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Final Report: RCRA Facility Investigation, Part 2 Phase III Soils Study, Ammunition Burning Ground, SWMU 03/10, Naval Surface Warfare Center Crane, Indiana

by *Paul Albertson, James H. May, WES*
John Stephen Nohrstedt, Robert W. Magee, Phil Payonk, Wilmington District

WES

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by Paul Albertson, James H. May

U.S. Army Corps of Engineers
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

John Stephen Nohrstedt, Robert W. Magee, Phil Payonk

U.S. Army Engineer District, Wilmington
69 Darlington Avenue
Wilmington, NC 28403

Final report

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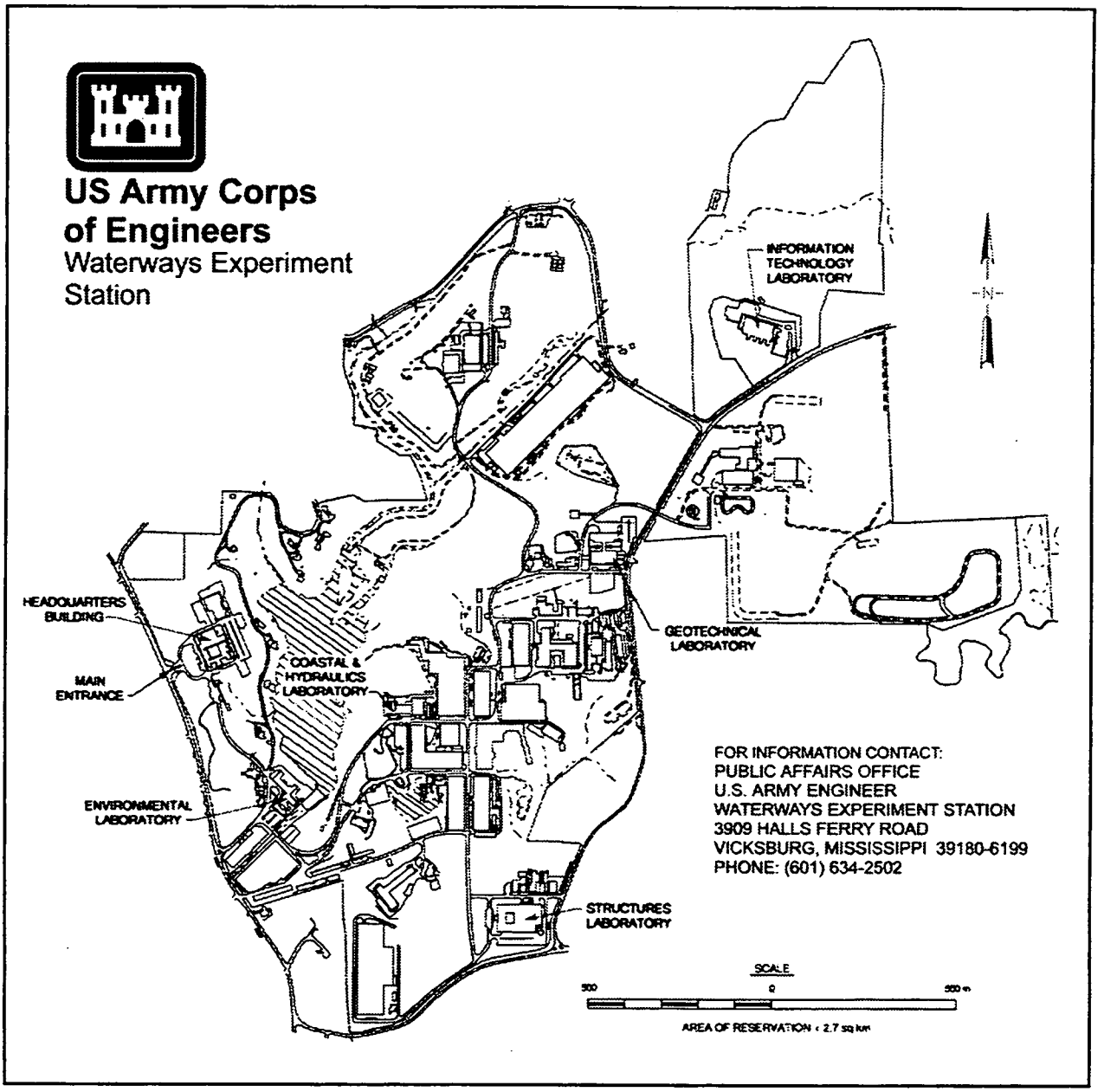

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Contents

Preface vi

Executive Summary vii

Acronyms and Abbreviations ix

Conversion Factors, Non-SI to SI Units of Measurement xi

1—Introduction 1

Objectives of the Investigation 1
Site Location and Description 1
Facility History 1
Site Setting 4

2—Study History 7

Regulatory Status 7
Previous Studies 8

3—Physical Characteristics of the Study Area 19

Physiography 19
Geology 19
Soils 20
Hydrogeology 20

4—Site Investigation 36

Field Work 36
Approach 36
Survey and geophysical investigation 36
Surface soil sampling 37
Soil borings and subsurface soil sampling 37
Laboratory Analyses 38
Physical analyses of soil sample 38
Chemical analyses 38
Chemical data quality control 38

5—Results of Investigation 42

Physical Characteristics of Soils 42
Chemical Analyses of Surface Soils 42
Introduction 42
Volatile organic analytes (VOAs) 42

Explosives 47
Polycyclic aromatic hydrocarbons (PAHs) 48
Metals and inorganics 48
Chemical Analyses of Subsurface Soils 50
Introduction 50
Volatile organic analytes (VOAs) 50
Explosives 54
Polycyclic aromatic hydrocarbons (PAHs) 55
Metals and inorganics 56
Summary of Analytical Results and Estimate of Extent of Contamination 57
Volatile organic analytes (VOAs) 57
Explosives 57
Polycyclic aromatic hydrocarbons (PAHs) 58
Metals and inorganics 58
Estimate of extent of explosives and metals contaminants 58

6—Conclusions 68

Releases at ABG 68
Extent of Releases at ABG 68

7—Recommendations 69

References 70

Appendix A: Tables A1

Appendix B: Boring Logs B1

Appendix C: Physical Analyses of Soil C1

Appendix D: Chain of Custody Forms D1

Appendix E: Data Validation Report E1

List of Figures

Figure 1. Location map for NSWC crane 2

Figure 2. Site map ammunition burning ground NSWC crane 3

Figure 3. Locations of the open burning/thermal treatment units. 5

Figure 4. Well/boring locations, previous studies 13

Figure 5. Well/boring locations previous studies 15

Figure 6. Site geologic map 17

Figure 7. Site plan of geologic sections 21

Figure 8. Geologic Section A-A' 23

Figure 9. Geologic Section B-B' 25

Figure 10. Geologic Sections C-C' and D-D' 27

Figure 11. Geologic Section E-E' 29

Figure 12. Geologic Section F-F' 31
Figure 13. Soil thickness map 33
Figure 14. USGS soil classification 35
Figure 15. Borings and surface sample locations 39
Figure 16. Depth of soil samples 43
Figure 17. Surface sample locations 45
Figure 18. Boring locations 51
Figure 19. Sample locations for 1990 and 1993 soil sampling 59
Figure 20. Contaminated area (total explosives) 0 in.-30 in. deep 61
Figure 21. Contaminated area (explosives and metals) 30 in.-90 in. deep 63
Figure 22. Contaminated area (metals) 0 in.-30 in. deep 64
Figure 23. Extent of contamination 0 in.-30 in. deep 65
Figure 24. Extent of contamination 30 in.-90 in. deep 66

Preface

A Resource Conservation and Recovery Act Facility Investigation, Phase III Soils Study was conducted at the Ammunition Burning Ground Site, Naval Surface Warfare Center Crane (NSWCC), Indiana, by personnel of the Geotechnical Laboratory (GL), U.S. Army Engineer Waterways Experiment Station (WES), and the U.S. Army Engineer District, Wilmington (CESAW). The field work was done in August 1993. The data reduction, draft report preparation, and final editing were conducted between September 1993 and July 1998.

The primary author of this report was Mr. Paul Albertson, WES. Contributing authors were Mr. Stephen Nohrstedt, Ms. Zainul Kidwai, Messrs. Phil Payonk, and Frank Yelverton, CESAW, and Dr. James May, WES. Also contributing to the report were Mses. Benita Abraham and Evelyn Villanueva, and Mr. Bennie Washington, WES. Ms. Adrienne Wilson, Naval Facilities Engineering Command, provided oversight, and Mr. James Hunsicker, NSWCC, Manager of the Environmental Protection Department at Crane, and Mr. Tom Brent, NSWCC, managed the project. Mr. William Murphy was the Principal Investigator, and Dr. May was the Program Manager for WES.

At the time the work was conducted English units were used, and a metric conversion table is provided.

This study was performed in the Geotechnical Laboratory, WES, under the supervision of Dr. A. G. Franklin, former Chief Earthquake Engineering and Geosciences Division (EEGD), Dr. Lillian Wakeley, acting Chief, EEGD, and Dr. W. F. Marcuson III, Director.

At the time of publication of this report, Dr. Robert W. Whalin was the Director, and COL Robin R. Cababa, EN, was the Commander of WES.

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Executive Summary

To fulfill the Corrective Action Requirements of its Resource Conservation and Recovery Act (RCRA) Storage Permit, the Naval Surface Warfare Center Crane (NSWC Crane) has conducted an RCRA Facility Investigation (RFI) Part 2, Phase III Soils Study for the Ammunition Burning Ground (ABG), solid waste management unit (SWMU) 03/10. The ABG is located in a stream valley and covers approximately 20 acres. It is located in the NW 1/4 of Section 28 and the SW 1/4 of Section 21, T5N, R3W. Access to the ABG is by facility Road H463 off Highway 58.

Thirty-three surface (grab) soil samples were collected and thirty-two soil borings were made in August 1993 to determine the extent of soil contaminants identified in the Part 1 RFI Phase III soils investigation. The soil samples were analyzed for contaminants of concern including volatile organics, polycyclic aromatic hydrocarbons (PAHs), explosives, and inorganics, principally metals.

The soils analyses indicated that ABG waste disposal activities have contributed residues of explosives compounds and metal contaminants to the soils. PAHs and VOAs were also released, but in concentrations that were generally below 1 mg/kg (ppm). The explosives HMX, RDX, TNB, TNT, 2,4-DNT, 2,6-DNT, 2A-DNT, and 4A-DNT were detected. Explosives with highest concentration were HMX, RDX, and TNT. Several metals and inorganic constituents in ABG soils had consistently higher concentrations than nearby background soils. In some cases the concentrations of metals and inorganics were 100 times the background which suggested the release of these constituents to ABG soils. Constituents that were greater than 100 times background included cadmium, calcium, copper, lead, zinc, and tin.

The extent of contaminated soils at the ABG was estimated. For this delineation, contamination was defined as soils with one or more of the following conditions: cadmium concentrations greater than 10 mg/kg; lead concentrations greater than 500 mg/kg, or total explosives (sum of all explosives detected) greater than 10 mg/kg. For the surface soils data (0 to 30 in. deep), the area of contamination is about 10.98 acres. For the deeper soils (30 to 90 in. deep), the area of contamination is about 1.99 acres. The extent of contamination in surface soils (< 30 in. below ground surface) was greater than that for the deeper soils.

The results of this Part 2, RFI Phase III Soils study should be coordinated with appropriate State and Federal regulatory agencies.

Acronyms and Abbreviations

ABG	Ammunition Burning Ground
ALG	Analytical Laboratory Group
CAAA	Crane Army Ammunition Activity
CAP	Corrective Action Programs
CAR	Corrective Action Requirements
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CMS	Corrective Measure Study
DNT	dinitrotoluene
DQCR	Daily Quality Control Report
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAS	Initial Assessment Study
IDEM	Indiana Department of Environmental Management
IDW	Investigation-Derived Waste
IRP	Installation Restoration Program
mg/kg	milligrams per kilogram
msl	mean sea level
NACIP	Navy Assessment and Control of Installation Pollutants
NCP	National Oil and Hazardous Substances Contingency Plan
NEESA	Naval Energy & Environmental Support Activity
NSWC	Crane Naval Surface Warfare Center Crane
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PEP	Pyrotechnics, Explosives, and Propellants
PPDDE	para, para' DDE (a pesticide)
PPDDT	para, para' DDT (a pesticide)
ppm	parts per million
RCRA/HSWA	Resource Conservation and Recovery Act/Hazardous and Solid Waste Amendments
RD/RA	Remedial Design/Remedial Action
RDX	Hexahydro-1,3,5 trinito-1,3,5-triazine
RFA	RCRA Facility Assessment

RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SWMU	Solid Waste Management Unit
TCE	trichloroethylene
TNB	trinitrobenzene
TNT	2,4,6-trinitrotoluene
TSD	Treatment, Storage, or Disposal Facility
USACE	United States Army Corps of Engineers
USACESAW	United States Army Corps of Engineers Wilmington District
USACEWES	United States Army Corps of Engineers Waterways Experiment Station
USEPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
VOA	Volatile Organic Compound Analysis

Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
acres	4,046.873	square meters
feet	0.3048	meters
feet per mile	0.1893935	meters per kilometer
inches	2.54	centimeters
miles (U.S. statute)	1.609347	kilometers

1 Introduction

Objectives of the Investigation

RFI Phase III Investigations are release characterization studies. The purpose of the RFI is to collect data necessary to characterize the site for evaluating and developing effective remedial alternatives. The objectives of this investigation are:

a. Determine the nature and extent of soil contamination.

b. Gather necessary data to support the corrective measure study (CMS).

Site Location and Description

The Naval Surface Warfare Center, Crane (NSWC Crane) is located in Indiana approximately 40 miles southwest of Bloomington and 74 miles south of Indianapolis (Figure 1). NSWC Crane covers approximately 62,463 acres or roughly 100 square miles in Davies, Greene, and Martin Counties of Indiana. The Ammunition Burning Ground (ABG) occupies approximately 20 acres. It is located in the NW 1/4 of Section 28 and the SW 1/4 of Section 21, T5N, R3W. Access to the ABG is by facility Road H463 off Highway 58 (Figure 2).

Facility History

The facility, originally called Naval Ammunition Depot (NAD), Burns City, was opened in 1941 to serve as an inland ammunition production and storage center. The Depot's name was changed to NAD, Crane in 1943. The name was changed again in 1975 to Naval Weapons Support Center, Crane. The name was changed again in 1992 to Naval Surface Warfare Center, Crane. Today Naval Surface Warfare Center, Crane's mission is to "Provide quality and responsive engineering, technical and material support to the Fleet for combat subsystems, equipment and components, microelectronics technology,

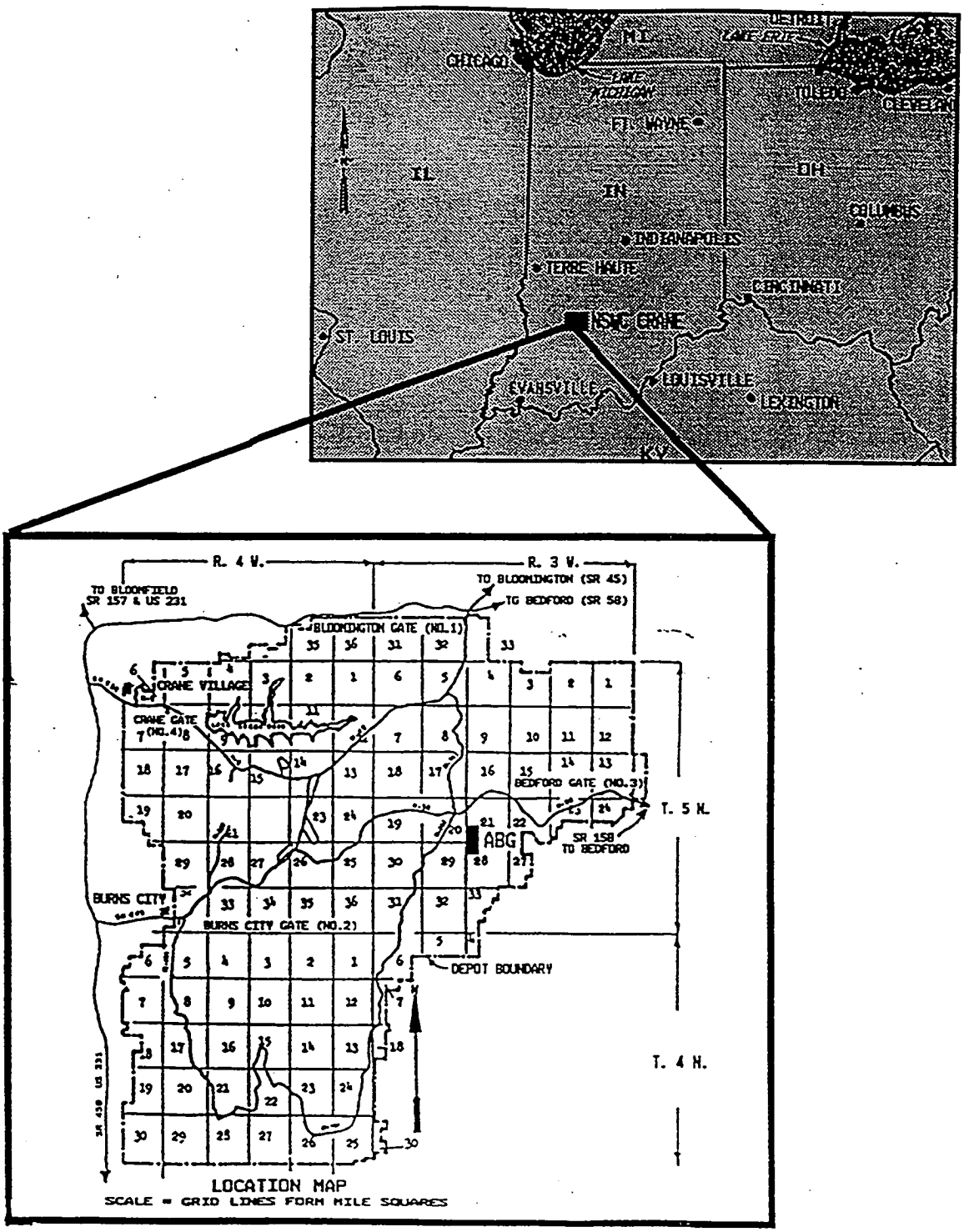


Figure 1. Location map for NSWC Crane

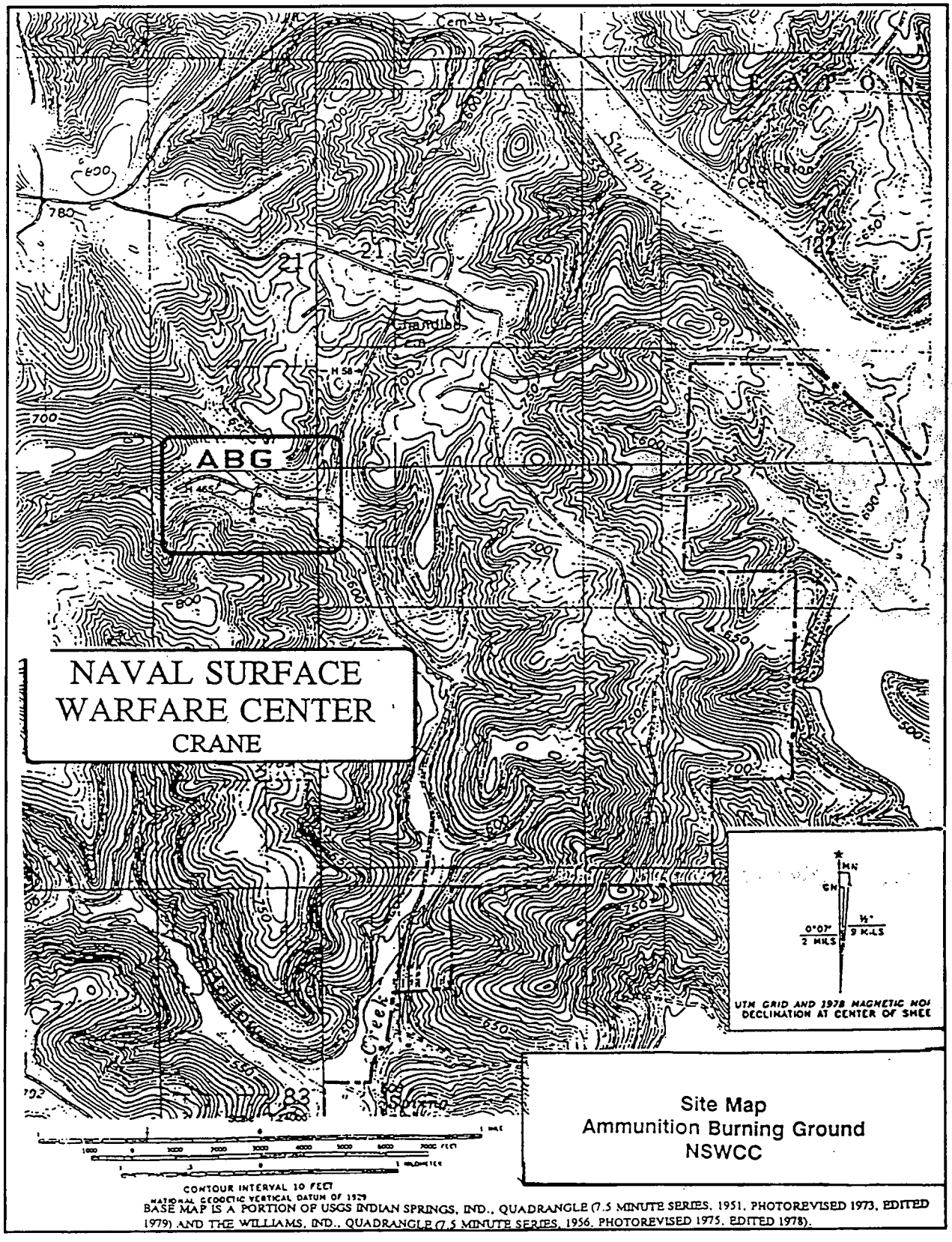


Figure 2. Site map Ammunition Burning Ground NSWC Crane

microwave components, electronic warfare, acoustic sensors tests, engineering, pyrotechnics, small arms, electronic module test and systems command." Under the Single Service Management Program, a segment of the Center's mission is to provide support (including environmental protection) to the Crane Army Ammunition Activity (CAAA). The Army is tasked with the production and renovation of conventional ammunition and related items, the performance of manufacturing, engineering, and product quality assurance to support production; and the storage, shipment, demilitarization, and disposal of conventional ammunition and related components. Because of the nature of the Army's operations, CAAA contributes significant financial support for the environmental program through an Interservice Support Agreement.

All environmental activities on the installation, including permitting activities, remain the responsibility of the Navy. The Navy has applied to Region V of the United States Environmental Protection Agency (USEPA) for a Resource Conservation and Recovery Act (RCRA) permit for thermal treatment (open burning/open detonation) of pyrotechnics, explosives, and propellants (PEP) at the ABG Subpart X unit.

Site Setting

Ordnance and ordnance-contaminated materials from NSWC Crane production areas have been taken to the ABG for treatment by burning since the 1940's. The ABG is used extensively for destroying unwanted materials contaminated with explosives, bare explosives, rocket motors, candles, flares, solvent, detonators, and fuse materials. Several separate burning areas are located within the site proper. The largest quantities of materials were destroyed from 1956 to 1960, when 15,000 lb per day of smokeless powder was destroyed. In the same period, about 46,000 lb per day of high explosives were burned. The area is also used for flashing the residue from bombs and projectiles after they have been subjected to melt out or drill out operations for removal of the bulk of the explosive.

The locations of the various open burning/thermal treatment units are shown in Figure 3. Three surface impoundments were constructed in 1975 to remove liquids from otherwise combustible sludge resulting from the blending and loading of munitions. The impoundments were modified in 1982 to include a liner and leachate collection system for each. The impoundments have been replaced by the sludge burn pads (area 1 of Figure 3) and are under closure. Surface burning of ordnance was formerly conducted on the ground surface, but burning pans are now used to prevent contact of burn products with the ground. Typically, bulk propellants or other energetic materials are poured into the burning pans to a few inches in depth, primed, and remotely initiated. Examples of these items are:

a. Bulk propellant and high explosives, which are burned (thermally treated) in clay-lined steel pans. Twenty pans are set up for this

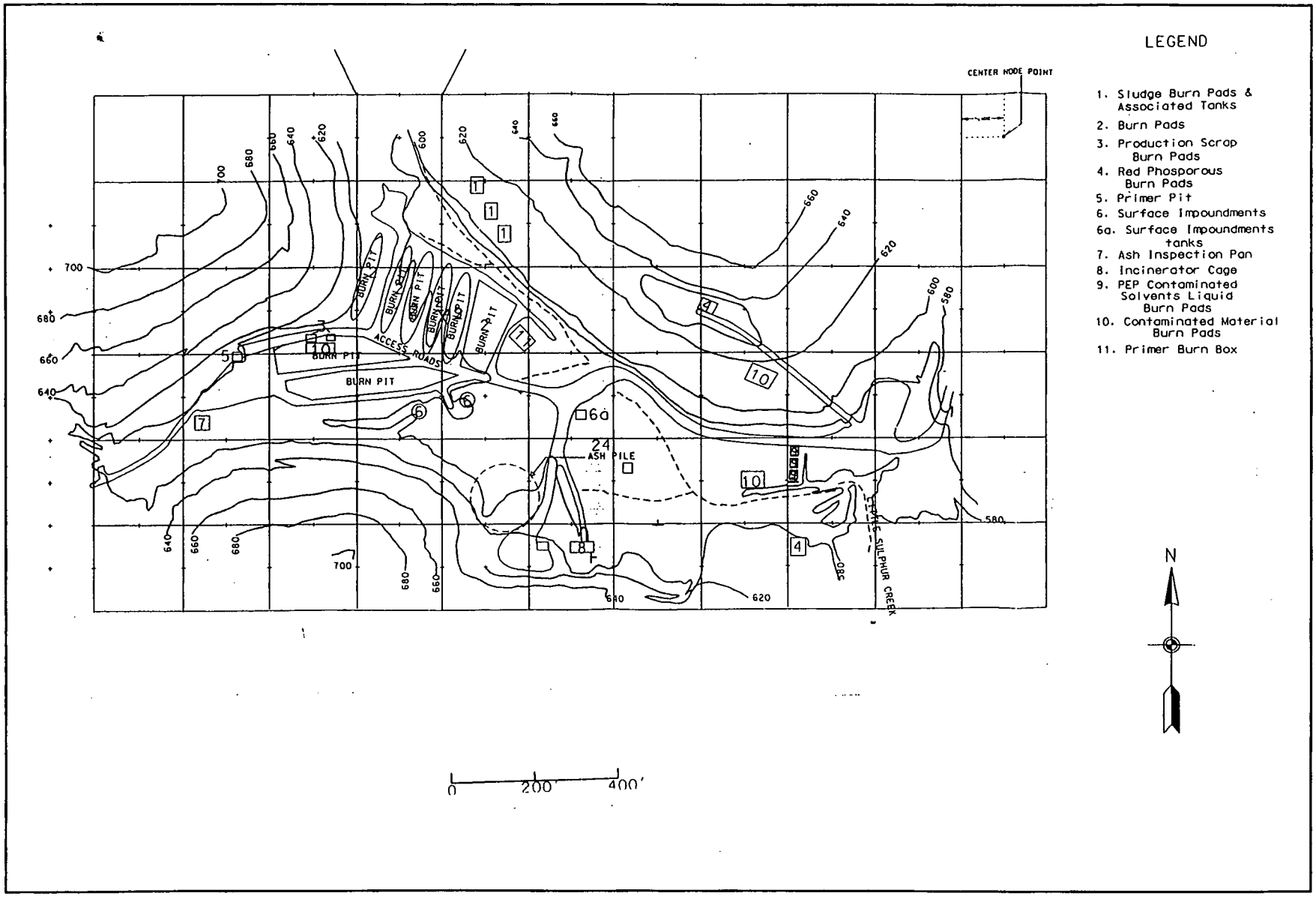


Figure 3. Locations of the open burning/thermal treatment units

operation. Two of the pans are specifically set aside for the burning of production scrap.

b. PEP (pyrotechnics, explosives, and propellants)-contaminated solvent and liquids burned in one unlined steel pan.

c. Waste bulk pyrotechnics burned in one unlined steel pan.

d. Waste red phosphorous burned in unlined steel pans. Currently, four pans are set up for this operation.

e. Desensitized black powder (powder that has been stabilized in water) is burned in an unlined steel pan. There is one pan set up for this operation.

The primer pit, incendiary cage and burn box are used for thermal treatment of ammunition components (e.g., small impact-sensitive primers) and pyrotechnic munitions.

The area labeled "Ash Pile" is the site of a former stockpile of burn residue which has been removed under a RCRA closure plan (Figure 3).

2 Study History

Regulatory Status

Under the authority of RCRA as amended by Hazardous and Solid Waste Amendments (HSWA), a hazardous waste treatment, storage, and disposal facility must be permitted by the USEPA. In December 1989, NSWC Crane was issued a storage permit. A RCRA Facility Assessment (RFA) for the NSWC Crane Facility was completed. The ABG was designated a Solid Waste Management Unit (SWMU). The Corrective Action Requirements (CAR) were negotiated between the Navy and the USEPA Region V. As part of the CAR, the NSWC Crane is to conduct a RFI at its SWMUs. An RFI is a three-part study, consisting of a Phase I, Environmental Monitoring Report; a Phase II, Release Assessment; and a Phase III, Release Characterization Study. Phase I and Phase II have been completed. The RFI Phase III Soil Study was divided into two parts. The U.S. Army Corps of Engineers Waterways Experiment Station (USACEWES) conducted the Part 1 Study. A Draft Report was prepared in November 1992. The Part 2 Study was conducted in August 1993 by the U.S. Army Corps of Engineers, Wilmington District (USACESAW). The results of the Part 2 Study are presented in this report.

Crane's USEPA Permit as of July 1995 stipulates the following: "The R-150 Tank, and the Waste Pile and Surface Impoundment Units at the Ammunition Burning Grounds are RCRA regulated units that are subject to 40 CFR Part 265, Subpart G closure requirements. Closure plans have been submitted to the State and some closure activities have been performed. It is apparent at these units that contamination in the area may not be distinguishable between the regulated units and the SWMU under or around them. Therefore, for the purposes of consistent remedial investigations, the Permittee shall perform one corrective action investigation at these units that will allow for compliance with both the closure and the Corrective Action requirements. This will allow for one investigation for soil and ground water at these units, instead of two separate regulatory investigations for the same media. The RFI Work Plans have been submitted for these units, and the Permittee shall continue to define the rate and extent of contamination, perform a risk assessment, evaluate Corrective Measures, and provide Corrective Measures Implementation at these units... It is the intent of this permit to avoid duplication of effort at these units, and to have one monitoring and Corrective Action program to serve both State and Federal requirements of protection..."

Previous Studies

A sequence of remedial investigations and remedial actions has been performed at the NSWC Crane. Investigations began at the NSWC Crane after the initial discovery in early 1981 of a potential hazardous substance release from the Center. The investigations have proceeded since 1981 and continue at the time of this writing. In April 1981, the U.S. Navy implemented the Navy Assessment and Control of Installation Pollutants (NACIP) Program, now known as the Installation Restoration Program (IRP), to identify and control environmental contamination from past use and treatment of hazardous substances at the NSWC Crane. The IRP program is designed to conform to the scope and purposes of the National Oil and Hazardous Substances Contingency Plan (NCP) established by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, and amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The IRP consists of five major steps; (a) Preliminary Assessment (formerly IAS), (b) Site Inspection (formerly Confirmation Study), (c) Remedial Investigation/ Feasibility Study (RI/FS), and (d) Remedial Design/Remedial Action (RD/RA).

An Initial Assessment Study (IAS) for the NSWC Crane began in April 1981 and was completed in May 1983 by the Naval Energy and Environmental Support Agency (NEESA). Assistance was provided by the Ordnance and Environmental Support Agency and the USACEWES. The IAS recommended site inspections be performed at 14 sites: Nine ordnance sites and five non-ordnance sites. The IAS identified the ABG as a site requiring investigation because of past hazardous waste treatment. The ongoing hazardous waste management operations at the ABG also mandated compliance with Subtitle C of the RCRA. On 19 May 1980, the USEPA finalized Phase I of the RCRA hazardous waste regulatory program, which became effective 19 November 1980. By this date, the NSWC Crane had to comply with the codified regulatory sections of the RCRA. In October 1980 the NSWC Crane filed a RCRA Section 3010 notification and a Part A permit application to operate as a treatment, storage, or disposal (TSD) facility. The NSWC Crane was qualified for and obtained Part A "interim status," which allowed the facility to legally operate as though it had a permit. The ABG then became subject to 40 CFR Part 265 (interim status standards). Part 265 (as well as Parts 260 through 280) is divided into subparts that address the general operating requirements for hazardous waste management facilities and the technical standards applicable to specific units.

In August 1981 the NSWC Crane notified the USEPA of four surface impoundments (dewatering beds) at the ABG and one waste impoundment. A groundwater monitoring program was required at the ABG pursuant to (a) 40 CFR Part 265-Subpart F and (b) the IRP. The groundwater monitoring program began at the NSWC Crane in 1981. Through a Military Interservice Procurement Request, the Navy contracted the USACEWES to conduct hydrogeologic investigations at ten sites, eight identified in the IAS and two new sites. The work was performed under authority provided by NAVCOMPT Document Number N00164-IMP-04575, dated June 1981 and amended

October 1981. The USACEWES-installed monitoring wells from August 1981 to December 1981 at the ABG and provided a report in April 1982 (Dunbar 1982). Results of the monitoring program suggested the presence of groundwater contamination at the ABG. Pursuant to 40 CFR 265 Subpart F, USACEWES performed six studies at selected sites from June to October 1983. The ABG was one of the sites. The final report for the 1983-84 studies at the ABG was provided in April 1984 (Dunbar 1984).

The HSWA of RCRA established corrective action programs (CAP), Section 3004, at TSD facilities. The provision required the NSWC Crane to address past releases of hazardous waste or hazardous constituents at SWMU's and regulated units. The first step of the CAP required the NSWC Crane to submit a Hazardous Waste Management Report (known as the SWMU report) to the USEPA. The SWMU report listed the ABG and all of the IAS-identified hazardous waste sites as SWMU's and was submitted to the USEPA in January 1985. The next step of the CAP, a RFA, was conducted by A. T. Kearney, a USEPA contractor. The contractor conducted a file search of the facility and a site visitation and prepared a report in 1987 which characterized possible releases from 100 SWMU's. On 22 June 1987 the USEPA promulgated amendments to allow the information related to detailed corrective action planning to be developed by USEPA Regional Administrators after the issuance of a RCRA permit through the use of compliance schedules included in the permit.

A hydrogeological investigation of the ABG and surrounding area was conducted by the USACEWES in 1986-87. The Hunt (1988) report identified factors influencing or controlling the flow of potentially contaminated groundwater into and out of the ABG. Work included emplacement of 66 exploration borings and monitoring wells in three aquifers, geologic and hydrologic field mapping, literature survey and consultation with geologists at the Indiana Geological Survey, Bloomington. The study area included the area surrounding the ABG, especially that to the south.

The Hunt (1988) hydrogeological investigation and report are partial fulfillment of the (a) Ground Water Assessment Plan, Ammunition Burning Grounds Hazardous Waste Treatment Site, NWSC, (May, 1986); (b) the 1989 USEPA RCRA Part B Permit's CAP; and (c) the RI phase of the IRP at the ABG. The report by Hunt (1988) concluded that flow through solution passages in the Beech Creek limestone is the primary conduit for groundwater leaving the ABG and that flow through the conduits can be "rapid." The report recommended that increased emphasis be given to monitoring of springs and that injection of tracers (i.e., dye tracer test) be considered to confirm direction and rate of movement away from the ABG through solution conduits.

On 3 April 1989, the Navy submitted three documents to the USEPA Region V: (a) an updated Groundwater Assessment Plan for the ABG; (b) a Dye Tracer Test Proposal; and (c) the Hunt (1988) ABG hydrogeologic investigation. Technical review comments, dated 22 June 1989, were submitted by the USEPA Region V to the NSWC Crane for the three documents. After discussions in a May 1989 meeting between the USEPA, USACEWES, and the Navy, the USACEWES installed five additional monitoring wells (July and

August 1989) in the vicinity of the ABG. As requested by the USEPA comments, the Dye Tracer Test proposal was rewritten and submitted to the USEPA in July 1989.

Final approval of the Dye Tracer Test Proposal and the Hunt (1988) report were established in the Federal portion of the joint RCRA storage permit issued to the U.S. Navy by the USEPA and the State of Indiana. The Federal portion of the RCRA Permit, dated 20 December 1989, established the HSWA Corrective Action Requirements and Compliance Schedules (RCRA Section 3004). The compliance schedules obligated the NSWC Crane to perform RCRA Facility Investigations (RFI) at 30 SWMU's, and, if contamination were found, to conduct Corrective Measures Studies (CMS) and implement Corrective Measures, if needed. The State of Indiana obtained pre-HSWA authorization and issued the State portion of the permit which authorized the NSWC Crane to operate the Central Hazardous Waste Storage Facility, Building No. 2993. The Permit's RFI compliance schedule for the ABG established work plan submittals for the following: (a) Modified RFI Phase III Release Characterization for Groundwater; (b) RFI Phase III Release Characterization for Soil; and (c) RFI Phase II Release Assessment for Surface Water Bodies. In April 1990, the NSWC Crane submitted the Modified RFI Phase III Release Characterization Work Plan for Groundwater. The Work Plan scheduled the submittal of the Dye Tracer Report, the proposal to conduct a second Dye Tracer Test, progress reports, and the RFI Phase III Final Report for Groundwater. The RCRA Section 3004 Corrective Action Requirements of the Storage Permit have incorporated the IRP. RCRA will be the primary vehicle to further investigate and remediate the IRP sites. The NSWC Crane is also pursuing a USEPA, RCRA operating permit for thermal treatment (open burning/open detonation) of pyrotechnics, explosives, and propellants (PEP) at the following Subpart X units: the ABG, the Demolition Area, and the Old Rifle Range, which are also considered SWMU's.

As a part of the water sampling and chemical analysis program initiated by NSWC Crane in 1987, laboratory analysis and laboratory Quality Assurance (QA) and Quality Control (QC) data have been reported to NSWC Crane in a series of reports. The information from these reports formed the basis of a summary report, dated 1 April 1992, and prepared under contract by COMARCO, ESD of Bloomfield, Indiana. The groundwater was tested for a wide range of chemical parameters at various limits during the program. These parameters are discussed in 40 CFR (7-1-89) in sections 265.92, 265.93, and 265.94 Appendix III. (COMARCO 1992.)

The following summary information is taken directly from the COMARCO summary report (shown in *italics*). Wells placed prior to 1986 were not included in this report.

Water samples were collected from 40 wells and tested for a range of chemicals and properties. The four indicator parameters utilized by the USEPA, pH, specific conductance, total organic halogens, and total organic carbon were collected during all sampling periods in replicates. The 23 chemicals identified by the USEPA, and having national drinking water standards, were also tested,

as were six chemicals defining water quality. Tests for three explosives and three volatiles were also conducted from the earliest sampling period.

The data documents the presence of RDX, an explosive, in the water collected from a group of wells centered on a line running NW/SE through the center of the ABG. Chlorinated hydrocarbons, primarily trichloroethylene, are also present under the ABG and some of the adjacent area. The major concentrations are along the same NW/SE line. Significant quantities were also detected north of the ABG on the before-mentioned NW/SE line. Another significant concentration is at the western corner of the ABG. Barium is also present in significant quantities, although values do not approach the drinking water standards. The wells with major contaminants coincide with the major underground water flow detailed in the Hunt reports.

The following wells (Table 1 and Figures 4, 5 and 6) *exhibited values for 3 or more sampling periods which were different from the ambient levels found to exist regionally:*

Table 1
Wells Above Ambient Levels

Chemical Contaminant/Water Parameter	*Wells*
pH (1)	*03-C20, 03-C29, 03-C30*
TOX (4)	*03-C11, 03-C20, 03-C3P2, 03-C9P2*
Barium (22)	*03-C12, 03-C2P2, 03-C8P2, 03-C30, 03-C31, 03-B1, 03-B2, 03-B3, 03-B6*
Nitrate-N (28)	*03-C8P2*
Iron (9)	*03-C/P2*
Mg (47)	*03-B3, 03-B4*
RDX (15)	*03-C20, 03-C3P2, 03-C8P2, 03-C9P2*
TCE (18)	*03-C11, 03-C13, 03-C14, 03-C15, 03-C3P2, 03-C3P8, 03-C9P2*

Many wells exhibited values different from background levels for 1 or 2 sampling periods for the following chemical parameters: cadmium; lead (5 wells); selenium (4 wells); chloride (4 wells); HMX, DNB, and BIS.

The wells that had groundwater which provided significant amounts of man-made chemicals are centered in the ABG along a northwest/southeast line. Two wells outside the ABG, 03-C13 and 03-C31, also produced samples that had significant amounts of man-made chemicals. Trichloroethylene was present in samples from a number of wells throughout the ABG. Well 03-C9P2 has consistently high values and 03-C11 has extremely high values.

RDX, an explosive, was present in the water samples of a group of wells exiting through the ABG on a northwest/southeast line. Hunt's report details the geology of the area and indicates that the maximum water flow in the Beech Creek aquifer occurs along the general line of these wells. This water flows

into the area of solution passages and caverns in the southeast portion of the ABG.

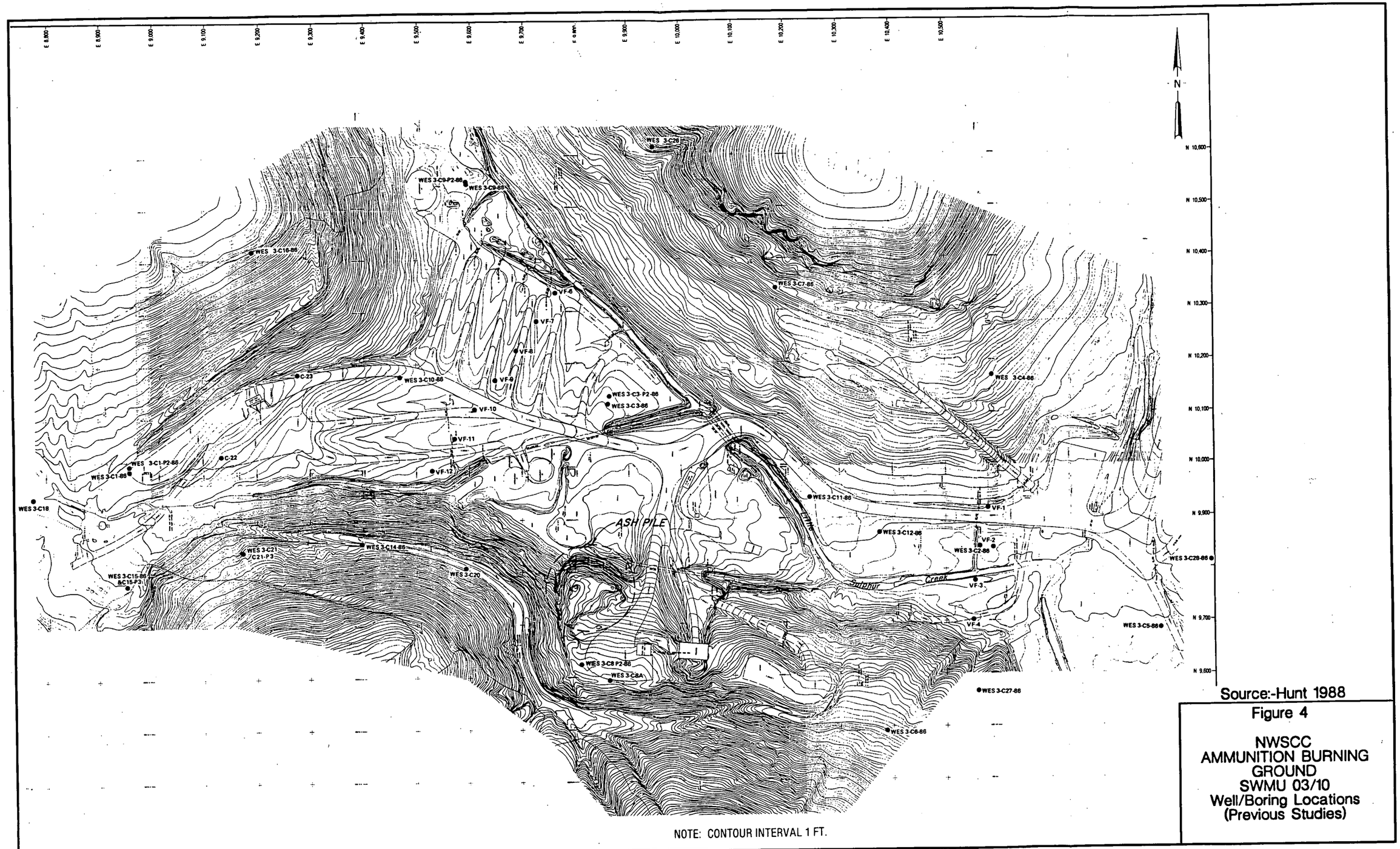
Nitrate values over the drinking water standard were obtained from wells 03-C9P2 and 03-C8P2. Well 03-C8P2, which has high values for four sampling periods, is adjacent to the former location of the ash pile. This material has been removed. It was the probable source of the high nitrate values.

Murphy (1994) provided additional analyses of the groundwater data pertaining to RDX, TCE and barium in the Final RFI Phase III Groundwater Report for the ABG. Murphy concluded that four monitoring well sites within the ABG were notably higher in RDX and/or TCE than other wells.

To investigate background conditions and to characterize the source(s) of contamination in the soils, a RFI Phase III Part 1 soils investigation was conducted by USACEWES in 1990. Twelve auger borings (03/10-1-90 through 03/10-12-90) were placed and soil samples were collected. Chemical analysis of the soil samples indicated contamination by explosives and metals as discussed in Chapter 1 of the RFI Phase III Part 1 Report.

Murphy and Wade (1994) conducted a Phase II Surface Water Assessment at the ABG and submitted a Draft report. The report concluded that explosives, metals, other inorganics, and certain volatile and semivolatile compounds have been released to the water and bottom sediments of streams at and below the ABG.

Reports describing the previous studies at the ABG, listed in chronological order, are (see References for full citations): Dunbar 1982; Naval Energy and Environmental Support Activity 1983; Dunbar 1984; May 1986; Woods 1986; Hazardous Material Technical Center 1986; Hunt 1988; Murphy and Ciocco 1990; Comarco 1992; U.S. Army Engineer Waterways Experiment Station 1992; U.S. Army Corps of Engineers, Wilmington District 1993; Murphy and Wade 1994; Murphy 1994.

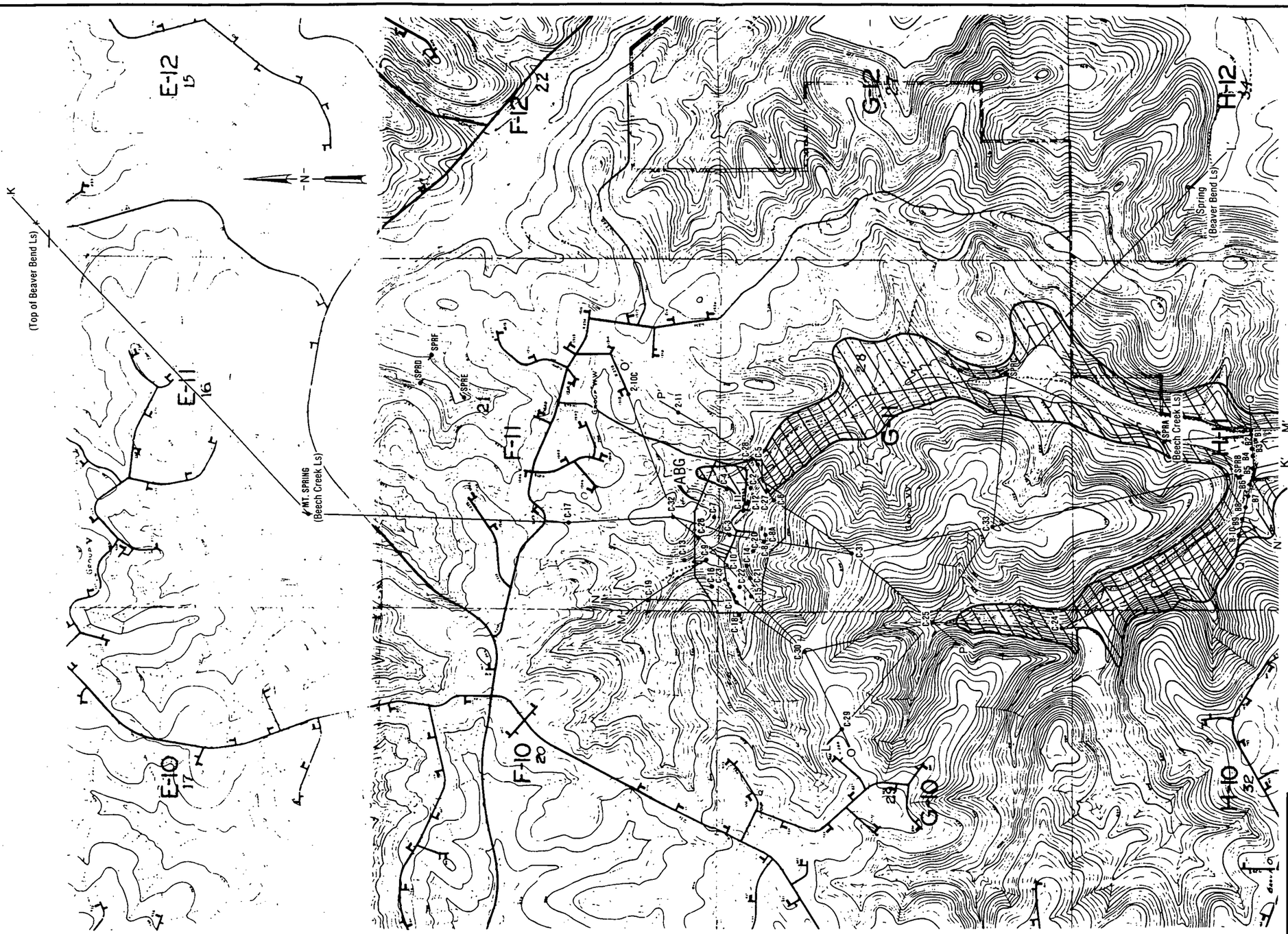


Source:-Hunt 1988

Figure 4

NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Well/Boring Locations
(Previous Studies)

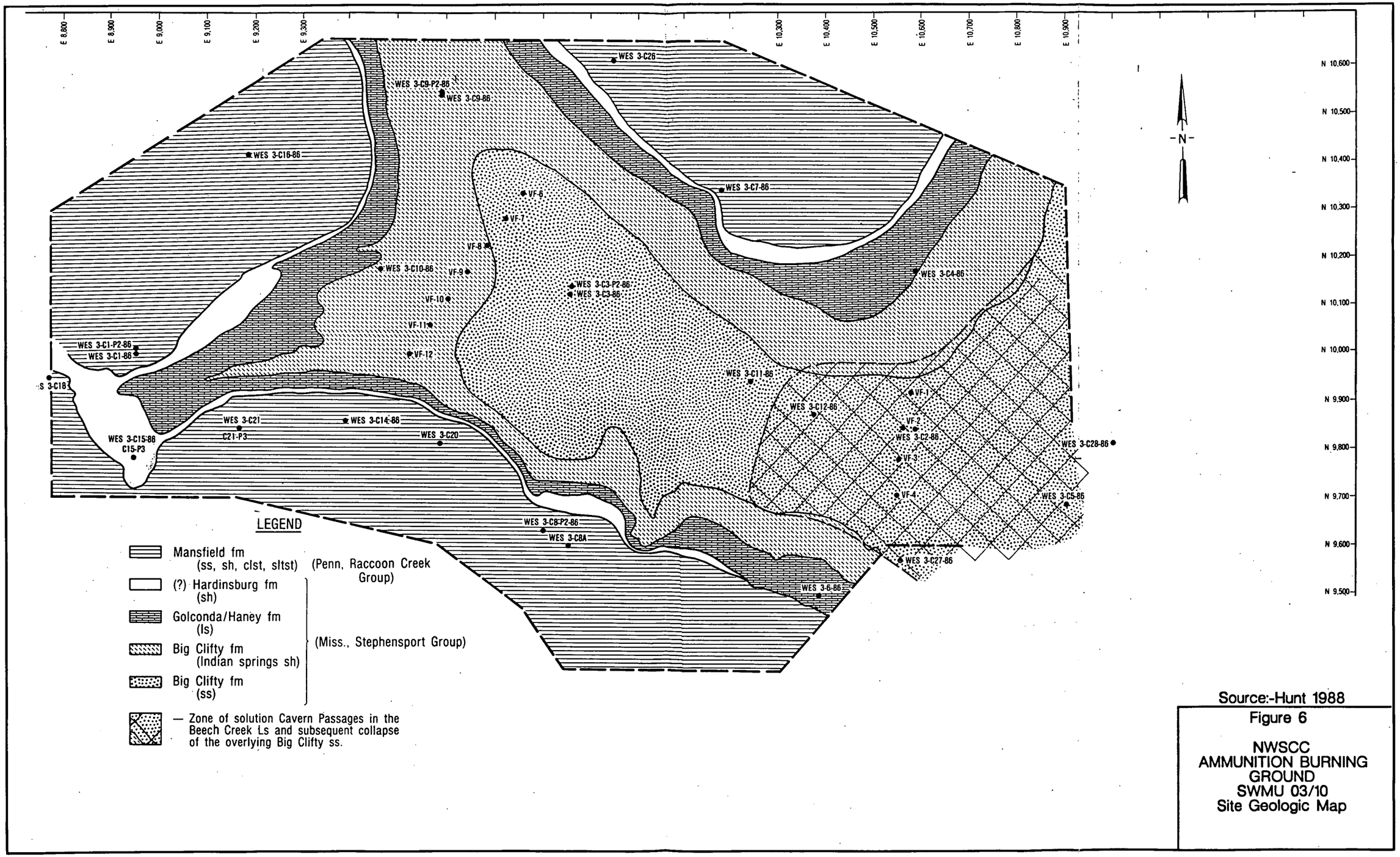
NOTE: CONTOUR INTERVAL 1 FT.



Source:-Hunt 1988

Figure 5

NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Well/Boring Locations
(Previous Studies)



Source:-Hunt 1988

Figure 6

NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Site Geologic Map

3 Physical Characteristics of the Study Area

Physiography

Much of the NSWC Crane is covered by forest. Its surface topography is a rugged plateau dissected by well-defined stream valleys. The surface elevations range from 470 ft mean sea level (msl) in the valleys to 800 ft msl on the ridges. The ABG is located within the Crawford Upland, a rugged, dissected plateau formed by differential erosion of Pennsylvanian and Mississippian sedimentary rocks. The site lies in the valley formed by Little Sulfur Creek. Surface drainage into and from the ABG is via this creek, which flows from the north to the southeast through the center of the ABG (Figure 2). A small tributary drainage way joins Little Sulfur Creek near the center of the site from the west-southwest.

Geology

The rock units underlying the operations area of the ABG consist of limestone, shale, and sandstone of the Mississippian aged Stephensport Group (Figure 6). Most of the ABG is situated in the dissected alluvial valley of Little Sulfur Creek. The surrounding hills are formed by shale and sandstone of the Pennsylvanian aged Raccoon Creek Group. The unconsolidated sediments of the ABG site are composed of residual soils formed by weathering of the underlying parent rock, alluvium, colluvium derived from the hill slopes, and modified soil, which is soil reworked by man. Modified soils are associated with the ABG operations.

The geology of the ABG was characterized with data from groundwater monitoring wells, auger soil borings and valley floor (VF) soil borings (Dunbar 1982 and 1984, Woods 1986, Hunt 1988, and Draft Part 1 RFI Phase III Soils Report 1992). The locations of the geologic sections are shown in Figure 7. Geologic sections A-A' and B-B' (Figures 8 and 9, respectively) are adapted from Hunt (1988). Descriptions of the sections and the drilling logs were presented in the Hunt (1988) report. The stratigraphic assignment of the sandstone units underlying the site has been changed from Hardinsburg (Dunbar

1982) to Big Clifty Formation, following Hunt (1988). Geologic sections C-C', D-D', E-E', and F-F' (Figures 10, 11, and 12, respectively) were constructed from data from the 1990 soil auger borings. Collectively, the sections portray the soil and rock stratigraphic relationships at the ABG.

Soils

The soil thickness at the ABG ranges from 0 to approximately 18 ft. The variability of soil thickness is apparent in Figure 13. The soil types that compose the ABG site are predominately silt (Unified Soil Classification System, or USCS, ML) and clays (CH) with lesser amounts of sand and gravel. Figure 14 explains the USCS symbology. The thicker sections of soil are alluvial and colluvial filling of the Little Sulfur Creek Valley. The thickest soils correspond to the areas of deepest incisions into the rock. Prior to and during fluvial incision, a residual soil formed from the weathering of parent rock material. Remnants of the residual soil make up a portion of the soil stratigraphic sequence.

The alluvial and colluvial soil zones of the ABG are delineated on the geologic sections (Figures 8, 9, 10, 11 and 12). An anthropogenic soil unit is identified on the geologic cross sections as "modified." "Anthropogenic" describes soils that have been modified by human activity, such as that associated with burning ground activity. The modified soil is chiefly colluvium and alluvium with cultural debris. The modified soil is shown on the cross sections as a continuous unit. Review of the ABG's history indicates that the modified soil has been reworked to a depth of two to three feet.

Hydrogeology

Previous studies have indicated that groundwater in the ABG study area occurs primarily in three rock aquifers: the uppermost or Golconda/Haney limestone, the middle or Big Clifty sandstone/Beech Creek limestone, and the lower or Beaver Bend limestone (Hunt 1988 and Murphy 1994). Groundwater migrates from the ABG principally through solution-widened channels in the Beech Creek limestone, a poorly developed karst with negligible surface expression. A thick shale at the base of the Beech Creek limestone dispenses the groundwater laterally down-gradient. Groundwater elevations range from about 558 ft msl in the central and northwest part to 542 ft msl in the southeast part of the ABG. The piezometric surface is about 40 to 50 ft below ground surface in the central part of the ABG. Groundwater flow in the Big Clifty/ Beech Creek aquifer is primarily to the south and southeast.

