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September 1998

US Army Corps of Engineers
Waterways Experiment Station

Final Report: RCRA Facility Investigation Phase II Soils, Old Burn Pit, Naval Surface Warfare Center Crane, Indiana

by Paul E. Albertson, James H. May, WES

Robert W. Magee, Phil Payonk, Larry Benjamin, Wilmington District

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Final Report: RCRA Facility Investigation Phase II Soils, Old Burn Pit, Naval Surface Warfare Center Crane, Indiana

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Final report

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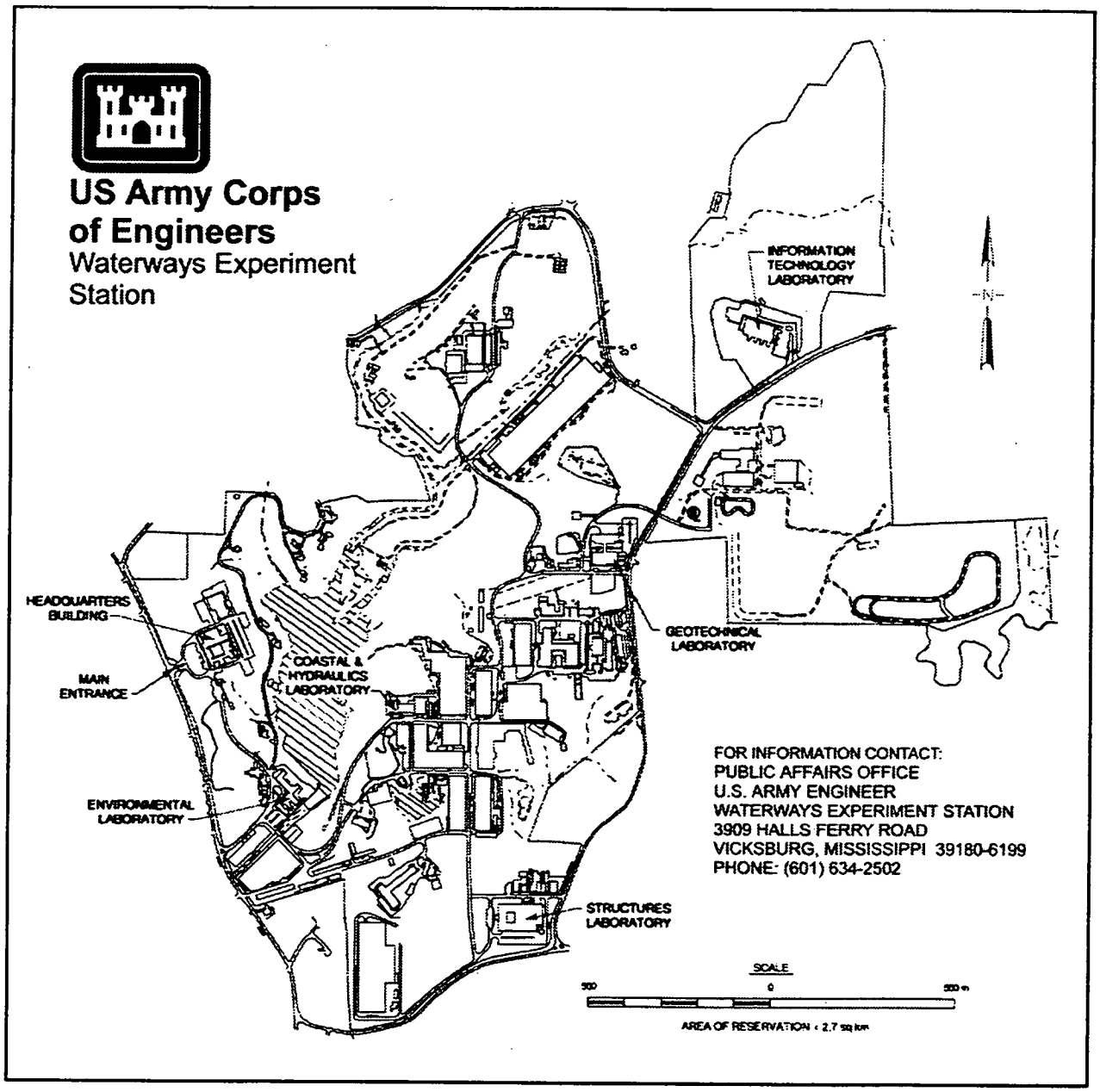

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Preface

A Resource Conservation and Recovery Act Facility Investigation Phase II Soils Study was conducted at the Old Burn Pit, 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, data analyses, and draft report were conducted during August 1990 through February 1991. The report was finalized in August 1998.

The primary author of this report was Mr. Paul Albertson, GL, WES. Contributing authors were Dr. James H. May, GL, WES, and Messrs. Robert Magee, Phil Payonk, and Larry Benjamin, CESAW. Also contributing to the report were Messrs. Mark Vispi, Elastic Brown, Vaugh Nixon, and Mses. Benita Abraham and Evelyn Villanueva, GL, WES. Mr. Jeffrey Ciocco provided oversight for Naval Facilities Engineering Command, and Mr. James Hunsicker, Environmental Protection Department, managed the project. Mr. William Murphy, Engineering Geology Branch, was Principal Investigator, and Dr. May was Program Manager for WES.

At the time the study was conducted, English units were used to record the data. A metric-English conversion table is provided.

This investigation 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 the 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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Acronyms and Abbreviations

CAAA	Crane Ammunition Army Activity
CAR	Corrective Action Requirements
CL	Lean clay
CH	Plastic clay
D-BHC	Delta berylium nitrate
EPA	Environmental Protection Agency
HMTC	Hazardous Materials Technical Center
HNU	Brand name for a photoionization detector
HW	Hazardous Waste
ICHEM	Sterile/Clean sampling bottles
IRP	Installation Restoration Program
J-Value	Detectable concentration (not quantifiable)
MH	Plastic silt
ML	Lean silt
NAD	Naval Army Depot
NEESA	Naval Energy and Environmental Support Activity
NSWCC	Naval Surface Warfare Center Crane
OBP	Old Burn Pit
PAH	Polycyclic Aromatic Hydrocarbons
PPDDE	Para, Para' Dichlorodiphenyl Ethane
PPDDT	Para, Para' Dichlorodiphenyl trichloroethane
QA/QC	Quality Assurance/Quality Control
RCRA/HSWA	Resource Conservation and Recovery Act/Hazardous and Solid Waste Amendments
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SC	Clayey sand
SM	Silty sand
SP	Poorly sorted sand
SW	Well sorted sand
SW-84	Standard EPA Method of Analyses
SWMU	Solid Waste Management Unit
TIC	Tentatively Identified Compounds

USACE	United States Army Corps of Engineers
USACEWES	United States Army Corps of Engineers Waterways Experiment Station
USCS	Unified Soil Classification System

Executive Summary

The Naval Surface Warfare Center Crane Indiana (NSWCC) is a naval facility located in southwestern Indiana. Its mission is to provide material, technical, and logistic support to the Navy. One of its primary and most prominent tasks is that NSWCC serves as an inland ammunition production and storage center.

