LANDFILL AND LITHIUM BATTERY

As summarized in Table 6-1, RFI Phase II Release Assessments for groundwater, surface water, soil, and subsurface gas are recommended. Recommendations for RFI Phase II Release Assessments are based on consideration of several subareas within the Sanitary Landfill. These subareas include the trench and fill disposal area, the lithium battery disposal area, the leachate collection ponds, and the fill area.

Because the area fill portion of the Sanitary Landfill is currently governed by an operating permit, no recommendations are offered for this subarea. Although an upgrade of the existing leachate collection ponds is proposed (Dames & Moore, 1992), documented releases to surface water warrant recommendation of a Phase II Release Assessment for this medium. A recommendation regarding soil in the leachate collection pond subarea is stayed pending sampling, removal, and disposal of leachate pond soils as proposed in the Basis of Design Report (Dames & Moore, 1992). The remaining Phase II Release Assessment Recommendations for the respective media summarized in Table 6-1 do apply to both the trench and fill disposal area and the lithium battery disposal area. The Phase II Release Assessment for groundwater may involve statistical analysis of data for those analytes detected above the MCL/SMCL and sampling to verify potential releases. The proposed sampling activities will be an extension of the existing monitoring network.

TABLE 6-1

RFI PHASE II RELEASE ASSESSMENT RECOMMENDATIONS
NWSCC
CRANE, INDIANA
NOVEMBER 1992

Media	SWMU #15/06 Roads and Grounds	SWMU #14/00 Sanitary Landfill	SWMU #16/16 Building 146
Groundwater	X	X	X
Surface Water	X	X	X
Soil	X	X	X
Air	-	-	-
Subsurface Gas	-	X	-

X = Denotes RFI Phase II Release Assessments recommended for designated medium.

RP/15EMRF/AA3

6.3 SWMU #16/16: CAST HIGH EXPLOSIVE FILL/INCINERATOR BUILDING 146

RFI Phase II Release Assessments are recommended for groundwater, surface water, and soil (Table 6-1). Information received concerning past operational practices at Building 146 indicate that contaminants have been released to surface water and soil. Qualification of a release to groundwater is dependent on evaluation of existing monitoring well data. Because the incinerators are no longer operable, a RFI Phase II Release Assessment for air is not recommended.

RP/15EMRF/AB5

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APPENDIX A

BIOLOGICAL FEATURES AT NWSCC

Table A-1 Major Tree Species
Table A-2 Partial List of Rare Plants
Table A-3 Partial List of Fauna

Source: NEESA, 1983

TABLE A-1

MAJOR TREE SPECIES
NWSCC
CRANE, INDIANA
MARCH 1992

Black Ash
White Ash
Large-toothed Aspen
Baldcypress
Basswood
Beech
River Birch
Boxelder
Ohio Buckeye
Butternut
Black Cherry
Black Maple
Red Maple
Sugar Maple
Yellow Poplar
Black Oak
Chestnut Oak
Chinquapin Oak
Pin Oak
Red Oak
Scarlet Oak
Shingle Oak
Cottonwood

American Elm
Red Elm
Hackberry
Bitternut Hickory
Mockernut Hickory
Pignut Hickory
Shagbark Hickory
Honeylocust
Black Locust
White Oak
Austrian Pine
Jack Pine
Pitch Pine
Scotch pine
Shortleaf Pine
Virginia Pine
White Pine
Yellow Poplar
Sweetgum
Black Walnut
Sycamore
Willow

RP/15EMRD/AE1

TABLE A-2

PARTIAL LIST OF RARE PLANTS
(Not listed as Federally threatened or endangered)
NWSCC
CRANE, INDIANA
MARCH 1992

Showy Orchi	Sessile Trillium
Lesser Fringed Orchi	Twinleaf
Ginseng	Sullivantia
Nodding Trillium	Pinnatifid Spleenwort
Large White Trillium	Maidenhair Spleenwort
Yellow Trillium	Vittaria

RP/15EMRD/AE1

TABLE A-3

PARTIAL LIST OF FAUNA
NWSCC
CRANE, INDIANA
MARCH 1992

Mammals

White-tailed deer
Beaver
Opossum
Various rats and mice
Raccoon
Cottontail rabbit
Red fox
Gray fox
Long-tailed weasel
Striped skunk
Mink
Coyote
Muskrat
Woodchuck (Groundhog)
Gray squirrel
Fox squirrel
Eastern chipmunk
Flying squirrel

Waterfowl

American coot
Canada goose
Mallard duck
Ringnecked duck
Lesser scaup
Hooded mergansers
Black duck
Redhead
Common merganser
Bufflehead
Common loon

Game Birds

Wild turkey
Ruffed grouse
Bobwhite quail
Woodcock

Raptors that Rest on Center

Red-tailed hawk
Red-shouldered hawk
Broad-winged hawk
Sparrow hawk
Coopers hawk
Sharp-shinned hawk
Great horned owl
Barred owl
Screech owl
Turkey vulture

Fall and Winter Raptor Visitors

Rough legged hawk
Marsh hawk
Short-eared owl
Long-eared owl
Saw-whet owl
Bald eagle
Golden eagle

Other Birds

Rock dove
Common flicker
Yellow-bellied sapsucker
Blue jay
Tufted titmouse
Red-breasted nuthatch
Mockingbird
Golden-crowned kinglet
House sparrow
Rufous-sided towhee
Field sparrow
Red-winged blackbird
Song sparrow
Killdeer
Mourning dove
Hairy woodpecker
Downy woodpecker
Common crow
Brown creeper

TABLE A-3 (Continued)

PARTIAL LIST OF FAUNA
NWSCC
CRANE, INDIANA
MARCH 1992

Other Birds (Continued)

Winter wren
American rober
Cedar waxwing
Cardinal
Dark-eyed junco
Whippoorwill
Swamp sparrow
Great blue heron
Herring gull
Belted kingfisher
Red-bellied woodpecker
Horned lark
Carolina chickadee
White-breasted nuthatch
Carolina wren
Eastern bluebird
Starling
American goldfinch
Tree sparrow
Purple martin
White-throated sparrow
Ruby-throated hummingbird

Amphibians

Eastern newt
Redbacked salamander
Two-lined salamander
Fowlers toad
Chorus frog
Cricket frog
Spring frog
Grey tree frog
Leopard frog
Bull frog
Green frog

Crustaceans

Crayfish

Reptiles

Spring softshell turtle
Snapping turtle
Box turtle
Painted turtle
Five lined skink
Fence lizard
Ground skink
Garter snake
Bended water snake
Dekays snake
Black racer
Black rat snake
Milk snake
Rough green snake
Hognose snake
Copper head
Rattle snake

Fish

Golden shiner
Redear sunfish
Channel catfish
Spotted sucker
Carp
Yellow perch
Warmouth
Largemouth bass
White bass
Brown bullhead
Bluegill sunfish
Walleye pike
White crappie
Yellow bullhead
Longear sunfish

Mollusks

Freshwater mussels

APPENDIX B

FINAL RCRA PERMIT TRANSMITTAL LETTER, TITLE PAGE, AND SIGNATURE PAGE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:
5HR-13

20 [illegible]

CERTIFIED MAIL: P 611 589 516
RETURN RECEIPT REQUESTED

Captain C.E. Johnson
Commanding Officer
Department of the Navy
Naval Weapons Support Center
Crane, Indiana 47522-5000

RE: Final RCRA Permit
Naval Weapons Support Center
Crane, Indiana
IN5 170 023 498

Dear Captain Johnson:

Enclosed is a copy of the Federal Portion of the final permit issued under the Resource Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984. Any noncompliance with this permit constitutes a violation of HSWA, and is grounds for enforcement action, permit termination, or other appropriate action.

The duration of this permit is five (5) years. However, the United States Environmental Protection Agency (U.S. EPA) may modify, revoke and reissue, or terminate this permit based on causes specified in Title 40 of the Code of Federal Regulations (40 CFR) Sections 270.41, 270.42, and 270.43, and in Section 3005(c)(3) of the amended RCRA.

This permit is effective as issued, as of the date indicated on the cover page of the permit. 40 CFR 124.19 explains the rights of appeal concerning this permit.

A copy of U.S. EPA's Response to Comments has also been enclosed, explaining all changes made between the draft permit and the final permit.

If you have any questions, please contact Ms. Carol Ann Witt of my staff, at (312) 886-6146, for assistance.

Sincerely,

Basil G. Constantelos, Director
Waste Management Division

cc: Kathy Prosser, IDEM w/enclosure
Jim Hunsicker, USN
Bill Muno, REB

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

Name of Permittee: Owner: United States Department of Navy
Operator: United States Department of Navy

Facility Location: Street Address: (None)
City, State: Crane, Indiana

EPA Identification Number: IN5 170 023 498

Issuance Date: 20 DEC 1989

Authorized Activities:

Pursuant to the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) of 1976, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, (42 U.S.C. §6901, et seq.), and regulations promulgated thereunder by the United States Environmental Protection Agency (U.S. EPA) (codified in Title 40 of the Code of Federal Regulations (CFR)), Federal permit conditions (hereinafter called the permit) of the RCRA permit are issued to United States Department of Navy (USN) (hereinafter called the Permittee), for the facility Naval Weapons Support Center (NWSC) located at Crane, Indiana.

The RCRA permit contains both the effective Federal permit conditions (contained herein) and the effective State permit conditions issued by the State of Indiana's RCRA program authorized under 40 CFR Part 271 (hereinafter called the State permit). When both this permit and the State permit are effective, the Permittee has an effective RCRA permit which authorizes the Permittee to conduct hazardous waste management activities as specified in the RCRA permit.

Permit Approval:

On January 31, 1986, the State of Indiana received final authorization pursuant to Section 3006 of RCRA, 42 U.S.C. §6926, and 40 CFR Part 271, to administer the pre-HSWA RCRA hazardous waste program. Since the State of Indiana has not yet received authorization to administer the entire hazardous waste program requirements of HSWA, additional permit conditions must be issued by the U.S. EPA to address these new requirements. These additional conditions are contained in this permit.

The Permittee must comply with all terms and conditions of this permit. This permit consists of the conditions contained herein (including those in any attachments) and the applicable regulations contained in 40 CFR Parts 260, 261, 262, 264, 266, 268, 270, and 124, and applicable provisions of HSWA.

This permit is based on the assumption that the information submitted in the permit application attached to the Permittee's letter, dated October 12, 1984, and in any subsequent amendments (hereinafter referred to as the application), and in the certification regarding potential releases from solid waste management units, dated June 13, 1985, is accurate. Any inaccuracies found in this information may be grounds for the termination, revocation and reissuance, or modification of this permit (see 40 CFR §270.41, §270.42 and §270.43) and potential enforcement action. The Permittee must inform U.S. EPA of any deviation from or changes in the information in the submitted information.

Effective Date:

The RCRA permit is effective when both this permit and the State permit are effective. This permit is effective as of thirty days after service of notice, unless a review is requested under 40 CFR §124.19 (unless no comments requested a change in the draft permit in which case the permit shall become effective immediately upon issuance), and shall remain in effect for 5 years, unless revoked and reissued, or terminated (40 CFR §270.41, §270.42, and §270.43), or continued in accordance with 40 CFR §270.51.

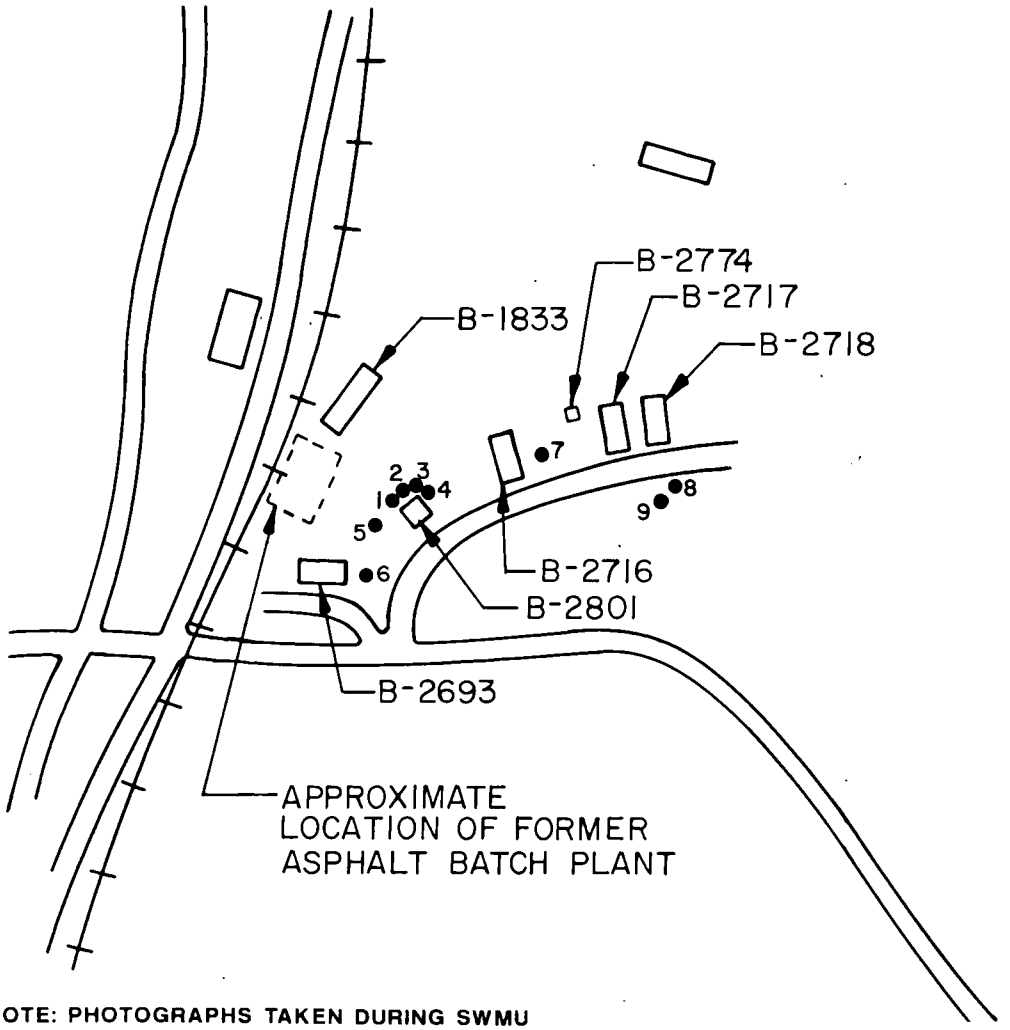
Issued this 20th day of Dec. 1989,

by Norman Niedergang.

for Basil G. Constantelos, Director
Waste Management Division

APPENDIX C

PHOTOGRAPH LOG - SWMU #15/06



NOTE: PHOTOGRAPHS TAKEN DURING SWMU RECONNAISSANCE OCT. 21-23, 1991.

●2 = APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

SOURCE: U.S.G.S., 1978, INDIANA SPRINGS, INDIANA, 7.5 MIN. TOPOGRAPHIC QUADRANGLE.

N

APPROXIMATE SCALE: 1" = 400

NOVEMBER 1992

FIGURE C-1

SWMU #15/06 : PHOTOGRAPH INDEX MAP

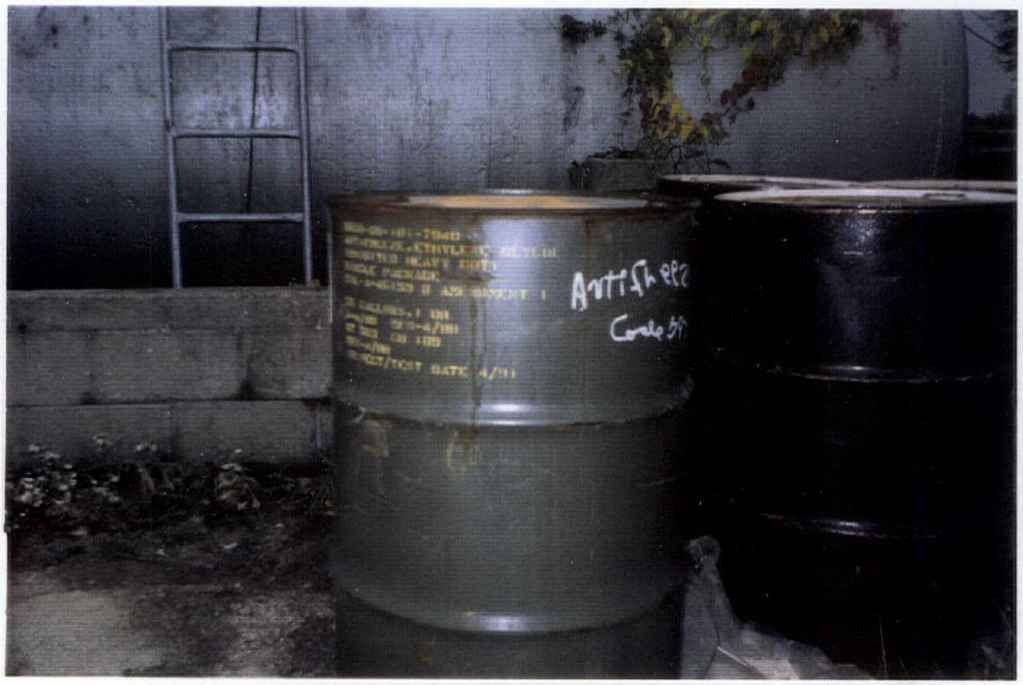
ENVIRONMENTAL MONITORING REPORT
NAVSURFWARCENDIV
CRANE, INDIANA

20602

Donohue ENGINEERS ARCHITECTS SCIENTISTS

L-10977

1



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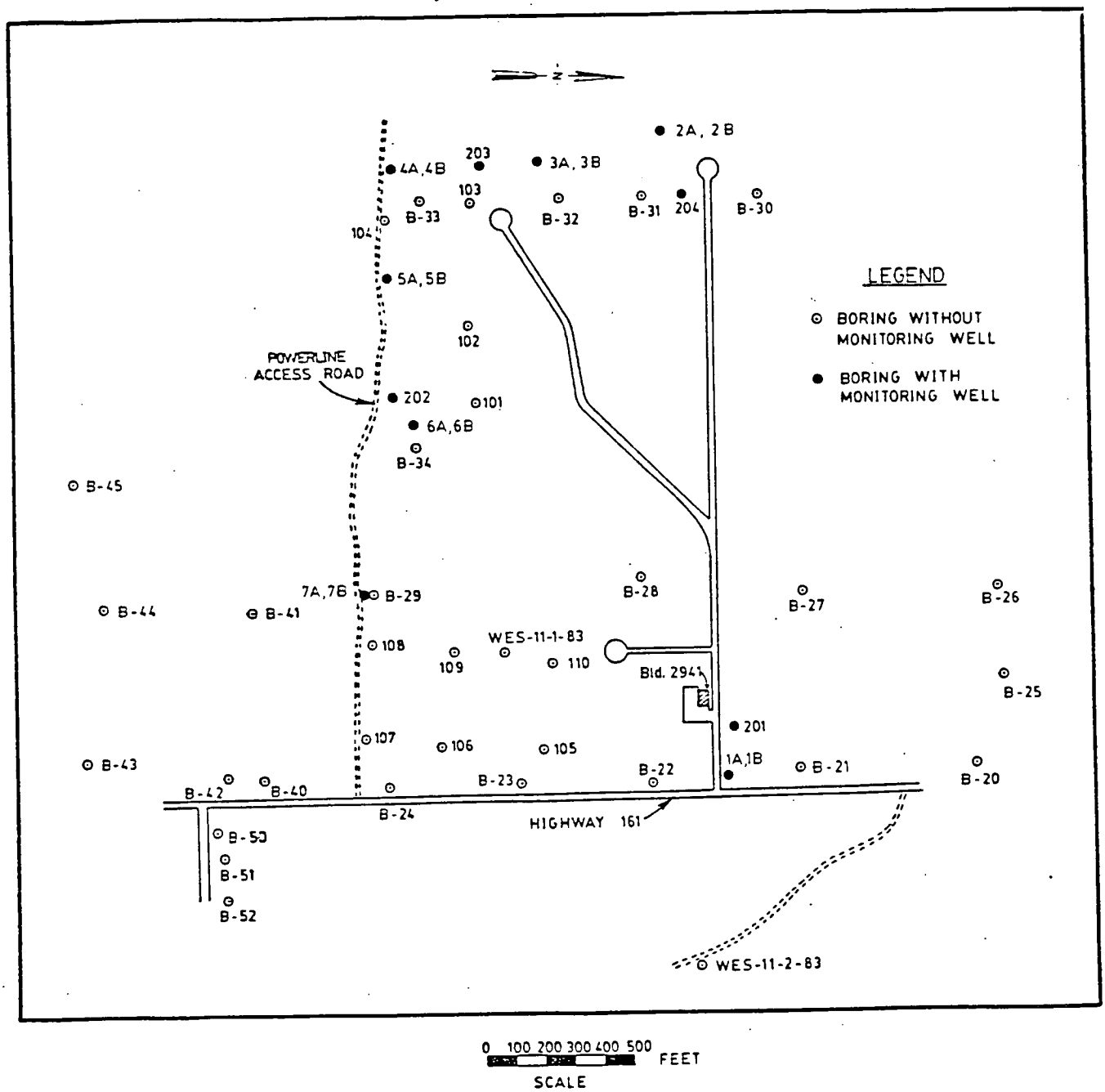
APPENDIX D

SANITARY LANDFILL BORING LOGS



Landfill Boring Locations

WORKING DRAFT

BORING LOG
FIELD DATA

Project NWSC Landfill Site Crane, IN Date 22 June 1983
Location NWSC Landfill Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El *700.0 Boring No. WES-11-1-83

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	Hyd Press	Cont	CLASSIFICATION AND REMARKS
1	22 Jun	0.0		0.0	0.5	0.0	2.0	3" Shelby Tube	0	St	Clay (CL): grey and brown, very
1A				0.5	1.0	2.0	2.1		0	Jar	soft, moist, organic matter.
				1.0	1.5				100		
				1.5	2.0				180		
			7.0	2.0	2.5				280		Sample length: 2.1 ft.
				0.0	5.0			5" Folding Auger			Cleanout
2	22 Jun	7.0		5.0	5.5	5.0	6.0	3" Fixed Piston	180	St	Gravelly Clay (CL): brown, grey,
2A				5.5	6.0	6.0	6.1		270	Jar	very stiff, brittle, gravel is
				6.0	6.5				360		fine to medium, weathered rock.
				6.5	7.0				450		
			8.0	7.0	7.45				500		Sample length 1.1 ft.
				5.0	9.0			5" Folding Auger			Cleanout.
				9.0	10.0			5-5/8" Rock Bit			Cleanout: very hard.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 3 Sheets

* Surface elevation from topographic map.

BORING LOG
FIELD DATA

Project _____ Site _____ Date _____
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. WES-11-1-83

SAMPLE NUMBER	DATE TAKEN 1983	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
		8.0	--	10.0	11.1			3" Pitcher Sampler			Tube was damaged --
											Sandstone: brown, reddish brown,
											very fine-grained.
				--	11.3			5-5/8" Rock Bit			Cleanout.
	23 Jun			11.3	13.2	11.3	13.2	4x5½ Core Barrel		Run 1	Sandstone, siltstone and shale.
	23 Jun		18.3	13.2	18.3	13.2	18.3	4x5½ Core Barrel		Run 2	Sandstone, siltstone, and shale.
											See drilling log page three for
											details.
	24 Jun										Water level overnight: 12.5 ft.
	24 Jun										Grouted hole.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Hole No. WES-11-1-83

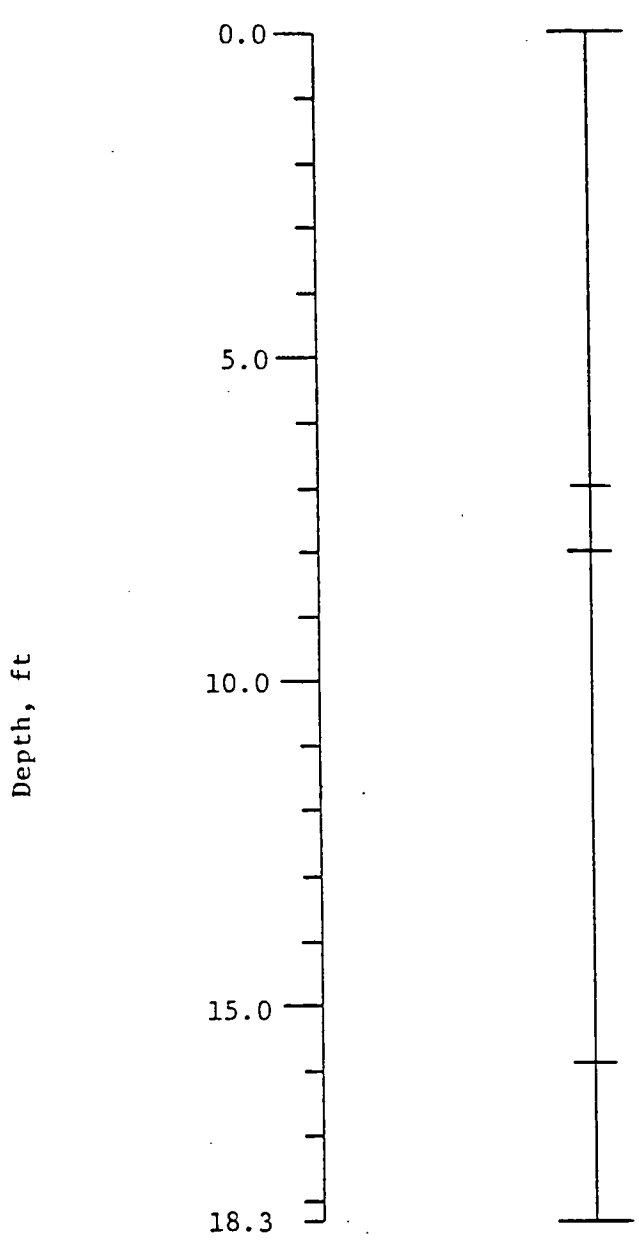
DRILLING LOG	DIVISION US Navy	INSTALLATION Crane, IN	SHEET 3 OF 3 SHEETS

1. PROJECT NWSC Landfill Characterization	10. SIZE AND TYPE OF BIT 4x5⅝" Diamond
2. LOCATION (Coordinates or Station) NWSC Landfill	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY CEWES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing
4. HOLE NO. (As shown on drawing title and file number) WES-11-1-83	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED -- ; UNDISTURBED 2
5. NAME OF DRILLER C. Drake	14. TOTAL NUMBER CORE BOXES Zero
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 22 Jun 83 ; COMPLETED 23 Jun 83
	17. ELEVATION TOP OF HOLE * 700.0
7. THICKNESS OF OVERBURDEN 7.0 ft	18. TOTAL CORE RECOVERY FOR BORING 100% %
8. DEPTH DRILLED INTO ROCK 11.3 ft	19. SIGNATURE OF INSPECTOR
9. TOTAL DEPTH OF HOLE 18.3 ft	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
690	10		Sandstone: brown, reddish brown, very fine-grained			
689	11		3" Pitcher Sampler			
688	12		Sandstone and siltstone (80%) Shale (20%): brown, reddish brown, grey, dark grey, very fine grained, very thinly bedded and horizontal in attitude, bedding ranges from 1/16" to 1/4" maximum, weathered, oxidized, soft.			RL Run 1 Began 8:02 Rec 1.9' End 8:16 Loss -- Time 14 min. Gain -- Drl time 14 min. Hyd press 100 PSI Water press -- RPM 75-150 Drl Action Smooth ~~Water~~ ret Brown, grey Remarks --
687	13		Run 1 RQD=31.6%	100%	--	
			Same as above. Run 2 Pitcher Sampler	100%		
686	14		fractured very fine-grained sandstone.			
685	15		Sandstone, siltstone, & shale: See above			RL Run 3 Began 8:50 Rec 4.8' End 9:10 Loss -- Time 20 min. Gain -- Drl time 20 min. Hyd press 100 PSI Water press -- RPM 75-150 Drl Action Smooth ~~Water~~ ret Brown, grey Remarks
684	16					
683	17		Sandstone: brown, reddish brown, very fine-grained, uniform, quartz sandstone, weathered.			
682	18		Run 3 RQD=37.5%	100%		
			* Surface elevation from topographic map.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.



700.0 ft MSL

Clay(CL): grey and brown, very soft, moist, organic matter.

Gravelly clay(CL): brown, grey, very stiff, brittle, gravel is fine to medium weathered sandstone and siltstone.

Sandstone, siltstone, and shale: brown, reddish brown sandstone and siltstone (80%) thinly bedded with grey to dark grey shale (20%), bedding ranges from 1/16 to 1/4-in and horizonal in attitude, very fine-grained weathered, oxidized.

Sandstone: brown, reddish brown, very fine-grained, uniform quartz sandstone, weathered, oxidized.

NWSC, Crane, Indiana
NWSC Landfill
Lithology
Boring Number: WES-11-1-83

BORING LOG
FIELD DATA

Project NWSC Landfill Site Crane, IN Date 23 Jun 83
Location NWSC Landfill - East of Hwy 161 Job No. 441-G150.13GR21/22
Drill Rig Failing Inspector J. Dunbar Operator C. Drake Surface El * 710.0 Boring No. WES-11-2-83

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	Hyd Press	Cont	CLASSIFICATION AND REMARKS
1	23 Jun	0.0		0.0	0.5	0.0	1.23		50	St	Gravelly clay (CL): brown,
1A				0.5	1.0	1.23	1.43		120	Jar	reddish brown, soft to stiff,
				1.0	1.5				400		weathered, dry.
			2.0	1.5	2.0				820		Sample length: 1.43 ft.
				0.0	3.2			5-5/8" Rock Bit			Cleanout for core barrel.
	23 Jun	2.0	8.2	3.2	8.2	3.2	8.2	4"x5½" Core Barrel		Run 1	Clay, shale, siltstone, and sand-
											stone - see boring log on page 2
											for details.
	24 Jun										Water level overnight: 3.8 ft.
	24 Jun										Grouted hole.

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 2 Sheets

[redacted] Surface elevation from topographic map [redacted]

Hole No. WES-11-2-83

DRILLING LOG	DIVISION US Navy	INSTALLATION Crane, IN	SHEET 2 OF 2 SHEETS

1. PROJECT NWSC Landfill Characterization	10. SIZE AND TYPE OF BIT 4x5½ in.-Diamond
2. LOCATION (Coordinates or Station) NWSC Landfill	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY CEWES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) WES-11-2-83	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED --- ; UNDISTURBED One
5. NAME OF DRILLER C. Drake	14. TOTAL NUMBER CORE BOXES Zero
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 3.8' below ground Surf
	16. DATE HOLE: STARTED 23 Jun 83; COMPLETED 23 Jun 83
7. THICKNESS OF OVERBURDEN 2.0 ft	17. ELEVATION TOP OF HOLE * 710.0
8. DEPTH DRILLED INTO ROCK 6.2 ft.	18. TOTAL CORE RECOVERY FOR BORING 100% %
9. TOTAL DEPTH OF HOLE 8.2 ft.	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
707.0	30		Sandstone: brown, very fine-grained, soft, weathered, oxidized.			23 June 1983
706.0	40		Clay: grey, soft-			
			Gravelly clay - weathered shale and sandstone - brown and grey.			WL -- Run 1 Began 1:52 Rec 5.0' End 2:15 Loss -- Time 23 min. Gain -- Drl time 23 min. Hyd press 100 PSI Water press -- RPM 75-150± Drl Action Smooth Water ret Brown, reddish brown Remarks --
705.0	50		Clay: grey, soft.			
704.0	60		Sandstone: reddish brown, brown, oxidized, weathered, very fine-grained, friable, breaks show weathering and partial filling (solution).			
			fractured			
703.0	70		Thinly bedded sandstone, siltstone and shale - brown to grey, soft.			
702.0	80		Run 1 RQD=24.0%	100%	--	

* Surface elevation from topographic map.

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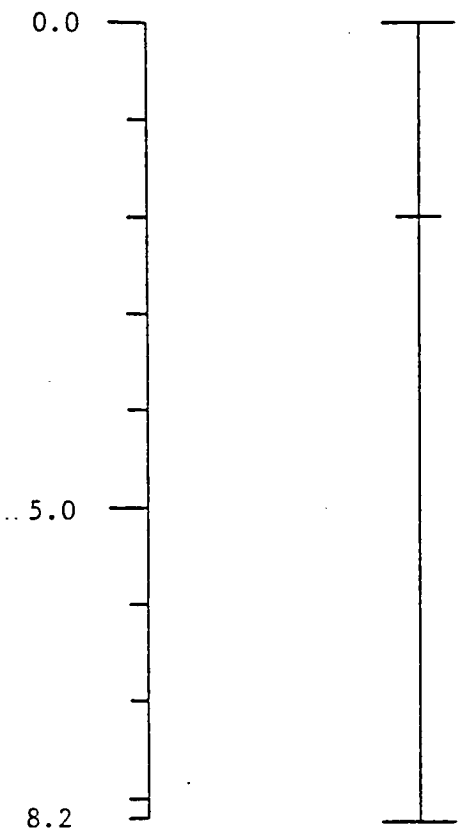
PROJECT | HOLE NO.



710.0 ft MSL

Gravelly clay(CL): brown, reddish brown, soft to stiff, weathered, dry.

Sandstone: brown, reddish brown, thinly bedded with shale and siltstone, very fine-grained, weathered, oxidized.

NWSC, Crane, Indiana
NWSC Landfill
Lithology
Boring Number: WES-11-2-83

ATEC Associates, Inc.
5150 East 65th Street/Indianapolis, Indiana 46220
317-849-4990, Telex 232-0055 ASAS

Corporate Office:
Indianapolis, IN

District Offices:
Atlanta, GA
Baltimore, MD
Birmingham, AL
Cincinnati, OH
Dallas, TX
Freeport, TX
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Louisville, KY
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Washington, DC
York, PA
Denver, Colorado

District Affiliates:
Beckley, WV
Norfolk, VA
Riyadh, S.A.

January 4, 1980

United States Navy
Naval Weapons Support Center
Crane, Indiana 47522

ATTN; Vince Crowder

Re: Test borings - Landville
Crane, Indiana
ATEC NO. D-79873

Gentlemen:

Submitted herewith are copies of boring logs for test borings drilled on the referenced project. Borings were drilled at the location designated in the field by your representative.

Thank you for the opportunity of being of assistance to you on this project. If there are any questions regarding the attached, please contact this office.

Very truly yours,

ATEC ASSOCIATES, INC.

Jimmie M. Mann
Corporate Drilling Manager

JMM/ra
enc.

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form 7

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT: U. S. Navy
BORING NO. 101
PROJECT NAME: Landfill
JOB NO. D-79873 DATE 11-29-79
PROJECT LOCATION: Crane, Indiana
STATION
BORING METHOD: HSA
FOREMAN: R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 In. 3–6 In. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Light Brown moist stiff CLAYEY SILT (ML)			5	1	4 7/8	75		
	6.5							
Light Brown dry hard CLAYEY SILT (ML)			10	2	9 18/35	100		
	14.2							
Brown dry hard CLAYEY SILT (ML) with trace fine Sand			15	3	15 14/50 0.3	100		
Bottom test boring @ 15.5'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER-
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED
BORING ____ DRILLED A FEW
FEET FROM BORING

Form 7

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT U. S. Navy
BORING NO. 102
PROJECT NAME Landfill
JOB NO. D-79873
DATE 11-29-79
PROJECT LOCATION Crane, Indiana
STATION
BORING METHOD HSA
FOREMAN R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 in. 3–6 in. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown slightly moist hard SILTY CLAY (CL) with sand Seams							1	Pushed Shelby Tube from 2.0' to 4.0'
			5					
				1	14 14/23			
			10					
Black wet SILTY CLAY (CL) with trace coarse SAND	11.5							Took auger sample of Black soil from 11.5' to 12.5'
	12.5							
Light Gray dry hard CLAYEY SILT (ML)				2	16 38/50 0.3			
			15					
Auger refusal @ 18.0'	18.0							
Bottom test boring @ 18.0'								
			20					

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS 8.5 FT.
AT COMPLETION ___ FT.