The soil is relatively impermeable with most rainfall exiting the site as surface runoff except in the channel of Little Sulphur Creek, where the Big Clifty is exposed and infiltration can occur. Vertical infiltration occurs in Little Sulphur Creek below about the center of the ABG site, since the alluvium is permeable. Groundwater moves downward through the soil by vertical

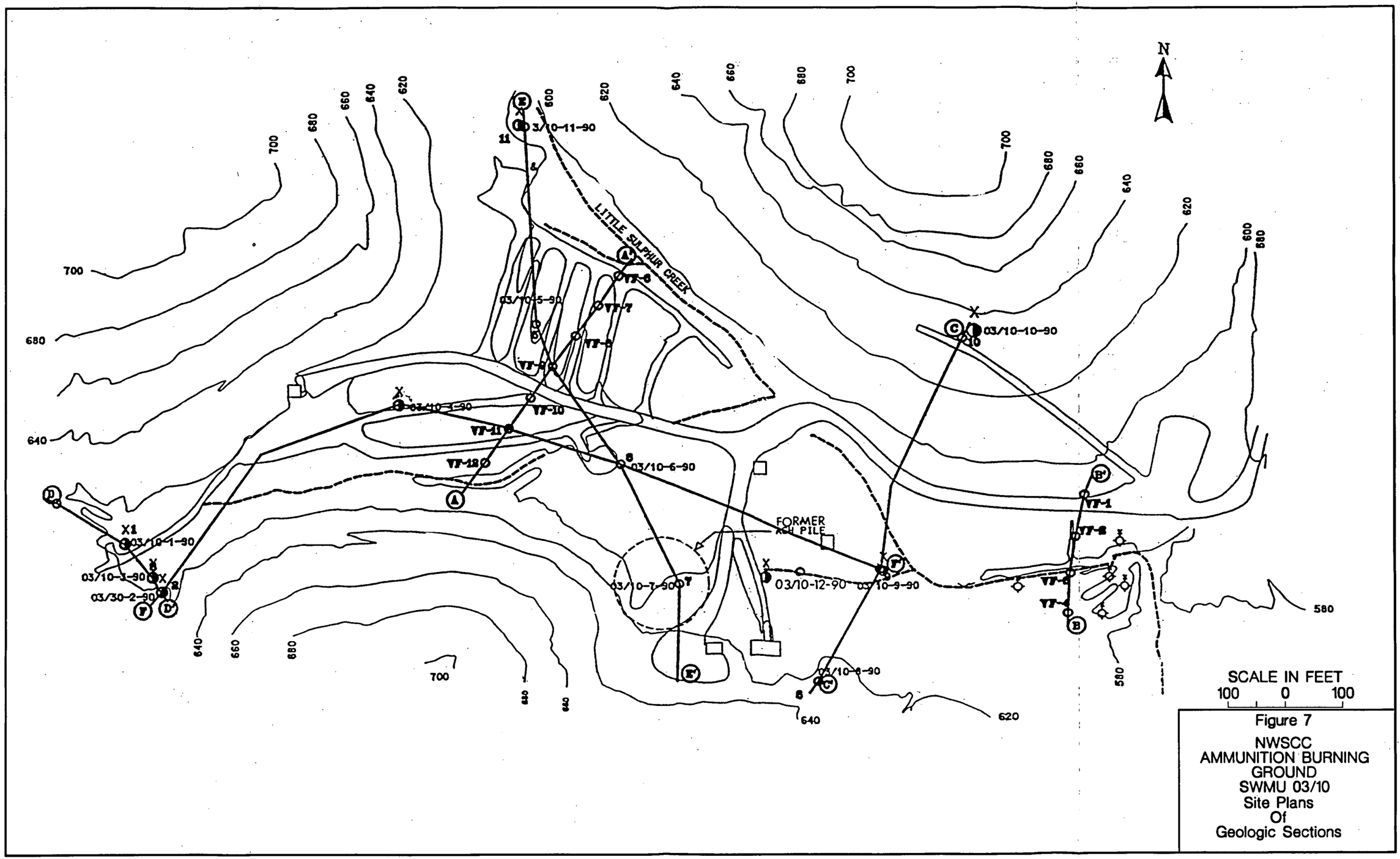
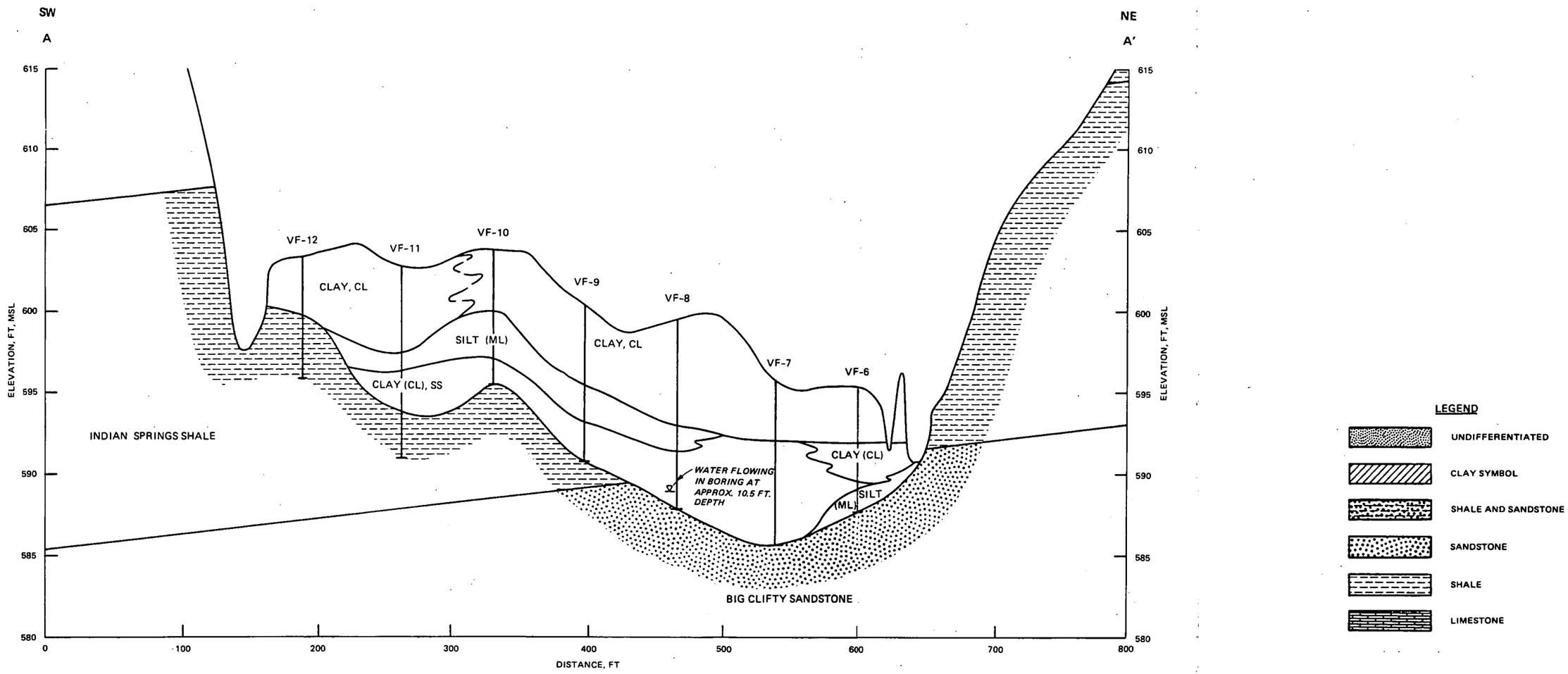


Figure 7
NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Site Plans
Of
Geologic Sections



Source:-Hunt 1988

Figure 8

NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Geologic Section A-A'

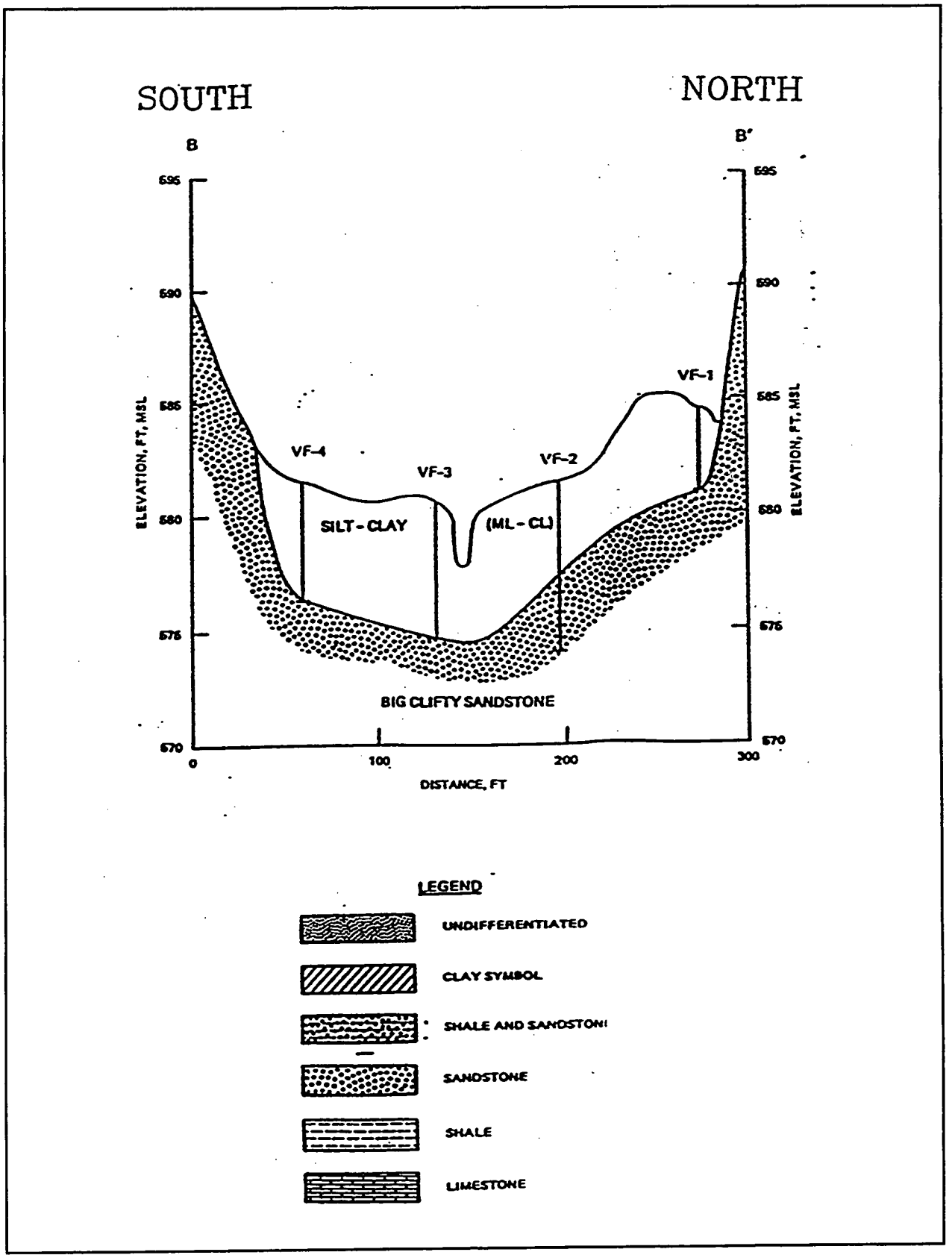


Figure 9. Geologic Section B-B'

infiltration, then laterally along the soil/rock interface until it reaches the fractured rock where the ground water enters the aquifer system.

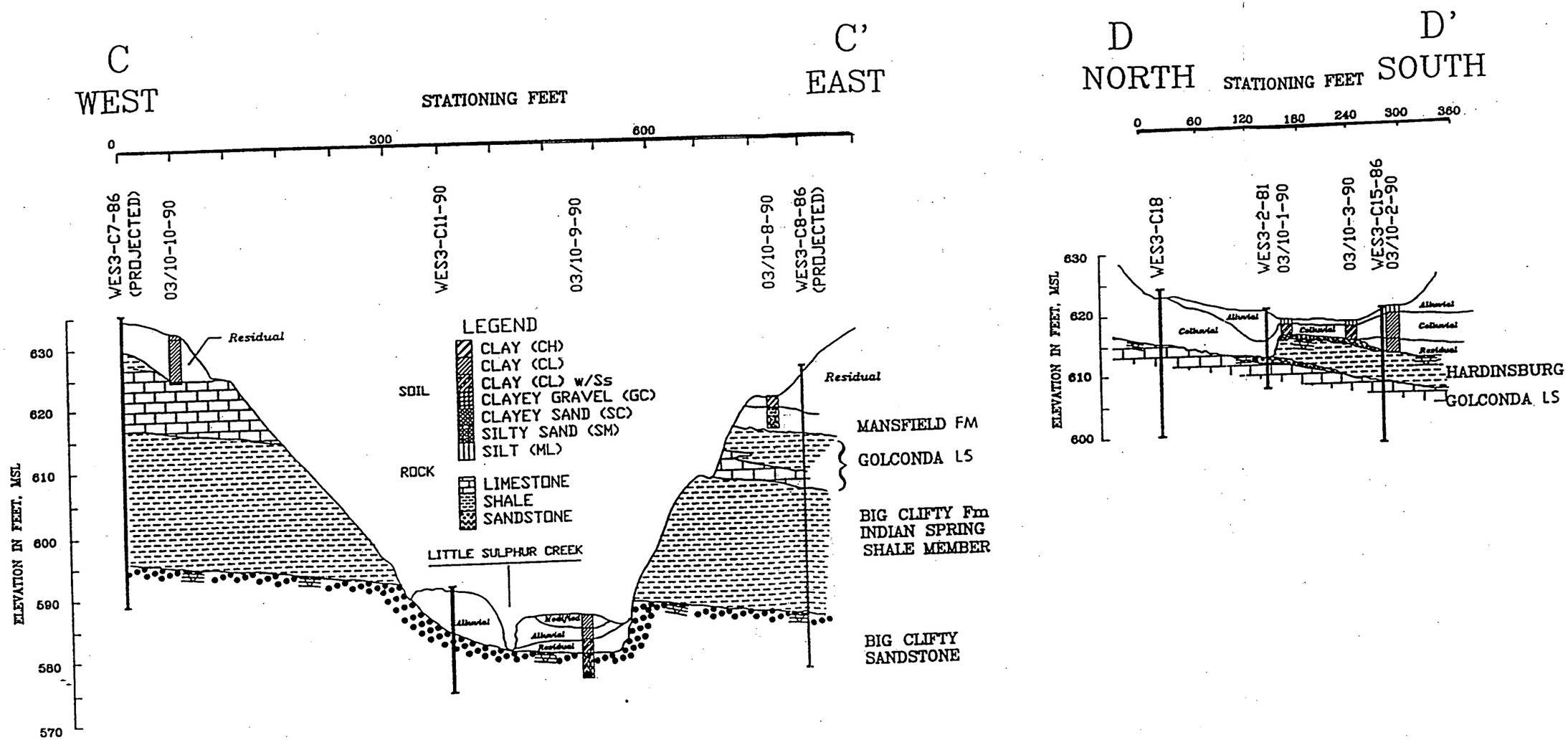


Figure 10

NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Geologic Sections
C-C' and D-D'

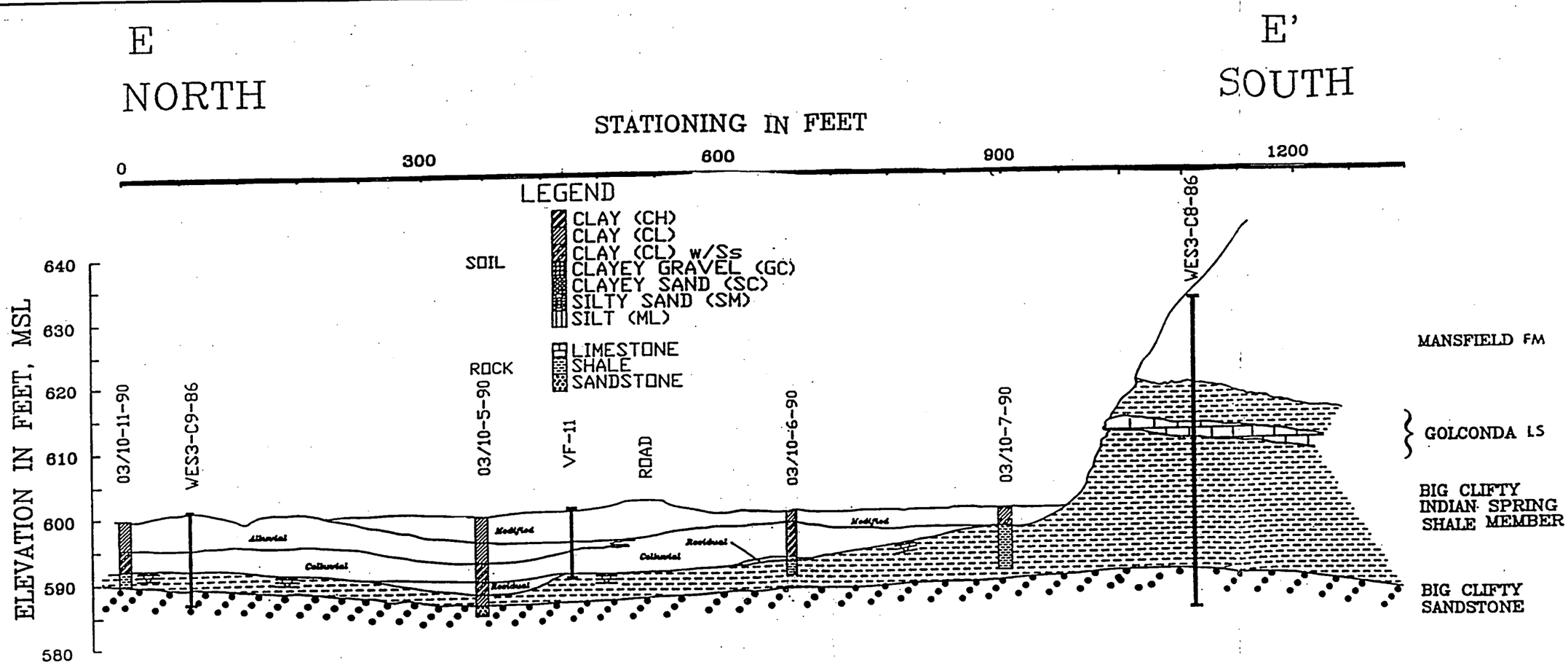


Figure 11

NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Geologic Section E-E'

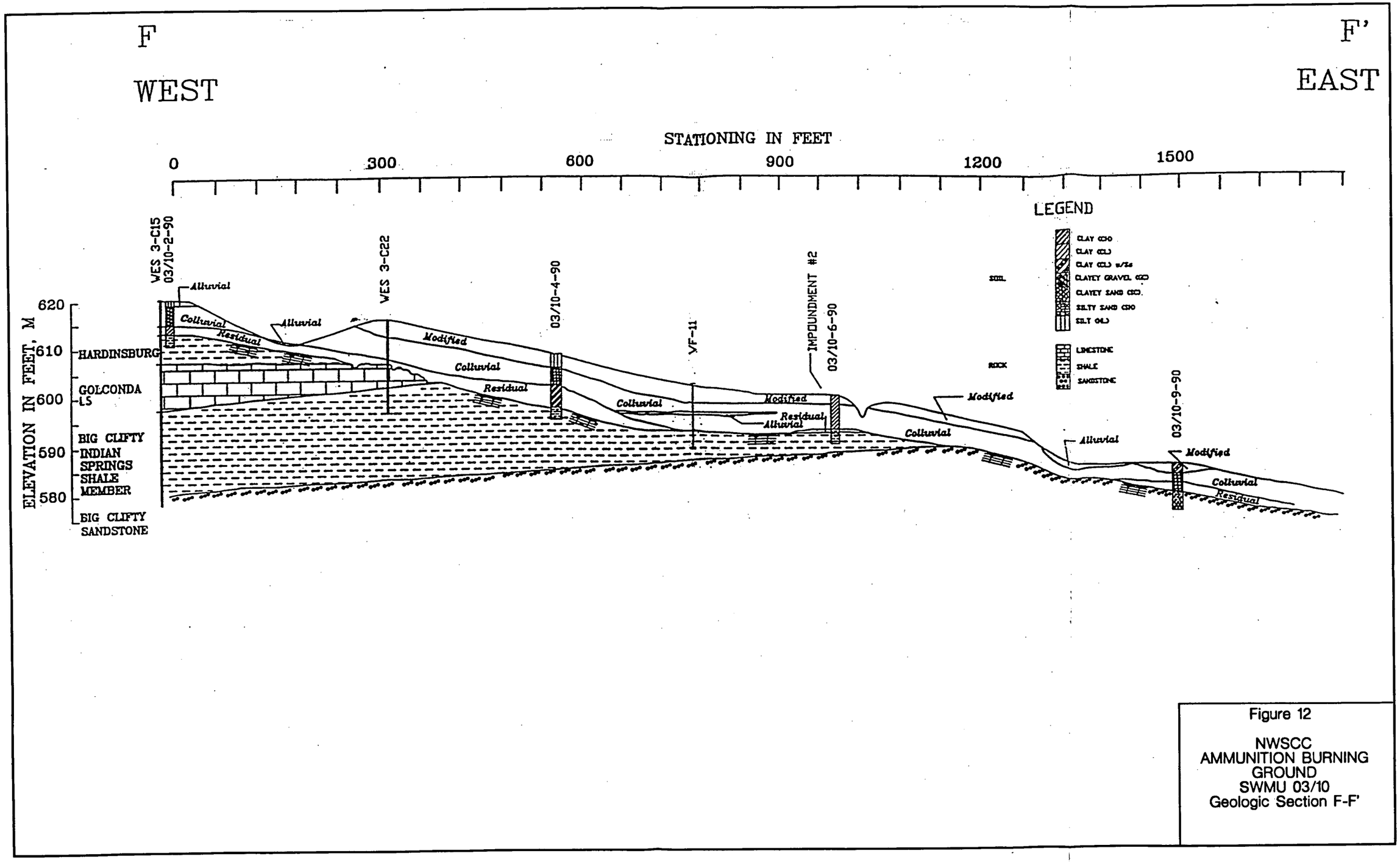


Figure 12

NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Geologic Section F-F'

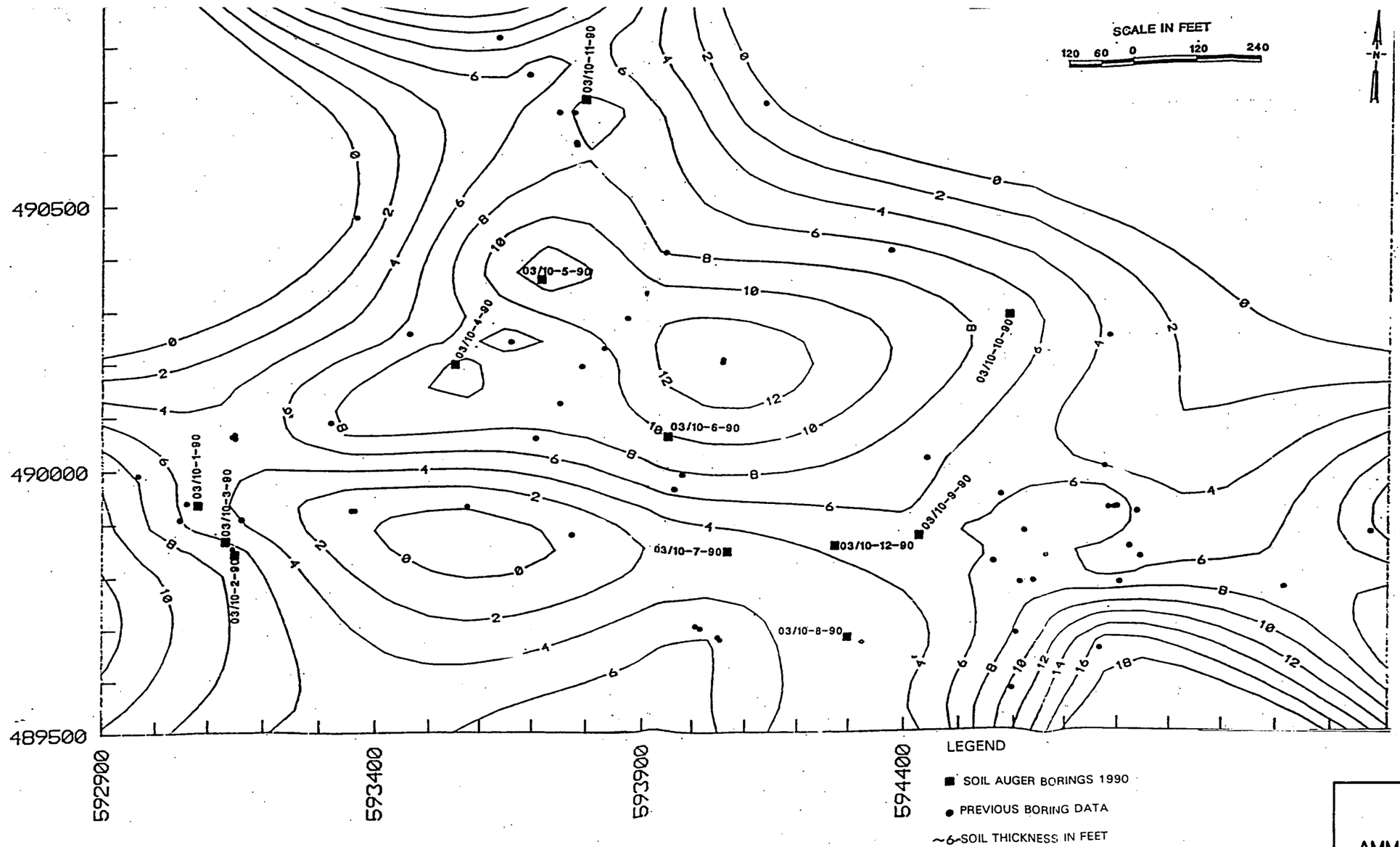


Figure 13

NWSCC
AMMUNITION BURNING
GROUND
SWMU 03/10
Soil Thickness Map

Major Divisions			Group Symbols	Typical Names	Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weights)		
1	2		3	4	5		
Coarse-grained Soils More than half of material is larger than No. 200 sieve size. The No. 200 sieve size is about the smallest particle visible to the naked eye.	Gravels More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.		
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.		
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixture.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).		
			GC	Clayey gravels, gravel-sand-clay mixtures.	Plastic fines (for identification procedures see CL below).		
	Sands More than half of coarse fraction is smaller than No. 4 sieve size.	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.		
			SP	Poorly graded sands or gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.		
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).		
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).		
Fine-grained Soils More than half of material is smaller than No. 200 sieve size. The No. 200 sieve size is about the smallest particle visible to the naked eye.					Identification Procedures on Fraction Smaller than No. 40 Sieve Size		
					Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL)
	Silts and Clays Liquid limit is less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium
			OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight
	Silts and Clays Liquid limit is greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to medium
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.		

Figure 14. Unified soil classification chart

4 Site Investigation

Field Work

Approach

The Part 2 Phase III investigation was a release characterization. Sampling locations in the Part 2 study were selected to determine the extent of the release and to evaluate its vertical and lateral distribution. To delineate the soil contamination, the ABG was divided up into acre blocks (Figure 15). Three basic criteria were used to locate the soil borings and surface sampling points in the acre grid system. First, the sampling locations were selected with a bias toward areas having the greatest probability of contamination. Based on the results of the previous investigation (Phase III Part 1 Soils) an area of probable contamination was identified. Emphasis was on placing more borings and surface sampling points in that area. Secondly, the sampling locations were placed in the vicinity of the areas identified as waste generating areas such as burn pads, surface impoundments, and primer burn box. The third criterion used in placing sampling locations was based on the results of the ABG groundwater study (Murphy 1994). Several monitoring wells indicated high concentration of TCE, RDX, and barium.

Although a total of 38 soil borings, which included three background borings, were proposed, only 32 borings were drilled. Six borings were canceled because of the inaccessibility of those locations. A total of 33 surface soil samples were collected during this investigation. The boring and surface sampling point locations are shown in Figure 15. Each sample point is numbered using elements which include: SWMU number, sample point, year of sampling, and sample number. Sample point numbers 1 through 38 were assigned to subsurface borings. Numbers 39 through 71 were assigned to surface sample points. For example, the first boring in the Part 2 investigation is SWMU 03/10-1-93-1 and the first surface sample is SWMU 03/10-39-93-1.

Survey and geophysical investigation

To make the sampling efforts as efficient as possible all sample locations were surveyed and marked with stakes and flags prior to the sampling.

A hand held magnetometer geophysical survey was performed to ensure the safe entry of personnel and equipment into each of the sampling sites. The areas where geophysical surveys were conducted include all the burn pads and the areas where soil borings and surface sampling points were located.

Surface soil sampling

The 33 surface soil sampling locations are shown in Figure 15. Sod and top soil were removed to a depth of approximately 6 in. below the ground surface. A sample from the interval 6 in. to 18 in. was then taken with precleaned stainless sampling trowel or scoop. The sample jar was then sealed. Following collection, soil samples were placed in locked ice chests (coolers) for storage at a temperature of 4 C° Chemical preservatives were not used. The coolers containing the samples with their accompanying chain of custody forms were transported to the analytical lab for analysis. Transport was by air freight with an overnight carrier service. A seal was placed on each cooler to ensure that the samples had not been disturbed during transport to the laboratory.

Soil borings and subsurface soil sampling

Thirty-two soil borings were placed using a truck mounted drilling rig. The boring locations are shown in Figure 15. Samples were taken at specified depths (0 in. to 30 in., 30 in. to 60 in., 60 in. to 90 in.) and/or at refusal. A standard-sized splitspoon sampler was used to collect the soil samples. The sampler was advanced through a hollow stem auger. At the surface, the sampler was opened and the sample was extracted, peeled, and bottled. Peeling is the process that removes the portion of the sample that is in direct contact with the sampler. The ends of the sample were not used. Samples were extruded into wide-mouth glass jars with minimal disturbance. Stainless steel tools were used to place the peeled samples into the containers. The sample jars were then sealed. Following collection, soil samples were stored and delivered as explained above. Following sample collection, the hole was backfilled using a cement-bentonite mixture.

To ensure that the soil samples would be representative of the site conditions, a QA/QC program was enforced. Field blanks, trip blanks, equipment rinsates, and duplicates were collected. Drilling and sampling equipment was decontaminated between sampling locations. Sample documentation procedures as outlined in the workplan were enforced. They included completion of Daily Quality Control Report (DQCR), field log book, sample labels, and chain of custody forms.

Laboratory Analyses

Physical analyses of soil samples

Soil samples from the auger borings were classified in the field according to the USCS. Selected soil samples were analyzed later in the laboratory.

Soil samples were characterized in the laboratory using standard U.S. Army Corps of Engineers geotechnical methods. These methods are defined in OCE, EM 1110-2-1906 (1970). The classification consists of a visual classification and a sieve and hydrometer analysis to determine grain size distribution of the samples. The sieve analysis determined the gradation of grain sizes ranging from the number 3 sieve to the number 200 sieve. The hydrometer analysis determined the percentage of silt and clay size particles in the sample.

Chemical analyses

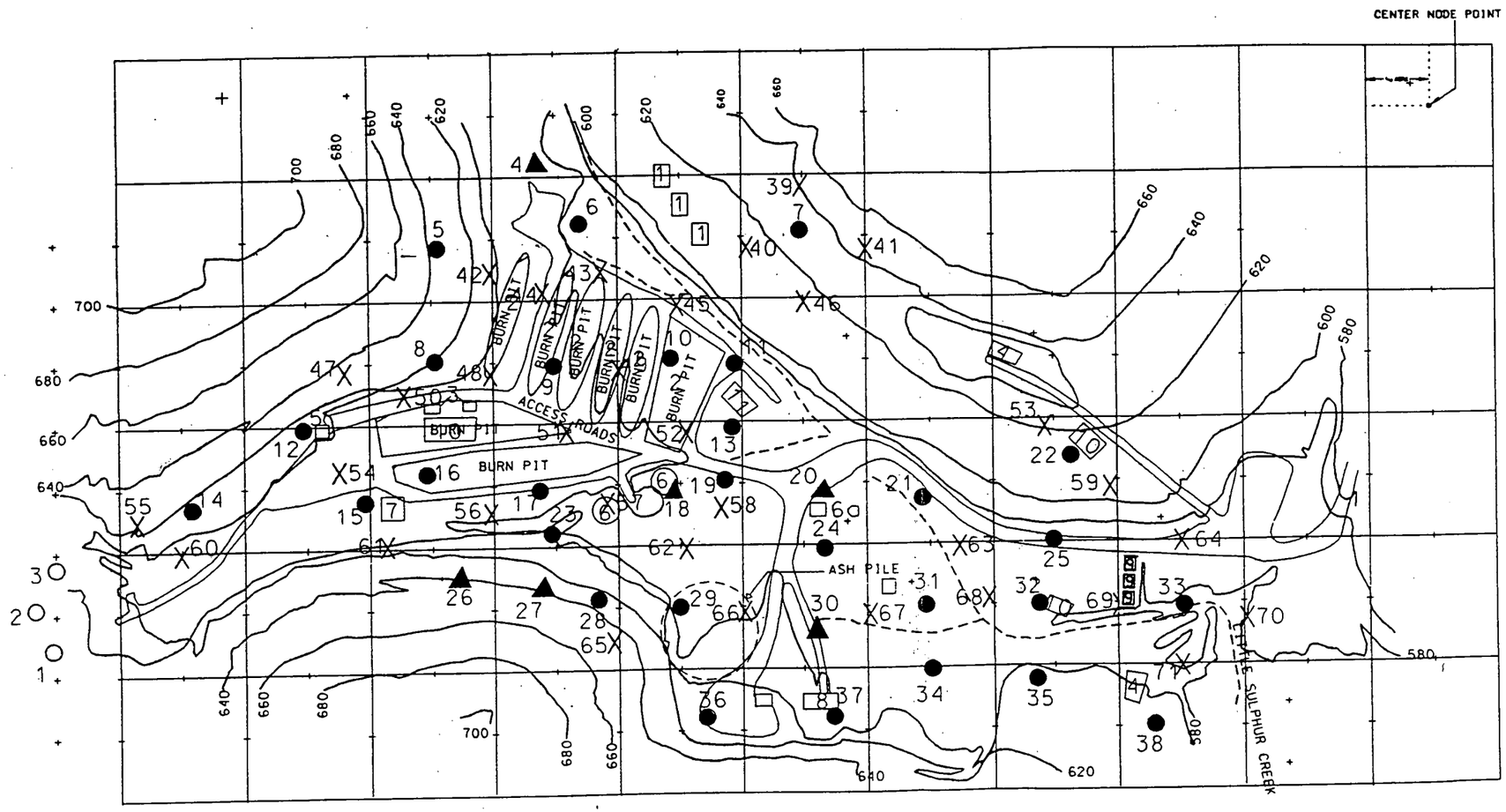
Soil samples were analyzed for explosives, polycyclic (polynuclear) aromatic hydrocarbons (PAHs), volatile organic compounds, and metals. A list of the target analytes and the methods of analysis is presented in Table A1. The decision to select certain chemical compounds for analysis was based on the results of the Part 1 RFI Phase III Soils study (U.S. Army Engineer Waterways Experiment Station 1992), which characterized contaminants in the ABG soils. Results of previous studies of the ABG area were summarized and listed in Chapter 2. The chemical composition of munitions likely burned at the ABG is provided in Table A2.

Chemical data quality control

A quality control program was enforced to ensure that the soil samples and the resultant chemical data represented the site conditions, that sources of extraneous contamination were determined, and that decisions based on chemical data were meaningful and supported.

Validity of the data is dependent on the level of quality control needed for the study. For this Part 2 RFI Phase III Soils Study, Ammunition Burning Ground, SWMU #03/10, a NEESA Level C, EPA Level 4 equivalent, Quality Control (QC) program was used. Other quality parameters used were analytical method-dependent and are described in USEPA 1986.

The data validation program began with the Part 2 RFI Phase III Soils Work Plan (U.S. Army Corps of Engineers, Wilmington District 1993). The work plan documented the objectives for the soils study and the procedures that would be used to meet those objectives. The data validation program continued in the field with chain of custody procedures and sample isolation and preservation. The tracking procedures were continued in the laboratory. A complete laboratory QA/QC plan was followed. Document management was started upon the receipt of the samples. Log books, bench sheets, and reports were



N

LEGEND

1. Sludge Burn Pads & Associated Tanks
2. Burn Pads
3. Production Scrap Burn Pads
4. Red Phosporous Burn Pads
5. Primer Pit
6. Surface Impoundments
6a. Surface Impoundments tanks
7. Ash Inspection Pan
8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box

○ BACKGROUND SOIL BORING 03/10-1-93

● SOIL BORING 03/10-5-93

X SURFACE SOIL SAMPLE 03/10-39-93

▲ BORING CANCELLED

Figure 15

NWSCC AMMUNITION BURNING GROUND SWMU 03/10 BORINGS AND SURFACE SAMPLE LOCATIONS

SCALE IN FEET 0 200 400

kept. All data were checked by the analyst, the inorganic-team leader or the organic-team leader, and the laboratory Chief before the data was released. The data were checked for completeness. The completeness check was to ensure that: (1) all samples and analyses were processed, (2) complete records including chain of custody for each analysis and associated QC samples were used, (3) procedures specified in project planning were followed, and (4) all required calibrations were performed. In addition to completeness, the following items were also checked:

a. Duplicate values for precision.

b. Recovery of spikes for accuracy.

c. Method blanks for contamination.

d. Surrogate recoveries for organic analyses.

e. Data for quality assurance check samples.

f. Reasonableness and trends.

If data fell outside acceptable limits as described in the analytical methods procedures, the sample was rerun if the required amount of sample was available. If the results continued to fall outside acceptable limits and the QA check sample data were good, then data were reported with qualifying explanations. Criteria for acceptable data were usually defined by the specific procedural method (i.e., SW-846).

The final data reports went through several review and approval levels. The data was finally checked for validity. The data was evaluated with respect to:

a. Detection limits.

b. Control limits for duplicates, matrix spikes, blanks, and surrogates.

c. Data control within control limits and corrective actions.

d. Flagging consistently out of control data.

A Chemical Data Quality Validation Report was prepared as a step in the data evaluation process and is contained in Appendix E.

5 Results of Investigation

Physical Characteristics of Soils

The depth of soil samples collected during the Part 2 Phase III investigations ranged from 0.5 to 10.0 ft below ground (Figure 16). The borings were terminated at refusal. Boring logs are presented in Appendix B and physical analysis data of soil samples is presented in Appendix C. Evaluation of boring logs and the results of the physical analysis of the soil samples indicate that soils from 0 in. to 30 in. depth are predominately inorganic sandy silts and clays (USCS ML-CL). The soils from 30 in. to 90 in. depth are composed of inorganic sandy silts, clays (USCS ML-CL) and fat clays (USCS CH) with lesser amounts of sand and gravel. The surface clays and silts contain roots and natural organic debris. The clay (USCS CH) represents the residual soil, a weathering product of the shale and limestone. Residual soils are also found as clay (USCS CL) with scattered sandstone fragments. A review of the site history indicates that the soil at the site has been reworked to a depth of two to three feet.

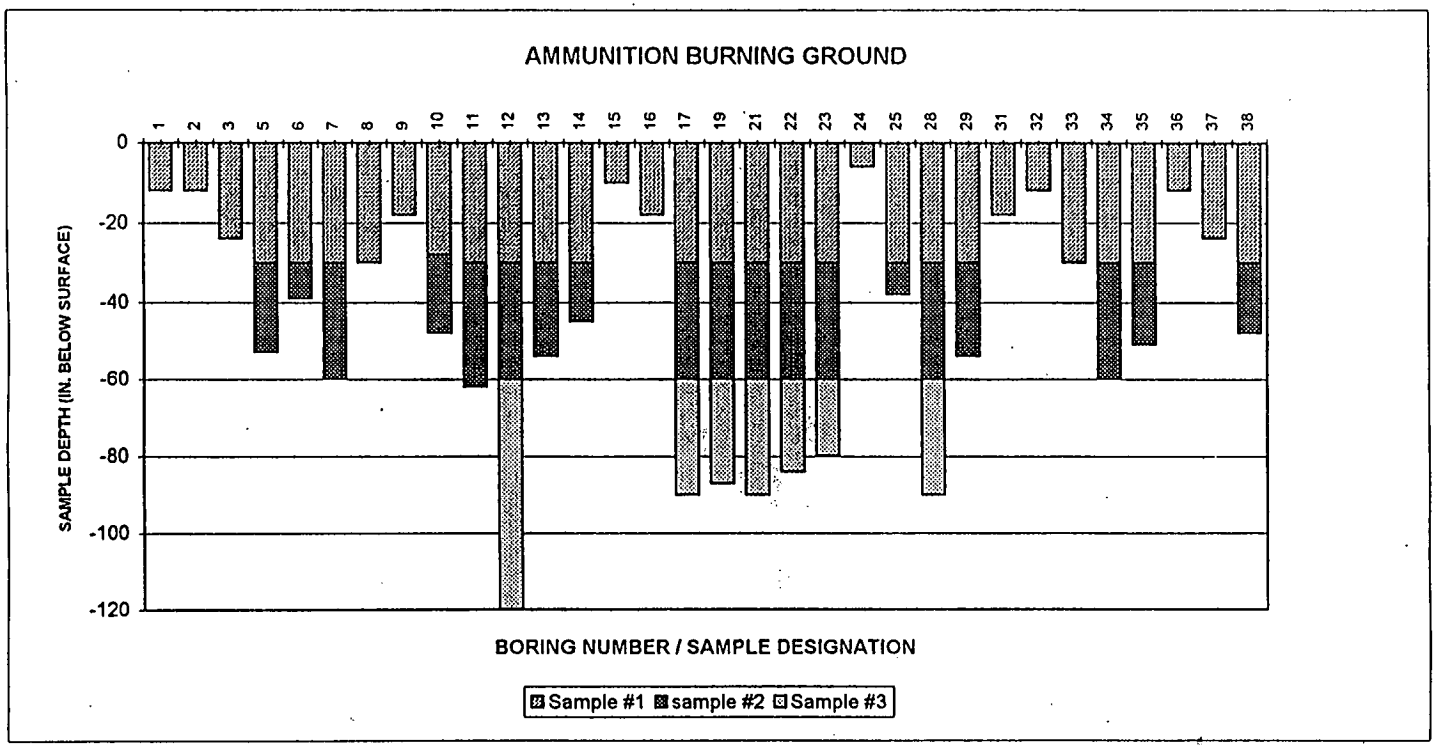
Chemical Analyses of Surface Soils

Introduction

Thirty-three surface soil grab samples were taken between August 10 and August 19, 1993 and submitted for chemical analyses. Three field duplicate samples were also taken. Figure 17 shows the ABG surface soil sample locations. These samples were taken from an interval between 6 and 18 in. below the ground surface. Chain of custody forms are presented in Appendix D and analytical data is presented in Appendix A.

Volatile organic analytes (VOAs)

The results of analyses of ABG surface soils for VOAs (EPA Method 8240 in USEPA 1986) are given in Table A3, and summarized in Table A4. Methylene chloride and acetone were found in most surface soil samples taken.



AMMUNITION BURNING GROUND, NWSC, CRANE INDIANA, SWMU 03/10.
DATES BORINGS MADE AND SAMPLES COLLECTED

Boring 1	21 Aug 93	Boring 7	21 Aug 93	Boring 13	21 Aug 93	Boring 21	22 Aug 93	Boring 32	24 Aug 93
Boring 2	21 Aug 93	Boring 8	21 Aug 93	Boring 14	24 Aug 93	Boring 23	25 Aug 93	Boring 33	23 Aug 93
Boring 3	21 Aug 93	Boring 9	20 Aug 93	Boring 15	25 Aug 93	Boring 24	24 Aug 93	Boring 34	22 Aug 93
Boring 5	20 Aug 93	Boring 10	19 Aug 93	Boring 16	25 Aug 93	Boring 25	24 Aug 93	Boring 35	23 Aug 93
Boring 6	20 Aug 93	Boring 11	19 Aug 93	Boring 17	25 Aug 93	Boring 28	24 Aug 93	Boring 36	22 Aug 93
		Boring 12	22 Aug 93	Boring 19	25 Aug 93	Boring 29	24 Aug 93	Boring 37	22 Aug 93
						Boring 31	24 Aug 93	Boring 38	23 Aug 93

Figure 16. Depth of soil samples

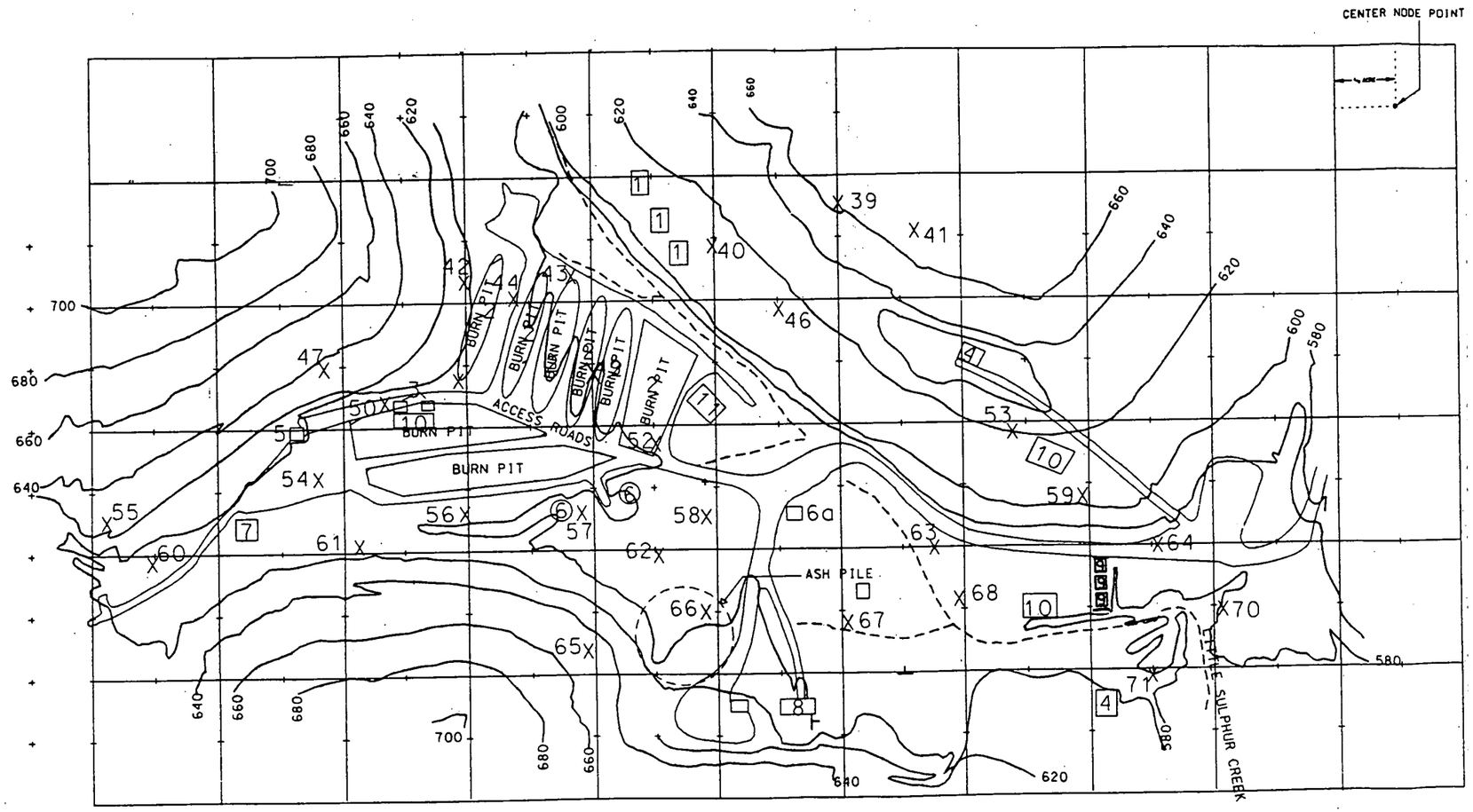
These constituents were also found in the associated method blanks (Table A5). These results suggest sample contamination from the laboratory environment rather than from processes associated with the field conditions. VOAs that may not be solely associated with laboratory environment contaminants were also detected and include T-xylene, ethyl benzene, toluene, and trichloroethene (also known as trichloroethylene, or TCE) (Table A4). The reported concentrations of T-xylene, ethyl benzene, and toluene ranged from 0.00061 to 0.0091 mg/kg dry weight and were all "J" qualified, that is, detected by the analytical instrumentation but not in sufficient quantities to accurately quantify, but estimated. The highest VOA concentration was trichloroethene from sample 56 (0.017 mg/kg). Trichloroethene was also found in "J" value concentrations in samples 66 and 67.

Table A4 compares concentrations of VOAs found in the ABG surface soils with risk-based concentrations (RBCs) promulgated by USEPA (USEPA Region III 1994). The RBCs are derived from toxicity constants from established sources and "standard" exposure scenarios corresponding to a fixed level of risk (i.e., a hazard quotient of one, or a lifetime cancer risk of 10^{-4}, whichever occurs at a lower concentration). The RBCs are not regulation or guidance and should not be viewed as a substitute for a site-specific risk assessment. The maximum concentrations of specific VOAs in ABG surface soils sampled did not exceed the USEPA Region III RBCs for respective VOAs for industrial soils.

Method blanks. Acetone and methylene chloride were reported in most method blanks for the VOA analyses (Table A5), which implies a laboratory contamination source for these constituents. The volatile organic compounds 2-butanone and T-xylene were also found in some method blanks in low concentrations, 0.004 and 0.0012 mg/kg, respectively. 2-Butanone was not found in any surface soil samples. T-Xylene was detected in a method blank associated with the analysis of the soil sample collected at station 54. The concentration of T-xylene in the method blank was 0.0012 mg/kg while the concentration in the soil sample was 0.003 mg/kg. All other samples where T-xylene was detected, six other stations including a duplicate of station 54, had no T-xylene in associated method blanks. These method blank analysis results were considered in the interpretation of the VOA soils analyses.

Equipment rinses. Sampling equipment for the surface soil sampling were disposable scoops. This equipment was used for sampling at one location and then disposed of. As a result, equipment rinse blanks were not taken. Because of the use-and-dispose sampling gear, contaminant carryover between samples is not considered a likely occurrence. Leaching of contaminants from the sample devices was not evaluated with rinse blanks but was not expected to occur.

Trip blanks. No VOA's other than methylene chloride and acetone were detected in the trip blanks (Table A6). Methylene chloride and acetone were also found in method blanks associated with the analyses of the trip blanks. These data indicate that cross-sample contamination did not occur within a sample shipment.



N

LEGEND

1. Sludge Burn Pads & Associated Tanks
2. Burn Pads
3. Production Scrap Burn Pads
4. Red Phosporous Burn Pads
5. Primer Pit
6. Surface Impoundments
6a. Surface Impoundments tanks
7. Ash Inspection Pan
8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box

X SURFACE SOIL SAMPLE 03/10-39-93

Figure 17

NWSCC AMMUNITION BURNING GROUND SWMU 03/10 SURFACE SAMPLE LOCATIONS

SCALE IN FEET

0 200 400

Explosives

The results of analyses of ABG surface soils for selected explosives compounds (EPA Method 8330) are given in Table A7 and summarized in Tables A8, A9, and A10.

HMX, RDX, TNB, TNT, 2,4-DNT, 2,6-DNT, 2A-DNT, and 4A-DNT were found in measurable quantities in the ABG surface soil samples. DNB and TETRYL were tested for but not detected in any sample. Explosives were found in 22 of 33 surface soil sample locations. HMX was found at 21 locations, TNT at 19 locations, and 4A-DNT at 17 locations. TNB, RDX, 2,4-DNT, and 2A-DNT had similar frequencies of occurrences, occurring in samples from 8, 9, 9, and 11 locations, respectively. The explosive, 2,6-DNT, was detected at four locations. HMX was the explosive with the highest concentration in 14 locations. TNT and RDX were the explosive compounds with the highest concentrations at four and three locations, respectively. Station 61 contained the highest concentration reported for 4 of the 8 explosive compounds reported (Figure 15).

RDX was the explosive compound with the highest concentration encountered, 1820 mg/kg at station 61. The highest HMX and TNT concentrations reported were 223.0 mg/kg at station 61 and 136.0 mg/kg at station 56, respectively. None of the other explosive compounds detected, TNB, 2,4-DNT, 2,6-DNT, 2A-DNT, and 4A-DNT, had maximum concentrations of over 10 mg/kg.

Table A8 summarizes the analyses of ABG surface soils for explosives using total explosive concentrations. Total explosive concentrations were determined by summing all concentrations of explosive compounds detected during the analysis of a specific soil sample. The total explosives categories are arbitrary for illustrative purposes. In 48.5 percent of the ABG surface soil samples, explosives were either not detected (33.3 percent) or were found in a total explosives concentration of less than 1 mg/kg (15.2 percent). About 76 percent of the surface soil samples taken contained less than 10 mg/kg total explosives. The total explosive categories, >10 mg/kg $<$ 100 mg/kg, >100 mg/kg $<$ 1000 mg/kg, and >1000 mg/kg characterized 15.2 percent, 6.1 percent and 1.7 percent of the samples, respectively.

There were two sampling locations with elevated total explosives concentrations. The highest one was centered around stations 61 and 56 in the west central portion of the ABG complex and the other around station 69 on the eastern edge of the ABG. Explosives were also found in areas between the two areas of elevated concentrations.

Table A9 compares the maximum concentrations of specific explosive compounds to the EPA Region III RBCs (risk-based concentrations) for industrial soils. The TNT in soils sampled at station 56, 136 mg/kg, exceeded the TNT RBC of 95 mg/kg (basis of the risk was a carcinogenic effect). The sum of DNT mixtures 2,4-DNT, 2,6-DNT, 2A-DNT, and 4A-DNT, 13.85 mg/kg at station 61, exceeded the DNT mixtures' RBC (carcinogenic effect) of

4.2 mg/kg. There were no RBCs established for the explosives with the highest concentration in ABG surface soils, RDX and HMX.

Method blanks. No explosives compounds tested were detected in the method blanks analyzed in association with the ABG soils analyses (Table A11). The method blanks analyses do not change the interpretation of explosives compound data previously presented.

Equipment rinses. Because of the use-and-dispose sampling gear, contaminant carryover between samples is not considered a likely occurrence. Leaching of explosive analytes from the sample devices is not expected to occur.

Polycyclic aromatic hydrocarbons (PAHs)

The results of analyses of ABG surface soils for PAHs (using EPA Method 8270 (semivolatile organics)) are given in Table A12 and summarized in Tables A13 and A14.

PAHs were present at 9 of 33 locations sampled. With the exception of benzo(b)fluoranthene at station 68, all specific PAH concentrations reported were "J" qualified. The concentration of benzo(b)fluoranthene at station 68 was 0.37 mg/kg, the highest specific PAH measured. Total PAH concentrations (the sum of all detected PAHs) were less than 1 mg/kg except for station 64 (1.079 mg/kg) and station 68 (3.102 mg/kg).

Table A14 shows that the maximum concentration of any PAHs detected did not exceed EPA Region III RBCs (risk-based concentrations) for industrial soils.

Method blanks. No PAH compounds tested were detected in the method blanks analyzed in association with the ABG surface soils analyses (Table A15). The method blanks analyses do not change the interpretation of explosives compound data previously presented.

Equipment rinses. Because of the use-and-dispose sampling gear, contaminant carryover between samples is not considered a likely occurrence. Leaching of PAHs from the sample devices was not evident as most samples (24 of 33) did not contain detectable amounts of those compounds.

Metals and inorganics

The results of analyses of ABG surface soils for selected inorganic analytes are given in Table A16. Tables A17 and A18 are summaries of the metals and inorganics analyses data.

The maximum concentrations of specific inorganic constituents in ABG surface soils sampled were distributed among seven sample locations (Tables A17 and A18). Soils from location 67 exhibited maximums for barium, chromium, iron, manganese, nickel, silver, tin, zinc, and total

phosphorus. Location 61 contained maximums for aluminum, cadmium, copper, and magnesium. Other constituent maximums were singularly distributed.

All the tested inorganic analytes occur naturally in soils. To assess the magnitude and significance of inorganic constituents found in the ABG surface soils sampled, comparison of the concentrations encountered were made with "background" soils in the vicinity of the ABG and with USEPA Region III RBCs. The background soils were taken from ABG soil borings 1, 2, and 3 (borings 03/10-1-93-1, 03/10-2-93-1, and 03/10-3-93-1) located in a remote part of the ABG valley (Figure 15). The Part 1 Phase III Soils investigation (U.S. Army Engineer Waterways Experiment Station 1992) indicated that the background boring soils are likely not contaminated with respect to inorganic constituents resulting from waste disposal activities at ABG.

Table A19 compares concentrations of inorganics in surface soils from the ABG area, where waste handling activities are likely to have occurred, with nearby background soils. ABG surface soils consistently had higher concentrations of inorganic constituents than the background soils. Concentrations of metals and inorganics in the ABG surface soils sampled were, in some cases, more than 100 times, or two orders of magnitude, higher than mean background concentrations. Surface soil samples in this category were scattered across the ABG valley floor and sample constituents in this category included cadmium, calcium, lead, copper, and zinc. Calcium and cadmium were the constituents most frequently meeting the criterion of 100 times the background. If one order of magnitude difference, 10 times the background, is used, the constituent list is expanded to include magnesium, silver, tin, and phosphorus, and most ABG stations sampled are included.

As shown in Table A20, ABG surface soils exceeded the EPA Region III RBC for industrial soils only for arsenic (for carcinogenic effects). However, the mean arsenic concentrations in the background soils also exceeded the arsenic risk-based concentration.

Method blanks. The results of analysis of method blanks used in association with the inorganic analyses of ABG surface soils are provided in Table A21. Some inorganic constituents were found in the method blanks but at low concentrations (i.e., below the Contract Laboratory Program - Contract Required Detection Limit but greater than the instrument detection limit and thus qualified by a "B"). The results presented previously were *not* corrected by subtracting any blank value. These method blank analyses do not change the interpretation of inorganic constituent data previously presented.

Equipment rinses. Because of the use-and-dispose sampling gear, contaminant carryover between samples is not considered a likely occurrence.

Chemical Analyses of Subsurface Soils

Introduction

Thirty-two soil borings were made in August 1993. Figure 18 shows the location of these borings and of the Part 1, 1990 borings. Soil samples for chemical analyses were taken from specified depths using a splitspoon. The depth from which each soil sample was taken is indicated in Figure 16. Also provided in Figure 16 are the dates of sample collection. Chain-of-custody forms are presented in Appendix D and analytical data is presented in Appendix A.

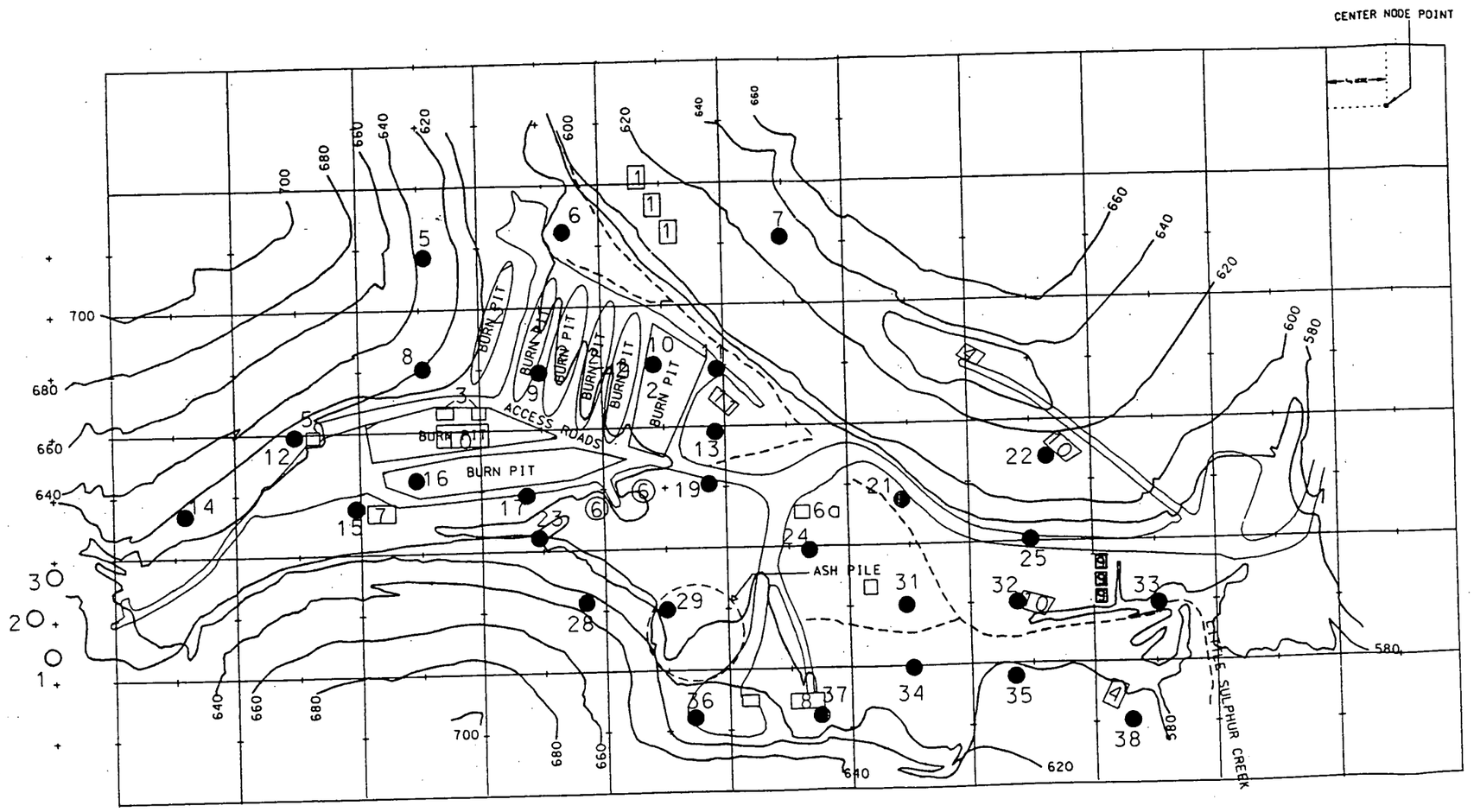
Volatile organic analytes (VOAs)

The results of analyses of ABG subsurface soils for VOAs (EPA Method 8240) are given in Table A22. Methylene chloride and acetone were found in most soil boring samples taken. These constituents were also found in the associated method blanks (Table A26). These results indicate sample contamination from the laboratory environment rather than from processes associated with the field conditions.

Tables A23 through A25 summarize the VOAs detected in ABG soil borings that were not considered solely laboratory contaminants. VOAs were detected in 11 of the 32 soil borings made. In 5 of the 11 borings with VOAs, the maximum concentration determined was qualified as a "J" value. The borings where analyses resulted in concentrations that were not qualified by a "J" included borings 10, 17, 23, 25, 28, and 29. VOAs were detected in the uppermost samples (sample #1, from 0 to 60 in. below the ground surface, Figure 16), mid-depth samples (sample #2, from 28 to 62 in. below the ground surface), and bottom samples (sample #3, from 60 to 90 in. below the ground surface).

Eight VOAs were detected, including trans-1,2-dichloroethene, cis-1,2-dichloroethene, 1,1,1-trichloroethane, trichloroethene, toluene, ethyl benzene, styrene, and t-xylene.

Of these VOAs, 1,1,1-trichloroethane, ethyl benzene, and styrene occurred in concentrations that were detected by the analytical instrumentation but not large enough to accurately quantify. The maximum concentrations of 4 of the 8 different VOAs, cis-1,2-dichloroethene (2.3 mg/kg), trans-1,2-dichloroethene (0.29 mg/kg), trichloroethene (0.2 mg/kg), and ethyl benzene (0.0028 mg/kg) occurred in samples from boring 17. Boring 25 contained maximum concentrations of two VOAs, styrene (0.0017 mg/kg) and xylene (0.012 mg/kg). Maximum concentrations of toluene (0.0067 mg/kg) and 1,1,1-trichloroethane (0.00057 mg/kg) occurred at borings 10 and 19, respectively.



N

LEGEND

1. Sludge Burn Pads & Associated Tanks
2. Burn Pads
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6a. Surface Impoundments tanks
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8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box

○ BACKGROUND SOIL BORING 03/10-1-93

● SOIL BORING 03/10-5-93

Figure 18

NWSCC AMMUNITION BURNING GROUND SWMU 03/10 BORING LOCATIONS

SCALE IN FEET 0 200 400

Xylene, the most frequently occurring VOA, was found in eight borings. Cis-1,2-dichloroethene, trichloroethene, and toluene were found in five borings. Styrene and 1,1,1-trichloroethane were found only in borings 25 and 19, respectively. Cis-1,2-dichloroethene was the VOA with the highest concentration in borings 17, 23, and 28. T-xylene was the VOA with the highest concentration in borings 11, 25, and 38; toluene in borings 10 and 21; and trichloroethene in borings 29 and 35.

RFI Part 2 - Phase III Soils Report pages 53-56

With respect to sample depth, the highest concentrations of some VOAs occurred at the deepest samples within a boring, samples #3. Trans-1,2-dichloroethene and cis-1,2-dichloroethene were in this category. Conversely, trans-1,2-dichloroethene was not found in any sample #1, the shallowest boring sample. The highest concentrations of trichloroethene occurred in a sample #2. The VOA 1,1,1-trichloroethane was found only in sample #1. Sample depth associations for t-xylene, styrene, toluene, and ethyl benzene were not clear, except that styrene and toluene were not found in any sample #3.

As shown in Table A24, the ABG subsurface soils sampled did not exceed any EPA Region III RBC for industrial soils for specific VOAs.

Method blanks. Acetone and methylene chloride were reported in all method blanks associated with the VOA analyses of the soil boring samples (Table A26). These constituents are considered laboratory contaminants. The VOA, 2-butanone, was found in one method blank in a low concentration, 0.0040 mg/kg. However this compound was not detected in any of the soil boring samples analyzed. These method blank analysis results were considered in the interpretation of the VOA subsurface soils analyses.