In 1989 NSWCC was given a Final RCRA Storage Permit. The permit contained Corrective Action Requirements (CAR). These requirements are being fulfilled through the Navy's Installation Restoration Program (IRP). The IRP conforms to the scope and purpose of the National Oil and Hazardous Substances Pollution Contingency Plan (March 1980). The requirements included the need for RCRA Facilities Investigations (FRI) to be done at its hazardous waste disposal units. These units are called Solid Waste Management Units (SWMU). RFIs have three phases, a Phase I Environmental Monitoring Report, a Phase II Release Assessment and a Phase III Release Characterization Study. A RFI Phase II, soils investigation was performed at the Old Burn Pit (OBP) waste disposal site. This study was conducted by U.S. Army Corps of Engineers (USACE) personnel. This study is built from three work elements. The field work was done in October 1990, analytical work was done between October 1990 and January 1991, and the data reduction and report writing was done between December 1990, and August 1991. The report ws revised for publication in 1998.

At the OBP various types of solid and liquid wastes were burned. The ash and unburned debris from the operation were pushed into a dump area at the site. The site is no longer used as a burn area; it is presently used as a parking area for delivery trailers.

The objectives of this study were (1) to describe the soil conditions around the site, and (2) to identify and characterize the operation residuals. Soil samples were collected using hollow stem augering and shelby tube sampling techniques. To determine the chemical character of the waste residues, samples were taken from the burn pit and dump areas. Data derived from soil samples taken from borings located away from the operational areas were used to establish background control conditions. A plan was developed for this investigation. To safeguard the data quality, the plan's rigid Quality Assurance/Quality Control (QA/QC) procedures were followed. The QC level selected for this study is a Level "C." The soil samples were analyzed for the presence of

volatile and semivolatile organic compounds (EPA Methods 8240 and 8270), and inorganic compounds including toxic metals and phosphorus. Explosive wastes were not brought to the location and the sampling package did not include explosive compound analysis. All analytical methods used were EPA SW-846 analytical methods.

Soil descriptions were drawn from 9 auger borings drilled in 1990, 19 groundwater monitoring wells drilled in 1981 and 1983, field observations, and physical soil test data. The soil thickness of the OBP site ranges from zero to almost 60 ft. The unconsolidated earth materials were classified as clay (CL and CH), silt (ML and MH) and sand (SC, SW, SM and SP). The types of soils found at the OBP site are: residual soils, Pleistocene Epoch lacustrine (lake deposits) and alluvial (outwash) deposits, colluvium, and reworked soil associated with the burning activity. One sandy horizon was interpreted to be an ancient river deposit. Groundwater was encountered at shallow depth (4 to 6 ft) in all but three borings. Permeabilities for the soil are in the order of 2×10^{-5} and 8×10^{-6} cm/sec for silt (ML) and clay (CL), and 2×10^{-2} to 5×10^{-3} cm/sec for the sands. The clay soils are relatively impermeable. Sand deposits act as a conduit for groundwater flow. In clay and silt horizons, groundwater moves very slowly by downward vertical infiltration, then laterally along the soil/rock interface until it reaches fractured rock and enters the rock aquifer system or encounters a sand horizon. In the sand zones groundwater moves laterally through the sand body. The preferential groundwater flow in the sand horizons offers an explanation for the western movement of the contaminant plume. The contaminant plume may be traveling in the sand body.

Based on the inorganic analytical data a release of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, aluminum, barium, calcium, cobalt, iron, magnesium, manganese, sodium, and total phosphorus to the soils has occurred at the Old Burn Pit SWMU 05/03. The maximum inorganic constituent concentrations were determined from borings 8 and 9. A clear pattern of contamination of the OBP soils with volatile organic compounds attributable to the activities at the site is not evident. Two borings 5 and 9 were stopped at shallow depths because of high levels of detected volatile organics. Semivolatile organic compounds were detected in soil samples from borings 5, 6, 8, and 9. The most frequent type of semivolatile organic compound present was polycyclic aromatic hydrocarbons (PAHs). With the exception of concentrations of fluoranthene and pyrene (7.80 mg/kg and 12.0 mg/kg respectively) found in boring 8, the semivolatile organic compounds were found in "J" value concentrations. Pesticides and herbicides were found in the soil samples from all borings except boring 6 and 8. The concentration levels of these compounds detected in the soils were mostly "J" value levels. No PCBs were detected in the soils from the area. No direct link between the pesticide/herbicide concentrations and the burning activity was established.

It is concluded that contaminated conditions at the Old Burn Pit are verified, that soil conditions are influencing contaminant migration, and that further study is needed.

It is recommended that RCRA Facilities Investigation, Phase III soils investigation be done at the OBP. This study should include further soils testing, and chemical analysis of soils and stream sediments.

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

Background

Naval Surface Warfare Center, Crane (NSWCC) is a naval facility located in southwestern Indiana, approximately 40 miles southwest of Bloomington, Indiana and 74 miles south of Indianapolis, Indiana. The location of NSWCC is shown on Figure 1. The facility covers approximately 62,463 acres in Davies, Greene, and Martin Counties. It is located in a rural, sparsely populated area. The acreage surrounding the base is either wooded or farmed land. The majority of NSWCC is covered by forest. Its surface topography is that of a rugged dissected plateau cut by well-defined stream valleys. The surface elevations range from 470 ft in the valleys to 800 ft on the ridges.

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. Today Naval Weapons Support Center Crane's (NSWCC) mission is to "Provide quality and responsive engineering, technical and material support to the Fleet for combat subsystems, equipment and components, Microelectronic Technology, 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.