*THESE SHELBY TUBE SAMPLES OBTAINED IN BORING ___ DRILLED A FEW FEET FROM BORING ___

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form 7

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT: U. S. Navy
BORING NO.: 103
PROJECT NAME: Landfill
JOB NO.: D-79873
DATE: 11-29-79
PROJECT LOCATION: Crane, Indiana
STATION:
BORING METHOD: HSA
FOREMAN: R. Jones
ROCK CORE DIA. ____ in.
INSPECTOR:
SHELBY TUBE O.D. ____ in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 In. 3–6 In. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown moist soft SILTY CLAY with trace Sand						80	1	Pushed Shelby Tube from 3.0' to 5.0'
			5					
	6.5							
Gray dry hard CLAYEY SILT (ML) with coal Seams								
Auger refusal @ 9.1'	9.1			1	35/50 / 0.1	100		
Bottom test boring @ 9.1'			10					

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED
BORING ____ DRILLED A FE
FEET FROM BORING

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT U. S. Navy
BORING NO. 104
PROJECT NAME Landfill
JOB NO. D-79873
DATE 11-29-79
PROJECT LOCATION Crane, Indiana
STATION
BORING METHOD HSA
FOREMAN R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 in. 3–6 in. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown moist SILTY CLAY (CL)						75	1	Pushed Shelby Tube from 3.0' to 5.0'
			5					
	7.5							
Brown slightly moist very stiff CLAYEY SILT (ML)				1	12	75		
Coal	9.8		10		14/15			
Brown dry hard CLAYEY SILT(ML)	10.0							
	13.6							
Coal	13.8			2	50	100		
Gray dry hard CLAYEY SILT (ML) Auger refusal @ 15.5'	15.5		15		0.4			
Bottom test boring @ 15.5'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION ____ FT.

*THESE SHELBY TUBE SAMPLES OBTAINED IN BORING ____ DRILLED A FEW FEET FROM BORING

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT U. S. Navy
BORING NO. 105
PROJECT NAME Landfill
JOB NO. D-79873
DATE 12-1-79
PROJECT LOCATION Crane, Indiana
STATION
BORING METHOD HSA
FOREMAN R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 In. 3–6 In. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown moist medium stiff SILTY CLAY						100	1	Pushed Shelby Tube from 2.0' to 4.0'
	5.0		5					
Brown dry hard CLAYEY SILT with Sandstone clay Seams Auger refusal @ 7.0'	7.0							
Bottom test boring @ 7.0'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING
MD – MUD DRILLING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.
AFTER ____ HRS. ____ FT.

*THESE SHELBY TUBE SAMPLES OBTAINED
BORING ____ DRILLED A F
FEET FROM BORING ____

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT: U. S. Navy
BORING NO.: 106
PROJECT NAME: Landfill
JOB NO.: D-79873
DATE: 12-1-79
PROJECT LOCATION: Crane, Indiana
STATION:
BORING METHOD: HSA
FOREMAN: R. Jones
ROCK CORE DIA. ____ in.
INSPECTOR:
SHELBY TUBE O.D. ____ in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 In. 3–6 In. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown moist medium stiff SILTY CLAY	3.0							
Brown moist very stiff CLAYEY SILT (ML)			5	1	4 8/10	100		
	7.9							
Gray dry hard CLAYEY SILT (ML) with Siltstone Seams			10	2	6 21/40	100		
Auger refusal @ 12.3	12.3							
Bottom test boring @ 12.3'								Boring is standing in water

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS 3.0 FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED IN BORING ____ DRILLED A FEW FEET FROM BORING

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Fo

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT U. S. Navy
BORING NO. 107
PROJECT NAME Landfill
JOB NO. D-79873
DATE 12-1-79
PROJECT LOCATION Crane, Indiana
STATION
BORING METHOD HSA
FOREMAN R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 in. 3–6 in. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown moist stiff SILTY CLAY	2.5							
Brown slightly moist very stiff CLAYEY SILT (ML)			5	1	8 11/13	100		
	6.5							
Brown dry hard CLAYEY SILT (ML) with Siltstone Seams			10	2	17 46/50 0.3	100		
Auger refusal @ 11. 2'	11.2							
Bottom test boring @ 11.2'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED
BORING ____ DRILLED A F
FEET FROM BORING

Form

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT U. S. Navy
BORING NO. 108
PROJECT NAME Landfill
JOB NO. D-79873 DATE 12-1-79
PROJECT LOCATION Crane, Indiana
STATION
BORING METHOD HSA
FOREMAN R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 in. 3–6 in. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown moist CLAYEY SILT (ML)						100	1	Pushed Shelby tube from 2.0' to 4.0'
			5					
	6.0							
Brown dry hard CLAYEY SILT (ML)								
				1	13 33/50 0.4	100		
			10					
Auger refusal @ 12.0'	12.0							
Bottom test boring @ 12.0'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED IN BORING ____ DRILLED A FEW FEET FROM BORING ____

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

For

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
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CLIENT U. S. Navy
BORING NO. 109
PROJECT NAME Landfill
JOB NO. D-79873
DATE 12-1-79
PROJECT LOCATION Crane, Indiana
STATION
BORING METHOD HSA
FOREMAN R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 in. 3–6 in. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown moist soft SILTY CLAY	3.0							
Light Brown slightly moist stiff CLAYEY SILT (ML)	6.5		5	1	3 8/10	100		
Light Brown and Gray dry hard CLAYEY SILT (ML) with Siltstone Seams			10	2	17/50 0.4	100		
Auger refusal @ 11.0'	11.0							
Bottom test boring @ 11.0'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED
BORING ____ DRILLED A FE
FEET FROM BORING ____

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT: U. S. Navy
BORING NO.: 110
PROJECT NAME: Landfill
JOB NO.: D-79873
DATE: 12-1-79
PROJECT LOCATION: Crane, Indiana
STATION:
BORING METHOD: HSA
FOREMAN: R. Jones
ROCK CORE DIA. ____ in.
INSPECTOR:
SHELBY TUBE O.D. ____ in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 In. 3–6 In. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown slightly moist very stiff CLAYEY SILT (ML)				1	7 10/15	100		
	5.5		5					
Light Gray hard CLAYEY SILT(ML) with Weathered Siltstone Seams								
Auger refusal @ 10.0'	10.0		10	2	50 0.5	100		
Bottom test boring @ 10.0'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED IN BORING ____ DRILLED A FEW FEET FROM BORING

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
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Affiliates: Beckley/Norfolk/Riyadh

CLIENT U. S. Navy
BORING NO. 201
PROJECT NAME Landfill
JOB NO. D-79873
DATE 11-25-79
PROJECT LOCATION Crane, Indiana
STATION
BORING METHOD HSA
FOREMAN R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 in. 3–6 in. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown slightly moist very stiff CLAYEY SILT (ML)								Sandstone ledge 6.3' to 6.4'
				1	4 8/10	50		Back filled with gravel and set Bentonite Seal
			5					
Auger refusal @ 6.9'	6.9							Set Observation well to 6.9'
Bottom test boring @ 6.9'								
			10					

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED
BORING _____ DRILLED A FEW
FEET FROM BORING

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT U. S. Navy
BORING NO. 202
PROJECT NAME Landfill
JOB NO. D-79873
DATE 11-29-79
PROJECT LOCATION Crane, Indiana
STATION
BORING METHOD HSA
FOREMAN R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 In. 3–6 In. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil								
Brown moist SILTY CLAY (CL)	3.7					40	1	Pushed Shelby Tube from 3.0' to 3.9'
Brown dry hard CLAYEY SILT with trace fine to medium Sand			5					
Auger refusal @ 6.2'	6.2							Set Observation well to 6.2' with Bentonite Seal
Bottom test boring @ 6.2'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED IN BORING ____ DRILLED A FEW FEET FROM BORING

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT: U. S. Navy
BORING NO. 203
PROJECT NAME: Landfill
JOB NO. D-79873
DATE 11-29-79
PROJECT LOCATION: Crane, Indiana
STATION
BORING METHOD: HSA
FOREMAN: R. Jones
ROCK CORE DIA. ____ in.
INSPECTOR
SHELBY TUBE O.D. ____ in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 In. 3–6 In. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Top soil	0.3							
Brown moist stiff SILTY CLAY								
							1	Pushed Shelby Tube from 3.0' to 5.0'
			5					
								Set Observation well to 7.0'
Auger refusal @ 7.0'	7.0							
Bottom test boring @ 7.0'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED BORING ____ DRILLED A FEW FEET FROM BORING

ATEC Associates, Inc.

Consulting Geotechnical & Materials Engineers

Form

RECORD OF SOIL EXPLORATION

Reply To:

Home Office: Indianapolis
Offices: Atlanta/ Baltimore/Birmingham/Cincinnati/Dallas/Freeport/ Houston/Louisville/Salisbury/Washington, DC/York
Affiliates: Beckley/Norfolk/Riyadh

CLIENT: U. S. Navy
BORING NO. 204
PROJECT NAME: Landfill
JOB NO. D-79873 DATE 12-1-79
PROJECT LOCATION: Crane, Indiana
STATION
BORING METHOD: HSA
FOREMAN: R. Jones
ROCK CORE DIA. in.
INSPECTOR
SHELBY TUBE O.D. in.

SOIL CLASSIFICATION SURFACE ELEVATION–	Stratum Depth, Ft.	Ground Water	Depth Scale, Ft.	SPT ** Sample No.	SPT ** Blows/6 in. 3–6 in. Increments	SPT ** Recovery, %	Shelby Tube No.	BORING & SAMPLING NOTES
Topsoil								
Brown moist soft SILTY CLAY						100	1	Could only push tube 18" 3.0' 4.5'
	5.0		5					
Brown dry hard CLAYEY SILT with Sandstone Seams								
Auger refusal @ 7.4'	7.4							Set Observation well to 7.4'
Bottom test boring @ 7.4'								

BORING METHOD
HSA – HOLLOW STEM AUGER
CFA – CONTINUOUS FLIGHT AUGER
DC – DRIVEN CASING

GROUND WATER
NOTED ON RODS ____ FT.
AT COMPLETION dry FT.

*THESE SHELBY TUBE SAMPLES OBTAINED IN BORING ____ DRILLED A FEW FEET FROM BORING

ATEC Associates, Inc.
5150 East 65th Street/Indianapolis, Indiana 46220
317-849-4990, Telex 232-055 ASAS

Corporate Office:
Indianapolis, IN

District Offices:
Atlanta, GA
Baltimore, MD
Birmingham, AL
Cincinnati, OH
Dallas, TX
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Louisville, KY
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Washington, DC
York, PA
Denver, Colorado

District Affiliates:
Beckley, WV
Norfolk, VA
Riyadh, S.A.

January 17, 1980

U. S. Dept. of the Navy
Naval Weapons Support Center
Crane, Indiana 47522
ATTN: Vince Crowder

Re: Geological Investigation and
Well installation - sanitary
Landfill - Crane, Indiana
ATEC # D-79873

Gentlemen:

Submitted herewith are laboratory tests for the above referenced project. These tests were assigned and the results summarized by a Soils Engineer.

We wish to remind you that we will store the samples for 30 days after which time they will be discarded unless you request otherwise.

We have also enclosed our invoice for services performed. If you have any questions concerning these enclosures, please contact this office.

We appreciate the opportunity to be of service to you on this project.

Very truly yours,

ATEC ASSOCIATES, INC.

Jimmie M. Mann
Corporate Drilling Manager

JMM/ra
enc.

ATEC ASSOCIATES, INC.
5150 East 65th Street
Indianapolis, Indiana 46220

U. S. DEPARTMENT OF THE NAVY
Geological Investigation and
Well installation - sanitary
Landfill - Crane, Indiana

PERMEABILITY AND CATION EXCHANGE TEST RESULTS

BORING	SAMPLE	DEPTH	MOISTURE CONTENT	DRY DENSITY	RATE OF PERMEABILITY (CM/SCC)	CATION EXCHANGE CAPACITY (MEG/100G)
102	1	3'-4.5'	24.4	103.9	8.9 x 10-8	7.8
103	1	3'-5'	20.9	108.9	2.1 x 10-8	10.5
104	1	3'-5'	19.3	107.7	4.8 x 10-8	7.9
105	1	2'-4'	23.1	98.5	4.8 x 10-8	8.4
108	1	2'-4'	24.4	99.1	1.9 x 10-8	10.2
202	1	3'-3.9'	24.0	100.9	8.7 x 10-8	13.1
203	1	3'-5'	17.1	126.3	2.6 x 10-8	9.6
204	1	3'-4.5'	18.3	106.5	Less than* 10-7 *No bleeding noted in 11-days	12.3

TEC ASSOCIATES, INC.
150 East 65th Street
Indianapolis, Indiana 46220

U. S. DEPARTMENT OF THE NAVY
Geological Investigation and
Well installation - sanitary
Landfill - Crane, Indiana

SIEVE ANALYSIS

(% passing)

BORING	SAMPLE	DEPTH	1"	3/4"	1/2"	3/8"	#4	#8	#16	#30	#50	#100	#200
01	1	3.5' - 5'	--	--	--	100	99	99	98	97	96	92	82.6
01	2	8.5' - 10'	--	--	--	100	94	90	87	85	84	84	82.8
01	3A	13.5' - 15'	--	--	--	--	100	99	99	98	97	95	92.1
01	3B	13.5' - 15'	--	--	--	100	96	92	85	80	75	69	62.3
02	Auger	11.5' - 12.5' -		--	--	100	99	96	93	90	89	85	75.9
02	1	8.5' - 10'	100	91	84	84	78	73	69	66	63	55	40.9
02	2	13.5 - 15'	--	--	--	--	--	--	100	99.4	99.4	99.4	99.3
03	1	8.5' - 10'	--	--	--	--	--	--	--	--	--	100	99.9
04	1	8.5' - 10'	--	--	--	--	100	99	97	95	94	92	91.6
04	2A	13.5 - 15'	--	--	--	100	94	79	71	64	61	55	49.5
04	2B	13.5'- 15'	--	--	--	--	--	100	99	99	99	99	98.3
06	1	3.5'- 5'	--	--	--	--	100	99	98	98	98	96	94.7
06	2	8.5'- 10'	--	--	100	98	91	86	84	82	82	81	80.7
07	1	3.5'-5'	--	--	100	98	95	93	92	91	90	90	88.6
07	2	8.5'-10'	--	--	--	100	99	96	92	89	87	85	83.6
08	1	8.5'-10'	--	--	100	98	88	83	79	76	75	73	71.6
09	1	3.5'-5'	--	--	--	--	100	99	98	97	97	95	91.3
09	2	8.5'-10'	--	100	92	89	81	75	73	71	70	69	68.2

TEC ASSOCIATES, INC.

U.S. NAVY - CRANE, INC.

SIEVE ANALYSIS

ORING	SAMPLE	DEPTH	1"	3/4"	1/2"	3/8"	(% passing) #4	#8	#16	#30	#50	#100	#200
10	1	3.5'-5'	--	--	--	100	99	97	94	91	89	88	86.3
10	2	8.5'-10'	--	100	98	92	92	79	76	73	72	69	67.2
01	1	3.5'-5'	--	--	--	100	98	96	93	91	90	89	87.7

APPENDIX E

HISTORICAL GROUNDWATER LEVELS AT THE SANITARY LANDFILL

Ground-Water Elevations

NWSC Landfill

Well Number: 1A

Top of Pipe Elevation: 713.57 ft MSL

Bottom of Well Elevation: 672.32 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	27.16	686.41	
19 Aug 81	28.5	685.07	
17 Sep 81	26.75	686.82	
6 Dec 81	26.83	686.74	
11 Jun 82	27.33	686.24	
22 Sep 82	26.00	687.57	
20 Oct 82	27.00	686.57	
14 Dec 82	27.00	686.57	
21 May 83	27.05	686.52	
17 Jul 83	25.38	688.19	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 1B

Top of Pipe Elevation: 713.62 ft MSL

Bottom of Well Elevation: 694.32 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	19.19	694.43	
19 Aug 81	19.00	694.62	
17 Sep 81	--	--	Dry
6 Dec 81	--	--	Dry
11 Jun 82	19.50	694.12	Dry
22 Sep 82	20.00	693.62	Dry
20 Oct 82	19.67	693.95	Dry
14 Dec 82	19.50	694.12	Dry
21 May 83	17.30	696.32	
17 Jul 83	18.12	695.50	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 2A

Top of Pipe Elevation: 671.56 ft MSL

Bottom of Well Elevation: 629.86 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	25.75	645.81	
19 Aug 81	25.08	646.48	
17 Sep 81	25.13	646.43	
6 Dec 81	25.58	645.98	
11 Jun 82	25.10	646.46	
22 Sep 82	25.00	646.56	
20 Oct 82	25.17	646.39	
14 Dec 82	25.00	646.56	
21 May 83	25.6	645.96	
17 Jul 83	23.71	647.85	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 2B

Top of Pipe Elevation: 671.78 ft MSL

Bottom of Well Elevation: 657.68 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	13.75	658.03	
19 Aug 81	14.17	657.61	Dry
17 Sep 81	--	--	Dry
6 Dec 81	--	--	Dry
11 Jun 82	14.80	656.98	Dry
22 Sep 82	14.88	656.90	Dry
20 Oct 82	14.67	657.11	Dry
14 Dec 82	15.00	656.78	Dry
21 May 83	--	--	Dry
17 Jul 83	13.38	658.40	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 3A

Top of Pipe Elevation: 677.64 ft MSL

Bottom of Well Elevation: 631.39 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	39.16	638.48	
19 Aug 81	38.58	639.06	
17 Sep 81	38.79	638.85	
6 Dec 81	38.42	639.22	
11 Jun 82	35.50	642.14	
22 Sep 82	31.50	646.14	
20 Oct 82	35.83	641.81	
14 Dec 82	37.00	640.64	
21 May 83	39.70	637.94	
17 Jul 83	32.60	645.04	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 3B

Top of Pipe Elevation: 677.91 ft MSL

Bottom of Well Elevation: 667.11 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	8.58	669.33	
19 Aug 81	6.04	671.87	
17 Sep 81	6.54	671.37	
6 Dec 81	3.75	674.16	
11 Jun 82	3.9	674.01	
22 Sep 82	5.33	672.58	
20 Oct 82	8.50	669.41	
14 Dec 82	2.50	675.41	
21 May 83	2.80	675.11	
17 Jul 83	4.92	672.99	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 4A

Top of Pipe Elevation: 687.95 ft MSL

Bottom of Well Elevation: 640.45 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	24.00	663.95	
19 Aug 81	19.04	668.91	
17 Sep 81	18.75	669.20	
6 Dec 81	24.08	663.87	
11 Jun 82	18.7	669.25	
22 Sep 82	20.00	667.95	
20 Oct 82	20.33	667.62	
14 Dec 82	19.92	668.03	
21 May 83	14.7	673.25	
17 Jul 83	25.00	662.95	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 4B

Top of Pipe Elevation: 687.93 ft MSL

Bottom of Well Elevation: 661.03 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	21.25	666.68	
19 Aug 81	17.33	670.60	
17 Sep 81	17.46	670.47	
6 Dec 81	13.67	674.26	
11 Jun 82	12.0	675.93	
22 Sep 82	15.25	672.68	
20 Oct 82	13.25	674.68	
14 Dec 82	3.33	684.60	
21 May 83	3.00	684.93	
17 Jul 83	13.33	674.60	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 5A

Top of Pipe Elevation: 693.69 ft MSL

Bottom of Well Elevation: 651.69 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	19.08	674.61	
19 Aug 81	18.17	675.52	
17 Sep 81	18.79	674.90	
6 Dec 81	19.25	674.44	
11 Jun 82	19.10	674.59	
22 Sep 82	19.50	674.19	
20 Oct 82	19.25	674.44	
14 Dec 82	18.75	674.94	
21 May 83	19.30	674.39	
17 Jul 83	17.85	675.84	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 5B

Top of Pipe Elevation: 693.66 ft MSL

Bottom of Well Elevation: 675.86 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	3.33	690.33	
19 Aug 81	3.08	690.58	
17 Sep 81	4.04	689.62	
6 Dec 81	5.17	688.49	
11 Jun 82	5.1	688.56	
22 Sep 82	6.50	687.16	
20 Oct 82	8.83	684.83	
14 Dec 82	7.00	686.66	
21 May 83	2.1	691.56	
17 Jul 83	5.85	687.81	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 6A

Top of Pipe Elevation: 688.51 ft MSL

Bottom of Well Elevation: 646.21 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	6.42	682.09	
19 Aug 81	6.96	681.55	
17 Sep 81	7.63	680.88	
6 Dec 81	8.08	680.43	
11 Jun 82	6.90	681.61	
22 Sep 82	7.00	681.51	
20 Oct 82	6.50	682.01	
14 Dec 82	6.83	681.68	
21 May 83	6.70	681.81	
17 Jul 83	5.38	683.13	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 6B

Top of Pipe Elevation: 688.64 ft MSL

Bottom of Well Elevation: 673.74 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	6.25	682.39	
19 Aug 81	7.04	681.60	
17 Sep 81	7.60	681.04	
6 Dec 81	6.83	681.81	
11 Jun 82	6.00	682.64	
22 Sep 82	7.00	681.64	
20 Oct 82	6.17	682.47	
14 Dec 82	5.08	683.56	
21 May 83	5.10	683.54	
17 Jul 83	5.92	682.72	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 7A

Top of Pipe Elevation: 711.04 ft MSL

Bottom of Well Elevation: 669.04 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	28.75	682.29	
19 Aug 81	28.63	682.41	
17 Sep 81	28.83	682.21	
6 Dec 81	29.50	681.54	
11 Jun 82	29.50	681.54	
22 Sep 82	29.50	681.54	
20 Oct 82	29.00	682.04	
14 Dec 82	28.42	682.62	
21 May 83	29.30	681.74	
17 Jul 83	27.27	683.77	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 7B

Top of Pipe Elevation: 711.11 ft MSL

Bottom of Well Elevation: 681.31 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	23.58	687.53	
19 Aug 81	24.08	687.03	
17 Sep 81	--	--	Dry
6 Dec 81	--	--	Dry
11 Jun 82	24.30	686.81	
22 Sep 82	24.00	687.11	
20 Oct 82	24.50	686.61	
14 Dec 82	24.33	686.78	
21 May 83	--	--	Dry
17 Jul 83	23.00	688.11	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 201

Top of Pipe Elevation: 714.82 ft MSL

Bottom of Well Elevation: 704.12 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	7.75	707.07	
19 Aug 81	3.25	711.57	
17 Sep 81	8.25	706.57	
6 Dec 81	--	--	Dry
11 Jun 82	7.00	707.82	
22 Sep 82	7.00	707.82	
20 Oct 82	5.67	709.15	
14 Dec 82	4.00	710.82	
21 May 83	9.90	704.92	
14 Jul 83	5.71	709.11	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 202

Top of Pipe Elevation: 688.72 ft MSL

Bottom of Well Elevation: 680.62 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	6.67	682.05	
19 Aug 81	5.50	683.22	
17 Sep 81	5.63	683.09	
6 Dec 81	5.25	683.47	
11 Jun 82	4.50	684.22	
22 Sep 82	6.00	682.72	
20 Oct 82	6.25	682.47	
14 Dec 82	5.08	683.64	
21 May 83	3.30	685.42	
14 Jul 83	5.75	682.97	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 203

Top of Pipe Elevation: 684.38 ft MSL

Bottom of Well Elevation: 672.38 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	9.33	675.05	
19 Aug 81	8.83	675.55	
17 Sep 81	9.04	675.34	
6 Dec 81	7.50	676.88	
11 Jun 82	7.50	676.88	
22 Sep 82	8.00	676.38	
20 Oct 82	8.75	675.63	
14 Dec 82	7.00	677.38	
21 May 83	7.00	677.38	
17 Jul 83	7.54	676.84	

* All measurements by NWSC

Ground-Water Elevations

NWSC Landfill

Well Number: 204

Top of Pipe Elevation: 686.38 ft MSL

Bottom of Well Elevation: 676.38 ft MSL

Date	Depth to Water (ft)	Elevation (ft msl)	Remarks
25 Jun 81*	8.58	677.80	
19 Aug 81	7.46	678.92	
17 Sep 81	7.54	678.84	
6 Dec 81	4.58	681.80	
11 Jun 82	5.80	680.58	
22 Sep 82	6.50	679.88	
20 Oct 82	8.50	677.88	
14 Dec 82	5.00	681.38	
21 May 83	4.70	681.68	
17 Jul 83	5.71	680.67	

* All measurements by NWSC

APPENDIX F

OPERATING PERMIT FOR SANITARY LANDFILL OPERATION (OPP 51-2) (1988-1990)

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
NANCY A. MALOLEY, Commissioner

105 South Meridian Street
P.O. Box 6015
Indianapolis 46206-6015
Telephone 317-232-8603

May 5, 1988

09 7 pu
09A
09B
09C
09D

VIA CERTIFIED MAIL P 652 576 969

Commanding Officer
Department of the Navy
Crane Naval Weapons Support Center
Crane, Indiana 47522

Re: Issuance of Amendment to Construction Plan Permit
Renewal of Operating Permit for Sanitary Landfill Operation (OPP 51-2)
Crane Naval Weapons Support Center Landfill
Martin County

Dear Sir:

You are hereby notified that the Commissioner of the Department of Environmental Management (Department) approved the amended plans and specifications submitted on August 31, 1987, for the above-referenced solid waste management facility. The issuance of this amendment does not supersede the requirements of any other agency of local, State, or federal government.

The review of information submitted in your application for renewal of an operating permit for a sanitary landfill, which we received on August 24, 1987, has also been completed. The sanitary landfill project located on Highway 161, 1/2 mile southwest of Burns City, on Crane Naval Weapons Support Center property, was issued a construction plan permit on October 24, 1980. More specifically, the site is located in part of the S 1/2 of the NE 1/4 and part of the N 1/2 of the SE 1/4 of Section 6, and part of the SW 1/4 of the SW 1/4 of the NW 1/4, and part of the W 1/2 of the NW 1/4 of the SW 1/4 of Section 5, T4N, R4W, and contains approximately 70 acres of which approximately 31 acres are approved for landfilling. This facility shall be operated in accordance with Rule 330 IAC 4-1, et seq. (Regulation SPC-18), and Construction Plan Permit SW-239.

You are certified as having completed the requirements for renewal of an operating permit in accordance with IC 19-2-1 and IC 13-7, and the rules and regulations promulgated thereunder and are hereby authorized to operate the solid waste facility described above, subject to the terms of this letter.

Enclosure (1)

The above-referenced sanitary landfill project is hereby granted the amendment to Construction Plan Permit SW-239 and a renewal of Operating Permit No. 51-2 with the following conditions:

1. That final cover be limited to clay-type soil (Unified Soil Classifications of CL, ML, CH, and OH). The use of sand or gravel (Unified Soil Classifications of SP, SM, SC, SW, and GP) for final cover is prohibited. The daily and intermediate cover shall be limited to the soil material as specified in the amendment plans submitted to this office on August 31, 1987.

2. That any areas which have not received final cover or additional solid waste within ninety (90) days of the time of filling must have an intermediate cover of one (1) foot of soil applied and maintained.

3. That when any portion of the site reaches within three (3) feet of final elevation as shown on the map entitled "Proposed Contours," Drawing No. 5316, dated August 26, 1987, compacted final cover shall be applied, not less than three (3) feet in depth. Vegetation shall be provided to prevent soil erosion. Final cover shall have a slope of not less than two percent (2%).

* 4. That a series of permanent, visible, boundary markers which delineate the approved fill boundaries as shown on the map entitled "Crane Sanitary Landfill," Drawing PWO No. 4638, submitted to this office on August 24, 1987, be established within sixty (60) days of receipt of this letter.

5. That if any sand or gravel seams are encountered during excavation, they shall be completely removed and backfilled with compacted clay soil to approved base grade or excavated to a minimum of five (5) feet and backfilled to approved base grade with compacted clay soil.

6. That if bedrock is encountered during excavation, it shall be sealed from solid waste by a minimum of five (5) feet of compacted clay soil.

7. That hazardous wastes, as defined in 320 IAC 4.1, shall not be accepted at this site. That hazardous wastes, as defined in 330 IAC 4, shall not be accepted at this site without prior written approval from the Department of Environmental Management.

8. That solid waste not be placed in standing water.

* 9. That water quality samples shall be taken and tested individually on a quarterly basis. The following sampling months have been determined for this site: March, June, September, and December. Sampling shall be conducted during each of these months and water quality results shall be submitted to this office by the end of the

following month. Along with each submittal, the static water level elevation (referenced to mean sea level), measured prior to purging and sampling of the wells, shall also be submitted. Each sample shall be analyzed for the following chemical parameters: field pH, field specific conductance, dissolved iron, chloride, total dissolved solids, chemical oxygen demand, and total hardness. The March analysis shall include these additional chemical parameters: cyanide, copper, lead, phenol, and total organic carbon. The detection limits for all chemical parameters must be defined when submitting all quarterly groundwater sampling results.

* 10. That all monitoring wells be affixed with permanent identification numbers within thirty (30) days of receipt of this letter. The wells shall be maintained properly, and be accessible at all times. Proper maintenance includes keeping the wells securely capped at all times, repaired of any cracks, and maintaining mounds of clay-type soil around the casings (unless the wells are grouted with cement or a concrete pad has been provided). At a minimum, a compacted soil or sod-covered drive graded to promote surface drainage, reasonably level and smooth, with vegetation height controlled, shall be provided to access each monitoring well.

11. That if any nuisance or pollution conditions are created, immediate corrective action will be taken by the operator.

12. That the bottom of the (trench) excavations not exceed eight (8) feet in depth for trench Nos. 16 through 18 and not exceed three (3) feet in trench Nos. 19 through 34, and shall be shallower where necessary to maintain an undisturbed soil barrier of at least five (5) feet over the (bedrock) unit. This shall be confirmed by conducting a soil boring down to bedrock for each cell (trench) after the subgrade has been prepared. The borehole must be properly sealed prior to placement of solid waste. The boring results shall be submitted along with a location map to the Geology Section of the Office of Solid and Hazardous Waste Management (OSHWM) within fifteen (15) days prior to placement of solid waste.

13. That when the filling operation commences in Phase 5 (current on-site road) as shown on the map entitled "Crane Sanitary Landfill" Drawing PWO No. 4638, submitted to this office on August 24, 1987, proper surface run-off control shall be implemented to prevent drainage water from entering the area of the working face. Upon the completion of Phase 5, this area shall be properly final covered and graded as specified in condition No. 3 of this letter.

* 14. That prior to the placement of solid waste in the new portion of a trench, the top three (3) feet of the base of the trench shall be recompacted to ninety percent (90%) modified Proctor density. This shall be done in lifts not greater than twelve (12)-inches with a sheepsfoot roller. The preparation of the trench base shall be certified, as to depths and compaction, by a professional engineer registered in the State of Indiana. Such certification must be submitted to this office within thirty (30) days after each section has been prepared and prior to placement of solid waste over the recompacted base. Each certification shall accurately identify the boundaries of the area being certified and the testing locations on a topographic plot plan.

Pursuant to IC 13-7-10-2.5(b), IC 4-21.5-3-5(f), and IC 4-21.5-3-5(h), these permits take effect fifteen (15) days from receipt of this notice unless a Petition for Review and a Petition for Stay of Effectiveness are filed within this fifteen (15)-day period. If a Petition for Review and a Petition for Stay of Effectiveness are filed, any part of these permits within the scope of the Petition for Stay is stayed an additional fifteen (15) days. The portions of the permits for which a Petition for Stay has been filed will take effect at the expiration of the additional fifteen (15)-day period, unless or until an Administrative Law Judge stays the permit in whole or in part.

This letter will serve as your two (2)-year operating permit effective once all appeals have been exhausted or once all applicable time periods for filing appeals have expired. You will be notified by separate letter of the effective date of this permit.

If you have any questions regarding this matter, please contact Mr. James Evans of this office at AC 317/232-7199.