Equipment rinses and field blanks. Five equipment rinsates and one field blank (source water used for cleaning) were collected for subsurface ABG soil sampling. Methylene chloride, chloroform, bromodichloromethane, and dibromochloromethane were found in all equipment rinses and the field blank (Table A27). Acetone was detected in one rinse. Methylene chloride and acetone were found in method blanks associated with these analyses, which implies a laboratory source for these contaminants. Because chloroform, bromodichloromethane, and dibromochloromethane were found in the field blank, they may have been derived from the initial washing with potable water. Neither chloroform, bromodichloromethane, nor dibromochloromethane were detected in any of the ABG subsurface soil samples.

Trip blanks. Methylene chloride was reported in all trip blanks analyzed (Table A28). Acetone was found in one trip blank. These constituents are considered laboratory contaminants as they were also found in method blanks associated with the analyses of the trip blanks. These data indicate that cross sample VOA contamination did not occur within the sample shipment.

Explosives

The results of analyses of ABG subsurface soils for selected explosives compounds (EPA Method 8330) are given in Table A29 and summarized in Tables A30, A31, and A32.

HMX, RDX, TNB, TNT, 2,4-DNT, 2,6-DNT, 2A-DNT, and 4A-DNT were found in measurable quantities in the ABG subsurface soil samples. DNB and TETRYL were tested for but not detected in any sample. Explosives were found in 16 of 32 soil borings made. HMX was found in 14 of the 16 borings with detectable explosives and was the explosive with the highest concentration in nine borings. TNT, RDX, 2A-DNT, and 4A-DNT were similarly distributed, being found in 11, 13, 10, and 11 borings, respectively. RDX was the maximum explosive compound in 3 borings and TNT in two borings. TNB and 2,4-DNT were maximum explosives in one boring each.

The maximum concentrations of specific explosives ranged from 2,030 mg/kg for TNT to 0.375 mg/kg for 2,6-DNT. Within that range, RDX and HMX had maximum concentrations of 274 and 232 mg/kg, respectively. Maximum concentrations were 37.5 mg/kg for TNB and 11.6 mg/kg for 2,4-DNT. The explosives 2A-DNT and 4A-DNT had maximum concentrations of less than 2.50 mg/kg.

Explosives were represented at all sample depths. Except for borings 17 and 35, the highest concentrations of explosives in a specific boring came from the shallowest sample, sample #1 (depth range 0 to 30 in. below the ground surface). However, the highest concentrations of HMX, RDX, TNB, and TNT occurred in sample #2 of borings 17 and 35 (from 28 in. to 62 in. below ground surface).

Table A32 summarizes the ABG subsurface soils using total explosive concentrations. Total explosive concentrations were determined by summing all concentrations of explosive compounds detected during the analysis of a specific soil sample. The total explosives categories are arbitrary for illustrative purposes. Most, 67.2 percent, of all ABG subsurface soil samples contained less than 1 mg/kg of total explosives. Eighty-one percent of the samples taken contained less than 10 mg/kg total explosives. The total explosive categories, >10 mg/kg <100 mg/kg, >100 mg/kg $<$ 1000 mg/kg, and >1000 mg/kg characterized 12.1 percent, 5.2 percent and 1.7 percent of the samples, respectively.

For the soil boring data, specifically from surficial sample #1, explosives concentrations were generally highest in borings 17 and 29 in the central ABG area and boring 35 in the east ABG area. Considering the slightly deeper sample #2 data, the foci are still centered on borings 17 and 35. The boring 17 area was the only area with explosives detected in the deeper sample #3.

Table A31 compares the maximum concentrations of specific explosive compounds in ABG soil boring samples to the EPA Region III RBCs for industrial soils. The TNT RBC for industrial soils is 95 mg/kg (basis of the risk was a carcinogenic effect). Only sample #2 from boring 35, with a TNT

concentration of 2,030 mg/kg, exceeded this RBC. The sum of DNT mixtures 2,4-DNT, 2,6-DNT, 2A-DNT, and 4A-DNT, in samples 6 #1, 12 #1, and 17 #1 exceeded the DNT mixtures RBC (carcinogenic effect) of 4.2 mg/kg. There were no RBCs provided for RDX and HMX, which are present in some ABG soil boring samples.

Method blanks. No explosives compounds were detected in the method blanks analyzed in association with the ABG subsurface soils analyses (Table A33).

Equipment rinses and field blanks. Five equipment rinsates and one field blank were collected during the subsurface ABG soil sampling (Table A34). No explosives compounds were detected in those equipment rinses and field blank. Thus, evidences of sample to sample contamination due to incomplete sampling equipment cleaning were not observed.

Polycyclic aromatic hydrocarbons (PAHs)

The results of analyses of ABG subsurface soils for PAHs (using EPA Method 8270 (semivolatile organics) are given in Table A35 and summarized in Tables A36 and A37.

PAHs were present in 11 of 32 soil borings in less than 1 mg/kg concentrations. All specific PAH concentrations reported were "J" qualified. Maximum concentrations of specific PAH compounds occurred in samples taken from borings 6, 19, and 23. The highest specific PAH measured was phenanthrene, which had an estimated (J value) concentration of 0.21 mg/kg at sample #1 of boring 19. PAH concentrations in ABG subsurface soils sampled did not exceed EPA Region III RBCs for PAHs for industrial soils (Table A36).

Total PAH concentrations (the sum of all detected PAHs) were all less than 1 mg/kg (Table A37). The highest total PAH concentration from an ABG soil boring sample was 0.823 mg/kg for sample #1 from boring 19.

Method blanks. No PAH compounds tested were detected in the method blanks analyzed in association with the ABG surface soils analyses (Table A38). These method blank analysis results were considered in the interpretation of the soils analyses for PAHs.

Equipment rinses and field blank. No PAHs were detected in equipment rinses or field blanks (Table A39). These results indicate that cross-contamination of samples or equipment contamination did not occur and was not a factor in the results obtained from the analyses of ABG subsurface soils for PAHs.

Metals and inorganics

The results of analyses of ABG subsurface soils for selected metals and inorganic analytes are given in Table A40. Table A41 is a statistical summary of the metals and inorganic analyses data.

The maximum concentrations of specific inorganic analytes in ABG subsurface soils were distributed among seven borings (Table A42). Boring 31 contained the maximum concentration with respect to barium, copper, chromium, iron, sodium, tin, zinc, and total phosphorus. Borings 12, 22, 23, 33, 34, and 36 contained maximums of either 1 or 2 inorganic constituents. Maximum concentrations of silver, arsenic, barium, calcium, chromium, copper, iron, mercury, sodium, nickel, lead, tin, zinc, and total phosphorus occurred within the more surficial samples within a boring (sample #1, from 0 to 60 in. below the ground surface). Maximums of aluminum, cadmium, cobalt, magnesium, and manganese occurred in mid-boring samples (sample #2, from 28 to 62 in. below the ground surface). Only the maximum for arsenic occurred in a lower boring sample (sample #3, from 60 to 90 in. below the ground surface).

Table A43 the ABG area, where waste handling activities are likely to have occurred, with those from nearby background borings, borings 1, 2, and 3 placed in a more remote part of the ABG valley. Soils from the ABG SWMU #03/10 area borings consistently had higher concentrations of inorganic constituents than the background soils. Concentrations of metals and inorganics in the ABG soils sampled were, in some cases, more than 100 times, or two orders of magnitude, higher than mean background concentrations. Soils borings with samples in this category were scattered widely across the ABG valley floor. Constituents in this category included cadmium, calcium, copper, zinc, and tin. Calcium and cadmium were the most frequent constituents meeting the criterion of 100 times background. Only boring 31, sample 1 had other constituents, namely copper, tin, and zinc, in concentrations greater than 100 times the background. If 10 times the background is used as the criterion, the constituent list for all ABG soil samples is expanded to include lead, magnesium, mercury, nickel, silver, and phosphorus and most ABG stations sampled are included.

Considering sample depth within soil borings, only three borings, 23, 28, and 35, had mid- or lower depth samples where soils contained a metal concentration 100 times greater than background. In these samples cadmium was at least 100 times greater than background.

As shown in Table A44 ABG area subsurface soils exceeded the EPA Region III RBC for industrial soils only for arsenic (for carcinogenic effects). However, the mean arsenic concentrations in the background soils (3.7 mg/kg from Table A43) also exceeded the arsenic RBC of 1.6 mg/kg.

Method blanks. The results of analysis of method blanks used in association with the inorganic analyses of ABG subsurface soils are provided in Table A45. Some inorganic constituents were found in the method blanks but at low concentrations (i.e., frequently below the Contract Laboratory Program-Contract Required Detection Limit but greater than the instrument detection

limit, and thus qualified by a "B"). The results presented previously were *not* corrected by subtracting any blank value. These method blank analyses do not change the interpretation of inorganic constituent data previously presented.

Equipment rinses. The results of the analyses of five equipment rinses and one field blank for inorganic constituents are provided in Table A46. Inorganic analytes were found in the equipment rinses and the field blank. However, the concentrations of inorganic constituents were not great enough to change the interpretation of data as previously discussed.

Summary of Analytical Results And Estimate of Extent of Contamination

Volatile organic analytes (VOAs)

VOAs were detected in several surface and subsurface ABG soil samples. Highest concentrations of VOAs were the solvents cis- and trans- isomers of 1,2-dichloroethene (2.3 mg/kg and 0.29 mg/kg, respectively) and trichloroethene (0.2 mg/kg). Maximum concentrations occurred at the depth of approximately 30 to 90 in. below the ground surface. Surface VOAs were scattered among several locations. In deeper soil samples, VOAs occurred only in the area of the contaminated material burn pads (Boring 17) and to a lesser extent near the PEP contaminated solvents liquid burn pads (Boring 25). See Figure 3 for locations of ABG operational units. Soil sample locations are shown in Figure 19.

Explosives

HMX, RDX, TNB, TNT, 2,4-DNT, 2,6-DNT, 2A-DNT, and 4A-DNT were detected in surface and subsurface ABG soil samples. Thus a release of these compounds as a result of waste management activities at ABG is confirmed. Of the explosives detected, RDX, TNT and HMX were the most significant in terms of maximum concentrations. RDX and TNT occurred in concentrations greater than 1,000 mg/kg and HMX in concentrations greater than 200 mg/kg. The remaining explosives had maximum concentrations generally less than 10 mg/kg.

Explosives occurred at all sample depths. However, the samples obtained from 0 to 60 in. below the ground surface had higher concentrations of explosives than the deeper soil samples. Low concentrations of explosives (defined as less than 10 mg/kg total explosives (sum of all explosives detected)) were scattered widely. Total explosives in concentrations greater than 100 mg/kg occurred at fewer locations (surface grab locations 56, 69, and 61 and soil borings 29, 35, and 17) (Figure 20). Concentrations of total explosives greater than 1,000 mg/kg occurred infrequently, in only one surface grab sample and one soil boring (surface grab location 61 and soil boring 35).

Polycyclic aromatic hydrocarbons (PAHs)

PAHs were detected in ABG surface and subsurface soils in concentrations that were generally less than 1 mg/kg total PAH (sum of all detectable PAHs). Two surface soil samples, from locations 64 and 68, contained the highest PAH concentrations at 1.079 and 3.102 mg/kg total PAH, respectively.

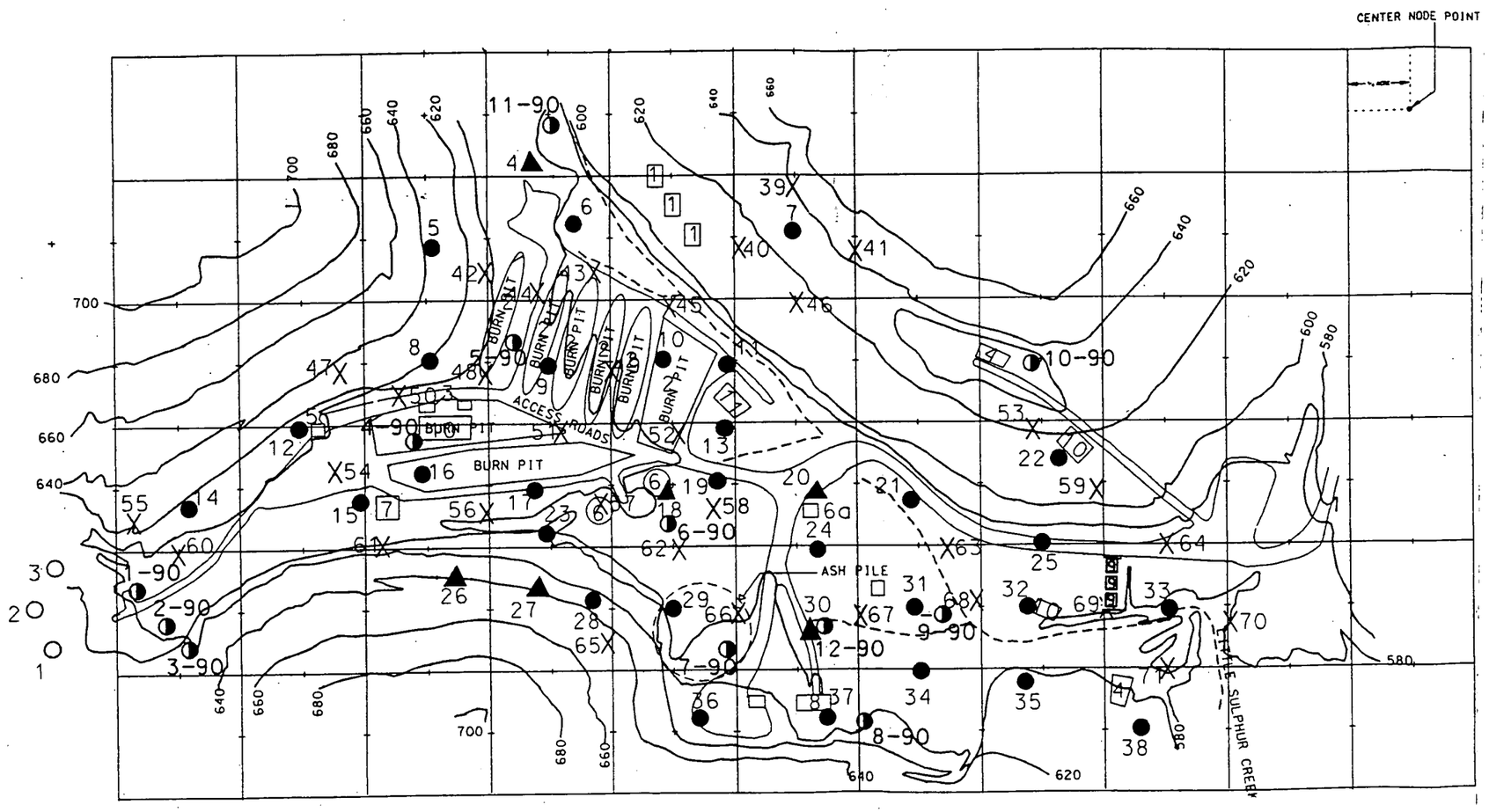
Metals and inorganics

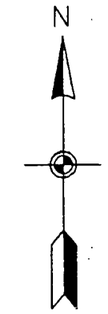
Several metal and inorganic constituents in the ABG surface and subsurface soils sampled had consistently higher concentrations than the background soils. Surficial soil samples (surface grabs and surface samples from the soil borings) that were 100 times higher than mean background concentrations were scattered widely across the ABG valley floor. These comparisons indicate that waste management activities at ABG have released metal and inorganic constituents to the soils. Constituents that were greater than 100 times background included cadmium, calcium, copper, lead, zinc, and tin. Calcium and cadmium were the most frequent constituents meeting the specified criteria. Surface grab sample 67 and soil boring 31, sample 1 had more constituents greater than 100 times the background (i.e., cadmium, calcium, copper, lead, and zinc for sample 67 and cadmium, copper, lead, tin, and zinc for boring 31 sample 1). Only borings 23, 28, and 35 had mid or lower depth samples where a single constituent, cadmium, had concentrations 100 times greater than the background concentrations. If 10 times the background is used as the criterion, the constituent list for all ABG soil samples is expanded to include magnesium, mercury, nickel, silver, and phosphorus, and most ABG stations sampled are included.

Estimate of extent of explosives and metals contaminants

The intent of this Part 2, RFI Phase III, Soil Investigation was to determine the extent of soil contamination at ABG resulting from waste management activities. Both 1990 (Part 1 soils) and 1993 (Part 2 soils) data were addressed to determine the extent of contamination. Figure 19 illustrates all the sample locations for the 1990 and 1993 sampling activities.

Based on the 1990 and 1993 soils data, the waste disposal activities have contributed residues of explosives compounds and metal contaminants to the soils. PAHs and VOAs were also released, but in concentrations that were generally below 1 mg/kg. Therefore, this assessment of the extent of soils contamination will focus on explosives and metals. Concentrations of total explosives and selected metals, in surface and soil boring samples to an approximate depth of 30 in. below the ground surface for both the 1990 and 1993 data, were evaluated using Intergraphs' "InRoads" software application. A digital terrain model or surface was created using the soil sample locations and constituent concentrations. These surfaces were triangulated and then contoured as concentration isopleths. Similar evaluations were performed for soil samples taken at sample depths greater than 30 in. below the ground surface.





LEGEND

1. Sludge Burn Pads & Associated Tanks
2. Burn Pads
3. Production Scrap Burn Pads
4. Red Phosporous Burn Pads
5. Primer Pit
6. Surface Impoundments
6a. Surface Impoundments tanks
7. Ash Inspection Pan
8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box

○ BACKGROUND SOIL BORING 03/10-1-93

● SOIL BORING 03/10-5-93

X SURFACE SOIL SAMPLE 03/10-39-93

▲ BORING CANCELLED

◑ 1990 SOIL BORING 1-90

Figure 19
NWSCC AMMUNITION BURNING GROUND SWMU 03/10 SAMPLE LOCATIONS FOR 1990 & 1993 SAMPLING
SCALE IN FEET
0 200 400

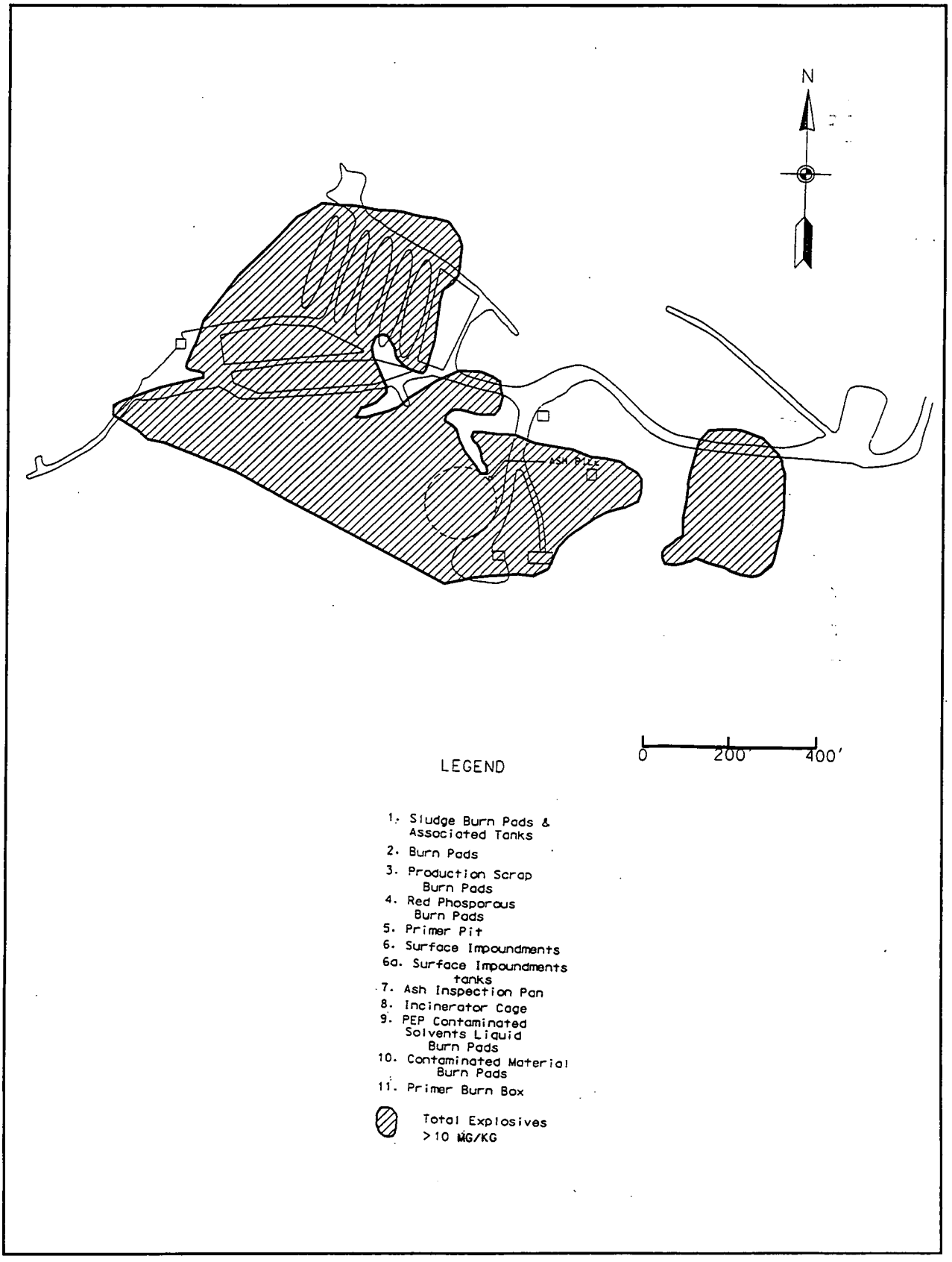


Figure 20. Contaminated area (total explosives) 0 in.-30 in. deep

However, it should be noted that the data available to create the model decreases significantly as sample depth increases.

In Figure 20, the 10 mg/kg total explosives isopleth is shown as an arbitrary limit for explosives compound contamination of surface and boring soil samples (0 - 30 in. below the ground surface). The total explosives contour was developed using surface grab and soil boring (sample #1) data. For soils deeper than 30 in., Figure 21 illustrates a 10 mg/kg total explosives contamination limit. For soils greater than 30 in. below the ground surface, only samples 2 and 3 from 1993 boring 17 and sample 2 from 1993 boring 35 exceeded the 10 mg/kg total explosives criterion.

Soil concentrations of cadmium, lead, zinc, copper, tin, and calcium that were two orders of magnitude (100 times) above background concentrations were scattered across the ABG valley. Maximum concentrations of many metal and inorganic constituents in ABG soils occurred near surface sample station 61 and boring 31. Of the metals and inorganics that were greater than 100 times the background (calcium, lead, zinc, copper, and tin), cadmium and lead are constituents with maximum contaminant concentrations established in the TCLP (40 CFR 261.24 and Appendix II to Part 261, USEPA Method 1311 in USEPA 1986). The regulatory level of contaminants in leachates for toxicity characteristic is 5.0 mg/L and 1.0 mg/L for lead and cadmium, respectively. A solid waste exhibits the toxicity characteristic if the TCLP leachate (extract) from a representative sample is equal or greater than the listed value. Risk-based concentrations are not available for lead. Following recent USEPA guidance for soil screening (USEPA 1994), soils concentrations of 500 mg/kg lead and greater and 10 mg/kg cadmium and greater were used to estimate areas of concern with respect to exceeding the TCLP regulatory levels. TCLP analyses are required to determine if the ABG soils actually leach lead and cadmium at levels above TCLP maximum contaminant levels. Major portions of the metals concentrations in soils are not readily leached. The leachable concentration is soil and metal specific.

The estimated extent of ABG soils that contain greater than 10 mg/kg cadmium or greater than 500 mg/kg lead are shown on Figure 21 and 22. For the soil greater than 30 in. below the ground surface, only one soil sample had lead or cadmium concentrations exceeding the arbitrary contaminant limits, that being 1990 soil boring 12, sample 4. Figure 21 illustrates the extent of cadmium and lead contamination in soils greater than 30 in. deep.

Figures 23 and 24 illustrate estimates of the extent of contamination by explosives and metals in ABG soils based on samples taken 0 to 30 in. deep and 30 to 90 in. deep, respectively. For this delineation, contamination was defined as soils with one or more of the following conditions: cadmium concentrations greater than 10 mg/kg; lead concentrations greater than 500 mg/kg, or total explosives greater than 10 mg/kg. For the 0 to 30 in. sample data, the area of contamination was about 478,513 sq ft (10.98 acres). Assuming that all the soil in the defined area to a depth of 30 in. is contaminated, the volume of contaminated soil is 1,196,282 cu ft or 44,307 cu yd. For the 30 to 90 in. sample data, the area of contamination was 86,472 sq ft

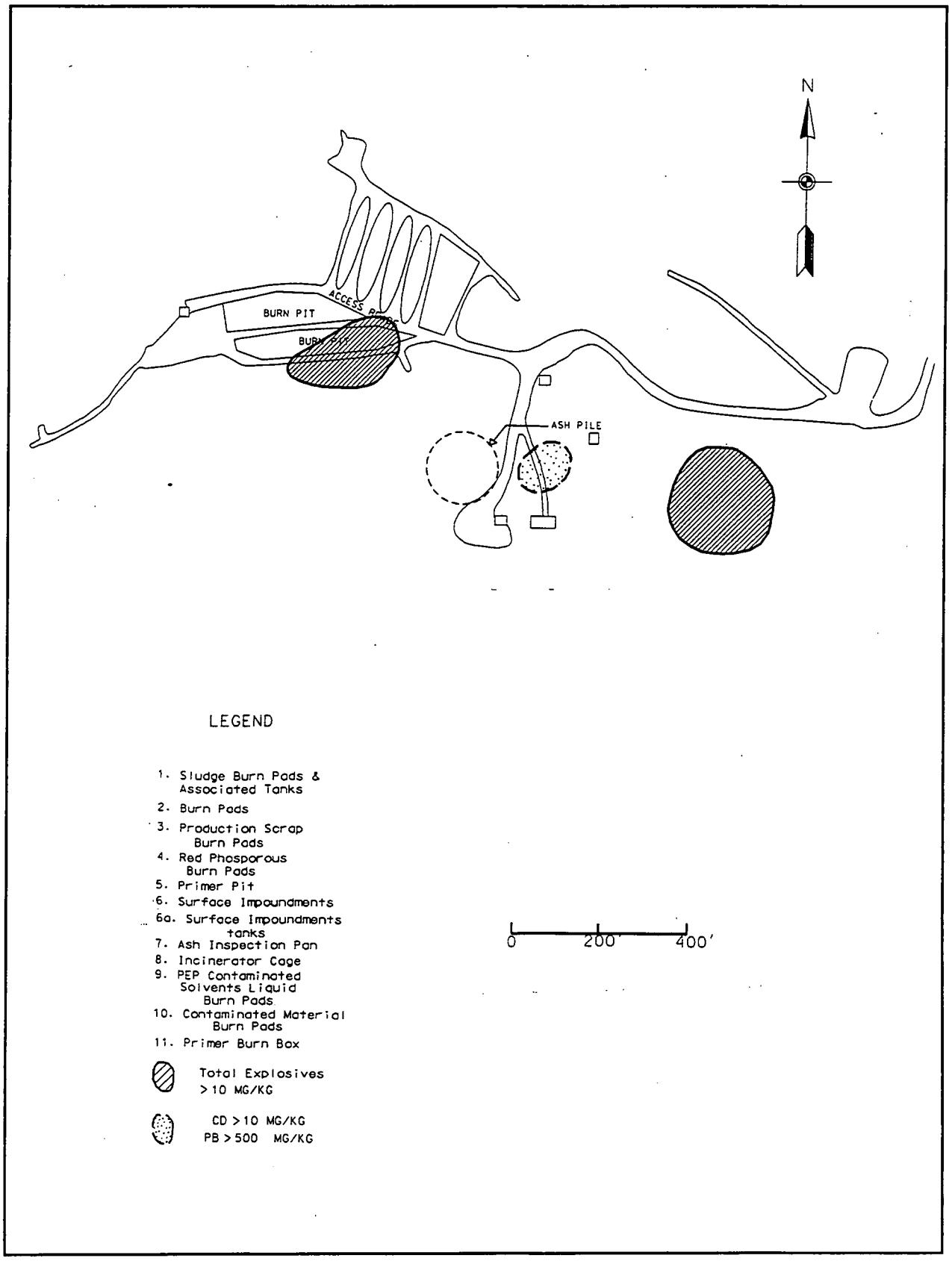


Figure 21. Contaminated area (explosives and metals) 30 in.-90 in. deep

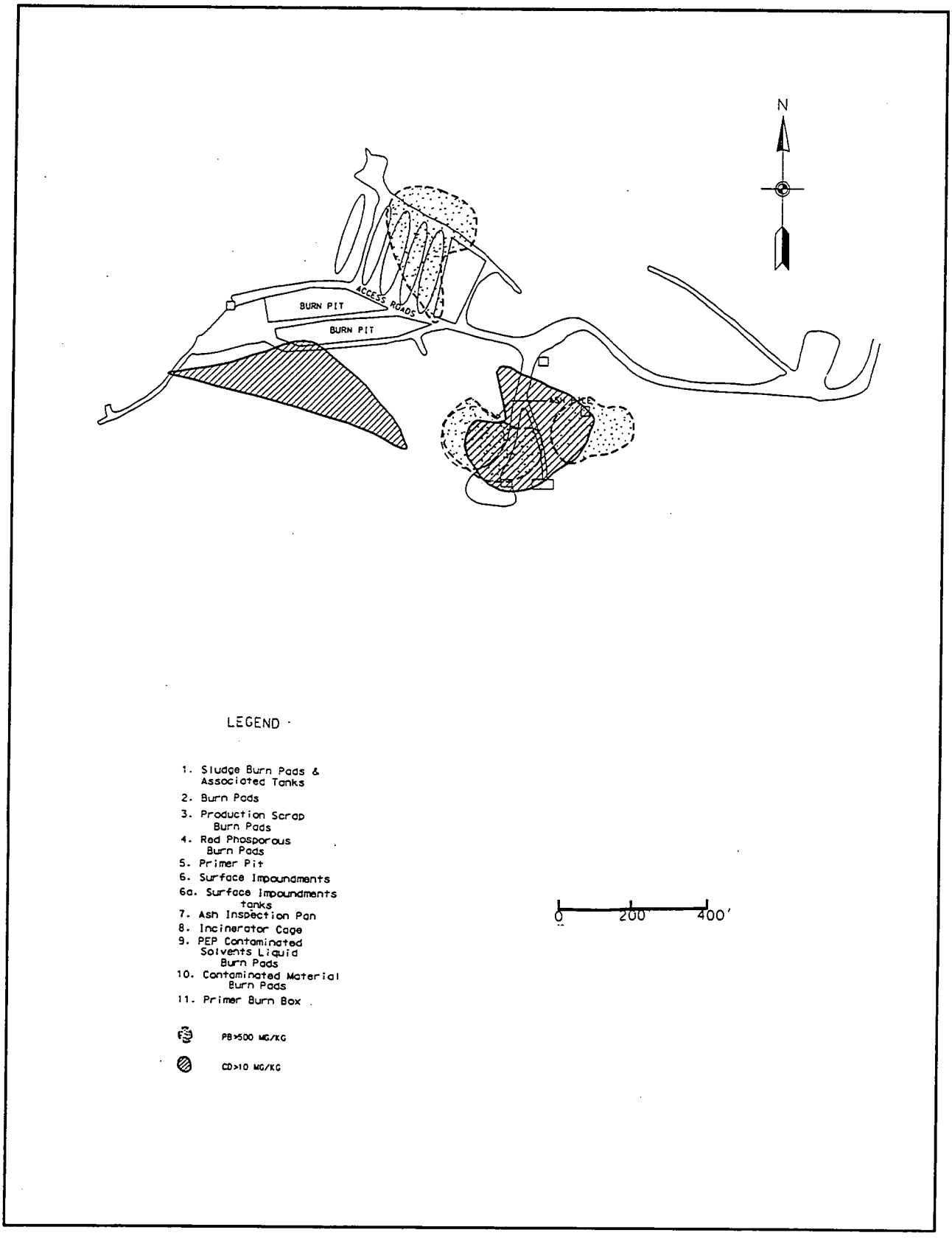


Figure 22. Contaminated area (metals) 0 in.-30 in. deep

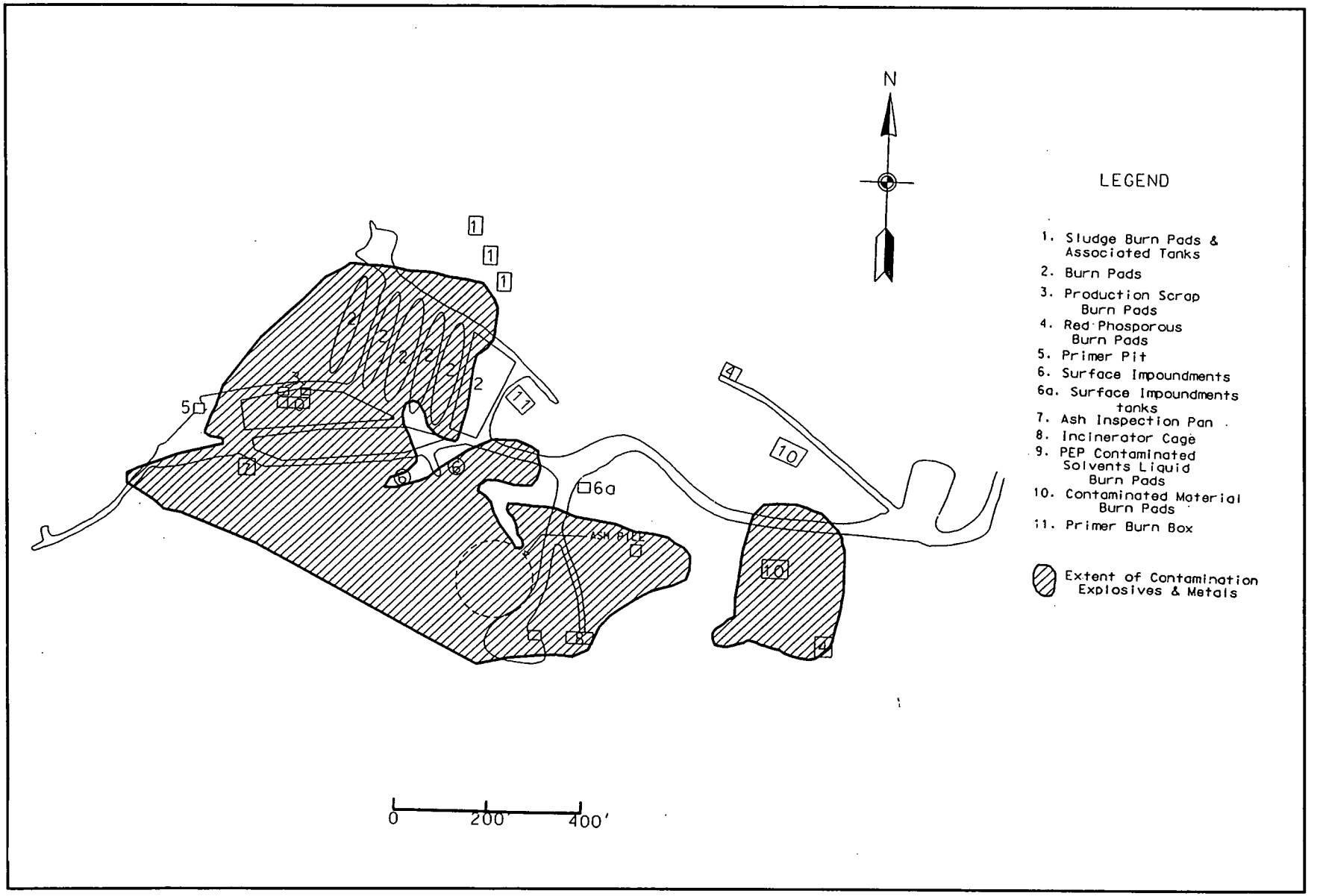


Figure 23. Extent of contamination 0 in.-30 in. deep

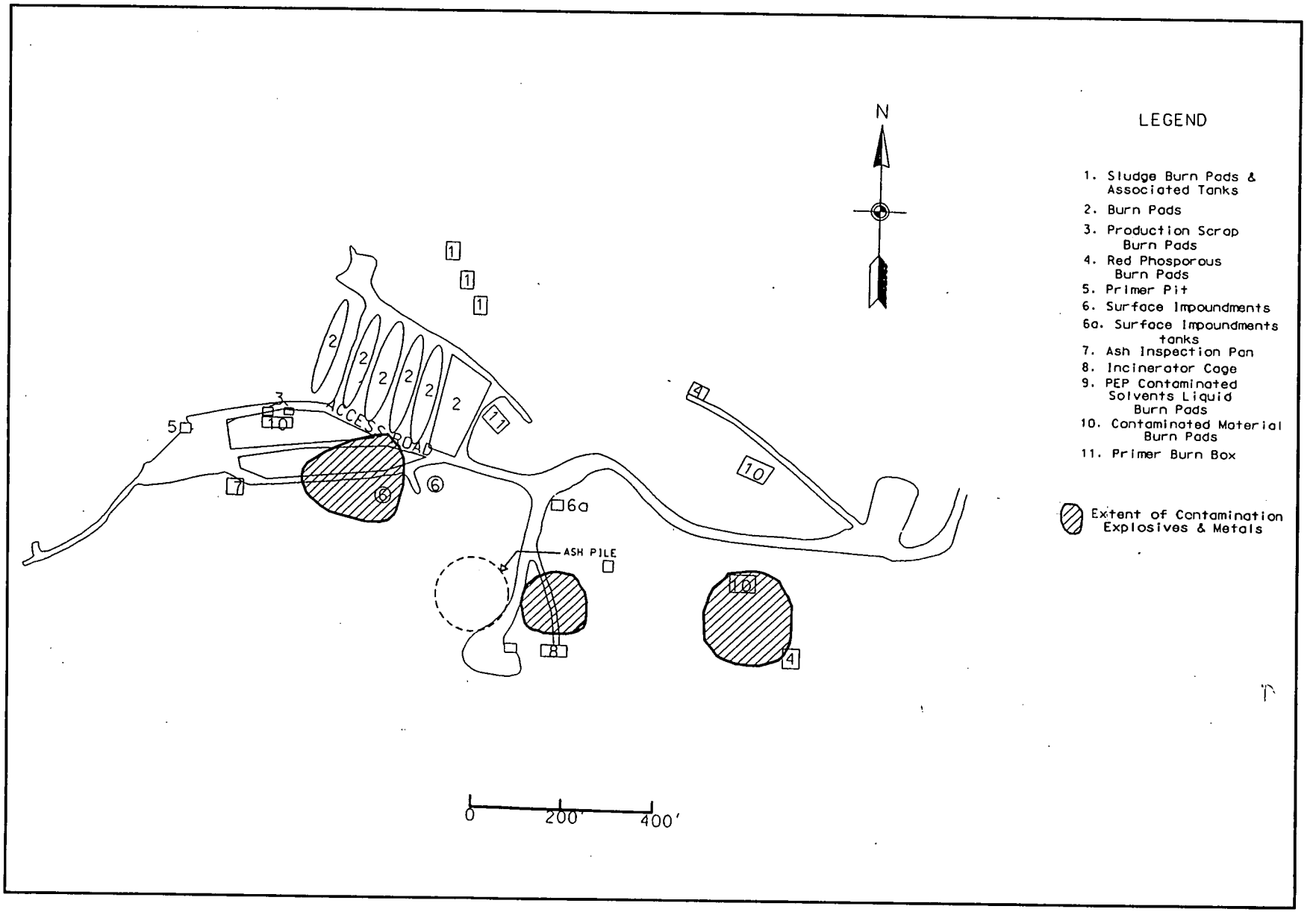


Figure 24. Extent of contamination 30 in.-90 in. deep

(1.99 acres). Assuming that all the soil in the defined area and between 30 to 90 in. deep is contaminated, the volume of contaminated soil is estimated to be 432,360 cu ft or 16,013 cu yd.

6 Conclusions

Releases at ABG

The disposal activities have contributed residues of explosives compounds and metal contaminants to the soils. PAHs and VOAs were also released, but in concentrations that were generally below 1 mg/kg.

The explosives HMX, RDX, TNB, TNT, 2,4-DNT, 2,6-DNT, 2A-DNT, 4A-DNT were detected. Explosives with highest concentration were HMX, RDX, and TNT.

Several metals and inorganic constituents in ABG soils had consistently higher concentrations than nearby background soils. In some cases the concentrations of metals and inorganics were 100 times the background which suggested the release of these constituents to ABG soils. Constituents that were greater than 100 times background included cadmium, calcium, copper, lead, zinc and tin.

Extent of Releases at ABG

The area where total explosives were greater than 10 mg/kg and 100 mg/kg, that is, the extent of explosives contamination, was estimated. Explosives occurred at all sample depths but were more frequent and at higher concentrations in samples less than 30 in. below ground surface. Accordingly, the extent of contamination in surface soils (<30 in. below ground surface) was greater than that for the deeper soils.

The area where cadmium and lead contamination in ABG soils exceeded their USEPA-suggested limits of 10 mg/kg and 500 mg/kg, respectively, were estimated. In some cases, but not all, these areas corresponded to the same areas where total explosives exceeded concentrations of 10 or 100 mg/kg. With respect to soil depth, the metals contamination was a near-surface (<30 in. below ground surface) phenomenon.

7 Recommendations

The results of this Part 2, RFI Phase III Soils study should be coordinated with appropriate State and Federal regulatory agencies to determine if the report satisfies the requirements in the NSWC Crane's schedule of compliance. Action levels for each of the contaminants identified should be established. Action levels are indicators of whether a Corrective Measures Study beyond the RFI must be conducted and whether further action will be required.

Toxicity characteristic leachate procedure analyses (TCLP)(40 CFR 261.24 and Appendix II to Part 261, EPA Method 1311 in SW846) should be conducted on representative soils from estimated contaminated areas. A solid waste exhibits the toxicity characteristic and may be a RCRA hazardous waste if the TCLP leachate from a sample is equal to or greater than the regulatory level.

NOTE: The above recommendations were acted on and the appropriate corrective measures were implemented.

References

COMARCO, ESD. (1992). "Analysis and graphic presentation of the chemical parameters of ground water from the A.B.G. at the Crane Division Naval Surface Warfare Center Crane, Indiana, Volume I."

Dunbar, Joseph B. (1982). "Hydrogeological investigation of waste disposal sites at the Naval Weapons Support Center Crane, Indiana," U.S. Army Corps of Engineers, Waterways Experiment Station.

Dunbar, Joseph B. (1984). "Hydrogeological site characterization of the Ammunition Burning Ground for Hazardous Waste Disposal Facility, Naval Weapons Support Center Crane, Indiana," U.S. Army Corps of Engineers, Waterways Experiment Station.

Hazardous Material Technical Center. (1986). "Navy assessment & control of installation pollutants for formations study for sites 1, 3, 5, and 8 at the Naval Weapons Support Center Crane."

Hunt, Richard W. (1988). "Geology and hydrogeology of the Ammunition Burning Ground Crane Naval Weapons Support Center," U.S. Army Corps of Engineers, Waterways Experiment Station.

May, James H. (1986). "Groundwater assessment plan Ammunition Burning Grounds Hazardous Waste Treatment Site," U.S. Army Corps of Engineers Waterways Experiment Station.

Murphy, William L. (1994). "Final report, RCRA facility investigation, phase III, groundwater release characterization, SWMU 03/10, Ammunition Burning Ground," Two Volumes. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Murphy, William L., and Ciocco, Jeffrey. (1990). "Dye trace of Beech Creek Aquifer Ammunition Burning Ground, Naval Weapons Support Center, Crane, Indiana," U.S. Army Corps of Engineers Waterways Experiment Station.

Murphy, W. L. and Wade, Roy. (1994). "Draft report, RCRA facility investigation, phase II release assessment for surface water, SWMU 03/10,

Ammunition Burning Ground," U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Naval Energy and Environmental Support Activity. (1983). "Initial assessment study of Naval Weapons Support Center Crane, Indiana."

Naval Energy and Environmental Support Activity. (1988). "Sampling and chemical analysis quality assurance requirements for the Navy installation restoration program."

Naval Surface Warfare Support Center, Crane, Indiana. (1992). Personnel communication in: "Comments on draft Part I RFI Phase III soils report for: Ammunition Burning Ground, SWMU 03/10, Naval Surface Warfare Center, Crane, Indiana."

Office, Chief of Engineers (OCE). (1970). *Laboratory soils testing*, EM 1110-2-1906, Washington, DC.

U.S. Army Engineers Waterways Experiment Station. (1992). "Draft RFI Phase III Part 1 soils report for Ammunition Burning Ground, SWMU 03/10 Naval Surface Warfare Center, Crane, Indiana."

U.S. Army Corps of Engineers, Wilmington District. (1993). "DRAFT Part 2 RFI Phase III soils work plan for: Ammunition Burning Ground, SWMU #03/10, Naval Surface Warfare Center Crane, Indiana," Wilmington, North Carolina.

U.S. Environmental Protection Agency (USEPA). (1986). *Test methods for evaluating solid waste, physical/chemical methods, SW846*, Third Edition, November (with revisions).

U.S. Environmental Protection Agency (USEPA). (1994). "Soil screening guidance," EPA/540/R-94/101 PB95-963529, Office of Solid Waste and Emergency Response, Washington, DC.

U.S. Environmental Protection Agency, Region III. (1994). Risk-based concentration table, Fourth Quarter 1994. Roy L. Smith, Senior Toxicologist (3HW13), U.S. EPA Region III.

Woods, Harry K. (1986). "Hydrogeological investigation of selected areas at the Ammunition Burning Grounds Naval Weapons Support Center Crane, Indiana, Geotechnical Laboratory, U.S. Army Engineers Waterways Experiment Station."

Appendix A
Tables

Table A1. Ammunition Burning Ground, NWSC, SWMU#03/10. Target analytes and laboratory methods used for analyses of soils.

	SOILS METHODS from SW-846 AND OTHER*		
	Technique	Sample Preparation	Analysis
ORGANIC ANALYSES			
Volatiles	GC/MS	8270	8270
PAHs (BNA semi volatile organics)	GC/MS	3540/3550	8240
Explosives HMX, RDX, TNB, DNB, TETRYL, TNT 2,4-DNT, 2,6-DNT, 2A-DNT, 4A-DNT	HPLC	8330	8330
INORGANIC ANALYSES			
Aluminum	DCP	3050	6010
Antimony	GFAA	3050	7041
Arsenic	GFAA	3050	7060
Barium	DCP	3050	D4190-82 [1]
Cadmium	GFAA	3050	6010
Calcium	ICP	3050	6010
Chromium	DCP	3050	D4190-82
Cobalt	DCP	3050	D4190-82
Copper	DCP	3050	D4190-82
Iron	DCP	3050	D4190-82
Lead	DCP	3050	D4190-82
Manganese	DCP	3050	D4190-82
Magnesium	ICP	3050	6010
Mercury	CV	7471	7471
Nickel	DCP	3050	D4190-82
Phosphorous	Colorimetric	365.4 [2]	365.4
Silver	DCP	3050	D4190-82
Sodium	ICP	3050	6010
Tin	ICP	3050	6010
Zinc	ICP	3050	6010

* Abbreviations:
GFAA = Graphite Furnace Atomic Absorption; CV = Cold Vapor; ICP = Inductively Coupled Plasma - Atomic Emission Spectroscopy, and DCP = Direct Current Plasma - Atomic Emission Spectroscopy ;

Note: All are U.S. EPA SW864 except as indicated by superscripts 1 and 2

U.S. Environmental Protection Agency, Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with revisions.

Method D4190-82 [1] in ASTM, 1987 Annual Book of ASTM Standards, Water and Environmental Technology, VOL 11.01 and 11.02. 1987. 1916 Race Street, Philadelphia, PA 10103.

Method 365.4 [2] in U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Waste, EPA 600/4-79-020, March 1979 and EPA 600/4-82-055 December 1982. Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268.

Table A2. Ammunition Burning Ground, NSWC Crane (SWMU #3/10). Composition of materials likely burned at the ABG.

Solid Propellants

Nitrocellulose, Nitroglycerine, Inorganic Nitrates, Metal Salts, Metals, Carbohydrates, Dyes, Ammonium Picrate, Potassium Nitrate

Liquid Propellants

Fuels -
Alcohols, Hydrocarbons, Aniline, Hydrazine, Boranes, Liquid Hydrogen, Anhydrous Ammonia

Oxidizers -
Nitric Acids, Hydrogen Peroxide, Chlorine Triflouride, Dinitrogen Tetroxide

Low Explosives

Black Powder - Coal or Charcoal, Sulfur, Potassium or Sodium Nitrate

Black Powder Substitutes - Benite, Eimite, Boron - Potassium Nitrate

Pyrotechnics

Oxidizers - Chlorates, Perchlorates, Peroxides, Chromates, Nitrates

Fuels - Aluminium and Magnesium Powder, Barium Chromate - Boron
Mixture, Sulfur

Binders - Shellac, Linseed Oil, Paraffin, Resins

Color Intensifiers - Organic Chlorides, Barium and Copper Salts, Strontium Salts, Dyes

Coolants -
Magnesium Carbonate, Sodium Bicarbonate

High Explosives

Primer - Potassium Chlorate, Lead Thiocyanate, Calcium Silicide, Antimony Sulfide, Lead Azide, Lead Styphnate, Mercury Fulminate, Diazodinitrophenol

Booster - Tetryl, PETN, RDX

Bursting - Ammonium Nitrate, TNT, Picratol, DBX, HBX, Trinitrophenol, Ammonium Picrate, Nitroglycerin, Nitrostarch, Powdered Aluminium, HMX

Table A3. (Page 1 of 4). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU#03/10. Results of analyses of surface soils EPA Method 8240 (VOAs -volatile organic analytes) soil analyses for surface soil samples. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	SURFACE SOIL SAMPLE STATION										
VOLATILE ANALYTE	39	40	41	42	43	44	45	46	47	48	48D
Chloromethane	0.011 U	0.01 U	0.01 U	0.11 U	0.011 U	0.011 U	0.01 U	0.01 U	0.011 U	0.11 U	0.11 U
Bromomethane	0.011 U	0.01 U	0.01 U	0.11 U	0.011 U	0.011 U	0.01 U	0.01 U	0.011 U	0.11 U	0.11 U
Vinyl Chloride	0.011 U	0.01 U	0.01 U	0.11 U	0.011 U	0.011 U	0.01 U	0.01 U	0.011 U	0.11 U	0.11 U
Chloroethane	0.011 U	0.01 U	0.01 U	0.11 U	0.011 U	0.011 U	0.01 U	0.01 U	0.011 U	0.11 U	0.11 U
Methylene Chloride	0.014 B	0.08 B	0.059 B	0.041 B	0.098 B	0.074 B	0.059 B	0.066 B	0.096 B	0.048 B	0.027 B
1,1-Dichloroethene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
1,1-Dichloroethane	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
T-1,2-Dichloroethene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
cis-1,2-Dichloroethene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Chloroform	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
1,2-Dichloroethane	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
1,1,1-Trichloroethane	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Carbon Tetrachloride	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Bromodichloromethane	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
1,2-Dichloropropane	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
T-1,3-Dichloropropene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Trichloroethene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Dibromochloromethane	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Cis-1,3-Dichloropropene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
1,1,2-Trichloroethane	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Benzene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Bromoform	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
1,1,2,2-Tetrachloroethane	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Tetrachloroethene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Toluene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Chlorobenzene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Ethylbenzene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Acetone	0.011 U	0.088 BJ	0.025 BJ	0.075 BJ	0.11 U	0.034 BJ	0.1 U	0.012 BJ	0.028 BJ	0.021 BJ	0.023 BJ
2-Butanone	0.11 U	0.1 U	0.1 U	0.11 U	0.11 U	0.11 U	0.1 U	0.1 U	0.11 U	0.11 U	0.11 U
Carbondisulfide	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
2-Hexanone	0.0055 U	0.005 U	0.005 U	0.055 U	0.055 U	0.055 U	0.05 U	0.005 U	0.055 U	0.055 U	0.055 U
4-Methyl-2-Pentanone	0.0055 U	0.005 U	0.005 U	0.055 U	0.055 U	0.055 U	0.05 U	0.005 U	0.055 U	0.055 U	0.055 U
Styrene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0055 U	0.0055 U
Vinyl Acetate	0.0055 U	0.005 U	0.005 U	0.055 U	0.055 U	0.055 U	0.05 U	0.005 U	0.055 U	0.055 U	0.055 U
T-Xylene	0.0055 U	0.005 U	0.005 U	0.0055 U	0.0092 J	0.0055 U	0.005 U	0.005 U	0.0006 J	0.0055 U	0.0055 U
1,2-Dichloroethane-d4(76-114)	97.6	104	99	98.3	93.9	98.4	99	103	94.2	101	99.2
Toluene-D8(88-110)	96.7	97.3	99.4	99.8	99.5	99.9	97.6	101	100	98.3	98.1
4-Bromofluorobenzene(86-115)	94.4	99	97.4	100	93.2	102	92.4	98.5	96.7	98.9	97.7

Notes: Station - See Figure 5.1 for locations. 48D indicates a field duplicate taken at station 48.

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

E - Identifies compounds whose concentration exceeded the calibration range of the GC/MS instrument.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

B - Analyte found in asociated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A3. (Page 2 of 4). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU#03/10. Results of analyses of surface soils EPA Method 8240 (VOAs -volatile organic analytes) soil analyses for surface soil samples. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	SURFACE SOIL SAMPLE STATION										
Volatile Analyte	49	50	50D	51	52	53	54	54D	55	56	57
Chloromethane	0.11 U	0.011 U	0.011 U	0.011 U	0.11 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U
Bromomethane	0.11 U	0.011 U	0.011 U	0.011 U	0.11 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U
Vinyl Chloride	0.11 U	0.011 U	0.011 U	0.011 U	0.11 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U
Chloroethane	0.11 U	0.011 U	0.011 U	0.011 U	0.11 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U
Methylene Chloride	0.087 B	0.024 B	0.059 B	0.051 B	0.033 B	0.026 B	0.13 B	0.037 B	0.068 B	0.036 B	0.03 B
1,1-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
1,1-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Trans-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
cis-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Chloroform	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
1,2-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
1,1,1-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Carbon Tetrachloride	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Bromodichloromethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
1,2-Dichloropropane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Trans-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Trichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.017	0.0055 U
Dibromochloromethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Cis-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
1,1,2-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Benzene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Bromoform	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
1,1,2,2-Tetrachloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Tetrachloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Toluene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Chlorobenzene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Ethylbenzene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0016 J	0.0008 J	0.0055 U	0.006 U	0.0055 U	0.0055 U
Acetone	0.11 U	0.018 BJ	0.023 BJ	0.018 BJ	0.11 U	0.026 BJ	0.033 BJ	0.051 BJ	0.017 BJ	0.027 BJ	0.014 BJ
2-Butanone	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1 U	0.1 U	0.11 U	0.12 U	0.11 U	0.11 U
Carbondisulfide	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
2-Hexanone	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U
4-Methyl-2-Pentanone	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U
Styrene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U
Vinyl Acetate	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U
T-Xylene	0.0009 U	0.005 U	0.001 J	0.005 U	0.0055 U	0.0092 U	0.0048 J	0.0027 BJ	0.006 U	0.005 U	0.005 U
1,2-Dichloroethane-d4(76-114)	99.9	96	102	95.9	101	112	99.1	104	96.7	97.8	104
Toluene-D8(88-110)	98.9	98.6	101	99.7	98.6	101	98.5	100	99.9	96.9	102
4-Bromofluorobenzene(86-115)	96.5	94.3	101	96.8	102	102	89.9	99.4	97.1	90.8	104

Notes: Station - See Figure 5.1 for locations. 54D indicates a field duplicate taken at station 54.

EPA Method 8240 - in Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

E - Identifies compounds whose concentration exceeded the calibration range of the GC/MS instrument.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

B - Analyte found in associated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A3. (Page 3 of 4). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU#03/10. Results of analyses of surface soils EPA Method 8240 (VOAs -volatile organic analytes) soil analyses for surface soil samples. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	SURFACE SOIL SAMPLE STATION										
VOLATILE ANALYTE	58	59	60	61	62	63	64	65	66	67	68
Chloromethane	0.11 U	0.011 U	0.012 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.012 U	0.012 U	0.011 U
Bromomethane	0.11 U	0.011 U	0.012 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.012 U	0.012 U	0.011 U
Vinyl Chloride	0.11 U	0.011 U	0.012 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.012 U	0.012 U	0.011 U
Chloroethane	0.11 U	0.011 U	0.012 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.012 U	0.012 U	0.011 U
Methylene Chloride	0.037 B	0.099 B	0.037 B	0.1 B	0.092 B	0.078 B	0.082 B	0.072 B	0.072 B	0.087 B	0.035 B
1,1-Dichloroethene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
1,1-Dichloroethane	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Trans-1,2-Dichloroethene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
cis-1,2-Dichloroethene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Chloroform	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
1,2-Dichloroethane	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
1,1,1-Trichloroethane	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Carbon Tetrachloride	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Bromodichloromethane	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
1,2-Dichloropropane	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Trans-1,3-Dichloropropene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Trichloroethene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0008 U	0.0007 U	0.0055 U
Dibromochloromethane	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Cis-1,3-Dichloropropene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
1,1,2-Trichloroethane	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Benzene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Bromoform	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
1,1,2,2-Tetrachloroethane	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Tetrachloroethene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Toluene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Chlorobenzene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Ethylbenzene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Acetone	0.11 U	0.3 BE	0.015 BJ	3.7 BE	0.015 BJ	0.032 BJ	0.027 BJ	0.02 BJ	0.027 BJ	0.02 BJ	0.018 BJ
2-Butanone	0.11 U	0.1 U	0.12 U	0.12 U	0.11 U	0.1 U	0.11 U	0.12 U	0.12 U	0.12 U	0.1 U
Carbondisulfide	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
2-Hexanone	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.0055 U	0.06 U	0.06 U	0.06 U	0.055 U
4-Methyl-2-Pentanone	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.0055 U	0.06 U	0.06 U	0.06 U	0.055 U
Styrene	0.0055 U	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0055 U
Vinyl Acetate	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.0055 U	0.06 U	0.06 U	0.06 U	0.055 U
T-Xylene	0.001 J	0.0055 U	0.006 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.006 U	0.006 U	0.0024 J
1,2-Dichloroethane-d4(76-114)	98.8	98	97.4	99.5	99	99.8	105	108	101	101	107
Toluene-D8(88-110)	97.3	98.8	99.9	95.8	100	96.6	91.5	100	100	97.9	100
4-Bromofluorobenzene(86-115)	93.2	93.3	92.1	84.2	99.9	95.8	83.5	106	99.6	83	76.5

Notes: Station - See Figure 5.1 for locations. 64D indicates a field duplicate taken at station 64.

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

E - Identifies compounds whose concentration exceeded the calibration range of the GC/MS instrument.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

B - Analyte found in associated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A3. (Page 4 of 4). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU#03/10. Results of analyses of surface soils EPA Method 8240 (VOAs -volatile organic analytes) soil analyses for surface soil samples. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	SURFACE SOIL SAMPLE STATION		
VOLATILE ANALYTE	69	70	71
Chloromethane	0.012 U	0.011 U	0.012 U
Bromomethane	0.012 U	0.011 U	0.012 U
Vinyl Chloride	0.012 U	0.011 U	0.012 U
Chloroethane	0.012 U	0.011 U	0.012 U
Methylene Chloride	0.078 B	0.014 B	0.022 B
1,1-Dichloroethene	0.006 U	0.0055 U	0.006 U
1,1-Dichloroethane	0.006 U	0.0055 U	0.006 U
Trans-1,2-Dichloroethene	0.006 U	0.0055 U	0.006 U
cis-1,2-Dichloroethene	0.006 U	0.0055 U	0.006 U
Chloroform	0.006 U	0.0055 U	0.006 U
1,2-Dichloroethane	0.006 U	0.0055 U	0.006 U
1,1,1-Trichloroethane	0.006 U	0.0055 U	0.006 U
Carbon Tetrachloride	0.006 U	0.0055 U	0.006 U
Bromodichloromethane	0.006 U	0.0055 U	0.006 U
1,2-Dichloropropane	0.006 U	0.0055 U	0.006 U
Trans-1,3-Dichloropropene	0.006 U	0.0055 U	0.006 U
Trichloroethene	0.006 U	0.0055 U	0.006 U
Dibromochloromethane	0.006 U	0.0055 U	0.006 U
Cis-1,3-Dichloropropene	0.006 U	0.0055 U	0.006 U
1,1,2-Trichloroethane	0.006 U	0.0055 U	0.006 U
Benzene	0.006 U	0.0055 U	0.006 U
Bromoform	0.006 U	0.0055 U	0.006 U
1,1,2,2-Tetrachloroethane	0.006 U	0.0055 U	0.006 U
Tetrachloroethene	0.006 U	0.0055 U	0.006 U
Toluene	0.06 U	0.0055 U	0.00061 J
Chlorobenzene	0.006 U	0.0055 U	0.006 U
Ethylbenzene	0.006 U	0.0055 U	0.006 U
Acetone	0.053 BJ	0.012 BJ	0.037 BJ
2-Butanone	0.12 U	0.11 U	0.12 U
Carbondisulfide	0.006 U	0.0055 U	0.006 U
2-Hexanone	0.006 U	0.0055 U	0.006 U
4-Methyl-2-Pentanone	0.006 U	0.0055 U	0.006 U
Styrene	0.006 U	0.0055 U	0.006 U
Vinyl Acetate	0.006 U	0.0055 U	0.006 U
T-Xylene	0.006 U	0.0055 U	0.006 U
1,2-Dichloroethane-d4(76-114)	105	99.2	103
Toluene-D8(Surrogate (88-110))	96	98.4	97.5
4-Bromofluorobenzene(88-115)	94.6	93.4	97.1

Notes: Station - See Figure 5.1 for locations.

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

E - Identifies compounds whose concentration exceeded the calibration range of the GC/MS instrument.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

B - Analyte found in asociated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A4. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary by station of results of analyses of surface soils for VOAs.