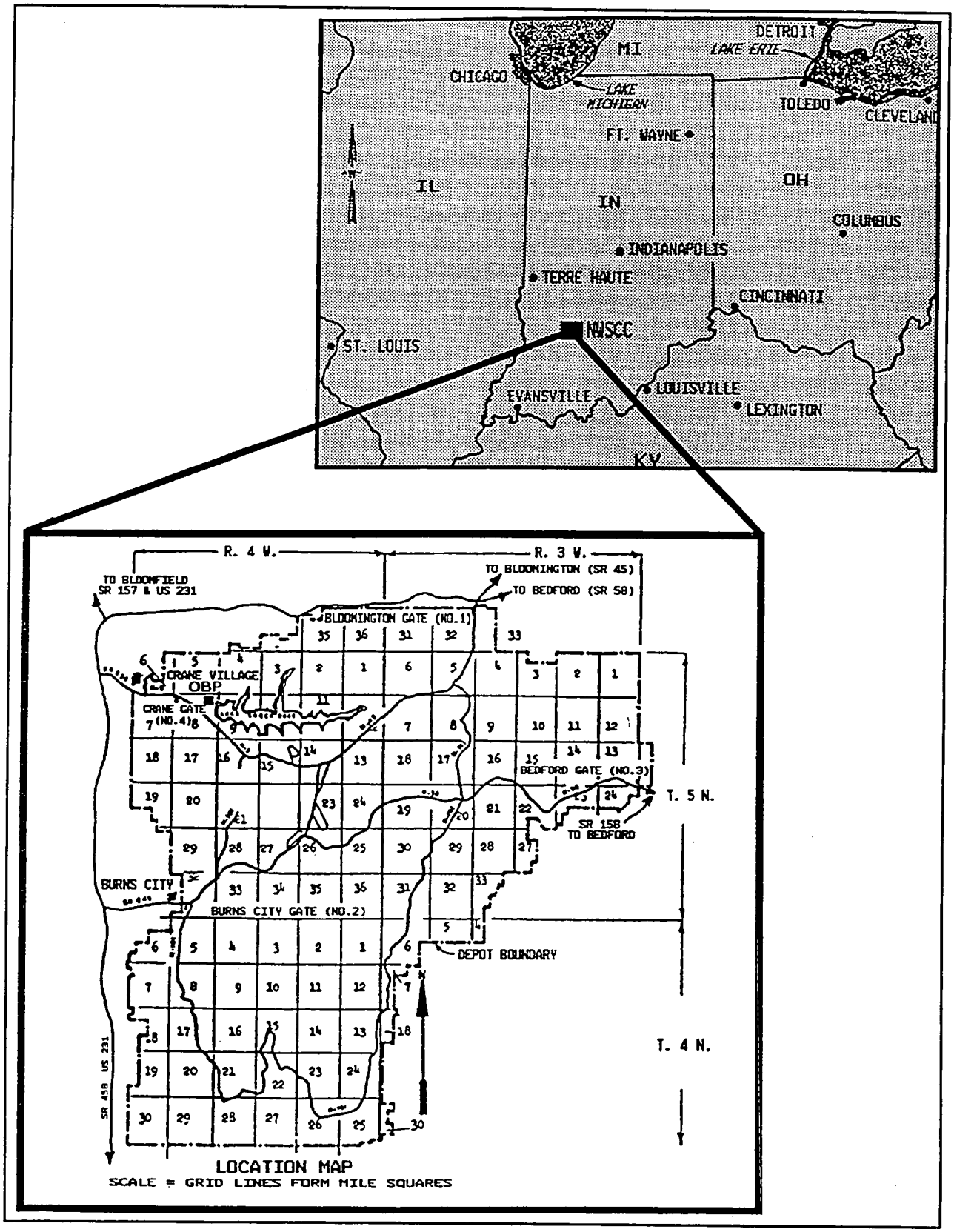


Figure 1. Location map showing the location of NWSCC and Old Burn Pit

As previously stated all environmental activities on the installation, including permitting activities, remain the responsibility of the Navy. The Navy is required by the Hazardous Waste (HW) regulations to permit all the HW treatment operations conducted at NSWCC.

Investigation Background

In 1989, the Navy was granted a Final RCRA Storage Permit for its hazardous waste storage facility. As part of the conditions setforth in the Final Permit, NSWCC was to conduct RCRA Facility Investigations (RFI) at thirty Solid Waste Management Units (SWMU). The OBP is considered to be a past operational SWMU. Surface and shallow subsurface soil investigations are part of that RFI process. The U.S. Army Corps of Engineers' Waterways Experiment Station (USACEWES) conducted the study. The field work was done in October 1990, analytical work was done between October 1990 and January 1991, and the data reduction and report writing was done between December 1990 and August 1991. The report was revised for publication in July 1998.

Site Setting

The OBP site was used from 1942 to 1972. Rubbish including wood, paper, building material, and industrial wastes were burned at the site. No explosive materials or explosive wastes were burned here. Ash from this operation and metal debris were buried in the gully to the north of the burn area. Today the site is used as a parking area for delivery trailers. Since 1972 the site has been revegetated. Groundwater studies (Dunbar, 1982 and 1984) indicate that a contaminated groundwater plume is migrating from the area.

The OBP occupies approximately 25 acres. The OBP is located in the northwest corner of the facility in the NE 1/4 of Section 8, T5N, R4W (Figure 1). The area is approximately 2,000 ft east of the Crane Gate, Gate No. 4. It is accessed using Crane Road H-331 off of Crane Road H-5 (Figure 2).

Project Objective

RFI Phase II studies are release assessments studies. Their purpose is to determine if a chemical release has occurred and to characterize the host medium. This study examined soil samples in two ways. The physical attributes of the soil were characterized and the chemical contaminants in the soil were identified.