Sincerely,

Jane Magee

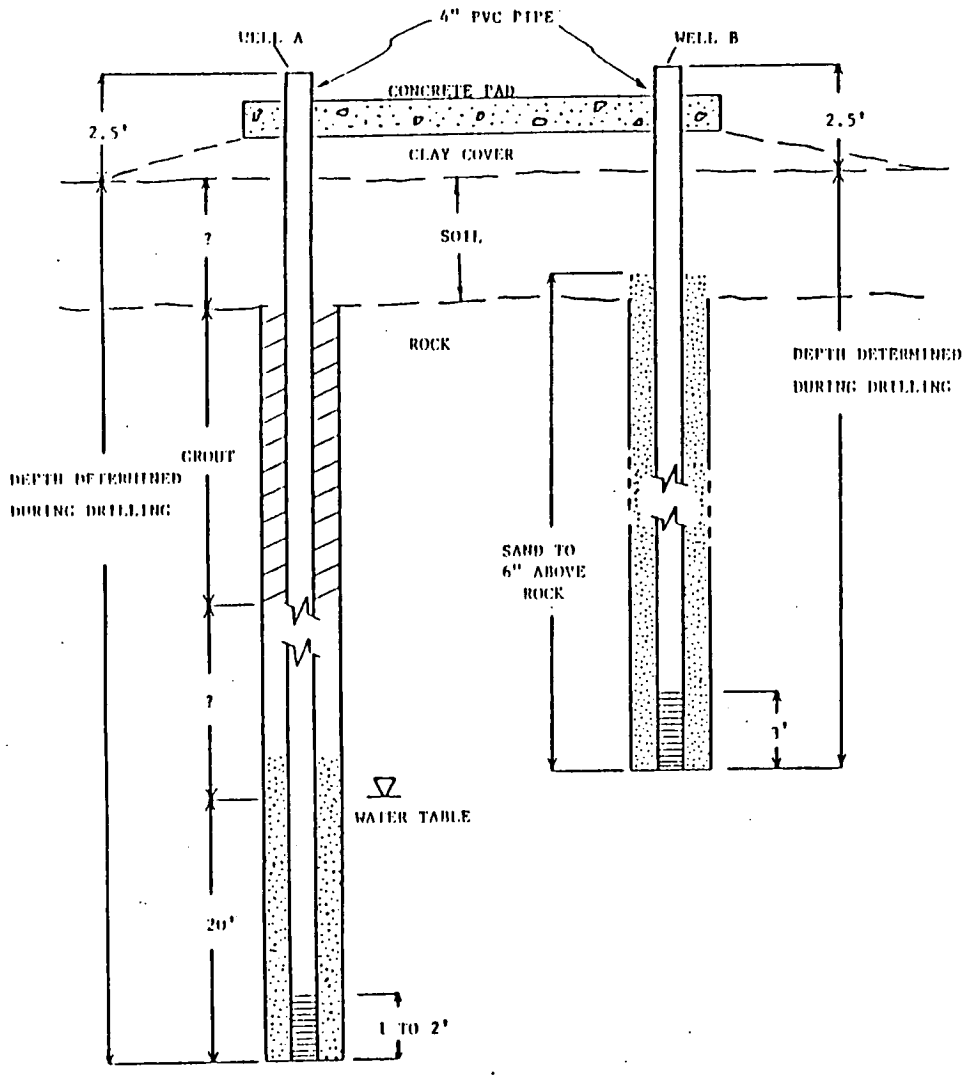
Jane Magee
Assistant Commissioner for
Solid and Hazardous Waste Management

DLK/drc

cc: Martin County Health Department
Martin County Commissioners
Mr. Stephen Gentry
Mr. David Becka
Mr. James Evans
Mr. Steven Poe
Mr. David Phillips, Department of Natural Resources

APPENDIX G

SANITARY LANDFILL WELL CONSTRUCTION



WELL NUMBER	DEPTH TO WATER	DEPTH OF WELL
1A	26.0	42.0
1B	17.0	19.0
2A	--	41.5
2B	3.8	14.0
3A	40.5	46.5
3B	2.6	10.0
4A	10.6	47.0
4B	2.5	26.5
5A	18.0	41.5
5B	1.5	17.5
6A	7.0	42.0
6B	5.0	14.5
7A	28.5	41.5
7B	--	23.0

Depths measured on 3 December 1979

Well Construction and Depths for Wells 1 through 7

APPENDIX H

LANDFILL-SPECIFIC SPECIAL WASTES MONTHLY DISPOSAL SUMMARIES

APPENDIX H

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - ASBESTOS*
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
August 91	Trans	01014	400 cu yds	04-03-92	1 cu yd		
	B-5	01014	400 cu yds	04-03-92	120 cu ft		Floor Tile
	B-DRMO	01014	400 cu yds	04-03-92	60 cu ft		Lined Safes
	B-128	01014	400 cu yds	04-03-92	196 cu ft		Lined Safes
	B-2921	01014	400 cu yds	04-03-92	6 cu ft		Tank Insulation
	B-2720	01014	400 cu yds	04-03-92	112 cu ft	127.5 cu yds	
July 91	B-2071/585	01014	400 cu yds	04-03-92	9 cu ft		
	B-64	01014	400 cu yds	04-03-92	0.7 cu ft		
	B-2922	01014	400 cu yds	04-03-92	64 cu ft		
	B-56	01014	400 cu yds	04-03-92	4 cu ft		
	B-64	01014	400 cu yds	04-03-92	288 cu ft	108.3 cu yds	
June 91	B-77	01014	400 cu yds	04-03-92	16 cu ft		
	B-2517	01014	400 cu yds	04-03-92	40 cu ft		
	B-45	01014	400 cu yds	04-03-92	80 cu ft		
	B-16	01014	400 cu yds	04-03-92	100 sq ft	94.8 cu yds	
May 91	MFA	01014	400 cu yds	04-03-92	12 sq yds		
	B-2917	01014	400 cu yds	04-03-92	4 cu ft		
	B-18	01014	400 cu yds	04-03-92	96 cu ft		
	B-7	01014	400 cu yds	04-03-92	60 cu ft	88.1 cu yds	
April 91	B-169	01014	400 cu yds	04-30-92	160 sq ft		
	B-2906	01014	400 cu yds	04-30-92	16 cu ft		
	B-2967	01014	400 cu yds	04-30-92	4 cu ft		
	B-1820	01014	400 cu yds	04-30-92	960 sq ft	68.1 cu yds	
Feb/March 91	B-169	01014	400 cu yds	04-30-92	816 cu ft		
	B-160	01014	400 cu yds	04-30-92	32 cu ft		
	B-8	01014	400 cu yds	04-30-92	160 cu ft		
	B-150	01014	400 cu yds	04-30-92	112 cu ft		
	B-133	01014	400 cu yds	04-30-92	64 cu ft		
	B-2	01014	400 cu yds	04-30-92	16 cu ft		
	B-133	01014	400 cu yds	04-30-92	288 cu ft	55.1 cu yds	

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
January 91	B-2805	00097	400 cu yds	04-30-91	160 cu ft		
	B-2739	00097	400 cu yds	04-30-91	12 cu ft		
	B-18	00097	400 cu yds	04-30-91	32 cu ft		
December 90	B-37	0097	400 cu yds	04-30-91	16 cu ft		
	B-121	0097	400 cu yds	04-30-01	4 cu ft		
	MFA	0097	400 cu yds	04-30-91	96 cu ft		
	B-2805	0097	400 cu yds	04-30-91	80 cu ft		
	B-2805	0097	400 cu yds	04-30-91	96 cu ft		
	B-146	0097	400 cu yds	04-30-91	4 cu ft	93.43 cu yds	
November 90	B-124	0097	400 cu yds	04-30-91	114 cu ft		
	B-12	0097	400 cu yds	04-30-91	183 cu ft		
	B-12	0097	400 cu yds	04-30-91	154 cu ft	94.97 cu yds	
October 90	B-56	0097	400 cu yds	04-30-91	16 cu ft		
	Contractor	0097	400 cu yds	04-30-91	6 cu yds	78.27 cu yds	
September 90	B-126	0097	400 cu yds	04-30-91	32 cu ft		
	B-126	0097	400 cu yds	04-30-91	16 cu ft		
	B-126	0097	400 cu yds	04-30-91	16 cu ft	71.68 cu yds	
August 90	B-124	0097	400 cu yds	04-30-91	16 cu ft		
	B-2707	0097	400 cu yds	04-30-91	16 cu ft		
	B-2707	0097	400 cu yds	04-30-91	160 cu ft		
	B-2707	0097	400 cu yds	04-30-91	32 cu ft		
	B-2707	0097	400 cu yds	04-30-91	176 cu ft		
	B-2702	0097	400 cu yds	04-30-91	32 cu ft		
	B-126	0097	400 cu yds	04-30-91	8 cu ft		
	B-140	0097	400 cu yds	04-30-91	4 cu ft		
	B-2044	0097	400 cu yds	04-30-91	4 cu ft	69.31 cu yds	
July 90	B-2	0097	400 cu yds	04-31-91	24 cu yds		
	B-2	0097	400 cu yds	04-31-91	24 cu yds		
	B-2	0097	400 cu yds	04-31-91	24 cu yds		
	B-2	0097	400 cu yds	04-31-91	24 cu yds	52.72 cu yds	

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
May 90	B02760	0097	400 cu yds	04-31-91	80 cu ft		
	B-2760	0097	400 cu yds	04-31-91	64 cu ft		
	B-124	0097	400 cu yds	04-31-91	24 cu ft		
	B-41	0097	400 cu yds	04-31-91	16 cu ft	49.22 cu yds	
April 90	B-1884	0097	400 cu yds	04-31-91	160 cu ft		
	B-107	0097	400 cu yds		48 cu ft		
	B-1884	0097	400 cu yds		288 cu ft		
	B-2693	0097	400 cu yds		620 cu ft		
	B-5	0097	400 cu yds		32 cu ft	43.11 cu ft	
March 90	B-2707	0097	400 cu yds	04-30-91	0.59 cu yd	0.59 cu yd	
February 90	B-2714	90195	400 cu yds	04-30-90	6 cu ft		
	B-2721	90195	400 cu yds	04-30-90	48 cu ft		
	B-2721	90195	400 cu yds	04-30-90	96 cu ft		
	B-2721	90195	400 cu yds	04-30-90	80 cu ft		
	B-2721	90195	400 cu yds	04-30-90	112 cu ft		
	B-2721	90195	400 cu yds	04-30-90	48 cu ft		
	B-2721	90195	400 cu yds	04-30-90	48 cu ft	268.3 cu yds	
January 90	B-11	80110	400 cu yds	04-30-90	2 cu ft		
	B-41	80110	400 cu yds	04-30-90	8 cu ft		
	DRMO	80110	400 cu yds	04-30-90	1 cu yd	252.1 cu yds	
December 89	B-126	80110	400 cu yds	04-30-90	8 cu ft		
	B-148	80110	400 cu yds	04-30-90	16 cu ft		
	B-121	80110	400 cu yds	04-30-90	160 cu ft		
	B-124	80110	400 cu yds	04-30-90	4 cu ft	250.8 cu yds	
November 89	B-124	80110	400 cu yds	04-30-89	8 cu ft		
	B-152	80110	400 cu yds	04-30-89	8 cu ft		
	B-152	80110	400 cu yds	04-30-89	10 cu ft		
	B-37	80110	400 cu yds	04-30-89	30 cu ft		
	B-37	80110	400 cu yds	04-30-89	32 cu ft		
	B-126	80110	400 cu yds	04-30-89	8 cu ft	243.6 cu yds	

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
October 89	B-199	80110	400 cu yds	04-30-90	112 cu ft		
	B-199	80100	400 cu yds	04-30-90	96 cu ft		
	B02801	80110	400 cu yds	04-30-90	54 cu ft		
	B-2801	80110	400 cu yds	04-30-90	160 cu ft		
	B-199	80110	400 cu yds	04-30-90	48 cu ft		
	B-199	80110	400 cu yds	04-30-90	176 cu ft		
	B-199	80110	400 cu yds	04-30-90	112 cu ft		
	B-101	80110	400 cu yds	04-30-90	16 cu ft		
	B-190	80110	400 cu yds	04-30-90	8 cu ft		
	B-64	80110	400 cu yds	04-30-90	96 cu ft	240.1 cu yds	
September 89	B-39	80110	400 cu yds	04-30-90	20 cu ft		
	B-199	80110	400 cu yds	04-30-90	96 cu ft		
	B-199	80110	400 cu yds	04-30-90	132 cu ft		
	B-199	80110	400 cu yds	04-30-90	96 cu ft		
	B-199	80110	400 cu yds	04-30-90	16 cu ft		
	B-199	80110	400 cu yds	04-30-90	64 cu ft		
	B-199	80110	400 cu yds	04-30-90	64 cu ft		
	B-199	80110	400 cu yds	04-30-90	8 cu ft		
	B-2516	80110	400 cu yds	04-30-90	32 cu ft		
	B-2516	80110	400 cu yds	04-30-90	32 cu ft		
	B-2516	80110	400 cu yds	04-30-90	15 cu yds	207.5 cu yds	Chemically treated Z-suits
	B-199	80110	400 cu yds	04-30-90	32 cu ft		
	B-199	80110	400 cu yds	04-30-90	116 cu ft		
	B-199	80110	400 cu yds	04-30-90	164 cu ft		
	B-199	80110	400 cu yds	04-30-90	132 cu ft		
	B-2516	80110	400 cu yds	04-30-90	16 cu ft		
	B-199	80110	400 cu yds	04-30-90	32 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
August 89	B-2502	80110	400 cu yds	04-30-90	16 cu ft		
	B-2682	80110	400 cu yds	04-30-90	160 cu ft		
	B-2682	80110	400 cu yds	04-30-90	48 cu ft		
	B-4	80110	400 cu yds	04-30-90	4 cu ft		
	B-2044	80110	400 cu yds	04-30-90	16 cu ft		
	B-101	80110	400 cu yds	04-30-90	32 cu ft	153.6 cu yds	
July 89	B-122	80110	400 cu yds	04-30-90	48 cu ft		
	B-122	80110	400 cu yds	04-30-90	64 cu ft		
	B-121	80110	400 cu yds	04-30-90	32 cu ft		
	B-107	80110	400 cu yds	04-30-90	2 cu ft		
	B-152	80110	400 cu yds	04-30-90	8 cu ft	143.4 cu yds	
June 89	B-2502	80110	400 cu yds	04-30-90	80 cu ft		
	B-2502	80110	400 cu yds	04-30-90	16 cu ft		
	B-2502	80110	400 cu yds	04-30-90	64 cu ft		
	B-2502	80110	400 cu yds	04-30-90	4 cu ft		
	B-1818	80110	400 cu yds	04-30-90	16 cu ft		
	B-41	80110	400 cu yds	04-30-90	16 cu ft	137.7 cu yds	
May 89	B-143	80110	400 cu yds	04-30-90	2 cu ft		
	B-2693	80110	400 cu yds	04-30-90	4 cu ft		
	B-2502	80110	400 cu yds	04-30-90	8 cu ft		
	B-2502	80110	400 cu yds	04-30-90	48 cu ft		
	B-2502	80110	400 cu yds	04-30-90	64 cu ft		
	B-2502	80110	400 cu yds	04-30-90	64 cu ft	130.7 cu yds	
April 89	B-56	80110	400 cu yds	04-30-90	64 cu ft		
	B-2087	80110	400 cu yds	04-30-90	48 cu ft		
	B-169	80110	400 cu yds	04-30-90	48 cu ft		
	B-169	80110	400 cu yds	04-30-90	96 cu ft		
	B-169	80110	400 cu yds	04-30-90	96 cu ft		
	B-169	80110	400 cu yds	04-30-90	80 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-169	80110	400 cu yds	04-30-90	48 cu ft		
	B-2044	80110	400 cu yds	04-30-90	32 cu ft		
	B-169	80110	400 cu yds	04-30-90	48 cu ft		
	B-169	80110	400 cu yds	04-30-90	60 cu ft		
	B-169	80110	400 cu yds	04-30-90	72 cu ft		
	B-169	80110	400 cu yds	04-30-90	16 cu ft		
	B-2693	80110	400 cu yds	04-30-90	24 cu ft		
	B-37	80110	400 cu yds	04-30-90	2 cu ft		
	B-56	80110	400 cu yds	04-30-90	4 cu ft		
	PW	80110	400 cu yds	04-30-90	1 cu ft	1,237.7 cu yds	
March 89	B-2597	80110	400 cu yds	05-31-89	32 cu ft		
	B-10	80110	400 cu yds	05-31-89	32 cu ft		
	B-153	80110	400 cu yds	05-31-89	96 cu ft		
	B-41	80110	400 cu yds	05-31-89	16 cu ft		
	B-2540	80110	400 cu yds	05-31-89	12 cu ft		
	B-138	80110	400 cu yds	05-31-89	48 cu ft		
	B-138	80110	400 cu yds	05-31-89	48 cu ft		
	B-1833/ B-1848	80110	400 cu yds	05-31-89	1,104 cu ft		
	B-1833/ B-1848	80110	400 cu yds	05-31-89	592 cu ft	96.3 cu yds	
February 89	B-13	Not listed	Not listed	5-89	144 cu ft		
	B-13	Not listed	Not listed	5-89	48 cu ft		
	B-13	Not listed	Not listed	5-89	16 cu ft		
	B-36	Not listed	Not listed	5-89	8 cu ft		
	B-126	Not listed	Not listed	5-89	32 cu ft		
	B-152	Not listed	Not listed	5-89	64 cu ft		
	B-2044	Not listed	Not listed	5-89	4 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-127	Not listed	Not listed	5-89	96 cu ft		
	B-127	Not listed	Not listed	5-89	132 cu ft		
	B-127	Not listed	Not listed	5-89	48 cu ft	22.8 cu yds	
January 89	B-2917	Not listed	400 cu yds	05-31-89	48 cu ft		
	B-151	Not listed	400 cu yds	05-31-89	2 cu ft	1.8 cu yds	
December 88	B-158	Not listed	Not listed	05-31-89	16 cu ft		Pipe Insulation
	B-2044	Not listed	Not listed	05-31-89	2 cu ft		Pipe Insulation
	B-2044	Not listed	Not listed	05-31-89	2 cu ft		Pipe Insulation
	B-2682	Not listed	Not listed	05-31-89	3 cu ft		Pipe Insulation
	B-149	Not listed	Not listed	05-31-89	2 cu ft		Pipe Insulation
	B-2674	Not listed	Not listed	05-31-89	2 cu ft		Pipe Insulation
	B-169	Not listed	Not listed	05-31-89	8 cu ft		Pipe Insulation
	B-2044	Not listed	Not listed	05-31-89	32 cu ft	90.8 cu yds	Pipe Insulation
November 88	B-103	Not listed	Not listed	05-31-89	64 cu ft		Pipe Insulation
	B-158	Not listed	Not listed	05-31-89	80 cu ft		Pipe Insulation
	B-158	Not listed	Not listed	05-31-89	64 cu ft		Pipe Insulation
	B-115	Not listed	Not listed	05-31-89	16 cu ft		Pipe Insulation
	B-158	Not listed	Not listed	05-31-89	64 cu ft		Pipe Insulation
	B-158	Not listed	Not listed	05-31-89	32 cu ft		Pipe Insulation
	B-158/ B-159	Not listed	Not listed	05-31-89	16 cu ft		Pipe Insulation
	B-158 B-159	Not listed	Not listed	05-31-89	32 cu ft		Pipe Insulation
	B-158 B-159	Not listed	Not listed	05-31-89	45 cu ft	88.3 cu yds	Pipe Insulation
October 88	B-150	Not listed	Not listed	05-31-89	64 cu ft		Pipe Insulation
	B-150	Not listed	Not listed	05-31-89	80 cu ft		Pipe Insulation
	B-150	Not listed	Not listed	05-31-89	64 cu ft		Pipe Insulation

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-150	Not listed	Not listed	05-31-89	32 cu ft		Pipe Insulation
	B-150	Not listed	Not listed	05-31-89	8 cu ft		Pipe Insulation
	B-2713	Not listed	Not listed	05-31-89	8 cu ft		Pipe Insulation
	B-2713	Not listed	Not listed	05-31-89	2 cu ft		Pipe Insulation
	B-2084	Not listed	Not listed	05-31-89	32 cu ft		Pipe Insulation
	B-115	Not listed	Not listed	05-31-89	16 cu ft		Pipe Insulation
	B-2084	Not listed	Not listed	05-31-89	32 cu ft		Pipe Insulation
	B-2084	Not listed	Not listed	05-31-89	64 cu ft		Pipe Insulation
	B-2084	Not listed	Not listed	05-31-89	32 cu ft		Pipe Insulation
	B-103	Not listed	Not listed	05-31-89	8 cu ft		Pipe Insulation
	DRMO	Not listed	Not listed	05-31-89	64 cu ft	73 cu yds	Fire fighting clothing
September 88	B-41	Not listed	400 cu yds	05-31-89	16 cu ft		
	B-128	Not listed	400 cu yds	05-31-89	32 cu ft		
	B-2516	Not listed	400 cu yds	05-31-89	8 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	64 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	160 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	96 cu ft		
	B-5	Not listed	400 cu yds	05-31-89	48 cu ft		
	B-5	Not listed	400 cu yds	05-31-89	48 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	96 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	96 cu ft		
	B-41 SW	Not listed	400 cu yds	05-31-89	4 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	102 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	92 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	92 cu ft		
	B-5	Not listed	400 cu yds	05-31-89	32 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	16 cu ft		
	B-150	Not listed	400 cu yds	05-31-89	32 cu ft	54.3 cu yds	

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
August 88	B-2044	Not listed	400 cu yds	Not listed	16 cu ft		
	B-180	Not listed	400 cu yds	Not listed	16 cu ft		
	B-126	Not listed	400 cu yds	Not listed	32 cu ft		
	B-115	Not listed	400 cu yds	Not listed	16 cu ft	16 cu yds	
July 88	B-2044	Not listed	400 cu yds	05-31-89	6 cu ft		Pipe Insulation
	B-2989	Not listed	400 cu yds	05-31-89	3 cu ft		Pipe Insulation
	B-54	Not listed	400 cu yds	05-31-89	10 cu ft		Shingles & Transite
	B-150	Not listed	400 cu yds	05-31-89	4 cu ft	13 cu yds	Pipe Insulation
June 88	Cover letter but no summary in file.						
May 88	B-1848	Not listed	400 cu yds	05-31-89	48 cu ft		
	B-106	Not listed	400 cu yds	05-31-89	16 cu ft		
	B-18	Not listed	400 cu yds	05-31-89	128 cu ft		
	B-37	Not listed	400 cu yds	05-31-89	16 cu ft		
	B-6	Not listed	400 cu yds	05-31-89	96 cu ft		
	B-37	Not listed	400 cu yds	05-31-89	16 cu ft		
	B-200	Not listed	400 cu yds	05-31-89	6 cu ft	12 cu yds	
April 88	B-138	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-169	Not listed		05-30-86	24 cu ft		
	B-155	Not listed		05-30-86	8 cu ft		
	B-166	Not listed		05-30-86	160 cu ft		
	Qtrs A	Not listed		05-30-86	8 cu ft		
	B-166	Not listed		05-30-86	48 cu ft		
	B-166	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-166	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-124	Not listed	6,000 cu ft	05-30-86	6 cu ft		
	B-37	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-124	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-37	Not listed	6,000 cu ft	05-30-86	6 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-1848	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-155	Not listed	6,000 cu ft	05-30-86	112 cu ft		
	B-1848	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-200	Not listed	6,000 cu ft	05-30-86	10 cu ft		
	B-1848	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-1848	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-1848	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-1848	Not listed	6,000 cu ft	05-30-86	104 cu ft		
	B-1848	Not listed	6,000 cu ft	05-30-86	104 cu ft		
	B-1848	Not listed	6,000 cu ft	05-30-86	48 cu ft	19,713 cu ft since 05-30-86	
March 88	B-120	Not listed	6,000 cu ft	05-30-86	24 cu ft		
	B-115	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-199	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-1848	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-125	Not listed	6,000 cu ft	05-30-86	48 cu ft	18,563 cu ft since 05-30-86	
February 88	B-168	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-168	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-168	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-37	Not listed	6,000 cu ft	05-30-86	20 cu ft		
	B-37	Not listed	6,000 cu ft	05-30-86	24 cu ft		
	B-157	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-157	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-39	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-157	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-166	Not listed	6,000 cu ft	05-30-86	8 cu ft	18,315 cu ft since 05-30-86	

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
January 88	B-174	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-174	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-174	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-174	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-2972	Not listed	6,000 cu ft	05-30-86	15 cu ft		
	B-MFB	Not listed	6,000 cu ft	05-30-86	36 cu ft		
	B-174	Not listed	6,000 cu ft	05-30-86	16 cu ft	18,023 cu ft since 05-30-86	
December 87	B-1	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-1	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-1	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-1	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-1	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-56	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-174	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2507	Not listed	6,000 cu ft	05-30-86	8 cu ft	17,812 cu ft since 05-30-86	
November 87	B-77	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	86 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-2693	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	80 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	112 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	112 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	176 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	200 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-170	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	16 cu ft	clean up	

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-125	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2084	Not listed	6,000 cu ft	05-30-86	144 cu ft		
	B-2520	Not listed	6,000 cu ft	05-30-86	4 cu ft	17,260 cu ft since 05-30-86	
October 87	B-2692	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2521	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	148 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-2722	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2722	Not listed	6,000 cu ft	05-30-86	296 cu ft		
	B-2722	Not listed	6,000 cu ft	05-30-86	220 cu ft		
	B-2722	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2722	Not listed	6,000 cu ft	05-30-86	clean up		
	B-10	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2	Not listed	6,000 cu ft	05-30-86	98 cu ft	16,026 cu ft since 05-30-86	
September 87	B-2517	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-106	Not listed	6,000 cu ft	05-30-86	192 cu ft		
	B-106	Not listed	6,000 cu ft	05-30-86	180 cu ft		
	B-106	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-155	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-106	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2699	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2709	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-124	Not listed	6,000 cu ft	05-30-86	32 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-150	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2693	Not listed	6,000 cu ft	05-30-86	320 cu ft		
	Qtrs A	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	Qtrs A	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-2674	Not listed	6,000 cu ft	05-30-86	320 cu ft		
	B-115	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-41	Not listed	6,000 cu ft	05-30-86	2 cu ft		
	B-115	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-115	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2517	Not listed	6,000 cu ft	05-30-86	4 cu ft	14,752 cu ft since 05-30-86	
August 87	B-152	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-126	Not listed	6,000 cu ft	05-30-86	72 cu ft		
	B-155	Not listed	6,000 cu ft	05-30-86	1 cu ft		
	B-128	Not listed	6,000 cu ft	05-30-86	10 cu ft		
	B-171	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-155	Not listed	6,000 cu ft	05-30-86	10 cu ft		
	MFA	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	MFA	Not listed	6,000 cu ft	05-30-86	220 cu ft		
	MFA	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	MFB	Not listed	6,000 cu ft	05-30-86	220 cu ft		
	Tank Farm	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-150	Not listed	6,000 cu ft	05-30-86	16 cu ft	13,102 cu ft since 05-30-86	
July 87	MFA	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	MFA	Not listed	6,000 cu ft	05-30-86	100 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-170	Not listed	6,000 cu ft	05-30-86	10 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-2701	Not listed	6,000 cu ft	05-30-86	136 cu ft		
	B-2715	Not listed	6,000 cu ft	05-30-86	15 cu ft		
	B-600	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-123	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-40	Not listed	6,000 cu ft	05-30-86	28 cu ft		
	MFA	Not listed	6,000 cu ft	05-30-86	50 cu ft		
	MFA	Not listed	6,000 cu ft	05-30-86	35 cu ft		
	MFB	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-103	Not listed	6,000 cu ft	05-30-86	30 cu ft		
	MFB	Not listed	6,000 cu ft	05-30-86	112 cu ft		
	B-3036	Not listed	6,000 cu ft	05-30-86	4 cu ft	12,461 cu ft since 05-30-86	
June 87	B-2720	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-151, 153 & 154	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-151, 153 & 154	Not listed	6,000 cu ft	05-30-86	54 cu ft		
	B-151, 153 & 154	Not listed	6,000 cu ft	05-30-86	54 cu ft		
	B-151, 153 & 154	Not listed	6,000 cu ft	05-30-86	80 cu ft		
	B-2533	Not listed	6,000 cu ft	05-30-86	10 cu ft		
	B-2044	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-2044	Not listed	6,000 cu ft	05-30-86	192 cu ft		
	B-2807	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2510	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2044	Not listed	6,000 cu ft	05-30-86	144 cu ft		
	B-2714	Not listed	6,000 cu ft	05-30-86	96 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-2044	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-145	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2715	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	BR-150	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	BR-140	Not lsited	6,000 cu ft	05-30-86	160 cu ft		
	MFA	Not listed	6,000 cu ft	05-30-86	240 cu ft		
	BR-140	Not listed	6,000 cu ft	05-30-86	3 cu ft	1,729 cu ft since 05-30-86	
May 87	B-64	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	288 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2044	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-2044	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-103	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-121	Not listed	6,000 cu ft	05-30-86	5 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	90 cu ft		
	B-107	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	10 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	90 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	150 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-107	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-1818	Not listed	6,000 cu ft	05-30-86	16 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-41	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-2508	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2508	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	80 cu ft		
	B-1909	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2701	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-1884	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-39	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2508	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	20 cu ft		
	B-2508	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-122	Not listed	6,000 cu ft	05-30-86	180 cu ft		
	B-122	Not listed	6,000 cu ft	05-30-86	80 cu ft	9,840 cu ft since 05-30-86	
April 87	B-102	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-102	Not listed	6,000 cu ft	05-30-86	92 cu ft		
	B-102	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-102	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-151	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	MFB	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	192 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	100 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	256 cu ft		
	B-122	Not listed	6,000 cu ft	05-30-86	20 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	480 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-64	Not listed	6,000 cu ft	05-30-86	352 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	160 cu ft	8,191 cu ft since 05-30-86	
March 87	B-2737	Not listed	6,000 cu ft	05-30-86	240 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	240 cu ft		
	B-2693	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	240 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	260 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	260 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	320 cu ft		
	B-155	Not listed	6,000 cu ft	05-30-86	150 cu ft		
	B-13	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-37	Not listed	6,000 cu ft	05-30-86	6 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	3 cu ft		
	B-2692	Not listed	6,000 cu ft	05-30-86	6 cu ft		
	B-2697	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2637	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-101	Not listed	6,000 cu ft	05-30-86	30 cu ft		
	B-101	Not listed	6,000 cu ft	05-30-86	80 cu ft		
	B-2044	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2992	Not listed	6,000 cu ft	05-30-86	4 cu ft	6,091 cu ft since 05-30-86	
February 87	B-13	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	320 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-2737	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	144 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	176 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	110 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	75 cu ft		
	B-1923	Not listed	6,000 cu ft	05-30-86	45 cu ft		
	B-56 & 1885	Not listed	6,000 cu ft	05-30-86	32 cu ft	3,668 cu ft since 05-30-86	
January 87	B-66	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2693	Not listed	6,000 cu ft	05-30-86	18 cu ft		
	B-180	Not listed	6,000 cu ft	05-30-86	300 cu ft		
	B-180	Not listed	6,000 cu ft	05-30-86	120 cu ft		
	B-2500	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-150	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2693	Not listed	6,000 cu ft	05-30-86	2 cu ft		
	B-1818	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-138	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-138	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2516	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-138	Not listed	6,000 cu ft	05-30-86	160 cu ft	2,186 cu ft since 05-30-86	
December 86	B-180	Not listed	6,000 cu ft	05-30-86	280 cu ft		
	B-180	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-180	Not listed	6,000 cu ft	05-30-86	180 cu ft		
	Pyro Area	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-180	Not listed	6,000 cu ft	05-30-86	80 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-180	Not listed	6,000 cu ft	05-30-86	100 cu ft		
	B-2803	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2682	Not listed	6,000 cu ft	05-30-86	16 cu ft	1,354 cu ft since 05-30-86	
November 86	B-2519	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-156	Not listed	6,000 cu ft	05-30-86	2 cu ft		
	B-2059	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2737	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-2713	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-1922	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-2087	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-180	Not listed	6,000 cu ft	05-30-86	184 cu ft		
	B-136	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-18	Not listed	6,000 cu ft	05-30-86	16 cu ft	522 cu ft since 05-30-86	
October 86	B-169	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-8	Not listed	6,000 cu ft	05-30-86	80 cu ft		
	B-173	Not listed	6,000 cu ft	05-30-86	34 cu ft		
	B-150	Not listed	6,000 cu ft	05-30-86	10 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	50 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	16 cu ft		
	B-2516	Not listed	6,000 cu ft	05-30-86	2 cu ft	3,091 cu ft since 05-30-86	
September 86	B-104	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2719	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-2781	Not listed	6,000 cu ft	05-30-86	2 cu ft		
	B-136	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-127	Not listed	6,000 cu ft	05-30-86	32 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-136	Not listed	6,000 cu ft	05-30-86	3 cu ft		
	B-2735	Not listed	6,000 cu ft	05-30-86	2 cu ft		
	B-1817	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-41	Not listed	6,000 cu ft	05-30-86		clean up used vacuum cleaner	
	B-190	Not listed	6,000 cu ft	05-30-86	2 cu ft		
	B-2731	Not listed	6,000 cu ft	05-30-86	12 cu ft	2,883 cu ft since 05-30-86	
August 86	B-180	Not listed	6,000 cu ft	05-30-86	80 cu ft		
	B-2	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-198	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-77	Not listed	6,000 cu ft	05-30-86	2 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	120 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	120 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	220 cu ft		
	B-2731	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-127	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	220 cu ft		
	B-2929	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-41 NE	Not listed	6,000 cu ft	05-30-86	16 cu ft	2,558 cu ft since 05-30-86	
July 86	B-64	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-200	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-115	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-115	Not listed	6,000 cu ft	05-30-86	180 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	120 cu ft		
	B-55	Not listed	6,000 cu ft	05-30-86	64 cu ft		

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-104	Not listed	6,000 cu ft	05-30-86	360 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	60 cu ft		
	B-121	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-128	Not listed	6,000 cu ft	05-30-86	48 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	240 cu ft		
	B-150	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-121	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-64	Not listed	6,000 cu ft	05-30-86	10 cu ft		
	B-143	Not listed	6,000 cu ft	05-30-86	32 cu ft	1,528 cu ft since 05-30-86	
June 86	B-41	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-115	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-106	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-3064	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	B-2038	Not listed	6,000 cu ft	05-30-86	4 cu ft		
	B-2038	Not listed	6,000 cu ft	05-30-86	64 cu ft		
	B-12	Not listed	6,000 cu ft	05-30-86	40 cu ft		
	B-169	Not listed	6,000 cu ft	05-30-86	160 cu ft		
	B-104	Not listed	6,000 cu ft	05-30-86	96 cu ft		
	B-12	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-133	Not listed	6,000 cu ft	05-30-86	8 cu ft		
	Scrap Yard	Not listed	6,000 cu ft	05-30-86	32 cu ft		
	B-107	Not listed	6,000 cu ft	05-30-86	37.5 cu ft		
	B-133	Not listed	6,000 cu ft	05-30-86	8 cu ft	89.9 cu ft	
May 86	B-2701	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-2532	Not listed	6,000 cu ft	05-30-86	4 cu ft		Pipe Insulation
	B-171	Not listed	6,000 cu ft	05-30-86	180 cu ft		Pipe Insulation
	B-171	Not listed	6,000 cu ft	05-30-86	180 cu ft		Pipe Insulation

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-126	Not listed	6,000 cu ft	05-30-86	3 cu ft		Pipe Insulation
	B-37	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-152	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-154	Not listed	6,000 cu ft	05-30-86	4 cu ft		Pipe Insulation
	B-126	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
April 86	B-126	Not listed	6,000 cu ft	05-30-86	4 cu ft	7,145 cu ft	Pipe Insulation
	B-12	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-123	Not listed	6,000 cu ft	05-30-86	2 cu ft		Pipe Insulation
	B-77	Not listed	6,000 cu ft	05-30-86	160 cu ft		Pipe Insulation
	B-77	Not listed	6,000 cu ft	05-30-86	160 cu ft		Pipe Insulation
	B-77	Not listed	6,000 cu ft	05-30-86	180 cu ft		Pipe Insulation
	B-77	Not listed	6,000 cu ft	05-30-86	300 cu ft		Pipe Insulation
	B-2815 & 2816	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-115	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-2720	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-115	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-115	Not listed	6,000 cu ft	05-30-86	144 cu ft		Pipe Insulation
	B-198	Not listed	6,000 cu ft	05-30-86	20 cu ft	6,706 cu ft	Pipe Insulation
March 86	B-5	Not listed	6,000 cu ft	05-30-86	53 cu ft		Pipe Insulation
	B-5	Not listed	6,000 cu ft	05-30-86	53 cu ft		Pipe Insulation
	B-5	Not listed	6,000 cu ft	05-30-86	53 cu ft		Pipe Insulation
	B-128	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-128	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-138	Not listed	6,000 cu ft	05-30-86	54 cu ft		Pipe Insulation
	B-138	Not listed	6,000 cu ft	05-30-86	72 cu ft		Pipe Insulation
	B-2734	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-2734	Not listed	6,000 cu ft	05-30-86	8 cu ft		Pipe Insulation

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-2692	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-34	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-56	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-56	Not listed	6,000 cu ft	05-30-86	32 cu ft	5,500 cu ft	Pipe Insulation
February 86	B-10	Not listed	6,000 cu ft	05-30-86	30 cu ft		Pipe Insulation
	B-38	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-2521	Not listed	6,000 cu ft	05-30-86	90 cu ft		Pipe Insulation
	B-64	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-2735	Not listed	6,000 cu ft	05-30-86	4 cu ft		Pipe Insulation
	Qtrs A	Not listed	6,000 cu ft	05-30-86	4 cu ft		Pipe Insulation
	B-73	Not listed	6,000 cu ft	05-30-86	4 cu ft		Pipe Insulation
	B-106	Not listed	6,000 cu ft	05-30-86	24 cu ft	5,031 cu ft	Pipe Insulation
January 86	B-2681	Not listed	6,000 cu ft	05-30-86	48 cu ft		Pipe Insulation
	B-2530	Not listed	6,000 cu ft	05-30-86	96 cu ft		Pipe Insulation
	B-2530	Not listed	6,000 cu ft	05-30-86	320 cu ft		Pipe Insulation
	B-2681	Not listed	6,000 cu ft	05-30-86	100 cu ft		Pipe Insulation
	B-2681	Not listed	6,000 cu ft	05-30-86	96 cu ft		Pipe Insulation
	B-2681	Not listed	6,000 cu ft	05-30-86	112 cu ft		Pipe Insulation
	B-2681	Not listed	6,000 cu ft	05-30-86	160 cu ft	4,811 cu ft	Pipe Insulation
December 85	B-2701	Not listed	6,000 cu ft	05-30-86	8 cu ft		Pipe Insulation
	B-115	Not listed	6,000 cu ft	05-30-86	4 cu ft		Pipe Insulation
	B-124	Not listed	6,000 cu ft	05-30-86	4 cu ft		Pipe Insulation
	B-146, B-8	Not listed	6,000 cu ft	05-30-86	132 cu ft		Pipe Insulation
	B-146	Not listed	6,000 cu ft	05-30-86	30 cu ft	2,917 cu ft	Pipe Insulation
November 85	B-2706	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-2044	Not listed	6,000 cu ft	05-30-86	64 cu ft		Pipe Insulation
	B-2681	Not listed	6,000 cu ft	05-30-86	1,110 cu ft		Pipe Insulation
	B-56	Not listed	6,000 cu ft	05-30-86	20 cu ft		Pipe Insulation

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	B-40 NE	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-148	Not listed	6,000 cu ft	05-30-86	150 cu ft	2,739 cu ft	Pipe Insulation
October 85	B-11	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-1886	Not listed	6,000 cu ft	05-30-86	8 cu ft		Pipe Insulation
	B-41	Not listed	6,000 cu ft	05-30-86	8 cu ft		Pipe Insulation
	B-107	Not listed	6,000 cu ft	05-30-86	200 cu ft		Pipe Insulation
	B-45	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-120	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	MFB	Not listed	6,000 cu ft	05-30-86	50 cu ft		Pipe Insulation
	B-2698	Not listed	6,000 cu ft	05-30-86	8 cu ft		Pipe Insulation
	B-2693	Not listed	6,000 cu ft	05-30-86	4 cu ft	1,347 cu ft	Pipe Insulation
September 85	3" Area	Not listed	6,000 cu ft	05-30-86	8 cu ft		Pipe Insulation
	B-107	Not listed	6,000 cu ft	05-30-86	64 cu ft		Pipe Insulation
	B-2674	Not listed	6,000 cu ft	05-30-86	4 cu ft		Pipe Insulation
	B-1885	Not listed	6,000 cu ft	05-30-86	48 cu ft		Pipe Insulation
	B-126	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-126	Not listed	6,000 cu ft	05-30-86	16 cu ft	989 cu ft	Pipe Insulation
August 85	B-56	Not listed	6,000 cu ft	05-30-86	16 cu ft		Pipe Insulation
	B-2521	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation
	B-136	Not listed	6,000 cu ft	05-30-86	112 cu ft		Pipe Insulation
	B-2517	Not listed	6,000 cu ft	05-30-86	8 cu ft		Pipe Insulation
	B-300	Not listed	6,000 cu ft	05-30-86	8 cu ft		Pipe Insulation
	3" Area	Not listed	6,000 cu ft	05-30-86	48 cu ft	817 cu ft	Pipe Insulation
July 85	B-125	Not listed	6,000 cu ft	05-30-86	32 cu ft	593 cu ft	Pipe Insulation
June 85	B-36, 13, 116	Not listed	6,000 cu ft	05-30-86	201 cu ft		Pipe Insulation
	B-13	Not listed	6,000 cu ft	05-30-86	48 cu ft		Pipe Insulation
	B-13	Not listed	6,000 cu ft	05-30-86	32 cu ft		Pipe Insulation

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
	MFA	Not listed	6,000 cu ft	05-30-86	64 cu ft		Pipe Insulation
	B-2642	Not listed	6,000 cu ft	05-30-86	16 cu ft	561 cu ft	Pipe Insulation
May 85	B-126	Not listed	6,000 cu ft	05-30-86	192 cu ft		Pipe Insulation
	B-12	Not listed	6,000 cu ft	05-30-86	8 cu ft	200 cu ft year-to-date	Pipe Insulation
April 85	Not in file						
March 85	Public Works	Not listed	Not listed	Not listed	20 bags		Bagged Asbestos
	Public Works	Not listed	Not listed	Not listed	13 bags		Bagged Asbestos
	Public Works	Not listed	Not listed	Not listed	18 bags		Bagged Asbestos
	Public Works	Not listed	Not listed	Not listed	35 bags		Bagged Asbestos
	Public Works	Not listed	Not listed	Not listed	10 bags	393 bags	Bagged Asbestos
February 85	NWSC	Not listed	Not listed	Not listed	57 bags		Bagged Asbestos
	NWSC	Not listed	Not listed	Not listed	15 bags		Bagged Asbestos
	NWSC	Not listed	Not listed	Not listed	150 bags		Bagged Asbestos
	NWSC	Not listed	Not listed	Not listed	65 bags		Bagged Asbestos
	NWSC	Not listed	Not listed	Not listed	6 bags	297 bags	Bagged Asbestos
January 85	NWSC	Not listed	Not listed	Not listed	4 bags	4 bags	Bagged Asbestos
December 84	NWSC	Not listed	Not listed	Not listed	12 bags		Bagged Asbestos
	NWSC	Not listed	Not listed	Not listed	31 bags		Bagged Asbestos
	NWSC	Not listed	Not listed	Not listed	4 bags	754 bags	Bagged Asbestos
November 84	NWSC	Not listed	Not listed	Not listed	40 bags		Bagged Asbestos
	NWSC	Not listed	Not listed	Not listed	115 bags	707 bags	Bagged Asbestos
October 84	Public Works	Not listed	Not listed	Not listed	97 bags	552 bags	Bagged Asbestos
September 84	Public Works	Not listed	Not listed	Not listed	20 bags	455 bags	Bagged Asbestos
August 84	NWSC	Not listed	Not listed	Not listed	44 bags	435 bags	Bagged Asbestos
July 84	NWSC	Not listed	Not listed	Not listed	164 bags	391 bags	
June 84	NWSC	Not listed	Not listed	Not listed	25 bags		Bagged Asbestos
	NWSC	Not listed	Not listed	Not listed	44 bags	227 bags	Bagged Asbestos
April 84	Demolition, renovation projects	Not listed	Not listed	Not listed	116 bags	158 bags	ACM

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES
ASBESTOS
NWSCC, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
March 84	NWSC	Not listed	Not listed	Not listed	42 bags 35-gal bags	42 bags Material	Bagged Asbestos Construction
January 84	NWSC	Not listed	Not listed	Not listed	16.5 bags	16.5 bags	Bagged Asbestos Material

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

* Unit inconsistencies are reported as found in records review.