BY STATION

STATION	NUMBER OF DIFFERENT VOAs DETECTED	TOTAL SAMPLE VOAs (mg/kg)	MAXIMUM VOA IN STATION CONC (mg/kg)	NAME
43	1	0.0092	0.0092(J)	T-xylene
47	1	0.0006	0.0006(J)	T-xylene
49	1	0.0009	0.0009(J)	T-xylene
50	1	0.001	0.001(J)	T-xylene
53	2	0.011	0.009(J)	T-xylene
54	2	0.0056	0.0048(J)	T-xylene
56	1	0.017	0.017	Trichloroethene
58	1	0.00098	0.00098(J)	T-xylene
66	1	0.00084	0.00084(J)	Trichloroethene
67	1	0.00068	0.00068(J)	Trichloroethene
68	1	0.0024	0.0024(J)	T-xylene
71	1	0.00061	0.00061(J)	Toluene

Note: Where field duplicates were taken, the highest total concentration and occurrence all VOAs from both samples were included.
Total VOAs - Sum of all VOAs with detectable concentrations.
J - Indicates an estimated value below accurate quantitation limits

BY VOA

VOA DETCTED	OCCURRENCE BY STATION	MAXIMUM CONCENTRATION ENCOUNTERED (mg/kg)	LOCATION OF MAXIMUM	RBC INDUSTRIAL SOILS mg/kg
T-Xylene	43, 47, 49, 50, 53, 58, 68	0.0092(J)	43	1000000 n
Ethyl Benzene	53, 54	0.002(J)	53	100000 n
Toluene	71	0.00061(J)	71	200000 n
Trichloroethene	56, 66, 67	0.017	56	260 n

Note:
RBC - Risk-Based Concentrations - Risk-Based Concentration Table, Fourth Quarter 1994.
Roy L. Smith, Senior Toxicologist (3HW15), U.S. EPA Region III.
Risk Based Concentrations are in mg/kg.
Basis of RBC: c = carcinogenic effect; n = noncarcinogenic effect

Table A5. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of method blanks associated with analyses of surface soils collected August 1993 for volatile organics using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	METHOD BLANK								
ANALYTE	MB1	MB2	MB3	MB4	MB5	MB6	MB7	MB8	MB9
Chloromethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Bromomethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Vinyl Chloride	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Chloroethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Methylene Chloride	0.0087	0.0069	0.0087	0.0100	0.0069	0.01	0.0012 J	0.012	0.0012
1,1-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
cis-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chloroform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,1-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Carbon Tetrachloride	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromodichloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloropropane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Dibromochloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Cis-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Benzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromoform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2,2-Tetrachloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Tetrachloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Toluene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chlorobenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Ethylbenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Acetone	0.0016 J	0.0047 J	0.0016 J	0.0078 J	0.0047 J	0.0083 J	0.0042 J	0.0041 J	0.0041 J
2-Butanone	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.0040 J	0.0040 J
Carbondisulfide	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
2-Hexanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
4-Methyl-2-Pentanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Styrene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Vinyl Acetate	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
T-Xylene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0012 J	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane-d4(70-121)	92.9	92.7	92.9	94.3	92.7	99.8	95.3	91.5	91.5
Toluene-D8(81-117)	98.5	100.0	98.5	102.0	100.0	99.6	99.6	101.0	101.0
4-Bromofluorobenzene(74-121)	100.0	100.0	100.0	102.0	100.0	100.0	100.0	101.0	101.0

Notes:

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

J - Indicates an estimated value below accurate quantitation limits

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

MB1 - Samples from stations 39, 40, 64, 69, and 71

MB2 - Samples from stations 41, 46, and 70

MB3 - Samples from station 63

MB4 - Samples from station 53, 54, 68

MB5 - Samples from stations 59, 61

MB6 - Samples from stations 54D

MB7 - Samples from locations 42, 45, 48, 48D, 49, 52, and 58

MB8 - Samples from locations 43, 44, 62, 65, 66, and 67

MB9 - Samples from locations 47, 50, 50D, 51, 55, 56, 57, and 60

Table A6. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of trip blanks associated with shipment of ABG surface soils sampled for volatile organics. Concentrations are mg/L (ppm). Blanks with detectable concentrations are shown in gray.

	TRIP BLANK			
ANALYTE	TB1	MB/TB1	TB2	MB/TB1
Chloromethane	0.010 U	0.010 U	0.010 U	0.010 U
Bromomethane	0.010 U	0.010 U	0.010 U	0.010 U
Vinyl Chloride	0.010 U	0.010 U	0.010 U	0.010 U
Chloroethane	0.010 U	0.010 U	0.010 U	0.010 U
Methylene Chloride	0.014 B	0.0040 J	0.011 B	0.0040 J
1,1-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
cis-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chloroform	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,1-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Carbon Tetrachloride	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromodichloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloropropane	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Dibromochloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Cis-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Benzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromoform	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2,2-Tetrachloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Tetrachloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Toluene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chlorobenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Ethylbenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Acetone	0.010 U	0.0054 J	0.020 BJ	0.0054 J
2-Butanone	0.10 U	0.10 U	0.10 U	0.10 U
Carbondisulfide	0.0050 U	0.0050 U	0.0050 U	0.0050 U
2-Hexanone	0.050 U	0.050 U	0.050 U	0.050 U
4-Methyl-2-Pentanone	0.050 U	0.050 U	0.050 U	0.050 U
Styrene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Vinyl Acetate	0.050 U	0.050 U	0.050 U	0.050 U
T-Xylene	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane-d4(70-121)	100.0	99.4	102.0	99.4
Toluene-D8(81-117)	101.0	99.7	101.0	99.7
4-Bromofluorobenzene(74-121)	102.0	101.0	103.0	101.0

Notes:

EPA Method 8240 - in Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

J - Indicates an estimated value below accurate quantitation limits

B - Analyte is found in the associated blank as well as the sample.

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

TB1 - cooler #4 (8/17/93 - date shipped); samples from stations 42, 45, 48, 49, 52, 58

TB1 - cooler #5 (8/18/93); samples from locations 43, 44, 62, 65, 66, and 67

MB/TB1 - Method Blank analyzed with Trip Blank 1

Table A7. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of surface soil samples for explosive compounds. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

SURFACE SOIL SAMPLE STATION

EXPLOSIVE	39	40	41	42	43	44	45	46	47	48	48D	49
HMX	2.20 U	2.20 U	2.20 U	8.90	3.74	6.05	11.40	2.20 U	2.20 U	0.28 J	0.03 J	3.16
RDX	1.00 U	1.00 U	1.00 U	3.58	0.45 J	10.90	0.48 J	1.00 U	1.00 U	19.50	0.67 J	0.42 J
TNB	0.25 U	0.25 U	0.25 U	0.24 J	0.25 U	0.10 J	0.50	0.25 U	0.25 U	0.46	0.06 J	0.25 U
DNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
TNT	0.25 U	0.25 U	0.25 U	0.93	0.16 J	0.22	0.06 J	0.25 U	0.25 U	18.20	0.71	0.15 J
2,4-DNT	0.25 U	0.25 U	0.25 U	0.13 J	1.30	0.25 U	0.02 J	0.25 U	0.25 U	0.12 J	0.03 J	1.06
2,6-DNT	0.26 U	0.26 U	0.26 U	0.26 U	0.31	0.15 J	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.58
2A-DNT	0.25 U	0.25 U	0.25 U	0.58	0.25 U	0.44	0.25 U	0.25 U	0.25 U	0.62	0.17 J	0.18 J
4A-DNT	0.25 U	0.25 U	0.25 U	0.75	0.12 J	0.39	0.14 J	0.25 U	0.25 U	0.25 U	0.25	0.26
TOT EXP	ND	ND	ND	15.11	6.08	18.25	12.6	ND	ND	39.18	1.92	5.81

EXPLOSIVE	50	50D	51	52	53	54	54D	55	56	57	58	59
HMX	2.20 U	0.09 J	0.29 J	1.38 J	2.20 U	2.20 U	2.20 U	2.20 U	0.19 J	9.20	0.11 J	2.20 U
RDX	1.00 U	1.00 U	0.64 J	0.82 J	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	0.04 J	1.00 U
TNB	0.25 U	0.25 U	0.25 U	0.10 J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
DNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
TNT	0.43	3.22	0.70	0.48	0.25 U	0.25 U	0.25 U	0.25 U	136.00	0.13 J	0.05 J	0.25 U
2,4-DNT	0.25 U	0.25 U	0.25 U	0.84	0.25 U	0.25 U	0.25 U	0.25 U	0.13 J	0.25 U	0.05 J	0.25 U
2,6-DNT	0.26 U	0.26 U	0.26 U	0.36	0.26 U	0.26 U	0.25 U	0.26 U	0.26 U	0.26 U	0.10 J	0.26 U
2A-DNT	0.15 J	0.25 J	0.25 U	0.27	0.25 U	0.25 U	0.25 U	0.25 U	0.48	0.25 U	0.03 J	0.25 U
4A-DNT	0.17 J	0.23 J	0.12 J	0.51	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.08 J	0.25 U
TOT EXP	0.75	3.79	1.75	4.76	ND	ND	ND	ND	136.80	9.33	0.46	ND

EXPLOSIVE	60	61	62	63	64	65	66	67	68	69	70	71
HMX	2.20 U	223.00	19.20	2.20 U	2.20 U	6.05	0.13 J	2.88	0.17 J	64.00	1.50 J	0.30 J
RDX	1.00 U	1820.00	3.02	1.00 U	1.00 U	1.00 U	1.00 U	1.36	1.00 U	192.00	1.00 U	1.00 U
TNB	0.25 U	1.44	1.60	0.25 U	0.25 U	0.25 U	0.25 U	0.20 J	0.12 J	0.25 U	0.25 U	0.25 U
DNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
TNT	0.25 U	19.80	0.57	0.25 U	0.25 U	0.05 J	0.18 J	1.38	0.10 J	3.82	0.25 U	0.25 U
2,4-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.10 J	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DNT	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
2A-DNT	0.25 U	5.65	0.21 J	0.25 U	0.25 U	0.25 U	0.25 U	0.25	0.25 U	0.25 U	0.25 U	0.25 U
4A-DNT	0.25 U	8.20	0.34	0.25 U	0.11 J	0.25 U	0.06 J	0.44	0.13 J	0.76	0.25 U	0.25 U
TOT EXP	ND	2078.09	24.94	ND	0.11	6.11	0.37	6.61	0.52	260.58	1.50	0.30

Notes: Sample ID is as follows, Station 39 is surface sample 39. 48D is a field duplicate taken at station 48.

J - Indicates an estimated value below accurate quantitation limits

U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.

TOTAL EXP - A total of all explosive compounds determined for that sample. ND means none detected.

Table A8. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Total explosives concentrations in surface soil samples. Total explosives are the sum of concentrations of all detectable explosive compounds. Less than detection limit results were summed as zero.

TOTAL EXPLOSIVES CATEGORY	SAMPLE LOCATION	NUMBER IN CATEGORY	% TOTAL NUMBER SAMPLES	CUMMULATIVE %
NONE DETECTED	39 40 41 46 47 53 54 55 59 60 63	11	33.3	33.3
>ND < 1 mg/kg	58 64 66 68 71	5	15.2	48.5
>1 mg/kg < 10 mg/kg	43 49 50 51 52 57 65 67 70	9	27.3	75.8
>10 mg/kg < 100 mg/kg	42 44 45 48 62	5	15.2	91
>100 mg/kg < 1000 mg/kg	56 69	2	6.1	97.1
>1000 mg/kg	61	1	3.0	100.1
		TOTAL NO. SAMPLES - 33		

Note:
Duplicates - Field duplicates were taken at 48, 50, 54. For this summary the highest totla explosive concentration of the twp samples used.

Table A9. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary by explosive analyte of the results of analyses of surface soil sample analyses for explosives.

EXPLOSIVE DETECTED	OCCURRENCE BY SAMPLE							NUMBER OF STATIONS WITH SPECIFIC EXP
HMX	42	43	44	45	48(J)	49	50(J)	[21]
	51(J)	52(J)	56(J)	57	58(J)	61	62	
	65	66(J)	67	68(J)	69	70(J)	71(J)	
RDX	42	43(J)	44	45(J)	48	49(J)	51(J)	[13]
	52(J)	58(J)	61	62	67	69		
TNB	42(J)	44(J)	48	52(J)	61	62	67(J)	[8]
	68(J)							
TNT	42	43(J)	44	45(J)	48	49(J)	50	[19]
	51	52	56	57(J)	58(J)	61	62	
	65(J)	66(J)	67	68(J)	69			
2,4-DNT	42(J)	43	45(J)	48(J)	49	52	56(J)	[9]
	58(J)	67(J)						
2,6-DNT	43	44(J)	49	52	58(J)			[4]
2A-DNT	42	44	48	49(J)	50(J)	52	56	[11]
	58(J)	61	62(J)	67				
4A-DNT	42	43(J)	44	45(J)	48	49	50(J)	[17]
	51(J)	52	58(J)	61	62	64(J)	66(J)	
	67	68(J)	69					

Note: J- Indicates that concentration reported was an estimated value below accurate quantitation limits
Duplicates - Where field duplicates were taken, the highest concentration and all explosives from both samples were included.

EXPLOSIVE COMPOUND	MAXIMUM CONCENTRATION ENCOUNTERED (mg/kg)	LOCATION OF MAXIMUM	RBC INDUSTRIAL SOILS mg/kg
HMX	223.0	61	-
RDX	1820.0	61	-
TNB	1.60	62	51 n
DNB	NONE DETECTED	-	100 n
TETRYL	NONE DETECTED	-	10000 n
TNT	136	56	95 c
2,4-DNT	1.3	43	2000 n *
2,6-DNT	0.58	49	1000 n *
2A-DNT	5.65	61	*
4A-DNT	8.2	61	*
TOTAL EXP	2078	61	-

RBC - Risk-Based Concentrations - Risk-Based Concentration Table, Fourth Quarter 1994.
Roy L. Smith, Senior Toxicologist (3HW15), U.S. EPA Region III.
Risk Based Concentrations are in mg/kg.
Basis of RBC: c = carcinogenic effect; n = noncarcinogenic effect
(-) No RBC avaiable
(*) An RBC for DNT mixture is 4.2 mg/kg as a carcinogenic effect

Table A10. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary by station of the results of analyses of surface soil samples collected August 1993 for explosive compounds.

STATION	NUMBER OF DIFFERENT EXPLOSIVES DETECTED BY STATION	MAXIMUM EXP IN STATION CONC (mg/kg)	NAME
42	7	8.90(J)	HMX
43	6	3.74	HMX
44	7	10.90	RDX
45	6	11.40	HMX
48	6	19.5	RDX
49	7	3.16	HMX
50	3	0.52(J)	HMX
51	4	0.70	TNT
52	8	1.82(J)	HMX
56	4	136.0	TNT
57	2	9.20	HMX
58	7	0.11	HMX
61	5	1820.0	RDX
62	6	19.20	HMX
64	1	0.11(J)	4A-DNT
65	2	6.05	HMX
66	3	0.18(J)	TNT
67	7	2.88	HMX
68	4	0.17(J)	HMX
69	4	192.0	RDX
70	1	1.50(J)	HMX
71	1	0.30(J)	HMX

SUMMARY

EXPLOSIVE	NO. OF MAXIMUMS
HMX	14
RDX	4
TNT	3
4A-DNT	1

(J) - Indicates an estimated value accurate detection limits

Duplicates - Where field duplicates were taken, the highest concentration and all explosives from both samples were included.

Table A11. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of method blanks associated with analyses of surface soils for explosives (EPA Method 8330). Concentrations are mg/kg. Method blanks are shown for associated group of sample analyses indicated by station. All method blanks had the same detection levels and results (i.e., none detected), therefore results are presented only once.

METHOD BLANK - ASSOCIATED ANALYSES
Method Blank - 42, 45, 48, 48D, 49, 52, 58
Method Blank - 47, 50, 50D, 51, 55, 56, 57, 60
Method Blank - 53, 54, 54D, 59, 61, 63, 68
Method Blank - 43, 44, 62, 65, 66, 67
Method Blank - 39, 40, 41, 46, 64, 69, 70, 71

EXPLOSIVE	CONCENTRATION mg/kg
HMX	2.20 U
RDX	1.00 U
TNB	0.25 U
DNB	0.25 U
TETRYL	0.65 U
TNT	0.25 U
2,4-DNT	0.25 U
2,6-DNT	0.26 U
2A-DNT	0.25 U
4A-DNT	0.25 U

Note: U - Compound was analyzed for but mot detected. Detection limits are given before the U symbol.
D - Field duplicate sample.

Table A12. (Page 1 of 3). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of surface soils for PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

ANALYTE	STATION 39	40	41	42	43	44	45	46	47	48	48 D	49
Naphthalene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Acenaphthylene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Acenaphthene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Fluorene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Phenanthrene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Anthracene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Fluoranthene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Pyrene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Chrysene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Benzo(a)Anthracene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Benzo(b)Fluoranthene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Benzo(k)Fluoranthene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Benzo(a)Pyrene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Indeno(1,2,3-C,D)Pyrene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Dibenzo(A,H)Anthracene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
Benzo(G,H,I)Perylene	0.34 U	0.35 U	0.36 U	0.4 U	0.38 U	0.38 U	0.35 U	0.36 U	0.38 U	0.38 U	0.38 U	0.36 U
2-Methylnaphthalene	-	-	-	-	0.38 U	0.38 U	-	-	-	-	-	-
TOTAL PAH	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Fluorobiphenyl(Surr (30-115))	61.0	36.7	25.1	57.8	59.0	51.7	51.3	31.0	53.8	50.6	28.6	45.0
p-Terphenyl-D14(Surr (18-137))	81.4	79.2	28.7	93.6	97.2	85.7	77.6	91.3	89.9	86.8	76.2	76.9
1,2-Dichloroben.-d4(Surr (20-13	51.5	29.7	25.1	48.5	44.3	38.6	32.7	22.9	38.7	41.2	23.0	33.7

Notes:

Method 8270 - In Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.

J - Indicates an estimated value below accurate quantitation limits

U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.

(-) - No analysis reported for this compound.

Surr - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

48 D - Field duplicate for soil sample from station 48.

TOTAL PAH - Sum of all detectable concentrations of PAHs. ND indicates none detected.

Table A12. (Page 2 of 3). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of surface soils for PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	STATION											
ANALYTE	50	50 D	51	52	53	54	54 D	55	56	57	58	59
Naphthalene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Acenaphthylene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Acenaphthene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Fluorene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Phenanthrene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.045 J	0.021 J	0.38 U	0.016 J	0.38 U	0.35 U	0.35 U
Anthracene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Fluoranthene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.084 J	0.042 J	0.38 U	0.015 J	0.38 U	0.35 U	0.35 U
Pyrene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.074 J	0.037 J	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Chrysene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.063 J	0.041 J	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Benzo(a)Anthracene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.047 J	0.023 J	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Benzo(b)Fluoranthene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.053 J	0.033 J	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Benzo(k)Fluoranthene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.039 J	0.025 J	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Benzo(a)Pyrene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.038 J	0.39 U	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Indeno(1,2,3-C,D)Pyrene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.032 J	0.39 U	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Dibenzo(A,H)Anthracene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
Benzo(G,H,I)Perylene	0.38 U	0.38 U	0.38 U	0.38 U	0.37 U	0.033 J	0.03 J	0.38 U	0.38 U	0.38 U	0.35 U	0.35 U
2-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL PAH	ND	ND	ND	ND	ND	0.508	0.210	ND	0.031	ND	ND	ND
2-Fluorobiphenyl(Surr (30-115))	61.5	62.4	62.8	46.7	43.6	35.3	34.7	61.4	59.1	64.2	45.6	45.4
p-Terphenyl-D14(Surr (18-137))	78.1	96.7	97.8	80.4	85.4	90.9	92.1	87.8	76.8	89.4	81.6	93.2
1,2-Dichloroben.-d4(Surr (20-13	49.0	52.4	50.8	39.9	30.8	29.9	26.8	49.9	33.2	44.5	33.5	41.9

Notes:

Method 8270 - in Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.

J - Indicates an estimated value below accurate quantitation limits

U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.

(-) - No analysis reported for this compound.

Surr - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

48 D - Field duplicate for soil sample from station 48.

TOTAL PAH - Sum of all detectable concentrations of PAHs. ND indicates none detected.

Table A12. (Page 3 of 3). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of surface soils for PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

ANALYTE	STATION 60	61	62	63	64	65	66	67	68	69	70	71
Naphthalene	0.38 U	0.41 U	0.04 J	0.39 U	3.6 U	0.38 U	0.02 J	0.035 J	0.35 U	0.38 U	0.36 U	0.37 U
Acenaphthylene	0.38 U	0.41 U	0.38 U	0.39 U	3.6 U	0.38 U	0.38 U	0.38 U	0.35 U	0.38 U	0.36 U	0.37 U
Acenaphthene	0.38 U	0.41 U	0.38 U	0.39 U	3.6 U	0.38 U	0.38 U	0.38 U	0.35 U	0.38 U	0.36 U	0.37 U
Fluorene	0.38 U	0.41 U	0.38 U	0.39 U	3.6 U	0.38 U	0.38 U	0.38 U	0.35 U	0.38 U	0.36 U	0.37 U
Phenanthrene	0.38 U	0.022 J	0.084 J	0.39 U	0.051 J	0.38 U	0.054 J	0.079 J	0.066 J	0.38 U	0.36 U	0.029 J
Anthracene	0.38 U	0.41 U	0.38 U	0.39 U	3.6 U	0.38 U	0.38 U	0.38 U	0.026 J	0.38 U	0.36 U	0.37 U
Fluoranthene	0.38 U	0.41 U	0.04 J	0.39 U	0.17 J	0.38 U	0.028 J	0.026 J	0.24 J	0.38 U	0.36 U	0.37 U
Pyrene	0.38 U	0.41 U	0.043 J	0.39 U	0.18 J	0.38 U	0.033 J	0.028 J	0.33 J	0.38 U	0.36 U	0.021 J
Chrysene	0.38 U	0.41 U	0.02 J	0.39 U	0.19 J	0.38 U	0.03 J	0.038 J	0.32 J	0.38 U	0.36 U	0.37 U
Benzo(a)Anthracene	0.38 U	0.41 U	0.38 U	0.39 U	0.073 J	0.38 U	0.38 U	0.38 U	0.2 J	0.38 U	0.36 U	0.37 U
Benzo(b)Fluoranthene	0.38 U	0.41 U	0.38 U	0.39 U	0.2 J	0.38 U	0.023 J	0.024 J	0.37	0.38 U	0.36 U	0.37 U
Benzo(k)Fluoranthene	0.38 U	0.41 U	0.38 U	0.39 U	0.11 J	0.38 U	0.014 J	0.016 J	0.31 J	0.38 U	0.36 U	0.37 U
Benzo(a)Pyrene	0.38 U	0.41 U	0.38 U	0.39 U	0.055 J	0.38 U	0.38 U	0.38 U	0.28 J	0.38 U	0.36 U	0.37 U
Indeno(1,2,3-C,D)Pyrene	0.38 U	0.41 U	0.38 U	0.39 U	0.021 J	0.38 U	0.38 U	0.38 U	0.23 J	0.38 U	0.36 U	0.37 U
Dibenzo(A,H)Anthracene	0.38 U	0.41 U	0.38 U	0.39 U	3.6 U	0.38 U	0.38 U	0.38 U	0.04 J	0.38 U	0.36 U	0.37 U
Benzo(G,H,I)Perylene	0.38 U	0.41 U	0.017 J	0.39 U	0.029 J	0.38 U	0.38 U	0.38 U	0.21 J	0.38 U	0.36 U	0.37 U
2-Methylnaphthalene	-	-	0.063 J	-	-	0.38 U	0.022 J	0.07 J	-	-	-	-
TOTAL PAH		0.022	0.307	ND	1.079	ND	0.15	0.316	3.102	ND	ND	0.050
2-Fluorobiphenyl(Surr (30-115))	60.2	33.8	59.6	33.2	59.9	43.6	62.0	54.8	42.1	32.7	50.6	25.4
p-Terphenyl-D14(Surr (18-137))	82.2	89.4	90.5	91.9	94.0	96.9	104.0	104	86.9	85.8	78.6	83.2
1,2-Dichloroben.-d4(Surr (20-13	42.9	19.7	44.8	26.9	10.0	32.6	51.8	33.4	32.2	23.5	37.5	25.4

Notes:

Method 8270 - in Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.

J - Indicates an estimated value below accurate quantitation limits

U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.

(-) - No analysis reported for this compound.

Surr - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

TOTAL PAH - Sum of all detectable concentrations of PAHs. ND indicates none detected.

Table A13. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary by station of results of analyses of surface soils for PAHs.

STATION	NUMBER OF DIFFERENT PAHs DETECTED	TOTAL SAMPLE PAHs (mg/kg)	MAXIMUM PAH IN STATION CONC (mg/kg)	NAME
54	10	0.508	0.084(J)	Fluoranthene
56	2	0.031	0.016(J)	Phenanthrene
61	1	0.022	0.022(J)	Phenanthrene
62	6	0.303	0.084(J)	Phenanthrene
64	10	1.079	0.20(J)	Benzo(b)fluoranthene
66	9	0.15	0.054(J)	Phenanthrene
67	8	0.316	0.079(J)	Phenanthrene
68	12	3.102	0.37	Benzo(b)fluoranthene
71	2	0.05	0.029(J)	Phenanthrene
MAX	12	3.102		
MIN	1	0.022		
MEAN	7	0.618		

Note: Where field duplicates were taken, the highest total concentration and occurrence all PAHs from both samples were included.
Total PAHs - Sum of all PAHs with detectable concentrations.

Table A14. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary by specific PAH of results of analyses of surface soils using EPA Method 8270.

PAH	OCCURRENCE BY STATION								NUMBER OF STATIONS WITH SPECIFIC PAH	MAXIMUM CONCENTRATION ENCOUNTERED (mg/kg)	LOCATION OF MAXIMUM	INDUSTRIAL SOILS RBC mg/kg
Low Molecular Weight PAHs												
Naphthalene	62	66	67						[3]	0.04(J)	62	41000n
Acenaphthylene	ND								[0]	ND	-	no RBC
Acenaphthene	ND								[0]	ND	-	61000n
Fluorene	ND								[0]	ND	-	41000n
Phenanthrene	54	56	61	62	64	66	67	68	[9]	0.084(J)	62	no RBC
	71											
Anthracene	68								[1]	0.066(J)	68	310000n
2-Methylnaphthalene	66	67							[2]	0.07(J)	67	no RBC
High Molecular Weight PAHs												
Fluoranthene	54	56	62	64	66	67	68		[7]	0.24(J)	68	41000n
Pyrene	54	62	64	66	67	68	71		[7]	0.33(J)	68	31000n
Chrysene	54	62	64	66	67	68			[6]	0.32(J)	68	390c
Benzo(a)Anthracene	54	64	68						[3]	0.20(J)	68	3.90c
Benzo(b)Fluoranthene	54	64	66	67	68				[5]	0.4	68	3.90c
Benzo(k)Fluoranthene	54	64	66	67	68				[5]	0.31(J)	68	39.0c
Benzo(a)Pyrene	54	64	68						[3]	0.28(J)	68	0.39c
Indeno(1,2,3-C,D)Pyrene	54	64	68						[3]	0.23(J)	68	3.90c
Dibenzo(A,H)Anthracene	68								[1]	0.040(J)	68	0.39c
Benzo(G,H,I)Perylene	54	62	64	68					[4]	0.21(J)	68	no RBC

Note: Where field duplicates were taken, the occurrence of a PAH in either sample was listed.
ND - None detected; No RBC - No RBC listed in reference.
J - Indicates that concentration reported was an estimated value below accurate quantitation limits.
RBC - Risk-Based Concentrations - Risk-Based Concentration Table, Fourth Quarter 1994.
Roy L. Smith, Senior Toxicologist (3HW15), U.S. EPA Region III.
Risk Based Concentrations are in mg/kg.
Basis of RBC: c = carcinogenic effect; n = noncarcinogenic effect

Table A15. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of method blanks for PAHs using EPA Method 8270. Concentrations are mg/kg. Method blanks are shown for associated group of sample analyses indicated by station..

	METHOD BLANK							
PAH ANALYTE	MB1	MB2	MB3	MB4	MB5	MB6	MB7	MB8
Naphthalene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Acenaphthylene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Acenaphthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Fluorene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Phenanthrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Chrysene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(a)Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(b)Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(k)Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(a)Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Indeno(1,2,3-C,D)Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Dibenzo(A,H)Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(G,H,I)Perylene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
2-Methylnaphthalene	-	-	-	-	-	-	-	0.33 U
2-Fluorobiphenyl(Surr (30-115))	61	39	61	30.2	57.4	60.4	56.2	57.4
p-Terphenyl-D14(Surr (18-137))	81.2	93	81.2	90.6	86.9	87.8	89.3	86.9
1,2-Dichloroben.-d4(Surr (20-130))	45.3	35.1	45.3	23.8	46.9	49.1	37.7	46.9

Note: U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

EPA Method 8270 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

(-) - No analysis reported .

Surr - Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

MB1 - Samples from stations 39, 41, 69, and 71

MB2 - Samples from stations 54, 59, 61, 63, and 68

MB3 - Samples from stations 45, 48, 48D, 49, 52, and 58

MB4 - Samples from stations 43, 44, 62, 65, 66, and 67

MB5 - Samples from stations 47, 50, 50D, 51, 55, 56, 57, and 60

MB6 - Samples from stations 40, 46, 64, and 69

MB7 - Samples from stations 53 and 54D

MB8 - Samples from station 42

Table A16. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Results of Inorganic analyses of surface soil samples. Concentrations are mg/kg dry weight (ppm).

SAMPLE	AL	SB	AS	BA	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN	TP
	ANALYTE																			
39	8190	0.9 UN	4.26	41.2	0.09 B	7720	11	8.6	5.8	14800	6.1	1820	365	0.16	11.9	1 U	80 B	5 U	33.1	150
40	8200	0.9 UN	20.7	47.1	0.15 B	3260	13.4	10.3	7.7	21300	6.5	1090	428	0.1 U	12.8	1 U	69.7 B	5 U	48.2	152
41	9610	0.9 UN	4.33	49.7	0.12 B	1340	11.3	10.1	12.9	16200	11.7	1080	692	0.123	13.8	1 U	111 B	5 U	73.1	293
42	17000	0.9 UN	8.42	1410	2.63	23900	32.9	18	265	23900	372	10000	739	0.733	29.3	2.2 *	130 B	6 U	135	188
43	8620	2.63 BN	3.56	208	1.26	104000	10.9	7.3	93.6 N*	10900	1510	12800	335	0.106	12	1 U	143 B	5 U	189	92.1
44	15300	0.9 UN	6	104	0.47 B	7040	18.7	11.2	37.8 N*	24100	240	2320	534	0.173	22.1	1 U	85.2 B	5 U	179	199
45	7660	1.4 BN	4.2	138	1.26	88400	9.7	11.2	29.7	10500	948	19700	478	1.926	13.6	1 U*	180 B	5 U	137	93.5
46	10200	0.9 UN	4.37	55.8	0.12 B	1420	13.9	9.3	11.6	15500	10.7	1190	456	0.109	12.2	1 U	70.3 B	5 U	51.1	185
47	7980	0.9 UN	10.5 N	42.6	0.17 B	316 B	14.5	11.4	10.1 *	19300	14.1 N*	697	291	2.51	8.1	1 U	26.8 B	5 U	40.1	122
48	12900	0.9 UN	5.58	984	1	28700	18.3	18.9	73.8	23600	163	5670	598	0.808	23.8	1 U*	68.9 B	5 U	110	243
49	7010	0.9 UN	4.08	111	0.7	78000	9.6	10.3	58.5	10300	1270	15900	365	0.928	11.8	1 U*	103 B	5 U	131	76.8
50	9830	0.9 UN	6.93	463	7.9 N	27100	15.7	12.8	80.2 *	18800	96 N*	3610	569	4.71	16.5	1 U	91.9 B	5 U	476	232
51	10500	0.9 UN	6.64 N	184	1.81	30400	14.2	10.5	122	15800	93.1 N*	7600	510	0.564	13.1	1 U	148 B	5 U	304	231
52	11000	0.9 UN	8.24	116	0.34 B	11100	15.5	13.6	18.5	19600	42.5	3410	318	0.41	26.1	1 U*	113 B	5 U	80.9	152
53	17600	0.9 UN	7.7	60.3	0.05 B	724	21.3 *	7.7	13.1	25900	11.8	1930	211	0.1 U	11.3	1 U	117 B	5 U	50.7	152
54	6690	1.36 BN	5.57	142	4.99	34300	13.2 *	10.4	84.9	17000	88.2	2280	346	2.54	20.6	1 U	61.1 B	5 U	509	147
55	7410	0.9 UN	6.91 N	84.1	1	17300	13.3	14.2	35.2 *	16900	31.7 N*	1430	556	0.856	13.5	1 U	31 B	5 U	120	190
56	14700	0.9 UN	5.62 N	154	1	20800	14.7	13.9	38.7 *	13300	62.4 N*	5500	361	2.33	26.7	1 U	61.1 B	5 U	177	180
57	9370	0.9 UN	5.38 N	94.7	0.27 B	4090	15.2	7.59	17.8 *	19200	21.6 N*	1750	250	2.77	9.29	1 U	58.7 B	5 U	69.8	206
58	6460	1.26 BN	5.38	177	2.24	83800	13.4	12.9	85.6	14200	95.5	9810	784	1.13	19	1 U*	131 B	5 U	405	364
59	12400	0.9 UN	5.18	95.9	0.22 B	2810	16.2 *	9.19	14.5	18900	20.8	1610	404	0.1 U	17	1 U	67.3	5 U	53.5	167
60	7510	0.9 UN	4.68 N	88.7	1.04	1400	10.4	14.2	22.4 *	13200	24.8 N*	843	802	3.05	12.2	1 U	31.5 B	5 U	114	200
61	80400	2.34 UN	3	578	68.8	9630	21.1 *	11.1	776	17100	280	29000	835	3.34	25.9	1.7	86 B	5 U	1440	175
62	10500	2.94 BN	6.54	347	0.85	132000	29.2	11.8	504 N*	20100	377	6080	2490	0.438	24.9	1.1	107 B	5.7	1600	348
63	18500	0.9 UN	6.03	336	0.22 B	4220	26 *	17.4	21.1	22100	13.9	3070	504	0.1 U	39	1 U	246 B	5 U	58.1	154
64	7860	2.07 BN	4.16	137	3 W	114000	16	8	99.8	13200	107	8810	548	0.168	13.9	1 U	135 B	5 U	489	25.4 U
65	10900	0.9 UN	6.02	155	0.83	2030	17.5	10.5	34 N*	28400	35.2	1720	853	0.186	20.9	1 U	52.9 B	5 U	130	142
66	13300	4.91 BN	11.8	830	5.54	8550	26.2	13.1	290 N*	28300	538	3080	1620	0.44	31.3	1 U	62.3 B	8.4	1850	977
67	26800	8.79 UN	11.1	1410	20.8	49600	70.2	17.2	1310 N*	40100	1070	6160	2830	0.724	42.6	19	226 B	52.7	3930	1250
68	11200	1.58 BN	6.78	486	6.04	64700	19.8 *	12.3	148	17900	232	4780	956	0.276	22	1 U	108 B	5 U	434	482
69	14000	1.12 BN	6.9	355	0.79	2780	17.3	13.2	54.2	21600	55.9	1610	870	0.234	19.8	1 U	79.8 B	5 U	184	124
70	8330	1.13 BN	5	157	0.7	9060	10.3	10.8	36.6	15300	42.4	1530	655	0.173	13.4	1 U	89.6 B	5 U	122	218
71	11400	0.9 UN	5.79	194	0.5	2400	15.6	13.3	26.6	19100	21.6	1230	1050	0.116	17.8	1 U	65.3	5 U	97	174

Notes:

U - Analyte was analyzed for but not detected. Detection limits are given before the U symbol.

B - Reported value is less than the Contract Required Detection Limit but greater than the Instrument Detection Limit.

W - Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

N - Spike sample recovery not within control limits.

* - Duplicate analysis not within control limits.

Table A17. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Summary statistics for results of inorganic analyses of surface soil samples. See Table 5.2.13 for complete data. MAX, MIN, and MEAN concentrations are mg/kg dry weight (ppm).

	ANALYTE									
STAT	AL (33)	SB *	AS (26)	BA (33)	CD (33)	CA (33)	CR (27)	CO (33)	CU (20)	FE (33)
MAX	80400 [61]	-	20.7 [40]	1410 [67]	68.8 [61]	132000 [62]	70.2 [67]	18.8 [48]	776 [61]	40100 [67]
MIN	6460 [58]	-	3 [61]	41.2 [39]	0.052 [53]	316 [47]	9.6 [49]	7.3 [43]	5.8 [39]	10300 [49]
MEAN1	13313	-	6.6	298.1	4.15	29603	17.7	11.9	92.2	18982
STD DEV	12776	-	3.6	362.6	12.23	37668	11.9	3.0	172.5	6056
MEAN2	13313	-	6.6	298.1	4.15	29603	17.7	11.9	92.2	18982
STD DEV	12776	-	3.6	362.6	12.23	37668	11.9	3.0	172.5	6056

STAT	PB (26)	MG (33)	MN (33)	HG (33)	NI (33)	AG (27)	NA (33)	SN (33)	ZN (33)	TP (33)
MAX	1510 [43]	29000 [61]	2830 [67]	4.71 [50]	42.6 [67]	18.7 [67]	246 [63]	52.7 [67]	3930 [67]	1250 [67]
MIN	6.1 [39]	697 [47]	211 [53]	< 0.1 [*]	8.1 [47]	< 1 [*]	26.8 [47]	< 5 [*]	33.1 [39]	< 25.4 [64]
MEAN1	291.2	5428	715	0.98	19.0	1.7	98.1	6.6	418.8	245.0
STD DEV	426.9	6247	577	1.20	8.3	3.4	50.3	8.3	774.3	242.5
MEAN2	291.2	5428	715	0.98	19.0	1.2	98.1	4.3	418.8	244.6
STD DEV	426.9	6247	577	1.21	8.3	3.5	50.3	8.8	774.3	242.9

Note:

AL (33) - Inorganic analyte i.e., aluminum. Number in parentheses is the number of surface soil analyses used to compute the statistic. Data qualified by a W, N, or * (see Notes on Table 5.2.13) were not used.

SB (*) - All data for SB was qualified by an "N" and therefore not used for these comparisons.

80400 [61] - Analyte concentration in mg/kg dry weight (ppm). Number in brackets, i.e., [61] is the sample location where the MAX or MIN occurred. Where a MIN was the detection limit and occurred at more than one location a [*] symbol is given.

MEAN1 - Mean was computed using the reported detection limit for those samples with results reported as < detection limits (U qualified).

MEAN2 - Mean was computed using 1/2 detection limit for those samples with results reported as < detection limits (U qualified).

Table A18. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Location of maximum concentrations of inorganic constituents.

SURFACE SOIL SAMPLE LOCATION WHERE CONSTITUENT MAXIMUM OCCURRED	CONSTITUENT(S)
67	Ag, Ba, Cr, Fe, Mn, Ni, Sn, Zn, Total P
61	Al, Cd, Cu, Mg
63	Na
62	Ca
50	Hg
48	Co
43	Pb
40	As

Table A19. (Page 1 of 2). Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Comparison of ABG surface soils to nearby "background samples". Ratio of sample concentration to mean background concentration for a specific metal or inorganic constituent is given. See Table 5.2.13 for complete data. Constituents greater than 100 times the background are shaded in gray.

RATIO ABG SAMPLE CONCENTRATION / MEAN BACKGROUND CONCENTRATION FOR INDICATED CONSTITUENT

SAMPLE	AL	SB	AS	BA	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN	TP
39	1.0	-	1.2	1.0	4.5	23.6	0.9	-	1.1	0.9	0.8	2.5	-	1.6	2.1	1.0	2.1	1.0	1.2	1.5
40	1.0	-	5.6	1.1	7.5	9.9	1.0	-	1.5	1.4	0.9	1.5	-	1.0	2.3	1.0	1.8	1.0	1.8	1.5
41	1.1	-	1.2	1.2	6.1	4.1	0.9	-	2.5	1.0	1.6	1.5	-	1.2	2.5	1.0	2.9	1.0	2.7	2.9
42	2.0	-	2.3	33.1	131.5	72.9	2.6	-	51.0	1.5	49.5	13.6	-	7.3	5.2	-	3.4	1.0	5.1	1.8
43	1.0	-	1.0	4.9	63.0	317.3	0.8	-	-	0.7	200.8	17.3	-	1.1	2.1	1.0	3.7	1.0	7.1	0.9
44	1.8	-	1.6	2.4	23.3	21.5	1.4	-	-	1.5	31.9	3.1	-	1.7	3.9	1.0	2.2	1.0	6.7	1.9
45	0.9	-	1.1	3.2	63.0	269.7	0.8	-	5.7	0.7	126.1	26.7	-	19.3	2.4	-	4.7	1.0	5.2	0.9
46	1.2	-	1.2	1.3	5.9	4.3	1.1	-	2.2	1.0	1.4	1.6	-	1.1	2.2	1.0	1.8	1.0	1.9	1.8
47	0.9	-	-	1.0	8.6	1.0	1.1	-	-	1.2	-	0.9	-	25.1	1.4	1.0	0.7	1.0	1.5	1.2
48	1.5	-	1.5	23.1	49.9	87.6	1.4	-	14.2	1.5	21.7	7.7	-	8.1	4.3	-	1.8	1.0	4.1	2.4
49	0.8	-	1.1	2.6	35.2	237.9	0.7	-	11.3	0.7	168.9	21.5	-	9.3	2.1	-	2.7	1.0	4.9	0.8
50	1.1	-	1.9	10.9	-	82.7	1.2	-	-	1.2	-	4.9	-	47.1	2.9	1.0	2.4	1.0	17.9	2.3
51	1.2	-	-	4.3	90.5	92.7	1.1	-	23.5	1.0	-	10.3	-	5.6	2.3	1.0	3.8	1.0	11.4	2.3
52	1.3	-	2.2	2.7	16.8	33.9	1.2	-	3.6	1.3	5.7	4.6	-	4.1	4.7	-	2.9	1.0	3.0	1.5
53	2.1	-	2.1	1.4	2.6	2.2	1.7	-	2.5	1.7	1.6	2.6	-	1.0	2.0	1.0	3.0	1.0	1.9	1.5
54	0.8	-	1.5	3.3	249.5	104.6	1.0	-	16.3	1.1	11.7	3.1	-	25.4	3.7	1.0	1.6	1.0	19.1	1.4
55	0.9	-	-	2.0	49.8	52.8	1.0	-	-	1.1	-	1.9	-	8.6	2.4	1.0	0.8	1.0	4.5	1.9
56	1.7	-	-	3.6	50.0	63.5	1.1	-	-	0.9	-	7.5	-	23.3	4.8	1.0	1.8	1.0	6.7	1.8
57	1.1	-	-	2.2	13.5	12.5	1.2	-	-	1.2	-	2.4	-	27.7	1.7	1.0	1.5	1.0	2.8	2.0
58	0.8	-	1.5	4.2	112.0	255.6	1.0	-	16.5	0.9	12.7	13.3	-	11.3	3.4	-	3.4	1.0	15.2	3.6
59	1.4	-	1.4	2.3	10.9	8.6	1.3	-	2.8	1.2	2.8	2.2	-	1.0	3.0	1.0	1.7	1.0	2.0	1.6
60	0.9	-	-	2.1	52.0	4.3	0.8	-	-	0.8	-	1.1	-	30.5	2.2	1.0	0.8	1.0	4.3	2.0
61	9.4	-	0.8	13.6	3440.0	29.4	1.6	-	149.2	1.1	37.2	39.3	-	33.4	4.6	1.7	2.2	1.0	54.1	1.7
62	1.2	-	1.8	8.1	42.5	402.7	2.3	-	-	1.3	50.1	8.2	-	4.4	4.4	1.1	2.8	1.1	60.2	3.4
63	2.2	-	1.6	7.9	11.1	12.9	2.0	-	4.1	1.4	1.8	4.2	-	1.0	7.0	1.0	6.4	1.0	2.2	1.5
64	0.9	-	1.1	3.2	150.0	-	1.2	-	19.2	0.8	14.2	11.9	-	1.7	2.5	1.0	3.5	1.0	18.4	0.2
65	1.3	-	1.6	3.6	41.6	6.2	1.4	-	-	1.8	4.7	2.3	-	1.9	3.7	1.0	1.4	1.0	4.9	1.4
66	1.6	-	3.2	19.5	277.0	26.1	2.0	-	-	1.8	71.5	4.2	-	4.4	5.6	1.0	1.6	1.7	69.5	9.5
67	3.1	-	3.0	33.1	1040.0	151.3	5.4	-	-	2.6	142.3	8.3	-	7.2	7.6	18.7	5.9	10.5	147.7	12.2
68	1.3	-	1.8	11.4	302.0	197.4	1.5	-	28.5	1.1	30.9	6.5	-	2.8	3.9	1.0	2.8	1.0	16.3	4.7
69	1.6	-	1.9	8.3	39.3	8.5	1.3	-	10.4	1.4	7.4	2.2	-	2.3	3.5	1.0	2.1	1.0	6.9	1.2
70	1.0	-	1.4	3.7	35.2	27.6	0.8	-	7.0	1.0	5.6	2.1	-	1.7	2.4	1.0	2.3	1.0	4.6	2.1
71	1.3	-	1.6	4.6	25.2	7.3	1.2	-	5.1	1.2	2.9	1.7	-	1.2	3.2	1.0	1.7	1.0	3.6	1.7

Note:
(-) - Comparison not made due to data being qualified by a W, N, or * (see notes Table 5.2.14).
Mean - Means were computed using the reported detection limit for those samples with results reported as < detection limits (U qualified).
Ratios - Ratios were computed using the detection limit in those cases where less than detection concentrations were reported.

Table A19. (Page 2 of 2). Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Comparison of ABG surface soils to nearby "background samples". Ratio of ABG concentration to background concentration for a specific metal or inorganic constituent is given. See Table 5.2.16 for complete data. MAX, MIN, and MEAN concentrations are mg/kg dry weight (ppm).

ABG - SWMU 03/10, SURFACE SAMPLES

ANALYTE PPM (MG/KG)

	AL	SB	AS	BA	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN	TP
Max	80400	*	21	1410	68.8	132000	70.2	19	776	40100	1510	29000	2830	4.71	42.6	18.7	246	52.7	3930	1250
Min	6460	*	3.0	41.2	0.052	316	9.6	7.3	5.8	10300	6.1	697	211	<0.10	8.1	<1.0	26.8	<5.0	33.1	<25.4
Mean	13313	*	6.6	298.1	4.15	29603	17.7	12	92.2	18982	291	5428	715	0.98	19.0	1.7	98.1	6.6	418.8	245
ABG Background Soil Borings (03/10-1-93-1, 03/10-2-93-1, and 03/10-3-93-1)																				
Max	10100	*	5.2	69.3	0.03	622	15.9	*	6.7	28400	9.99	755	*	<0.10	7.8	<1.0	47.3	<5.0	39	131
Min	9150	*	2	23.1	< 0.02	74.4	10.9	*	3.1	9040	5.56	710	*	<0.10	3.7	<1.0	26.1	<5.0	9.39	56.3
Mean	8570	*	3.7	42.6	0.02	327.8	12.9	*	5.2	15596	7.52	738	*	< 0.10	5.6	<1.0	38.5	<5.0	26.6	102.4

COMPARISON OF ABG BACKGROUND WITH ABG SWMU SOILS FOR SPECIFIC ANALYTE - GREATER CONCENTRATION IS INDICATED

	AL	SB	AS	BA	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN	TP
Max	ABG	-	ABG	ABG	ABG	ABG	ABG	-	ABG	ABG	ABG	ABG	-	ABG	ABG	ABG	ABG	ABG	ABG	ABG
Mean	ABG	-	ABG	ABG	ABG	ABG	ABG	-	ABG	ABG	ABG	ABG	-	ABG	ABG	ABG	ABG	ABG	ABG	ABG
RATIO ABG SWMU MAX / ABG BACKGROUND MAX																				
	8.0	-	4.0	20.3	2293.3	212.2	4.42	-	115.8	1.4	151.2	38.4	-	76.9	5.5	6.59	5.2	1722.2	100.8	9.5
RATIO ABG SWMU MEAN / ABG BACKGROUND MEAN																				
	1.6	-	1.8	7.0	207.5	90.3	1.4	-	17.7	1.2	38.7	7.4	-	9.8	3.4	1.20	2.5	1.0	15.7	2.4
RATIO ABG SWMU MIN / ABG BACKGROUND MIN																				
	0.7	-	1.5	1.8	2.6	4.2	0.9	-	1.9	1.1	1.1	1.0	-	1.0	2.2	1.7	1.0	1.3	3.5	0.5

Note:
(*) - All data qualified by a W, N, or * (see notes Table 5.2.13) and not used for these comparisons.
(-) - Comparison not made due to data being out of control limits.
Mean - Means were computed using the reported detection limit for those samples with results reported as < detection limits (U qualified).
Ratios - Ratios were computed using the detection limit in those cases where less than detection concentrations were reported.

Table A20. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Comparison of results of inorganic analyses of ABG surface soil samples to EPA Region III RBCs (risk-based concentrations) for industrial soils. Concentrations are mg/kg dry weight (ppm). Table entries shaded in gray indicate mean or max ABG surface soil concentration greater than the RBC.

ANALYTE	ABG SURFACE SOIL MAX	ABG SURFACE SOIL MEAN	RBC RISK-BASED CONCENTRATIONS* INDUSTRIAL SOIL
AL	80400	13313	1000000 n
SB	-	-	410 n
AS	20.7	6.6 (33)	1.6 c
AS	20.7	6.6	310 n
BA	1410	298.1	72000 n
CD	68.8	4.15	510 n
CA	132000	29603	-
CR(VI)	70.2	17.7	5100 n
CO	18.8	11.9	61000 n
CU	776	92.2	38000 n
FE	40100	18982	-
PB	1510	291.2	-
MG	29000	5428	-
MN	2830	715	5100 n
HG	4.71	0.98	310 n
NI	42.6	19	20000 n
AG	18.7	1.7	5100 n
NA	246	98.1	-
SN	52.7	6.6	610000 n
ZN	3930	418.8	310000 n

Notes:

Risk-Based Concentrations * - Risk-Based Concentration Table, Fourth Quarter 1994.
Roy L. Smith, Senior Toxicologist (3HW15), U.S. EPA Region III.
Risk Based Concentrations are in mg/kg. Basis of RBC: c = carcinogenic effect
Basis of RBC: c = carcinogenic effect; n = noncarcinogenic effect

MEAN - Mean computed using the reported detection limit for those samples with results reported as < detection limit (U qualified). See Table 5.2.17.

(-) - No risk-based concentration available.

(#) - Number of samples that exceeded the occupational soil risked-based concentration

CR(VI) - Chromium VI and compounds.

Table A21. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Results of inorganic analyses of method blanks associated with the analyses of ABG surface soil samples. Concentrations are mg/kg dry weight (ppm).

BLANK ID	AL	SB	AS	BA	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN
BLK DGST 1	7.9 B	0.3 UN	0.2 U	2 U	0.334 B	50.8	1 U	3.2 B	0.6 U	4.4 B	4 U	27 U	0.6 U	NA	1.3	1 U	20 U	5 U	1.9 B
BLK DGST 2	2 U	0.3 UN	0.2 U	2 U	0.02 U	34.9	1 U	1.5 U	0.6 U	5.3	4 U	27 U	0.6 U	NA	1 U	1 U	62.4	5 U	1 U
BLK DGST 3	2.1 B	0.3 UN	0.2 U	2 U	0.107 B	74.5	1 U	1.5 U	0.6 U	2.5 U	4 U	27 U	0.7 U	0.1 U	1 U	1 U	70.4 B	5 U	1 U
BLK DGST 4	5.4 B	0.3 UN	0.2 U	2 U	0.02 U	43.8	1 U	3.2 B	0.6 U	4.4 B	4 U	27 U	0.6 U	NA	1 U	1 U	20 U	5 U	1.8 B
BLK DGST 5	5.9 B	0.3 UN	0.2 U	2 U	0.104 B	33.6	1 U	1.5 U	0.6 U	4.4 B	4 U	27 U	0.6 U	0.1 U	1 U	1 U	20 U	5 U	1.3 B

Note:

BLK DGST 1 - Blank Digest run with samples 48, 42, 54 Dup, 58, 52, 49, and 45

BLK DGST 2 - Blank Digest run with samples 39, 40, 41, 46, 64, 70, 71, and 69

BLK DGST 3 - Blank Digest run with samples 63, 68, 59, 53, 54, 61, and 54 Dup

BLK DGST 4 - Blank Digest run with samples 56, 50, 57, 51, 55, 60, 47, and 50 Dup

BLK DGST 5 - Blank Digest run with samples 43, 44, 65, 62, 67, and 66

U - Analyte was analyzed for but not detected. Detection limts are given before the U symbol.

B - Reported value is less than the Contract Required Detection Limit but greater than the Instrument Detection Limit

N - Spike recovery not within control limits

Table A22. (Page 1 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	BORING/SAMPLE										
ANALYTE	1#1	1#1D	2#1	3#1	5#1	5#2	6#1	6#2	7#1	7#2	8#1
Chloromethane	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U
Bromomethane	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U
Vinyl Chloride	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U
Chloroethane	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U
Methylene Chloride	0.17 B	0.019 B	0.092 B	0.1 B	0.034 B	0.04 B	0.048 B	0.026 B	0.05 B	0.056 B	0.03 B
1,1-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
1,1-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Trans-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
cis-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Chloroform	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
1,2-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
1,1,1-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Carbon Tetrachloride	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Bromodichloromethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
1,2-Dichloropropane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Trans-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Trichloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Dibromochloromethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Cis-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
1,1,2-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Benzene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Bromoform	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
1,1,2,2-Tetrachloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Tetrachloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Toluene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.00082 J	0.0055 U	0.006 U	0.0055 U
Chlorobenzene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Ethylbenzene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Acetone	0.013 BJ	0.035 BJ	0.01 BJ	0.021 BJ	0.011 BJ	0.01 BJ	0.11 U	0.015 BJ	0.11 U	0.12 U	0.015 BJ
2-Butanone	0.11 U	0.11 U	0.11 U	0.12 U	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.12 U	0.11 U
Carbondisulfide	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
2-Hexanone	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.006 U	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U
4-Methyl-2-Pentanone	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.006 U	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U
Styrene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
Vinyl Acetate	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.006 U	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U
T-Xylene	0.0055 U	0.0065 U	0.0055 U	0.006 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U
1,2-Dichloroethane-d4(76-114)	103	98.9	105	99.4	108	109	109	120	101	99.5	107
Toluene-D8 (88-110)	100	101	100	101	102	102	100	102	98.7	99.2	100
4-Bromofluorobenzene (86-115)	107	102	107	104	99.5	107	94.8	107	94.3	104	97.1

Notes: Sample ID - 1#1 indicates boring number 1, sample 1. 1#1D indicates a field duplicate of the boring 1 sample 1.

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

B - Analyte found in associated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last 3 rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A22. (Page 2 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

ANALYTE	8#1D	9#1	10#1	10#2	11#1	11#2	12#1	12#2	12#3	13#1	13#2
Chloromethane	0.011 U	0.011 U	0.0011 U	0.012 U	0.0011 U	0.0011 U	0.011 U	0.011 U	0.012 U	0.01 U	0.011 U
Bromomethane	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U	0.01 U	0.011 U
Vinyl Chloride	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U	0.01 U	0.011 U
Chloroethane	0.011 U	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U	0.01 U	0.011 U
Methylene Chloride	0.026 B	0.051 B	0.047 B	0.046 B	0.03 B	0.032 B	0.045 B	0.034 B	0.065 B	0.046 B	0.038 B
1,1-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
1,1-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Trans-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
cis-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Chloroform	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
1,2-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
1,1,1-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Carbon Tetrachloride	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Bromodichloromethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
1,2-Dichloropropane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Trans-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Trichloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Dibromochloromethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Cis-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
1,1,2-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Benzene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Bromoform	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
1,1,2,2-Tetrachloroethane	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Tetrachloroethene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Toluene	0.0055 U	0.0055 U	0.0055 U	0.0067	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Chlorobenzene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Ethylbenzene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
Acetone	0.012 BJ	0.11 U	0.024 BJ	0.024 BJ	0.026 BJ	0.016 BJ	0.044 BJ	0.024 BJ	0.029 BJ	0.012 BJ	0.11 U
2-Butanone	0.11 U	0.12 U	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.12 U	0.1 U	0.11 U
Carbondisulfide	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.005 U	0.0055 U
2-Hexanone	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.05 U	0.055 U
4-Methyl-2-Pentanone	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.05 U	0.055 U
Styrene	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.05 U	0.0055 U
Vinyl Acetate	0.055 U	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.05 U	0.055 U
T-Xylene	0.0055 U	0.0055 U	0.00085 J	0.0006 U	0.00127 J	0.0055 U	0.0055 U	0.0055 U	0.006 U	0.05 U	0.0055 U
1,2-Dichloroethane-d4 (76-114)	108	97.6	99.1	96.5	97.4	94.3	103	108	94.7	103	107
Toluene-D8 (88-110)	100	99.9	98.5	99.3	97.4	98.6	101	100	100	99.7	102
4-Bromofluorobenzene (86-115)	99.8	101	96.9	96.3	92.7	90.7	103	107	101	94.2	100

Note:

Sample ID - 8#1 indicates boring number 8, sample 1. 8#1D indicates a field duplicate of the boring 8 sample 1.

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U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

B - Analyte found in associated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last 3 rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A22. (Page 3 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	BORING/SAMPLE										
ANALYTE	14#1	14#2	15#1	16#1	16#1D	17#1	17#2	17#3	19#1	19#2	19#3
Chloromethane	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.12 U	0.01 U	0.011 U	0.012 U
Bromomethane	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.12 U	0.01 U	0.011 U	0.012 U
Vinyl Chloride	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.12 U	0.01 U	0.011 U	0.012 U
Chloroethane	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.12 U	0.01 U	0.011 U	0.012 U
Methylene Chloride	0.047 B	0.055 B	0.042 B	0.046 B	0.028 B	0.016 B	0.016 B	0.32 B	0.013 B	0.016 B	0.034 B
1,1-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
1,1-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Trans-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0036 J	0.29	0.005 U	0.0055 U	0.006 U
cis-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0025 J	0.058	2.3	0.005 U	0.0055 U	0.0059 J
Chloroform	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
1,2-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
1,1,1-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.00057 J	0.0055 U	0.006 U
Carbon Tetrachloride	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Bromodichloromethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
1,2-Dichloropropane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Trans-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Trichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06	0.2	0.073	0.005 U	0.0055 U	0.006 U
Dibromochloromethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Cis-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
1,1,2-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Benzene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Bromoform	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
1,1,2,2-Tetrachloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Tetrachloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Toluene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.001 J	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Chlorobenzene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Ethylbenzene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0026 J	0.005 U	0.0055 U	0.006 U
Acetone	0.016 BJ	0.018 BJ	0.026 BJ	0.023 BJ	0.017 BJ	0.019 BJ	0.019 BJ	0.58 BJ	0.014 BJ	0.015 BJ	0.036 BJ
2-Butanone	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	1.2 U	0.1 U	0.11 U	0.12 U
Carbondisulfide	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
2-Hexanone	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.05 U	0.055 U	0.06 U
4-Methyl-2-Pentanone	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.05 U	0.055 U	0.06 U
Styrene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
Vinyl Acetate	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U	0.05 U	0.055 U	0.06 U
T-Xylene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.06 U	0.005 U	0.0055 U	0.006 U
1,2-Dichloroethane-d4(70-121)	97.6	102	97.8	103	109	102	98.6	97.3	107	106	114
Toluene-D8(81-117)	100	102	98.7	98.7	102	95.9	98.4	100	99.4	101	102
4-Bromofluorobenzene(74-121)	102	105	97.3	106	102	88.7	99.7	90.3	88	104	107

Note:

Sample ID - 16#1 indicates boring number 16, sample 1. 16#1D indicates a field duplicate of the boring 16 sample 1.

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B - Analyte found in asociated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last 3 rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A22. (Page 4 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for volatile organic analytes (VOAs)s using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	BORING/SAMPLE										
ANALYTE	21#1	21#2	21#3	22#1	22#2	22#3	23#1	23#2	23#3	24#1	25#1
Chloromethane	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.01 U	0.011 U
Bromomethane	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.01 U	0.011 U
Vinyl Chloride	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.01 U	0.011 U
Chloroethane	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.01 U	0.011 U
Methylene Chloride	0.018 B	0.037 B	0.11 B	0.083 B	0.056 B	0.056 B	0.092 B	0.11 B	0.074 B	0.044 B	0.027 B
1,1-Dichloroethene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
1,1-Dichloroethane	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Trans-1,2-Dichloroethene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
cis-1,2-Dichloroethene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0064	0.005 U	0.0055 U
Chloroform	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
1,2-Dichloroethane	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
1,1,1-Trichloroethane	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Carbon Tetrachloride	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Bromodichloromethane	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
1,2-Dichloropropane	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Trans-1,3-Dichloropropene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Trichloroethene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0016 J	0.0008 U	0.005 U	0.0055 U
Dibromochloromethane	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Cis-1,3-Dichloropropene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
1,1,2-Trichloroethane	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Benzene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Bromoform	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
1,1,2,2-Tetrachloroethane	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Tetrachloroethene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Toluene	0.0055 U	0.0018 J	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0015 J
Chlorobenzene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
Ethylbenzene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0021 J
Acetone	0.31 BE	0.16 B	0.096 B	0.01 BJ	0.11 U	0.013 BJ	0.035 BJ	0.048 BJ	0.022 BJ	0.067 B	0.027 BJ
2-Butanone	0.11 U	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.1 U	0.11 U
Carbondisulfide	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0055 U
2-Hexanone	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.05 U	0.055 U
4-Methyl-2-Pentanone	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.05 U	0.055 U
Styrene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.005 U	0.0017 U
Vinyl Acetate	0.055 U	0.055 U	0.06 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.05 U	0.055 U
T-Xylene	0.0055 U	0.0055 U	0.006 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0014 J	0.00078 U	0.005 U	0.012
1,2-Dichloroethane-d4(Surrogate	111	114	110	98.8	97.8	106	108	111	109	108	110
Toluene-D8(Surrogate (81-117))	101	101	101	97.6	98.1	101	101	102	97.4	98.2	99.9
4-Bromofluorobenzene(Surrogate	103	105	104	92.2	96.9	107	102	93.4	82	85.7	90.5

Notes: Sample ID - 21#1 indicates boring number 21, sample 1.

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

B - Analyte found in asociated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last 3 rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

E - Identifies compounds whose concentrations exceeded the calibration range of the GC/MS for that specific analysis.