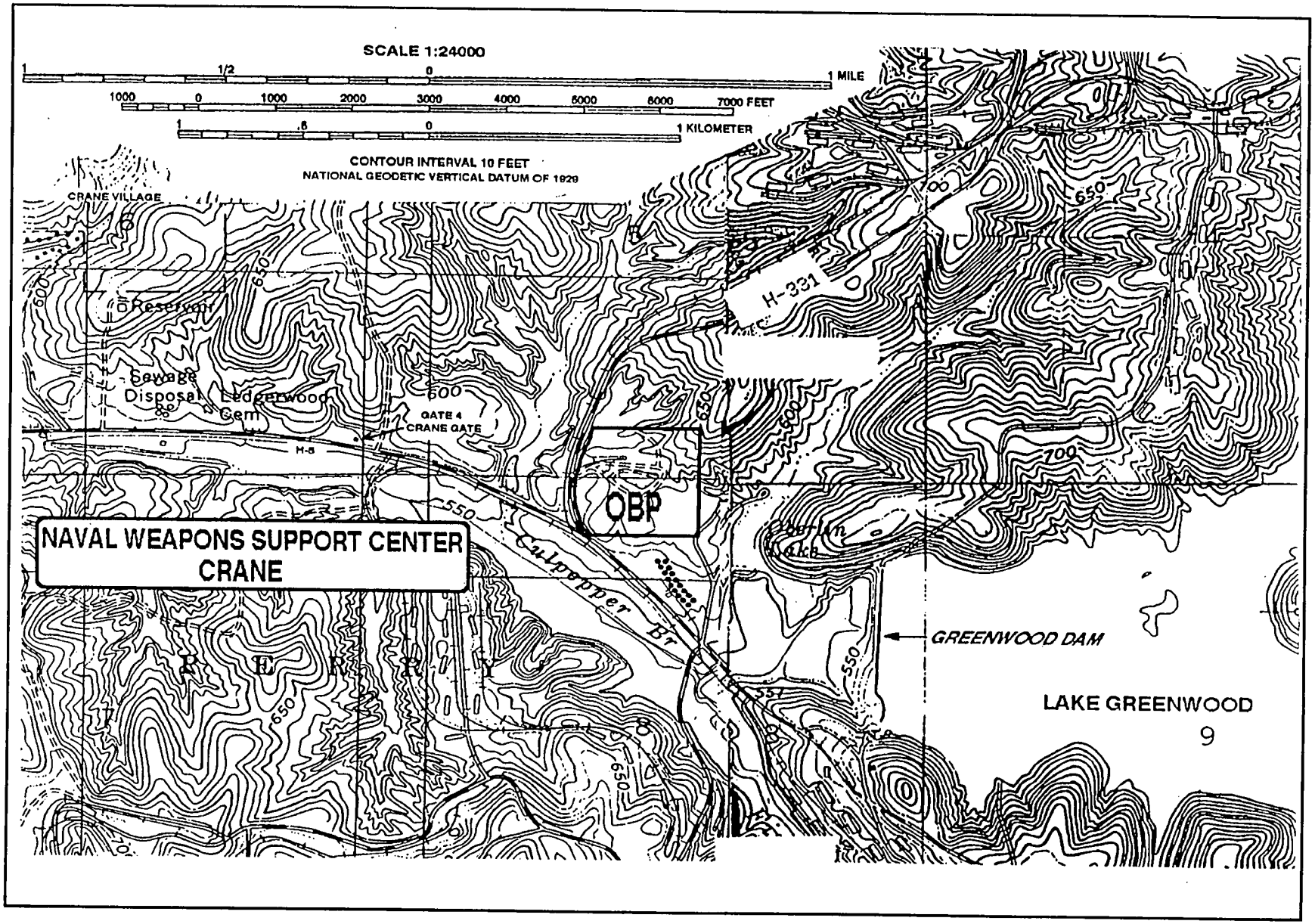


Figure 2. Site map NWSCC Old Burn Pit

At this site trash and other waste were burned and the resultant ash was buried. The goals of this study were to determine if any lasting effects of the releases could be detected, and to investigate the physical properties exhibited by the surface earth materials. Any contamination at the site should be concentrated in the burn pit and at the ash disposal site. Following that reasoning the sampling was biased to locations in the burn pit in the vicinity of the pit, and at the ash disposal location. Three background borings were drilled at this site (05/03-01-90, 5/03-02-90 and 05/03-03-90). They were located within the unit boundary but removed from the burn pit and disposal site. They were drilled, sampled, and analyzed using procedures identical to those at the other boring locations at this site (boring locations are shown on Figure 3). The physical characterization of the soils was accomplished using standard USACEs' procedures. The chemical characterization was accomplished using EPA SW-846 methods.

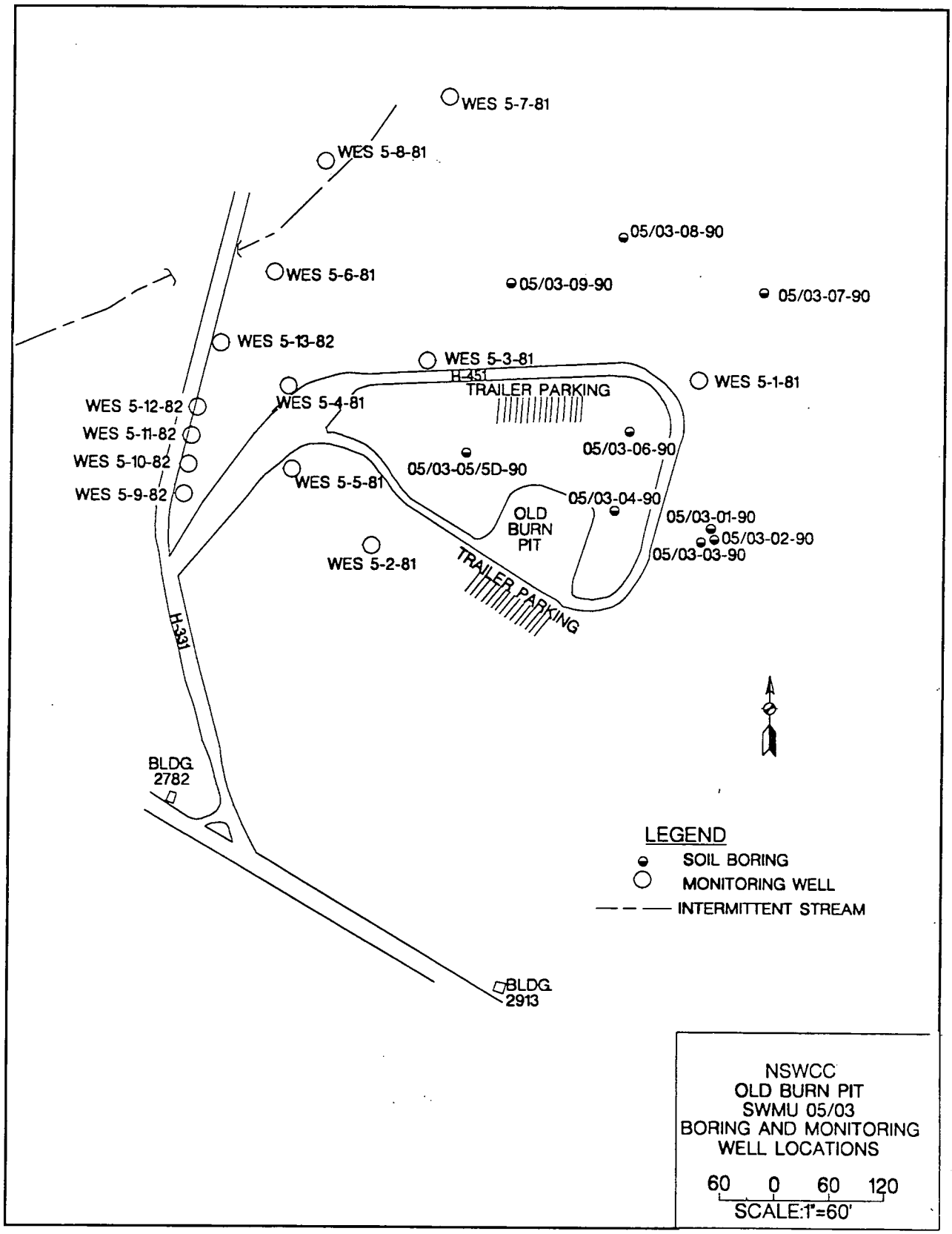


Figure 3. NSWCC Old Burn Pit SWMU 05/03 boring and monitoring well locations

2 Previous Studies

Previous studies of the OBP have been described in several reports. These reports (listed by date; oldest first) are:

a. 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. Draft report.

b. Naval Energy and Environmental Support Activity. 1983. *Initial Assessment Study of the Naval Weapons Support Center, Crane, Indiana*, May.

c. Dunbar, Joseph B. 1983. *Definition of Contaminated Ground-Water Plumes at Selected Waste Disposal Sites, Naval Weapons Support Center, Crane, Indiana*, Geotechnical Laboratory, U.S. Army Corps of Engineers, Waterways Experiment Station. Draft report.

d. Dunbar, Joseph B. 1984. *Definition of Contaminated Ground-Water Plumes at Selected Waste Disposal Sites, Naval Weapons Support Center, Crane, Indiana*, Geotechnical Laboratory, U.S. Army Corps of Engineers, Waterways Experiment Station. Draft report.

e. Hazardous Material Technical Center. 1985. *Confirmation Study for Sites 2, 4, 6, and 10 at the Naval Weapons Support Center Crane*, June.