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - GRIT BLAST RESIDUE*
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
August 91	CAAA	00489	50 tons	06-30-91	4.8 tons	4.8 tons	
June 91	CAAA	00489	50 tons	06-30-91	1 ton	4 tons	
May 91	CAAA	00484	50 tons	06-30-91	2.7 tons	3 tons	
April 91	CAAA	00489	50 tons	06-30-91	650 lbs	650 lbs	
July 84	B-125	Not listed	Not listed	Not listed	50 lbs	600 lbs	
June 84	B-107	Not listed	Not listed	Not listed	2,000 lbs	4,000 lbs	
	B-125	Not listed	Not listed	Not listed	50 lbs	550 lbs	
	B-41 NE	Not listed	Not listed	Not listed	300 lbs	585 lbs	
May 84	B-155	Not listed	Not listed	Not listed	1,000 lbs	4,800 lbs	
	B-125	Not listed	Not listed	Not listed	25 lbs	525 lbs	
	B-107	Not listed	Not listed	Not listed	2,000 lbs	4,000 lbs	
	B-106	Not listed	Not listed	Not listed	10,000 lbs	55,000 lbs	
April 84	B-106	Not listed	Not listed	Not listed	25,000 lbs	45,000 lbs	
	B-107	Not listed	Not listed	Not listed	2,000 lbs	2,000 lbs	
	B-125	Not listed	Not listed	Not listed	350 lbs	500 lbs	
March 84	B-41 NE	Not listed	Not listed	Not listed	285 lbs	285 lbs	
	B-125	Not listed	Not listed	Not listed	50 lbs	150 lbs	
	B-155	Not listed	Not listed	Not listed	3,000 lbs	3,800 lbs	
	B-106	Not listed	Not listed	Not listed	20,000 lbs	20,000 lbs	
	B-2171	Not listed	Not listed	Not listed	5,000 lbs	5,600 lbs	
February 84	B-125	Not listed	Not listed	Not listed	100 lbs	100 lbs	
	B-155	Not listed	Not listed	Not listed	800 lbs	800 lbs	
	B-2171	Not listed	Not listed	Not listed	600 lbs	600 lbs	
January 84	NWSC	Not listed	Not listed	Not listed	2 tons	2 tons	

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

* Unit inconsistencies are reported as found in records review.

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - INERT FILLER*
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
August 91	CAAA	00222	40 tons	04-30-92	3,000 lbs	2.5 tons	Inert Filler
September 85	B-169	Not listed	50 cu yds	12-31-85	16 cu ft	16 cu ft	Inert Filler #1; 50% Gypsum 25% Stearic Acid 50% Barium Sulfate 5% Woo Rosin

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

* Unit inconsistencies are reported as found in records review.

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - ELECTROSTATIC PRECIPITATOR
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
July 91	CAAA	00627	40 (55-gal) drums	10-13-91	6 (55-gal) drums	7 (55-gal) drums	
April 91	CAAA	00627	40 (55-gal) drums	10-31-91	1 55-gal drum	1 55-gal	drum

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - DRY PAINT BOOTH FILTERS
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
June 91	CAAA	00489	20 cu yds	06-30-91	2 cu yds	4 cu yds	
May 91	CAAA	00484	20 cu yds	06-30-91	2 cu yds	2 cu yds	

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - CONTAMINATED SOIL
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
June 90	NWSCC	80110	500 cu yds	04-30-91	10 cu yds	10 cu yds	Fuel Oil Cont Sand and Gravel
November 89	B-199-150	90199	500 cu yds	04-30-90	40 cu yds	40 cu yds	Contaminated Dirt and Gravel
June 86	B-128	Not listed	100 cu yds	10-31-86	15 cu yds	15 cu yds	Oil Saturated Soil
March 86	B-36	Not listed	100 cu yds	10-31-86	0.5 cu yds		Oil Saturated Soil
	OTA- (Rockeye Area)	Not listed	100 cu yds	10-31-86	2 cu yds	5.5 cu yds	Oil Saturated Soil
September 85	B-39	Not listed	100 cu yds	10-31-86	3 cu yds	3 cu yds	Oil Saturated Soil

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - FILTER MEDIA*
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
January 89	Cell #1	Not listed	110 cu yds	02-29-89	236 cu ft		
	Cell #2	Not lsited	110 cu yds	02-29-89	236 cu ft		
	Cell #3	Not listed	110 cu yds	02-29-89	236 cu ft		
	Cell #4	Not listed	110 cu yds	02-29-89	236 cu ft	34 cu yds	

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

* Unit inconsistencies are reported as found in records review.

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - SANDBLAST GRIT WITH PAINT CHIPS
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
July 88	Water Tower #4	Not listed	500 cu yds	08-31-88	120 cu yds		
	Water Tower #3 & #2	Not listed	500 cu yds	08-31-88	54 cu yds		
	Water Tower #6 & #5	Not listed	500 cu yds	08-31-88	72 cu yds	246 cu yds	

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

APPENDIX H (Continued)

LANDFILL-SPECIFIC SPECIAL WASTES
MONTHLY DISPOSAL SUMMARIES - MISCELLANEOUS
NWSCC
CRANE, INDIANA
MARCH 1992

Month, Year	Generator	Case No.	Approved Amount	Approval Exp. Date	Volume Rec'd this Month	Volume to Date	Comments
April 91	B-1782	00868	1,995 (50) lb bags	04-31-91	1,200 lb	1,200 lb	Carbon Black
October 85	B-41 NW	Not listed	5 cu yds	10-31-86	5 cu yds	5 cu yds	Plastic Coated Ferrous Wire

Source: Monthly Special Waste Reports-Letters From NWSCC to IDEM, Special Projects Section, Office of Solid and Hazardous Waste Management.

* Unit inconsistencies are reported as found in records review.

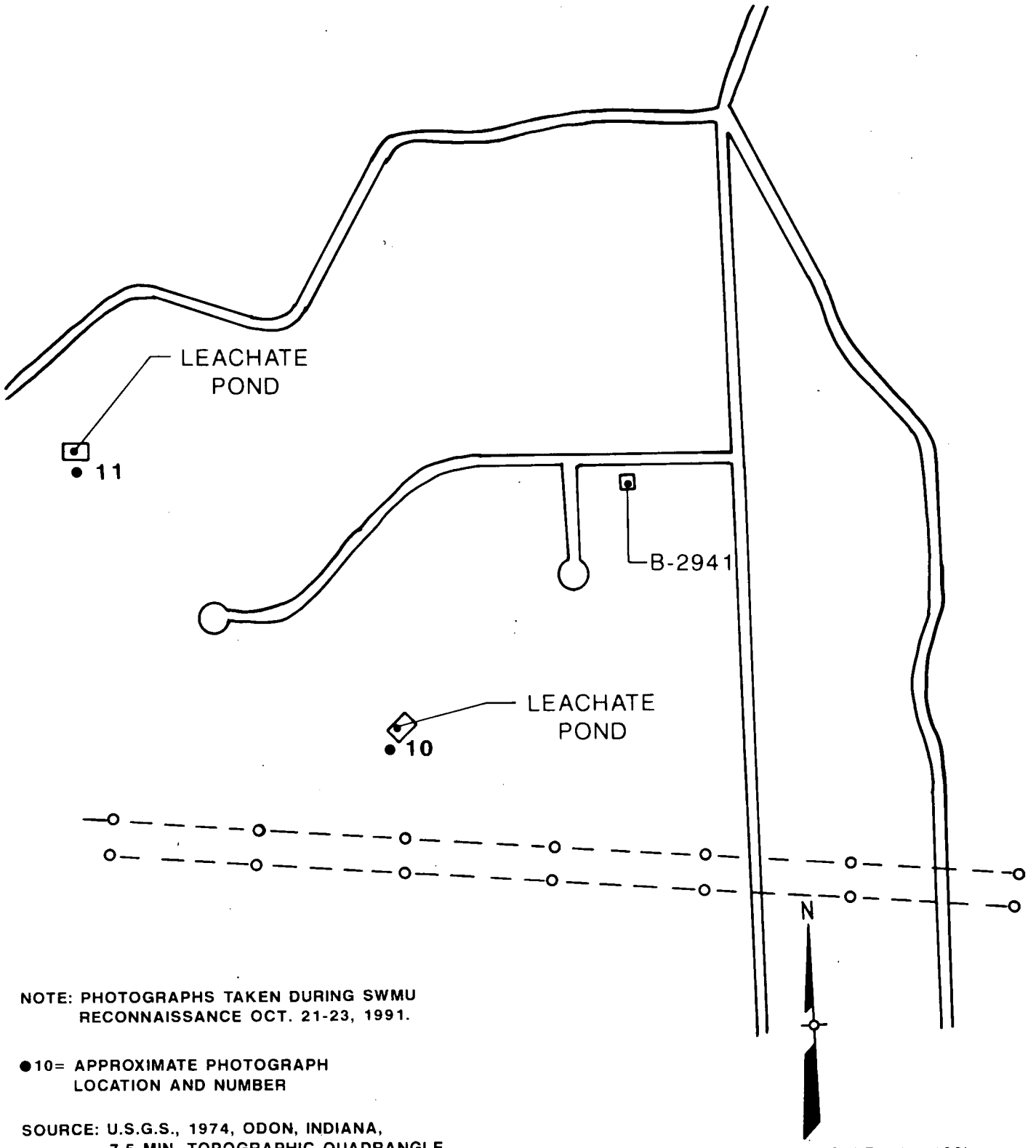
RP/15EMRD/AE5

APPENDIX I

PHOTOGRAPH LOG - SWMU #14/00

CLEAN CTO #0015

EPA ID NO. IN5 170 023 498
NAVSURFWARCENDIV EMR
NOVEMBER 1992



NOTE: PHOTOGRAPHS TAKEN DURING SWMU RECONNAISSANCE OCT. 21-23, 1991.

●10= APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

SOURCE: U.S.G.S., 1974, ODON, INDIANA, 7.5 MIN. TOPOGRAPHIC QUADRANGLE.

APPROXIMATE SCALE: 1" = 400'

NOVEMBER 1992

FIGURE I-1

SWMU #14/00 : PHOTOGRAPH INDEX MAP

ENVIRONMENTAL MONITORING REPORT
NAVSURFWARCENDIV
CRANE, INDIANA

20602

Donohue ENGINEERS ARCHITECTS SCIENTISTS

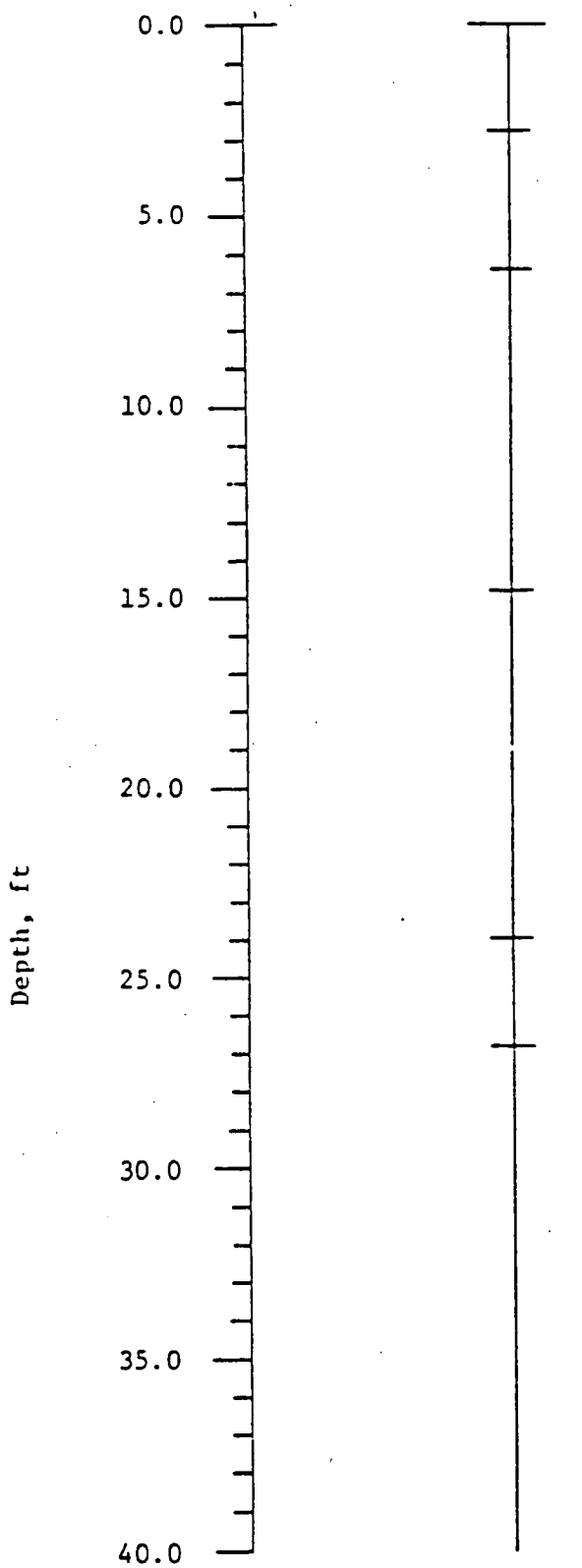
L-10976

10

11

APPENDIX J

BUILDING 146 BORING LOGS



764.37 ft MSL

Sandy clay(CL): brown, soft, damp, very fine-grained sand, gravelly (sandstone).

Siltstone: brown to light grey, uniform, composition (quartz), soft to stiff, highly weathered damp.

Clay Shale: red, brown, black, orange brown, very thinly bedded (1/16"-1/4") highly weathered, soft to very stiff, brittle, and contains iron concreations or lenses.

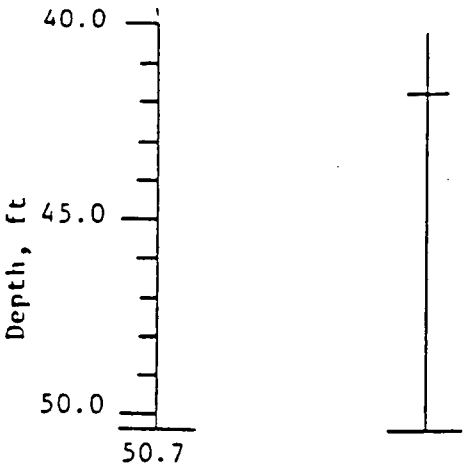
Shale: dark grey to black, weathered and oxidized in regions, very thinly bedded, contains micro subhedral grains of calcite.

Coal: black, soft to moderately hard, earth bituminous, brittle, blocky, contains limoni and approximately 5% sulfides (pyrite and chalcopyrite).

Sandstone: white to light grey, red, and brown, thinly bedded, fractured, oxidized, uniform, predominantly very fine-grained quartz sand, moderately to slightly friable, bedding dips approximately 15 degrees from horizontal with cross-bedding visible.

continued

NWSC, Crane, Indiana
Building 146-Ordnance Demil Facility
Lithology
Boring Number: WES-14-1-83

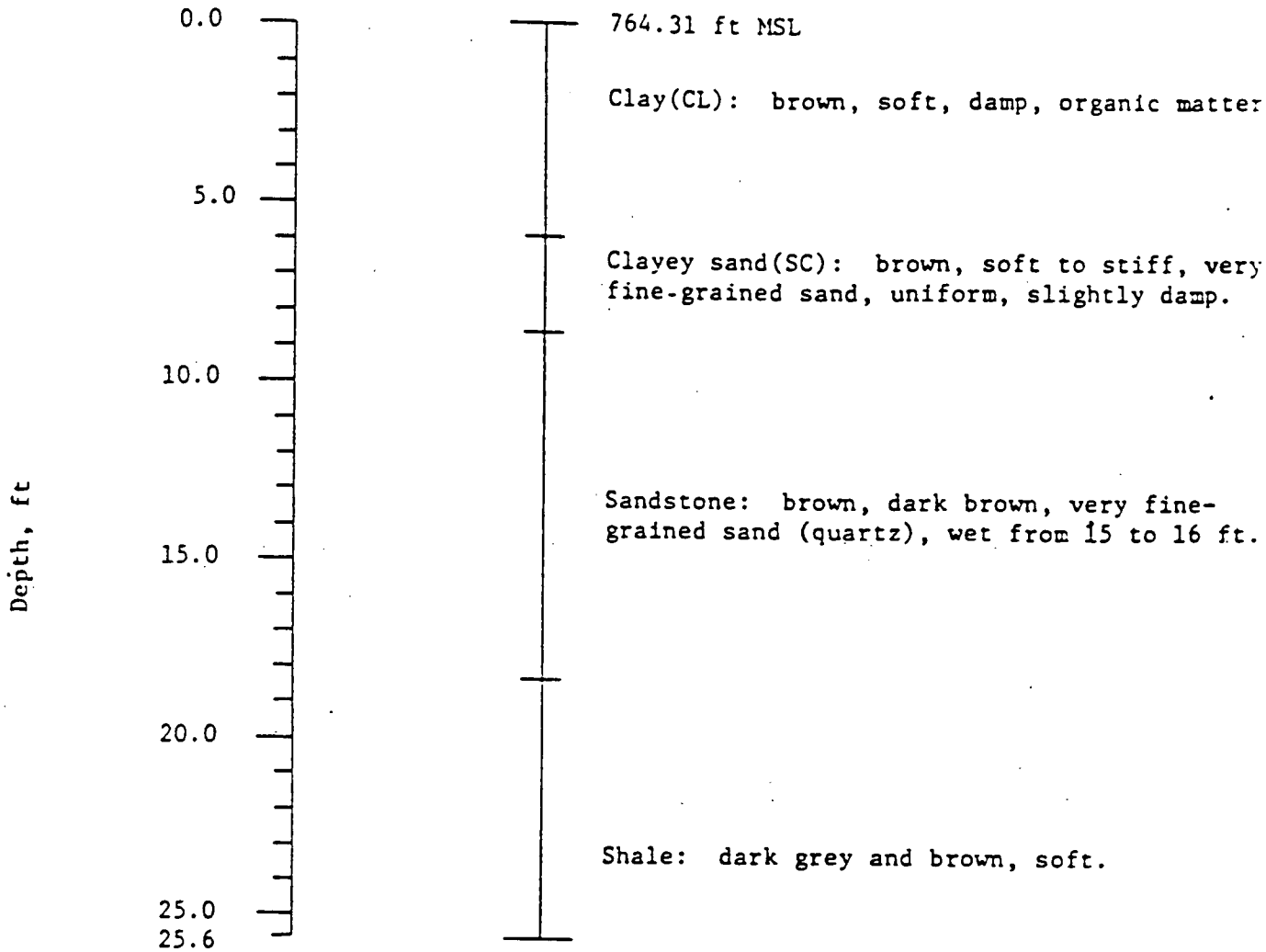


724.37 ft MSL

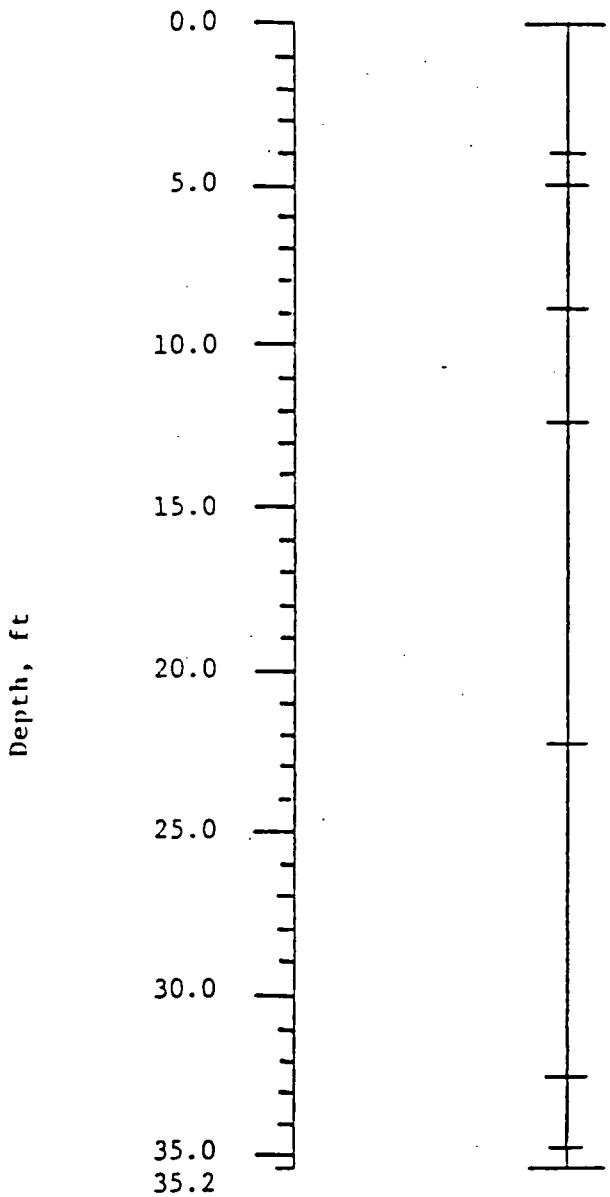
Sandstone (60%) and shale (40%): very fine-grained sandstone interbedded with black soft shale. Bedding consists of very fine lamina, randomly bedded displaying irregular near shore deposition.

Shale: dark grey, sandy, uniform, soft

NWSC, Crane, Indiana
Building 146 Ordnance Demil Facility
Lithology
Boring Number: WES-14-1-83



NWSC, Crane, Indiana
Building 146-Ordnance Demil Facility
Lithology
Boring Number: WES-14-2-83



761.65 ft MSL

Clay (CL): brown, soft, sandy, damp, organic matter (roots)

Clay (CL): greenish grey, very soft, damp

Sandstone: brown, soft, very fine-grained, clay lenses

Shale: brown, weathered, hard from 8.8 to 11 ft (iron)

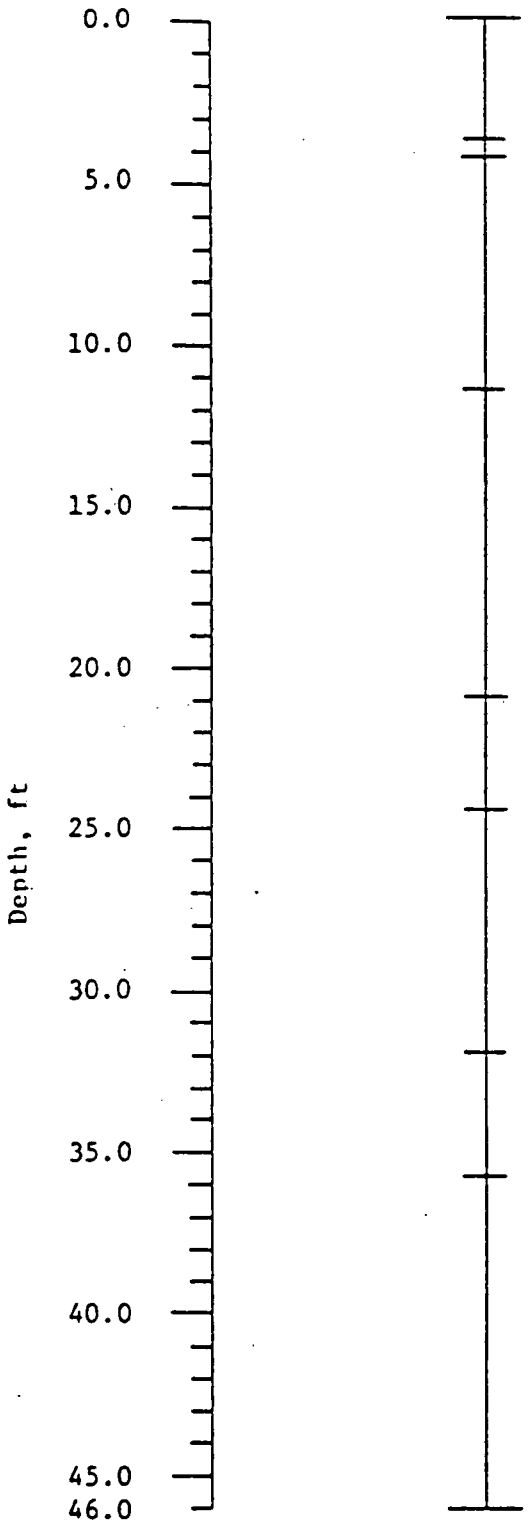
Sandstone: brown, grey (beginning at 15 ft), very fine-grained, soft

Shale: grey, dark grey, soft, water at 25 ft

Coal: black, soft (bituminous)

Shale: see above

NWSC, Crane, Indiana
Building 146-Ordnance Demil Facility
Lithology
Boring Number: WES-14-3-83



760.73 ft MSL

Sandy silt (ML): brown with grey streaks, soft, damp, very fine-grained sand.

Coal: black, soft, earthy

Siltstone: light to dark grey, light brown, soft.

Shale: grey, red (13.3 - 13.8 ft), soft

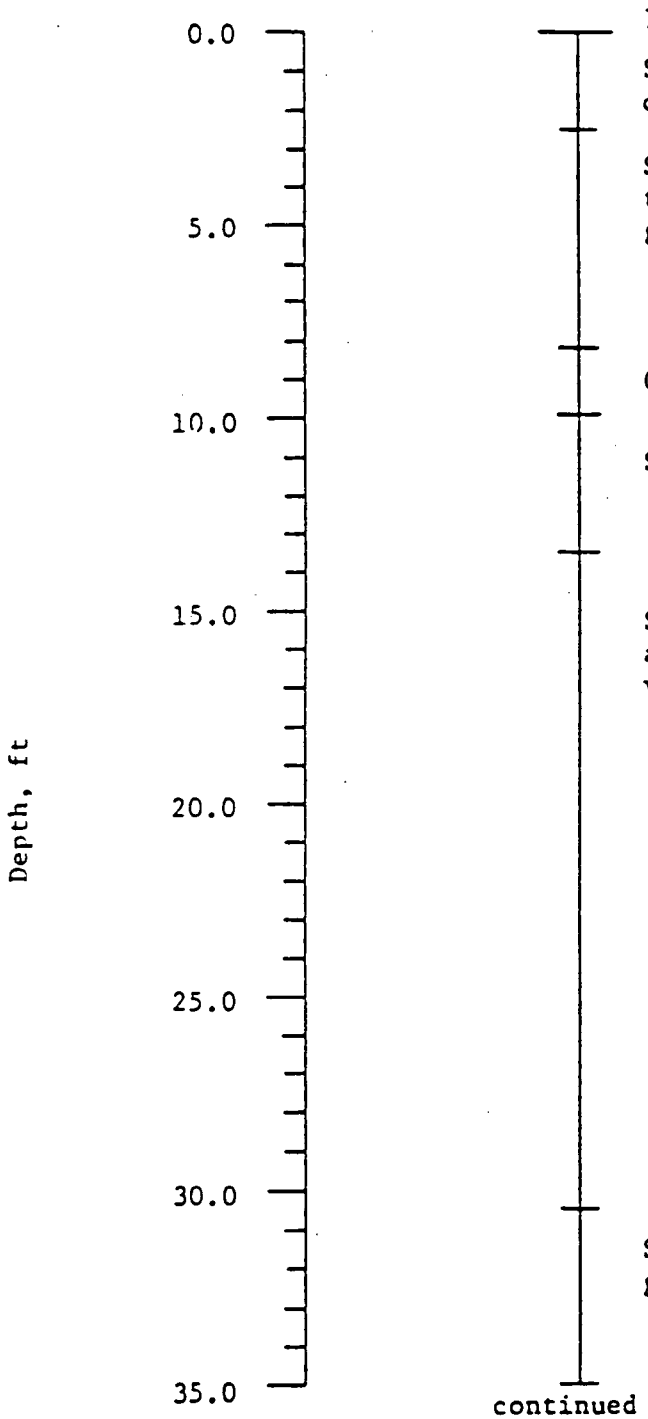
Sandstone and shale: grey to dark grey, soft thinly bedded, soft.

Shale: dark grey, soft

Coal: black, soft, wet between 35-36 ft (bituminous)

Sandstone and/or shale (?)- no cuttings, very wet

NWSC, Crane, Indiana
Building 146-Ordnance Demil Facility
Lithology
Boring Number: WES-14-4-83



767.10 ft MSL

Sandy clay(CL): brown, soft to very stiff, dry, sandy- very fine-grained sand.

Sandstone and clay: brown, reddish brown, thinly bedded, weathered, soft, very fine grained sandstone.

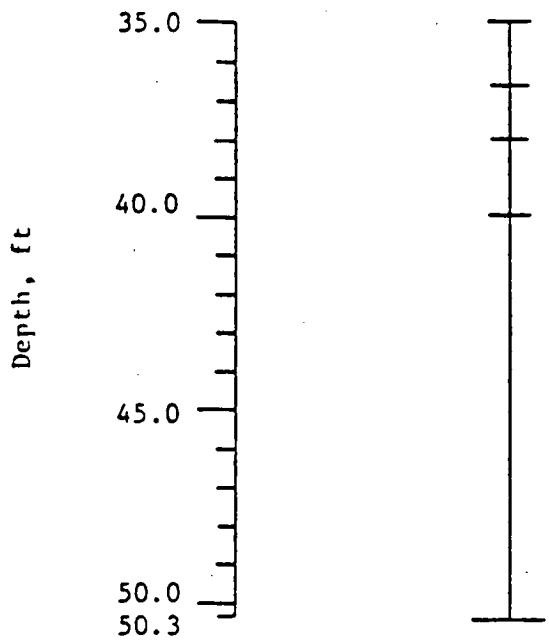
Coal: black, soft

Shale: light grey, soft, uniform

Sandstone and shale: light brown to brown and light grey to dark grey thinly bedded very fine-grained sandstone, soft.

Shale: grey, soft, uniform, sandy - fine-grained.

NWSC, Crane, Indiana
Building 146-Ordnance Demil Facility
Lithology
Boring Number: WES-14-5-83



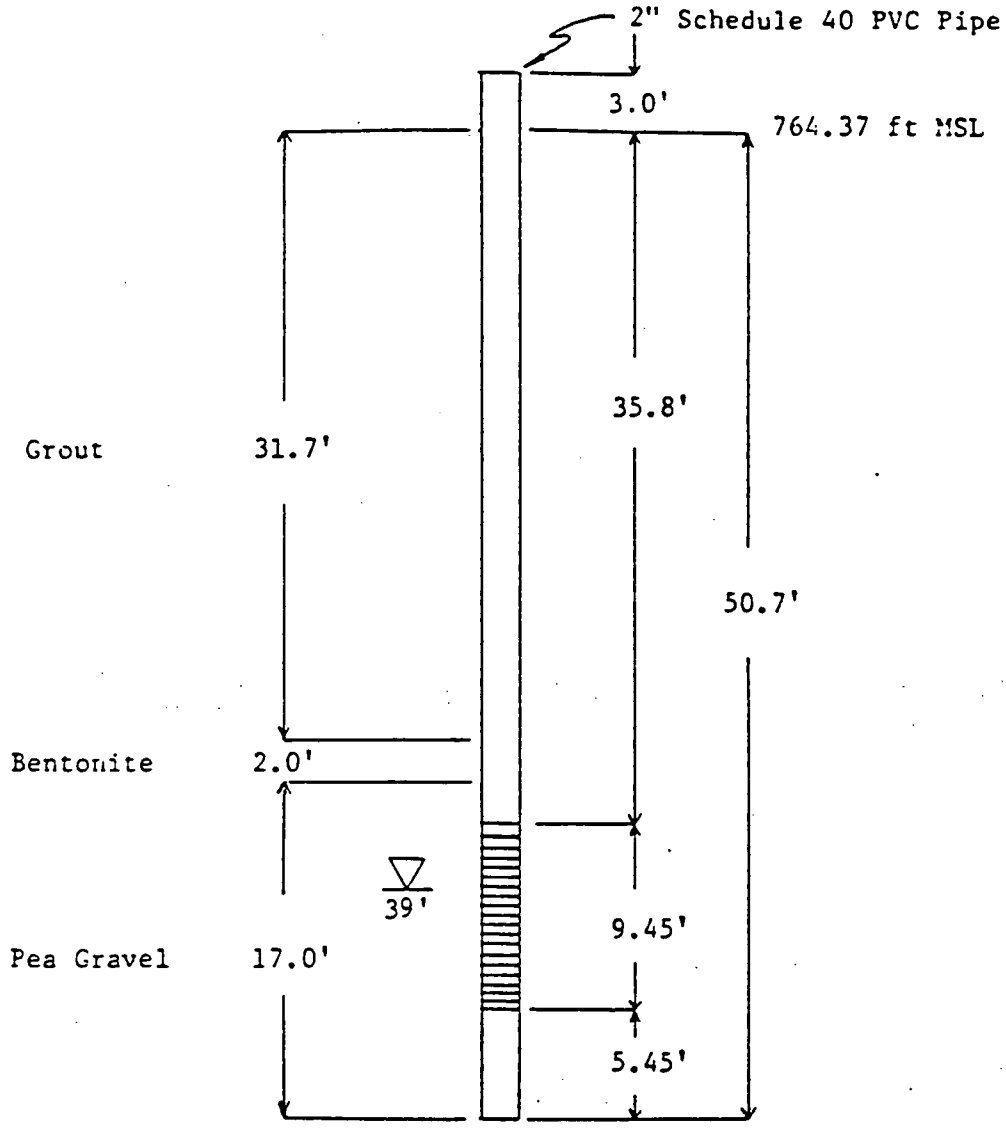
732.10 ft MSL
Coal: black, soft, brittle, uniform - bituminous.
Shale: grey, soft, thinly bedded with very fine-grained sandstone.
Sandstone: grey, shaley, very fine-grained.