Table A22. (Page 5 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	BORING/SAMPLE										
ANALYTE	25#2	28#1	28#2	28#3	29#1	29#2	31#1	32#1	33#1	33#1D	34#1
Chloromethane	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Bromomethane	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Vinyl Chloride	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Chloroethane	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.011 U	0.012 U
Methylene Chloride	0.019 B	0.058 B	0.035 B	0.07 B	0.031 B	0.036 B	0.097 B	0.029 B	0.016 B	0.016 B	0.024 B
1,1-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
1,1-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Trans-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0011 J	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
cis-1,2-Dichloroethene	0.0055 U	0.0055 U	0.0055 U	0.057	0.002 J	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Chloroform	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
1,2-Dichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
1,1,1-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Carbon Tetrachloride	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Bromodichloromethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
1,2-Dichloropropane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Trans-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Trichloroethene	0.0055 U	0.0055 U	0.0055 U	0.0018 J	0.021	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Dibromochloromethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Cis-1,3-Dichloropropene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
1,1,2-Trichloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Benzene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Bromoform	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
1,1,2,2-Tetrachloroethane	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Tetrachloroethene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Toluene	0.0055 U	0.0008 J	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Chlorobenzene	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Ethylbenzene	0.0016 J	0.0055 U	0.0055 U	0.0055 U	0.00081 J	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Acetone	0.038 BJ	0.013 BJ	0.028 BJ	0.063 BJ	0.036 BJ	0.038 BJ	0.012 BJ	0.11 U	0.045 BJ	0.028 BJ	0.063 B
2-Butanone	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.12 U
Carbondisulfide	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
2-Hexanone	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U
4-Methyl-2-Pentanone	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U
Styrene	0.0006 J	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
Vinyl Acetate	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.055 U	0.06 U
T-Xylene	0.0095	0.0035 J	0.0055 U	0.0055 U	0.0051 J	0.0023 J	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.006 U
1,2-Dichloroethane-d4(76-114)	105	111	110	105	109	106	109	105	106	99.8	108
Toluene-D8(88-110)	100	98.8	102	100	100	100	100	101	99.9	99.5	101
4-Bromofluorobenzene(86-115)	91.5	88	97.3	88.2	94.3	102	90.1	96.4	103	97.8	100

Notes: Sample ID - 33#1 indicates boring number 33, sample 1. 33#1D indicates a field duplicate for boring 33 sample 1.

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B - Analyte found in associated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last 3 rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

E - Identifies compounds whose concentrations exceeded the calibration range of the GC/MS for that specific analysis.

Table A22. (Page 6 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	BORING/SAMPLE							
ANALYTE	34#2	35#1	35#2	36#1	37#1	37#1D	38#1	38#2
Chloromethane	0.012 U	0.011 U	0.012 U	0.01 U	0.011 U	0.011 U	0.011 U	0.011 U
Bromomethane	0.012 U	0.011 U	0.012 U	0.01 U	0.011 U	0.011 U	0.011 U	0.011 U
Vinyl Chloride	0.012 U	0.011 U	0.012 U	0.01 U	0.011 U	0.011 U	0.011 U	0.011 U
Chloroethane	0.012 U	0.011 U	0.012 U	0.01 U	0.011 U	0.011 U	0.011 U	0.011 U
Methylene Chloride	0.012 B	0.02 B	0.041 B	0.044 B	0.027 B	0.022 B	0.088 B	0.07 B
1,1-Dichloroethene	0.006 U	0.0055 U	0.006 U	0.01 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
1,1-Dichloroethane	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Trans-1,2-Dichloroethene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
cis-1,2-Dichloroethene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Chloroform	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
1,2-Dichloroethane	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
1,1,1-Trichloroethane	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Carbon Tetrachloride	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Bromodichloromethane	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
1,2-Dichloropropane	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Trans-1,3-Dichloropropene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Trichloroethene	0.006 U	0.0055 U	0.0019 J	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Dibromochloromethane	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Cis-1,3-Dichloropropene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
1,1,2-Trichloroethane	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Benzene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Bromoform	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
1,1,2,2-Tetrachloroethane	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Tetrachloroethene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Toluene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Chlorobenzene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Ethylbenzene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Acetone	0.029 B	0.035 BJ	0.079 BJ	0.012 BJ	0.014 BJ	0.025 BJ	0.1 BJ	0.099 BJ
2-Butanone	0.12 U	0.11 U	0.12 U	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U
Carbondisulfide	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
2-Hexanone	0.06 U	0.055 U	0.06 U	0.05 U	0.055 U	0.055 U	0.055 U	0.055 U
4-Methyl-2-Pentanone	0.06 U	0.055 U	0.06 U	0.05 U	0.055 U	0.055 U	0.055 U	0.055 U
Styrene	0.006 U	0.0055 U	0.006 U	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Vinyl Acetate	0.06 U	0.055 U	0.06 U	0.05 U	0.055 U	0.055 U	0.055 U	0.055 U
T-Xylene	0.006 U	0.0055 U	0.0013 J	0.005 U	0.0055 U	0.0055 U	0.0055 U	0.0024 J
1,2-Dichloroethane-d4(70-121)	107	100	100	106	102	111	98	105
Toluene-D8(81-117)	101	98.2	97.5	90.4	99.9	100	98.4	97.4
4-Bromofluorobenzene(74-121)	103	95.5	97.4	76.6	101	102	100	85.1

Notes: Sample ID - 37#1 indicates boring number 37, sample 1. 37#1D indicates a field duplicate for boring 37 sample 1.

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U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

B - Analyte found in asociated method blank as well as sample.

J - Indicates an estimated value below accurate quantitation limits

Last 3 rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A23. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary of ABG soil borings with detectable volatile organic analytes (VOAs, EPA Method 8240) .

	NUMBER OF DIFFERENT	OCCURRENCE OF VOAs BY SAMPLE			MAXIMUM VOA IN BORING	
BORING	VOAs DETECTED	SAMPLE #1	SAMPLE #2	SAMPLE #3	CONC (mg/kg)	NAME
10	2	0	2	NS	0.0067	Toluene
11	1	1	0	NS	0.0017(J)	T-Xylene
17	5	3	3	4	2.3	cis-1,2-Dichloroethene
19	1	1	0	1	0.00057(J)	1,1,1-Trichloroethane
21	1	0	1	0	0.0016(J)	Toluene
23	3	0	2	3	0.0064	cis-1,2-Dichloroethene
25	4	4	3	NS	0.012	T-Xylene
28	5	2	0	3	0.057	cis-1,2-Dichloroethene
29	4	4	1	NS	0.021	Trichloroethene
35	2	0	2	NS	0.0019(J)	Trichloroethene
38	1	0	1	NS	0.0024(J)	T-Xylene

Note: (J) - Indicates an estimated value below accurate detection limits.
NS - No sample taken.
0 - Sample taken but VOAs were not detected.

Table A24. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary of results of analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240.

VOAs DETECTED	OCCURRENCE BY SAMPLE								NUMBER BORINGS WITH SPECIFIC VOA	OCCURRENCE OF SPECIFIC VOA BY SAMPLE SAMPLE #1	SAMPLE #2	SAMPLE #3
Trans-1,2-Dichloroethene	17#2(J)	17#3	28#3(J)						[2]	-	2	1
cis-1,2-Dichloroethene	17#1(J)	17#2	17#3	19#3(J)	23#3	28#3	29#1(J)		[5]	2	1	4
1,1,1-Trichloroethane	19#1(J)								[1]	1	-	-
Trichloroethene	17#1	17#2	17#3	23#2(J)	23#3(J)	28#3(J)	29#1	35#2(J)	[5]	2	3	2
Toluene	10#2	17#1(J)	21#2(J)	25#1(J)	28#1(J)				[5]	4	1	-
Ethylbenzene	17#3(J)	25#1(J)	25#2(J)	29#1(J)					[3]	2	2	3
Styrene	25#1(J)	25#2(J)							[1]	1	-	-
T-Xylene	10#1(J)	10#2(J)	11#1(J)	23#2(J)	23#3(J)	25#1	25#2	28#1(J)	[8]	5	6	1
	29#1(J)	29#2(J)	35#2(J)	38#2(J)								

Note: J- indicates that concentration reported was an estimated value below accurate quantitation limits.
(-) - indicates analyte did not occur in that sample type

VOAs DETECTED	Maximum Concentration Encountered (mg/kg)	Location of Maximum	RBC INDUSTRIAL SOILS (mg/kg)
Trans-1,2-Dichloroethene	0.29	17#3	10000 n
cis-1,2-Dichloroethene	2.3	17#3	10000 n
1,1,1-Trichloroethane	0.00057(J)	19#1	92000 n
Trichloroethene	0.2	17#2	260 n
Toluene	0.0067	10#2	200000 n
Ethylbenzene	0.0028(J)	17#3	100000 n
Styrene	0.0017(J)	25#1	200000 n
T-Xylene	0.012	25#1	1000000 n

Notes:
RBC - Risk-Based Concentrations - Risk-Based Concentration Table, Fourth Quarter 1994.
Roy L. Smith, Senior Toxicologist (3HW15), U.S. EPA Region III.
Risk Based Concentrations are in mg/kg.
Basis of RBC: c = carcinogenic effect; n = noncarcinogenic effect

Table A25. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary of results by sample depth of analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240.

SAMPLE TYPE	VOAs DETECTED	OCCURENCE BY BORING					MAXIMUM CONCENTRATION OF SPECIFIC VOA (MG/KG)
SAMPLE # 1	Trans-1,2-Dichloroethene	None					-
33 Samples Collected	cis-1,2-Dichloroethene	17#1(J)	29#1(J)				0.0025(J)
Depth Range: 0 - 30 inches	1,1,1-Trichloroethane	19#1(J)					0.00057(J)
	Trichloroethene	17#1	29#1				0.06
	Toluene	17#1	25#1(J)	29#1			0.001(J)
	Ethylbenzene	25#1(J)	29#1(J)				0.0021(J)
	Styrene	25#1(J)					0.0017(J)
	T-Xylene	10#1(J)	11#1(J)	25#1	28#1(J)	29#1(J)	0.012
SAMPLE # 2	Trans-1,2-Dichloroethene	17#2(J)					0.0038(J)
19 Samples Collected	cis-1,2-Dichloroethene	17#2					0.058
Depth Range: 28 - 62 inches	1,1,1-Trichloroethane	None					-
	Trichloroethene	17#2	23#2(J)	35#2(J)			0.2
	Toluene	10#2	21#2(J)				0.0067
	Ethylbenzene	25#2(J)					0.0016(J)
	Styrene	25#2(J)					0.0006(J)
	T-Xylene	10#2(J)	23#2(J)	25#2	29#2(J)	35#2(J)	0.0095
		38#2(J)					
SAMPLE # 3	Trans-1,2-Dichloroethene	17#3	28#3(J)				0.29
7 Samples Collected	cis-1,2-Dichloroethene	17#3	19#3(J)	23#3	28#3		2.3
Depth Range: 60 - 90 inches	1,1,1-Trichloroethane	None					-
	Trichloroethene	17#3	23#3(J)	28#3(J)			0.073
	Toluene	None					-
	Ethylbenzene	17#3(J)					0.0028(J)
	Styrene	None					-
	T-Xylene	23#3(J)					0.00078(J)

Note:
J- indicates that concentration reported was an estimated value below accurate quantitation limits
(-) - Not applicable

Table A26. (Page 1 of 2). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of method blanks associated with analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	METHOD BLANK									
ANALYTE	MB1	MB2	MB3	MB4	MB5	MB6	MB7	MB8	MB9	MB10
Chloromethane	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Bromomethane	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Vinyl Chloride	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Chloroethane	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Methylene Chloride	0.0040 J	0.0069	0.043	0.0027 J	0.0019 J	0.0039 J	0.0026 J	0.0019 J	0.0039 J	0.0120
1,1-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
cis-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chloroform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,1-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Carbon Tetrachloride	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0055 U	0.0055 U	0.0055 U	0.0050 U
Bromodichloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0055 U	0.0055 U	0.0055 U	0.0050 U
1,2-Dichloropropane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0055 U	0.0055 U	0.0055 U	0.0050 U
Trans-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0055 U	0.0055 U	0.0055 U	0.0050 U
Trichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0055 U	0.0055 U	0.0055 U	0.0050 U
Dibromochloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0055 U	0.0055 U	0.0055 U	0.0050 U
Cis-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Benzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromoform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2,2-Tetrachloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Tetrachloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Toluene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chlorobenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Ethylbenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Acetone	0.0054 J	0.0047 J	0.0065 U	0.033 J	0.034 J	0.0063 J	0.0033 J	0.034 J	0.0063 J	0.0041 J
2-Butanone	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.0040 J
Carbondisulfide	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
2-Hexanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
4-Methyl-2-Pentanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Styrene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Vinyl Acetate	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
T-Xylene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane-d4(70-121)	99.4	92.7	106.0	104.0	95.0	101.0	104.0	95.0	101.0	91.6
Toluene-D8(81-117)	99.7	100.0	100.0	100.0	99.8	101.0	100.0	99.8	101.0	101.0
4-Bromofluorobenzene(74-121)	101.0	100.0	99.8	102.0	102.0	101.0	102.0	102.0	101.0	101.0

Notes:

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

J - Indicates an estimated value below accurate quantitation limits

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

MB1 - Samples from borings 5, 6, 8, 13, and 8 Dup

MB2 - Samples from borings 1, 2, 3, 7, 9, and 22

MB3 - Samples from borings 12, 14, 36, 37, and 1 Dup

MB4 - Samples from borings 21, 24, 34, and 37 Dup

MB5 - Samples from borings 38, 35, 33, and 33 Dup

MB6 - Samples from borings 31, 32, 25, 29, and 28

MB7 - Samples from borings 19 and 23

MB8 - Samples from borings 17 (samples 1 and 2), 15 and 16

MB9 - Samples from borings 17 (sample 3) and 16 Dup

MB10 - Samples from borings 10 and 11

Table A26. (Page 2 of 2). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of method blanks associated with analyses of subsurface soils for volatile organic analytes (VOAs) using EPA Method 8240 . Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

	METHOD BLANK							
ANALYTE	MB11	MB12	MB13	MB14	MB15	MB16	MB17	MB18
Chloromethane	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Bromomethane	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Vinyl Chloride	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Chloroethane	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Methylene Chloride	0.0040 J	0.0047 J	0.0047 J	0.0040 J	0.0047 J	0.0047 J	0.0047 J	0.0047 J
1,1-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
cis-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chloroform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,1-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Carbon Tetrachloride	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromodichloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloropropane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Dibromochloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Cis-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Benzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromoform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2,2-Tetrachloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Tetrachloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Toluene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chlorobenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Ethylbenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Acetone	0.0054 J	0.0065 J	0.0066 U	0.0054 J	0.0068 J	0.0088 J	0.0068 J	0.0066 J
2-Butanone	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Carbondisulfide	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
2-Hexanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
4-Methyl-2-Pentanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Styrene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Vinyl Acetate	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
T-Xylene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane-d4(70-121)	99.4	101.0	106.0	99.4	101.0	101.0	101.0	101.0
Toluene-D8(81-117)	99.7	99.0	100.0	99.7	99.0	99.0	99.0	99.0
4-Bromofluorobenzene(74-121)	101.0	102.0	99.8	101.0	102.0	102.0	102.0	102.0

Notes:

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

J - Indicates an estimated value below accurate quantitation limits

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

MB11 - Associated with TB4, FIELD BLANK, and RINSE1

MB12 - Associated with TB5

MB13 - Associated with TB6 and RINSE3

MB14 - Associated with TB7

MB15 - Associated with TB8 and RINSE2

MB16 - Associated with TB9

MB17 - Associated with TB10 and RINSE4

MB18 - Associated with TB11, TB12, and RINSE5

Table A27. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of trip blanks associated with shipment of subsurface soil samples for volatile organic analyses. Concentrations are mg/L (ppm). Blanks with detectable concentrations are shown in gray.

	TRIP BLANK								
ANALYTE	TB4	TB5	TB6	TB7	TB8	TB9	TB10	TB11	TB12
Chloromethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Bromomethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Vinyl Chloride	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Chloroethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Methylene Chloride	0.010 B	0.012 B	0.0052 B	0.0040 BJ	0.0051 B	0.0059 B	0.0049 BJ	0.0056 BJ	0.0038 BJ
1,1-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
cis-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chloroform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,1-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Carbon Tetrachloride	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromodichloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloropropane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Dibromochloromethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Cis-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Benzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromoform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2,2-Tetrachloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Tetrachloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Toluene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chlorobenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Ethylbenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Acetone	0.011	0 10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2-Butanone	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Carbondisulfide	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
2-Hexanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
4-Methyl-2-Pentanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Styrene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Vinyl Acetate	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
T-Xylene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane-d4(70-121)	99.5	100.0	101.0	101.0	99.9	100.0	100.0	95.0	101.0
Toluene-D8(81-117)	99.9	99.5	99.4	101.0	98.7	100.0	99.5	98.5	101.0
4-Bromofluorobenzene(74-121)	99.7	100.0	102.0	100.0	101.0	101.0	101.0	99.6	101.0

Notes:

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

J - Indicates an estimated value below accurate quantitation limits

B - Analyte is found in the associated blank as well as the sample.

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

TB4 - cooler #7 (8/20/93 - date shipped); samples from borings 10 and 11

TB5 - cooler #8 (8/23/93); samples from borings 21, 24, and 34

TB6 - cooler #9 (8/23/93); samples from borings 12, 14, 36, 37, and 1 Dup

TB7 - cooler #10 (8/23/93); samples from borings 5, 6, 8, 13, and 8 Dup

TB8 - cooler #11 (8/23/93); samples from borings 1, 2, 3, 7, 9, and 22

TB9 - cooler #12 (8/24/94); samples from borings 28, 35, 33, and 33 Dup

TB10 - cooler #13 (8/25/93); samples from borings 31, 32, 26, 29, and 28

TB11 - cooler #14 (8/26/93); samples from borings 19 and 23

TB12 - cooler #15 (8/26/93); samples from borings 15, 17, 16, and 16 Dup

Table A28. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of equipment rinse and field blanks associated with sampling of subsurface soils for volatile organic analyses. Concentrations are mg/L (ppm). Blanks with detectable concentrations are shown in gray.

	RINSATE BLANKS					
ANALYTE	RINSE1	RINSE2	RINSE3	RINSE4	RINSE5	FIELD BLANK
Chloromethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Bromomethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Vinyl Chloride	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Chloroethane	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Methylene Chloride	0.0023 BJ	0.0031 BJ	0.0024 BJ	0.0029 BJ	0.0026 BJ	0.0031 BJ
1,1-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
cis-1,2-Dichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chloroform	0.083	0.072	0.074	0.058	0.11	0.090
1,2-Dichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,1-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Carbon Tetrachloride	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromodichloromethane	0.011	0.010	0.010	0.0083	0.013	0.012
1,2-Dichloropropane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trans-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Trichloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Dibromochloromethane	0.0014 J	0.0017	0.00076 J	0.00068 J	0.0022 J	0.0017 J
Cis-1,3-Dichloropropene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2-Trichloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Benzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Bromoform	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,1,2,2-Tetrachloroethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Tetrachloroethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Toluene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Chlorobenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Ethylbenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Acetone	0.011	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2-Butanone	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Carbondisulfide	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
2-Hexanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
4-Methyl-2-Pentanone	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Styrene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Vinyl Acetate	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
T-Xylene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
1,2-Dichloroethane-d4(70-121)	101.0	101.0	101.0	101.0	99.9	101.0
Toluene-D8(81-117)	101.0	99.4	99.8	98.5	97.8	102.0
4-Bromofluorobenzene(74-121)	103.0	101.0	100.0	101.0	100.0	103.0

RINSATE and FIELD BLANK DESCRIPTION

RINSE 1 - Collected 8/20/93; borings 10 and 11 collected this day
RINSE 2 - Collected 8/23/93; borings 1, 2, 3, 7, 8, 13, and 22 collected this day
RINSE 3 - Collected 8/23/93; borings 12, 14, 22, 24, 34, 36, and 37 collected this day
RINSE 4 - Collected 8/25/93; borings 25, 28, 29, 31, and 32 collected this day
RINSE 5 - Collected 8/26/93; borings 19, and 23 collected this day
FIELD BLANK - Collected 8/20/93

Notes:

EPA Method 8240 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.

U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.

J - Indicates an estimated value below accurate quantitation limits

B - Analyte is found in the associated blank as well as the sample.

Last three rows in table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A29. (Page 1 of 2). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soil samples for explosive compounds. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

EXPLOSIVE	1#1	1#1D	2#1	3#1	5#1	5#2	6#1	6#2	7#1	7#2	8#1
HMX	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	1.28 J	0.099 J	2.2 U	2.2 U	2.2 U
RDX	1 U	1 U	1 U	1 U	1 U	1 U	0.085 J	1 U	1 U	0.1 U	1 U
TNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
DNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
TNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.805	0.138 J	0.25 U	0.25 U	0.25 U
2,4-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	4.2	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DNT	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.115 J	0.26 U	0.26 U	0.26 U	0.26 U
2A-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4A-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.06 J	0.25 U	0.25 U	0.25 U	0.25 U
TOTAL EX	ND	ND	ND	ND	ND	ND	6.545	0.237	ND	ND	ND

EXPLOSIVE	8#1D	9#1	10#1	10#2	11#1	11#2	12#1	12#2	12#3	13#1	13#2
HMX	2.2 U	9.85	1.11 J	1.24 J	0.45 J	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
RDX	1 U	19.2	0.77 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
TNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
DNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
TNT	0.25 U	0.181 J	0.25 U	0.25 U	0.195 J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	11.6	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DNT	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.375	0.26 U	0.26 U	0.26 U	0.26 U
2A-DNT	0.25 U	0.196 J	0.215 J	0.25 U	0.2 J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4A-DNT	0.25 U	0.426	0.11 J	0.25 U	0.245 J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TOTAL EX	ND	29.853	2.205	1.24	1.09	ND	11.975	ND	ND	ND	ND

EXPLOSIVE	14#1	14#2	15#1	16#1	16#1D	17#1	17#2	17#3	19#1	19#2	19#3
HMX	2.2 U	2.2 U	2.2 U	0.52 J	2.2 U	14.6	61	3.36	16	2.2 U	2.2 U
RDX	1 U	1 U	1 U	0.06 J	0.075 J	18.8	27.4	10.2	1.41	1 U	1 U
TNB	0.25 U	0.25 U	2.45	0.25 U	0.25 U	2.1	2.96	0.25 U	0.66	0.25 U	0.25 U
DNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
TNT	0.25 U	0.25 U	1.61	0.25 U	0.125 J	7.55	60.7	2.28	0.36	0.25 U	0.25 U
2,4-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.17	0.075 J	0.25 U	0.09 J	0.25 U	0.25 U
2,6-DNT	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
2A-DNT	0.25 U	0.25 U	0.26	0.25 U	0.25 U	2.2	1.24	0.25 U	0.25 U	0.25 U	0.25 U
4A-DNT	0.25 U	0.25 U	0.18 J	0.25 U	0.25 U	2.48	2.16	0.105 J	0.25 U	0.25 U	0.25 U
TOTAL EX	ND	ND	4.50	0.58	0.2	47.9	399.18	15.945	17.86	ND	ND

Notes: Sample ID - 1#1 indicates boring number 1, sample 1. 1#1D indicates a field duplicate for boring 1, sample 1.
J - Indicates an estimated value below accurate quantitation limits
U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.
TOTAL EXP - A total of all explosive compounds determined for that sample. ND means none detected.

Table A29. (Page 2 of 2). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soil samples for explosive compounds. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray.

EXPLOSIVE	21#1	21#2	21#3	22#1	22#2	22#3	23#1	23#2	23#3	24#1	25#1
HMX	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	0.25 J	0.08 J	2.2 U	2.2 U	2.2 U
RDX	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.265	1 U	1 U
TNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
DNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
TNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.335	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DNT	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
2A-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.125 J	0.25 U	0.25 U	0.25 U	0.25 U
4A-DNT	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.08 J	0.25 U	0.25 U	0.25 U	0.25 U
TOTAL EXP	ND	ND	ND	ND	ND	ND	0.71	0.08	0.265	ND	ND

EXPLOSIVE	25#2	28#1	28#2	28#3	29#1	29#2	31#1	32#1	33#1	33#1D	34#1
HMX	2.2 U	5.45	3.8	2.2 U	128	0.6 J	129 J	0.41 J	2.2 U	0.035 J	2.2 U
RDX	1 U	16.4	2.06	1 U	41.2	0.35 J	0.235 J	1 U	1 U	1 U	1 U
TNB	0.25 U	0.065 J	0.25 U	0.25 U	2.26	0.25 U	0.26	0.25 U	0.25 U	0.25 U	0.25 U
DNB	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	65 U	0.65 U	0.65 U
TNT	0.25 U	12.3	1.25	0.26	0.685	0.02 J	0.04 J	0.25 U	0.25 U	0.02 J	0.25 U
2,4-DNT	0.25 U	0.25 U	0.25 U	0.03 J	0.065 J	0.25 U	0.1 J	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DNT	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
2A-DNT	0.25 U	0.025 J	0.25 U	0.085 J	1.56	0.125 J	0.01 J	0.25 U	0.25 U	0.25 U	0.25 U
4A-DNT	0.25 U	0.25 U	0.02 J	0.08 J	1.57	0.06 J	0.125 J	0.25 U	0.25 U	0.25 U	0.25 U
TOTAL EXP	ND	34.24	7.13	0.455	175.28	1.155	2.06	0.41	ND	0.055	ND

EXPLOSIVE	34#2	35#1	35#2	36#1	37#1	37#1D	38#1	38#2
HMX	2.2 U	117	232	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
RDX	1 U	1.35	60.5 J	1 U	1 U	1 U	1 U	1 U
TNB	0.25 U	0.225 J	37.5	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
DNB	0.25 U	0.25 U	25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.65 U	0.65 U	65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
TNT	0.25 U	2.78	2030	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DNT	0.25 U	0.06 J	25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DNT	0.26 U	0.26 U	26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
2A-DNT	0.25 U	1.38	25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4A-DNT	0.25 U	1.18	25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TOTAL EXP	ND	123.98	2360	ND	ND	ND	ND	ND

Notes: Sample ID - 33#1 indicates boring number 33, sample 1. 33#1D indicates a field duplicate for boring 33, sample 1.
J - Indicates an estimated value below accurate quantitation limits
U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.
(-) - No analysis reported for this compound.
TOTAL EXP - A total of all explosive compounds determined for that sample. ND means none detected.

Table A30. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary by boring number of the results of analyses of subsurface soil samples for explosive compounds.

BORING	NUMBER OF DIFFERENT EXPLOSIVES DETECTED				MAXIMUM EXP IN BORING		
	BY BORING	SAMPLE #1	SAMPLE #2	SAMPLE #3	CONC (mg/kg)	SAMPLE NO.	NAME
6	6	6	2	NS	1.28(J)	#1	HMX
9	5	5	NS	NS	19.2	#1	RDX
10	4	4	1	NS	1.24(J)	#1	HMX
11	4	4	0	NS	0.45(J)	#1	HMX
12	2	2	0	0	11.6	#1	2,4-DNT
15	4	4	NS	NS	2.45	#1	TNB
16	3	2	NS	NS	0.52(J)	#1	HMX
17	7	7	6	4	274	#2	RDX
19	4	4	0	0	16	#1	HMX
23	5	4	1	1	0.335	#1	TNT
28	7	5	4	4	16.4	#1	RDX
29	6	6	5	NS	128	#1	HMX
31	7	7	NS	NS	1.29	#1	HMX
32	1	1	NS	NS	0.41(J)	#1	HMX
33	2	2	NS	NS	0.035(J)	#1	HMX
35	7	7	4	NS	2030	#2	TNT

Notes:

Number of borings made = 32, sampled as follows: Sample #1s- 32; Sample # 2s - 19; and Sample #3s - 7.

(J) - Indicates an estimated value accurate detection limits

NS - No sample taken

0 - Sample taken but explosives were not detected

Duplicates - Where field duplicates were taken, the highest concentration and all explosives from both samples were included.

Table A31. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary by explosive analyte of analyses of subsurface soil samples.

EXPLOSIVE DETECTED	OCCURRENCE BY SAMPLE								NUMBER OF BORINGS WITH SPECIFIC EXP	OCCURENCE OF SPECIFIC EXP BY SAMPLE SAMPLE #1	SAMPLE #2	SAMPLE#3
HMX	6#1(J)	6#2(J)	9#1	10#1(J)	10#2(J)	11#1(J)	16#1(J)	17#1	[14]	14	7	1
	17#2	17#3	19#1	23#1(J)	23#2(J)	28#1	28#2	29#1				
	29#2(J)	31#1(J)	32#1(J)	33#1(J)	35#1	35#2						
RDX	6#1(J)	6#2(J)	9#1	10#1(J)	16#1(J)	17#1	17#2	17#3	[11]	10	5	2
	19#1	23#3	28#1	28#2	29#1	29#2(J)	31#1(J)	35#1				
	35#2(J)											
TNB	9#1	10#1(J)	15#1	17#1	28#1(J)	31#1(J)	35#1(J)	35#2	[7]	7	1	-
TNT	6#1	6#2(J)	9#1(J)	11#1(J)	15#1	16#1(J)	17#1	17#2	[13]	13	5	2
	17#3	19#1	23#1	28#1	28#2	28#3	29#1	29#2(J)				
	31#1(J)	33#1	35#1	35#2								
2,4-DNT	6#1	12#1	17#1	17#2(J)	19#1(J)	28#3(J)	31#1(J)	35#1(J)	[7]	6	1	1
2,6-DNT	6#1(J)	12#1							[2]	2	-	-
2A-DNT	9#1(J)	10#1(J)	11#1(J)	15#1	17#1	17#2	23#1(J)	28#1(J)	[10]	10	2	1
	28#3(J)	29#1	29#2(J)	31#1(J)	35#1							
4A-DNT	6#1(J)	9#1	10#1(J)	11#1(J)	15#1(J)	17#1	17#2	17#3(J)	[11]	10	3	2
	23#1(J)	28#2(J)	28#3(J)	29#1	29#2(J)	31#1(J)	35#1					

Note: J- Indicates that concentration reported was an estimated value below accurate quantitation limits

(-) - Analyte did not occur in this sample type

Duplicates - Where field duplicates were taken, the highest concentration and all explosives from both samples were included.

EXPLOSIVE COMPOUND	MAXIMUM CONCENTRATION ENCOUNTERED (mg/kg)	LOCATION OF MAXIMUM	RBC INDUSTRIAL SOILS mg/kg
HMX	232	35#2	-
RDX	274	17#2	-
TNB	37.5	35#2	51 n
DNB	NONE DETECTED	-	100 n
TETRYL	NONE DETECTED	-	10000 n
TNT	2030	35#2	95 c
2,4-DNT	11.6	12#1	2000 n *
2,6-DNT	0.375	12#1	1000 n *
2A-DNT	1.56	29#1	*
4A-DNT	2.48	17#1	*
TOTAL EXP	2360	35#2	-

Note:

RBC - Risk-Based Concentrations - Risk-Based Concentration Table, Fourth Quarter 1994.

Roy L. Smith, Senior Toxicologist (3HW15), U.S. EPA Region III.

Risk Based Concentrations are in mg/kg.

Basis of RBC: c = carcinogenic effect; n = noncarcinogenic effect

(-) No RBC available

(*) An RBC for DNT mixture is 4.2 mg/kg as a carcinogenic effect

Table A32. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Total explosives concentrations in subsurface soil samples collected August 1993. Total explosives are the sum of concentrations of all detectable explosive compounds. Less than detection limit results were summed as zero.

TOTAL EXPLOSIVES CATEGORY	SAMPLE LOCATION BY SAMPLE	NUMBER IN CATEGORY	% of TOTAL NUMBER OF SAMPLES	CUMMULATIVE %
NONE DETECTED	1#1 2#1 3#1 5#1 7#1 8#1 13#1 14#1 21#1 22#1 24#1 25#1 33#1 34#1 36#1 37#1 38#1 5#2 7#2 11#2 12#2 13#2 14#2 19#2 21#2 22#2 25#2 34#2 38#2 12#3 19#3 21#3 22#3	TOTAL NO. SAMPLES - 33 SAMPLE #1 - 17 SAMPLE #2 - 12 SAMPLE #3 - 4	56.9	56.9
>ND < 1 mg/kg	16#1 23#1 32#1 33#1 6#2 23#2	TOTAL NO. SAMPLES - 6 SAMPLE #1 - 4 SAMPLE #2 - 2 SAMPLE #3 - 0	10.3	67.2
>1 mg/kg < 10 mg/kg	6#1 10#1 11#1 15#1 31#1 10#2 28#2 29#2	TOTAL NO. SAMPLES - 8 SAMPLE #1 - 5 SAMPLE #2 - 3 SAMPLE #3 - 0	13.8	81.0
>10 mg/kg < 100 mg/kg	9#1 12#1 17#1 19#1 28#1 29#1 17#3	TOTAL NO. SAMPLES - 7 SAMPLE #1 - 6 SAMPLE #2 - 0 SAMPLE #3 - 1	12.1	93.1
>100 mg/kg < 1000 mg/kg	29#1 35#1 17#2	TOTAL NO. SAMPLES - 3 SAMPLE #1 - 2 SAMPLE #2 - 1 SAMPLE #3 - 0	5.2	98.3
>1000 mg/kg	35#2	TOTAL NO. SAMPLES - 1 SAMPLE #1 - 0 SAMPLE #2 - 1 SAMPLE #3 - 0	1.7	99.0
	TOTAL NUMBER OF BORINGS = 32	TOTAL NO. SAMPLES - 58 SAMPLE #1 32 SAMPLE #2 19 SAMPLE #3 7		

Notes:

Duplicates - Field duplicates were taken at 1#1, 8#1, 16#1, 33#1, and 37#1. For this summary the highest concentration of the two samples was used. and all explosives detected in the two samples were used.

Sample Depth - SAMPLE #1 - Depth range 0 - 30 inches below ground surface

SAMPLE#2 - Depth range 28 - 62 inches below the ground surface

SAMPLE#3 - Depth range 60 - 90 inches below the ground surface

Table A33. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of method blanks associated with analyses of subsurface soils for explosives (EPA Method 8330). Concentrations are mg/kg. Method blanks are shown for associated group of sample analyses indicated by station. All method blanks had the same detection levels and results (i.e., none detected), therefore results are presented only once.

METHOD BLANK - ASSOCIATED ANALYSES
Method Blank 1 - Borings 5, 6, 8, 13, and 8D
Method Blank 2 - Borings 1, 2, 3, 7, 9, and 22
Method Blank 3 - Borings 12, 14, 36, 37, and 1D
Method Blank 4 - Borings 21, 24, 34, and 37D
Method Blank 5 - Borings 38, 35, 33, and 33D
Method Blank 6 - Borings 31, 32, 25, 29, and 28
Method Blank 7 - Borings 19, 23, 17, 16, 15, and 16D
Method Blank 8 - Borings 10 and 11

EXPLOSIVE	CONCENTRATION mg/kg
HMX	2.20 U
RDX	1.00 U
TNB	0.25 U
DNB	0.25 U
TETRYL	0.65 U
TNT	0.25 U
2,4-DNT	0.25 U
2,6-DNT	0.26 U
2A-DNT	0.25 U
4A-DNT	0.25 U

Note: U - Compound was analyzed for but mot detected. Detection limits are given before the U symbol.
D - Field duplicate sample.
Borings - all samples collected at each boring included

Table A34. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of equipment rinses and a field blank associated with the sampling of subsurface soils for explosives (EPA Method 8330). Concentrations are mg/l. All rinses and field blanks had the same detection levels and results (i.e., none detected), therefore results are presented only once. Rinses were collected following the last boring for the day indicated.

RINSE AND FIELD BLANK	DATE AND SAMPLES COLLECTED THAT DATE
RINSE 1	- Collected August 19, 1993 (borings 10 and 11)
FIELD BLANK	- Collected August 19
RINSE 2	- Collected August 21 (borings 1, 2, 3, 7, 8, 13, and 22)
RINSE 3	- Collected August 22 (borings 12, 14, 22, 24, 34, 36, and 37)
RINSE 4	- Collected August 24 (borings 25, 28, 29, 31, and 32)
RINSE 5	- Collected August 25 (borings 19 and 23)

EXPLOSIVE	CONCENTRATION mg/l
HMX	0.020 U
RDX	0.020 U
TNB	0.020 U
DNB	0.020 U
TETRYL	0.050 U
TNT	0.020 U
2,4-DNT	0.020 U
2,6-DNT	0.020 U
2A-DNT	0.020 U
4A-DNT	0.020 U

Note: U - Compound was analyzed for but mot detected. Detection limits are given before the U symbol.
D - Field duplicate sample.
Borings - all samples collected at each boring included

Table A35. (Page 1 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray. Total PAHs are the sum of all detectable PAH concentrations.

	BORING & SAMPLE NO.										
ANALYTE	1#1	1#1D	2#1	3#1	5#1	5#2	6#1	6#2	7#1	7#2	8#1
Naphthalene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.35 U	0.4 U	0.38 U
Acenaphthylene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.35 U	0.4 U	0.38 U
Acenaphthene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.35 U	0.4 U	0.38 U
Fluorene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.35 U	0.4 U	0.38 U
Phenanthrene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.021 J	0.38 U	0.35 U	0.4 U	0.38 U
Anthracene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.35 U	0.4 U	0.38 U
Fluoranthene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.048 J	0.38 U	0.35 U	0.4 U	0.38 U
Pyrene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.058 J	0.38 U	0.35 U	0.4 U	0.38 U
Chrysene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.064 J	0.38 U	0.35 U	0.4 U	0.38 U
Benzo(a)Anthracene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.031 J	0.38 U	0.35 U	0.4 U	0.38 U
Benzo(b)Fluoranthene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.071 J	0.38 U	0.35 U	0.4 U	0.38 U
Benzo(k)Fluoranthene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.037 J	0.38 U	0.35 U	0.4 U	0.38 U
Benzo(a)Pyrene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.034 J	0.38 U	0.35 U	0.4 U	0.38 U
Indeno(1,2,3-C,D)Pyrene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.028 J	0.38 U	0.35 U	0.4 U	0.38 U
Dibenzo(A,H)Anthracene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.35 U	0.4 U	0.38 U
Benzo(G,H,I)Perylene	0.38 U	0.39 U	0.38 U	0.38 U	0.38 U	0.38 U	0.027 J	0.38 U	0.35 U	0.4 U	0.38 U
2-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	||-
TOTAL PAH	ND	ND	ND	ND	ND	ND	0.419	ND	ND	ND	ND
2-Fluorobiphenyl(30-115)	59.3	60	59.5	44.4	52.2	59.4	52.2	56.3	41.4	45.3	49.9
p-Terphenyl-D14(18-137)	85.7	89.7	81.6	98,6	96.1	95.8	99.7	84.5	92.1	95.9	88.6
1,2-Dichlorobenzene-d4(20-130)	37.3	39.2	49.1	27	37	42.4	40.5	43.2	34.5	36.7	42.4

Notes: Sample ID - 1#1 indicates boring number 1, sample 1. 1#1D indicates a field duplicate for boring 1, sample 1.
Method 8270 - In Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.
J - Indicates an estimated value below accurate quantitation limits
U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.
(-) - No analysis reported for this compound.
Last three rows of table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A35. (Page 2 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray. Total PAHs are the sum of all detectable PAH concentrations.

	BORING & SAMPLE NO.										
ANALYTE	8#1D	9#1	10#1	10#2	11#1	11#2	12#1	12#2	12#3	13#1	13#2
Naphthalene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Acenaphthylene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Acenaphthene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Fluorene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Phenanthrene	0.38 U	0.4 U	0.38 U	0.38 U	0.016 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Anthracene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Fluoranthene	0.38 U	0.4 U	0.38 U	0.38 U	0.024 J	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Pyrene	0.38 U	0.4 U	0.38 U	0.38 U	0.026 J	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Chrysene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Benzo(a)Anthracene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Benzo(b)Fluoranthene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Benzo(k)Fluoranthene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Benzo(a)Pyrene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Indeno(1,2,3-C,D)Pyrene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Dibenzo(A,H)Anthracene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
Benzo(G,H,I)Perylene	0.38 U	0.4 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
2-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-
TOTAL PAH	ND	ND	ND	ND	0.066	ND	ND	ND	ND	ND	ND
2-Fluorobiphenyl(30-115)	58.7	44.1	40.4	54.5	61.5	55.4	48.5	35.7	44.1	55.9	51.9
p-Terphenyl-D14(18-137)	92	50.5	83.5	92.2	94.1	91.4	87.9	93.6	94.4	95.7	95.8
1,2-Dichlorobenzene-d4(20-130)	47.2	37	27.9	38.6	37.9	41.8	31.2	25	32.2	40.4	28.6

Notes: Sample ID - 8#1 indicates boring number 8, sample 1. 8#1D indicates a field duplicate for boring 8, sample 1.
Method 8270 - In Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.
J - Indicates an estimated value below accurate quantitation limits
U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.
(-) - No analysis reported for this compound.
Last three rows of table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A35. (Page 3 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray. Total PAHs are the sum of all detectable PAH concentrations.

	BORING & SAMPLE NO.										
ANALYTE	14#1	14#2	15#1	16#1	16#1D	17#1	17#2	17#3	19#1	19#2	19#3
Naphthalene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.12 J	0.37 U	0.37 U
Acenaphthylene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
Acenaphthene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
Fluorene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
Phenanthrene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.022 J	0.038 J	0.37 U	0.21 J	0.37 U	0.37 U
Anthracene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.015 J	0.37 U	0.37 U
Fluoranthene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.025 J	0.051 J	0.37 U	0.066 J	0.37 U	0.37 U
Pyrene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.028 J	0.051 J	0.37 U	0.076 J	0.37 U	0.37 U
Chrysene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.045 J	0.37 U	0.042 J	0.37 U	0.37 U
Benzo(a)Anthracene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.024 J	0.37 U	0.028 J	0.37 U	0.37 U
Benzo(b)Fluoranthene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.028 J	0.37 U	0.024 J	0.37 U	0.37 U
Benzo(k)Fluoranthene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.037 U	0.031 J	0.37 U	0.026 J	0.37 U	0.37 U
Benzo(a)Pyrene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.015 J	0.37 U	0.015 J	0.37 U	0.37 U
Indeno(1,2,3-C,D)Pyrene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
Dibenzo(A,H)Anthracene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U
Benzo(G,H,I)Perylene	0.38 U	0.38 U	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.021 J	0.37 U	0.37 U
2-Methylnaphthalene	-	-	0.35 U	0.37 U	0.35 U	0.37 U	0.37 U	0.37 U	0.18 J	0.37 U	0.37 U
TOTAL PAH	ND	ND	ND	ND	ND	0.075	0.283	ND	0.823	ND	ND
2-Fluorobiphenyl(30-115)	50.3	50.6	40.3	41.6	49	30.6	46.4	49.4	60	39.2	33
p-Terphenyl-D14(18-137)	85.5	90.7	62.6	90.4	98.2	98.8	86.2	80.9	69.7	89	82.4
1,2-Dichlorobenzene-d4(20-130)	34	35.7	34.3	40.1	38.4	19.8	8.6	41.8	35.4	29.5	18.1

Notes: Sample ID - 16#1 indicates boring number 16, sample 1. 16#1D indicates a field duplicate for boring 16 sample 1.
Method 8270 - In Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.
J - Indicates an estimated value below accurate quantitation limits
U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.
(-) - No analysis reported for this compound.
Last three rows of table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A35. (Page 4 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray. Total PAHs are the sum of all detectable PAH concentrations.

	BORING & SAMPLE NO.										
ANALYTE	21#1	21#2	21#3	22#1	22#2	22#3	23#1	23#2	23#3	24#1	25#1
Naphthalene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.37 U	0.34 U	0.37 U
Acenaphthylene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.37 U	0.34 U	0.37 U
Acenaphthene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.37 U	0.34 U	0.37 U
Fluorene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.37 U	0.34 U	0.37 U
Phenanthrene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.08 J	0.34 U	0.37 U
Anthracene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.37 U	0.34 U	0.37 U
Fluoranthene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.042 J	0.34 U	0.37 U
Pyrene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.037 J	0.34 U	0.37 U
Chrysene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.057 J	0.34 U	0.37 U
Benzo(a)Anthracene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.022 J	0.34 U	0.37 U
Benzo(b)Fluoranthene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.016 J	0.029 J	0.34 U	0.37 U
Benzo(k)Fluoranthene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.009 J	0.031 J	0.34 U	0.37 U
Benzo(a)Pyrene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.015 J	0.34 U	0.37 U
Indeno(1,2,3-C,D)Pyrene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.028 J	0.34 U	0.37 U
Dibenzo(A,H)Anthracene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.37 U	0.34 U	0.37 U
Benzo(G,H,I)Perylene	0.39 U	0.39 U	0.39 U	0.38 U	0.38 U	0.38 U	0.37 U	0.37 U	0.13 J	0.34 U	0.37 U
2-Methylnaphthalene	-	-	-	-	-	-	0.37 U	0.37 U	0.37 U	-	-
TOTAL PAH	ND	ND	ND	ND	ND	ND	ND	ND	0.471	ND	ND
2-Fluorobiphenyl(30-115)	36.6	43.1	58.7	44.3	50.3	49.5	29.9	30.4	31.3	36.7	39.8
p-Terphenyl-D14(18-137)	61.6	93.1	96.5	94.7	91.2	96.4	87.9	75.3	90.3	77.2	101
1,2-Dichlorobenzene-d4(20-130)	25.6	24.2	32.1	29.9	36.9	35.9	22.6	27.2	9.2	10.3	20.9

Notes: Sample ID - 21#1 indicates boring number 21, sample 1.
Method 8270 - in Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.
J - Indicates an estimated value below accurate quantitation limits
U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.
(-) - No analysis reported for this compound.
Last three rows of table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A35. (Page 5 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray. Total PAHs are the sum of all detectable PAH concentrations.

	BORING & SAMPLE NO.										
ANALYTE	25#2	28#1	28#2	28#3	29#1	29#2	31#1	32#1	33#1	33#1D	34#1
Naphthalene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.021 J	0.37 U	0.39 U	0.39 U	0.39 U
Acenaphthylene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Acenaphthene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Fluorene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Phenanthrene	0.37 U	0.037 J	0.37 U	0.37 U	0.039 J	0.036 J	0.057 J	0.37 U	0.39 U	0.39 U	0.39 U
Anthracene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Fluoranthene	0.37 U	0.37 U	0.37 U	0.37 U	0.031 J	0.37 U	0.021 J	0.37 U	0.39 U	0.39 U	0.39 U
Pyrene	0.37 U	0.37 U	0.37 U	0.37 U	0.034 J	0.37 U	0.028 J	0.37 U	0.39 U	0.39 U	0.39 U
Chrysene	0.37 U	0.37 U	0.021 J	0.37 U	0.019 J	0.37 U	0.023 J	0.37 U	0.39 U	0.39 U	0.39 U
Benzo(a)Anthracene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Benzo(b)Fluoranthene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Benzo(k)Fluoranthene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Benzo(a)Pyrene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Indeno(1,2,3-C,D)Pyrene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Dibenzo(A,H)Anthracene	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.39 U	0.39 U	0.39 U
Benzo(G,H,I)Perylene	0.37 U	0.37 U	0.023 J	0.37 U	0.37 U	0.036 J	0.055 J	0.37 U	0.39 U	0.39 U	0.39 U
2-Methylnaphthalene	-	-	-	-	-	-	-	-	-	-	-
TOTAL PAH	ND	0.037	0.044	ND	0.123	0.072	0.205	ND	ND	ND	ND
2-Fluorobiphenyl(30-115)	40.9	48.6	41.3	46.3	33.5	46.2	30.9	54.8	49.9	54.1	57.5
p-Terphenyl-D14(18-137)	98	101	96.4	89.6	103	84	99.1	96.8	100	98.7	97.7
1,2-Dichlorobenzene-d4(20-130)	30.6	39.6	28.8	33.4	14.4	21.7	19.8	35.3	25.6	33.6	40.5

Notes: Sample ID - 33#1 indicates boring number 33, sample 1. 33#1D indicates a field duplicate for boring 33 sample 1.
Method 8270 - in Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.
J - Indicates an estimated value below accurate quantitation limits
U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.
(-) - No analysis reported for this compound.
Last three rows of table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A35. (Page 6 of 6). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of subsurface soils for PAHs using EPA Method 8270 (semivolatile organics). Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations are shown in gray. Total PAHs are the sum of all detectable PAH concentrations.

	BORING & SAMPLE NO.							
ANALYTE	34#2	35#1	35#2	36#1	37#1	37#1D	38#1	38#2
Naphthalene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Acenaphthylene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Acenaphthene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Fluorene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Phenanthrene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Anthracene	0.39 U	0.39 U	0.39 U	0.036 J	0.35 U	0.34 U	0.39 U	0.39 U
Fluoranthene	0.39 U	0.39 U	0.023 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Pyrene	0.39 U	0.39 U	0.021 J	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Chrysene	0.39 U	0.39 U	0.021 J	0.34 U	0.018 J	0.34 U	0.39 U	0.39 U
Benzo(a)Anthracene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Benzo(b)Fluoranthene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Benzo(k)Fluoranthene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Benzo(a)Pyrene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Indeno(1,2,3-C,D)Pyrene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Dibenzo(A,H)Anthracene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
Benzo(G,H,I)Perylene	0.39 U	0.39 U	0.39 U	0.34 U	0.35 U	0.34 U	0.39 U	0.39 U
2-Methylnaphthalene	-	-	-	-	-	-	-	-
TOTAL PAH	ND	ND	0.065	0.036	0.018	ND	ND	ND
2-Fluorobiphenyl(Surrogate (30-1	52.8	48.6	51.8	34.9	48.1	46.5	31.2	32.2
p-Terphenyl-D14(Surrogate (18-	103	98.9	104	82.3	94.2	72.6	93.1	99
1,2-Dichlorobenzene-d4(Surroga	36.6	25.5	32.2	19	30.4	38.9	20	14.2

Notes: Sample ID - 37#1 indicates boring number 37, sample 1. 37#1D indicates a field duplicate for boring 37 sample 1.
Method 8270 - In Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.
J - Indicates an estimated value below accurate quantitation limits
U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.
(-) - No analysis reported for this compound.
Last three rows of table - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Table A36. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary of results by PAH analyte of analyses of subsurface soils using EPA Method 8270 (semivolatile organics).

PAH	OCCURRENCE BY STATION	TOTAL NO. BORINGS WITH SPECIFIC PAH	SAMPLE #1	SAMPLE #2	SAMPLE #3	MAXIMUM CONC. MG/KG	LOCATION OF MAXIMUM	INDUSTRIAL SOILS RBC MG/KG
Low Molecular Weight PAHs								
Naphthalene	19#1 31#1,	[2]	2	-	-	0.12J	19#1	41000n
Acenaphthylene	ND	[0]	-	-	-	ND	ND	no RBC
Acenaphthene	ND	[0]	-	-	-	ND	ND	61000n
Fluorene	ND	[0]	-	-	-	ND	ND	41000n
Phenanthrene	6#1, 11#1 17#1, 17#2 19#1, 23#3, 28#1, 29#1 28#2, 31#1,	[10]	7	2	1	0.21J	19#1	no RBC
Anthracene	19#1,	[1]	1	-	-	0.015J	19#1	31000n
2-Methylnaphthalene	19#1	[1]	1	-	-	0.18J	19#1	no RBC
High Molecular Weight PAHs								
Fluoranthene	6#1, 11#1 17#1, 17#2 19#1, 23#3, 29#1, 31#1 35#2,	[9]	6	2	1	0.066J	19#1	41000n
Pyrene	6#1, 11#1 17#1, 17#2 19#1, 23#3, 29#1, 31#1 35#2,	[9]	6	2	1	0.076J	19#1	31000n
Chrysene	6#1, 17#2 19#1, 23#3 28#2, 29#1, 31#1, 37#1	[8]	5	2	1	0.064J	6#1	390c
Benzo(a)Anthracene	6#1, 17#2 19#1, 23#3,	[4]	2	1	1	0.031J	6#1	3.90c
Benzo(b)Fluoranthene	6#1, 17#2 19#1, 23#3,	[4]	2	1	1	0.071J	6#1	3.90c
Benzo(k)Fluoranthene	6#1, 17#2 19#1, 23#3,	[4]	2	1	1	0.037J	6#1	39.0c
Benzo(a)Pyrene	6#1, 17#2 19#1, 23#3,	[4]	2	1	1	0.034J	6#1	0.39c
Indeno(1,2,3-C,D)Pyrene	6#1, 23#3,	[2]	1	-	1	0.13J	23#3	3.90c
Dibenzo(A,H)Anthracene	ND	[0]	-	-	-	ND	ND	0.39c
Benzo(G,H,I)Perylene	6#1, 19#1 23#3, 28#2 29#2, 31#1,	[6]	3	2	1	0.13J	23#3	no RBC

Notes: ND - Not detected; No RBC - No RBC listed in reference.
RBC - Risk-Based Concentrations - Risk-Based Concentration Table, Fourth Quarter 1994.
Roy L. Smith, Senior Toxicologist (3HW15), U.S. EPA Region III.
Risk Based Concentrations are in mg/kg.
Basis of RBC: c = carcinogenic effect; n = noncarcinogenic effect

Table A37. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Summary of results of analyses of subsurface soils collected August 1993 for polycyclic aromatic hydrocarbons using EPA Method 8270 (semivolatile organics) .

Station	Number of Different PAHs Detected	Total Sample PAHs (mg/kg)
6#1	10	0.419
11#1	3	0.066
17#1	3	0.075
17#2	8	0.283
19#1	12	0.823
23#3	10	0.471
28#1	1	0.037
28#2	2	0.044
29#1	4	0.123
29#2	2	0.072
31#1	6	0.205
35#2	3	0.065
36#1	1	0.036
37#1	1	0.018
MAX	12	0.823
MIN	1	0.018
MEAN	5	0.2209

Table A38. (Page 1 of 2). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10.. Results of analyses of method blanks for PAHs using EPA Method 8270. Concentrations are mg/kg. Method blanks are shown for associated group of sample analyses as indicated on page 2. Except as indicated all samples from a boring were analyzed as a group.

	METHOD BLANK									
PAH ANALYTE	MB1	MB 2	MB 3	MB 4	MB 5	MB 6	MB 7	MB 8	MB 9	MB 10
Naphthalene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Acenaphthylene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Acenaphthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Fluorene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Phenanthrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Chrysene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(a)Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(b)Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(k)Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(a)Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Indeno(1,2,3-C,D)Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Dibenzo(A,H)Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(G,H,I)Perylene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
2-Methylnaphthalene	-	-	-	-	-	-	-	0.33 U	-	-
2-Fluorobiphenyl(Surr (30-115))	56.2	56.2	60.6	61.9	57.1	57.1	61.9	60.4	45.9	57.3
p-Terphenyl-D14(Surr (18-137))	89.3	89.3	92.0	79.8	94.5	94.5	79.8	87.8	88.2	114
1,2-Dichloroben.-d4(Surr (20-130))	37.7	37.7	42.5	45.3	35.4	35.4	45.3	49.1	21.3	38.6

Note:
U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.
EPA Method 8270 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.
(-) - No analysis reported .
Dup - Duplicate sample.

Table A38. (Page 2 of 2). Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of method blanks for PAHs using EPA Method 8270. Concentrations are mg/kg. Method blanks are shown for associated group of sample analyses as indicated . Except as indicated all samples from a boring were analyzed as a group.

	METHOD BLANK				
PAH ANALYTE	MB 11	MB 12	MB 13	MB 14	MB 15
Naphthalene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Acenaphthylene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Acenaphthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Fluorene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Phenanthrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Chrysene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(a)Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(b)Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(k)Fluoranthene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(a)Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Indeno(1,2,3-C,D)Pyrene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Dibenzo(A,H)Anthracene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
Benzo(G,H,I)Perylene	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U
2-Methylnaphthalene	-	-	-	-	-
2-Fluorobiphenyl(Surr (30-115))	57.3	60.6	30.8	61.9	45.9
p-Terphenyl-D14(Surr (18-137))	114	92.0	65.2	79.8	88.2
1,2-Dichloroben.-d4(Surr (20-130))	38.6	42.5	24.8	45.3	34.0

METHOD BLANK/SAMPLE ASSOCIATIONS

MB 1 - borings 5, 6, 8, 13, and 8 Dup.
MB 2 - borings 1, 2, 3, 7, and 9
MB 3 - borings 12 and 14.
MB 4 - boring 36.
MB 5 - borings 37 and 1 Dup.
MB 6 - borings 21, 24, 34, and 37 Dup.
MB 7 - borings 21, 24, 34, and 37 Dup (second blank).
MB 8 - borings 10, and 11.
MB 9 - boring 29 (sample 2).
MB 10 - borings 31, 32, 25, 28, and 29 (sample 1).
MB 11 - borings 38, 35, 33, and 33 Dup.
MB 12 - boring 22.
MB 13 - borings 19, 23 (samples 1 & 2), 17 (samples 1 & 3), and 16.
MB 14 - borings 15 and 16 Dup.
MB 15 - borings 17 (sample 2) and 23 (sample 3).

Note:
U - Compound was analyzed for but not detected. Detection limits are given before the U symbol.
EPA Method 8270 - In Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods SW846, Third Edition, November 1986, with July 1992 revisions.
(-) - No analysis reported .
Dup - Duplicate sample.

Table A39. Ammunition Burning Ground, NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of equipment rinses and field blank for polycyclic aromatic hydrocarbons using EPA Method 8270 (semivolatile organics).

	RINSE AND FIELD BLANK mg/l (PPM)					
ANALYTE	RNS1	FLD BLK	RNS2	RNS3	RNS4	RNS5
Naphthalene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Acenaphthylene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Acenaphthene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Fluorene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Phenanthrene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Anthracene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Fluoranthene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Pyrene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Chrysene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Benzo(a)Anthracene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Benzo(b)Fluoranthene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Benzo(k)Fluoranthene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Benzo(a)Pyrene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Indeno(1,2,3-C,D)Pyrene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Dibenzo(A,H)Anthracene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Benzo(G,H,I)Perylene	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
2-Methylnaphthalene	-	-	-	-	-	-
TOTAL PAH	ND	ND	ND	ND	ND	ND
2-Fluorobiphenyl(30-115)	55.2	68.3	65.9	76.7	63.3	74.0
p-Terphenyl-D14(18-137)	92.4	95.9	97.1	101.0	92.7	95.3
1,2-Dichlorobenzene-d4(20-130)	50.8	51.0	48.9	58.9	46.8	56.9

Notes:

RINSE 1 - Collected 8/19/93; borings 10 and 11 collected this day

RINSE 2 - Collected 8/21/93; borings 1, 2, 3, 7, 8, 13, and 22 collected this day

RINSE 3 - Collected 8/22/93; borings 12, 14, 22, 24, 34, 36, and 37 collected this day

RINSE 4 - Collected 8/24/93; borings 25, 28, 29, 31, and 32 collected this day

RINSE 5 - Collected 8/25/93; borings 19, and 23 collected this day

FIELD BLANK - Collected 8/19/93

Method 8270 - in Test Methods for Evaluating organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with July 1992 Revisions.

U - Compound was analyzed for but was not detected. Detection limits are given before the U symbol.

(-) - No analysis reported for this compound.

(20-130) - Surrogate recoveries. Surrogate recoveries measure method performance. Acceptable recoveries (defined by the method) are given in parentheses.

Method Blanks - Mehtod blanks were run with each rinse and field blank. No PAHs were detected in the method blanks at detection limits that were the same as above.

Table A40. (Page 1 of 2). Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Results of inorganic analyses of subsurface soil samples. See Figure 5.3.1 for sample locations. Concentrations are mg/kg dry weight (ppm).