Information from these previous studies provided the background for planning the RFI described in this report.

3 Procedures

Approach

The intent of a Phase II study is to evaluate the presence or absence of a release, and to characterize the hazardous waste and its constituents. Chemical analysis was performed using SW-846 analytical methods. The soil was physically characterized using USACE's geotechnical procedures. This Release Assessment was accomplished by judiciously selecting sample locations, selecting the appropriate analytes and using proper analytical methods. The study effort focused on verifying the presence of contaminants in the soil column. In order to determine background conditions for inorganic compounds which may be natural constituents of earth materials, surface soil samples were taken in an area of the site removed from the disposal activities.

Soil samples were taken in each boring and were used to determine the physical characteristics of the soil. When more than one soil horizon was detected, each soil horizon was sampled. All borings were advanced to refusal (top of rock)/or +55 ft.

Stratified samples were taken from vertical soil borings. Nine borings (05/03-01-90 through 05/03-03-09-90) were drilled using a truck mounted drilling rig. The boring locations are shown on Figure 3. Those soil samples were used to identify contaminant levels and soil characteristics. For testing of the physical properties of the soils, at least one disturbed soil sample per boring was collected. Soil samples for chemical analysis were taken from the 3 in. to 6 in. interval and from the recognizably contaminated (the ash layer) horizon. If no recognizably contaminated layer was found in the soil boring, then a soil sample from 6 in. above either the top of rock or the groundwater table (the shallower of the two) was taken (Figure 4). Actual sample depths and their sample identification are shown on Figure 4. Sample identification numbers consist of SWMU number, boring number, year sample was taken and sample number. The boring locations were determined from the existing monitoring wells by field personnel. The well and boring coordinates were converted from known latitude and longitude to Indiana State Grid coordinates.

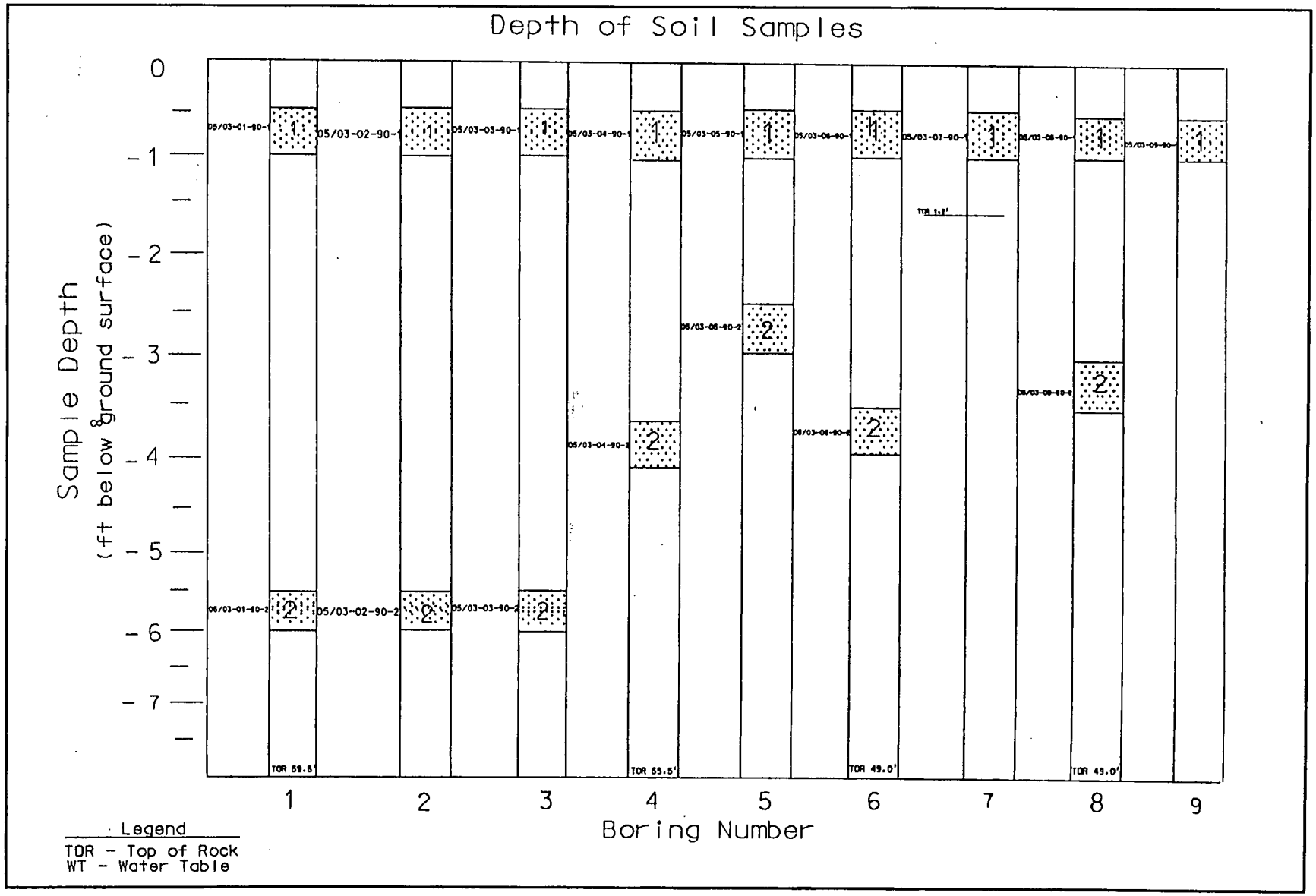


Figure 4. NRP SWMU No 05/03 - NWSCC

Field Methods

Soil borings were placed using a Failing 1500 drilling rig equipped with a hollow stem auger. Samples were taken at specified depths. All sample depths were above the groundwater table and top-of-rock. A Shelby Tube sampler was advanced through a hollow stem auger, pressed to its full length, and then extracted. At the surface the soil was extracted from the sampler, peeled, and bottled in the shortest time possible. Peeling is the process that removes and discards the portion of the sample which is in direct contact with the sampler. Ends of the sample were not used. Samples were analyzed for the presence of inorganics (SW-846 Methods 6010, 7471, 7060 and 7740), organics (SW-846 Methods 8240 and 8270), and pesticides and herbicides (SW-846 Methods 8140 and 8150). Samples for volatile organic compound analysis were taken, bottled, and capped within 15 sec from the time the sampler was opened. All other samples were extruded into wide-mouth glass jars or other containers with minimal disturbance of the sample.