Shale: grey, soft, thinly bedded with very fine-grained sandstone.

NWSC, Crane, Indiana
Building 146-Ordnance Demil Facility
Lithology
Boring Number: WES-14-5-83

APPENDIX K

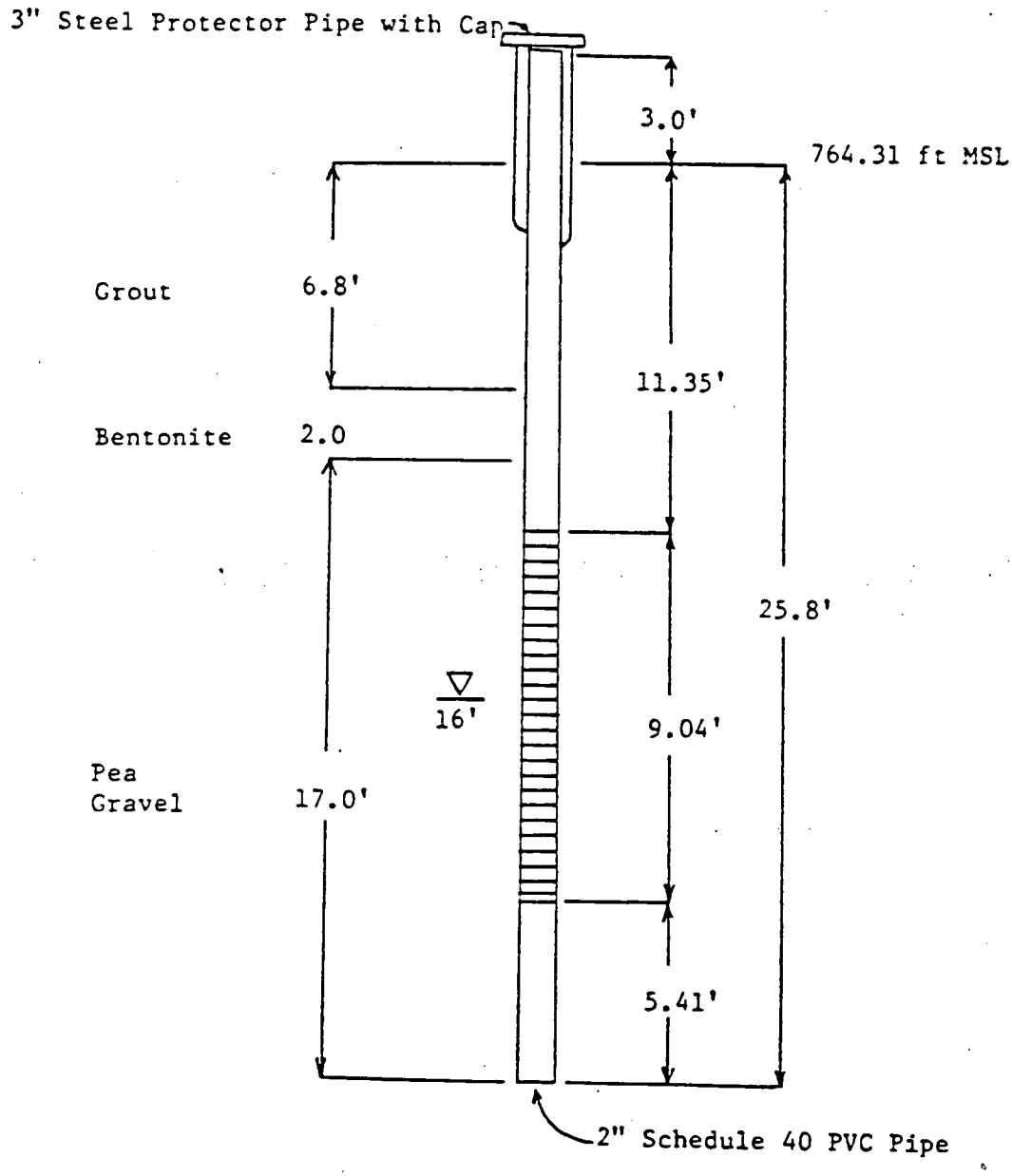
BUILDING 146 WELL CONSTRUCTION DIAGRAMS



Water Depth at Time of Drilling

Well Screen

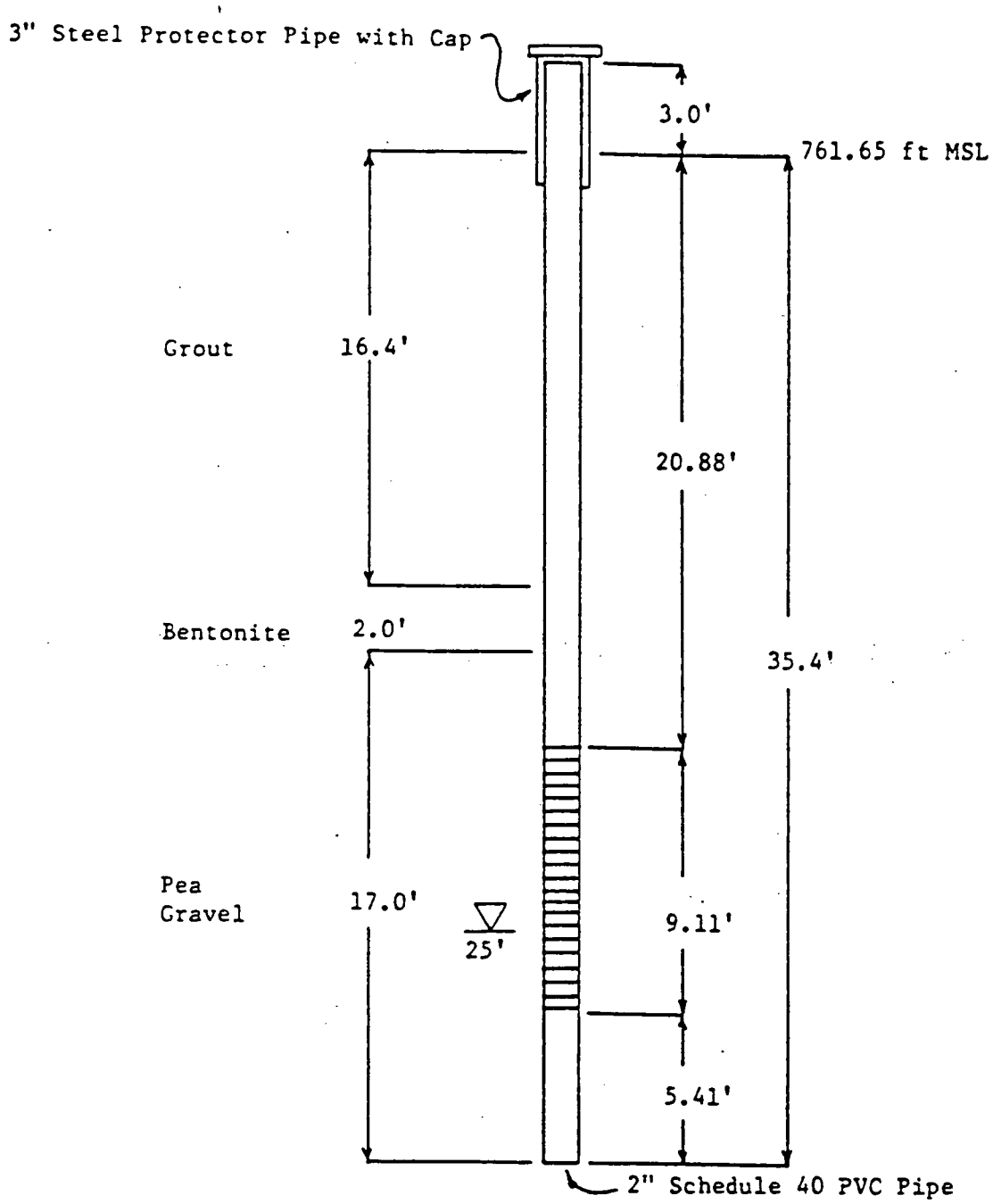
NWSC, Crane, Indiana
Building 146-Ordnance
Demil Facility
Well Completion
Boring Number: WES-14-1-83



Water Depth at Time of Drilling

Well Screen

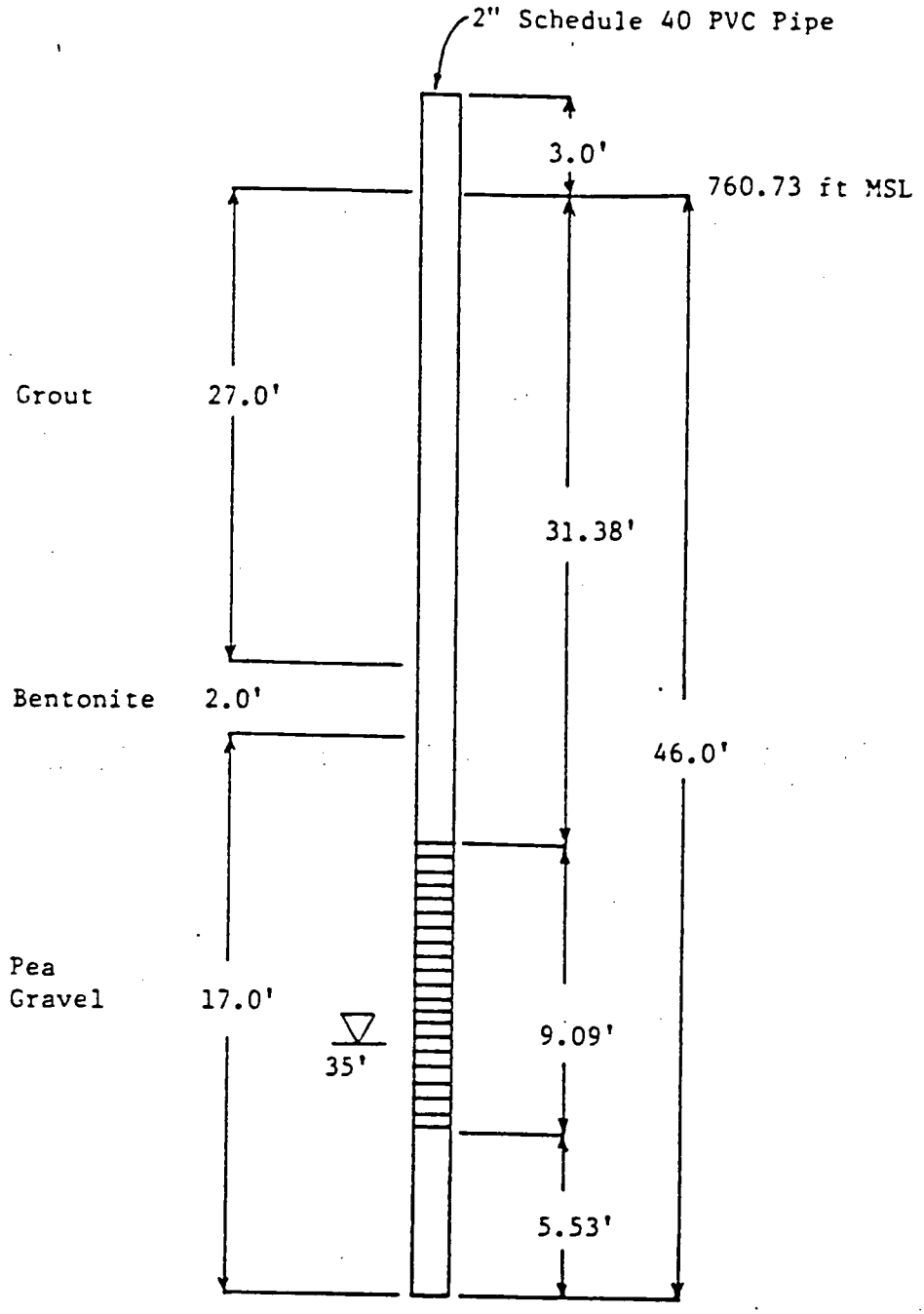
NWSC, Crane, Indiana
Building 146-Ordnance
Demil Facility
Well Completion
Boring Number: WES-14-2-83



Water Depth at Time of Drilling

Well Screen

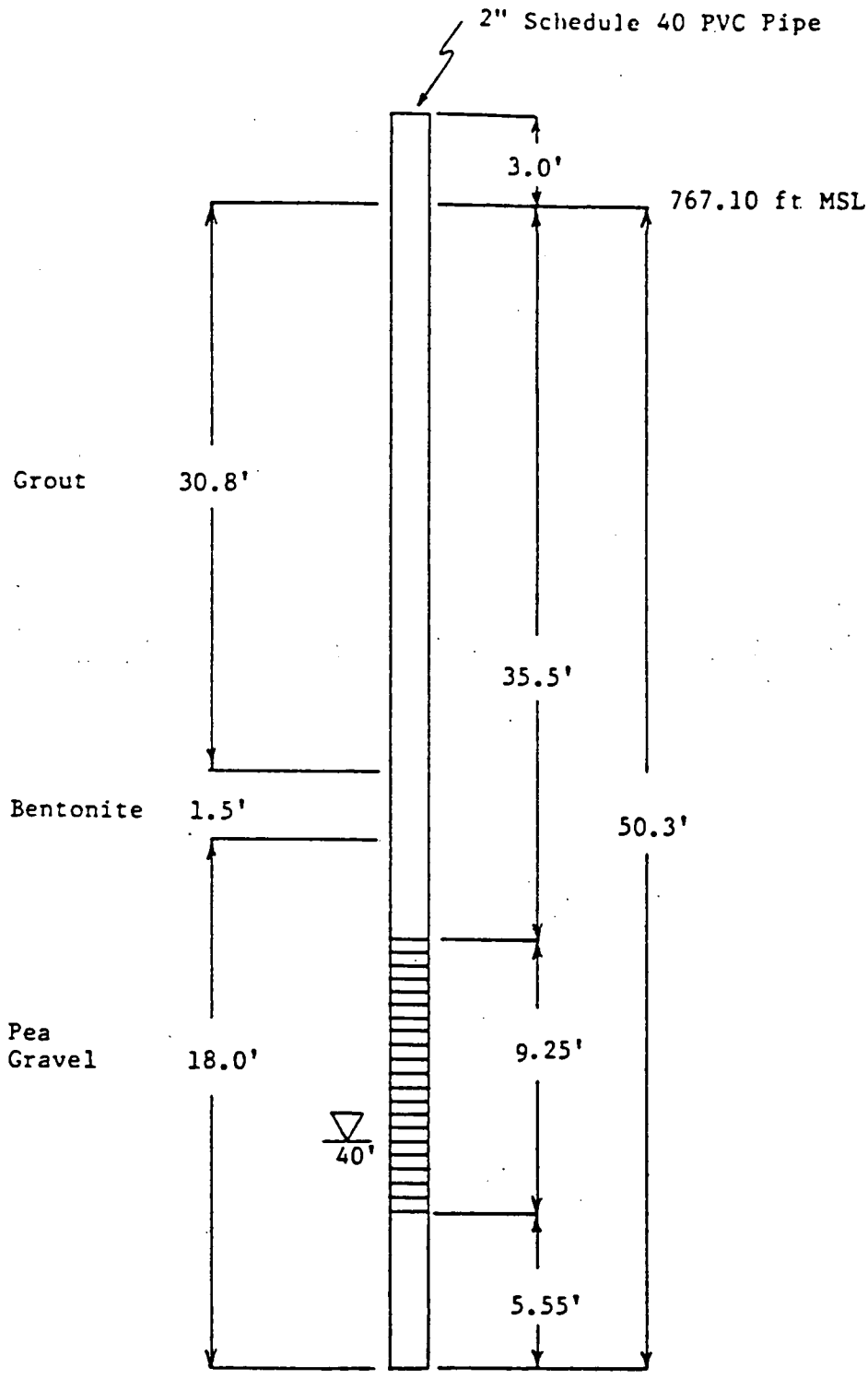
NWSC, Crane, Indiana
Building 146-Ordnance
Demil Facility
Well Completion
Boring Number: WES-14-3-83



Water Depth at Time of Drilling

Well Screen

NWSC, Crane, Indiana
Building 146-Ordnance
Demil Facility
Well Completion
Boring Number: WES-14-4-83



Water Depth at Time of Drilling

Well Screen

NWSC, Crane, Indiana
Building 146-Ordnance
Demil Facility
Well Completion
Boring Number: WES-14-5-83

APPENDIX L

HISTORICAL GROUNDWATER LEVELS AT BUILDING 146

Ground-Water Elevations

Building 146 - Ordnance Demil Facility

Boring Number: WES-14-1-83

Top of Pipe Elevation: 767.37 ft MSL

Screen Interval Elevation: from 728.57 to 719.12 ft MSL

Grid Coordinates:

Date	Time	Depth to Water, ft	Water Elevation, ft MSL	Remarks
29 Jul 83	8:25	28.88	735.49	Open hole
30 Jul 83	10:41	33.20	734.17	
1 Aug 83	10:05	34.58	732.79	
2 Aug 83	9:34	33.05	734.32	Purged well
3 Aug 83	12:17	37.65	729.72	Sampled well
4 Aug 83	10:04	35.48	731.89	
5 Aug 83	1:33	35.40	731.97	
9 Aug 83	8:55	35.46	731.91	
16 Aug 83	7:51	35.57	731.80	
23 Aug 83	8:42	35.83	731.54	
30 Aug 83	8:41	35.87	731.50	
7 Sep 83	8:02	35.85	731.52	
13 Sep 83	1:31	36.10	731.27	
20 Sep 83	7:44	36.17	731.20	
27 Sep 83	9:32	36.35	731.02	
4 Oct 83	4:25	36.35	731.02	

Ground-Water Elevations

Building 146 - Ordnance Demil Facility

Boring Number: WES-14-2-83

Top of Pipe Elevation: 767.31 ft MSL

Screen Interval Elevation: from 752.96 to 743.92 ft MSL

Grid Coordinates:

Date	Time	Depth to Water, ft	Water Elevation, ft MSL	Remarks
29 Jul 83	8:12	13.45	750.86	Open hole
30 Jul 83	11:32	14.57	752.74	
1 Aug 83	9:59	15.38	751.93	
2 Aug 83	9:58	15.50	751.81	Purged well
3 Aug 83	11:58	15.55	751.76	Sampled well
4 Aug 83	9:45	15.44	751.87	
5 Aug 83	1:26	15.37	751.94	
9 Aug 83	8:45	15.29	752.02	
16 Aug 83	7:45	15.38	751.93	
23 Aug 83	8:34	15.43	751.88	
30 Aug 83	8:32	15.32	751.99	
7 Sep 83	7:55	15.50	751.81	
13 Sep 83	1:23	15.56	751.75	
20 Sep 83	7:36	15.52	751.79	
27 Sep 83	9:27	15.78	751.53	
4 Oct 83	4:15	15.59	751.72	

Ground-Water Elevations

Building 146 - Ordnance Demil Facility

Boring Number: WES-14-3-83

Top of Pipe Elevation: 764.65 ft MSL

Screen Interval Elevation: from 740.77 to 731.66 ft MSL

Grid Coordinates:

Date	Time	Depth to Water, ft	Water Elevation, ft MSL	Remarks
30 Jul 83	11:09	20.65	744.00	Open hole
1 Aug 83	10:09	27.64	737.01	
2 Aug 83	9:23	27.05	737.60	Purged well
3 Aug 83	12:04	27.84	736.81	Sampled well
4 Aug 83	9:58	27.40	737.25	
5 Aug 83	1:38	26.89	737.76	
6 Aug 83	4:17	26.73	737.92	
9 Aug 83	8:51	26.35	738.30	
16 Aug 83	7:55	25.42	739.23	
23 Aug 83	8:51	25.13	739.52	
30 Aug 83	8:38	24.28	740.37	
7 Sep 83	7:59	22.50	742.15	
13 Sep 83	1:28	22.60	742.05	
20 Sep 83	7:39	22.68	741.97	
27 Sep 83	9:39	22.67	741.98	
4 Oct 83	4:21	22.75	741.90	

Ground-Water Elevations

Building 146 - Ordnance Demil Facility

Boring Number: WES-14-4-83

Top of Pipe Elevation: 763.73 ft MSL

Screen Interval Elevation: from 729.35 to 720.26 ft MSL

Grid Coordinates:

Date	Time	Depth to Water, ft	Water Elevation, ft MSL	Remarks
2 Aug 83	1:05	30.78	732.95	Purged well
3 Aug 83	12:38	30.31	733.42	Sampled well
4 Aug 83	10:00	30.27	733.46	
5 Aug 83	1:36	30.13	733.60	
6 Aug 83	4:18	29.95	733.78	
9 Aug 83	8:57	29.83	733.90	
16 Aug 83	7:53	29.89	733.84	
23 Aug 83	8:49	29.95	733.78	
30 Aug 83	8:44	29.98	733.75	
7 Sep 83	8:04	30.20	733.53	
13 Sep 83	1:34	30.35	733.38	
20 Sep 83	7:47	30.64	733.09	
27 Sep 83	9:36	30.90	732.83	
4 Oct 83	4:31	31.05	732.68	

APPENDIX M

SOIL AND WATER SAMPLING LOCATIONS
NORTH AND SOUTH DITCH - BUILDING 146

Ground-Water Elevations

Building 146 - Ordnance Demil Facility

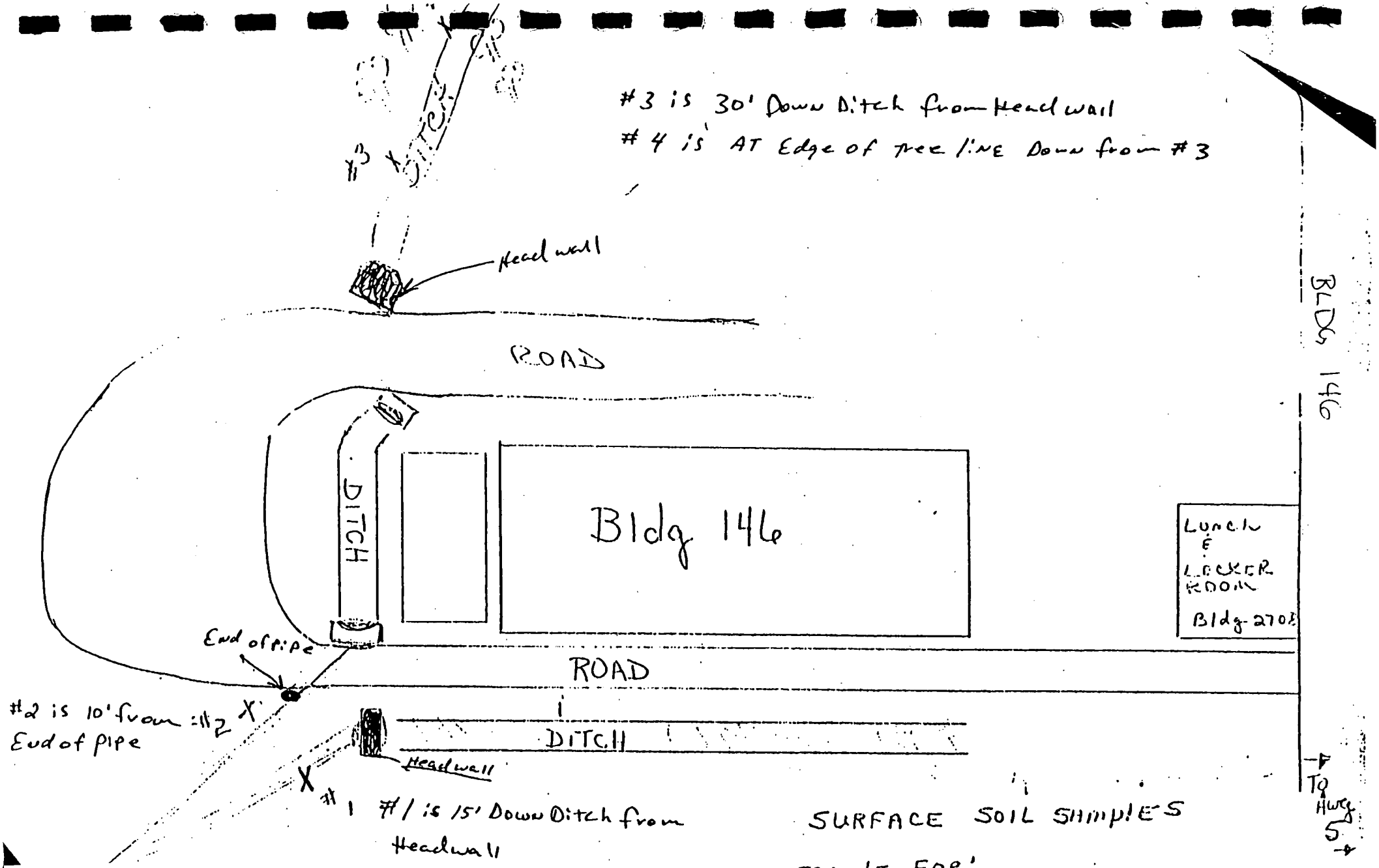
Boring Number: WES-14-5-83

Top of Pipe Elevation: 770.10 ft MSL

Screen Interval Elevation: from 731.60 to 722.35 ft MSL

Grid Coordinates:

Date	Time	Depth to Water, ft	Water Elevation, ft MSL	Remarks
24 Sep 83	11:59	37.13	732.97	
26 Sep 83	10:25	37.51	732.59	
27 Sep 83	9:35	37.54	732.56	
28 Sep 83	2:57	37.50	732.60	
30 Sep 83	4:28	37.70	732.40	
1 Oct 83	8:25	37.83	732.27	
3 Oct 83	9:30	37.77	732.33	
4 Oct 83	4:27	37.75	732.35	



SURFACE SOIL SAMPLES

SAMPLE FOR:
EP TOX METALS & RDX, TNT, HMX

SAMPLE ID
B146-1 -
THRU
B146-4...

Figure M-1
1985 Soil Sample Locations
Building 146 South Ditch

Source: Accompanied 1985 Analytical Reports received from NWSCC.

Water Quality Engr Sp Study No. 81-24-8806-80, 4-14 Jun 79

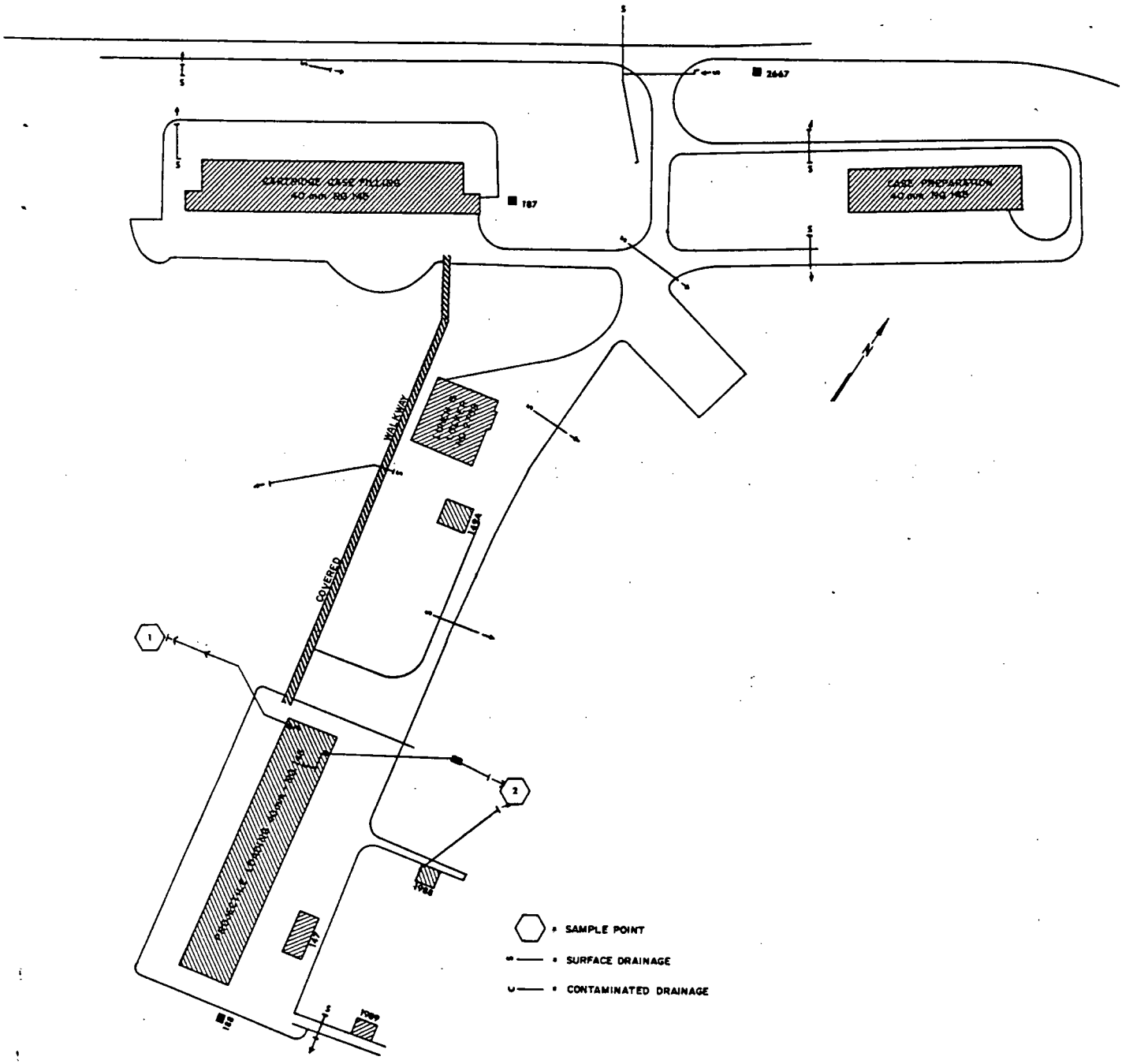


Figure M-2
1979 Soil and Water Sample Locations
Building 146 North Ditch

Source: Department of Army, 1980.