BORING & SAMPLE	ANALYTE																			
	AG	AL	AS	BA	CA	CD	CO	CR	CU	FE	HG	MG	MN	NA	NI	PB	SB	SN	ZN	TP
1.1	1.0 U	6460	1.89	69.3	622	0.020 U	1.7 *	12	3.1	9350	0.100 U	710	7 *	47.3 B	3.7	5.56	0.90 UN	5.00 U	9.39	56.3
1.1D	1.0 U	2490	0.60 UN	35.5	393 B	0.020 U	2.1 B	5.5	2.4 B	5230	0.100 U	397 B	6.4	33.3 B	2.4 B	4.23	0.90 UN	5.00 U	6.6	61.2
2.1	1.0 U	10100	5.24	35.4	287 B	0.022 B	7.6 *	15.9	6.7	28400	0.100 U	755	231 *	42.2 B	7.8	9.99	0.90 UN	5.00 U	31.3	131
3.1	1.0 U	9150	3.83	23.1	74.4 B	0.030 B	3.3 B*	10.9	5.9	9040	0.100 U	748	49.5 *	26.1 B	5.2	7	0.90 UN	5.00 U	39	120
5.1	1.0 U	12300	4.82	103	2020	0.189 B	14.2	18.6	13.7	22100	0.100 U	1440	721	87.6 B	18.4	17.2	0.90 UN	5.00 U	63.1	196
5.2	1.0 U	20300	4.02	188	16700	0.358 B	17.3	31.2	17	37100	0.100 U	2690	1650	95.8 B	42.6	14.4	0.90 UN	5.00 U	58.3	268
6.1	1.4	11700	7.70	480	5320	0.847	12.3	17.7	52.2	23600	0.100 U	2320	429	63.9 B	24.1	41.7	0.90 UN	5.00 U	17.1	222
6.2	1.0 U	10900	7.37	225	3470	0.281 B	14.7	18.8	21	28400	0.100 U	2040	1040	56 B	22.8	30.4	0.90 UN	5.00 U	130	288
7.1	1.0 U	11000	4.91	56.1	630	0.116 B	13.0 *	15.6	7.7	27000	0.100 U	1030	512 *	58.8 B	16.1	12	0.90 UN	5.00 U	87.5	210
7.2	1.0 U	22000	8.87	51.9	557	0.046 B	7.2 *	29.5	20.2	30700	0.100 U	2820	296 *	56.4 B	17.3	14.9	0.90 UN	5.00 U	76.8	212
8.1	1.0 U	11100	5.66	118	2020	0.720	13.7	17.8	59.1	24000	0.249	1170	366	63.7 B	20.3	27.1	0.90 UN	5.00 U	86	183
8.1D	1.0 U	12700	5.76	156	36000	0.953	15.7	21.4	21.4	31000	0.407	1820	731	89.9 B	29.1	24.4	0.90 UN	5.00 U	72	258
9.1	1.0 U	15900	6.42	81.8	4860	0.093 B	15.0 *	22.6	15.1	29900	0.100 U	1790	550 *	110 B	23.1	29.2	0.90 UN	5.00 U	60.5	188
10.1	1.0 U	10000	7.39	51.7	1150	0.067 B	20.4	17.1	8.8	25400	0.336	1070	875	53.1 B	18.7	13.2	0.90 UN	5.00 U	55.5	160
10.2	1.0 U	10400	6.70	91.8	6540	0.281 B	17.5	17.9	11.8	32300	0.294	1980	977	62.9 B	23.2	37.2	0.90 UN	5.00 U	358	289
11.1	1.0 U	13200	5.24	176	23300	0.876	12.1	17.5	41.9	19300	4.260	4320	493	84.2	19.2	174	1.03 BN	5.00 U	133	349
11.2	1.0 U	5550	4.61	66.9	833	0.092 B	18.4	11.5	4.9	19500	0.113	451 B	1130	38.6 B	15.6	11.2	0.90 UN	5.00 U	32.6	319
12.1	1.0 U	7440	6.21	132	4760	0.978	19.0	11.3	38.4	21000	7.690	968	746	63.7 B	12.7	40.9	1.48 BN	5.00 U	208	194
12.2	1.0 U	8770	6.03	50.3	145 B	0.020 U	10.9	11.4	7.1	17300	0.100 U	655	662	39.2 B	10.1	12.6	0.90 UN	5.00 U	34.7	136
12.3	1.0 U	10700	6.32	48.9	142 B	0.320 B	10.6	15.9	8.69	20300	0.100 U	1330	444	41.8 B	9.59	13	0.90 UN	5.00 U	35.1	181
13.1	1.0 U	12000	7.72	73.6	2490	0.200 B	13.4	18.9	12.9	28900	0.100 U	1170	566	66.8 B	24.3	12.9	0.90 UN	5.00 U	74.4	191
13.2	1.0 U	11100	7.41	57.7	1900	0.091 B	14.5	18.8	9.89	24900	0.100 U	1120	510	67.2 B	19.6	11.2	0.90 UN	5.00 U	59.6	196
14.1	1.0 U	9040	4.44	70	4050	0.208 B	7.8	13.8	13	18300	0.100 U	1580	171	43.3 B	10	100	0.90 UN	5.00 U	64	183
14.2	1.0 U	9180	8.88	49.2	473 B	0.058 B	6.8	15.4	13.5	16100	0.100 U	1760	56.6	40.2 B	11.9	11.9	0.90 UN	5.00 U	48	133
15.1	1.0 U	14100	7.51	78.1	1770	0.257 B	14.7	17.7	12.5 *	19800	0.100 U	1440	368	60.9 B	24.5	11.9 *	0.90 UN	5.00 U	62.8	114
16.1	1.0 U	9540	8.15	245	14600	1.500	13.6	20	47.1 *	41300	0.100 U	2100	543	72 B	22	75.8 *	0.90 UN	5.00 U	996	175
16.1D	1.3 *	8840	8.82	127	4220	0.361	12.9	14.9	31.8 *	25500	0.100 U	1370	452	55.2 B	12.1	60.2 *	0.90 UN	5.00 U	112	190
17.1	1.0 U	20800	5.48	463	11300	3.090	16.0	20.3	152 *	24000	0.891	7730	1180	96.1 B	25.3	183 *	0.90 UN	5.00 U	458	209
17.2	1.0 U	17800	7.93	121	4680	1.060	18.2	18.6	35.2 *	35000	0.396	1920	761	58 B	18.3	90.5 *	0.90 UN	5.00 U	193	177
17.3	1.0 U	8820	10.70	55.9	1300	0.173 B	16.0	16.8	10.6 *	33400	0.934	866	620	53.6 B	15.2	14.4 *	0.90 UN	5.00 U	167	197
19.1	1.0 U	9210	5.12	258	13800	3.870	12.2	17.5	195 *	14200	0.219	8690	882	199 B	18.4	212 *	1.71 BN	5.00 U	852	517
19.2	1.0 U	10600	6.97	65	1630	0.079 B	12.3	21.3	7.3 *	24500	0.100 U	826	816	69.7 B	13.4	10.1 *	0.90 UN	5.00 U	47.6	159
19.3	1.0 U	14400	7.18	77.2	1010	0.057	10.4	20.3	14 *	26800	0.100 U	1640	339	43.4 B	10.9	8.9 *	0.90 UN	5.00 U	51.1	247

Notes: Sample ID - 1.1 indicates boring 1, sample 1. Sample 1.1D is a field duplicate of sample 1.1.
U - Analyte was analyzed for but not detected. Detection limits are given before the U symbol.
B - Reported value is less than the Contract Required Detection Limit but greater than the Instrument Detection Limit.
W - Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.
N - Spike sample recovery not within control limits.
* - Duplicate analysis not within control limits.

Table A40. (Page 2 of 2). Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Results of inorganic analyses of subsurface soil samples. See Figure 5.3.1 for sample locations. Concentrations are mg/kg dry weight (ppm).

BORING & SAMPLE	ANALYTE																			
	AG	AL	AS	BA	CA	CD	CO	CR	CU	FE	HG	MG	MN	NA	NI	PB	SB	SN	ZN	TP
21.1	1.0 U	7840	5.14	138	6040	0.492 BN	10.7	9.6	22.7	17600	0.336	1390	417	47.7 B	12.9	24.4	0.90 UN	5.10	91	169
21.2	1.0 U	10600	3.95	72.1	1700	0.089 BN	9.79	11.7	7.19	19100	0.100 U	1150	330	81.8	11.2	4.7	0.90 UN	5.00 U	30.8	66.9
21.3	1.0 U	9070	6.29	102	3270	0.050 BN	10.5	12.9	7.1	23200	0.100 U	1280	372	70.8	13.2	5.6	0.90 UN	5.00 U	136	97.5
22.1	1.0 U	18500	6.63	83.4	9120	0.499 B	12.5 *	25.7	34.1	25600	0.100 U	2380	950 *	126 B	20.6	31.2	0.90 UN	5.00 U	117	379
22.2	1.0 U	42000	3.61	141	1380	0.091 B	58.3 *	41.1	21.4	48800	0.100 U	6490	2760	420 B	64.4	25.3	0.90 UN	5.00 U	47.5	209
22.3	1.0 U	20400	17.3	69.8	17700	0.121 B	13.4 *	31.2	18.9	50400	0.100 U	3740	98.5 *	151 B	59.4	15.1	0.90 UN	5.00 U	115	196
23.1	1.0 U	12600	7.39	569	8310	3.430	14.5	22.4	45.7 *	26600	0.962	1970	574	52.8 B	26.6	37.6 *	0.90 UN	5.00 U	300	202
23.2	1.0 U	17100	7.04	82.3	4070	7.870	14.1	25.4	13.9 *	19500	0.100 U	2820	121	226 B	43.3	13.4 *	0.90 UN	5.00 U	61.1	171
23.3	1.0 U	14000	52.1	57.5	3140	0.133 B	8.1	22.2	12 *	22900	0.100 U	2120	30.8	107 B	20.1	35.1 *	0.90 UN	5.00 U	22.5	242
24.1	1.0 U	2630	2.82	56.6	115000	0.528 N	9.4	6.8	34.3	7810	0.100 U	17300	324	114	10.8	26.5	0.90 UN	5.00 U	80.8	116
25.1	1.0 U	11000	6.42 N	80.9	1220	0.217 B	12.7	16.5	8.89	28900	0.100 U	957	1000	69.2 B	17.8	7.8 *	0.90 UN	5.00 U	80.2	220
25.2	1.0 U	9300	5.84 N	52.9	907	0.114 B	14.4	14.3	10.2	23000	0.279	842	933	36.7 B	15.9	9.9 *	0.90 UN	5.00 U	61.1	144
28.1	1.0 U	13800	9.06 N	82.3	7060	0.376 B	11.2	20.7	32.7	28300	0.100 U	1810	302	64.3 B	17.4	30.2 *	0.90 UN	5.00 U	228	159
28.2	1.0 U	10800	7.29 N	50.8	1770	0.128 B	10.5	17.2	14.8	31000	0.100 U	1120	282	49.9 B	13	9.99 *	0.90 UN	5.00 U	188	128
28.3	1.0 U	17300	14.7 N	326	2950	2.610	22.6	38.1	94.7	49200	0.850	2580	782	71.7 B	35.8	135 *	1.72 BN	5.00 U	337	176
29.1	2.6	12900	12.1 N	290	6120	4.330	11.9	29.6	171	40500	0.598	2210	698	60.1 B	20.6	344 *	8.30 N	5.00 U	2160	375
29.2	1.0 U	12500	8.23 N	158	1670	0.162 B	12	19.4	14.1	23100	0.100 U	2470	311	96.6 B	29	17.9 *	0.90 UN	5.00 U	75.3	197
31.1	6.6	14600	11.9 N	1740	20300	4.580	25.1	86.4	616	129000	0.100 U	3580	2310	755	52.4	4940 *	36.90 N	1550.00	3370	1220
32.1	1.0 U	9620	10.3 N	170	3190	3.000	16.7	21.5	33.1	43700	0.100 U	1070	1270	49.4 B	22.2	21.3 *	0.90 UN	5.00 U	213	584
33.1	1.0 U	8390	6.29	166	12200	0.226 BN	14.9	13.9	15.3	19100	0.100 U	1170	800	68.9 B	17	18	0.90 UN	5.00 U	102	223
33.1D	1.0 U	9560	7.11	254	3250	0.689 N	13.7	13.8	31.4	21200	0.100 U	1150	842	38.7 B	17.2	30.6	0.90 UN	5.00 U	123	302
34.1	1.0 U	13900	9.85	323	3240	0.423 BN	24.9	18.1	19.1	36500	0.100 U	2320	2450	95.4	87.2	10.7	0.90 UN	5.00 U	79.6	148
34.2	1.0 U	9010	5.93	70.3	1140	0.039 BN	28.7	12.7	6.7	30200	0.100 U	897	1300	64	11.9	12.8	1.07 BN	5.00 U	40.6	118
35.1	3.2	21200	5.17	520	4550	2.460 N	15.2	14.9	19.2	17100	0.100 U	1580	2540	45.4 B	19.5	351	0.90 UN	5.00 U	457	721
35.2	1.2	17500	5.04	503	4820	2.040	12.9	13.6	143	16400	0.100 U	1390	1610	47.1 B	17.1	255	1.62 BN	5.00 U	319	807
36.1	1.0 U	5610	6.52	328	171000	2.190	13.8	16.6	136	16800	0.100 U	10000	61.3	85.2 B	17.5	361	2.96 BN	5.00 U	879	164
37.1	1.0 U	5890	5.67	195	3650	1.140	11.5	12.2	30.7	17900	0.100 U	2280	480	41.7 B	13.2	24.8	0.90 UN	5.00 U	172	373
37.1D	1.0 U	4390	6.88	198	3950	1.200 N	9.5	8.1	41.6	15900	0.100 U	2190	568	36.2 B	11.7	22.1	0.90 UN	5.00 U	123	250
38.1	1.0 U	7760	6.32	145	961	0.313 BN	11.3	11.8	28.3	19400	0.118	782	395	29.7 B	9.5	15.7	0.90 UN	5.00 U	42.4	170
38.2	1.0 U	9110	3.37	103	510	0.096 BN	16.1	8.6	6.7	11400	0.100 U	716	1420	29.3 B	11.2	14.1	0.90 UN	5.00 U	27.5	246

Notes: Sample ID - 1.1 indicates boring 1, sample 1.

U - Analyte was analyzed for but not detected. Detection limits are given before the U symbol.

B - Reported value is less than the Contract Required Detection Limit but greater than the Instrument Detection Limit.

W - Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

N - Spike sample recovery not within control limits.

* - Duplicate analysis not within control limits.

Table A41. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Summary statistics for results of inorganic analyses of subsurface soil samples. See Table 5.3.19 for complete data. MAX, MIN, and MEAN concentrations are mg/kg dry weight (ppm).

STAT	AG (58)	AL (58)	AS (49)	BA (58)	CA (58)	CD (48)	CO (49)	CR (58)	CU (47)	FE (58)
					ANALYTE					
MAX	6.59 [33#1]	42000 [22#2]	52.10 [23#3]	1740 [31#1]	171000 [36#1]	7.87 [23#2]	28.7 [34#2]	86.4 [31#1]	616 [31#1]	129000 [31#1]
MIN	<1.0 [*]	2630 [24#1]	1.99 [1#1]	23.1 [3#1]	74.4 [3#1]	< 0.02 [*]	6.8 [14#2]	6.8 [24#1]	3.1 [1#1]	7810 [24#1]
MEAN1	1.2	12405	7.29	178.2	9472.8	1.02	14.3	19.4	41.3	27153
STD DEV	0.81	5803	6.95	248.1	26524	1.61	4.47	11.2	93.0	16635
MEAN2	0.7	12405	7.29	178.2	9472.8	1.02	14.3	19.4	41.3	27153
STD DEV	0.91	5803	6.95	248.1	26524	1.61	4.47	11.2	93.0	16635

STAT	HG (58)	MG (58)	MN (50)	NA (58)	NI (58)	PB (58)	SB (*)	SN (58)	ZN (58)	TP (58)
MAX	7.69 [12#1]	17300 [12#2]	2760 [22#2]	755 [31#1]	87.2 [34#1]	361 [36#1]	-	1550 [31#1]	3370 [31#1]	1220 [31#1]
MIN	< 0.10 [*]	451 [11#2]	30.8 [23#3]	26.1 [3#1]	3.7 [1#1]	4.7 [21#1]	-	< 5.0 [*]	9.39 [1#1]	56.3 [1#1]
MEAN1	0.392	2371	804.4	88.2	21.3	49.1	-	31.6	248.8	245.2
STD DEV	1.132	2750	641.1	106.70	14.8	88.7	-	202.9	533.9	191
MEAN2	0.356	2371	804.4	88.2	21.3	49.1	-	29.2	248.8	245.2
STD DEV	1.142	2750	641.1	106.70	14.8	88.7	-	203.2	533.9	191

Note:

AG(58) - Inorganic analyte i.e., silver. Number in parentheses is the number of subsurface soil analyses used to compute the statistic. Data qualified by a W, N, or * (see Notes on Table 5.3.19) were not used. Field duplicates were not used in this statistical summary.

SB (*) - All data for SB was qualified by an "N" and therefore not used for these comparisons.

2630 [24#1] - Analyte concentration in mg/kg dry weight (ppm). Number in brackets, i.e., [24#1] is the boring (24) and sample number (1) for the MAX or MIN. Where a MIN was the detection limit and occurred at more than one location a [*] symbol is given.

MEAN1 - Mean was computed using the reported detection limit for those samples with results reported as < detection limits (U qualified).

MEAN2 - Mean was computed using 1/2 detection limit for those samples with results reported as < detection limits (U qualified).

Table A42. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Location of maximum concentrations of inorganic constituents.

BORING WHERE CONSTITUENT MAXIMUM OCCURRED	CONSTITUENT(S)
12	Hg and Mg
22	Al and Mn
23	As and Cd
31	Ba, Cr, Cu, Fe, Na, Sn, Zn, and TP
33	Ag
34	Co and Ni
36	Ca and Pb

Tabel A43. (Page 1 of 3). Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Comparison of ABG subsurface soils to nearby "background samples". Ratio of sample concentration to mean background concentration for a specific metal or inorganic constituent is given. See Table 5.3.19 for complete data. Constituents greater than 100 times the background are shaded in gray.

RATIO ABG SAMPLE CONCENTRATION / MEAN BACKGROUND CONCENTRATION FOR INDICATED CONSTITUENT

SAMPLE	AL	SB	AS	BA	CA	CD	CO	CR	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN	TP
5.1	1.4	-	1.3	2.4	6.2	9.5	-	1.5	2.6	1.4	2.3	2.0	-	1.0	3.3	1.0	2.3	1.0	2.4	1.9
5.2	2.4	-	1.1	4.4	50.9	17.9	-	2.5	3.3	2.4	1.9	3.6	-	1.0	7.6	1.0	2.5	1.0	2.2	2.6
6.1	1.4	-	2.1	11.3	16.2	42.4	-	1.4	10.0	1.5	5.5	3.1	-	1.0	4.3	1.4	1.7	1.0	0.6	2.2
6.2	1.3	-	2.0	5.3	10.6	14.1	-	1.5	4.0	1.8	4.0	2.8	-	1.0	4.1	1.0	1.5	1.0	4.9	2.8
7.1	1.3	-	1.3	1.3	1.9	5.8	-	1.3	1.5	1.7	1.6	1.4	-	1.0	2.9	1.0	1.5	1.0	3.3	2.1
7.2	2.6	-	2.4	1.2	1.7	2.3	-	2.4	3.9	2.0	2.0	3.8	-	1.0	3.1	1.0	1.5	1.0	2.9	2.1
8.1	1.3	-	1.5	2.8	6.2	36.0	-	1.4	11.4	1.5	3.6	1.6	-	2.5	3.6	1.0	1.7	1.0	3.2	1.8
8.1D	1.5	-	1.6	3.7	109.8	47.7	-	1.7	4.1	2.0	3.2	2.5	-	4.1	5.2	1.0	2.3	1.0	2.7	2.5
9.1	1.9	-	1.7	1.9	14.8	4.7	-	1.8	2.9	1.9	3.9	2.4	-	1.0	4.1	1.0	2.9	1.0	2.3	1.8
10.1	1.2	-	2.0	1.2	3.5	3.4	-	1.4	1.7	1.6	1.8	1.4	-	3.4	3.3	1.0	1.4	1.0	2.1	1.6
10.2	1.2	-	1.8	2.2	20.0	14.1	-	1.4	2.3	2.1	4.9	2.7	-	2.9	4.1	1.0	1.6	1.0	13.5	2.8
11.1	1.5	-	1.4	4.1	71.1	43.8	-	1.4	8.1	1.2	23.1	5.9	-	42.6	3.4	1.0	2.2	1.0	5.0	3.4
11.2	0.6	-	1.2	1.6	2.5	4.6	-	0.9	0.9	1.3	1.5	0.6	-	1.1	2.8	1.0	1.0	1.0	1.2	3.1
12.1	0.9	-	1.7	3.1	14.5	48.9	-	0.9	7.4	1.3	5.4	1.3	-	76.9	2.3	1.0	1.7	1.0	7.8	1.9
12.2	1.0	-	1.6	1.2	0.4	1.0	-	0.9	1.4	1.1	1.7	0.9	-	1.0	1.8	1.0	1.0	1.0	1.3	1.3
12.3	1.2	-	1.7	1.1	0.4	16.0	-	1.3	1.7	1.3	1.7	1.8	-	1.0	1.7	1.0	1.1	1.0	1.3	1.8
13.1	1.4	-	2.1	1.7	7.6	10.0	-	1.5	2.5	1.9	1.7	1.6	-	1.0	4.3	1.0	1.7	1.0	2.8	1.9
13.2	1.3	-	2.0	1.4	5.8	4.6	-	1.5	1.9	1.6	1.5	1.5	-	1.0	3.5	1.0	1.7	1.0	2.2	1.9
14.1	1.1	-	1.2	1.6	12.4	10.4	-	1.1	2.5	1.2	13.3	2.1	-	1.0	1.8	1.0	1.1	1.0	2.4	1.8
14.2	1.1	-	2.4	1.2	1.4	2.9	-	1.2	2.6	1.0	1.6	2.4	-	1.0	2.1	1.0	1.0	1.0	1.8	1.3
15.1	1.6	-	2.0	1.8	5.4	12.9	-	1.4	-	1.3	-	2.0	-	1.0	4.4	1.0	1.6	1.0	2.4	1.1
16.1	1.1	-	2.2	5.8	44.5	75.0	-	1.6	-	2.6	-	2.8	-	1.0	3.9	1.0	1.9	1.0	37.4	1.7
16.1D	1.0	-	2.4	3.0	12.9	18.1	-	1.2	-	1.6	-	1.9	-	1.0	2.2	1.3	1.4	1.0	4.2	1.9
17.1	2.4	-	1.5	10.9	34.5	154.5	-	1.6	-	1.5	-	10.5	-	8.9	4.5	1.0	2.5	1.0	17.2	2.0
17.2	2.1	-	2.1	2.8	14.3	53.0	-	1.5	-	2.2	-	2.6	-	4.0	3.3	1.0	1.5	1.0	7.3	1.7
17.3	1.0	-	2.9	1.3	4.0	8.7	-	1.4	-	2.1	-	1.2	-	9.3	2.7	1.0	1.4	1.0	6.3	1.9
19.1	1.1	-	1.4	6.1	42.1	193.5	-	1.4	-	0.9	-	11.8	-	2.2	3.3	1.0	5.2	1.0	32.0	5.0
19.2	1.2	-	1.9	1.5	5.0	4.0	-	1.7	-	1.6	-	1.1	-	1.0	2.4	1.0	1.8	1.0	1.8	1.6
19.3	1.7	-	1.9	1.8	3.1	2.9	-	1.6	-	1.7	-	2.2	-	1.0	1.9	1.0	1.1	1.0	1.9	2.4

Note:

(-) - Comparison not made due to data being qualified by a W, N, or * (see notes Table 5.3.19).

Mean - Means were computed using the reported detection limit for those samples with results reported as < detection limits (U qualified).

Ratios - Ratios were computed using the detection limit in those cases where less than detection concentrations were reported.,

Tabel A43. (Page 2 of 3). Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Comparison of ABG subsurface soils to nearby "background samples". Ratio of sample concentration to mean background concentration for a specific metal or inorganic constituent is given. See Table 5.3.19 for complete data. Constituents greater than 100 times the background are shaded in gray.

RATIO ABG SAMPLE CONCENTRATION / MEAN BACKGROUND CONCENTRATION FOR INDICATED CONSTITUENT

SAMPLE	AL	SB	AS	BA	CA	CD	CO	CR	CU	FE	PB	MG	MN	HG	NI	SN	ZN	TP
21.1	0.9	-	1.4	3.2	18.4	-	-	0.8	4.4	1.1	3.2	1.9	-	3.4	2.3	1.0	3.4	1.7
21.2	1.2	-	1.1	1.7	5.2	-	-	0.9	1.4	1.2	0.6	1.6	-	1.0	2.0	1.0	1.2	0.7
21.3	1.1	-	1.7	2.4	10.0	-	-	1.0	1.4	1.5	0.7	1.7	-	1.0	2.4	1.0	5.1	1.0
22.1	2.2	-	1.8	2.0	27.8	25.0	-	2.1	6.6	1.6	4.1	3.2	-	1.0	3.7	1.0	4.4	3.7
22.2	4.9	-	1.0	3.3	4.2	4.6	-	3.3	4.1	3.1	3.4	8.8	-	1.0	11.5	1.0	1.8	2.0
22.3	2.4	-	4.7	1.6	54.0	6.1	-	2.5	3.6	3.2	2.0	5.1	-	1.0	10.6	1.0	4.3	1.9
23.1	1.5	-	2.0	13.4	25.4	171.5	-	1.8	-	1.7	-	2.7	-	9.6	4.8	1.0	11.3	2.0
23.2	2.0	-	1.9	1.9	12.4	393.5	-	2.0	-	1.3	-	3.8	-	1.0	7.7	1.0	2.3	1.7
23.3	1.6	-	14.1	1.3	9.6	6.7	-	1.8	-	1.5	-	2.9	-	1.0	3.6	1.0	0.8	2.4
24.1	0.3	-	0.8	1.3	350.8	-	-	0.5	6.6	0.5	3.5	23.4	-	1.0	1.9	1.0	3.4	1.1
25.1	1.3	-	-	1.9	3.7	10.9	-	1.3	1.7	1.9	-	1.3	-	1.0	3.2	1.0	3.0	2.1
25.2	1.1	-	-	1.2	2.8	5.7	-	1.2	2.0	1.5	-	1.1	-	2.8	2.8	1.0	2.3	1.4
28.1	1.6	-	-	1.9	21.5	18.8	-	1.7	6.3	1.8	-	2.5	-	1.0	3.1	1.0	8.6	1.6
28.2	1.3	-	-	1.2	5.4	6.4	-	1.4	2.8	2.0	-	1.5	-	1.0	2.3	1.0	7.1	1.3
28.3	2.0	-	-	7.7	9.0	130.5	-	3.1	18.2	3.2	-	3.5	-	8.5	6.4	1.0	12.7	1.7
29.1	1.5	-	-	6.8	18.7	216.5	-	2.4	32.9	2.6	-	3.0	-	6.0	3.7	1.0	81.2	3.7
29.2	1.5	-	-	3.7	5.1	8.1	-	1.6	2.7	1.5	-	3.3	-	1.0	5.2	1.0	2.8	1.9
31.1	1.7	-	-	40.8	61.9	229.0	-	7.0	118.5	8.3	-	4.9	-	1.0	9.4	310.0	126.7	11.9
32.1	1.1	-	-	4.0	9.7	150.0	-	1.7	6.4	2.8	-	1.4	-	1.0	4.0	1.0	8.0	5.7
33.1	1.1	-	1.7	3.9	37.2	-	-	1.1	2.9	1.2	2.4	1.6	-	1.0	3.0	1.0	3.8	2.2
33.1D	1.1	-	1.9	6.0	9.9	-	-	1.1	6.0	1.4	4.1	1.6	-	1.0	3.1	1.0	4.6	2.9
34.1	1.6	-	2.7	7.6	9.9	-	-	1.5	3.7	2.3	1.4	3.1	-	1.0	15.6	1.0	3.0	1.4
34.2	1.1	-	1.6	1.7	3.5	-	-	1.0	1.3	1.9	1.7	1.2	-	1.0	2.1	1.0	1.5	1.2
35.1	2.5	-	1.4	12.2	13.9	-	-	1.2	3.7	1.1	46.7	2.1	-	1.0	3.5	1.0	17.2	7.0
35.2	2.0	-	1.4	11.8	14.7	102.0	-	1.1	27.5	1.1	33.9	1.9	-	1.0	3.1	1.0	12.0	7.9
36.1	0.7	-	1.8	7.7	521.7	109.5	-	1.3	26.2	1.1	48.0	13.6	-	1.0	3.1	1.0	33.0	1.6
37.1	0.7	-	1.5	4.6	11.1	57.0	-	1.0	5.9	1.1	3.3	3.1	-	1.0	2.4	1.0	6.5	3.6
37.1D	0.5	-	1.9	4.6	12.1	-	-	0.7	8.0	1.0	2.9	3.0	-	1.0	2.1	1.0	4.6	2.4
38.1	0.9	-	1.7	3.4	2.9	-	-	1.0	5.4	1.2	2.1	1.1	-	1.2	1.7	1.0	1.6	1.7
38.2	1.1	-	0.9	2.4	1.6	-	-	0.7	1.3	0.7	1.9	1.0	-	1.0	2.0	1.0	1.0	2.4

Note:
(-) - Comparison not made due to data being qualified by a W, N, or * (see notes Table 5.3.19).
Mean - Means were computed using the reported detection limit for those samples with results reported as < detection limits (U qualified).
Ratios - Ratios were computed using the detection limit in those cases where less than detection concentrations were reported.

Tabel A43. (Page 3 of 3). Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Comparison of ABG subsurface soils to nearby "background samples". Ratio of sample concentration to mean background concentration for a specific metal or inorganic constituent is given. See Table 5.3.19 for complete data. MAX, MIN, and MEAN concentrations are mg/kg dry weight (ppm).

ABG - SWMU 03/10 - All SOIL BORING SAMPLES

ANALYTE PPM (MG/KG)

	AL	SB	AS	BA	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN	TP
Max	42000	*	52	1740	7.87	171000	86.4	29	616	129000	361	17300	2760	7.69	87.2	6.59	755	1550	3370	1220
Min	2630	*	2.0	23.1	0.02	74.4	6.8	6.8	3.1	7810	4.7	451	30.8	<0.10	3.7	<1.0	26.1	<5.0	9.39	56.3
Mean	12405	*	7.3	178.2	1.02	9472.8	19.4	14	41.3	27153	49.1	2371	804	0.39	21.3	1.2	88.2	31.6	248.8	245.2
ABG Background Soil Borings 1, 2, and 3 (03/10-1-93-1, 03/10-2-93-1, and 03/10-3-93-1)																				
Max	10100	*	5.2	69.3	0.03	622	15.9	*	6.7	28400	9.99	755	*	<0.10	7.8	<1.0	47.3	<5.0	39	131
Min	9150	*	2	23.1	< 0.02	74.4	10.9	*	3.1	9040	5.56	710	*	<0.10	3.7	<1.0	26.1	<5.0	9.39	56.3
Mean	8570	*	3.7	42.6	0.02	327.8	12.9	*	5.2	15596	7.52	738	*	< 0.10	5.6	<1.0	38.5	<5.0	26.6	102.4

COMPARISON OF BACKGROUND WITH ABG SOILS FOR SPECIFIC ANALYTE - GREATER CONCENTRATION IS INDICATED

	AL	SB	AS	BA	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN	TP
Max	ABG	-	ABG	ABG	ABG	ABG	ABG	-	ABG	ABG	ABG	ABG	-	ABG	ABG	ABG	ABG	ABG	ABG	ABG
Mean	ABG	-	ABG	ABG	ABG	ABG	ABG	-	ABG	ABG	ABG	ABG	-	ABG	ABG	ABG	ABG	ABG	ABG	ABG
RATIO ABG MAX / BACKGROUND MAX																				
	4.2	-	9.9	25.1	262.3	274.9	5.43	-	91.9	4.5	36.1	22.9	-	76.9	11.2	6.59	16.0	310.0	86.4	9.3
RATIO ABG MEAN / BACKGROUND MEAN																				
	1.4	-	2.0	4.2	51.0	28.9	1.5	-	7.9	1.7	6.5	3.2	-	3.9	3.8	1.20	2.3	6.3	9.4	2.4
RATIO ABG MIN / BACKGROUND MIN																				
	0.3	-	1.0	1.0	2.6	1.0	0.6	-	1.0	0.9	0.8	0.6	-	9.8	1.0	1.7	1.0	1.3	1.0	0.5

Note:
(*) - All data qualified by a W, N, or * (see notes Table 5.3.19) not used for these comparisons. Field duplicates also not used for these comparisons.
(-) - Comparison not made due to data being out of control limits.
Mean - Means were computed using the reported detection limit for those samples with results reported as < detection limits (U qualified).
Ratios - Ratios were computed using the detection limit in those cases where less than detection concentrations were reported.

Table A44. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Comparison of results of inorganic analyses of ABG subsurface soil samples to EPA Region III RBCs (risk-based concentrations) for industrial soils. Concentrations are mg/kg dry weight (ppm). Table entries shaded in gray indicate mean or max ABG surface soil concentration greater than the RBC.

ANALYTE	ABG SURFACE SOIL MAX	ABG SURFACE SOIL MEAN	RBC RISK-BASED CONCENTRATIONS* INDUSTRIAL SOIL
AL	42000	12405	1000000 n
SB	-	-	410 n
AS	52.1	7.29 (49)	1.6 c
AS	52.1	7.29	310 n
BA	1740	178.2	72000 n
CD	7.87	1.02	510 n
CA	171000	9473	-
CR	86.4	19.4	5100 n CR(VI)
CO	28.7	14.3	61000 n
CU	616	41.3	38000 n
FE	129000	27153	-
PB	361	49.1	-
MG	17300	2371	-
MN	2760	804	5100 n
HG	7.69	0.392	310 n
NI	87.2	21.3	20000 n
AG	6.59	1.2	5100 n
NA	755	88.2	-
SN	1550	31.6	610000 n
ZN	3370	249	310000 n
TP	1220	245.2	-

Notes:

Risk-Based Concentrations * - Risk-Based Concentration Table, Fourth Quarter 1994.
Roy L. Smith, Senior Toxicologist (3HW15), U.S. EPA Region III.
Risk Based Concentrations are in mg/kg. Basis of RBC: c = carcinogenic effect
Basis of RBC: c = carcinogenic effect; n = noncarcinogenic effect

MEAN - Mean computed using the reported detection limit for those samples with results reported as < detection limit (U qualified). See Table 5.3.20.

(-) - No risk-based concentration available.

(#) - Number of samples that exceeded the occupational soil risked-based concentration

CR(VI) - Chromium VI and compounds.

Table A45. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Method blanks associated with the analyses of ABG subsurface soil samples for inorganic constituents. Concentrations are mg/kg dry weight (ppm).

	ANALYTE																		
BLANK ID	AG	AL	AS	BA	CA	CD	CO	CR	CU	FE	HG	MG	MN	NA	NI	PB	SB	SN	ZN
MB1	1 U	2 U	0.2 U	2 U	22.3 B	0.02 U	1.5 B	1 U	0.6 U	5.4	N/A	27 U	0.6 U	26 B	1 U	0.61	0.3 UN	5 U	2.3
MB2	1 U*	6.9 B	0.2 U	2 U	85.7 B	0.078 B	1.5 U	1 U	0.6 U*	5.6 B	N/A	27 U	0.6 U	20 U	1 U	4 U*	0.3 UN	5 U	7.7
MB3	1 U	3.5 B	0.2 U	2 U	23.2 B	0.043 BN	1.5 U	1 U	6 U	4 B	0.100 U	27 U	0.6 U	20.1 B	1 U	4 U	0.3 UN	5 U	11.3
MB4	1 U	8.2 B	0.2 UN	2 U	87.4 B	0.02 U	1.5 U	1 U	0.6 U	7.4 B	N/A	27 U	0.6 U	20 U	1 U	4 U*	0.3 UN	0.05 U	7.6
MB5	1 U	5.6 B	0.2 U	20 U	45.6 B	0.086 BN	2.7 B	1 U	0.6 U	6.2 B	N/A	27 U	0.6 U	20 U	1 B	4 U	0.3 UN	5 U	2.3
MB6	1 U	3.4 B	0.2 U	2 U	20	0.024 B	1.5 U	1 U	0.6 U	4.6 B	N/A	20 U	0.6 U	20 B	1 U	0.4	0.3 UN	0.05 U	1.3 B
MB7	1 U	4.7 B	0.2 U	2 U	20 U	0.02 U	1.5 U*	1 U	0.6 U	2.5 U	N/A	27 U	0.6 U*	26.4 B	1 U	0.44	0.3 UN	5 U	1.3 B
MB8	1 U	3.2 B	0.2 U	2 U	200 U	0.024 B	1.5 B	10 B	1.1	4.5 B	N/A	27 U	0.7 B	20.3 B	1 U	0.4	0.3 UN	5 U	1 U

Note:
BLK DGST 1 - Blank Digest run with samples from borings 12, 14, 38, 37, and 1 Dup
BLK DGST 2 - Blank Digest run with samples from borings 19, 23, 17, 16, 15, and 16 Dup
BLK DGST 3 - Blank Digest run with samples from borings 21, 24, 34, and 37 Dup.
BLK DGST 4 - Blank Digest run with samples from borings 31, 32, 25, 29, and 28.
BLK DGST 5 - Blank Digest run with samples from borings 38, 35, 33, and 33 Dup.
BLK DGST 6 - Blank Digest run with samples from borings 5, 6, 8, 13, and 8 Dup.
BLK DGST 7 - Blank Digest run with samples from borings 1, 2, 3, 7, 9, and 22.
BLK DGST 8 - Blank Digest run with samples from borings 10 and 11.
U - Analyte was analyzed for but not detected. Detection limts are given before the U symbol.
B - Reported value is less than the Contract Required Detection Limit but greater than the Instrument Detection Limit
N - Spike recovery not within control limits
* - Duplicate analysis not within control limits.

Table A46. Ammunition Burning Ground., NWSC, Crane, Indiana, SWMU #03/10. Results of analyses of equipment rinses and field blanks associated with the sampling of subsurface soils for inorganic analytes. Concentrations are mg/l (ppm).

BLANK ID	AL	SB	AS	BA	CD	CA	CR	CO	CU	FE	PB	MG	MN	HG	NI	AG	NA	SN	ZN	TP
RINSE 1	0.311	0.0030 U	0.0020 U	0.021 B	0.00088 B	14.5	0.010 U	0.015 B	0.0060 U	0.635	0.0024 B	3.25 B	0.025	0.0002 U	0.010 U	0.010 U	5.46	0.050 U	0.029	0.2 U
FIELD BLK	0.308	0.0030 U	0.0020 U	0.028 B	0.00020 U	15.3	0.010 U	0.024 B	0.0060 U	0.675	0.0032	3.61 B	0.030	0.0002 U	0.010 U	0.010 U	5.19	0.050 U	0.075	0.2 U
RINSE 2	0.159 B	0.0030 U	0.0020 U	0.020 U	0.00020 U	14.9	0.010 U	0.018 BN	0.0060 U	1.61	0.0010 U	3.22 B	0.049	0.0002 U	0.010 U	0.010 U	5.20	0.050 U	0.010 U	0.2 U
RINSE 3	0.204	0.0030 U	0.0020 U	0.020 U	0.00020 U	14.9	0.010 U*	0.020 B	0.0060 U	1.73	0.0020 B	3.11 B	0.056	0.0002 U	0.010 U	0.010 U	5.44	0.050 U	0.017 B	0.2 U
RINSE 4	0.128 B	0.0030 U	0.0020 U	0.020 U	0.00020 U	15.5	0.010 U	0.024 B	0.0060 U	1.69 N	0.0010 U	3.42 B	0.047	0.0002 U	0.010 U	0.010 U	5.27	0.050 U	0.010 U	0.2 U
RINSE 5	0.127 B	0.0030 U	0.0020 U	0.020 U	0.00020 U	16.1	0.010 U	0.028 B*	0.0060 U	2.93	0.0010 U	3.36 B	0.072	0.0002 U	0.010 U	0.010 U	5.13	0.050 U	0.010 U	0.2 U

Note:

RINSATE and FIELD BLANK DESCRIPTION

RINSE 1 - Collected 8/20/93; borings 10 and 11 collected this day

RINSE 2 - Collected 8/23/93; borings 1, 2, 3, 7, 8, 13, and 22 collected this day

RINSE 3 - Collected 8/23/93; borings 12, 14, 22, 24, 34, 36, and 37 collected this day

RINSE 4 - Collected 8/25/93; borings 25, 28, 29, 31, and 32 collected this day

RINSE 5 - Collected 8/26/93; borings 19, and 23 collected this day

FIELD BLANK - Collected 8/20/93

U - Analyte was analyzed for but not detected. Detection limits are given before the U symbol.

B - Reported value is less than the Contract Required Detection Limit but greater than the Instrument Detection Limit

N - Spike recovery not within control limits

* - Duplicate analysis not within control limits.

Appendix B
Boring Logs

Hole No. 03/10-1-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) See Boring Location Map	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-1-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED 1-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 8/21/93: COMPLETED 8/21/93
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN 1.0'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN
9. TOTAL DEPTH OF HOLE 1.0'	

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		CH, Brownish orange, fat clay.	100%	1 0"-12"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1515 Duplicate sample #5 taken
	1		REFUSAL @ 1.0'			
			BOTTOM OF HOLE 1.0' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			NOTE: Hole was dry during drilling and after completion.

B-1

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-2-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) :03/10-2-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED : :UNDISTURBED :1-chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE :STARTED :8/21/93 :COMPLETED :8/21/93
7. THICKNESS OF OVERBURDEN 1.0'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 1.0'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION a	FT 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
	0		CH, Brownish orange, fat clay	100%	1 0"-12"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1545
	1		REFUSAL @ 1.0'			
			BOTTOM OF HOLE @ 1.0' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			NOTE: Hole was dry during drilling and after completion.

B-2

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT | HOLE NO.

Hole No. 03/10-3-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-3-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED 1-chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 8/21/93: COMPLETED 8/21/93
7. THICKNESS OF OVERBURDEN 2.1'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 2.1'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Brownish orange, sandy silt			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1605
	1			100%	1 0"-24"	NOTE: Hole was dry during drilling and after completion.
	2		REFUSAL @ 2.1'			
			BOTTOM OF HOLE @ 2.1' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-3

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT | HOLE NO.

Hole No. 03/10/5-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) : 03/10-5-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	:DISTURBED :1-Geotech :UNDISTURBED :2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	:STARTED :8/20/93 :COMPLETED :8/20/93
		17. ELEVATION TOP OF HOLE	
7. THICKNESS OF OVERBURDEN 4.6'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
8. DEPTH DRILLED INTO ROCK N/A		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	
9. TOTAL DEPTH OF HOLE 4.6'			

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SC, Dark brown, clayey sand, trace of gravel			NOTE: Sample w/3" dia. 3.0' long Shelby tube
			ML, Dark brown, clayey silt			HNU= 0 TIME 1050
	1			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2					
	3		CH, Grayish tan, fat clay, few rock fragments.			HNU=0 TIME 1105
	4			100%	2 30"-53"	NOTE: Geotech. Sample taken at 30"-53"
	4.6		REFUSAL @ 4.6'			
			BOTTOM OF HOLE @ 4.6' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-4

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-6-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) :03/10-6-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED :1-Geotech :UNDISTURBED :2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE :STARTED :8/20/93 :COMPLETED :8/20/93
7. THICKNESS OF OVERBURDEN 3.4'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 3.4'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION a	FT 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
	1		ML, Brown, clayey silt, trace of gravel	100%	1 0"-30"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU-0 TIME 1012 NOTE: Hole was dry during drilling and after completion.
	2		CH, Gray, fat clay, with little sand and rock fragments			
	3			100%	2 30"-39"	HNU-0 TIME 1025 Geotech. Sample taken 30"-39"
	3.4		REFUSAL @ 3.4'			
			BOTTOM OF HOLE 3.4' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-7-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-7-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1-Geotech.; UNDISTURBED 2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 8/21/93; COMPLETED 8/21/93
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN 5.0'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN
9. TOTAL DEPTH OF HOLE 5.0'	

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Brown, clayey silt, with gravel			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1425
	1			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2					
	3					HNU- 0 TIME 1440
	4		With some gray silty sand.	100%	2 30"-60"	NOTE: Geotech. sample taken 30"-60"
	5		REFUSAL @ 5.0' BOTTOM OF HOLE @ 5.0' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-6

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

Hole No. 03/10-8-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-8-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1-Geotech.; UNDISTURBED 1-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 8/21/93; COMPLETED 8/21/93
7. THICKNESS OF OVERBURDEN 2.5'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 2.5'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SC, Brown, clayey sand			NOTE: Sample w/3" dia. 3.0' long Shelby tube
			CH, Brown, fat clay			HNU- 0 TIME 0945
	1			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2					NOTES: Duplicate sample #4 taken Geotech. sample 0"-30"
	2.5		REFUSAL @ 2.5' BOTTOM OF HOLE @ 2.5'			
			NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-7

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-9-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION :WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) :03/10-9-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED : :UNDISTURBED :1-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE :STARTED :8/20/93 :COMPLETED :8/20/93
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN 1.5'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN
9. TOTAL DEPTH OF HOLE 1.5'	

ELEVATION a	FT 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
	0		ML, Brown, clayey silt, trace of chert gravel	100%	1 0"-18"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 0938 NOTE: Hole was dry during drilling and after completion.
	1					
	1.5		BOTTOM OF HOLE @ 1.5' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-8

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

Hole No. 03/10-10-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) :03/10-10-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED :1-Geotech. :UNDISTURBED :2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ~~ELEVATION~~ GROUND WATER Level 4.0'
	16. DATE HOLE :STARTED :8/19/93 :COMPLETED :8/19/93
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN 4.2'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR ZAINUL KIDWAI/LARRY BENJAMIN
9. TOTAL DEPTH OF HOLE 4.2'	

ELEVATION a	FT 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
	0		ML, Dark brown, clayey silt, plastic, few rock fragments.	100%	1 0"-28"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1500 NOTE: Water Level during drilling 4.0' 24 hrs. 4.0'
	1 2					
	3 4		SC, Light and dark brown, clayey sand, few rock fragments, bottom sample saturated.	100%	2 28"-48"	HNU- 0 TIME 1530 Geotech. sample 28"-48"
			BOTTOM OF HOLE @ 4.2' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-9

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-11-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-11-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1-Geotech.; UNDISTURBED 2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN 5.2'	16. DATE HOLE: STARTED 8/19/93; COMPLETED 8/19/93
8. DEPTH DRILLED INTO ROCK N/A	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE 5.2'	18. TOTAL CORE RECOVERY FOR BORING N/A %
	19. SIGNATURE OF INSPECTOR ZAINUL KIDWAI/LARRY BENJAMIN

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Dark and light brown, clayey silt, low plasticity, some rock fragments.			NOTE: Sample w/3" dia. 3.0' long Shelby tube
						HNU- 0.5 TIME 1415
	1			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2					
	3					HNU- 0 TIME 1430
	4			100%	2 30"-62"	Geotech. sample 30"-62"
			Little silt at tip			
	5					
	5.2		REFUSAL @ 5.2'			
			BOTTOM OF HOLE @ 5.2'			
			NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-10

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

Hole No. 03/10-12-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) :03/10-12-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED :1-Geotech. :UNDISTURBED :3-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE :STARTED :8/22/93 :COMPLETED :8/22/93
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN 10.0'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN
9. TOTAL DEPTH OF HOLE 10.0'	

ELEVATION a	FT 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
	0		ML, Brown, clayey silt, with some rock fragments.	100%	1 0"-30"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 0945 NOTE: Water Level during drilling @ 10.0' 24 hrs. cave in @ 8.0'
	2			100%	2 30"-60"	HNU- 0 TIME 1020 Geotech. sample 30"-60"
	4		Dark brown, moist			
	6					
	8		Grayish tan	100%	3 90"-120"	HNU- 0 TIME 1100
	10		BOTTOM OF HOLE @ 10.0' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-11

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71 | PROJECT | HOLE NO.

Hole No. 03/10-13-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-13-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED	UNDISTURBED 2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED 8/21/93	COMPLETED 8/21/93
		17. ELEVATION TOP OF HOLE	
7. THICKNESS OF OVERBURDEN 4.6'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
8. DEPTH DRILLED INTO ROCK N/A		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	
9. TOTAL DEPTH OF HOLE 4.6'			

ELEVATION a	FT 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
	0		ML, Dark brown, clayey silt, trace of gravel and wood			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 0845
	1			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2					
			With wood			HNU- 0 TIME 0905
	3			100%	2 30"-54"	
	4					
	4.6		REFUSAL @ 4.6' BOTTOM OF HOLE @ 4.6' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-12

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-14-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) :03/10-14-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED :1-Geotech.	:UNDISTURBED :2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE :STARTED :8/22/93	:COMPLETED :8/22/93
7. THICKNESS OF OVERBURDEN 3.8'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 3.8'		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	

ELEVATION a	FT 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
	0		ML, Brown, sandy silt			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 0850
	1			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2					
	3		Clayey silt, with rock fragments	100%	2 30"-45"	HNU- 0 TIME 1430 Geotech. sample 30"-45"
	3.8		REFUSAL @ 3.8'			
			BOTTOM OF HOLE @ 3.8' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-13

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-15-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-15-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED 1-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN 0.8'	16. DATE HOLE: STARTED 8/25/93: COMPLETED 8/25/93
8. DEPTH DRILLED INTO ROCK N/A	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE 0.8'	18. TOTAL CORE RECOVERY FOR BORING N/A %
	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION a	FT 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
	0		ML, Brown, clayey silt, trace of gravel	100%	1 0"-10"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1330
	0.8		REFUSAL @ 0.8'			
			BOTTOM OF HOLE @ 0.8' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			NOTE: Hole was dry during drilling and after completion.

B-14

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71 | PROJECT | HOLE NO.

Hole No. 03/10-16-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) :03/10-16-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED : :UNDISTURBED :1-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE :STARTED :8/25/93 :COMPLETED :8/25/93
7. THICKNESS OF OVERBURDEN 1.5'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 1.5'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION a	FT 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
	0		ML, Brown, clayey silt, trace of gravel			NOTE: Sample w/3" dia. 3.0' long Shelby tube
	1		Some gray sand	100%	1 0"-18"	HNU- 0 TIME 1255 NOTE: Hole was dry during drilling and after completion.
	1.5		REFUSAL @ 1.5'			
			BOTTOM OF HOLE @ 1.5' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			Duplicate sample #8 taken

B-15

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-19-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) :03/10-19-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED :1-Geotech. :UNDISTURBED :3-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE :STARTED :8/25/93 :COMPLETED :8/25/93
7. THICKNESS OF OVERBURDEN 7.3'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 7.3'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Brown, clayey silt, with gravel	100%	1 0"-30"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 0905 NOTE: Water Level during drilling dry 24 hrs. dry
	2		CH, Brown, fat clay	100%	2 30"-60"	HNU- 0 TIME 0925 Geotech. sample 30"-60"
	4			100%	3 60"-87"	HNU- 0 TIME 0945
	6					
	7.3		SM, Black, fine, silty sand, moist REFUSAL @ 7.3'			
			BOTTOM OF HOLE @ 7.3'			

NOTE: Soils field classified in accordance with the Unified Soil Classification System.

B-17

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-17-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) :03/10-17-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED :1-Geotech.	:UNDISTURBED :3-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE :STARTED :8/25/93	:COMPLETED :8/25/93
		17. ELEVATION TOP OF HOLE	
7. THICKNESS OF OVERBURDEN 7.5'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
8. DEPTH DRILLED INTO ROCK N/A		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	
9. TOTAL DEPTH OF HOLE 7.5'			

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Brown, clayey silt, with trace of gravel			NOTE: Sample w/3" dia. 3.0' long Shelby tube
				100%	1 0"-30"	HNU- 0.1 TIME 1120 NOTE: Water Level during drilling @ 7.5' 24 hrs. cave in @ 3.2'
	2					
	4			100%	2 30"-60"	HNU- 0.1 TIME 1135 Geotech. sample 30"-60"
	6			100%	3 60"-90"	HNU- 0.1 TIME 1155
	7.5		BOTTOM OF HOLE @ 7.5' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-16

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71 | PROJECT | HOLE NO.

Hole No. 03/10-21-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING-1500
4. HOLE NO. (As shown on drawing title and file number) :03/10-21-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN :DISTURBED :1-Geotech. :UNDISTURBED :3-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE :STARTED :8/22/93 :COMPLETED :8/22/93
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN 7.5'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN
9. TOTAL DEPTH OF HOLE 7.5'	

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Brown, clayey silt, with trace of gravel	100%	1 0"-30"	NOTE: Sample w/3' dia. 3.0' long Shelby tube HNU= 0 TIME 1600 NOTE: Water Level during drilling @ 7.5' 24 hrs. cave in @ 6.5'
	2		SC, Light and dark brown, Clayey sand, few rock fragments.	100%	2 30"-60"	HNU= 0 TIME 1630 Geotech. sample 30"-60"
	4			100%	3 60"-90"	HNU= 0 TIME 1655
	6					
	7.5		BOTTOM OF HOLE @ 7.5' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-18

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

Hole No. 03/10-22-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-22-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1-Geotech. UNDISTURBED 3-Chemical	
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE STARTED 8/21/93 COMPLETED 8/21/93	
7. THICKNESS OF OVERBURDEN 7.1'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 7.1'		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Brown, clayey silt, with trace of gravel	100%	1 0"-30"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1050 NOTE: Hole was dry during drilling and after completion.
	2					
	4		CH, Brownish orange, fat clay	100%	2 30"-60"	HNU- 0 TIME 1110 Geotech. sample 30"-60"
	6			100%	3 60"-84"	HNU-0 TIME 1120
	7.1		REFUSAL @ 7.1'			
			BOTTOM OF HOLE @ 7.1' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-19

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-23-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-23-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1-Geotech.; UNDISTURBED 3-Chemical
	14. TOTAL NUMBER CORE BOXES N/A
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	15. ELEVATION GROUND WATER Level 4.1'
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	16. DATE HOLE STARTED 8/25/93; COMPLETED 8/25/93
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN 6.7'	18. TOTAL CORE RECOVERY FOR BORING N/A %
8. DEPTH DRILLED INTO ROCK N/A	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN
9. TOTAL DEPTH OF HOLE 6.7'	

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Brown, clayey silt, with traces of gravel	100%	1 0"-30"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1020 NOTE: Water Level during drilling @ 6.5' 24 hrs. @ 4.1'
	2		Grayish tan	100%	2 30"-60"	HNU- 0 TIME 1045 Geotech. sample 30"-60"
	4		Sandy silt, dense, moist	100%	3 60"-80"	HNU- 0 TIME 1100
	6					
	6.7		BOTTOM OF HOLE @ 6.7' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-20

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-24-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-24-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: ; UNDISTURBED: 1-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 8/22/93; COMPLETED 8/22/93
7. THICKNESS OF OVERBURDEN 0.5'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 0.5'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0.0		SM, Tan, fine/med. silty sand with gravel REFUSAL @ 0.5'	100%	1 0"-6"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1445
	0.5		BOTTOM OF HOLE @ 0.5' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			NOTE: Hole was dry during drilling and after completion.

B-21

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-25-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-25-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 1-Geotech.; UNDISTURBED 2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE STARTED 8/24/93 COMPLETED 8/24/93
7. THICKNESS OF OVERBURDEN 3.2'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 3.2'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION a	FT 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
	0		ML, Brown, clayey silt, trace of gravel			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU= 0 TIME 1100
	1		Sandy silt, tan	100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2		Clayey silt, with trace of rock fragments	100%	2 30"-38"	HNU= 0 TIME 1125 Geotech. sample 30"-38"
	3 3.2		REFUSAL @ 3.2'			
			BOTTOM OF HOLE @ 3.2' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-22

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-31-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-31-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: ; UNDISTURBED: 1-Chemical	
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 8/24/93; COMPLETED 8/24/93	
7. THICKNESS OF OVERBURDEN 1.5'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 1.5'		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	

ELEVATION a	FT 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
	0		ML, Brown, clayey silt, trace of nails and with gravel			NOTE: Sample w/3" dia. 3.0' long Shelby tube
	1				1 0"-18"	HNU= 0.1 TIME 0855 NOTE: Hole was dry during drilling and after completion.
	1.5		REFUSAL @ 1.5' BOTTOM OF HOLE @ 1.5' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-25

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-32-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2; PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-32-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: ; UNDISTURBED: 1-Chemical	
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 8/24/93; COMPLETED 8/24/93	
7. THICKNESS OF OVERBURDEN 1.2'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 1.2'		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	

ELEVATION a	FT 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
			ML, Tan, sandy silt	100%	1 0"-12"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1025 NOTE: Hole was dry during drilling and after completion.
	1					
	1.2		REFUSAL @ 1.2'			
			BOTTOM OF HOLE @ 1.2'			
			NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-26

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-33-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS

1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA	10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-33-93	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED: UNDISTURBED: 1-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE STARTED 8/23/93 COMPLETED 8/23/93
7. THICKNESS OF OVERBURDEN 2.5'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK N/A	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 2.5'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION a	FT 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
	0		ML, Brown, clayey silt trace of grass and with gravel			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1500
	1			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2					Duplicate sample #7 taken
	2.5		REFUSAL @ 2.5'			
			BOTTOM OF HOLE @ 2.5' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-27

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-34-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-34-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 1-Geotech. / UNDISTURBED 2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED 8/22/93 / COMPLETED 8/22/93
		17. ELEVATION TOP OF HOLE	
7. THICKNESS OF OVERBURDEN 5.0'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
8. DEPTH DRILLED INTO ROCK N/A		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	
9. TOTAL DEPTH OF HOLE 5.0'			

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		ML, Brownish orange, clayey silt, trace of gravel			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1330
	1			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	2					
	3		CH, Brownish tan, fat clay, trace of rock fragments			HNU- 0 TIME 1400
	4			100%	2 30"-60"	Geotech. sample 30"-60"
	5		REFUSAL @ 5.0' BOTTOM OF HOLE @ 5.0' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-28

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT | HOLE NO.

Hole No. 03/10-35-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-35-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 1-Geotech. / UNDISTURBED 2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED 8/23/93 / COMPLETED 8/23/93
7. THICKNESS OF OVERBURDEN 4.4'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 4.4'		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	

ELEVATION a	FT 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
	0		ML, Brown, sandy silt, trace of roots			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1358
	1 2			100%	1 0"-30"	NOTE: Hole was dry during drilling and after completion.
	3		SM, Tan, fine, silty sand			HNU- 0 TIME 1415
	4		ML, Clayey silt, brown, with gravel	100%	2 30"-51"	Geotech. sample 30"-50"
	4.4		REFUSAL @ 4.4' BOTTOM OF HOLE @ 4.4' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-29

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT | HOLE NO.

Hole No. 03/10-36-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-36-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: ; UNDISTURBED: 1-Chemical	
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 8/22/93; COMPLETED 8/22/93	
7. THICKNESS OF OVERBURDEN 1.0'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 1.0'		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	

ELEVATION a	FT 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
	1		ML, Tan, sandy silt, with rock fragments and asphalt REFUSAL @ 1.0'	100%	1 0"-12"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0.5 TIME 1145
			BOTTOM OF HOLE @ 1.0' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			NOTE: Hole was dry during drilling and after completion.

B-30

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-37-93

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART2, PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station) SEE BORING LOCATION MAP		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-37-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED 1-Chemical	
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 8/22/93: COMPLETED 8/22/93	
7. THICKNESS OF OVERBURDEN 2.0'		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 2.0'		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	

ELEVATION	FT DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		SC, Tan, clayey sand.			NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1305
	1		ML, Brown, clayey silt, trace of gravel	100%	1 0"-24"	NOTE: Hole was dry during drilling and after completion.
	2		REFUSAL @ 2.0' BOTTOM OF HOLE @ 2.0'			Duplicate sample #6 taken

NOTE: Soils field classified in accordance with the Unified Soil Classification System.

B-31

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03/10-38-93

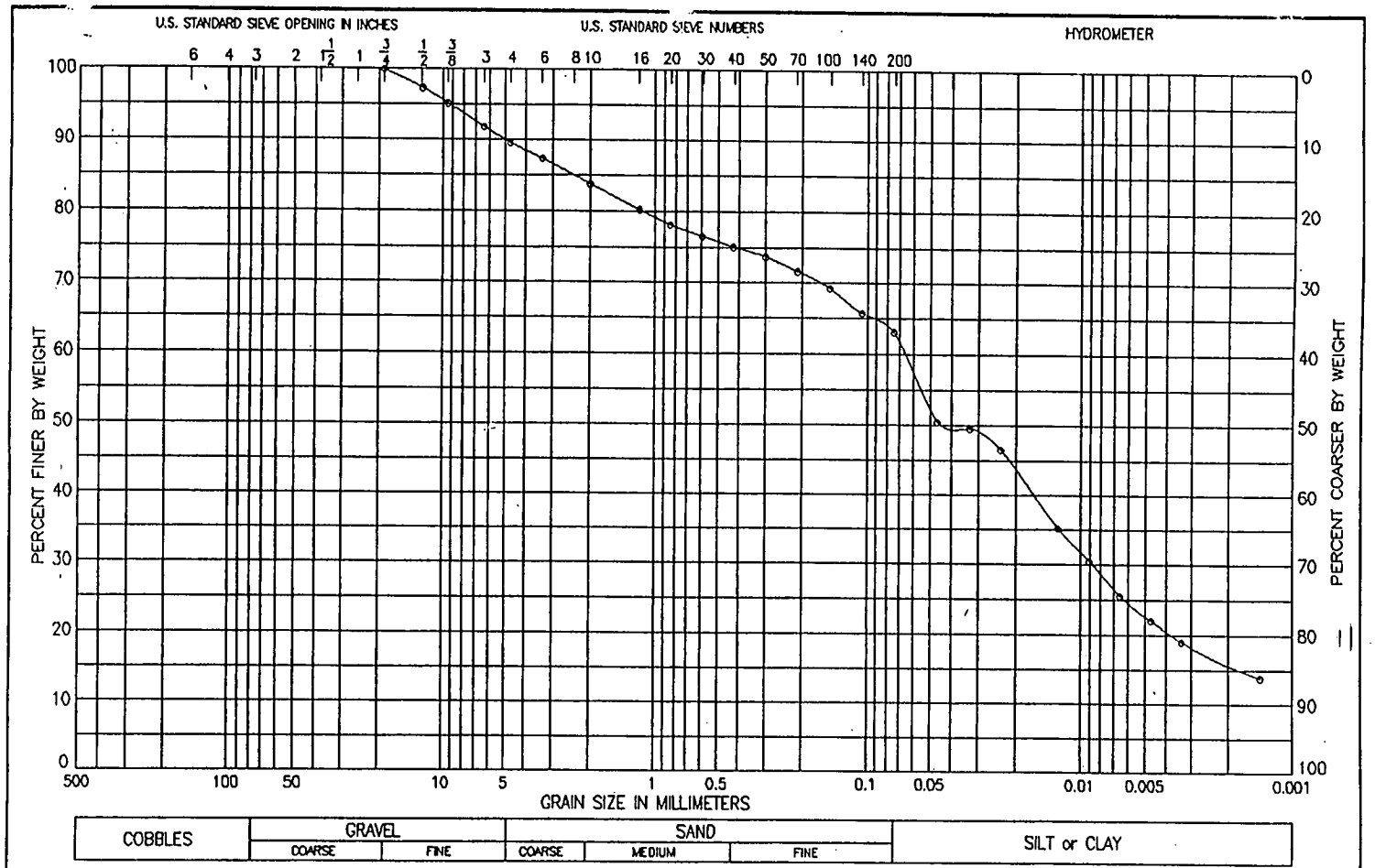
DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT ABG 03/10 RFI PART 2: PHASE III SOILS NSWC, CRANE, INDIANA		10. SIZE AND TYPE OF BIT 3" DIA. SHELBY TUBE	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY WATERWAYS EXPERIMENT STATION		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 03/10-38-93		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 1-Geotech. / UNDISTURBED 2-Chemical
5. NAME OF DRILLER ELASTIC BROWN/VON NIXON		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED 8/23/93 / COMPLETED 8/23/93
		17. ELEVATION TOP OF HOLE	
7. THICKNESS OF OVERBURDEN 4.0'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
8. DEPTH DRILLED INTO ROCK N/A		19. SIGNATURE OF INSPECTOR LARRY BENJAMIN	
9. TOTAL DEPTH OF HOLE 4.0'			

ELEVATION a	FT 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
	1		ML, Brown, clayey silt,	100%	1 0"-30"	NOTE: Sample w/3" dia. 3.0' long Shelby tube HNU- 0 TIME 1317 NOTE: Hole was dry during drilling and after completion,
	2					
	3		Rusted brown, sandy silt	100%	2 30"-48"	HNU- 0 TIME 1330 Geotech. sample 30"-48"
	4		REFUSAL @ 4.0'			
			BOTTOM OF HOLE @ 4.0' NOTE: Soils field classified in accordance with the Unified Soil Classification System.			

B-32

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Appendix C
Physical Analyses of Soils



LL	PL	PI	GS	NAT W,%	ORG,%
35	18	17	2.69 EST		3.2

CLASSIFICATION
SANDY CLAY (CL), BROWN; WITH GRAVEL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 5 SAMPLE NO. 1115

DEPTH/ELEV 30–54" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

ROJECT: CRANE, ABG SOILS, PART 2

BORING: 5 SAMPLE: 1115 DF: MD1495 .DAT
DEPTH: 30-54" DATE: 17 MAR 95

LL: 35 PL: 18 PI: 17 GS: 2.69 est WC: .00 OC: 3.20
CLASSIFICATION: 108
SANDY CLAY (CL), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 424.5 gms.
PARTIAL WEIGHT AFTER SPLIT: 56.8 gms.