Soil samples were collected and placed into sterilized (ICHEM) sample jars, bottles, and vials. Two 8-oz soil samples were collected for organic, inorganic, pesticides, herbicides, PCB, and semivolatile compound testing. Two 40 mL samples were taken for volatile organic compound analysis. After the collection, the samples, jars and bottles were sealed and placed in locked ice chests (coolers) for storage at a temperature of 4° Celsius. The coolers containing the samples with their accompanying Chain of Custody forms were transported to the analytical lab for analysis. Transport was by an overnight, air freight carrier service. A seal was placed on each cooler to ensure that the samples had not been disturbed during transport to the laboratory. Chemical preservatives were not used.

Following sample collection, the hole was backfilled using a cement bentonite grout. Cuttings not removed from the hole for sampling were contained in drums. The drums were identified and left on the site. The identification included information describing the contents of the drum and the boring from which the cuttings were taken. NSWCC had custody of the drums and was responsible for the disposal of their contents.

Chemical Testing

Analyte selection was based on the probability of a contaminant occurring at the site. The area was used to burn rubbish, solid wastes, and liquid wastes. No explosive wastes were burned here. The principle contaminants were expected to be organics and metal wastes. Groundwater monitoring has been performed at the site and the detected contaminants were organics. The groundwater testing results from OBP wells are found in the Hazardous Materials Technical Center (HMTC) Report, 1985. In each soil boring, two sets of samples were planned. These sample sets were to be one shallow subsurface sample and one sample from an evident or suspected contaminated zone. When no contaminated zone was found, the sampled horizon was the first

horizon which met one of the following conditions: (1) the base of the disturbed soil zone, (2) the top of the groundwater table or (3) the top of bedrock. A full list of analytical parameters are shown on Table 1 and the method of analysis for each analytes is shown on Tables 2 and 3. The list of analytical test parameters shown in Table 1 was selected on the basis of the probability of each contaminant occurring at the site. The 8240 and 8270 organics were selected because of their common industrial usage, their reported disposal and their detected presence in the groundwater. Pesticides, PCBs, and herbicides were and are used at NSWCC and they may have been burned at the site. Metals are always a possible contaminant at a dump site.

Table 1
List of Parameters

Inorganics		Organics
Aluminum	Magnesium	8240 Volatiles
Antimony	Manganese	8270 Semivolatiles
Arsenic	Mercury	Organochloride Pesticides
Barium	Nickel	Organophosphorus Pesticides
Beryllium	Phosphorus	Chlorinated Herbicides
Cadmium	Selenium	PCBs
Calcium	Silver	
Chromium	Sodium	
Cobalt	Thallium	
Copper	Zinc	
Iron		
Lead		

To ensure that the soil samples and their resultant chemical data were representative of the site conditions, a quality control program was enforced. As part of this quality control program, a sample tracking procedure was used. This process starts in the field with chain of custody procedures and sample isolation and preservation. The tracking procedures were continued in the laboratory. A complete laboratory quality assurance/quality control plan was followed. Document management was started upon the receipt of the samples. Log books, bench sheets, and reports were kept. All data were checked by the analyst, the inorganic team leader or the organic team leader, and the laboratory chief before the data were released. The data were checked for completeness. The completeness check was to ensure that: (1) all samples and analyses had been 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 calibrations were performed.

Table 2
Summary of Methods for Determination of Inorganic Metallic Analysis

Metal Analysis	Technique[1]	Soils Methods from SW-846	
		Extraction[2]	Analysis
Aluminum	ICP	3050	6010
Antimony	ICP	3050	6010
Arsenic	GF	3050	7060
Barium	ICP	3050	6010
Beryllium	ICP	3050	6010
Cadmium	ICP	3050	6010
Calcium	ICP	3050	6010
Chromium	ICP	3050	6010
Cobalt	ICP	3050	6010
Copper	ICP	3050	6010
Iron	ICP	3050	6010
Lead	ICP	3050	6010
Magnesium	ICP	3050	6010
Manganese	ICP	3050	6010
Mercury	CV		7471
Nickel	ICP	3050	6010
Phosphorus	ICP	3050	6010
Selenium	GF	3050	7740
Silver	ICP	3050	6010
Sodium	ICP	3050	6010
Thallium	ICP	3050	6010
Zinc	ICP	3050	6010

[1] Abbreviations: GF = Graphite Furnace, CV = Cold Vapor, and ICP = Inductively Coupled Plasma.
[2] Extraction process, when not noted, is included in the analytical method.

The following items are checked:

a. Completeness.

b. Duplicate values for precision.

c. Recovery of spikes for accuracy.

d. Method blanks for contamination.

e. Surrogate recoveries for organic analysis.

f. Data for QA check samples.

g. Reasonableness and trends.

Table 3
Summary of Methods for Determination of Organic Compound Analysis

Organic Analysis	Technique	Soils Methods	
		Extraction	Analysis
Volatiles	GC/MS	INC.[1]	8240
Semivolatiles	GC/MS	3540/3550	8270
Organochloride Pesticides & PCBs	GC/MS	3540/3550	8080
Organophosphorus Pesticides	GC/MS	3540/3550	8140
Chlorinated Herbicides	GC/MS	INC.[1]	8150

[1] INC. = extraction procedure included in method procedure.

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

Final data reports went through several laboratory review and approval levels. The generated data were finally checked for validity. The data were evaluated with respect to:

a. Detection limits.

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

c. Data control within control limits and corrective actions.

d. Flagging of consistently out of control data.

A validation report was prepared as a final step in the data preparation process.

Physical Parameter Analysis

Soil samples were characterized using standard USACE geotechnical methods. These methods are described in Corps of Engineers' Manual EM 1110-2-1906, Laboratory Soils Testing, 1970. The soil samples were described and classified in the field by the field crew and in the laboratory by the analyst. The lab classification consisted of a visual classification, a sieve and hydrometer analysis, determination of natural water content, USCS classification, and organic content. The sieves used to determine the gradation of grain sizes ranged from the number 4 sieve to the number 200 sieve. To determine the percentage of silt and clay in the fine fraction of the sample, hydrometer analytical methods were used.