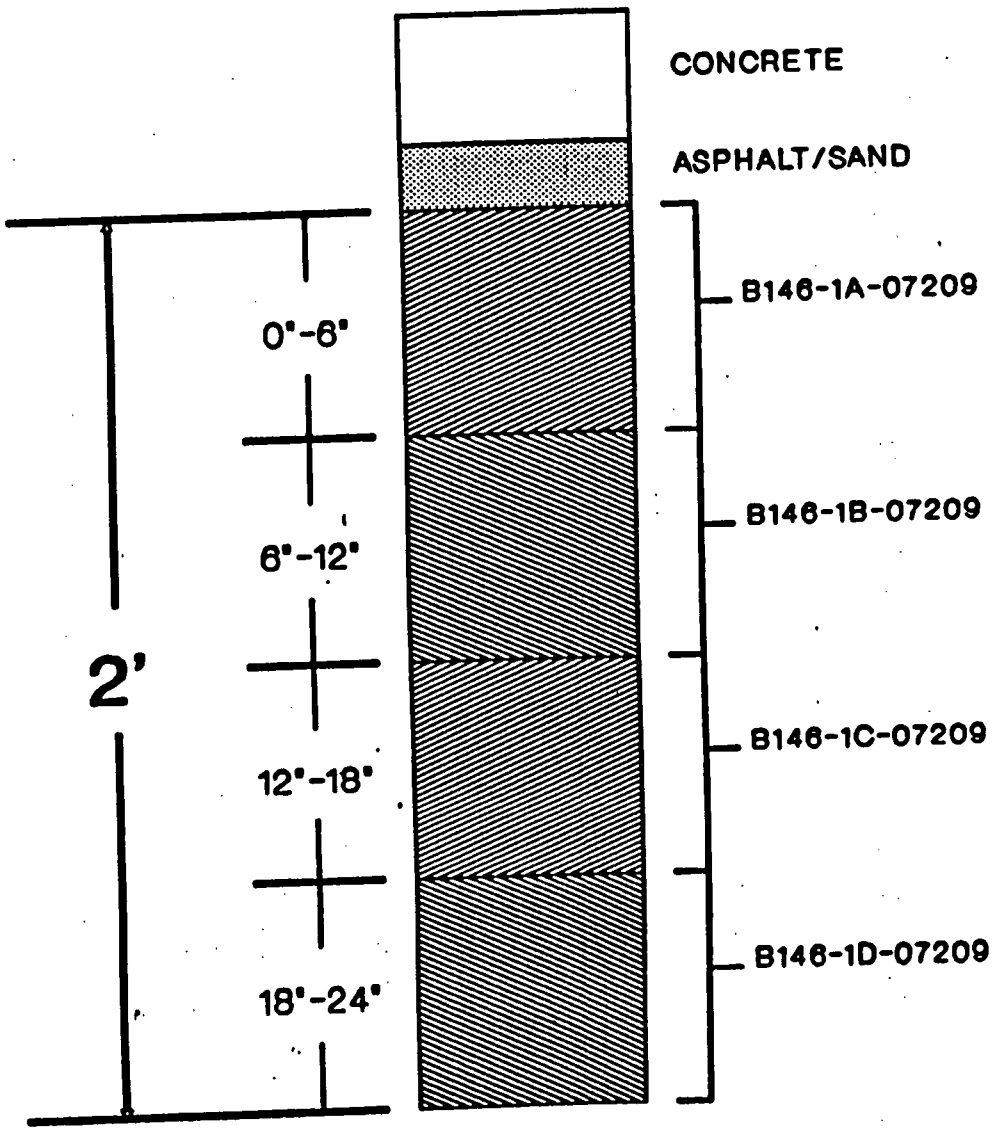
APPENDIX N

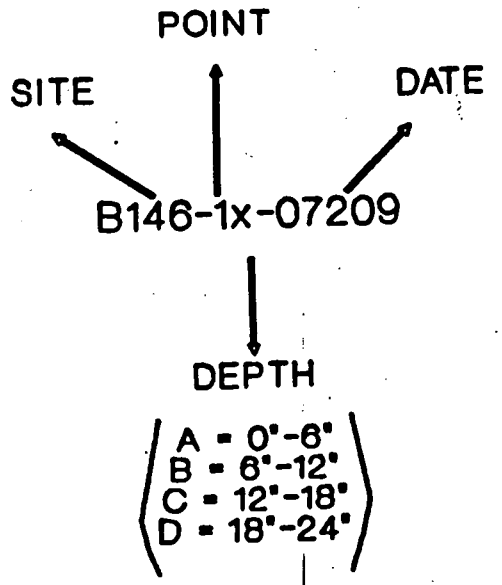
BUILDING 146 SOIL ANALYTICAL DATA

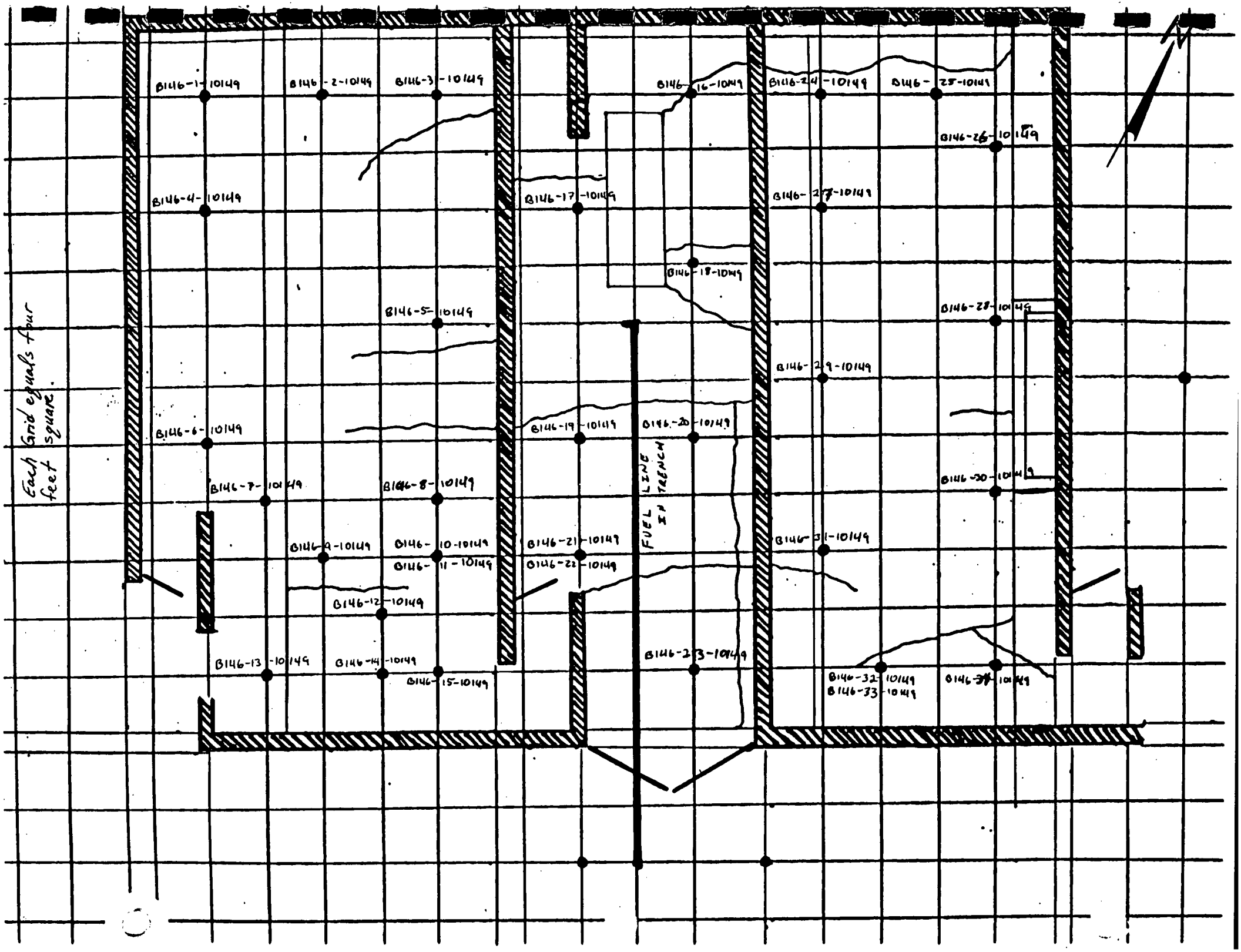
N-1 1989 Metals and PCB Analyses
N-2 1990 Background Analyses
N-3 1990 PCB Resampling analyses

APPENDIX N-1

1989 METALS AND PCB ANALYSES


CONCRETE
ASPHALT/SAND
B146-1A-07209
B146-1B-07209
B146-1C-07209
B146-1D-07209
0"-6"
6"-12"
12"-18"
18"-24"
2'


POINT
SITE
DATE
B146-1x-07209
DEPTH
A = 0"-6"
B = 6"-12"
C = 12"-18"
D = 18"-24"


Each Grid equals four feet square.
B146-1-10149
B146-2-10149
B146-3-10149
B146-4-10149
B146-5-10149
B146-6-10149
B146-7-10149
B146-8-10149
B146-9-10149
B146-10-10149
B146-11-10149
B146-12-10149
B146-13-10149
B146-14-10149
B146-15-10149
B146-16-10149
B146-17-10149
B146-18-10149
B146-19-10149
B146-20-10149
B146-21-10149
B146-22-10149
B146-23-10149
B146-24-10149
B146-25-10149
B146-26-10149
B146-27-10149
B146-28-10149
B146-29-10149
B146-30-10149
B146-31-10149
B146-32-10149
B146-33-10149
B146-34-10149
FUEL LINE IN TRENCH

ANALYTICAL METHODS FOR SOIL SAMPLES COLLECTED AS PART OF B-146 INCINERATOR CLOSURE ACTIVITIES

Sample Extraction Method 1310

Sample Digestion Method 1310

Parameter	Maximum Concentration mg/L	Test Method	Preservative	Holding Time
Arsenic	5.0	7060	Iced to 4° C	Non-aqueous
Mercury	0.2	7470	"	analyze as
Selenium	1.0	7740	"	soon as
Silver	5.0	7760	"	possible
Barium	100.0	6010	"	"
Cadmium	1.0	6010	"	"
T. Chromium	5.0	6010	"	"
Lead	5.0	6010	"	"
PCB	<50 PPM	8080	"	Extraction within 7 days Analyzed 30 days

Source: NWSCC Environmental Protection Division
Reference File No. 5090/H.3.0 0924

K/B/AG5

ANACON, INC.
9001 AIRPORT BLVD #605
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ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7116
DATE RECEIVED 10-17-89
P. O. #

SAMPLE DESCRIPTION: 32 Soil samples for Total Metals & PCB's

All results in mg/l unless otherwise specified

TEST RESULTS:

SAMPLE ID	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	PCB's
B-146-1A-10149	<0.05	21.7	1.60	9.65	31	<0.10	<0.10	<0.50	<0.01
1B	<0.50	126.3	3.70	7.5	415.5	<0.10	<0.10	<0.50	0.04
1C	<0.50	49.3	1.30	5.4	<0.50	<0.10	<0.10	<0.50	<0.01
1D	<0.50	19.2	<0.10	3.4	<0.50	<0.10	<0.10	<0.50	<0.01
2A	<0.50	19.3	<0.10	7.0	5.0	<0.10	<0.10	<0.50	0.1
2B	<0.50	13.6	<0.10	7.5	<0.50	<0.10	<0.10	<0.50	<0.01
2C	<0.50	17.4	<0.10	6.25	<0.50	<0.10	<0.10	<0.50	<0.01
2D	<0.50	11.4	<0.10	10.1	<0.50	<0.10	<0.10	<0.50	<0.01
3A	<0.50	53.4	<0.10	4.3	<0.50	<0.10	<0.10	<0.50	<0.01
3B	<0.50	121.7	1.75	19.1	63	<0.10	<0.10	<0.50	0.15
3C	<0.50	16.7	<0.10	5.8	10	<0.10	<0.10	<0.50	<0.01
3D	<0.50	18.9	<0.10	10.3	<0.50	<0.10	<0.10	<0.50	<0.01
4A	<0.50	12.7	<0.10	7.1	<0.50	<0.10	<0.10	<0.50	0.2
4B	<0.50	8.55	<0.10	7.6	<0.50	<0.10	<0.10	<0.50	<0.01
4C	<0.50	33.55	<0.10	2.6	2.5	<0.10	<0.10	0.50	<0.01

Submitted by: James K. Lee, Lab Director

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ANALYTICAL AND CONSULTING LABORATORIES
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SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7116 - page two
DATE RECEIVED 10-17-89
P. O. #

SAMPLE DESCRIPTION: 32 Soil samples for Total Metals & PCB's

All results in mg/l unless otherwise specified

TEST RESULTS:

SAMPLE ID	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	PCB's
4D	<0.50	8.45	<0.10	4.65	<0.5	<0.10	<0.10	<0.50	<0.01
5A	<0.50	37.5	<0.10	6.3	<0.5	<0.10	<0.10	<0.50	0.13
5B	<0.50	44.5	<0.10	6.5	<0.5	<0.10	<0.10	<0.50	<0.01
5C	<0.50	78.2	<0.10	6.7	18	<0.10	<0.10	10.6	<0.01
5D	<0.50	36.6	<0.10	8.2	17.5	<0.10	<0.10	4.9	<0.01
6A	<0.50	15.2	<0.10	9.2	<0.50	<0.10	<0.10	<0.50	<0.01
6B	<0.50	36.1	<0.10	5.3	<0.50	<0.10	<0.10	<0.50	<0.01
6C	<0.50	30.5	<0.10	5.5	7.5	<0.10	<0.10	5.20	<0.01
6D	<0.50	40.7	<0.10	10.9	<0.50	<0.10	<0.10	14.80	0.05
7A	0.63	312.35	<0.10	3.85	<0.50	<0.10	<0.10	<0.50	<0.01
7B	0.63	81.7	<0.10	4.3	<0.50	<0.10	<0.10	<0.50	<0.01
7C	<0.50	74.8	<0.10	3.8	<0.50	<0.10	<0.10	<0.50	<0.01
7D	<0.50	157.4	<0.10	8.9	5.0	<0.10	<0.10	<0.50	<0.01
8A	<0.50	23.6	<0.10	8.2	<0.50	<0.10	<0.10	<0.50	<0.01
8B	<0.50	30.6	<0.10	10.4	9.0	<0.10	<0.10	<0.50	0.5
8C	<0.50	36.0	<0.10	9.05	<0.50	<0.10	<0.10	<0.50	<0.01
8D	<0.50	33.7	<0.10	11.2	<0.10	<0.10	<0.50	<0.50	<0.01

Submitted by: James K. Lee

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ANALYTICAL AND CONSULTING LABORATORIES
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SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7134
DATE RECEIVED 10-31-89
P. O. #

SAMPLE DESCRIPTION: Soils, PCB & Metals

TEST RESULTS: All results in mg/l unless otherwise specified

PARAMETERS - RESULTS ARE IN mg/kg

SAMPLE ID	PCB	Ba	As	Cd	Cr	Pb	Hg	Se	Ag
B146-9A-10289	<.01	424.75	3.30	11.55	6.45	14.15			<0.50
B	<.01	220.69	1.75	<0.10	2.36	6.10	<0.10	<0.10	<0.50
C	<.01	182.43	1.85	<0.10	4.52	2.50	<0.10	<0.10	<0.50
D	.02	133.08	1.90	<0.10	10.59	3.25	<0.10	<0.10	<0.50
10A	.6	14.77	2.30	<0.10	5.68	1.45	<0.10	<0.10	<0.50
B	.7	99.25	2.20	1.20	12.17	8.05	<0.10	<0.10	<0.50
C	.07	98.46	1.95	1.11	14.72	19.00	<0.10	<0.10	<0.50
11A	<.01	12.30	1.80	<0.10	6.70	10.80	<0.10	0.13	<0.50
B	.07	32.55	2.00	<0.10	12.10	10.65	<0.10	0.10	<0.50
C	.08	33.50	2.35	<0.10	7.25	7.95	<0.10	<0.10	<0.50
12A	.05	40.10	4.25	<0.10	8.35	7.25	<0.10	<0.10	<0.50
B	<.01	21.95	2.20	0.25	8.00	15.00	<0.10	<0.10	<0.50
C	<.01	40.30	2.80	0.25	7.65	5.15	<0.10	<0.10	<0.50
D	.03	17.75	2.85	0.35	12.70	6.55	<0.10	<0.10	<0.50
13A	.1	11.65	1.90	<0.10	5.68	2.25	<0.10	0.17	<0.50

Submitted by: James K. Lee, Lab Director

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ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7134
DATE RECEIVED 10-31-89
P. O. #

SAMPLE DESCRIPTION: Soils, PCB & Metals

TEST RESULTS: All results in mg/l unless otherwise specified

PARAMETERS - Results in mg/kg

SAMPLE ID	PCB	Ba	As	Cd	Cr	Pb	Hg	Se	Ag
B	.05	23.34	3.00	<0.10	9.82	2.00	<0.10	<0.10	<0.50
C	.01	20.27	2.20	<0.10	6.98	8.55	<0.10	<0.10	<0.50
D	.7	20.46	3.50	<0.10	11.26	5.35	<0.10	<0.10	<0.50
14A	.1	57.36	2.35	<0.10	6.45	1.85	<0.10	<0.10	<0.50
B	0.25	39.70	1.80	<0.10	11.70	4.05	<0.10	<0.10	<0.50
C	<.01	29.22	2.55	<0.10	6.21	2.95	<0.10	<0.10	<0.50
D	<.01	50.88	1.35	<0.10	11.36	7.35	<0.10	<0.10	<0.50
15A	.09	34.90	3.25	<0.10	5.80	16.80	<0.10	<0.10	<0.50
B	<.01	27.70	1.75	0.20	8.95	11.00	<0.10	<0.10	<0.50
C	<.01	101.15	1.50	0.25	9.00	10.75	<0.10	<0.10	<0.50
D	.04	153.65	1.55	7.55	11.10	18.30	<0.10	<0.10	<0.50

Submitted by: James K. Lee, Lab Director

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ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7140 - page one
DATE RECEIVED 11-7-89
P. O. #

SAMPLE DESCRIPTION: 52 soil samples for Total Metals & PCB's

TEST RESULTS: All results in mg/l unless otherwise specified

PARAMETERS - mg/kg

SAMPLE ID	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	PCB's
B146-16A-11049	0.85	54.6	0.25	14.80	11.90	<0.1	<0.1	1.10	1.4
B146-16B-11049	1.40	81.7	<0.1	4.80	12.20	<0.1	<0.1	<0.5	1.5
B146-16C-11049	1.85	189.5	0.3	8.95	8.60	<0.1	<0.1	<0.5	<.01
B146-16D-11049	0.90	161.7	<0.1	7.00	8.70	<0.1	<0.1	<0.5	<.01
B146-17A-11049	<0.50	48.3	<0.1	11.35	9.45	<0.1	<0.1	<0.5	0.2
B146-17B-11049	1.00	42.8	<0.1	4.85	9.25	<0.1	<0.1	<0.5	.04
B146-17C-11049	2.05	91.15	0.1	6.55	8.10	<0.1	<0.1	<0.5	<.01
B146-17D-11049	1.05	15.85	<0.1	9.50	8.80	<0.1	<0.1	<0.5	0.1
B146-18A-11049	0.85	74.9	0.6	14.20	12.25	<0.1	<0.1	<0.5	0.7
B146-18B-11049	0.80	8.1	<0.1	6.15	6.25	<0.1	<0.1	<0.5	0.2
B146-18C-11049	0.80	31.5	0.35	6.80	18.55	<0.1	<0.1	<0.5	0.5
B146-18D-11049	0.90	55.5	1.3	10.80	8.95	<0.1	<0.1	<0.5	<.01
B146-19A-11049	0.70	43.75	<0.1	5.40	16.15	<0.1	<0.1	0.75	<.01
B146-19B-11049	0.90	40.7	<0.1	7.50	12.55	<0.1	<0.1	<0.5	3.3

Submitted by: James K. Lee, Lab Director

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ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7140 - page two
DATE RECEIVED 11-7-89
P. O. #

SAMPLE DESCRIPTION: 52 soil samples for Total Metals & PCB's

TEST RESULTS: All results in mg/l unless otherwise specified

PARAMETERS - mg/kg

SAMPLE ID	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	PCB's
B146-19C-11049	2.20	98.8	1.75	14.25	13.15	<0.1	<0.1	<0.5	1.4
B146-19D-11049	1.00	22.55	0.85	8.3	10.20	<0.1	<0.1	<0.5	0.1
B146-20A-11049	1.90	34.25	<0.1	5.6	15.05	<0.1	<0.1	<0.5	0.5
B146-20B-11049	0.60	21.75	<0.1	5.85	14.45	<0.1	<0.1	<0.5	0.5
B146-20C-11049	0.75	70.0	0.4	6.65	16.30	<0.1	<0.1	<0.5	0.4
B146-20D-11049	1.85	22.9	<0.1	17.05	22.40	<0.1	<0.1	<0.5	<.01
B146-21A-11049	2.00	54.75	<0.1	6.10	20.60	<0.1	0.35	<0.5	<.01
B146-21B-11049	1.70	149.6	<0.1	9.05	22.10	<0.1	<0.1	<0.5	0.5
B146-21C-11049	1.65	81.0	<0.1	6.80	25.20	<0.1	<0.1	<0.5	<.01
B146-21D-11049	1.65	70.55	0.25	11.20	22.05	<0.1	<0.1	<0.5	<.01
B146-22A-11049	3.80	57.45	<0.1	11.35	18.05	<0.1	0.15	<0.5	0.2
B146-22B-11049	4.55	72.05	0.15	10.80	12.25	<0.1	<0.1	<0.5	0.6
B146-22C-11049	1.90	198.05	<0.1	9.85	23.80	<0.1	<0.1	<0.5	1.1
B146-22D-11049	2.20	92.05	<0.1	9.30	22.75	<0.1	<0 1	<0.5	0.8

Submitted by: James K. Lee, Lab Director

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ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7140 - page three
DATE RECEIVED 11-7-89
P. O. #

SAMPLE DESCRIPTION: 52 soil samples for total metals & PCB's

TEST RESULTS: All results in mg/l unless otherwise specified

PARAMETERS - mg/kg

SAMPLE ID	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	PCB'
B146-23A-11049	1.30	29.2	<0.1	6.00	17.90	<0.1	0.50	<0.5	0.2
B146-23B-11049	1.25	15.2	<0.1	8.40	14.75	<0.1	<0.1	<0.5	2.1
B146-23C-11049	0.90	27.6	0.1	9.05	12.70	<0.1	<0.1	<0.5	2.3
B146-23D-11049	1.00	41.65	<0.1	11.30	8.55	<0.1	<0.1	<0.5	<.01
B146-24A-11049	1.20	26.35	0.15	10.40	13.45	<0.1	0.45	<0.5	0.3
B146-24B-11049	1.65	11.85	0.1	5.30	12.00	<0.1	0.30	<0.5	<.01
B146-24C-11049	4.40	78.45	<0.1	10.90	10.10	<0.1	<0.1	<0.5	10.5
B146-24D-11049	2.10	61.35	<0.1	11.60	8.25	<0.1	<0.1	<0.5	<.01
B146-25A-11049	1.35	15.00	<0.1	4.00	11.90	<0.1	0.45	<0.5	<.01
B146-25B-11049	5.55	62.85	<0.1	14.95	10.20	<0.1	<0.1	<0.5	0.5
B146-25C-11049	2.40	16.4	<0.1	2.10	17.00	<0.1	<0.1	<0.5	2.9
B146-25D-11049	2.00	13.1	<0.1	10.85	11.10	<0.1	<0.1	10.05	<.01
B146-26A-11049	1.60	13.75	<0.1	4.15	3.00	<0.1	0.35	<0.5	<.01
B146-26B-11049	2.95	236.3	<0.1	6.55	13.25	<0.1	0.30	2.0	1.5

Submitted by: James K. Lee, Lab Director

ANACON, INC.
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ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47511

ANACON # 7140 - page four
DATE RECEIVED 11-7-89
P. O. #

SAMPLE DESCRIPTION: 52 soil samples for total metals and PCB's

TEST RESULTS: All results in mg/l unless otherwise specified

PARAMETERS - mg/kg

SAMPLE ID	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	PCB's
B146-26C-11049	6.75	51.15	<0.1	18.00	8.75	<0.1	<0.1	<0.5	0.8
B146-26D-11049	6.05	46.9	<0.1	13.50	7.00	<0.1	<0.1	<0.5	<.01
B146-27A-11049	1.70	241.6	1.85	21.70	17.30	<0.1	0.40	1.85	0.2
B146-27B-11049	1.55	37.55	<0.1	4.25	11.95	<0.1	0.10	<0.5	0.4
B146-27C-11049	2.50	52.3	1.15	7.90	10.15	<0.1	<0.1	<0.5	1.04
B146-27D-11049	6.25	57.75	1.35	11.55	13.55	<0.1	<0.1	57.9	<.01
B146-28A-11049	2.35	225.65	<0.1	12.00	17.80	<0.1	<0.1	<0.5	<.01
B146-28B-11049	2.85	43.35	<0.1	13.80	3.85	<0.1	<0.1	<0.5	<.01
B146-28C-11049	2.40	35.3	<0.1	11.15	5.75	<0.1	<0.1	<0.5	<.01
B146-28D-11049	5.00	60.05	<0.1	12.90	7.05	<0.1	<0.1	<0.5	<.01

Submitted by: James K. Lee, Lab Director

ANACON, INC.
9001 AIRPORT BLVD. #605
HOUSTON, TEXAS 77061
(713) 941-6703

ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7185
DATE RECEIVED 12-5-89, 9:26 a.m.
P. O. #

SAMPLE DESCRIPTION: 23 soil samples

All results in mg/l unless otherwise specified

TEST RESULTS:

SAMPLE ID	PARAMETERS - mg/kg								
	PCB's	Ba	As	Cd	Cr	Pb	Hg	Se	Ag
B146-29A-12029	<0.01	421.00	1.90	<0.10	49.60	23.75	<0.10	1.45	1.35
B146-29B-12029	0.4	15.05	3.55	<0.10	4.25	9.65	<0.10	1.65	<0.50
B146-29C-12029	<0.01	93.20	4.50	0.48	11.15	13.30	<0.10	0.50	<0.50
B146-29D-12029	<0.01	89.45	8.70	0.40	14.85	15.00	<0.10	0.15	<0.50
B146-30A-12029	<0.01	80.25	5.70	0.20	12.10	17.25	<0.10	0.65	<0.50
B146-30B-12029	<0.01	114.15	5.15	<0.10	13.25	14.80	<0.10	0.55	<0.50
B146-30C-12029	<0.01	50.95	[illegible].15	<0.10	10.80	9.85	<0.10	0.25	<0.50
B146-30D-12029	<0.01	85.60	6.05	<0.10	17.30	12.80	<0.10	0.60	<0.50
B146-31A-12029	<0.01	160.75	4.40	1.26	6.50	24.85	<0.10	1.50	1.85
B146-31B-12029	<0.01	31.00	2.15	<0.10	3.45	17.05	<0.10	1.65	<0.50
B146-31C-12029	0.05	52.15	2.15	1.04	7.20	18.85	<0.10	0.65	<0.50
B146-32A-12029	<0.01	43.75	3.50	<0.10	9.10	16.75	<0.10	1.20	2.45
B146-32B-12029	<0.01	22.65	2.05	<0.10	6.95	16.00	<0.10	0.60	<0.50
B146-32C-12029	<0.01	48.60	5.60	<0.10	12.90	18.55	<0.10	0.90	<0.50
B146-32D-12029	<0.01	30.45	4.75	<0.10	7.15	18.10	<0.10	0.45	<0.50

Submitted by: James K. Lee, Lab Director

ANACON, INC.
9001 AIRPORT BLVD. #605
HOUSTON, TEXAS 77061
(713) 941-6703

ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7185 - page two
DATE RECEIVED 12-5-89, 9:26 a.m.
P. O. #

SAMPLE DESCRIPTION: 23 soil samples

All results in mg/l unless otherwise specified

TEST RESULTS:

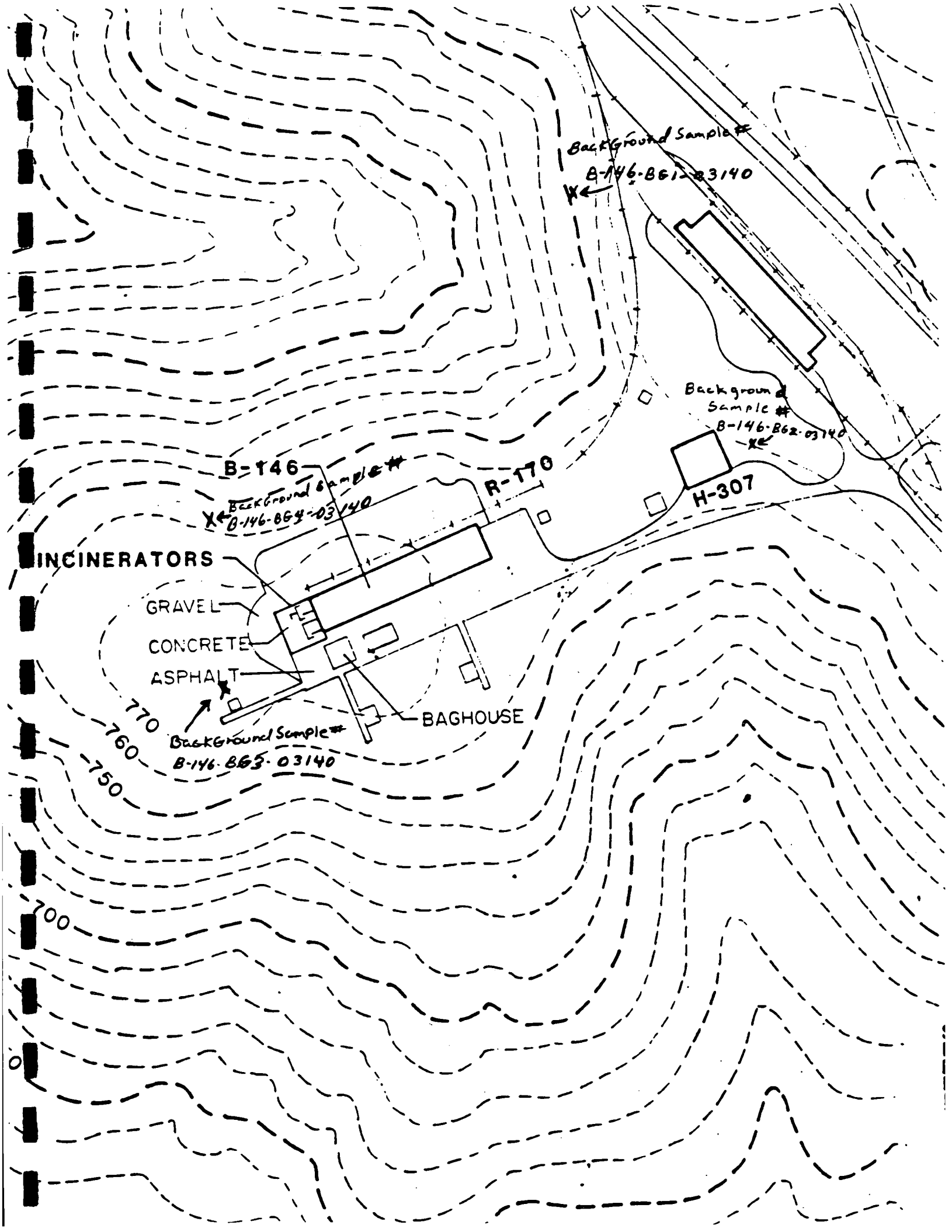
SAMPLE ID — PARAMETERS - mg/kg

	PCB's	Ba	As	Cd	Cr	Pb	Hg	Se	Ag
B146-33A-12029	<0.01	77.75	4.90	<0.10	3.35	15.90	<0.10	1.85	<0.50
B146-33B-12029	<0.01	49.50	2.40	0.80	7.45	16.60	<0.10	1.25	<0.50
B146-33C-12029	<0.01	27.50	9.00	<0.10	5.80	17.45	<0.10	0.40	<0.50
B146-33D-12029	<0.01	29.20	2.95	0.67	9.65	16.00	<0.10	0.10	<0.50
B146-34A-12029	0.1	54.05	4.55	0.30	6.40	21.65	<0.10	1.40	12.90
B146-34B-12029	0.06	42.70	3.55	<0.10	1.00	14.80	<0.10	0.80	0.80
B146-34C-12029	<0.01	58.60	2.25	<0.10	14.90	15.60	<0.10	1.10	<0.50
B146-34D-12029	<0.01	65.80	9.05	<0.10	19.45	12.30	<0.10	1.05	<0.50

Submitted by: James K. Lee, Lab Director

APPENDIX N-2

1990 BACKGROUND ANALYSES


Background Sample #
B-146-B61-03140
Background Sample #
B-146-B62-03140
B-146
Background Sample #
B-146-B64-03140
R-170
H-307
INCINERATORS
GRAVEL
CONCRETE
ASPHALT
BAGHOUSE
Background Sample #
B-146-B63-03140
770
760
750
700

ANACON, INC.
9001 AIRPORT BLVD. #005
HOUSTON, TEXAS 77061
(713) 941-6703

ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

SAMPLE ANALYSIS RESULTS

CUSTOMER NAVAL WEAPONS SUPPORT CENTER
Building 2516
Crane, Indiana 47522

ANACON # 7299
DATE RECEIVED 3-16-90
P. O. #

SAMPLE DESCRIPTION: 16 samples for PCB's and Total Metals

All results in mg/l unless otherwise specified

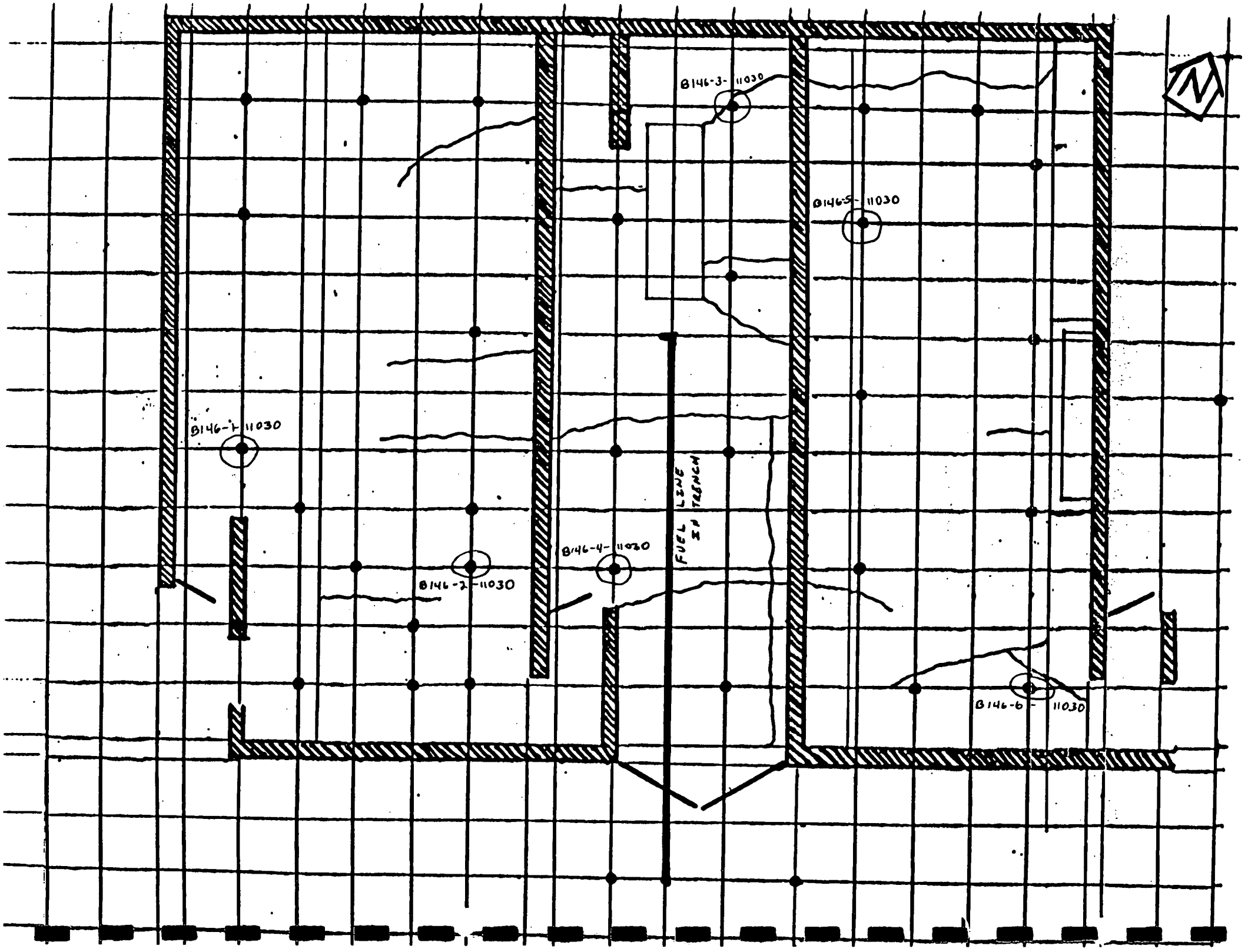
	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	PCB's
B146-BG1A-03140	3.10	93.00	<0.10	9.00	<0.10	115.00	<0.10	<0.50	<.01
1B	4.90	65.00	<0.10	16.00	<0.10	<0.25	<0.10	<0.50	<.01
1C	4.85	59.50	<0.10	15.00	<0.10	<0.25	<0.10	<0.50	<.01
1D	4.90	62.50	<0.10	15.50	<0.10	<0.25	<0.10	<0.50	<.01
2A	5.05	79.50	<0.10	13.50	<0.10	<0.25	<0.10	<0.50	<.01
2B	2.75	31.50	<0.10	10.00	<0.10	<0.25	<0.10	<0.50	<.01
2C	4.90	41.00	<0.10	14.00	<0.10	<0.25	<0.10	<0.50	<.01
2D	5.45	36.50	<0.10	15.50	<0.10	<0.25	<0.10	<0.50	<.01
3A	<0.50	121.50	<0.10	9.00	<0.10	182.50	<0.10	<0.50	<.01
3B	<0.50	10.50	<0.10	7.50	<0.10	<0.25	<0.10	<0.50	<.01
3C	<0.50	96.00	<0.10	6.50	<0.10	188.00	<0.10	<0.50	<.01
3D	<0.50	44.00	<0.10	8.50	<0.10	<0.25	<0.10	<0.50	<.01
4A	<0.50	989.50	8.00	32.00	<0.10	3518.00	<0.10	<0.50	<.01
4B	<0.50	333.50	<0.10	11.00	<0.10	90.00	<0.10	<0.50	<.01
4C	<0.50	143.00	<0.10	6.00	<0.10	73.00	<0.10	<0.50	<.01
4D	<0.50	58.00	<0.10	6.50	<0.10	<0.25	<0.10	<0.50	<.01

Submitted by: E. K. Lee
LAB DIRECTOR

Enclosure (1)

APPENDIX N-3

1990 PCB RESAMPLING ANALYSES


B146-1-11030
B146-2-11030
B146-3-11030
B146-4-11030
B146-5-11030
B146-6-11030
FUEL LINE IN TRENCH
N

ANACON, INC.
9001 AIRPORT BLVD, #605
HOUSTON, TEXAS 77061

PCB ANALYSIS DATA
ANACON #7627

mg/kg

	SAMPLE ID	1016	1221	1232	1242	1248	1254	1260
1	B146-1A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
2	B146-1B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
3	B146-1C	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
4	B146-1D	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
5	B146-2A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
6	B146-2B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
7	B146-2C	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8	B146-2D	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
9	B146-3A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
10	B146-3B REG	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
11	B146-3B DUP	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
13	B146-3C	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
14	B146-3D	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
15	B146-4A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
16	B146-4B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
17	B146-4C	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
18	B146-4D	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
19	B146-5A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
20	B146-5B	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
21	B146-5C	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
22	B146-5D	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

mg/kg

22 B146-5D	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
23 B146-6A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
24 B146-6B REG	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
25 B146-6B DUP	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
27 B146-6C	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
28 B146-6D	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

APPENDIX O

APE 1236 DEACTIVATION FURNACE FEED LIST (1990)