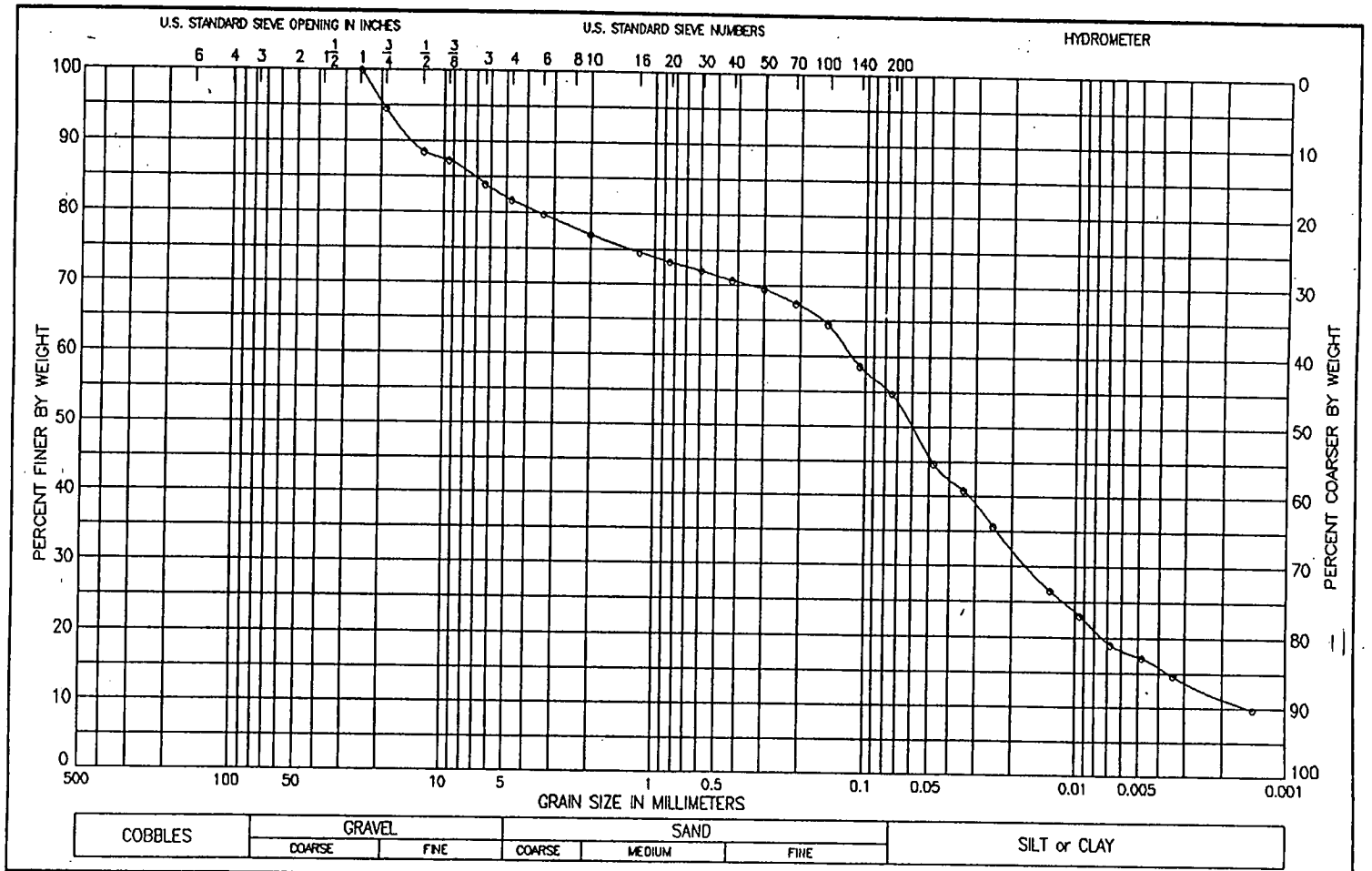
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	3/4 in	19.100	100.0	.0
11.2	1/2 in	12.500	97.4	2.6
9.1	3/8 in	9.500	95.2	4.8
14.3	No 3	6.350	91.8	8.2
9.5	No 4	4.750	89.6	10.4
9.6	No 6	3.350	87.3	12.7
15.2	No 10	2.000	83.8	16.2
2.4	No 16	1.180	80.2	19.8
3.8	No 20	.850	78.2	21.8
4.9	No 30	.600	76.5	23.5
5.9	No 40	.425	75.1	24.9
6.8	No 50	.300	73.7	26.3
8.2	No 70	.212	71.7	28.3
9.8	No 100	.150	69.3	30.7
12.2	No 140	.106	65.8	34.2
14.0	No 200	.075	63.1	36.9

HYDROMETER:

RDGS	TEMP			
21.5	22.5	.0466	50.5	49.5
21.1	22.5	.0331	49.5	50.5
19.8	22.5	.0237	46.5	53.5
15.0	22.5	.0128	35.2	64.8
12.9	23.0	.0091	30.5	69.5
10.8	23.0	.0066	25.6	74.4
9.3	23.0	.0047	22.1	77.9
8.0	23.0	.0034	19.0	81.0
6.0	22.0	.0014	13.9	86.1

PERCENT GRAVEL = 10.4
PERCENT SAND = 26.5
PERCENT FINES = 63.1

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
40	18	22	2.69 EST		3.8

CLASSIFICATION
GRAVELLY SANDY CLAY (CL), GRAY

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 6 SAMPLE NO. 1030

DEPTH/ELEV 30-40" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 6 SAMPLE: 1030 DF: MD1495 .DAT
DEPTH: 30-40" DATE: 17 MAR 95

LL: 40 PL: 18 PI: 22 GS: 2.69 est WC: .00 OC: 3.80
CLASSIFICATION: 108
GRAVELLY SANDY CLAY (CL), GRAY

TOTAL WEIGHT OF SAMPLE: 753.5 gms.
PARTIAL WEIGHT AFTER SPLIT: 52.1 gms.

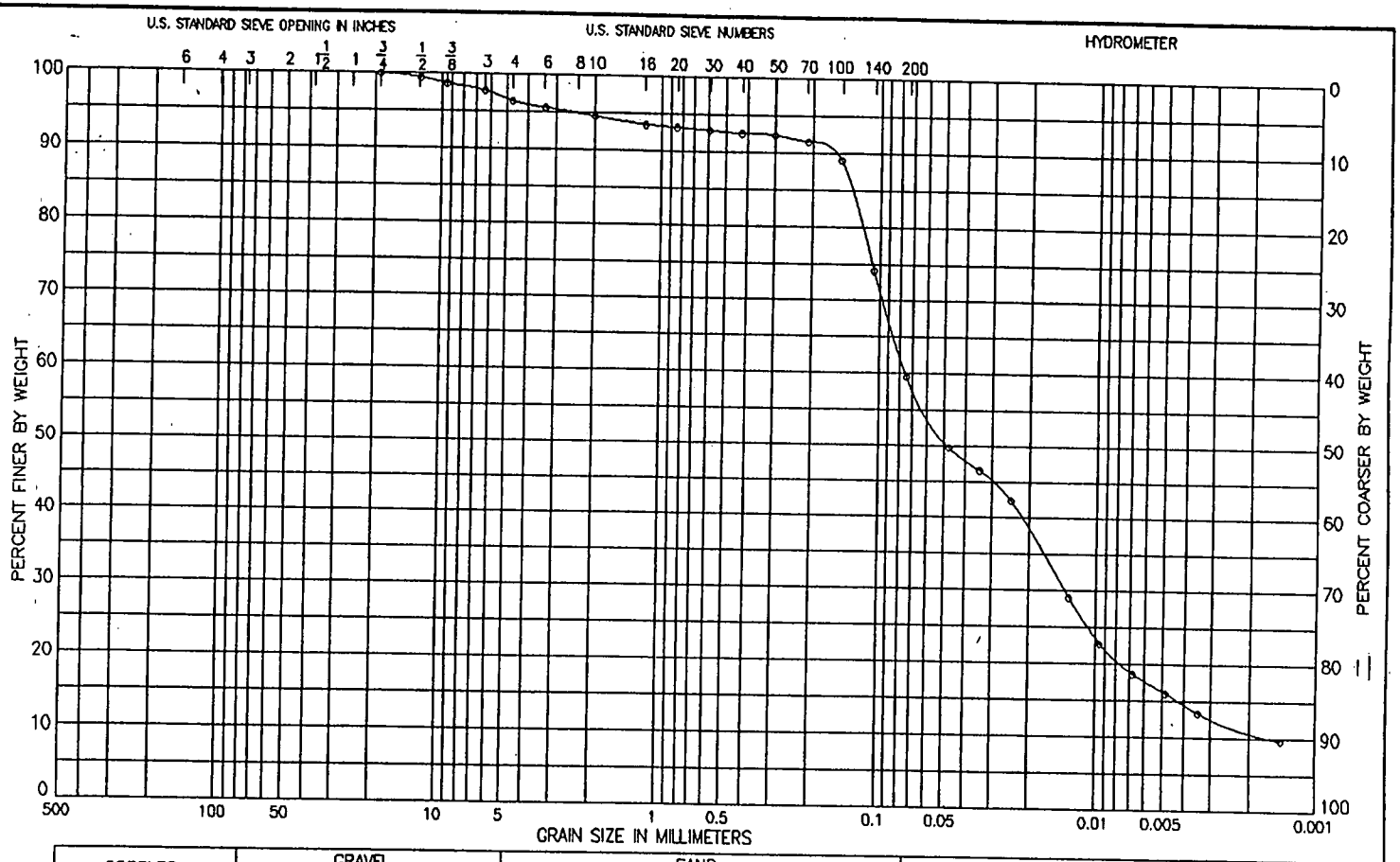
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1 in	25.000	100.0	.0
40.9	3/4 in	19.100	94.6	5.4
45.5	1/2 in	12.500	88.5	11.5
9.0	3/8 in	9.500	87.3	12.7
25.6	No 3	6.350	83.9	16.1
16.6	No 4	4.750	81.7	18.3
15.0	No 6	3.350	79.7	20.3
21.2	No 10	2.000	76.9	23.1
1.6	No 16	1.180	74.6	25.4
2.5	No 20	.850	73.2	26.8
3.3	No 30	.600	72.1	27.9
4.2	No 40	.425	70.7	29.3
5.0	No 50	.300	69.6	30.4
6.4	No 70	.212	67.5	32.5
8.4	No 100	.150	64.5	35.5
12.4	No 140	.106	58.6	41.4
15.0	No 200	.075	54.8	45.2

HYDROMETER:

RDGS	TEMP			
19.0	22.5	.0478	44.7	55.3
17.4	22.5	.0344	40.9	59.1
15.2	22.5	.0248	35.7	64.3
11.3	22.5	.0133	26.6	73.4
9.8	22.5	.0095	23.0	77.0
8.1	22.5	.0068	19.0	81.0
7.2	23.0	.0048	17.2	82.8
6.1	23.0	.0034	14.6	85.4
4.3	22.0	.0014	9.9	90.1

PERCENT GRAVEL = 18.3
PERCENT SAND = 27.0
PERCENT FINES = 54.8

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
28	16	12	2.69 EST		2.5

CLASSIFICATION
GRAVELLY SANDY CLAY (CL), BROWN; TRACE OF GRAVEL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 7 SAMPLE NO. 1445

DEPTH/ELEV 30-60" DATE 17 MAR 95

GRADATION CURVE

LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 7 SAMPLE: 1445 DF: MD1495 .DAT
DEPTH: 30-60" DATE: 17 MAR 95

LL: 28 PL: 16 PI: 12 GS: 2.69 est WC: .00 OC: 2.50
CLASSIFICATION: 108
GRAVELLY SANDY CLAY (CL), BROWN; TRACE OF GRAVEL

TOTAL WEIGHT OF SAMPLE: 578.1 gms.
PARTIAL WEIGHT AFTER SPLIT: 57.5 gms.

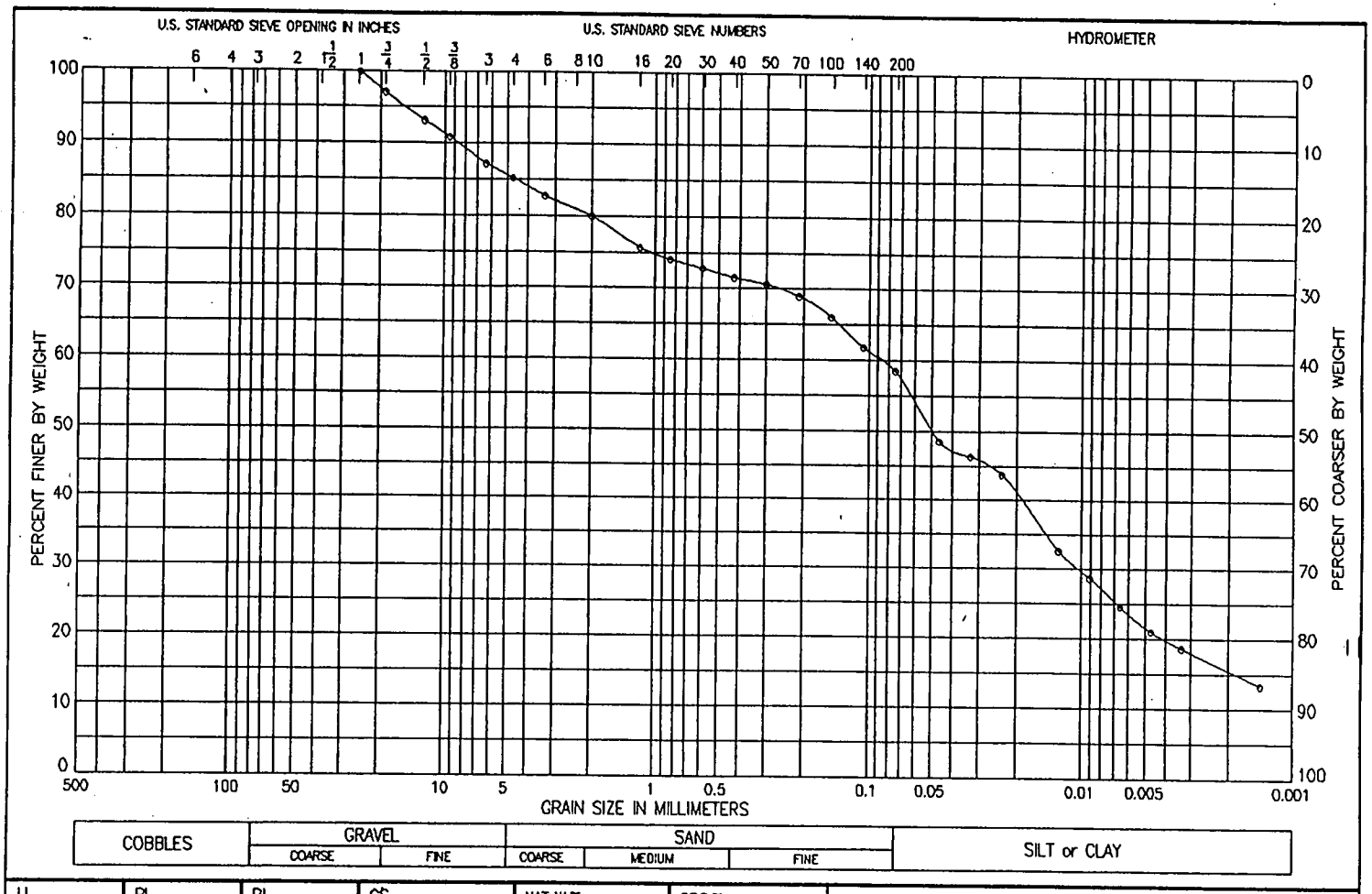
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	3/4 in	19.100	100.0	.0
2.9	1/2 in	12.500	99.5	.5
4.6	3/8 in	9.500	98.7	1.3
5.2	No 3	6.350	97.8	2.2
7.7	No 4	4.750	96.5	3.5
4.8	No 6	3.350	95.6	4.4
6.2	No 10	2.000	94.6	5.4
.6	No 16	1.180	93.6	6.4
.8	No 20	.850	93.3	6.7
1.0	No 30	.600	92.9	7.1
1.2	No 40	.425	92.6	7.4
1.3	No 50	.300	92.4	7.6
1.8	No 70	.212	91.6	8.4
3.3	No 100	.150	89.1	10.9
12.4	No 140	.106	74.2	25.8
21.3	No 200	.075	59.5	40.5

HYDROMETER:

RDGS	TEMP			
19.0	22.5	.0478	49.7	50.3
17.8	22.5	.0342	46.6	53.4
16.2	22.5	.0246	42.4	57.6
11.1	22.5	.0133	29.1	70.9
8.7	22.5	.0096	22.8	77.2
7.0	23.0	.0068	18.6	81.4
6.0	23.0	.0049	16.0	84.0
5.0	23.0	.0035	13.4	86.6
3.8	22.0	.0014	9.7	90.3

PERCENT GRAVEL = 3.5
PERCENT SAND = 36.9
PERCENT FINES = 59.5

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
37	17	20	2.69 EST		5.7

CLASSIFICATION
GRAVELLY SANDY CLAY (CL), BROWN

GRADATION CURVE | LABORATORY USAE WES – STF/GL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 8 SAMPLE NO. 0910

DEPTH/ELEV 24–30" DATE 17 MAR 95

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 8 SAMPLE: 0910 DF: MD1495 .DAT
DEPTH: 24-30" DATE: 17 MAR 95

LL: 37 PL: 17 PI: 20 GS: 2.69 est WC: .00 OC: 5.70
CLASSIFICATION: 108
GRAVELLY SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 501.6 gms.
PARTIAL WEIGHT AFTER SPLIT: 58.2 gms.

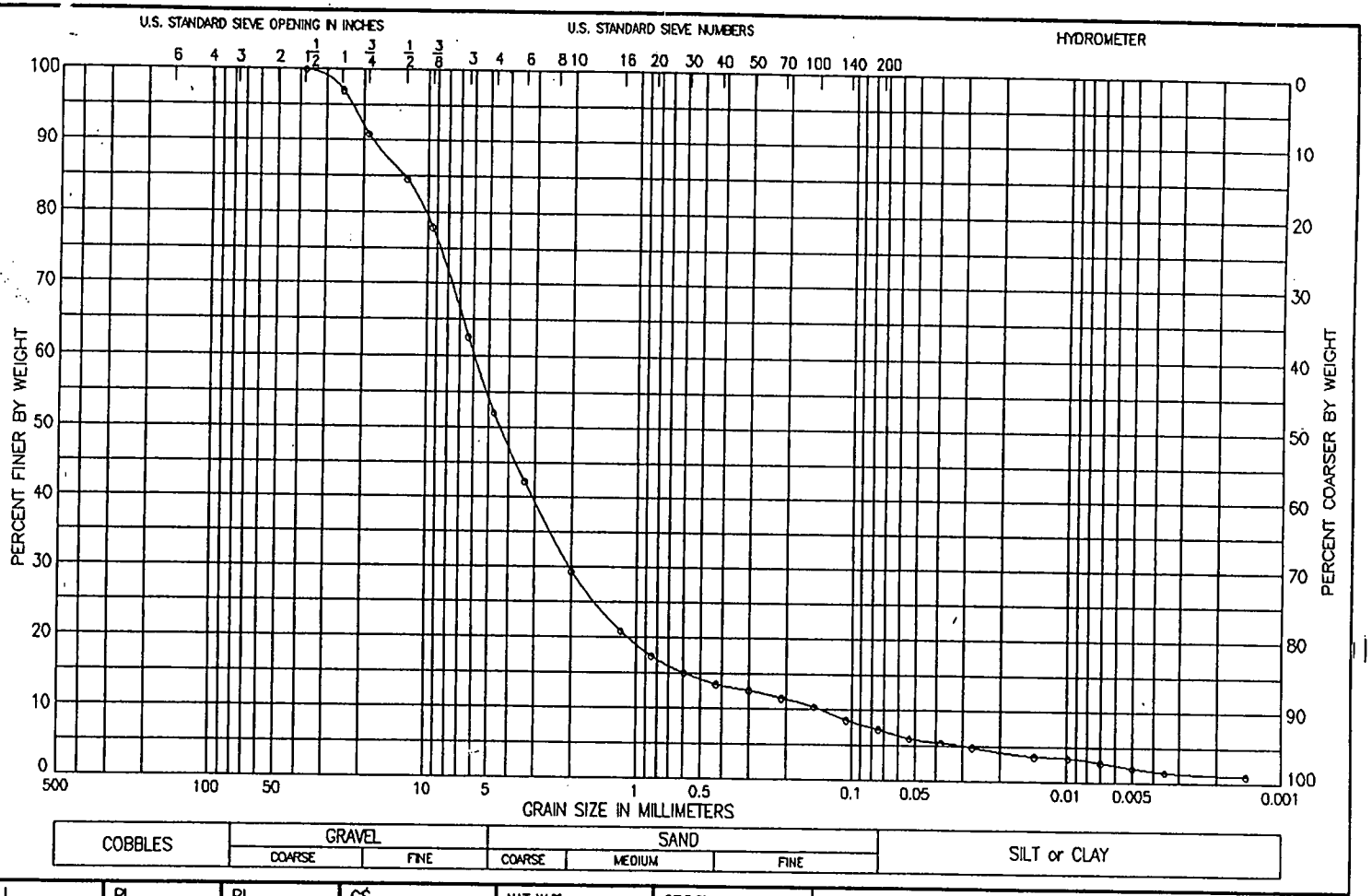
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1 in	25.000	100.0	.0
14.5	3/4 in	19.100	97.1	2.9
19.8	1/2 in	12.500	93.2	6.8
11.2	3/8 in	9.500	90.9	9.1
18.7	No 3	6.350	87.2	12.8
9.9	No 4	4.750	85.2	14.8
12.4	No 6	3.350	82.8	17.2
14.0	No 10	2.000	80.0	20.0
3.1	No 16	1.180	75.7	24.3
4.3	No 20	.850	74.1	25.9
5.2	No 30	.600	72.8	27.2
6.1	No 40	.425	71.6	28.4
6.8	No 50	.300	70.6	29.4
8.0	No 70	.212	69.0	31.0
10.1	No 100	.150	66.1	33.9
13.2	No 140	.106	61.8	38.2
15.6	No 200	.075	58.5	41.5

HYDROMETER:

RDGS	TEMP			
22.2	22.5	.0462	48.6	51.4
21.2	22.5	.0330	46.4	53.6
20.0	22.5	.0237	43.7	56.3
14.9	22.5	.0129	32.6	67.4
13.0	23.0	.0091	28.6	71.4
11.1	23.0	.0066	24.5	75.5
9.5	23.0	.0047	21.0	79.0
8.4	23.0	.0034	18.6	81.4
6.2	22.0	.0014	13.3	86.7

PERCENT GRAVEL = 14.8
PERCENT SAND = 26.7
PERCENT FINES = 58.5

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
29	17	12	2.69 EST		4.2

CLASSIFICATION
SANDY CLAYEY GRAVEL (GP-GC), GRAY

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 10 SAMPLE NO. 1530

DEPTH/ELEV 28-48" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 10 SAMPLE: 1530 DF: MD1495 .DAT
DEPTH: 28-48" DATE: 17 MAR 95

LL: 29 PL: 17 PI: 12 GS: 2.69 est WC: .00 OC: 4.20
CLASSIFICATION: 108
SANDY CLAYEY GRAVEL (GP-GC), GRAY

TOTAL WEIGHT OF SAMPLE: 785.9 gms.
PARTIAL WEIGHT AFTER SPLIT: 51.0 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1.5 in	37.500	100.0	.0
22.8	1 in	25.000	97.1	2.9
48.6	3/4 in	19.100	90.9	9.1
50.1	1/2 in	12.500	84.5	15.5
51.9	3/8 in	9.500	77.9	22.1
120.4	No 3	6.350	62.6	37.4
82.9	No 4	4.750	52.1	47.9
77.0	No 6	3.350	42.3	57.7
101.4	No 10	2.000	29.4	70.6
14.8	No 16	1.180	20.8	79.2
20.9	No 20	.850	17.3	82.7
24.9	No 30	.600	15.0	85.0
27.7	No 40	.425	13.4	86.6
29.1	No 50	.300	12.6	87.4
30.9	No 70	.212	11.6	88.4
33.0	No 100	.150	10.4	89.6
36.1	No 140	.106	8.6	91.4
38.3	No 200	.075	7.3	92.7

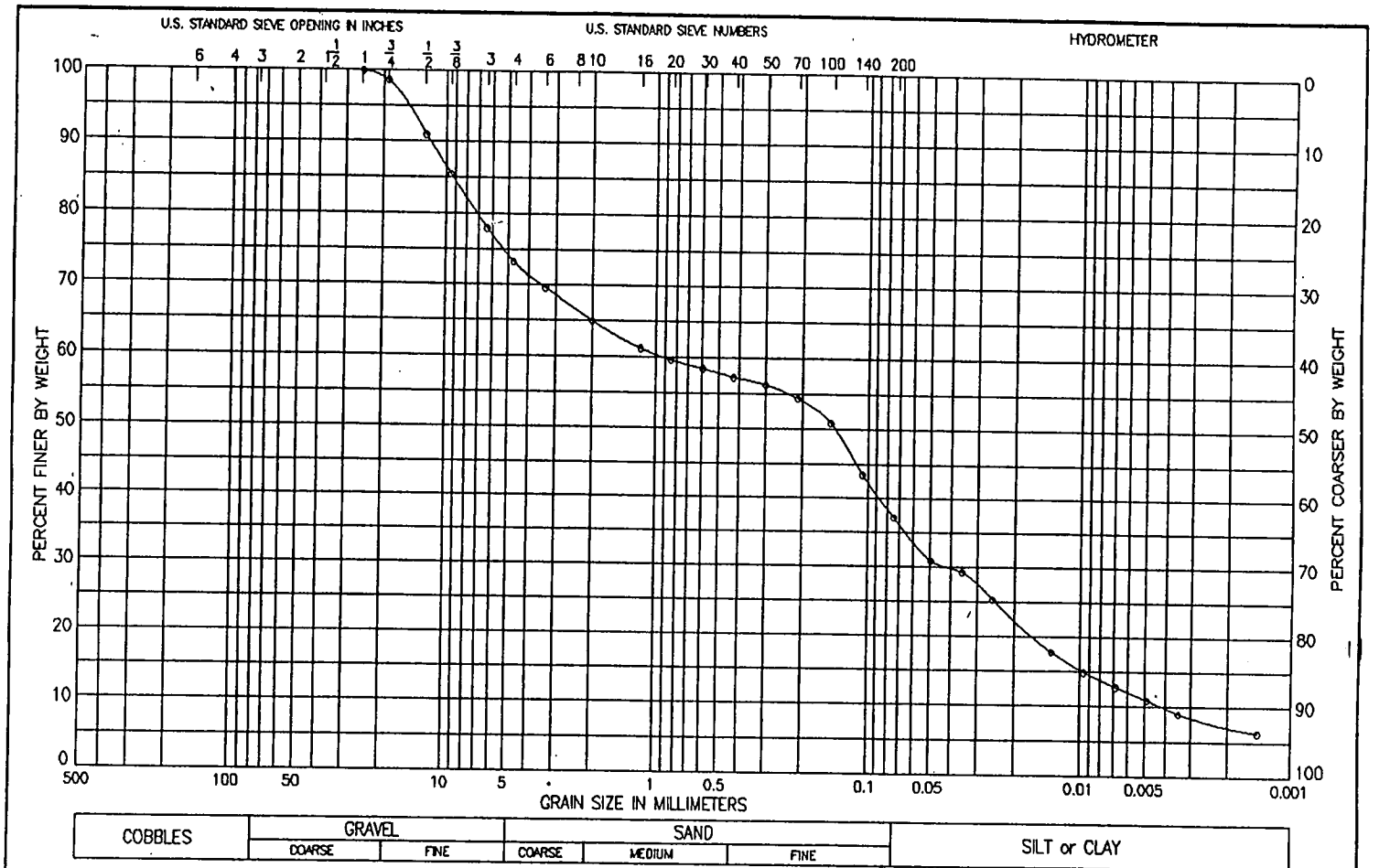
HYDROMETER:

RDGS	TEMP			
6.6	22.5	.0536	6.0	94.0
6.0	22.5	.0381	5.5	94.5
5.3	22.5	.0271	4.9	95.1
4.0	22.5	.0141	3.7	96.3
3.7	23.0	.0099	3.5	96.5
3.0	23.0	.0070	2.8	97.2
2.2	23.0	.0050	2.1	97.9
1.6	23.0	.0036	1.6	98.4
1.3	22.0	.0015	1.1	98.9

PERCENT GRAVEL = 47.9
PERCENT SAND = 44.8
PERCENT FINES = 7.3

D60 = 5.95
D30 = 2.07
D10 = .14
CU = 42.22
CC = 5.09

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
27	17	10	2.69 EST		3.3

CLASSIFICATION
GRAVELLY CLAYEY SAND (SC), GRAY

GRADATION CURVE | LABORATORY USAE WES – STF/GL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 11 SAMPLE NO. 1430

DEPTH/ELEV 30–62" DATE 17 MAR 95

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 11 SAMPLE: 1430 DF: MD1495 .DAT
DEPTH: 30-62" DATE: 17 MAR 95

LL: 27 PL: 17 PI: 10 GS: 2.69 est WC: .00 OC: 3.30
CLASSIFICATION: 108
GRAVELLY CLAYEY SAND (SC), GRAY

TOTAL WEIGHT OF SAMPLE: 811.9 gms.
PARTIAL WEIGHT AFTER SPLIT: 50.2 gms.

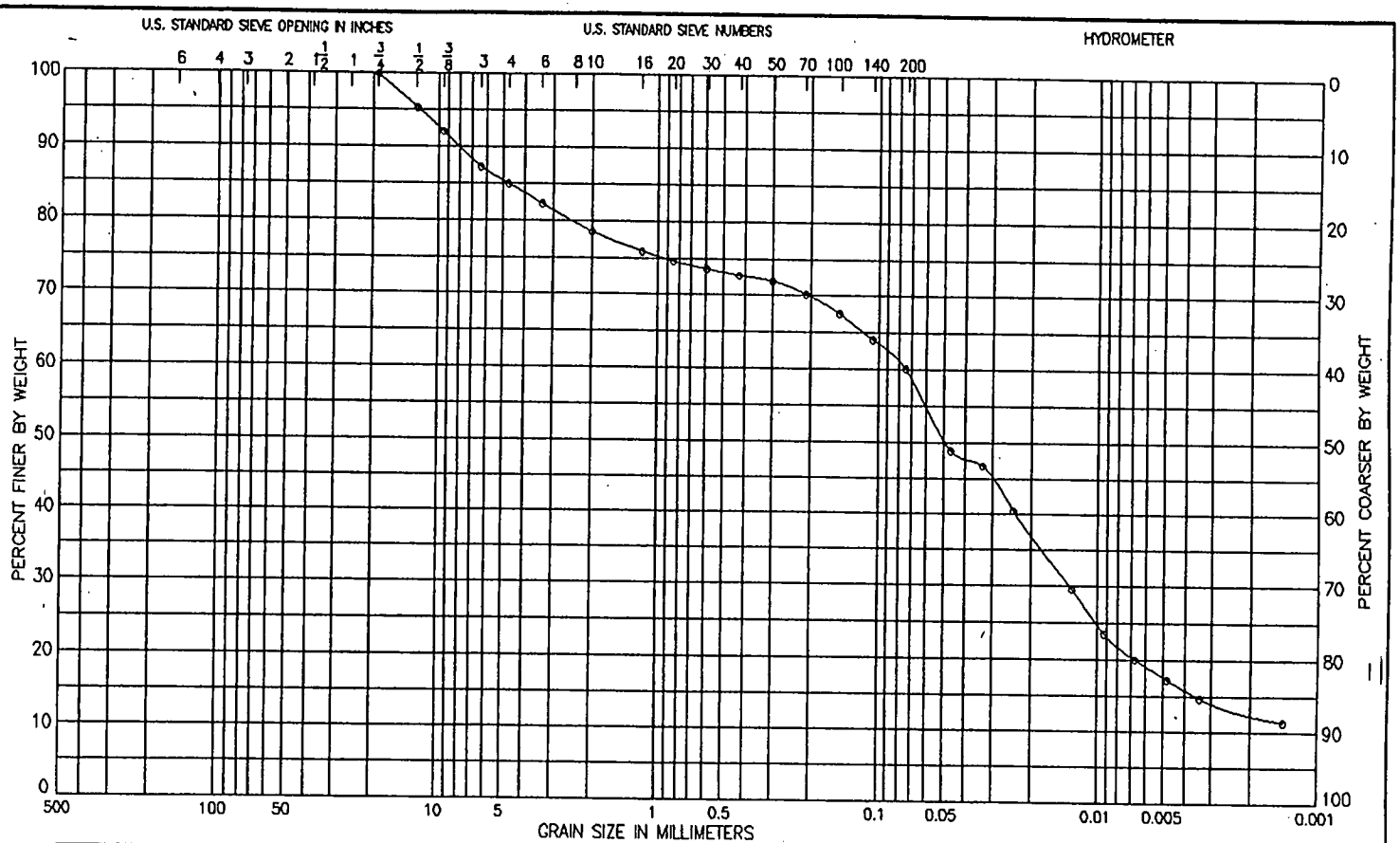
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1 in	25.000	100.0	.0
10.7	3/4 in	19.100	98.7	1.3
62.3	1/2 in	12.500	91.0	9.0
45.0	3/8 in	9.500	85.5	14.5
61.1	No 3	6.350	77.9	22.1
38.1	No 4	4.750	73.2	26.8
29.1	No 6	3.350	69.7	30.3
38.1	No 10	2.000	65.0	35.0
2.9	No 16	1.180	61.2	38.8
4.1	No 20	.850	59.7	40.3
5.0	No 30	.600	58.5	41.5
5.9	No 40	.425	57.3	42.7
6.7	No 50	.300	56.3	43.7
8.2	No 70	.212	54.4	45.6
10.9	No 100	.150	50.9	49.1
16.6	No 140	.106	43.5	56.5
21.4	No 200	.075	37.3	62.7

HYDROMETER:

RDGS	TEMP			
15.0	22.5	.0497	30.9	69.1
14.2	22.5	.0354	29.3	70.7
12.3	22.5	.0255	25.3	74.7
8.6	22.5	.0136	17.7	82.3
7.1	23.0	.0096	14.8	85.2
6.1	23.0	.0069	12.8	87.2
5.2	23.0	.0049	10.9	89.1
4.3	23.0	.0035	9.1	90.9
3.1	22.5	.0015	6.4	93.6

PERCENT GRAVEL = 26.8
PERCENT SAND = 36.0
PERCENT FINES = 37.3

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
27	17	10	2.69 EST		2.3

CLASSIFICATION
GRAVELLY SANDY CLAY (CL), BROWN

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 12 SAMPLE NO. 1040

DEPTH/ELEV 30-60" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 12 SAMPLE: 1040 DF: MD1495 .DAT
DEPTH: 30-60" DATE: 17 MAR 95

LL: 27 PL: 17 PI: 10 GS: 2.69 est WC: .00 OC: 2.30
CLASSIFICATION: 108
GRAVELLY SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 646.1 gms.
PARTIAL WEIGHT AFTER SPLIT: 53.7 gms.

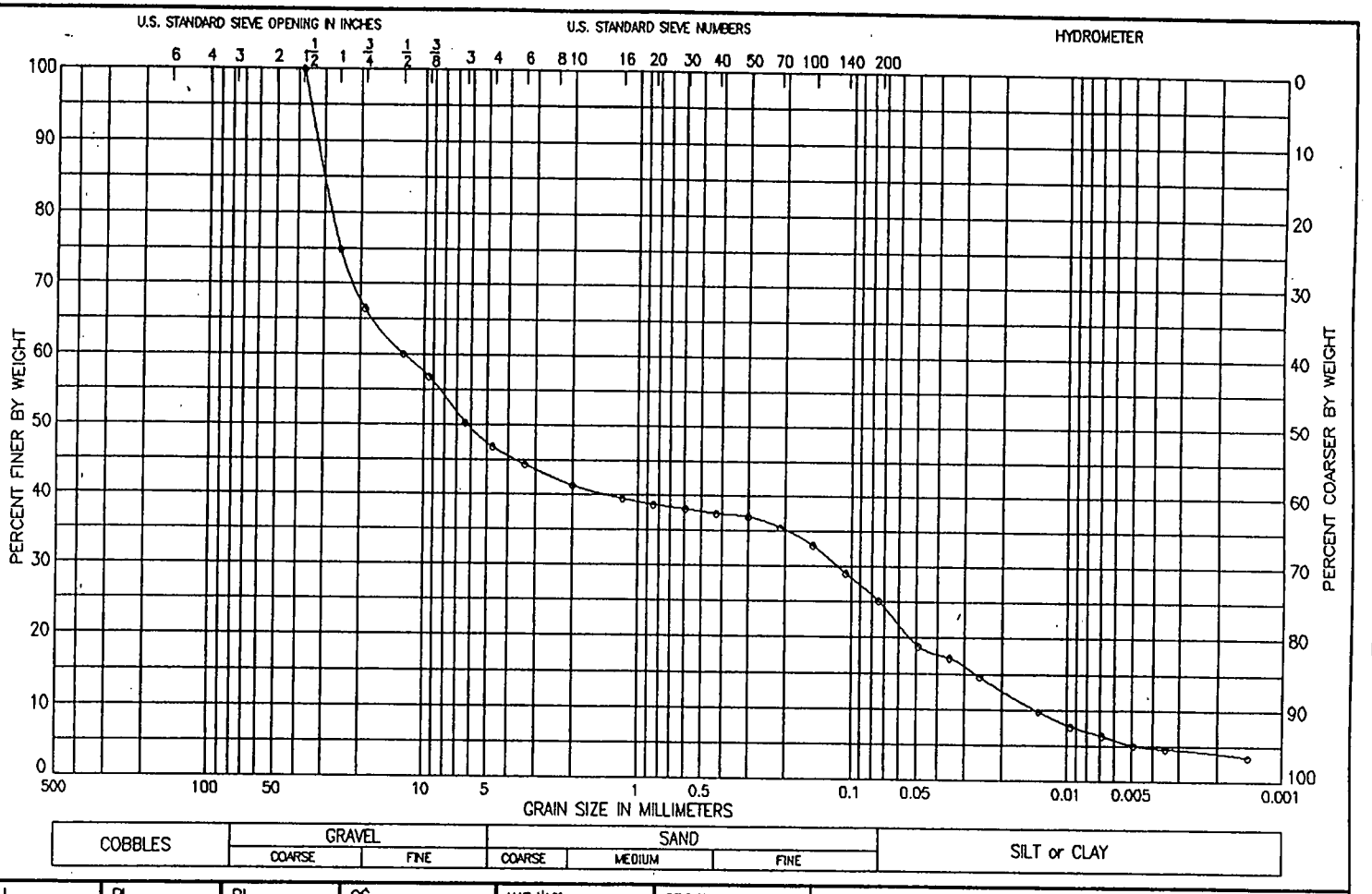
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	3/4 in	19.100	100.0	.0
30.3	1/2 in	12.500	95.3	4.7
20.7	3/8 in	9.500	92.1	7.9
30.9	No 3	6.350	87.3	12.7
15.1	No 4	4.750	85.0	15.0
17.6	No 6	3.350	82.3	17.7
23.9	No 10	2.000	78.6	21.4
1.8	No 16	1.180	75.9	24.1
2.7	No 20	.850	74.6	25.4
3.4	No 30	.600	73.6	26.4
4.0	No 40	.425	72.7	27.3
4.5	No 50	.300	72.0	28.0
5.7	No 70	.212	70.2	29.8
7.5	No 100	.150	67.6	32.4
9.9	No 140	.106	64.1	35.9
12.6	No 200	.075	60.1	39.9

HYDROMETER:

RDGS	TEMP			
21.0	22.5	.0468	48.9	51.1
20.1	22.5	.0334	46.8	53.2
17.4	22.5	.0243	40.5	59.5
12.7	22.5	.0131	29.6	70.4
10.0	23.0	.0094	23.5	76.5
8.5	23.0	.0067	20.0	80.0
7.3	23.0	.0048	17.2	82.8
6.2	23.0	.0034	14.7	85.3
4.9	22.5	.0014	11.4	88.6

PERCENT GRAVEL = 15.0
PERCENT SAND = 24.9
PERCENT FINES = 60.1

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
24	16	8	2.69 EST		2.5

CLASSIFICATION
SANDY CLAYEY GRAVEL (GC), BROWN

GRADATION CURVE | LABORATORY USAE WES – STF/GL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 14 SAMPLE NO. 0925

DEPTH/ELEV 30–45" DATE 17 MAR 95

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 14 SAMPLE: 0925 DF: MD1495 .DAT
DEPTH: 30-45" DATE: 17 MAR 95

LL: 24 PL: 16 PI: 8 GS: 2.69 est WC: .00 OC: 2.50
CLASSIFICATION: 108
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 475.2 gms.
PARTIAL WEIGHT AFTER SPLIT: 56.8 gms.

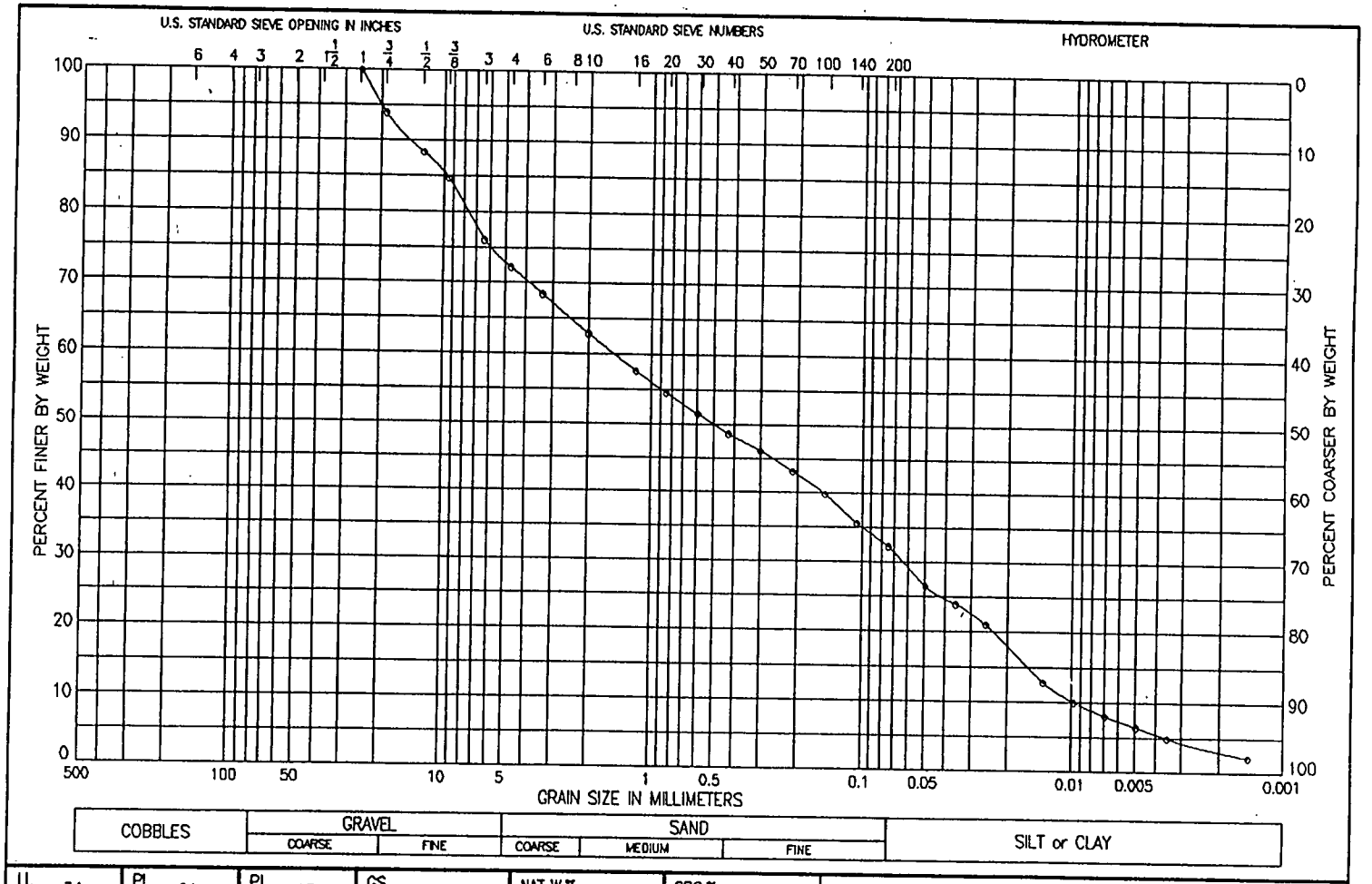
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1.5 in	37.500	100.0	.0
119.2	1 in	25.000	74.9	25.1
40.0	3/4 in	19.100	66.5	33.5
30.5	1/2 in	12.500	60.1	39.9
15.0	3/8 in	9.500	56.9	43.1
31.9	No 3	6.350	50.2	49.8
16.1	No 4	4.750	46.8	53.2
11.8	No 6	3.350	44.3	55.7
14.2	No 10	2.000	41.4	58.6
2.5	No 16	1.180	39.5	60.5
3.6	No 20	.850	38.7	61.3
4.4	No 30	.600	38.1	61.9
5.3	No 40	.425	37.5	62.5
5.9	No 50	.300	37.1	62.9
8.0	No 70	.212	35.5	64.5
11.5	No 100	.150	33.0	67.0
16.9	No 140	.106	29.0	71.0
22.3	No 200	.075	25.1	74.9

HYDROMETER:

RDGS	TEMP			
16.2	22.5	.0492	18.8	81.2
14.8	22.5	.0352	17.2	82.8
12.6	22.5	.0254	14.6	85.4
8.5	22.5	.0136	9.8	90.2
6.6	23.0	.0097	7.8	92.2
5.5	23.0	.0069	6.5	93.5
4.3	23.0	.0049	5.1	94.9
3.9	23.0	.0035	4.6	95.4
3.1	22.0	.0015	3.5	96.5

PERCENT GRAVEL = 53.2
PERCENT SAND = 21.7
PERCENT FINES = 25.1

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
34	21	13	2.69 EST		2.1

CLASSIFICATION
GRAVELLY CLAYEY SAND (SC), GRAY

PROJECT . CRANE, ABG SOILS, PART 2

BORING NO. 17 SAMPLE NO. 1145

DEPTH/ELEV 30-60" DATE 17 MAR 95

GRADATION CURVE . LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 17 SAMPLE: 1145 DF: MD1495 .DAT
DEPTH: 30-60" DATE: 17 MAR 95

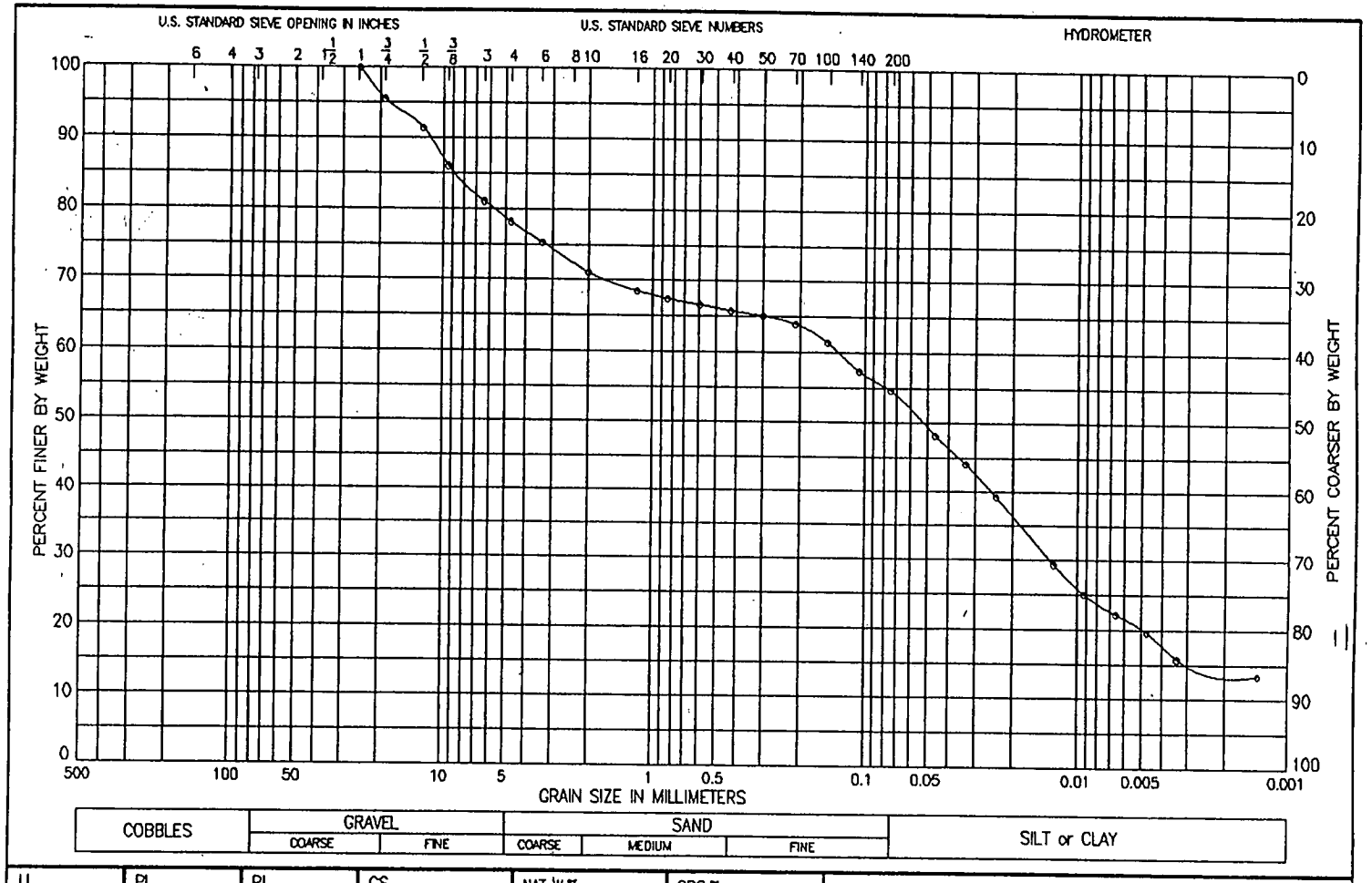
LL: 34 PL: 21 PI: 13 GS: 2.69 est WC: .00 OC: 2.10
CLASSIFICATION: 108
GRAVELLY CLAYEY SAND (SC), GRAY

TOTAL WEIGHT OF SAMPLE: 650.4 gms.
PARTIAL WEIGHT AFTER SPLIT: 50.6 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1 in	25.000	100.0	.0
39.1	3/4 in	19.100	94.0	6.0
36.9	1/2 in	12.500	88.3	11.7
23.6	3/8 in	9.500	84.7	15.3
56.2	No 3	6.350	76.0	24.0
24.7	No 4	4.750	72.2	27.8
24.7	No 6	3.350	68.5	31.5
36.3	No 10	2.000	62.9	37.1
4.2	No 16	1.180	57.7	42.3
6.7	No 20	.850	54.5	45.5
9.1	No 30	.600	51.6	48.4
11.5	No 40	.425	48.6	51.4
13.5	No 50	.300	46.1	53.9
15.9	No 70	.212	43.1	56.9
18.5	No 100	.150	39.9	60.1
21.9	No 140	.106	35.7	64.3
24.6	No 200	.075	32.3	67.7
HYDROMETER:				
RDGS	TEMP			
13.3	23.0	.0499	26.5	73.5
12.0	23.0	.0357	23.9	76.1
10.5	23.0	.0256	21.0	79.0
6.4	23.0	.0137	12.9	87.1
5.0	23.0	.0098	10.1	89.9
4.0	23.0	.0070	8.1	91.9
3.2	23.0	.0050	6.5	93.5
2.4	23.0	.0035	4.9	95.1
1.1	22.5	.0015	2.2	97.8

PERCENT GRAVEL = 27.8
PERCENT SAND = 39.9
PERCENT FINES = 32.3

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
31	17	14	2.69 EST		1.5

CLASSIFICATION
GRAVELLY SANDY CLAY (CL), BROWN

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 19 SAMPLE NO. 0935

DEPTH/ELEV 30-60" DATE 17 MAR 95

GRADATION CURVE

LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 19 SAMPLE: 0935 DF: MD1495 .DAT
DEPTH: 30-60" DATE: 17 MAR 95

LL: 31 PL: 17 PI: 14 GS: 2.69 est WC: .00 OC: 1.50
CLASSIFICATION: 108
GRAVELLY SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 723.5 gms.
PARTIAL WEIGHT AFTER SPLIT: 52.4 gms.

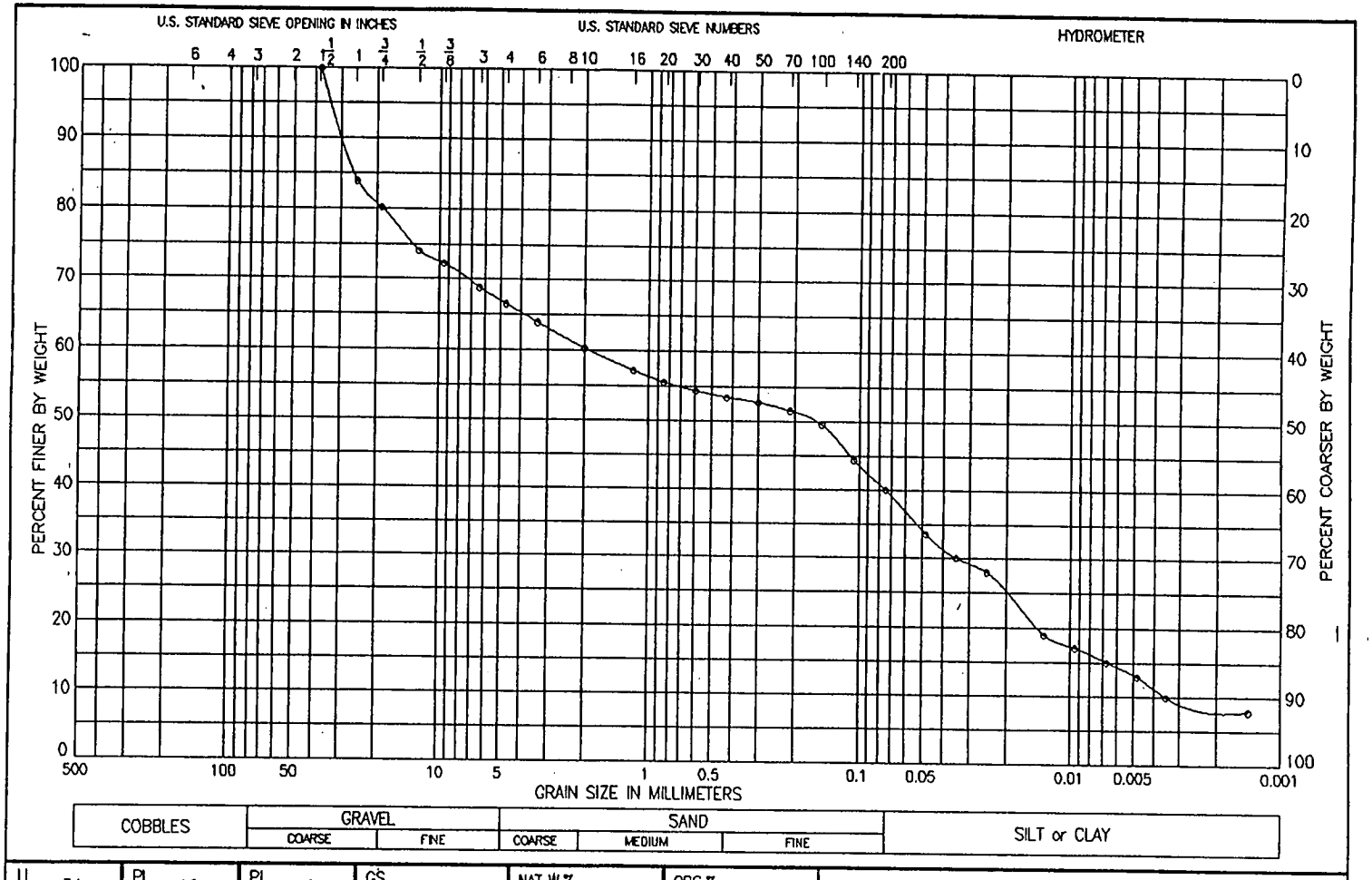
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1 in	25.000	100.0	.0
32.0	3/4 in	19.100	95.6	4.4
29.8	1/2 in	12.500	91.5	8.5
39.0	3/8 in	9.500	86.1	13.9
36.1	No 3	6.350	81.1	18.9
20.9	No 4	4.750	78.2	21.8
20.8	No 6	3.350	75.3	24.7
30.7	No 10	2.000	71.1	28.9
1.9	No 16	1.180	68.5	31.5
2.7	No 20	.850	67.4	32.6
3.3	No 30	.600	66.6	33.4
3.9	No 40	.425	65.8	34.2
4.4	No 50	.300	65.1	34.9
5.2	No 70	.212	64.0	36.0
7.1	No 100	.150	61.4	38.6
10.1	No 140	.106	57.4	42.6
12.1	No 200	.075	54.7	45.3

HYDROMETER:

RDGS	TEMP			
22.3	22.5	.0462	48.1	51.9
20.4	22.5	.0333	44.0	56.0
18.2	22.5	.0241	39.3	60.7
13.6	22.5	.0130	29.4	70.6
11.6	22.5	.0094	25.0	75.0
10.2	23.0	.0066	22.2	77.8
9.0	23.0	.0047	19.6	80.4
7.2	23.0	.0034	15.8	84.2
6.1	23.0	.0014	13.4	86.6

PERCENT GRAVEL = 21.8
PERCENT SAND = 23.5
PERCENT FINES = 54.7

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
34	16	18	2.69 EST		3.0

CLASSIFICATION
SANDY CLAYEY GRAVEL (GC), BROWN

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 21 SAMPLE NO. 1645

DEPTH/ELEV 30-60" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 21 SAMPLE: 1645 DF: MD1495 .DAT
DEPTH: 30-60" DATE: 17 MAR 95

LL: 34 PL: 16 PI: 18 GS: 2.69 est WC: .00 OC: 3.00
CLASSIFICATION: 108
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 379.1 gms.
PARTIAL WEIGHT AFTER SPLIT: 51.1 gms.

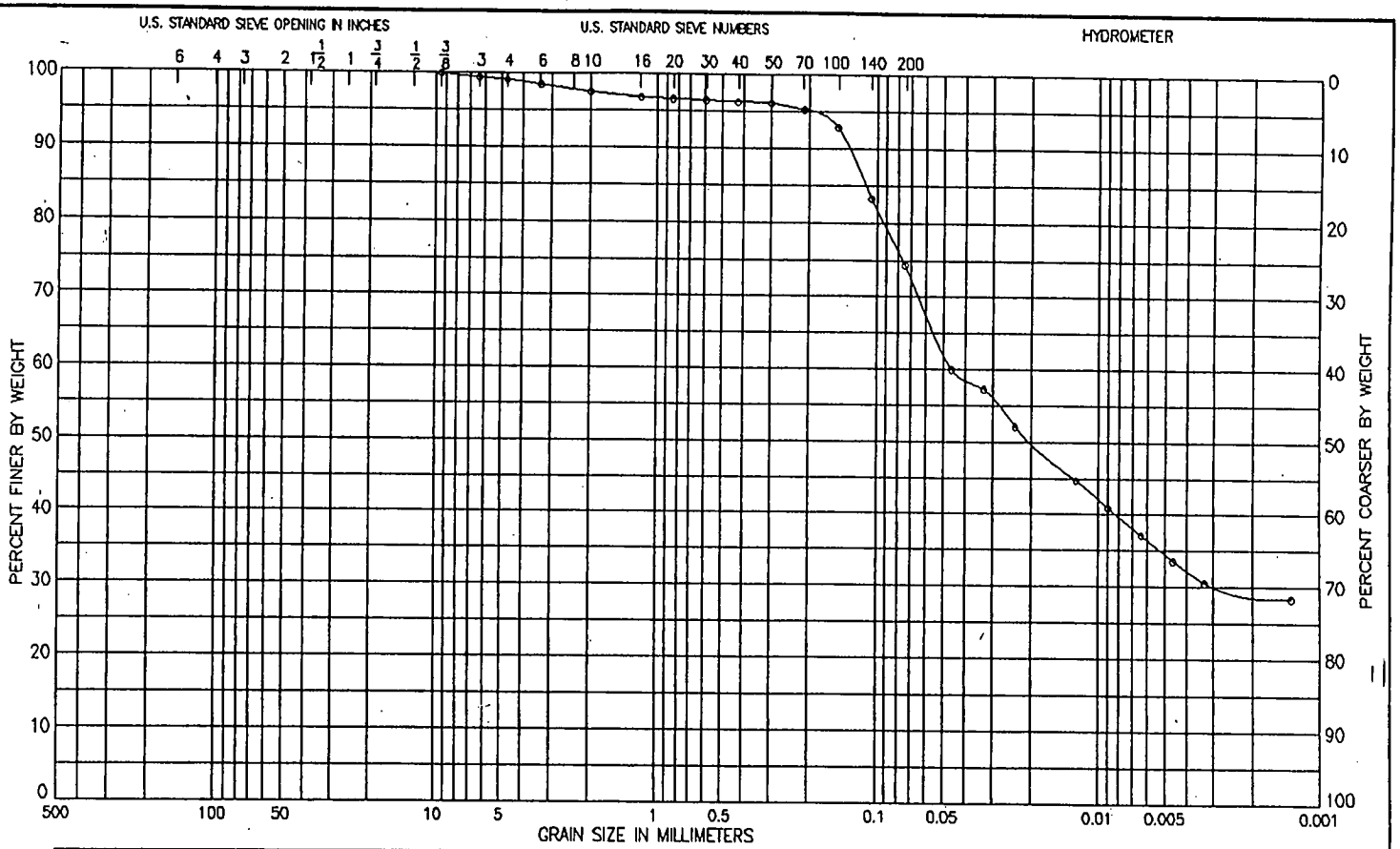
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1.5 in	37.500	100.0	.0
61.0	1 in	25.000	83.9	16.1
14.1	3/4 in	19.100	80.2	19.8
23.3	1/2 in	12.500	74.0	26.0
6.7	3/8 in	9.500	72.3	27.7
13.1	No 3	6.350	68.8	31.2
8.6	No 4	4.750	66.6	33.4
9.9	No 6	3.350	63.9	36.1
13.8	No 10	2.000	60.3	39.7
2.6	No 16	1.180	57.2	42.8
4.0	No 20	.850	55.6	44.4
5.0	No 30	.600	54.4	45.6
5.8	No 40	.425	53.5	46.5
6.4	No 50	.300	52.7	47.3
7.4	No 70	.212	51.6	48.4
9.1	No 100	.150	49.6	50.4
13.5	No 140	.106	44.4	55.6
17.1	No 200	.075	40.1	59.9

HYDROMETER:

RDGS	TEMP			
17.9	22.5	.0483	33.6	66.4
16.0	22.5	.0348	30.1	69.9
14.9	22.5	.0249	28.0	72.0
10.1	22.5	.0134	19.0	81.0
9.1	22.5	.0096	17.1	82.9
7.9	23.0	.0068	15.0	85.0
6.8	23.0	.0048	13.0	87.0
5.3	22.5	.0035	10.0	90.0
4.1	23.0	.0014	7.9	92.1

PERCENT GRAVEL = 33.4
PERCENT SAND = 26.4
PERCENT FINES = 40.1

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
52	19	33	2.69 EST		3.0

CLASSIFICATION
SANDY CLAY (CH), BROWN

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 22 SAMPLE NO. 1115

DEPTH/ELEV 30-60" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 22 SAMPLE: 1115 DF: MD1495R .DAT
DEPTH: 30-60" DATE: 17 MAR 95

LL: 52 PL: 19 PI: 33 GS: 2.69 est WC: .00 OC: 3.00
CLASSIFICATION: 108
SANDY CLAY (CH), BROWN

TOTAL WEIGHT OF SAMPLE: 274.3 gms.
PARTIAL WEIGHT AFTER SPLIT: 56.9 gms.