4 Site Characterization

Geologic Setting

The OBP is located on the Crawford Upland, a rugged, dissected plateau formed by differential erosion of Pennsylvanian and Mississippian Age sedimentary rocks. The rock units underlying the OBP and forming the surrounding hills consist of Mansfield Formation shales and sandstones of the Pennsylvanian Age Raccoon Creek Group. Most of the OBP is situated in the dissected alluvial valley of Culpepper Branch. The unconsolidated sediments of the OBP site were formed by several processes. Residual soils formed by weathering of the underlying parent rock. During the Pleistocene the OBP was filled with lacustrine (lake deposits) and alluvial (outwash) deposits which are facies included in the Atherton Formation (Grey, Wayne, and Wier 1970). The facies relationships of the Atherton Formation are shown on Figure 5 (Wayne 1963). Colluvium derived from the hillslopes, and soil reworked by man associated with the burning activity also compose the site.

Study Approach

The geology of the OBP site was characterized with 19 groundwater monitoring well borings (Dunbar 1982 and 1984), 9 auger soil borings described in section 3.0 FIELD METHODS of the OBP work plan, field observations and physical soil test data. The locations of the borings and geologic sections are presented on Figure 6. Geologic section A-A,' (Figure 7) is modified from Dunbar 1982. Descriptions of the section and the drilling logs were presented in the Dunbar (1982 and 1984) reports. Geologic sections B-B,' C-C' and D-D' (Figures 8, 9, and 10 respectively) present the 1990 soil auger borings. The detailed individual soil auger boring logs are presented in Appendix B. The geologic sections are self explanatory and collectively portray the relationships of the soil types and top of rock at the OBP site.

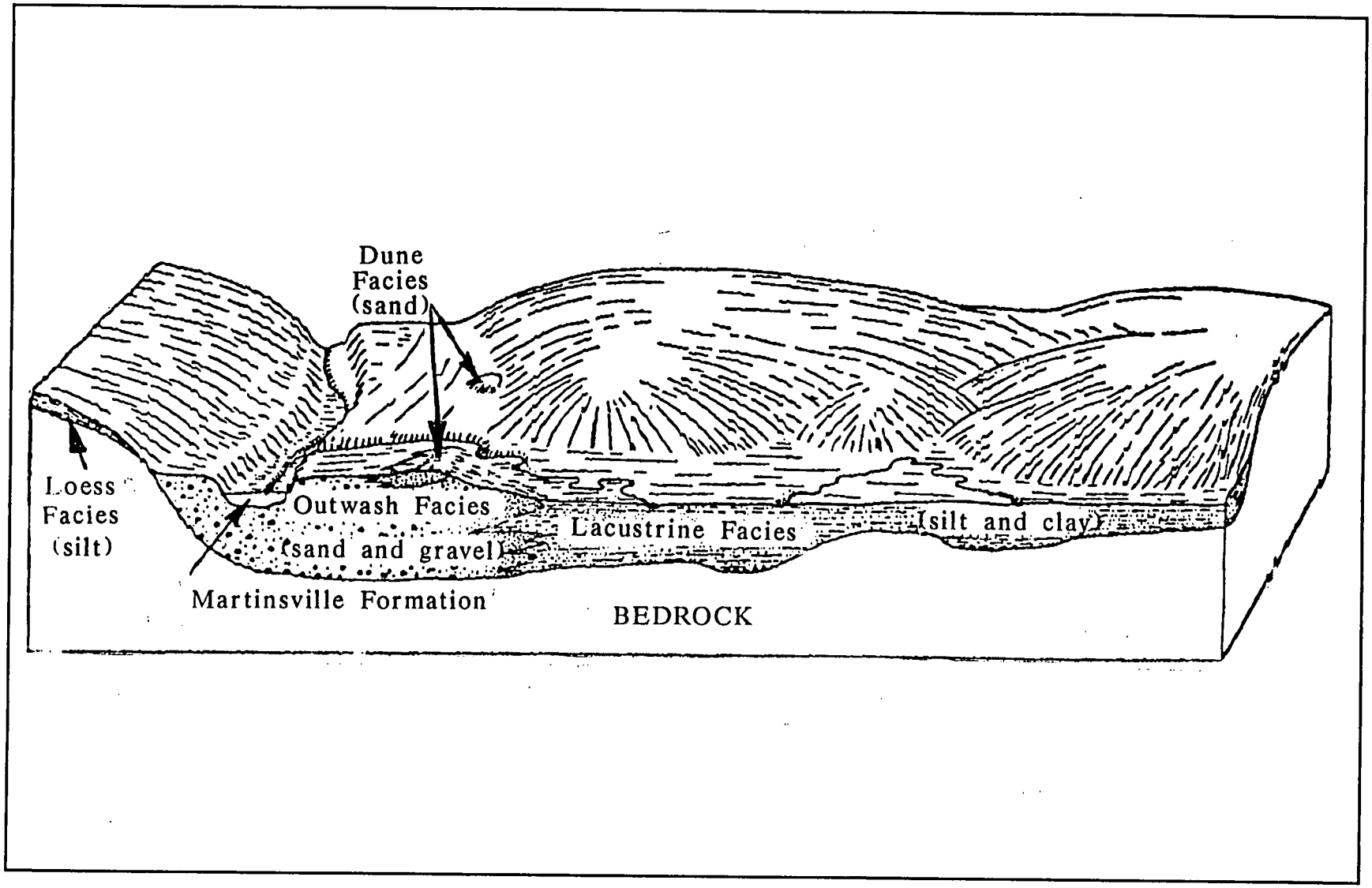


Figure 5. Block diagram showing facies relationships of the Atherton formation (modified from Wayne 1963)