TA1 C-1

APE 1236 DEACTIVATION FURNACE

FEED LIST

List of Munitions which may be treated

GROUP - I MUNITION	MODEL NUMBER	MIN KILN TEMP (F)	KILN SPEED (RPM)	MAX ITEMS FEED-RATE ITEMS/HR	MAX PEP FEED-RATE LB/HR	HEATING VALUE BTU/LB	MAX THERMAL INPUT BTU/HR	ASH LB/LB	MAX ASH FEEDRATE LB/HR	CHLORINE LB/LB	MAX CHLORINE FEED-RATE LB/HR	POHC DPA LB/HR	POHC DBP LB/HR	POHC NG LB/HR	POHC DNT LB/HR	POHC HCB LB/HR
20MM,HET	MK-4	400	1.8	900	92.89	4551	422768	0.0039	0.3646	0.0000	0.0000	0.8000				
20MM,HEI	M56A3	400	1.8	900	98.22	5625	552544	0.1416	13.9108	0.0000	0.0000	0.7000	4.24	7.43	0.24	
20MM,INC	M-96	400	1.8	900	82.11	4745	389583	0.2781	22.8351	0.0347	2.8453	0.4800				
20MM,HEI/DB	M97A2	400	1.8	900	82.16	5733	471025	0.1388	11.4052	0.0000	0.0000	0.9800	6.20	7.18	0.65	
20MM,HEI/SB	M97A2	400	1.8	900	82.16	5296	435104	0.1343	11.0322	0.0000	0.0000	0.8462	0.01	0.00	6.20	
20MM,HEI	M210	400	1.8	900	83.44	5773	480949	0.1624	13.5332	0.0061	0.5111	0.9700	6.17	7.14	0.65	
40MM,APT	M81	400	1.5	1780	35.70	6710	239518	0.2289	8.1700	0.1044	3.7300					
40MM,CTG	M385	400	1.5	660	6.53	4797	31286	0.0188	0.1229	0.0000	0.0000			1.03		
40MM,CTG	M407			660	8.36	821	6871	0.2270	1.8978	0.0610	0.5104			0.20		
76MM.HVTPT	M315A1	400	1.0	660	0.00	2254	3	0.4766	0.0007	0.0000	0.0000					
76MM.APT	M339	400	1.0	330	0.00	2254	2	0.4766	0.0003	0.0000	0.0000					
FUZES	MK20,MD2			600	unknown	unknown	unknown	unknown	unknown	unknown	unknown					
FUZES	MK21, MD1			600	unknown	unknown	unknown	unknown	unknown	unknown	unknown					
FUZES	MK-27	400	1.5	660	33.17	5202	172555	0.4632	15.3636	0.0001	0.0038					
FUZES	MK31, MD2			600	4.65	4885	22735	0.0660	0.3074	0.0000	0.0000					
AUX. DETONAT	MK43,M-0			900	unknown	unknown	unknown	unknown	unknown	unknown	unknown					
PNT. DETON	M48			660	0.58	1341	774	0.7832	0.4519	0.0160	0.0092					
AUX. DETON	MK52,MD0			660	unknown	unknown	unknown	unknown	unknown	unknown	unknown					
AUX. DETON	MK52,MD3			660	unknown	unknown	unknown	unknown	unknown	unknown	unknown					
AUX. DETON	MK54,MD0-2			900	unknown	unknown	unknown	unknown	unknown	unknown	unknown					
FUZE DETON	M66A1	300	1.2	660	10.13	4721	47807	0.2662	2.6953	0.0314	0.3183					
FUZE DETON	M66A2	300	1.2	660	10.13	4721	47807	0.2662	2.6953	0.3183	0.3183					

TABLE C-1 (CONTINUED)
APE-1236 DEACTIVATION FURNACE
FEED LIST

MUNITION	MODEL NUMBER	KILN TEMP (F)	KILN SPEED (RPM)	MAX ITEMS FEED-RATE ITEMS/HR	MAX PEP FEED-RATE LB/HR	HEATING VALUE BTU/LB	MAX THERMAL INPUT BTU/HR	ASH LB/LB	MAX ASH FEEDRATE LB/HR	CHLORINE LB/LB	MAX CHLORINE FEED-RATE LB/HR	POHC DPA LB/HR	POHC DBP LB/HR	POHC NG LB/HR	POHC DNT LB/HR	POHC HCB LB/HR
GRENADE FUZE	M204A2			1175	0.06	2701	161	0.6686	0.0398	0.0000	0.0000					
GRENADE FUZE	M206			1175	0.06	2701	161	0.6686	0.0398	0.0000	0.0000					
GRENADE FUZE	M213			1175	0.06	2701	161	0.6686	0.0398	0.0000	0.0000					
GRENADE FUZE	M215			1175	0.06	2701	161	0.6686	0.0398	0.0000	0.0000					
GRENADE FUZE	M502	400	1.7	440	20.86	5171	107888	0.0162	0.3370	0.0002	0.0049					
PNT DETON	M519	300	2.5	480	unknown	unknown	unknown	unknown	unknown	unknown	unknown					
PNT DETON	M557	400	1.7	440	24.01	5730	137557	0.0181	0.4357	0.0002	0.0060					
PNT DETON	M572			440	24.01	5730	137557	0.0181	0.4357	0.0002	0.0060					
ROCKMOTOR IGNITERS	M20A1			660	5.48	2419	13250	0.4106	2.2490	0.0021	0.0114					
ROCKMOTOR IGNITERS	MK-117	350	1.2	2280	9.77	2401	23461	0.4107	4.0131	0.0000	0.0000					
ROCKMOTOR IGNITERS	MK-118	350	1.2	2280	9.77	2401	23461	0.4107	4.0131	0.0000	0.0000					
ROCKMOTOR IGNITERS	MK125-5	300	2.7	6600	9.43	2401	22638	0.4107	3.8723	0.0000	0.0000					
MOTOR 3.5"		400	1.0	240	86.40	5116	442016	0.0316	2.7294	0.0200	1.7246			30.67		
EJECT CRTG	CCU-1/B	400	2.5	6600	7.82	5764	45049	0.4172	3.2608	0.0000	0.0000			1.20		
BOOSTER	M21A4	400	1.5	440	20.20	5216	105336	0.0084	0.1701	0.0000	0.0000					
BOOSTER	MK39-MD0			480	28.51	5261	150001	0.0000	0.0000	0.0000	0.0000					
IGNIT ELEM	M91			660	1.24	unknown	unknown	0.4009	0.4952	0.1141	0.1409					
DETENT		400	1.5	22500	32.14	5261	169104	0.0000	0.0000	0.0000	0.0000					
DETONATOR	M17			19500	13.33	2197	29275	0.5692	7.5855	0.0000	0.0000					
DETONATOR	M22			5860	3.49	2192	7650	0.5566	1.9431	0.0180	0.0630					
DETONATOR	M24			19500	10.86	1119	12154	0.7499	8.1475	0.0260	0.2821					
DETONATOR	M55	400		19500	3.65	1824	6667	0.5647	2.0638	0.0000	0.0000					
IMPUL CTG	MK15-MD0	400	1.5	45000	1.67	2331	3895	0.4401	0.7356	0.0000	0.0000					

TABLE C-1 (CONTINUED)
APE-1236 DEACTIVATION FURNACE
FEED LIST

MUNITION	MODEL NUMBER	KILN TEMP (F)	KILN SPEED (RPM)	MAX ITEMS FEED-RATE ITEMS/HR	MAX PEP FEED-RATE LB/HR	HEATING VALUE BTU/LB	MAX THERMAL INPUT BTU/HR	ASH LB/LB	MAX ASH FEEDRATE LB/HR	CHLORINE LB/LB	MAX CHLORINE FEED-RATE LB/HR	POHC DPA LB/HR	POHC DBP LB/HR	POHC NG LB/HR	POHC DNT LB/HR	POHC HCB LB/HR
CUTTER CTG.	M21			2640	0.81	3824	3101	0.1951	0.1582	0.0000	0.0000	0.0053		0.05		
CUTTER CTG.	M22			2640	0.81	3824	3101	0.1951	0.1582	0.0000	0.0000	0.0053		0.05		
FIN ASSY W/ PRIMER	81MM MORT	300	2.0	2640	46.71	5339	249393	0.0106	0.4958	0.0005	0.0223	0.3500		18.62		
PROPELLANT	M1, MP			240 LB/HR	240.00	5301	1272228	0.0000	0.0000	0.0000	0.0000	2.9000	14.40		28.80	
PROPELLANT	M7			125 LB/HR	125.00	5116	639491	0.0316	3.9488	0.0200	2.4950			44.40		

TABLE C-1 (CONTINUED)
APE-1236 DEACTIVATION FURNACE
FEED LIST

MUNITION	MODEL NUMBER	KILN TEMP (F)	KILN SPEED (RPM)	MAX ITEMS FEED-RATE ITEMS/HR	MAX PEP FEED-RATE LB/HR	HEATING VALUE BTU/LB	MAX THERMAL INPUT BTU/HR	ASH LB/LB	MAX ASH FEEDRATE LB/HR	CHLORINE LB/LB	MAX CHLORINE FEED-RATE LB/HR	POHC DPA LB/HR	POHC DBP LB/HR	POHC NG LB/HR	POHC DNT LB/HR	POHC HCB LB/HR
PRIMER, PERC	M26			99000(C)	25.46	1128	28724	0.6003	15.2822	0.1527	3.8870					
PRIMER, PERC	M47			1200(A)	51.60	2398	123740	0.4111	21.2141	0.0005	0.0263					
PRIMER, PERC	M68			1200(A)	51.60	2398	123740	0.4111	21.2141	0.0005	0.0263					
PRIMER, PERC	M79			1000(A)	54.43	2399	130562	0.4110	22.3713	0.0004	0.0219					
PRIMER, ELEC	M80A1			780 (A)	92.71	3220	298526	0.2458	22.6143	0.0004	0.0350					
FUZE, TIME	M65A1			13000 (A)	55.06	2401	132206	0.4107	22.6143	0.0000	0.0000					
PNT. DETON	M78A1			1900(E)	96.60	5151	497633	0.0212	2.0482	0.0003	0.0288					
BASE DETON	M91A1			1900(E)	95.92	5137	492719	0.0915	8.7727	0.0044	0.4219					
PI B. DET	M509A1			5500(E)	98.51	5158	508145	0.0118	1.1622	0.0000	0.0000					
FUZE, PROX	M513A1			1800(E)	99.85	5235	522702	0.0043	0.4336	0.0000	0.0000					
PNT DETON	M521			34000(A)	37.20	1895	70515	0.6007	22.3502	0.0176	0.6534					
PNT DETON	M525			2500(E)	96.43	4108	396174	0.0106	1.0211	0.0003	0.0310					
PNT DETON	M564			1900(E)	98.18	4085	401073	0.0278	2.7282	0.0034	0.3329					
SIMULATOR PROJECTILE	M74			500(A)	39.06	3471	135580	0.5557	21.7072	0.0000	0.0000					
SIGNAL ILL	AN-M37A2			4700(A)	54.29	2424	131621	0.4206	22.8346	0.0033	0.1770					0.01
SIGNAL ILL	AN-M43A2			5900(A)	53.73	2414	129739	0.4169	22.4040	0.0036	0.1928					0.08
SIGNAL ILL	M158			475 (A)	38.74	2996	116085	0.5877	22.7682	0.0006	0.0244					
ROCKET-3.5"	M29A2			270(E)	99.44	5055	502673	0.0401	3.9914	0.0196	1.9447			34.51		
MINE ACTIV	M1			14800(E)	99.76	4844	483197	0.0931	9.2926	0.0082	0.8196					
FUZE BOOSTER	M125A1			1800(E)	95.66	5602	535894	0.0043	0.4083	0.0000	0.0000					
IGNIT. CTG	M5A2			17400	99.43	5343	531237	0.0083	0.8276	0.0000	0.0000			39.77		
DELAY PLUNG	M1			105000(A)	32.55	1347	43842	0.6936	22.5775	0.0158	0.5134					

GENERIC FEEDRATE (A)ASH (C)CHLORINE (E)EXPLOSIVE (P)POHC

TABLE C-1 (CONTINUED)
APE-1236 DEACTIVATION FURNACE
FEED LIST
(UNCHARACTERIZED MUNITIONS)

MUNITION	MODEL NUMBER	KILN TEMP (F)	KILN SPEED (RPM)	MAX ITEMS FEED-RATE ITEMS/HR	MAX PEP FEED-RATE LB/HR	HEATING VALUE BTU/LB	MAX THERMAL INPUT BTU/HR	ASH LB/LB	MAX ASH FEEDRATE LB/HR	CHLORINE LB/LB	MAX CHLORINE FEED-RATE LB/HR	POHC DPA LB/HR	POHC DBP LB/HR	POHC NG LB/HR	POHC DNT LB/HR	POHC HCB LB/HR
20MM,HEI	MK-106	400	1.8	UNKNOWN												
20MM,API	MK-107	400	1.8	UNKNOWN												
20MM,HPT	M239	-	-	UNKNOWN												
20MM,HEIT	M599	400	1.8	INCOMPLETE												
20MM,APIT	M601	400	1.8	UNKNOWN												
PRIMER PER	M8			UNKNOWN												
PERCUSSION	M58			UNKNOWN												
PNT. DETON	M51	300	2.5	UNKNOWN												
AUX. DETON	MK-44			UNKNOWN												
PNT DETON	M255			UNKNOWN												
FUZE	M530A1			UNKNOWN												
PROXIMITY	M532			UNKNOWN												
MTSQ	M582			UNKNOWN												
FUZE	M605			UNKNOWN												
FUZE	XM764			UNKNOWN												
DEMOLITION	M80			UNKNOWN												
PROJECTILE	M115A2			UNKNOWN												
GRENADE	M116A1			UNKNOWN												
BOOBY-TRAP	M117			UNKNOWN												
BOOBY-TRAP	M118			UNKNOWN												
GRENADES	M31			UNKNOWN												
GRENADES	MK1			UNKNOWN												
EXPELLING CHARGE	UNKNOWN			UNKNOWN												
IGNITER	M2A2			UNKNOWN												

TABLE C-1 (CONTINUED)
APE-1236 DEACTIVATION FURNACE
FEED LIST
(UNCHARACTERIZED MUNITIONS)

MUNITION	MODEL NUMBER	KILN TEMP (F)	KILN SPEED (RPM)	MAX ITEMS FEED-RATE ITEMS/HR	MAX PEP FEED-RATE LB/HR	HEATING VALUE BTU/LB	MAX THERMAL INPUT BTU/HR	ASH LB/LB	MAX ASH FEEDRATE LB/HR	CHLORINE LB/LB	MAX CHLORINE FEED-RATE LB/HR	POHC DPA LB/HR	POHC DBP LB/HR	POHC NG LB/HR	POHC DNT LB/HR	POHC HCB LB/HR
DELAY	M549			UNKNOWN												
DETONATOR	XM580E1			UNKNOWN												
DETONATOR ASSY.	C70			UNKNOWN												
S&A ASSY. F/M718	UNKNOWN			UNKNOWN												
BODY ASSY F/M74	UNKNOWN			UNKNOWN												
S&A ASSY F/M75	UNKNOWN			UNKNOWN												
PROPEL CUP F/M75	UNKNOWN			UNKNOWN												
TRACER	M13			UNKNOWN												
LEAD	PA509			UNKNOWN												
SUB ASSY.	M605			UNKNOWN												
IMPULS CTG	MK12-MD1	250	2.5	UNKNOWN												
IMPULS CTG	MK12-MD2	250	2.5	UNKNOWN												
IMPULS CTG	MK12-MD1(NM)	250	2.5	UNKNOWN												
IMPULS CTG	MK14-MD0	250	2.5	UNKNOWN												

APPENDIX P

WASTE CHARACTERIZATION FOR NWSCC DEACTIVATION FURNACES (1983)

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

1LT Jenness/jg/AUTOVON
584-3500

REPLY TO
ATTENTION OF

HSHB-EA/WP

16 SEP 1983

SUBJECT: Waste Characterization for AMCCOM/DESCOM Deactivation Furnaces, Project No. 44-21-0353-83

Division Engineer
US Army Engineer Division, Huntsville
ATTN: HNDED-PM/CPT Cabellon
PO Box 1600
Huntsville, AL 35807

1. See Inclosure 1 for a listing of references.

2. The waste characterizations for the following installations are inclosed (Inclosures 2 thru 14):

a. Savanna Army Depot Activity

b. Tooele Army Depot

c. Lexington-Blue Grass Depot Activity

d. Red River Army Depot

e. Sierra Army Depot

f. Fort Wingate Depot Activity

g. Pueblo Army Depot Activity

h. Umatilla Depot Activity

i. Anniston Army Depot

j. Seneca Army Depot

k. Hawthorne Army Ammunition Plant

l. Crane Army Ammunition Activity

m. Navajo Depot Activity

3. The waste characterization for Letterkenny Army Depot was previously submitted in reference 8, Inclosure 1. Although the characterization for Navajo Depot Activity was submitted in reference 9, it is included again with supplemental information on the concentration of Principal Organic Hazardous Constituents (POHC). The characterization of waste munitions for Pine Bluff Arsenal will be completed upon receipt from the installation of a list of the munitions planned for disposal.

4. Chemical compositions were not found for all of the munitions submitted by the installations for characterization. The first page of the characterization for each installation lists those items not characterized at this time. Additional effort is being expended to properly characterize these munitions and the data will be provided at a later date.

5. The characterization of each item provided by the installations is presented separately. In the first column the munition is identified, the DOT shipping classification is shown and the total munition and the propellant, explosive and pyrotechnic (PEP) weights are listed. Column 2 identifies components of the munition. Next, the weight, in grains, of the constituents of the component is presented. The chemical composition and the proportion of each constituent are presented next. Under the column titled RCRA Requirements, the EPA hazardous waste number is shown for those chemical constituents covered by the Resource Conservation and Recovery Act (RCRA). Also shown is the potential for EP Toxicity, whether or not the waste is listed in Appendix VIII of 40 CFR 261 and if the constituent is a POHC. The last two columns show the constituent's fraction of the total weight and the PEP weight in parts per million. This information is presented only for POHC's. Constituents with chlorine have the fraction of chloride ion, in ppm, listed to aid in determining the potential for HCl emissions. In instances where more than one PEP component was used for the munition, the calculations used the total PEP weight that produced the worst case.

6. Class C explosives are not described in 40 CFR 261.23 as hazardous wastes. Therefore, they are not required to be included in the Part B permit. The characterizations of the Class C explosives have been included for your information, however. Both Class A and Class B explosives are defined as hazardous and must be included in the Part B permit application. The DOT shipping class for each munition can be found in the first column of the tables in the characterization. In a limited number of cases, DOT classes were not available.

7. The RCRA regulations require incinerators that dispose of hazardous waste must achieve a destruction efficiency of 99.99 percent for the POHC's in the waste stream. Items that contain POHC's may be excluded, at the discretion of the regulatory authority, from all permit requirements other than waste characterization and closure if the POHC is present in insignificant quantities. POHC's less than 100 ppm by weight are likely to qualify for exclusion. POHC's between 100 and 1000 ppm are considered on a case-by-case basis. Those POHC's greater than 1000 ppm have little chance of being granted an exclusion.

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SUBJECT: Waste Characterization for AMCCOM/DESCOM Deactivation Furnaces, Project No. 44-21-0353-83

8. The weight of the total munition being fed to the incinerator was used in determining the fraction of POHC's. The rationale behind this approach is that the complete munition is the waste, not just the PEP components. In the event the regulatory authorities refuse to accept this approach, the fraction of POHC's in the PEP component is also included in the tables.

9. Analytical methods have yet to be developed for many of the POHC's. As an example, in a recent negotiation, lead styphnate, a POHC, was in the waste stream. It was determined, however, that no method existed for analyzing it. On this basis, the regulatory authority issued an exclusion for lead styphnate.

10. Four compounds containing chlorine were identified in the waste characterizations. These were potassium chlorate (29% Cl^-), potassium perchlorate (20% Cl^-), polyvinyl chloride (57% Cl^-) and parlon-chlorinated rubber (65% Cl^-). Incinerators burning hazardous waste are required to limit emissions of HCl to 1.8 Kg/hr (4 lb/hr) by 40 CFR 264.343(b). The fractions presented in the tables for the chloride ion represent the chlorine available in the waste feed. This, however, may not be the concentration that would be detected in an actual stack gas analysis. The actual emissions will be dependent on the feed rate, the destruction efficiency of the compounds containing chlorine and the amount of chlorine reacting to form HCl. The limit for HCl emissions shown above is the Federal requirement. State and local governments may have more stringent requirements.

11. All of the foregoing assumes the munitions will be fed to the APE 1236 as complete rounds, fuzes, etc. If the munitions are broken down prior to entering the APE 1236, then each component must be considered separately. This would result in a significant increase in the number of hazardous constituents required for inclusion in the Part B permit application.

12. Questions regarding this matter may be referred to 1LT Jenness, this Agency, AUTOVON 584-2509/2510.

FOR THE COMMANDER:

Robert R. Fosdick, MAJ, MSC

14 Incl
as

NELSON H. LUND, P.E.
Colonel, MSC
Director, Environmental Quality

HSHB-EA/WP
SUBJECT: Waste Characterization for AMCCOM/DESCOM Deactivation Furnaces, Project No. 44-21-0353-83

CF:
HQDA (DASG-PSP) wo incl
Cdr, HSC (HSPA-P) w incl
Cdr, DARCOM (DRCSG) w incl
Cdr, DARCOM (DRCIS-A) w incl
Cdr, DARCOM I&SA (DRCIS-RI-IC) w incl
Cdr, AMCCOM (DRSMC-SGCR) w incl 12, 13
Cdr, DESCOM (DRSDS-RM-EF) w incl 2 thru 11 and 14
Cdr, Savanna Army Depot Activity (SDSLE-VAE) w incl 2
Cdr, Tooele Army Depot (SDSTE-ASF-E) w incl 3
Cdr, Lexington-Blue Grass Depot Activity (SDSAN-LAF) w incl 4
Cdr, Red River Army Depot (SDSRR-TF) w incl 5
Cdr, Sierra Army Depot (SDSSI-FE) w incl 6
Cdr, Ft Wingate Depot Activity (SDSTE-FWS) w incl 7
Cdr, Pueblo Army Depot Activity (SDSTE-PUA) w incl 8
Cdr, Umatilla Depot Activity (SDSTE-UAS) w incl 9
Cdr, Anniston Army Depot (SDSAN-DS-FE) w incl 10
Cdr, Seneca Army Depot (SDSSE-AD) w incl 11
Cdr, Hawthorne Army Ammunition Plant (SARHW-FE) w incl 12
Cdr, Crane Army Ammunition Activity (SARCN) w incl 13
Cdr, Navajo Depot Activity (SDSTE-NAS) w incl 14
Cdr, FAMC (PVNTMED Actv) w incl 2, 3, 8
Cdr, WRAMC (PVNTMED Actv) w incl 4, 11, 13
Cdr, BAMC (PVNTMED Actv) w incl 5
Cdr, LAMC (PVNTMED Actv) w incl 6, 12
Cdr, WBAMC (PVNTMED Actv) w incl 7, 14
Cdr, MAMC (PVNTMED Actv) w incl 9
Cdr, DDEAMC (PVNTMED Actv) w incl 10
Cdr, MEDDAC, Ft Sheridan (PVNTMED Actv) (2 cy) w incl 2
Cdr, MEDDAC, Ft Knox (PVNTMED Actv) (2 cy) w incl 4, 13
Cdr, MEDDAC, Ft Hood (PVNTMED Actv) (2 cy) w incl 5
Cdr, MEDDAC, Ft Carson (PVNTMED Actv) (2 cy) w incl 8
Cdr, MEDDAC, Ft McClellan (PVNTMED Actv) (2 cy) w incl 10
Cdr, MEDDAC, Ft Devens (PVNTMED Actv) (2 cy) w incl 11
Cdr, MEDDAC, Ft Huachuca (PVNTMED Actv) (2 cy) w incl 14
C, USAEHA-Rgn Div North w incl 3, 4, 11, 13
C, USAEHA-Rgn Div South w incl 5, 10
C, USAEHA-Rgn Div West w incl 2, 6, 7, 8, 9, 12, 14

Crane Army Ammunition Activity

The following items were not characterized because information concerning the chemical composition of the explosive components was not found.

1.	1305-00-039-1046-A746	CTG 20 mm HEI
2.	1305-00-039-1051-A744	CTG 20 mm HEI
3.	1305-00-484-1392-A808	CTG 20 mm HEI MK 106
4.	1305-00-839-1302-A874	CTG 20 mm TP MK 105-1
5.	1305-00-028-6527-A327	CTG 30 Cal
6.	1305-00-301-1642-A562	CTG 50 Cal M1
7.	1305-01-018-1551-A003	CTG 12 Gauge (Shotgun)
8.	1315-00-936-8253-C009	CTG, Ignition M285
9.	1335-00-038-4638-F562	CTG, Signal MK 43
10.	1325-00-301-1115-G305	Primer, Det Fuze M14
11.	1325-00-517-9772-G302	Primer, Det Fuze M14
12.	1325-LL-383-2913	Base Fuze Assembly
13.	1325-LL-280-8721	Base Fuze Assembly
14.	1325-LL-AM6-0029	Sensing Element (Fuze)
15.	1330-00-228-5825-G800	Grenade Adapter M1A1
16.	1330-00-228-5830-G805	Grenade Adapter M1A1
17.	1330-00-228-5857-G851	CHG, Hand Grenade (PRAC)
18.	1330-00-028-5902-G820	CTG, Grenade Ass't
19.	1330-00-028-5920-G980	Grenade, Rifle, AT, PRAC M11A3
20.	1330-00-301-1988	CTG, Grenade (Rifle) M30
21.	1336-00-563-0194-V625	Booster, Warhead MK 35
22.	1340-00-038-9183-Z90G	Initiator Assy (Warhead)
23.	1340-00-410-9403-H420	Initiator (RKT MTR) MK 282
24.	1340-LL-200-3013	Cup, Booster MK30
25.	1340-LL-AM2-0323-H260	Igniter, RKT M127
26.	1340-LL-038-9134	Igniter, RKT MTR MK 6-0
27.	1345-00-028-5121-K055	Fuze, Mine M10 Series
28.	1345-00-028-5128-K030	Primer, Igniter
29.	1356-00-399-8287-J686	Squib, Time Delay
30.	1356-00-555-5088-J631	Arming Device MK 2-1
31.	1356-00-671-3046-T685	Shutter Housing MK 1-0
32.	1361-00-038-9273-S395	Primer MK 250
33.	1361-00-528-5396-J396	Primer MK 25-1
34.	1361-00-807-3504	CTG, Impulse MK 33-1
35.	1370-00-119-2057-LW54	Fuze Assy MK 362-0
36.	1375-00-028-5211-M109	Blasting Cap M6
37.	1375-00-219-8583-M682	Cylinder, Ign
38.	1375-00-332-6119-DW67	CTG, Cutter
39.	1375-00-332-5832	CTG, Impulse
40.	1375-LL-224-C013	Detonator Initiator
41.	1377-00-038-4954-M175	CTG, Life Raft
42.	1377-00-038-8617-M390	CTG, Impulse
43.	1377-00-083-8752	Squib
44.	1377-00-293-8187-M190	CTG, Impulse MK 2-1

CRANE ARMY AMMUNITION ACTIVITY

45.	1377-00-302-8439-MC69	CTG, Impulse MK 152-0
46.	1377-00-433-9543-M723	CTG, Initiation MK 125
47.	1377-00-465-6293-M852	Squib MK 13
48.	1377-00-193-8834-M364	CTG, Impulse MK 125-0
49.	1377-00-885-3989-M701	CTG, Initiation MK 11
50.	1377-00-793-9926	CTG, Impulse M19
51.	1377-00-X78-0160	Squib 572
52.	1377-00-016-3683-M048	CTG, Impulse 291A
53.	1390-00-032-1666-Z9TI	Fuze, Aux Det MK 395-1
54.	1390-00-032-1669-Z6MD	Fuze, Aux Det MK 396-1
55.	1390-00-032-9734-M4E6	Fuze, Prox MK 7K2
56.	1390-00-032-9723-Z9TI	Fuze, MT MK 67-2
57.	1390-00-032-9725-N243	Fuze, MT MK 68-0
58.	1390-00-032-9726	Fuze, PT DET
59.	1390-00-038-9764-N857	Fuze, Base DET
60.	1390-00-038-9773-Z9TI	Fuze, Area DET MK 54-1
61.	1390-00-038-9785-Z9TR	Primer MK 14-1
62.	1390-00-069-3070-NX51	Delay Plunger Assy MK 1
63.	1390-00-069-3072-NX52	Delay Plunger
64.	1390-00-147-5898-Z9TI	Fuze, Area DET MK 384-0
65.	1390-00-152-4036	Safety Device MK 18-6
66.	1390-00-563-7712-N239	Fuze, Mech. MK 395-0
67.	1390-00-451-8694-Z9TZ	Fuze, Area DET MK 395-0
68.	1390-00-488-0970-Z6NN	Fuze, Area DET MK 379-1
69.	1390-00-676-7837-N331	Fuze, PT DET
70.	1390-00-737-9280-Z9TI	Fuze, Base DET MK 85-0
71.	1390-00-760-9564-Z9TX	Booster Assy MK 384-0
72.	1390-00-828-7449-N532	Primer, Perc
73.	1390-00-917-4158-Z9TZ	Fuze, Area DET MK 64-2
74.	1390-00-010-8702	Fuze, Prox
75.	1390-LL-AM2-0244	Detonator MK 19-0
76.	1390-LL-AM2-0333-Z6LW	Booster MK 395-0
77.	1390-LL-AM2-0517	Fuze, MT MK 58
78.	1390-LL-AM2-0614	Primer, M52AH
79.	1390-LL-B28-8383	Fuze
80.	1395-00-038-9776-Z9AR	Cup, Sealing MK 43
81.	1395-00-039-0451	Wad, Dyralin
82.	1399-21-OCR-X275	Signal, Distress
83.	9998-LL-F02-C013	Squib Assy
84.	9999-LL-160-C013	Cap Blasting
85.	9999-LL-787-0389	Detonator Assy
86.	9999-LL-A30-C12T	Primer
87.	9998-LL-K51-A013	CTG, 7.62 mm
88.	9999-LL-127-A013	CTG, 20 mm, TP
89.	1390-00-437-5748-N251	Fuze, MT MK 349
90.	1390-00-919-6083-N250	Fuze, MT MK 342-0

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.50 Caliber Armor Piercing Incendiary T49 DOT Class - C Total Weight Assume - 1,740 gr PEP Weight 275.7 gr	Primer	2.70 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	621 ppm	3,917 ppm
			5% Tetracene	D003		
			45% Barium Nitrate	EP Toxicity (D005), App VIII		
			10% Antimony Sulfide			
	Propellant Double Base	252 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	13,034 ppm	82,263 ppm
			0.15% Sodium Sulfate			
			0.90% Diphenylamine	POHC, App VIII	1,303 ppm	8,226 ppm
			0.65% Calcium Carbonate			
	Incendiary Mix	21 gr	50.0% Barium Nitrate	EP Toxicity (D005), App VIII		
			47.5% Magnesium			
			2.5% Aluminum			

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.45 Caliber Ball M1911 DOT Class - C Total Weight 331 gr PEP Weight 7.7 gr	Primer Fed 210	2.7 gr	40% Lead Styphnate 5% Tetracene 45% Barium Nitrate 10% Antimony Sulfide	EP Toxicity (D008), App VIII, POHC, D003 D003 EP Toxicity (D005), App VIII App VIII	3,263 ppm	140,260 ppm
	Propellant Single Base	5.0 gr	98.3% Nitrocellulose 0.7% Diphenylamine 1.0% Potassium Sulfate	D003 App VIII, POHC	106 ppm	4,545 ppm
	OR	OR	OR			
	Double Base	5.0 gr	82% Nitrocellulose 15% Nitroglycerin 0.75% Diphenylamine 1.5% Barium Nitrate 0.5% Potassium Nitrate 0.25% Graphite	D003 D003, App VIII, POHC POHC, App VIII EP Toxicity (D005), App VIII	2,266 ppm 113 ppm	97,403 ppm 4,870 ppm

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
M605, Fuze, Mine Combination DOT Class - C Total Weight Assume 680 gr PEP Weight 10.35 gr	Primer M42		53% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	272 ppm	17,923 ppm
	PA No. 100 Priming Mix	0.35 gr	22% Barium Nitrate 10% Aluminum Powder (Atomized) 10% Antimony Sulfide 5% Tetracene	EP Toxicity (D005), App VIII App VIII D003		
	Igniter Flash	10 gr	Black Powder	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 72 MODS 1-13, Fuze VT DOT Class Total Weight 19,995 gr PEP Weight 399.4 gr	Primer MK 121 MOD 0	0.77 gr	Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	39 ppm	1,928 ppm
		1.39 gr	75% DDNP 25% Potassium Chlorate	D003 *	5 ppm(Cl-)	252 ppm(Cl-)
	Detonator MK 54 MOD 0	4.70	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Booster MK 30 MOD 0	4.74 gr	Tetryl	D003		
	Lead	385 gr	Tetryl	D003		
	Auxiliary Detonator MK 44					
	Lead Azide Priming Mix	0.69 gr	Assume: 33.4% Potassium Chlorate 33.3% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum	* App VIII EP Toxicity (D008), App VIII, D003	3 ppm(Cl-)	167 ppm(Cl-)
		1.69 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		0.46 gr	Tetryl	D003		

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 52 MOD 3, Fuze Auxiliary Detonator	Detonator MK 37 MOD 0	1.60 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
DOT Class ___		0.46 gr	Tetryl	D003		
Total Weight 3,496 gr	Booster	385 gr	Tetryl	D003		
PEP Weight 387.1 gr	Lead		Tetryl	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 91 MOD 1, Fuze VT DOT Class ___ Total Weight 34,259 gr PEP Weight 456.81 gr	Primer MK 63 MOD 0	1.23 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		0.62 gr	PETN	D003		
	Detonator MK7 MOD 0 Primer MK 126 MOD 0 NOL No. 60 Mix	0.54 gr	60% Lead Styphnate	EP Toxicity (D008), App VIII. POHC, D003	10 ppm	709 ppm
			25% Barium Nitrate	EP Toxicity (D005), App VIII		
			10% Antimony Sulfide	App VIII		
			5% Tetracene	D003		
		64.68 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Booster MK 30 MOD 0 Lead Assembly	4.74 gr	Tetryl	D003		
		385 gr	Tetryl	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
M519, Fuze Point Detonating DOT Class ___ Total Weight 8,740 gr PEP Weight _____	Detonator M44 AN No. 6 Priming Mix	0.91 gr	33.4% Potassium Chlorate 33.3% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum	* App VIII EP Toxicity (D008), App VIII, D003	10 ppm(Cl^-)	
		2.85 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		1.60 gr	Tetryl	D003		
	Booster	-----	Tetryl	D003		

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
M51A5, Fuze Point Detonating DOT Class A or C* Total Weight	Detonator M24 AN No. 6 Priming Mix	1.05 gr	33.4% Potassium Chlorate 33.3% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum	** App VIII EP Toxicity (D008), App VIII, D003		288 ppm(Cl^-)
PEP Weight 352.76 gr		2.85 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Booster M21A4 Detonator M17	3.86 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		345 gr	Tetryl	D003		

* Class A if shipped in a wirebound crate; Class C if shipped in a wooden box.
** Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 52 MOD 0, Fuze Auxiliary Detonating DOT Class ____ Total Weight 3,496 gr PEP Weight 387 gr	Detonator MK 37 MOD 0	1.60 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		0.46 gr	Tetryl	D003		
	Booster	385.0 gr	Tetryl	D003		
	Lead	-----	Tetryl	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Detonator MK 29 MOD 0 DOT Class ___ Total Weight _____ PEP Weight 2.46 gr		2.46 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Booster M21A4 DOT Class - A Total Weight	Detonator M17	3.86 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
PEP Weight 348.86 gr		345 gr	Tetryl	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 30 MOD 0-3, Fuze Point Detonating DOT Class - C Total Weight 9,648 gr PEP Weight* 11.26 gr or 10.48 gr	Detonator MK 25 MOD 0 Lead Azide Mix	1.00 gr	33.4% Potassium Chlorate 33.3% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum	** App VIII EP Toxicity (D008), App VIII, D003	10 ppm(Cl^-)	9,242 ppm(Cl^-)
		3.10 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Relay Detonator MK 29 MOD 0	2.46 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Auxiliary Detonator MK 54 - 3"	4.70 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	OR	OR				
	MK 43 - 5", 6"	0.80 gr	33.4% Potassium Chlorate 33.3% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum	** App VIII EP Toxicity (D008), App VIII, D003	8 ppm(Cl^-)	7,394 ppm(Cl^-)
		1.69 gr	Lead Azide	EP Toxicity (D008), App VIII D003		
		1.43 gr	Tetryl	D003		

* PEP weight is dependent of the detonator used.
** Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 30 MOD 5 Fuze, Point Detonating DOT Class - C Total Weight 9,648 gr PEP Weight* 10.48 gr or 11.26 gr	Detonator MK 25 MOD 0 Lead Azide Mix	1.00 gr	28.3% Lead Azide 33.4% Potassium Chlorate 33.3% Antimony Sulfide 5.0% Carborundum	EP Toxicity (D008), App VIII, D003 ** App VIII	10 ppm(Cl^-)	9,242 ppm(Cl^-)
		3.10 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Relay Detonator MK 29 MOD 0	2.46 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Auxiliary Detonator MK 54 (3")	4.70 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	OR	OR				
	MK 43 (5", 6") Lead Azide Priming Mix	0.80 gr	33.4% Potassium Chlorate 33.3% Antimony Sulfide 28.3% Lead Azide 5.0% Carborundum	** App VIII EP Toxicity (D008), App VIII, D003	8 ppm(Cl^-)	7,394 ppm(Cl^-)
		1.69 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		1.43 gr	Tetryl	D003		