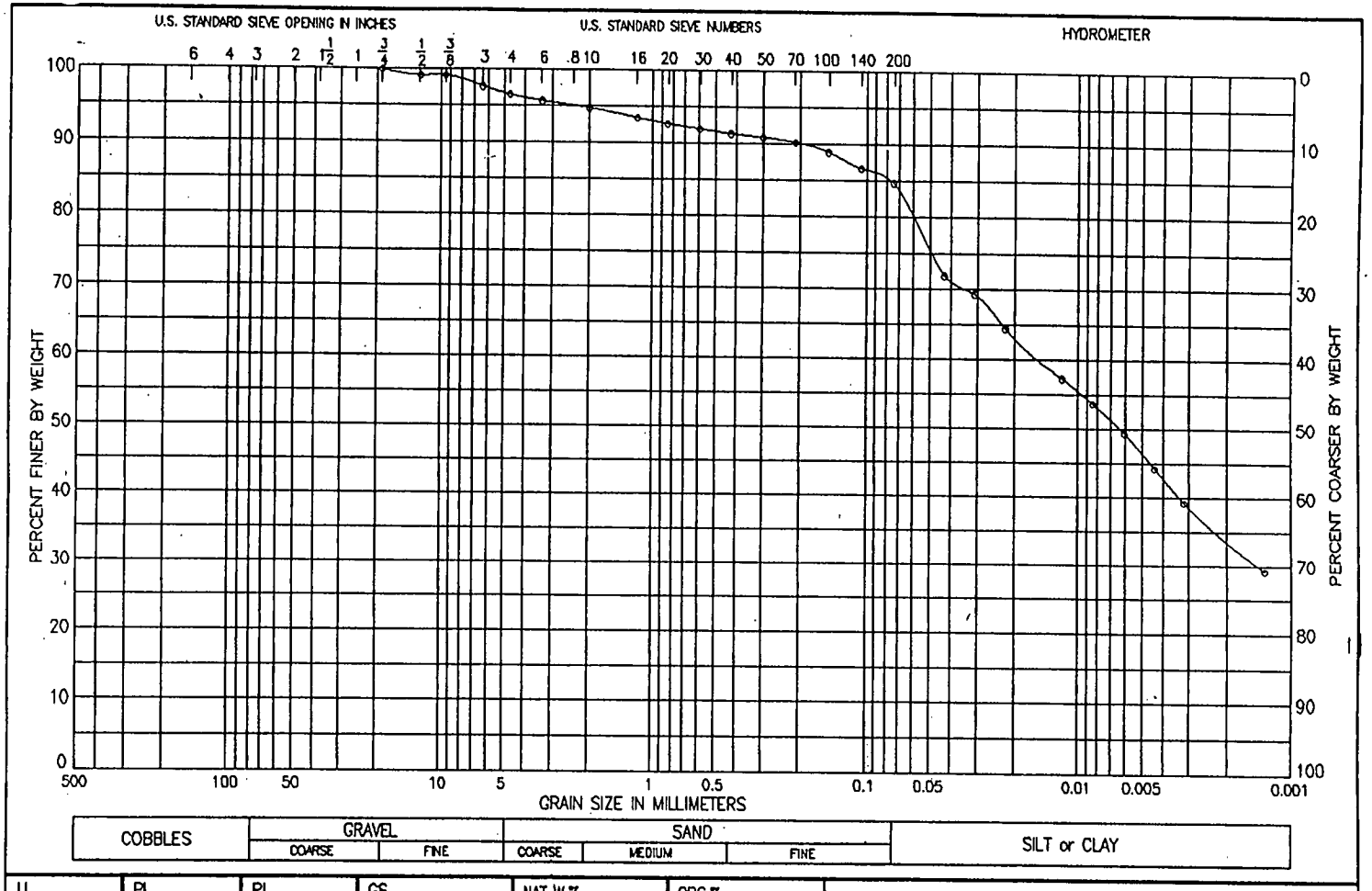
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	3/8 in	9.500	100.0	.0
1.5	No 3	6.350	99.5	.5
.8	No 4	4.750	99.2	.8
1.7	No 6	3.350	98.5	1.5
2.7	No 10	2.000	97.6	2.4
.4	No 16	1.180	96.9	3.1
.5	No 20	.850	96.7	3.3
.6	No 30	.600	96.5	3.5
.7	No 40	.425	96.4	3.6
.8	No 50	.300	96.2	3.8
1.3	No 70	.212	95.3	4.7
2.7	No 100	.150	92.9	7.1
8.3	No 140	.106	83.3	16.7
13.5	No 200	.075	74.4	25.6

HYDROMETER:

RDGS	TEMP			
22.0	22.5	.0463	60.0	40.0
21.0	22.5	.0331	57.3	42.7
19.1	22.5	.0239	52.1	47.9
16.4	22.5	.0127	44.8	55.2
15.0	22.5	.0091	40.9	59.1
13.5	23.0	.0064	37.1	62.9
12.2	23.0	.0046	33.6	66.4
11.2	22.5	.0033	30.6	69.4
10.3	23.0	.0014	28.4	71.6

PERCENT GRAVEL = .8
PERCENT SAND = 24.8
PERCENT FINES = 74.4

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
54	20	34	2.69 EST		3.3

CLASSIFICATION
CLAY (CH), GRAY; WITH SAND; TRACE OF GRAVEL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 23 SAMPLE NO. 1050

DEPTH/ELEV 30-60" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 23 SAMPLE: 1050 DF: MD1495R .DAT
DEPTH: 30-60" DATE: 17 MAR 95

LL: 54 PL: 20 PI: 34 GS: 2.69 est WC: .00 OC: 3.30
CLASSIFICATION: 108
CLAY (CH), GRAY; WITH SAND; TRACE OF GRAVEL

TOTAL WEIGHT OF SAMPLE: 433.8 gms.
PARTIAL WEIGHT AFTER SPLIT: 58.7 gms.

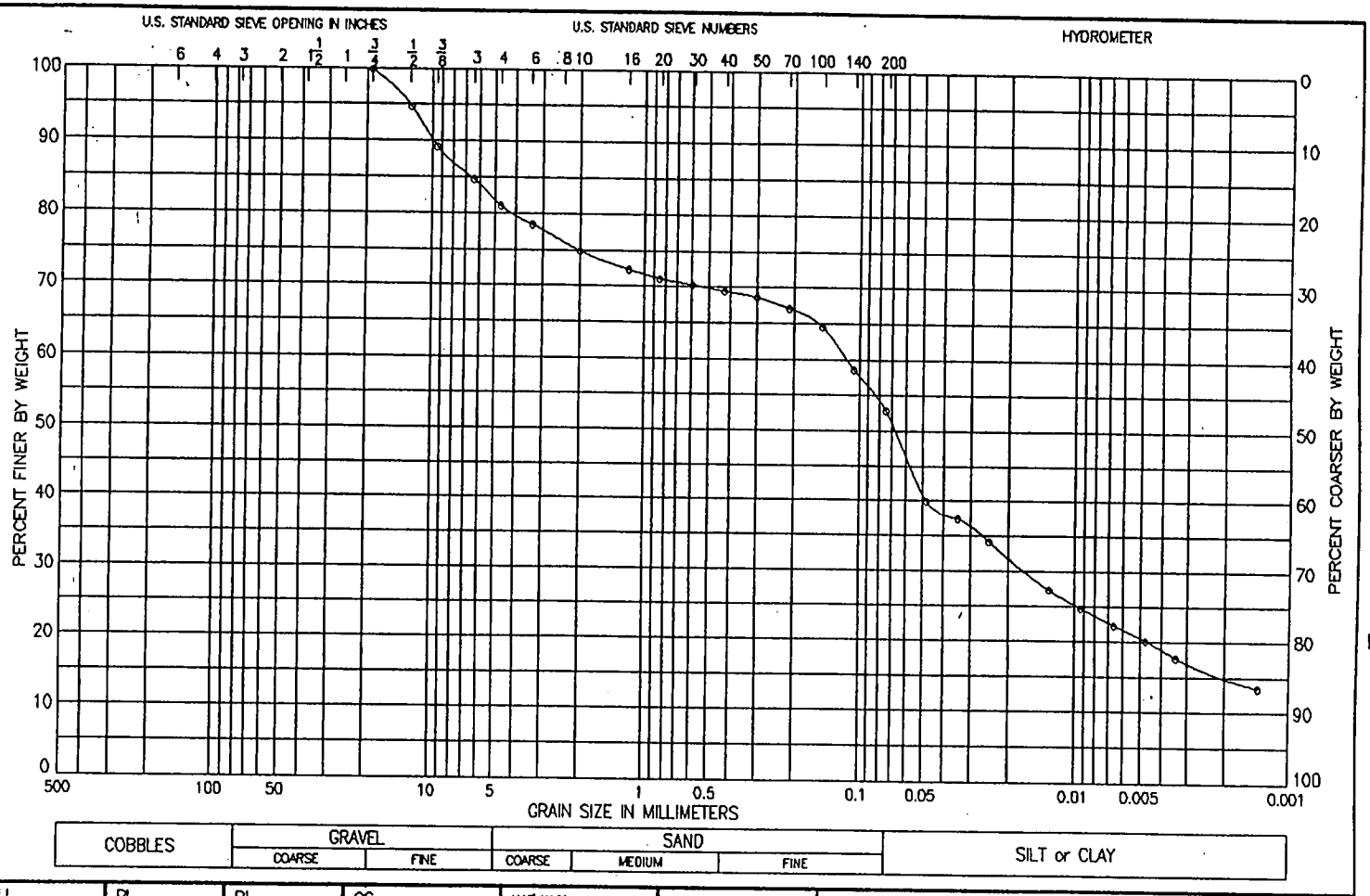
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	3/4 in	19.100	100.0	.0
3.6	1/2 in	12.500	99.2	.8
.0	3/8 in	9.500	99.2	.8
6.6	No 3	6.350	97.6	2.4
4.6	No 4	4.750	96.6	3.4
3.7	No 6	3.350	95.7	4.3
4.2	No 10	2.000	94.8	5.2
.8	No 16	1.180	93.5	6.5
1.3	No 20	.850	92.7	7.3
1.7	No 30	.600	92.0	8.0
2.1	No 40	.425	91.4	8.6
2.4	No 50	.300	90.9	9.1
2.8	No 70	.212	90.2	9.8
3.6	No 100	.150	89.0	11.0
5.0	No 140	.106	86.7	13.3
6.2	No 200	.075	84.8	15.2

HYDROMETER:

RDGS	TEMP			
28.0	22.5	.0432	72.0	28.0
27.0	22.5	.0309	69.4	30.6
25.1	22.5	.0224	64.5	35.5
22.3	22.5	.0119	57.3	42.7
20.9	22.5	.0086	53.7	46.3
19.1	23.0	.0061	49.3	50.7
17.1	23.0	.0044	44.2	55.8
15.3	22.5	.0032	39.3	60.7
11.3	23.0	.0013	29.3	70.7

PERCENT GRAVEL = 3.4
PERCENT SAND = 11.8
PERCENT FINES = 84.8

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
43	19	24	2.69 EST		3.3

CLASSIFICATION
GRAVELLY SANDY CLAY (CL), GRAY

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 25 SAMPLE NO. 1130

DEPTH/ELEV 30–36" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 25 SAMPLE: 1130 DF: MD1495 .DAT
DEPTH: 30-36" DATE: 17 MAR 95

LL: 43 PL: 19 PI: 24 GS: 2.69 est WC: .00 OC: 3.30
CLASSIFICATION: 108
GRAVELLY SANDY CLAY (CL), GRAY

TOTAL WEIGHT OF SAMPLE: 496.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 54.0 gms.

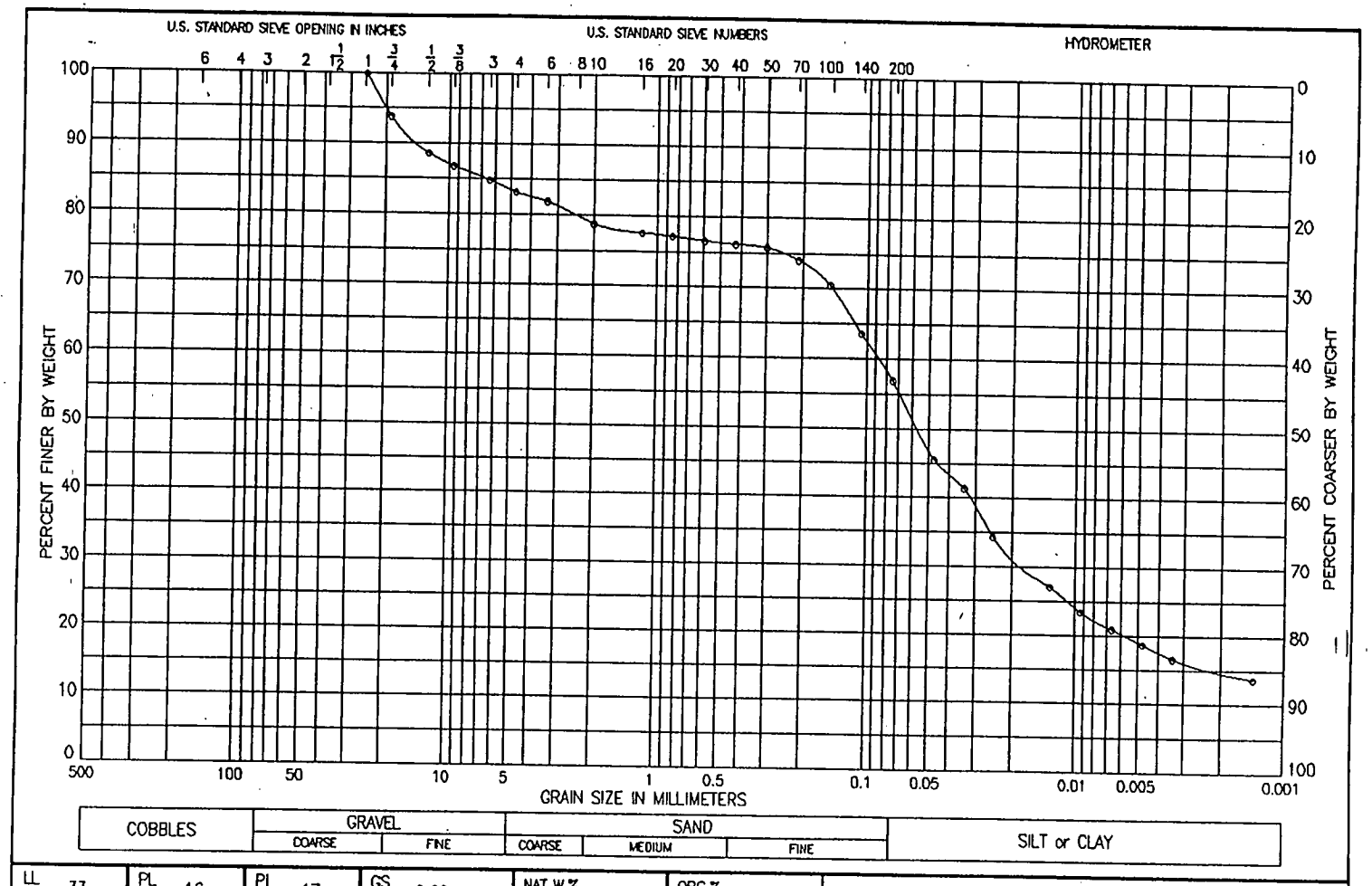
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	3/4 in	19.100	100.0	.0
26.3	1/2 in	12.500	94.7	5.3
27.3	3/8 in	9.500	89.2	10.8
22.3	No 3	6.350	84.7	15.3
18.2	No 4	4.750	81.1	18.9
12.8	No 6	3.350	78.5	21.5
18.0	No 10	2.000	74.9	25.1
1.8	No 16	1.180	72.4	27.6
2.7	No 20	.850	71.1	28.9
3.3	No 30	.600	70.3	29.7
3.9	No 40	.425	69.4	30.6
4.5	No 50	.300	68.6	31.4
5.6	No 70	.212	67.1	32.9
7.4	No 100	.150	64.6	35.4
11.7	No 140	.106	58.6	41.4
15.9	No 200	.075	52.8	47.2

HYDROMETER:

RDGS	TEMP			
18.1	22.5	.0482	39.9	60.1
17.0	22.5	.0345	37.5	62.5
15.5	22.5	.0247	34.2	65.8
12.4	22.5	.0132	27.4	72.6
11.2	22.5	.0094	24.7	75.3
10.0	23.0	.0066	22.3	77.7
9.0	23.0	.0047	20.1	79.9
8.0	22.5	.0034	17.7	82.3
6.0	23.0	.0014	13.5	86.5

PERCENT GRAVEL = 18.9
PERCENT SAND = 28.2
PERCENT FINES = 52.8

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
33	16	17	2.69 EST		2.6

CLASSIFICATION
GRAVELLY SANDY CLAY (CL), BROWN

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 28 SAMPLE NO. 1445

DEPTH/ELEV 30-60" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 28 SAMPLE: 1445 DF: MD1495 .DAT
DEPTH: 30-60" DATE: 17 MAR 95

LL: 33 PL: 16 PI: 17 GS: 2.69 est WC: .00 OC: 2.60
CLASSIFICATION: 108
GRAVELLY SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 541.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 55.1 gms.

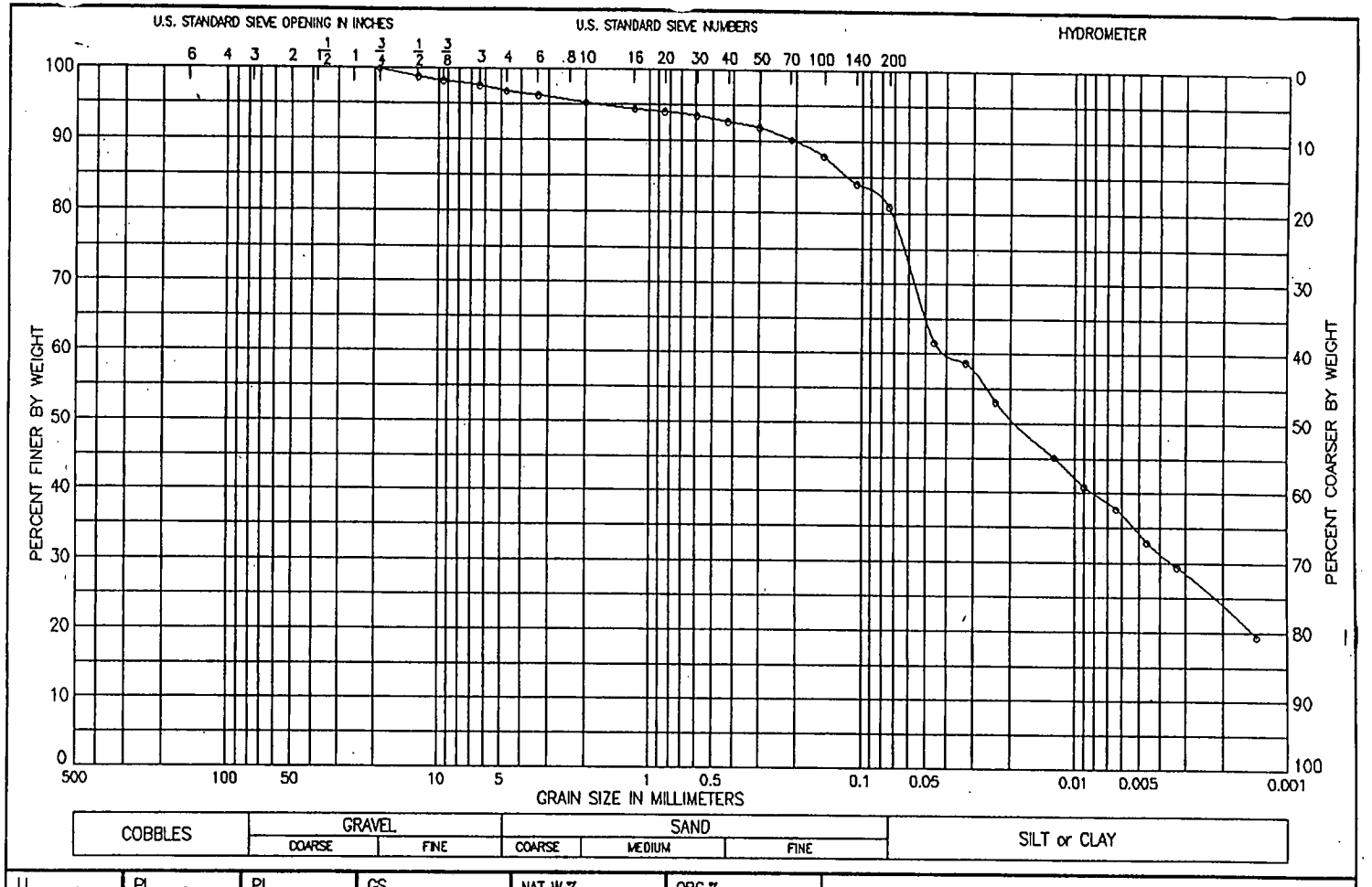
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1 in	25.000	100.0	.0
33.3	3/4 in	19.100	93.9	6.1
28.6	1/2 in	12.500	88.6	11.4
9.7	3/8 in	9.500	86.8	13.2
10.7	No 3	6.350	84.8	15.2
9.0	No 4	4.750	83.1	16.9
7.0	No 6	3.350	81.9	18.1
16.8	No 10	2.000	78.8	21.2
.8	No 16	1.180	77.6	22.4
1.1	No 20	.850	77.2	22.8
1.5	No 30	.600	76.6	23.4
1.8	No 40	.425	76.2	23.8
2.1	No 50	.300	75.8	24.2
3.3	No 70	.212	74.0	26.0
5.8	No 100	.150	70.5	29.5
10.6	No 140	.106	63.6	36.4
15.3	No 200	.075	56.9	43.1

HYDROMETER:

RDGS	TEMP			
20.0	22.5	.0473	45.5	54.5
18.2	22.5	.0341	41.4	58.6
15.1	22.5	.0248	34.4	65.6
11.9	22.5	.0132	27.1	72.9
10.3	22.5	.0095	23.4	76.6
9.1	23.0	.0067	20.9	79.1
8.1	23.0	.0048	18.7	81.3
7.3	22.5	.0034	16.6	83.4
5.9	23.0	.0014	13.6	86.4

PERCENT GRAVEL = 16.9
PERCENT SAND = 26.3
PERCENT FINES = 56.9

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
46	21	25	2.69 EST		4.1

CLASSIFICATION
SANDY CLAY (CL), GRAY; TRACE OF GRAVEL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 29 SAMPLE NO. 1400

DEPTH/ELEV 30-54" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 29 SAMPLE: 1400 DF: MD1495R .DAT
DEPTH: 30-54" DATE: 17 MAR 95

LL: 46 PL: 21 PI: 25 GS: 2.69 est WC: .00 OC: 4.10
CLASSIFICATION: 108
SANDY CLAY (CL), GRAY; TRACE OF GRAVEL

TOTAL WEIGHT OF SAMPLE: 613.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 57.1 gms.

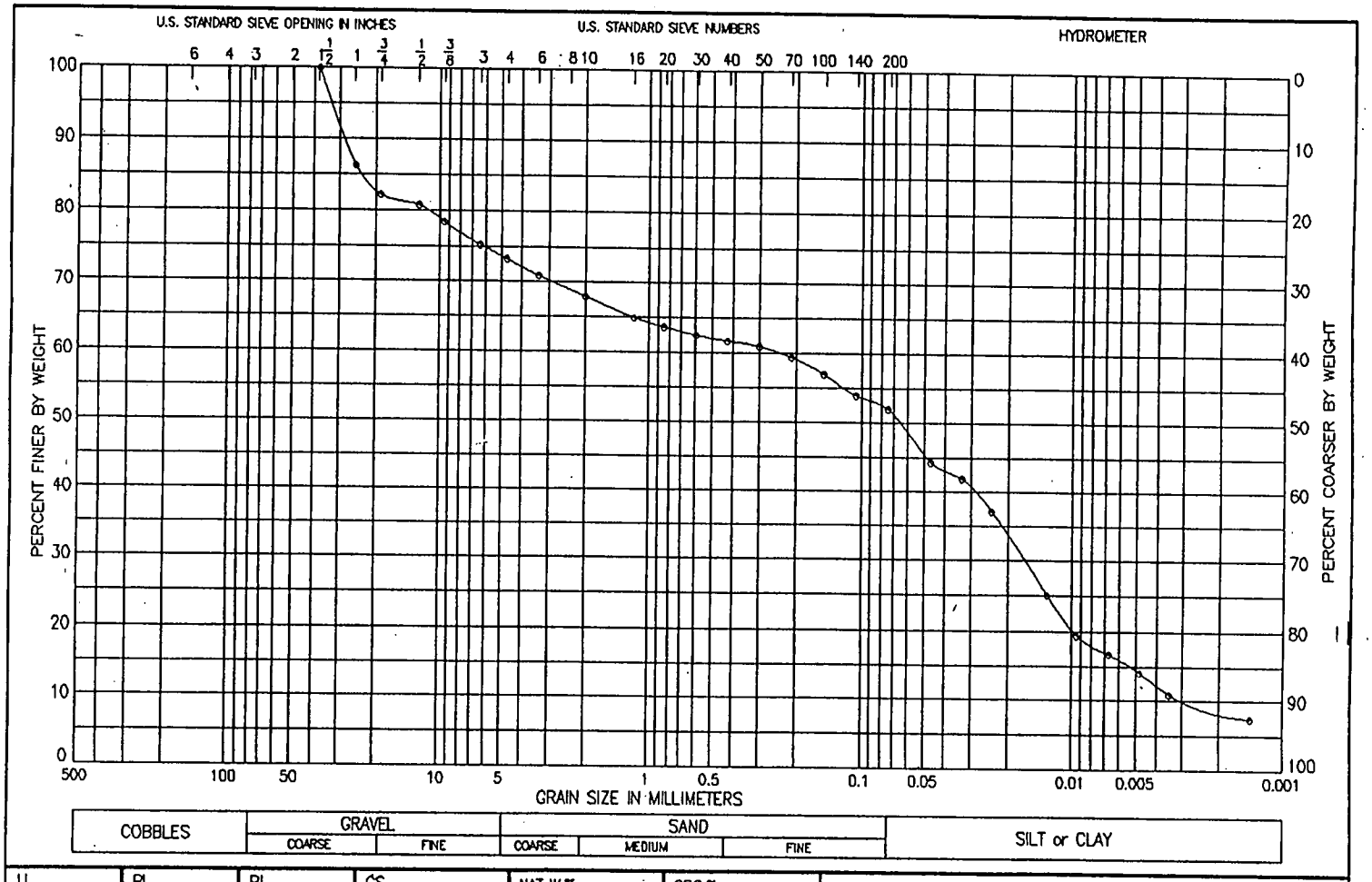
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	3/4 in	19.100	100.0	.0
6.9	1/2 in	12.500	98.9	1.1
3.5	3/8 in	9.500	98.3	1.7
4.2	No 3	6.350	97.6	2.4
4.6	No 4	4.750	96.9	3.1
3.6	No 6	3.350	96.3	3.7
6.4	No 10	2.000	95.2	4.8
.5	No 16	1.180	94.4	5.6
.7	No 20	.850	94.1	5.9
1.0	No 30	.600	93.6	6.4
1.5	No 40	.425	92.7	7.3
2.0	No 50	.300	91.9	8.1
3.0	No 70	.212	90.2	9.8
4.4	No 100	.150	87.9	12.1
6.7	No 140	.106	84.1	15.9
8.6	No 200	.075	80.9	19.1

HYDROMETER:

RDGS	TEMP			
23.2	22.5	.0457	61.6	38.4
22.1	22.5	.0327	58.7	41.3
20.0	22.5	.0237	53.1	46.9
17.0	22.5	.0126	45.1	54.9
15.4	22.5	.0090	40.9	59.1
14.1	23.0	.0064	37.7	62.3
12.3	23.0	.0046	32.9	67.1
11.1	22.5	.0033	29.5	70.5
7.2	23.0	.0014	19.4	80.6

PERCENT GRAVEL = 3.1
PERCENT SAND = 16.0
PERCENT FINES = 80.9

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
31	19	12	2.69 EST		3.0

CLASSIFICATION
SANDY GRAVELLY CLAY (CL), BROWN

GRADATION CURVE | LABORATORY USAE WES – STF/GL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 34 SAMPLE NO. 1415

DEPTH/ELEV 30–60" DATE 17 MAR 95

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 34 SAMPLE: 1415 DF: MD1495 .DAT
DEPTH: 30-60" DATE: 17 MAR 95

LL: 31 PL: 19 PI: 12 GS: 2.69 est WC: .00 OC: 3.00
CLASSIFICATION: 108
SANDY GRAVELLY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 577.2 gms.
PARTIAL WEIGHT AFTER SPLIT: 52.3 gms.

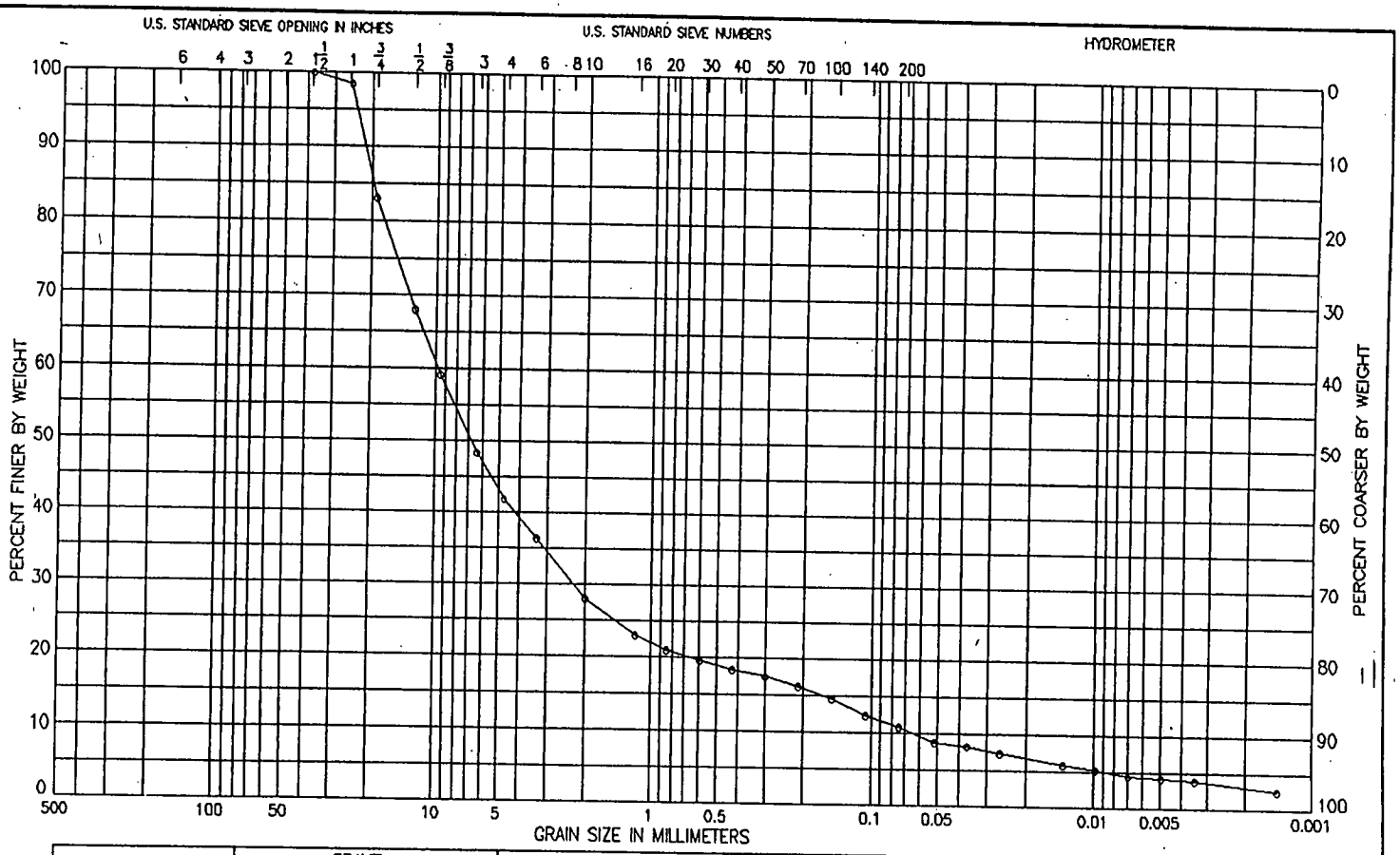
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1.5 in	37.500	100.0	.0
79.2	1 in	25.000	86.3	13.7
23.4	3/4 in	19.100	82.2	17.8
8.3	1/2 in	12.500	80.8	19.2
13.8	3/8 in	9.500	78.4	21.6
18.3	No 3	6.350	75.2	24.8
11.1	No 4	4.750	73.3	26.7
13.7	No 6	3.350	70.9	29.1
17.1	No 10	2.000	68.0	32.0
2.3	No 16	1.180	65.0	35.0
3.3	No 20	.850	63.7	36.3
4.2	No 30	.600	62.5	37.5
4.8	No 40	.425	61.7	38.3
5.4	No 50	.300	60.9	39.1
6.6	No 70	.212	59.4	40.6
8.4	No 100	.150	57.0	43.0
10.8	No 140	.106	53.9	46.1
12.3	No 200	.075	52.0	48.0

HYDROMETER:

RDGS	TEMP			
21.4	22.5	.0466	44.3	55.7
20.3	22.5	.0333	42.0	58.0
18.0	22.5	.0241	37.2	62.8
12.1	22.5	.0132	25.0	75.0
9.4	22.5	.0096	19.4	80.6
8.0	23.0	.0068	16.8	83.2
6.7	23.0	.0048	14.1	85.9
5.3	22.5	.0035	11.0	89.0
3.5	23.0	.0014	7.4	92.6

PERCENT GRAVEL = 26.7
PERCENT SAND = 21.3
PERCENT FINES = 52.0

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
29	17	12	2.69 EST		5.1

CLASSIFICATION
SANDY CLAYEY GRAVEL (GP-GC), BROWN

PROJECT: CRANE, ABG SOILS, PART 2

BORING NO. 35 SAMPLE NO. 1420

DEPTH/ELEV 30-50" DATE 17 MAR 95

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 35 SAMPLE: 1420 DF: MD1495 .DAT
DEPTH: 30-50" DATE: 17 MAR 95

LL: 29 PL: 17 PI: 12 GS: 2.69 est WC: .00 OC: 5.10
CLASSIFICATION: 108
SANDY CLAYEY GRAVEL (GP-GC), BROWN

TOTAL WEIGHT OF SAMPLE: 1285.2 gms.
PARTIAL WEIGHT AFTER SPLIT: 52.4 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	1.5 in	37.500	100.0	.0
18.7	1 in	25.000	98.5	1.5
198.7	3/4 in	19.100	83.1	16.9
193.1	1/2 in	12.500	68.1	31.9
113.8	3/8 in	9.500	59.2	40.8
140.3	No 3	6.350	48.3	51.7
82.0	No 4	4.750	41.9	58.1
70.5	No 6	3.350	36.4	63.6
108.3	No 10	2.000	28.0	72.0
9.5	No 16	1.180	22.9	77.1
13.3	No 20	.850	20.9	79.1
15.9	No 30	.600	19.5	80.5
18.1	No 40	.425	18.3	81.7
19.7	No 50	.300	17.5	82.5
22.2	No 70	.212	16.1	83.9
25.2	No 100	.150	14.5	85.5
29.3	No 140	.106	12.3	87.7
32.0	No 200	.075	10.9	89.1

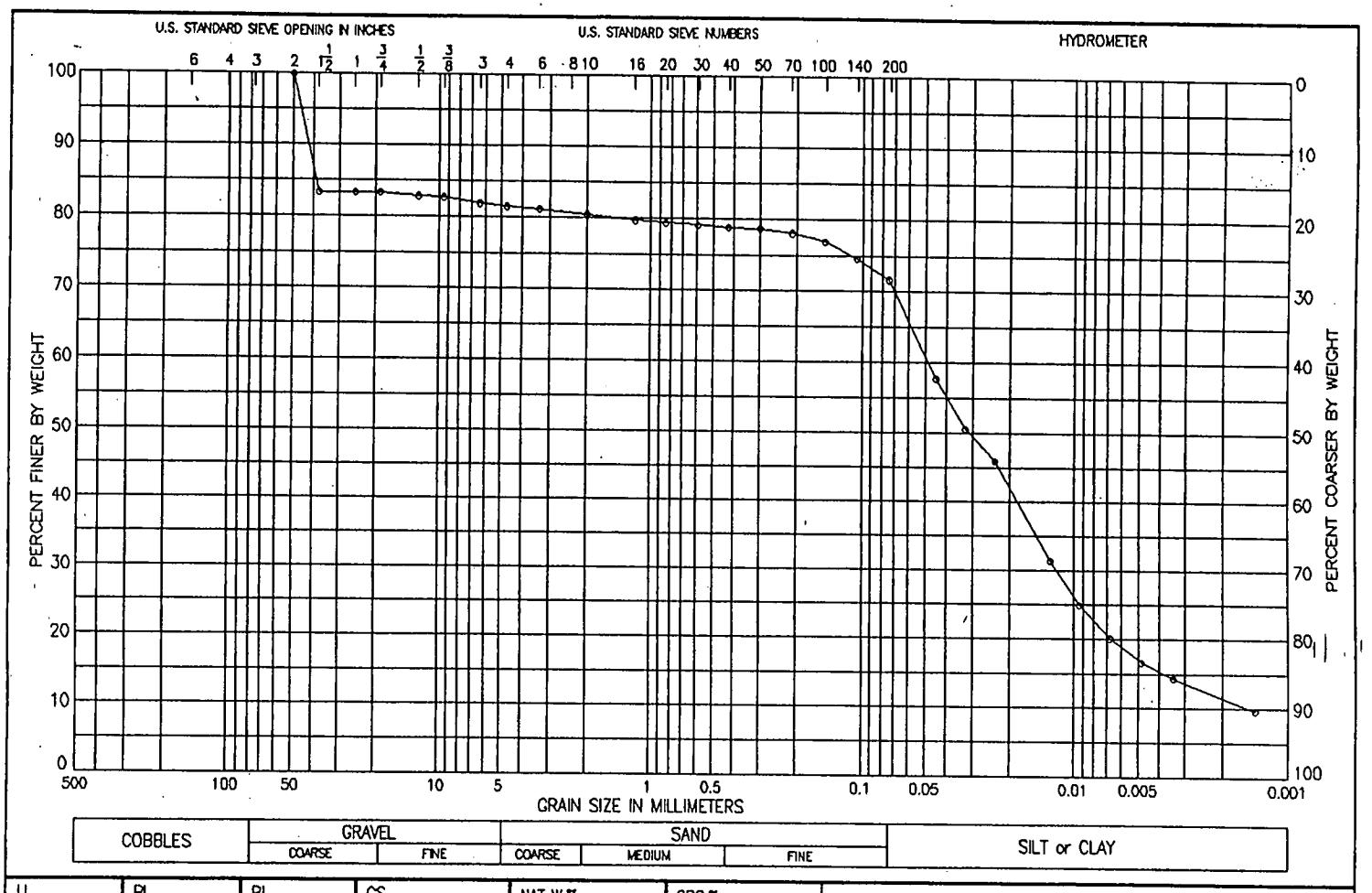
HYDROMETER:

RDGS	TEMP			
10.5	22.0	.0518	8.8	91.2
9.9	22.0	.0368	8.3	91.7
8.9	22.0	.0263	7.5	92.5
7.1	22.0	.0138	6.0	94.0
6.3	22.0	.0098	5.3	94.7
5.2	22.5	.0070	4.4	95.6
5.0	22.5	.0050	4.3	95.7
4.5	23.0	.0035	3.9	96.1
2.9	23.0	.0014	2.6	97.4

PERCENT GRAVEL = 58.1
PERCENT SAND = 31.0
PERCENT FINES = 10.9

D60 = 9.77
D30 = 2.32
D10 = .06
CU =175.46
CC = 9.90

EDE



LL	PL	PI	GS	NAT W,%	ORG,%
32	22	10	2.69 EST		3.2

CLASSIFICATION
GRAVELLY SILTY CLAY (CL), BROWN; WITH SAND

GRADATION CURVE | LABORATORY USAE WES – STF/GL

PROJECT CRANE, ABG SOILS, PART 2

BORING NO. 38 SAMPLE NO. 1335

DEPTH/ELEV 30–48" DATE 17 MAR 95

SIEVE ANALYSIS

PROJECT: CRANE, ABG SOILS, PART 2

BORING: 38 SAMPLE: 1335 DF: MD1495R .DAT
DEPTH: 30-48" DATE: 17 MAR 95

LL: 32 PL: 22 PI: 10 GS: 2.69 est WC: .00 OC: 3.20
CLASSIFICATION: 108
GRAVELLY SILTY CLAY (CL), BROWN; WITH SAND

TOTAL WEIGHT OF SAMPLE: 477.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 55.4 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	PERCENT COARSER
.0	2 in	50.000	100.0	.0
79.9	1.5 in	37.500	83.3	16.7
.0	1 in	25.000	83.3	16.7
.0	3/4 in	19.100	83.3	16.7
2.3	1/2 in	12.500	82.8	17.2
.6	3/8 in	9.500	82.7	17.3
3.6	No 3	6.350	81.9	18.1
2.2	No 4	4.750	81.5	18.5
1.6	No 6	3.350	81.1	18.9
3.4	No 10	2.000	80.4	19.6
.5	No 16	1.180	79.7	20.3
.7	No 20	.850	79.4	20.6
.9	No 30	.600	79.1	20.9
1.1	No 40	.425	78.8	21.2
1.2	No 50	.300	78.7	21.3
1.6	No 70	.212	78.1	21.9
2.4	No 100	.150	76.9	23.1
4.0	No 140	.106	74.6	25.4
6.0	No 200	.075	71.7	28.3

HYDROMETER:

RDGS	TEMP			
25.1	22.0	.0447	57.8	42.2
22.0	22.0	.0327	50.6	49.4
20.0	22.0	.0237	46.0	54.0
13.7	22.0	.0130	31.4	68.6
10.9	22.0	.0094	24.9	75.1
8.7	22.5	.0068	20.1	79.9
7.2	22.5	.0049	16.6	83.4
6.1	23.0	.0034	14.3	85.7
4.1	23.0	.0014	9.7	90.3

PERCENT GRAVEL = 18.5
PERCENT SAND = 9.8
PERCENT FINES = 71.7

EDE

Appendix D
Chain of Custody Forms

Cooler #1

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG - Crane SWMU # 03/10

SAMPLERS: (Signature) TAKrishnan

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	Metals	Explosive	Volatiles	Trip Blank		REMARKS
8.10.93	1415	03/10 - 39 - 93-1	5	1	1	1	2			
8.10.93	1430	03/10 - 40 - 93-1	5	1	1	1	2			chemical analysis of soil
8.10.93	1500	03/10 - 41 - 93-1	5	1	1	1	2			Sampling according to
8.10.93	1530	03/10 - 46 - 93-1	5	1	1	1	2			ABG - Part 2 RFI Phase III
8.11.93	9.30	03/10 - 64 - 93-1	5	1	1	1	2			Soils, Work Plan.
8.11.93	10.00	03/10 - 70 - 93-1	5	1	1	1	2			
8.11.93	10.15	03/10 - 71 - 93-1	5	1	1	1	2			
8.11.93	10.45	03/10 - 69 - 93-1	5	1	1	1	2			
~~8.11.93~~		~~Trip Blank~~ TAK	~~1~~ TAK					TAK		NO Trip Blank.
			40	8	8	8	16			

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
TAKrishnan	8.11.93 12.00				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Remarks	

WES FORM R Nov 89 2196 PREVIOUS EDITIONS OBSOLETE

cooler #2

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG-Crane SWMU # 03/10

SAMPLERS: (Signature) [illegible]

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	Metals	Explosives	Volatiles			REMARKS
8 11.93	1515	03/10 — 63 — 93-1	5	1	1	1	2			
8.11.93	1515	03/10 — 68 — 93-1	5	1	1	1	2			
8.11.93	1615	03/10 — 59 — 93-1	5	1	1	1	2			
8 11.93	1615	03/10 — 53 — 93-1	5	1	1	1	2			
8.12.93	915	03/10 — 54 — 93-1	5	1	1	1	2			
8.12.93	1015	03/10 — 61 — 93-1	5	1	1	1	2			
8.12.93	915	03/10 — Dup1 — 93-1	5	1	1	1	2			
		~~03/10 — 93-1~~	~~5~~	~~1~~	~~1~~	~~1~~	~~2~~	~~BK~~		

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
[illegible]	8.12.93 1115				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM R Nov 89 2196 PREVIOUS EDITIONS OBSOLETE

D-2

Cooler #3

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG - Crane SWMU #03/10

SAMPLERS: (Signature) TAKidwell

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	Metals	Explosives	Volatiles			REMARKS
8.12.93	1330	03/10 - 56-93-1	5	1	1	1	2			Cancelled see cooler #6 chain of custody for resample
8.12.93	1345	03/10 - 50-93-1	5	1	1	1	2			
8.12.93	1415	03/10 - 57-93-1	5	1	1	1	2			
8.12.93	1130	03/10 - 51-93-1	5	1	1	1	2			
8.16.93	8.45	03/10 - 55-93-1	5	1	1	1	2			
8.16.93	9.00	03/10 - 60-93-1	5	1	1	1	2			
8.16.93	9.30	03/10 - 47-93-1	5	1	1	1	2			
8.16.93	9.00	03/10 - Dup 2-93-1	5	1	1	1	2			Duplicate sample for QC

Resample all locations. Because of one day late arrival of samples at Lab. Ice was melted. Discussed with Kam & Steve. Z.K. 8.18.93

See cooler 6

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
TAKidwell	8.16.93 11.30				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Remarks	

WES FORM R Nov 80 2196 PREVIOUS EDITIONS OBSOLETE

Cooler #4

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CU ODY RECORD

PROJECT NAME - ABG-Crane SWMU # 03/10

SAMPLERS: (Signature) TAKidwai

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	Metals	Explosive	Volatiles	Trip Blank		REMARKS
8.16.93	1315	03/10 - 48 - 93 - 1	5	1	1	1	2			
8.16.93	1330	03/10 - 42 - 93 - 1	5	1	1	1	2			
8.16.93	1315	03/10 - Dup3 - 93 - 1	10	2	2	2	4			Duplicate for QA/QC.
8.17.93	9.30	03/10 - 58 - 93 - 1	5	1	1	1	2			
8.17.93	9.15	03/10 - 52 - 93 - 1	5	1	1	1	2			
8.17.93	10.15	03/10 - 49 - 93 - 1	5	1	1	1	2			
8.17.93	10.30	03/10 - 45 - 93 - 1	5	1	1	1	2			
8.17.93		Trip Blank - 1	2	-	-	-	-	2		

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
TAKidwai	8.17.93 11.30				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM 2196 R Nov 89

PREVIOUS EDITIONS OBSOLETE

D-4

Cooler #5

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG-Crane SWMU #03/10

SAMPLERS: (Signature) [illegible]

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	Metals	Explosive	Volatiles	Trip Blank	REMARKS
8.17.93	1330	03/10 - 43-93-1	5	1	1	1	2		
8.17.93	1345	03/10 - 44-93-1	5	1	1	1	2		
8.17.93	1400	03/10 - 65-93-1	5	1	1	1	2		
8.17.93	1415	03/10 - 62-93-1	5	1	1	1	2		
8.17.93	1430	03/10 - 67-93-1	5	1	1	1	2		
8.18.93	8.45	03/10 - 66-93-1	5	1	1	1	2		
8.18.93		Trip Blank-2	2	-	-	-	-	2	

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
[illegible]	8.18.93 9.45				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM R Nov 86 2196 PREVIOUS EDITIONS OBSOLETE

Cooler # 6

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME - ABG - Clare SWMU # 03-10

SAMPLERS: (Signature) TAKirkham

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	Metals	Explosives	Volatiles	Trip Blanks		REMARKS
8.19.93	7.45	03/10 - 56 - 93 - 1	5	1	1	1	2			
8.19.93	8.30	03/10 - 50 - 93 - 1	5	1	1	1	2			
8.19.93	9.15	03/10 - 57 - 93 - 1	5	1	1	1	2			
8.19.93	9.00	03/10 - 51 - 93 - 1	5	1	1	1	2			
8.19.93	8.00	03/10 - 55 - 93 - 1	5	1	1	1	2			
8.19.93	8.15	03/10 - 60 - 93 - 1	5	1	1	1	2			
8.19.93	8.45	03/10 - 47 - 93 - 1	5	1	1	1	2			
8.19.93	8.30	03/10 - Dup2 - 93 - 1	10	2	2	2	4	mx.		Duplicate for QA/QC.
8.19.93		Trip Blank 3						2		

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
TAKirkham	8.19.93 11.00				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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D-6

Cooler # 7

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG-Crane SWMU #03-10

SAMPLERS: (Signature) TAKidwell

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	Metals	Explosives	Volatiles	Trip Blanks	Rinsate	Field Blanks	REMARKS
8.19.93	1415	03/10-11-93-1	5	1	1	1	2				
8.19.93	1430	03/10-11-93-2	5	1	1	1	2				
8.19.93	1500	03/10-10-93-1	5	1	1	1	2				
8.19.93	1530	03/10-10-93-2	5	1	1	1	2				
8.19.93		Trip Blank 4	2					2			
8.19.93		Rinsate 1	5						5		Three one liter and Two vials.
8.19.93		Field Blank 1	5							5	(Three one liter + Two vials)

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
TAKidwell	8.20.93 10.AM				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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D-7

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUS DY RECORD

PROJECT NAME: ABG-CRANE SWMU # 03/10

SAMPLERS: (Signature) Larry Benjamin

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	METALS	EXPLOSIVES	VOLATILES	TRIP BLANK		REMARKS
8.22.93	1615	03/10-21-93-1	5	1	1	1	2			
8.22.93	1645	03/10-21-93-2	5	1	1	1	2			
8.22.93	1700	03/10-21-93-3	5	1	1	1	2			
8-22.93	1500	03/10-24-93-1	5	1	1	1	2			
8-22-93	1345	03/10-34-93-1	5	1	1	1	2			
8-22-93	1415	03/10-34-93-2	5	1	1	1	2			
8-22-93		TRIP BLANK 5	2					2		
8-22-93	1310	03/10-DUP-6-93-1	10	2	2	2	4			DUPLICATE for QA/QC

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Benjamin	8-23-93 0930				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG-- CRANE SUMMIT #03/10

SAMPLERS: (Signature) Larry Bergman

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	METALS	EXPLOSIVES	VOLATILES	TRIP BLANK	RINSATE	REMARKS
8-22-93	10:00	03/10-12-93-1	5	1	1	1	2			
8-22-93	10:40	03/10-12-93 2	5	1	1	1	2			
8-22-93	11:20	03/10-12-93 3	5	1	1	1	2			
8-22-93	0905	03/10-14-93-1	5	1	1	1	2			
8-22-93	0925	03/10-14-93-2	5	1	1	1	2			
8-22-93	12:00	03/10-36-93-1	5	1	1	1	2			
8-22-93	1310	03/10-37-93-1	5	1	1	1	2			
8-22-93		RINSATE 3	5						5	Three ONE LITER and TWO VIALS.
		TRIP BLANK 6						2		
8-21-93	1530	03/10-DUP 5-93-1	10	2	2	2	4			DUPLICATE FOR QA/QC

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Bergman	8-22-93 1025				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUS DY RECORD

PROJECT NAME: ABG- CRANE SWMU # 03/10

SAMPLERS: (Signature) Larry Benjamin

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	METALS	EXPLOSIVES	VOLATILES	TRIP BLANK		REMARKS
8-20-93	1100	03/10-5-93-1	5	1	1	1	2			
8-20-93	1115	03/10-5-93-2	5	1	1	1	2			
8-20-93	1015	03/10-6-93-1	5	1	1	1	2			
8-20-93	1030	03/10-6-93-2	5	1	1	1	2			
8-21-93	0955	03/10-8-93-1	5	1	1	1	2			
8-21-93	0850	03/10-13-93-1	5	1	1	1	2			
8-21-93	0910	03/10-13-93-2	5	1	1	1	2			
8-21-93	0955	03/10-DUP-4-93-1	10	2	2	2	4			
		TRIP BLANK 7						2		

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Benjamin	8-23-93 0900				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG- CRANE SWMU # 03/10

SAMPLERS: (Signature) Larry Berger

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	METALS	EXPLOSIVES	VOLATILES	TRIP BLANK	RINSATE	REMARKS
8-21-93	1530	03/10-1-93-1	5	1	1	1	2			
8-21-93	1550	03/10-2-93-1	5	1	1	1	2			
8-21-93	1615	03/10-3-93-1	5	1	1	1	2			
8-21-93	1430	03/10-7-93-1	5	1	1	1	2			
8-21-93	1445	03/10-7-93-2	5	1	1	1	2			
8-20-93	0945	03/10-9-93-1	5	1	1	1	2			
8-21-93	1100	03/10-22-93-1	5	1	1	1	2			
8-21-93	1115	03/10-22-93-2	5	1	1	1	2			
8-21-93	1130	03/10-22-93-3	5	1	1	1	2			
8-23-93		Trip Blank 8						2		
		Rinsate ~~#3~~ 2							5	three one liter and two vials.

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Berger	8-23-93 0830				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG - CRANE SWMU #03/10

SAMPLERS: (Signature) Larry Benjamin

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	METALS	EXPLOSIVES	VOLATILES	TRIP BLANK		REMARKS
8-23-93	1325	03/10-38-93-1	5	1	1	1	2			
8-23-93	1335	03/10-38-93-2	5	1	1	1	2			
8-23-93	1404	03/10-35-93-1	5	1	1	1	2			
8-23-93	1420	03/10-35-93-2	5	1	1	1	2			
8-23-93	1515	03/10-33-93-1	5	1	1	1	2			
8-23-93	1515	03/10-DUP7-93	10	2	2	2	4			
8-24-93		TRIP BLANK 9						2		

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Benjamin	8-24-93 0730				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG – CRANE SWMU # 03/10

SAMPLERS: (Signature) Larry Benjamin

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	METALS	EXPLOSIVES	VOLATILES	TRIP BLANK	RINSATE	REMARKS
8-24-93	0855	03/10-31-93-1	5	1	1	1	2			
8-24-93	1040	03/10-32-93-1	5	1	1	1	2			
8-24-93	1115	03/10-25-93-1	5	1	1	1	2			
8-24-93	1130	03/10-25-93-2	5	1	1	1	2			
8-24-93	1345	03/10-29-93-1	5	1	1	1	2			
8-24-93	1400	03/10-29-93-2	5	1	1	1	2			
8-24-93	1420	03/10-28-93-1	5	1	1	1	2			
8-24-93	1445	03/10-28-93-2	5	1	1	1	2			
8-24-93	1515	03/10-28-93-3	5	1	1	1	2			
8-24-93		RINSATE #4	5						5	three one liter and two vials
8-24-93		TRIP BLANK 10						2		

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Larry Benjamin	8-25-93 0800				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Remarks	

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COOLER

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG - CRANE SWMU #03/10

SAMPLERS: (Signature) Larry Benjamin

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	METALS	EXPLOSIVES	VOLATILES	TRIP BLANK	RINSATE	REMARKS
8-25-93	0915	03-10-19-93-1	5	1	1	1	2			
8-25-93	0935	03/10-19-93-2	5	1	1	1	2			
8-25-93	1000	03/10-19-93-3	5	1	1	1	2			
8-25-93	1030	03/10-23-93-1	5	1	1	1	2			
8-25-93	1050	03/10-23-93-2	5	1	1	1	2			
8-25-93	1110	03/10-23-93-3	5	1	1	1	2			
~~8-25-93~~	~~1335~~	~~03/10-15-93-1~~	~~5~~	~~1~~	~~1~~	~~1~~	~~2~~ 0			→ PUT IN COOLER #15
8-25-93		03/10-Rinsate #5	5						5	THREE ONE LITER and TWO VIALS
8-25-93		03/10-TRIP BLANK-11	2					2		

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Benjamin	8-26-93 0805				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: ABG - CRANE SWMU #03/10

SAMPLERS: (Signature) Larry Benjamin

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	PAHS	METALS	EXPLOSIVES	VOLATILES	TRIP BLANK	REMARKS
8-25-93	1125	03/10-17-93-1	5	1	1	1	2		
8-25-93	1145	03/10-17-93-2	5	1	1	1	2		
8-25-93	1200	03/10-17-93-3	5	1	1	1	2		
8-25-93	1300	03/10-16-93-1	5	1	1	1	2		
8-25-93	1300	03/10-DUP 8-93	10	2	2	2	4		
8-25-93		TRIP BLANK-12	2				-	2	
8-25-93	1335	03/10-15-93-1	5	1	1	1	2		

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Benjamin	8/26/93 0835				
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

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Appendix E
Data Validation Report

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

REPLY TO ATTENTION OF
CEWES-EE-C

24 May 1995

MEMORANDUM FOR US ARMY ENGINEER DISTRICT, WILMINGTON, 69 DARLINGTON AVENUE, WILMINGTON, NC 28403 (ATTN: MR. KIDWAI)

SUBJECT: Data validation for samples collected 10 August 1993 - 25 August 1993 - Crane ABG SWMU #3/10

1. Completeness check

a. All samples and analyses were processed except for one set of samples that was received late due to missed Federal Express delivery. At the instructions of Mr. Steve Norstead, these samples were not analyzed and a second set was collected.

b. Data reported included copies of all chain-of-custody records received from the field. QC results for blanks, spikes, duplicates and standard reference materials were included in the data report.

c. Procedures specified in the project planning document were followed for all analyses with the exception of tin that was analyzed by plasma emission spectrometer.

d A review of the raw data sheets shows that all calibrations were performed in accordance with SW-846 procedures.

2. All data were reported at or below project required detection limits.

3. Data were evaluated with respect to control limits for duplicates, spikes, blanks and surrogates. The following problems were noted and corrective actions taken where appropriate.

a. Duplicate results for a few of the metals samples had RPDs greater than desirable, however all other QC data were in control. No corrective action was required.

b. Volatile organic analysis had low levels of methylene chloride and acetone in both samples and lab blanks. These concentrations were below levels requiring corrective action. Acetone levels were above the high end of the calibration range for sample # 37072; this was attributed to the acetone/hexane mix being used by the drill crew to rinse the equipment (value was flagged with an "E"). Sample # 37234 showed cis-1,2-dichloroethene at levels above the calibration range. A smaller one-gram aliquot was analyzed

with a value still above the calibration range. An attempt to extract with methanol was not very successful due to the poor quality of HPLC grade methanol. This data was flagged with an "E".

4. All samples were analyzed within acceptable holding times.

5. Data for QA samples were within acceptable limits.

ANN B. STRONG
Chief, Environmental Chemistry Branch

REPORT DOCUMENTATION PAGE

Form Approved
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1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
September 1998

3. REPORT TYPE AND DATES COVERED
Final report

4. TITLE AND SUBTITLE
Final Report: RCRA Facility Investigation, Part 2 Phase III Soils Study, Ammunition Burning Ground, SWMU 03/10, Naval Surface Warfare Center Crane, Indiana

5. FUNDING NUMBERS

6. AUTHOR(S)
Paul Albertson, James H. May, John Stephen Nohrstedt, Robert W. Magee, Phil Payonk

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, MS 39180-6199

U.S. Army Engineer District, Wilmington
69 Darlington Avenue, Wilmington, NC 28403

8. PERFORMING ORGANIZATION REPORT NUMBER
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Charleston, SC 29411-0068

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12a. DISTRIBUTION/AVAILABILITY STATEMENT
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12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

An RCRA Facility Investigation, Phase III Soils Study was conducted at the Ammunition Burning Ground Site at the Naval Surface Warfare Center Crane, Indiana, by personnel of the U.S. Army Engineer Waterways Experiment Station (WES) and the U.S. Army Engineer District, Wilmington (CESAW). The field work was done in August 1993. The data reduction, draft report preparation, and final editing were conducted between September 1993 and August 1998. The soils analyses indicated that ABG waste disposal activities have contributed residues of explosives compounds and metal contamination to the soils. Explosives with highest concentration were HMX, RDX, and TNT. Cadmium, calcium, copper, lead, zinc, and tin were detected in concentrations much higher than normal.

14. SUBJECT TERMS

Contamination	Metals
Crane	Navy
Explosives	Soils

15. NUMBER OF PAGES
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UNCLASSIFIED

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