* PEP weight is dependent on the detonator used.
** Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 50 MOD 0-8, Fuze Mechanical Time	Primer MK 104 MOD 0	1.39 gr	75% DDNP 25% Potassium Chlorate	D003 *	6 ppm(Cl^-)	
DOT Class - C Total Weight 15,941 gr PEP Weight _____		0.77 gr	Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	48 ppm	
	Booster	-----	Black Powder	D003		
	Auxiliary Detonator MK 54	4.70 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 29 MOD 3, Fuze, Point Detonating DOT Class - C Total Weight 10,138 gr PEP Weight* 10.48 gr or 11.26 gr	Detonator MK 25 MOD 0	3.10 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Lead Azide Mix	1.00 gr	33.4% Potassium Chlorate	**	10 ppm(Cl-)	9,242 ppm(Cl-)
			33.3% Antimony Sulfide	App VIII		
			28.3% Lead Azide	EP Toxicity (D008), App VIII, D003		
			5.0% Carborundum			
	Relay Detonator MK 29 MOD 0	2.46 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Auxiliary Detonator MK 54, 5-6"	4.70 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	OR	OR				
	MK 43, 8" - Up Lead Azide	1.69 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Priming Mix	0.80 gr	33.4% Potassium Chlorate	**	8 ppm(Cl-)	7,394 ppm(Cl-)
			33.3% Antimony Sulfide	App VIII		
			28.3% Lead Azide	EP Toxicity (D008), App VIII, D003		
			5.0% Carborundum			
		1.43 gr	Tetryl	D003		

* PEP weight is dependent on the detonator used.
** Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 54 MOD 0-2, Fuze Auxiliary Detonating	Detonator MK 28 MOD 0	7.08 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
DOT Class _____		0.46 gr	Tetryl	D003		
Total Weight 5,313 gr	Booster	-----	Tetryl	D003		
PEP Weight _____	Lead	-----	Tetryl	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 74 MOD 0&1, Fuze, VT DOT Class ____ Total Weight 33,560 gr PEP Weight 9.75 gr	Primer MK 121 MOD 0	1.39 gr	75% DDNP 25% Potassium Chlorate	D003	3 ppm(Cl^-)	10,336 ppm(Cl^-)
		0.77 gr	Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	23 ppm	78,974 ppm
	Detonator MK 54 MOD 0	4.70 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Auxiliary Detonator MK 44 MOD 1 NOL No. 130 Mix	0.86 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	10 ppm	35,282 ppm
			20% Barium Nitrate	EP Toxicity (D005), App VIII		
			20% Lead Azide	EP Toxicity (D008), App VIII, D003		
			15% Antimony Sulfide	App VIII		
			5% Tetracene	D003		
		1.54 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		0.49 gr	Tetryl	D003		

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 43 MOD 0, Fuze Auxiliary Detonating	Detonator MK 28 MOD 0	7.08 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
DOT Class _____		0.46 gr	Tetryl	D003		
Total Weight 6,433 gr	Booster	-----	Tetryl	D003		
PEP Weight _____	Lead	-----	Tetryl	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 31, MOD 2, Fuze Base Detonating DOT Class _____ Total Weight 11,046 gr PEP Weight 54.3 gr	Primer MK 102 MOD 3 NOL No. 130 Mix	0.97 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	35 ppm	7,146 ppm
			20% Barium Nitrate	EP Toxicity (D005), App VIII		
			20% Lead Azide	EP Toxicity (D008), App VIII, D003		
			15% Antimony Sulfide	App VIII		
			5% Tetracene	D003		
	Detonator MK 33 MOD 0	3.70 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Booster	49.28 gr	Tetryl	D003		
	Secondary Primer MK 101 MOD 3 NOL No. 6 Mix	0.35 gr	60% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	19 ppm	3,867 ppm
			25% Barium Nitrate	EP Toxicity (D005), App VIII		
			10% Antimony Sulfide	App VIII		
			5% Tetracene	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 20 MOD 2, Fuze Base Detonating DOT Class ____ Total Weight 15,241 gr PEP Weight _____	Primer MK 102 MOD 1 NOL No. 130 Mix	0.97 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	25 ppm	
			20% Barium Nitrate	EP Toxicity (D005), App VIII		
			20% Lead Azide	EP Toxicity (D008), App VIII, D003		
			15% Antimony Sulfide	App VIII		
			5% Tetracene	D003		
	Detonator MK 33 MOD 0	3.70 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Booster	-----	Tetryl	D003		
	Lead	-----	Tetryl	D003		
	Delay	-----	Black Powder	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 21 MOD 1, Fuze Base Detonating DOT Class _____ Total Weight 15,312 gr PEP Weight _____	Primer MK 102 MOD 1 NOL No. 130 Mix	0.97 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	25 ppm	
			20% Barium Nitrate	EP Toxicity (D005), App VIII		
			20% Lead Azide	EP Toxicity (D008), App VIII, D003		
			15% Antimony Sulfide	App VIII		
			5% Tetracene	D003		
	Detonator MK 33 MOD 0	3.70 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Booster	-----	Tetryl	D003		
	Delay	-----	Black Powder	D003		
	Lead	-----	Tetryl	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK 61 MOD 0, Fuze Mechanical Time DOT Class - C Total Weight 15,941 gr PEP Weight	Primer MK 104 MOD 0 Winchester No. 329 Alt. FA No 70	0.43 gr	53.0% Potassium Chlorate 25.0% Lead Sulfocyanate 17.0% Antimony Sulfide 5.0% TNT	* EP Toxicity (D008), App VIII, POHC App VIII D003	4 ppm(Cl-) 7 ppm	
	Booster	-----	Black Powder	D003		
	Auxiliary Detonator MK 54	4.70 gr	Lead Azide	EP Toxicity (D008), App VIII D003		

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Detonator MK 35 MOD 3 DOT Class ____ Total Weight	Ignition Charge (NIS)	0.04 gr				
PEP Weight	Flash Charge	3.39 gr	72.7% Lead Oxide	EP Toxicity (D008), App VIII		
			18.5% Lead	EP Toxicity (D008), App VIII		
			6.5% Selenium	App VIII		
			2.3% Boron			
	Delay Mixture	*	Barium Peroxide	EP Toxicity (D005), App VIII		
			Selenium	App VIII		
			Talc			
		5.39 gr	DDNP	D003		
		11.09 gr	PETN	D003		

* Adjusted to give desired delay time

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Detonator MK 59 MOD 0 DOT Class _____ Total Weight _____ PEP Weight 2.71 gr		0.92 gr	Tetryl	D003		
		1.79 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Squib MK1 MOD 0						
XC9		0.08 gr	75% DDNP	D003		
DOT Class - C			25% Potassium Chlorate	*		3,946 ppm(Cl^-)
Total Weight						
		1.39 gr	Black Powder	D003		
PEP Weight 1.47 gr						

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
MK1 MOD 0, Fuzing System Bomb DOT Class _____ Total Weight _____ PEP Weight _____	Detonator MK 95 MOD 0 (STAB)					
	NOL No. 130 Mix		40% Lead Styphnate	EP Toxicity (D008), App VIII POHC, D003		
			20% Barium Nitrate	EP Toxicity (D005), App VIII		
			20% Lead Azide	EP Toxicity (D008), App VIII, D003		
			15% Antimony Sulfide	App VIII		
			5% Tetracene	D003		
		0.95 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		0.29 gr	RDX	D003		
	OR	OR				
	MK 96 MOD 0 (Electric)	0.08 gr	Colloidal Lead Azide	EP Toxicity (D008), App VIII, D003		
		1.00 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		1.00 gr	PETN	D003		
	Lead		Tetryl	D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
M9, Delay DOT Class - C Total Weight		1.08 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Delay Composition	*	52.3% Barium Chromate 25.7% Zirconium Nickel Alloy	EP Toxicity (D005), App VIII		
PEP Weight			12.3% Potassium Perchlorate 9.7% Rareox	**		

* Adjusted to give desired delay time.
** Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
M116, Fuze Bomb DOT Class ____ Total Weight 20,276 gr PEP Weight 12.32 gr	Primer-Detonator M16A1 Primer (M39A1)	6.16 gr	38% Lead Thiocyanate 37.0% Potassium Chlorate 10.5% Ground Glass 8.7% Barium Nitrate 5.8% TNT	EP Toxicity (D008), App VIII, POHC * EP Toxicity (D005), App VIII D003	115 ppm 33 ppm(Cl^-)	190,000 ppm 53,650 ppm(Cl^-)
	Relay M5	1.39 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Detonator M17	3.54 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		1.23 gr	Tetryl	D003		

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Booster MK 39 MOD 0 DOT Class - A Total Weight		415.8 gr	Tetryl	D003		
PEP Weight 415.8 gr						

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
7.62 mm Tracer M62 DOT Class - C Total Weight 383 gr PEP Weight 54.1 gr	Primer FA34	0.60 gr	37% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	580 ppm	4,104 ppm
			4% Tetracene	D003		
			32% Barium Nitrate	EP Toxicity (D005), App VIII		
			15% Antimony Sulfide	App VIII		
			7% Aluminum			
			5% PETN	D003		
	Propellant Double Base	46 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	10,809 ppm	76,525 ppm
			0.15% Sodium Sulfate			
			0.90% Diphenylamine	POHC, App VIII	1,081 ppm	7,653 ppm
			0.65% Calcium Carbonate			
	Tracer R-284	6.5 gr	17% Polyvinyl Chloride	*	1,645 ppm(Cl^-)	11,642 ppm(Cl^-)
			55% Strontium Nitrate			
			28% Magnesium Powder			
	Igniter I-136	1.0 gr	10% Calcium Resinate			
			90% Strontium Peroxide			
	OR	OR	OR			
	I-280	1.0 gr	15% Magnesium Powder			
			8.5% Calcium Resinate			
			76.5% Strontium Peroxide			

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.22 Caliber, Ball, Long Rifle M24 DOT Class - C Total Weight 53 gr PEP Weight 2.74 gr	Primer	0.24 gr	Commercial Rimfire			
	Propellant	2.5 gr	98.5% Nitrocellulose 0.7% Diphenylamine 0.65% Calcium Carbonate 0.15% Sodium Sulfate	D003 App VIII, POHC	330 ppm	6,387 ppm

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
5.56 mm Grenade M195 DOT Class - C Total Weight 126 gr PEP Weight 25.6 gr	Primer	Assume 0.6 gr	Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	1,905 ppm*	9,375 ppm*
			Tetracene	D003		
			Barium Nitrate	EP Toxicity (D005), App VIII		
			PETN	D003		
			Antimony Sulfide	App VIII		
	Propellant Single Base	25.0 gr	98.3% Nitrocellulose 0.7% Diphenylamine 1.0% Potassium Sulfate	D003 POHC, App VIII	1,389 ppm	6,386 ppm

* Assuming that the primer mix is 40% lead styphnate.

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
7.62 mm Blank DOT Class - C Total Weight 235 gr PEP Weight* 15.1 gr or 18.1 gr	Primer FA34	0.60 gr	37% Lead Styphnate 4% Tetracene 32% Barium Nitrate 15% Antimony Sulfide 7% Aluminum 5% PETN	EP Toxicity (D008), App VIII, POHC, D003 D003 EP Toxicity (D005), App VIII, App VIII D003	945 ppm	14,702 ppm
	OR	OR	OR			
	FA43	0.58 gr				
	Propellant Single Base	17.5 gr	98.3% Nitrocellulose 1.0% Potassium Sulfate 0.7% Diphenylamine	D003 POHC, App VIII	521 ppm	6,768 ppm
	OR	OR	OR			
	Double Base	14.5 gr	82.0% Nitrocellulose 15.0% Nitroglycerin 0.75% Diphenylamine 1.5% Barium Nitrate 0.5% Potassium Nitrate 0.25% Graphite	D003 D003, App VIII, POHC POHC, App VIII EP Toxicity (D005), App VIII	9,255 ppm 463 ppm	144,040 ppm 7,202 ppm
	OR	OR	OR			
	Double Base	14.5 gr	89.3% Nitrocellulose 9.0% Nitroglycerin 0.15% Sodium Sulfate 0.90% Diphenylamine 0.65% Calcium Carbonate	D003 D003, App VIII, POHC POHC, App VIII	5,553 ppm 555 ppm	86,424 ppm 8,642 ppm

* PEP weight is dependent on the propellant used.

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
7.62 mm Ball M80 DOT Class - C Total Weight 392 gr PEP Weight* 42.1 gr or 46.6 gr	Primer FA 34	0.60 gr	37% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	566 ppm	5,273 ppm
			4% Tetracene	D003		
			32% Barium Nitrate	EP Toxicity (D005), App VIII		
			15% Antimony Sulfide	App VIII		
			7% Aluminum			
			5% PETN	D003		
	Propellant Double Base	46.0 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	10,561 ppm	88,841 ppm
			0.15% Sodium Sulfate			
			0.90% Diphenylamine	POHC, App VIII	1,056 ppm	8,884 ppm
			0.65% Calcium Carbonate			
	OR	OR	OR			
	Single Base	41.5 gr	98.3% Nitrocellulose	D003		
			1.0% Potassium Sulfate			
			0.7% Diphenylamine	POHC, App VIII	741 ppm	6,900 ppm

* PEP weight is dependent on the propellant used.

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
5.56 mm Tracer M196 DOT Class - C Total Weight 177 gr PEP Weight 33.3 gr	Propellant Single Base	28.5 gr	98.3% Nitrocellulose 0.7% Diphenylamine 1.0% Potassium Sulfate	D003 POHC, App VIII	1,127 ppm	5,991 ppm
	Tracer Comp R-284	2.70 gr	17% Polyvinyl Chloride 55% Strontium Nitrate 28% Magnesium Powder	*	1,478 ppm(Cl^-)	7,857 ppm(Cl^-)
	Igniter Comp R-200	1.50 gr	65.65% Strontium Peroxide 3.4% Barium Peroxide 3.4% Lead Dioxide 6.0% Calcium Resinate 21.55% Magnesium Powder	EP Toxicity (D005), App VIII EP Toxicity (D008), App VIII		
	Primer	Assume: 0.6 gr	Assume: Lead Styphnate Tetracene Barium Nitrate Antimony Sulfide PETN	EP Toxicity (D008), App VIII, POHC, D003 D003 EP Toxicity (D005), App VIII App VIII D003	1,356 ppm**	7,207 ppm**

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].
** Assuming that the primer is 40% lead styphnate.

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.50 Caliber Spotter-Tracer M48A1 DOT Class - C Total Weight 1,744 gr PEP Weight 150.5 gr	Primer Fed 210	2.70 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	619 ppm	7,176 ppm
			5% Tetracene	D003		
			45% Barium Nitrate	EP Toxicity (D005), App VIII		
			10% Antimony Sulfide	App VIII		
	Nose Primer M26	1.79 gr	25% Lead Thiocyanate	EP Toxicity (D008), App VIII, POHC	257 ppm	2,973 ppm
			17% Antimony Sulfide	App VIII		
			53% Potassium Chlorate	*		
			5% TNT	D003	158 ppm(Cl-)	1,828 ppm(Cl-)
	Propellant Single Base	110 gr	98.3% Nitrocellulose	D003		
			1.0% Potassium Sulfate			
			0.7% Diphenylamine	POHC, App VIII		
	Tracer Comp R-256	4.0 gr	26.7% Strontium Peroxide		442 ppm	5,116 ppm
			5.0% Strontium Oxalate			
			8.3% Calcium Resinate			
			33.3% Strontium Nitrate			
			26.7% Magnesium Powder			
	OR	OR	OR			
	Comp R-284	5.0 gr	17% Polyvinyl Chloride	*	278 ppm(Cl-)	3,219 ppm(Cl-)
			55% Strontium Nitrate			
			28% Magnesium Powder			
	OR	OR	OR			
	Comp R-321	4.0 gr	16% Polyvinyl Chloride	*	209 ppm(Cl-)	2,424 ppm(Cl-)
			52% Strontium Nitrate			
			6% Parlon-Chlorinated Rubber	*	89 ppm(Cl-)	1,037 ppm(Cl-)
			26% Magnesium Powder			
	Incendiary Mix Comp IM-144	32 gr	50% Barium Nitrate	EP Toxicity (D005), App VIII		
			50% Red Phosphorus	D003		

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.50 Caliber Spotter-Tracer M48 DOT Class - C Total Weight 1,744 gr PEP Weight 133.5 gr	Primer Fed 210	2.70 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	619 ppm	8,090 ppm
			5% Tetracene	D003		
			45% Barium Nitrate	EP Toxicity (D005), App VIII		
			10% Antimony Sulfide	App VIII		
	Nose Primer	1.79 gr	25% Lead Thiocyanate	EP Toxicity (D008), App VIII POHC	257 ppm	3,352 ppm
			17% Antimony Sulfide	App VIII		
			53% Potassium Chlorate	*	158 ppm(Cl^-)	2,061 ppm(Cl^-)
			5% TNT	D003		
	Propellant Double Base	120 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	6,193 ppm	80,899 ppm
			0.15% Sodium Sulfate			
			0.9% Diphenylamine	POHC, App VIII	619 ppm	8,090 ppm
			0.65% Calcium Carbonate			
	Tracer Comp R-256	4.0 gr	26.7% Strontium Peroxide			
			5.0% Strontium Oxalate			
			8.3% Calcium Resinate			
			33.3% Strontium Nitrate			
			26.7% Magnesium Powder			
	OR	OR	OR			
	Comp R-284	5.0 gr	17% Polyvinyl Chloride	*	278 ppm(Cl^-)	3,629 ppm(Cl^-)
			55% Strontium Nitrate			
			28% Magnesium Powder			
	OR	OR	OR			
	Comp R-321	4.0 gr	16% Polyvinyl Chloride	*	209 ppm(Cl^-)	2,733 ppm(Cl^-)
			52% Strontium Nitrate			
			6% Parlon-Chlorinated Rubber	*	89 ppm(Cl^-)	1,169 ppm(Cl^-)
			26% Magnesium Powder			
	Igniter I-276	5.0 gr	83.98% Barium Peroxide	EP Toxicity (D005), App VIII		
			1.02% Zinc Stearate			
			15.0% Magnesium Powder			

* Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.50 Caliber Armor Piercing Incendiary, M8 DOT Class - C Total Weight 1,764 gr PEP Weight* 249.45 gr or 253.0 gr	Primer Fed 210	2.70 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII POHC, D003	612 ppm	4,330 ppm
			5% Tetracene	D003		
			45% Barium Nitrate	EP Toxicity (D005), App VIII		
			10% Antimony Sulfide	App VIII		
	Propellant Double Base	235 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	11,990 ppm	84,787 ppm
			0.15% Sodium Sulfate			
			0.90% Diphenylamine	POHC, App VIII	1,199 ppm	8,479 ppm
			0.65% Calcium Carbonate			
	OR	OR	OR			
	Single Base	235 gr	98.3% Nitrocellulose	D003		
			0.7% Diphenylamine	POHC, App VIII	933 ppm	6,595 ppm
			1.0% Potassium Sulfate			
	Incendiary IM-11	15.3 gr	50% Barium Nitrate	EP Toxicity (D005), App VIII		
			47.5% Magnesium			
			2.5% Aluminum			
	OR	OR	OR			
	IM-161	11.75 gr				

* PEP weight is dependent on the incendiary used.

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.30 Caliber Carbine Tracer M27 DOT Class - C Total Weight 191 gr PEP Weight 22.2 gr	Primer Fed 210	2.7 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	5,654 ppm	48,649 ppm
			5% Tetracene	D003		
			45% Barium Nitrate	EP Toxicity (D005), App VIII		
			10% Antimony Sulfide	App VIII		
	Propellant Double Base	13.0 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	6,126 ppm	52,703 ppm
			0.15% Sodium Sulfate			
			0.90% Diphenylamine	POHC, App VIII	613 ppm	5,270 ppm
			0.65% Calcium Carbonate			
	Tracer Comp R-256	5.5 gr	26.7% Strontium Peroxide			
			5.0% Strontium Oxalate			
			8.3% Calcium Resinate			
			33.3% Strontium Nitrate			
			26.7% Magnesium Powder			
	Igniter Comp I-276	1.0 gr	83.98% Barium Peroxide	EP Toxicity (D005), App VIII		
			1.02% Zinc Stearate			
			15.00% Magnesium Powder			
	OR	OR	OR			
	Comp I-285	1.0 gr	15.0% Magnesium Powder			
			76.5% Strontium Peroxide			
			8.5% Calcium Resinate			

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.30 Caliber Blank M1909 DOT Class - C Total Weight 218 gr PEP Weight 12.6 gr	Primer FA 34	0.60 gr	37% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	1,018 ppm	17,619 ppm
			4% Tetracene	D003		
			32% Barium Nitrate	EP Toxicity (D005), App VIII		
			15% Antimony Sulfide	App VIII		
			7% Aluminum			
			5% PETN	D003		
	OR	OR	OR			
	FA 36	0.60 gr	36% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	991 ppm	17,143 ppm
			3% Tetracene	D003		
			29% Barium Nitrate	EP Toxicity (D005), App VIII		
			9% Lead Peroxide	EP Toxicity (D008), App VIII		
			9% Antimony Sulfide	App VIII		
			9% ZIR (Zirconium)			
			5% PETN	D003		
	Propellant Double Base	12.0 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	4,954 ppm	85,714 ppm
			0.15% Sodium Sulfate			
			0.90% Diphenylamine	POHC, App VIII	495 ppm	8,571 ppm
			0.65% Calcium Carbonate			
	OR	OR	OR			
	Single Base	12.0 gr	98.3% Nitrocellulose	D003		
			0.7% Diphenylamine	POHC, App VIII	385 ppm	6,667 ppm
			1.0% Potassium Sulfate			

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.30 Caliber Carbine Ball M1 DOT Class - C Total Weight 196 gr PEP Weight 15.7 gr	Primer Fed 210	2.70 gr	40% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	5,510 ppm	68,790 ppm
			5% Tetracene	D003		
			45% Barium Nitrate	EP Toxicity (D005), App VIII		
			10% Antimony Sulfide	App VIII		
	Propellant Double Base	13 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII. POHC	5,969 ppm	74,522 ppm
			0.15% Sodium Sulfate			
			0.65% Calcium Carbonate			
			0.90% Diphenylamine	POHC, App VIII	597 ppm	7,452 ppm

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.30 Caliber Armor Piercing M2 DOT Class - C Total Weight 424 gr PEP Weight 55.6 gr	Primer FA34	0.60 gr	37% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	524 ppm	3,993 ppm
			4% Tetracene	D003		
			32% Barium Nitrate	EP Toxicity (D005), App VIII		
			15% Antimony Sulfide	App VIII		
			5% PETN	D003		
			7% Aluminum			
	OR	OR	OR			
	Primer FA36	0.60 gr	36% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003	509 ppm	3,885 ppm
			3% Tetracene	D003		
			29% Barium Nitrate	EP Toxicity (D005), App VIII		
			9% Lead Peroxide	EP Toxicity (D008), App VIII		
			9% ZIR (Zirconium)			
			9% Antimony Sulfide	App VIII		
			5% PETN	D003		
	Propellant Double Base	55 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	11,675 ppm	89,029 ppm
			0.15% Sodium Sulfate			
			0.90% Diphenylamine	POHC, App VIII	1,168 ppm	8,903 ppm
			0.65% Calcium Carbonate			
	OR	OR	OR			
	Single Base	55 gr	98.3% Nitrocellulose	D003		
			0.7% Diphenylamine	POHC, App VIII	908 ppm	6,925 ppm
			1.0% Potassium Sulfate			

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
20 mm High Explosive M97A2 DOT Class - A Total Weight 4.000 gr PEP Weight 809.95 gr	Primer M52A3B1 Mix FA874	3.0 gr	42.8% Barium Nitrate	EP Toxicity (D005), App VIII		
			40.2% Lead Styphnate	EP Toxicity (D008), App VIII, POHC, D003		
			15.4% Calcium Silicide			
			1.0% Gum Arabic			
			0.6% Acetylene Black			
	Propellant Double Base	508 gr	89.3% Nitrocellulose	D003		
			9.0% Nitroglycerin	D003, App VIII, POHC	11,430 ppm	56,448 ppm
			0.15% Sodium Sulfate			
			0.90% Diphenylamine	POHC, App VIII	1,143 ppm	5,645 ppm
			0.65% Calcium Carbonate			
	Fuze M503A2 PD	1.62 gr	53% Potassium Chlorate	*		
			17% Antimony Sulfide	App VIII		
			25% Lead Sulfocyanate	EP Toxicity (D008), App VIII, POHC	101 ppm	500 ppm
			5% Lead Azide	EP Toxicity (D008), App VIII, D003		
	Detonator M42	3.85 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
		3.23 gr	Tetryl	D003		
	Lead	3.01 gr	Tetryl	D003		
	Booster	167.24 gr	Tetryl	D003		
	High Explosive Incendiary H-781	120 gr	64% Comp A4	D003		
			35% Aluminum Powder			
			1% Graphite			

* Control of HCl emissions upon incineration may be required [20 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
20 mm Armor Piercing Tracer M95 DOT Class - C Total Weight 3,990 gr PEP Weight 494.6 gr	Primer M52A3B1 Mix FA874	3.0 gr	42.8% Barium Nitrate 40.2% Lead Styphnate 15.4% Calcium Silicide 1.0% Gum Arabic 0.6% Acetylene Black	EP Toxicity (D005), App VIII EP Toxicity (D008), App VIII, POHC, D003		
	Propellant Double Base	470 gr	89.3% Nitrocellulose 9.0% Nitroglycerin 0.15% Sodium Sulfate 0.90% Diphenylamine 0.65% Calcium Carbonate	D003 D003, App VIII, POHC POHC, App VIII	10,602 ppm 1,060 ppm	85,524 ppm 8,552 ppm
	Ignitor I-527	6.17 gr				
	Tracer R-322	15.43 gr				

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Ignition Cartridge M2	M9 Propellant	120 gr	57.75% Nitrocellulose	D003		
DOT Class - C			40.00% Nitroglycerin	D003, App VIII, POHC		
Total Weight			1.50% Potassium Nitrate			400,000 ppm
PEP Weight			0.75% Diphenylamine	POHC, App VIII		
120 gr						7,500 ppm

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Booster M21A4 DOT Class - A Total Weight 5.104 gr PEP Weight 348.9 gr		345 gr	Tetryl	D003		
		3.86 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.38 Caliber Ball M41 DOT Class - C Total Weight 203 gr PEP Weight* 4.38 gr or 5.18 gr	Primer K-75	0.38 gr	40% Lead Styphnate 5% Tetracene 45% Barium Nitrate 10% Antimony Sulfide	EP Toxicity (D008), App VIII, POHC, D003 D003 EP Toxicity (D005), App VIII App VIII	749 ppm	34,703 ppm
	Propellant Single Base	4.8 gr	98.3% Nitrocellulose 0.7% Diphenylamine 1.0% Potassium Sulfate	D003 POHC, App VIII	166 ppm	6,486 ppm
	OR	OR	OR			
	Double Base	4.0 gr	77.0% Nitrocellulose 20.0% Nitroglycerin 0.75% Diphenylamine 1.5% Barium Nitrate 0.5% Potassium Nitrate 0.25% Graphite	D003 D003, App VIII, POHC POHC, App VIII EP Toxicity (D005), App VIII	3,941 ppm 148 ppm	182,648 ppm 6,849 ppm

* PEP weight is dependent on the propellant used.

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
Fuze M78	M17	1.23 gr	Tetryl	D003		
DOT Class - C or A*		3.54 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
Total Weight	M1 Delay	0.65 gr	Black Powder	D003		
PEP Weight 356 gr		0.17 gr	25% Lead Thiocyanate 17% Antimony Sulfide 53% Potassium Chlorate 5% TNT	EP Toxicity (D005), App VIII, POHC App VIII * D003		119 ppm 73 ppm
	M7 Relay	1.54 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		
	Booster M21A4	345 gr	Tetryl	D003		
	OR M125	3.86 gr	Lead Azide	EP Toxicity (D008), App VIII, D003		

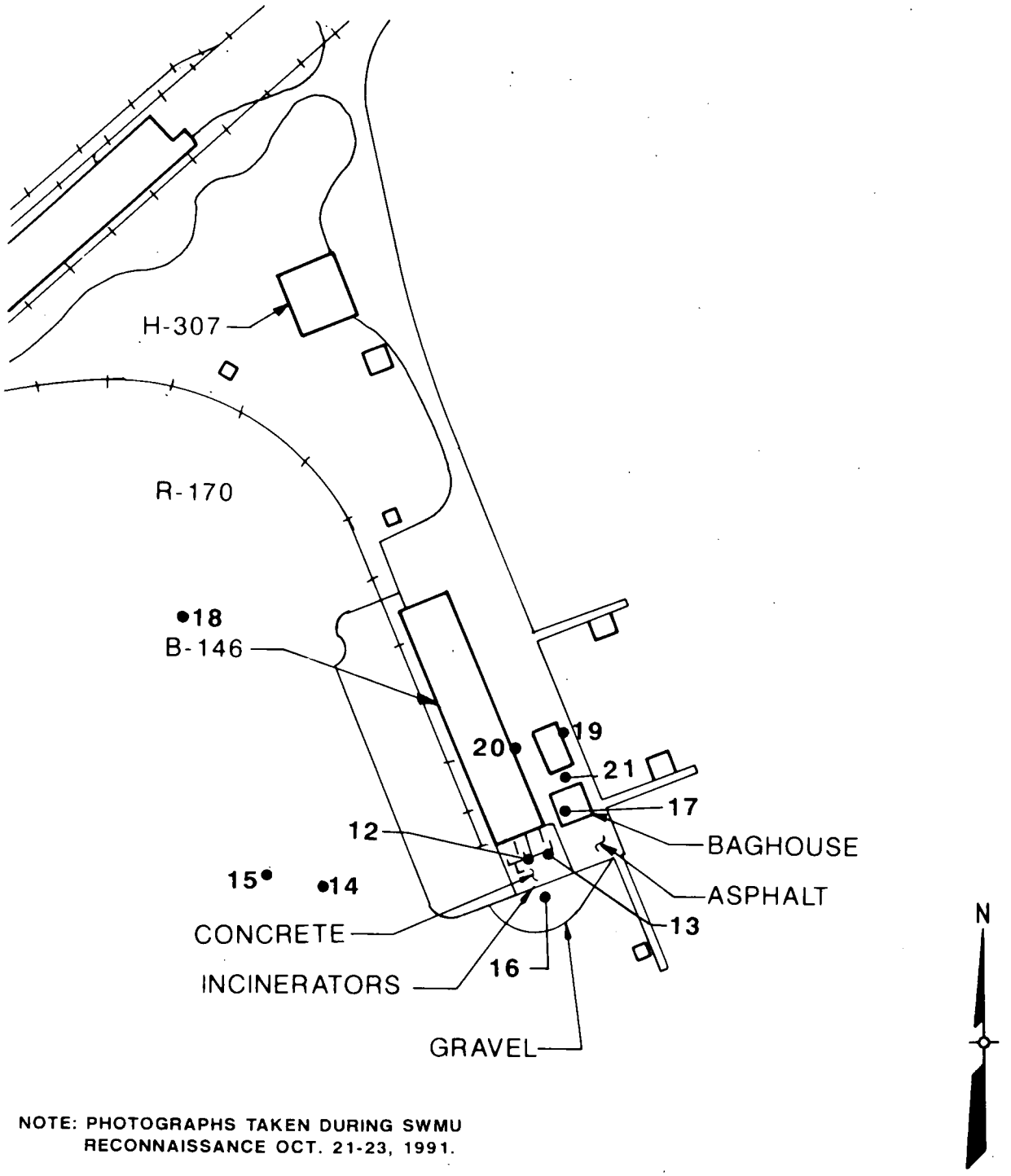
* Class C if shipped in a wooden box; Class A if shipped in a wirebound crate.
** Control of HCl emissions upon incineration may be required [40 CFR 264.343(b)].

CRANE ARMY AMMUNITION ACTIVITY

MUNITION	COMPONENT	WEIGHT	COMPOSITION	RCRA REQUIREMENTS	FRACTION OF TOTAL WEIGHT	FRACTION OF PEP WEIGHT
.30 Caliber Ball Match M72 DOT Class - C Total Weight 425 gr PEP Weight 50.6 gr	Primer FA34	0.60 gr	37% Lead Styphnate 4% Tetracene 32% Barium Nitrate 15% Antimony Sulfide 7% Aluminum 5% PETN	EP Toxicity (D008), App VIII, POHC, D003 D003 EP Toxicity (D005), App VIII App VIII D003	522 ppm	4,387 ppm
	OR	OR	OR			
	FA36	0.60 gr	36% Lead Styphnate 3% Tetracene 29% Barium Nitrate 9% Lead Peroxide 9% ZIR (Zirconium) 9% Antimony Sulfide 5% PETN	EP Toxicity (D008), App VIII, POHC, D003 D003 EP Toxicity (D005), App VIII EP Toxicity (D008), App VIII App VIII D003	508 ppm	4,269 ppm
	Propellant Single Base	50.0 gr	98.3% Nitrocellulose 0.7% Diphenylamine 1.0% Potassium Sulfate	D003 POHC, App VIII	824 ppm	6,917 ppm

APPENDIX Q

PHOTOGRAPH LOG - SWMU #16/16



NOTE: PHOTOGRAPHS TAKEN DURING SWMU RECONNAISSANCE OCT. 21-23, 1991.

●14 = APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER

APPROXIMATE SCALE: 1" = 400'

SOURCE: FIGURE B-4, SITE PLAN, CENTRAL STORAGE FACILITY; INCINERATORS, 1984

NOVEMBER 1992

FIGURE Q-1

SWMU #16/16 : PHOTOGRAPH INDEX MAP

ENVIRONMENTAL MONITORING REPORT
NAVSURFWARCENDIV
CRANE, INDIANA

20602

Donohue ENGINEERS ARCHITECTS SCIENTISTS

L-10975

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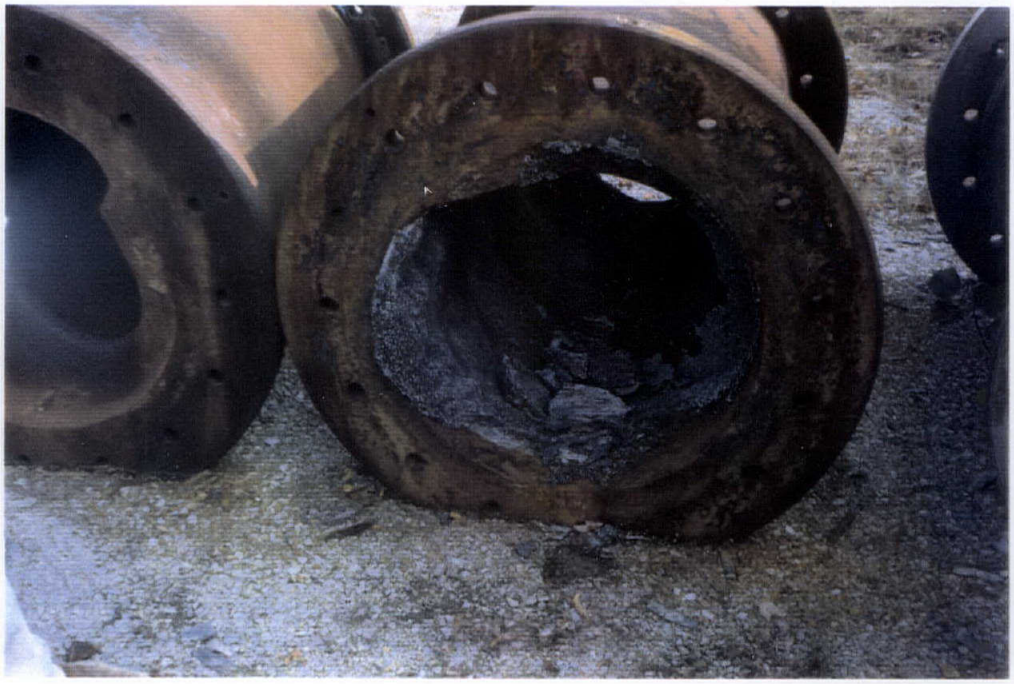

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