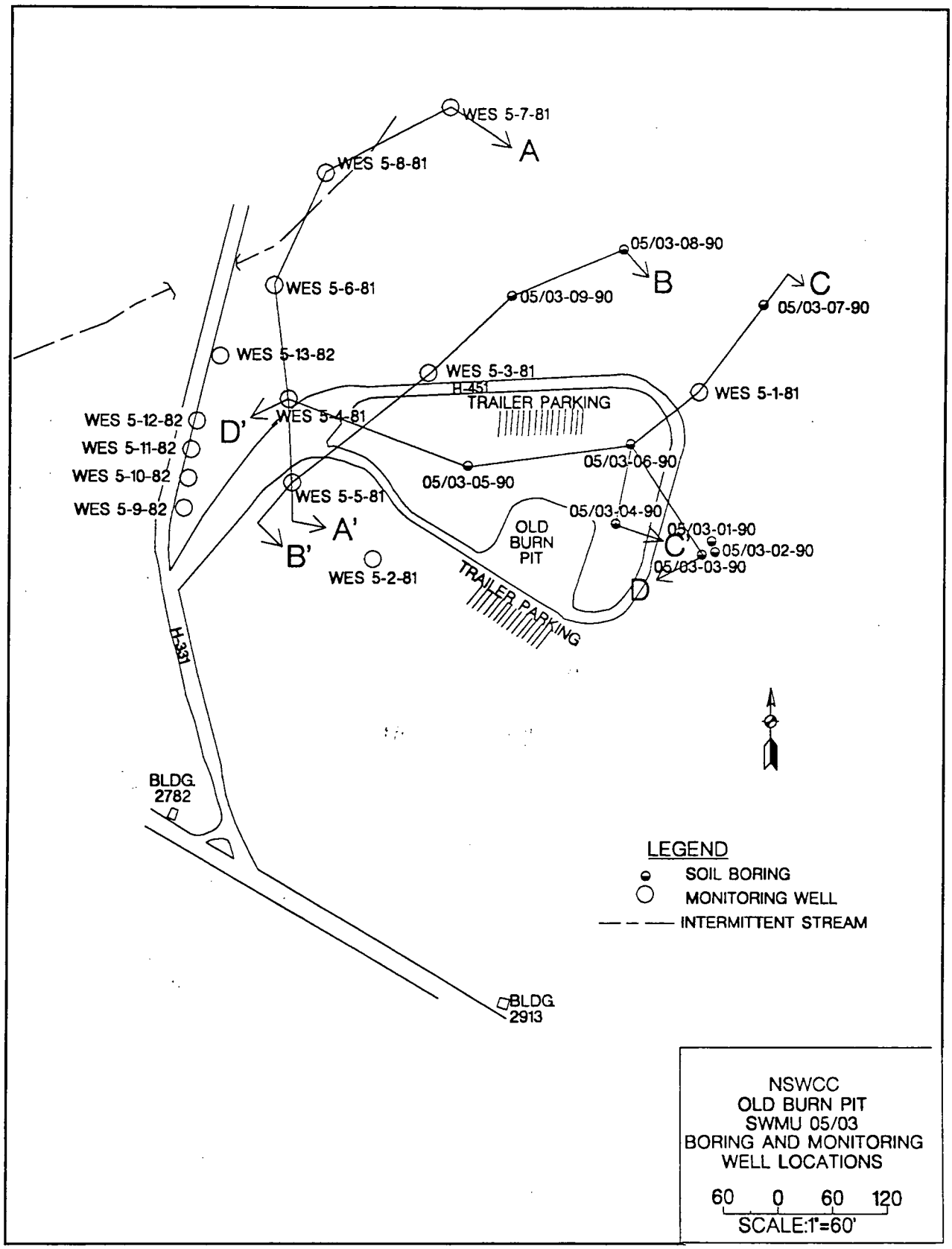


Figure 6. NSWCC Old Burn Pit SWMU 05/03 boring and monitoring well location and sections

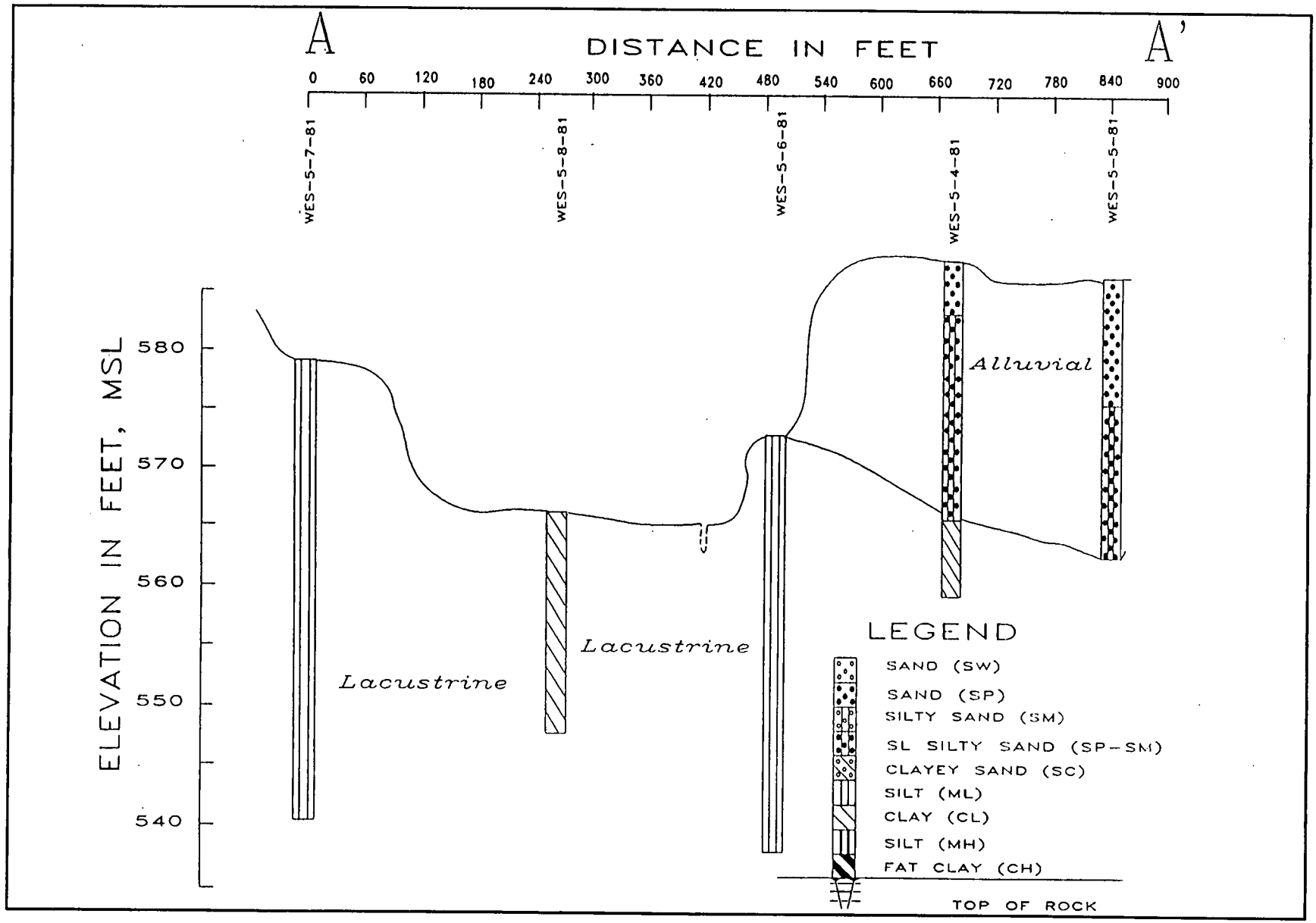


Figure 7. Old Burn Pit geologic section A-A' (modified after Dunbar 1982)

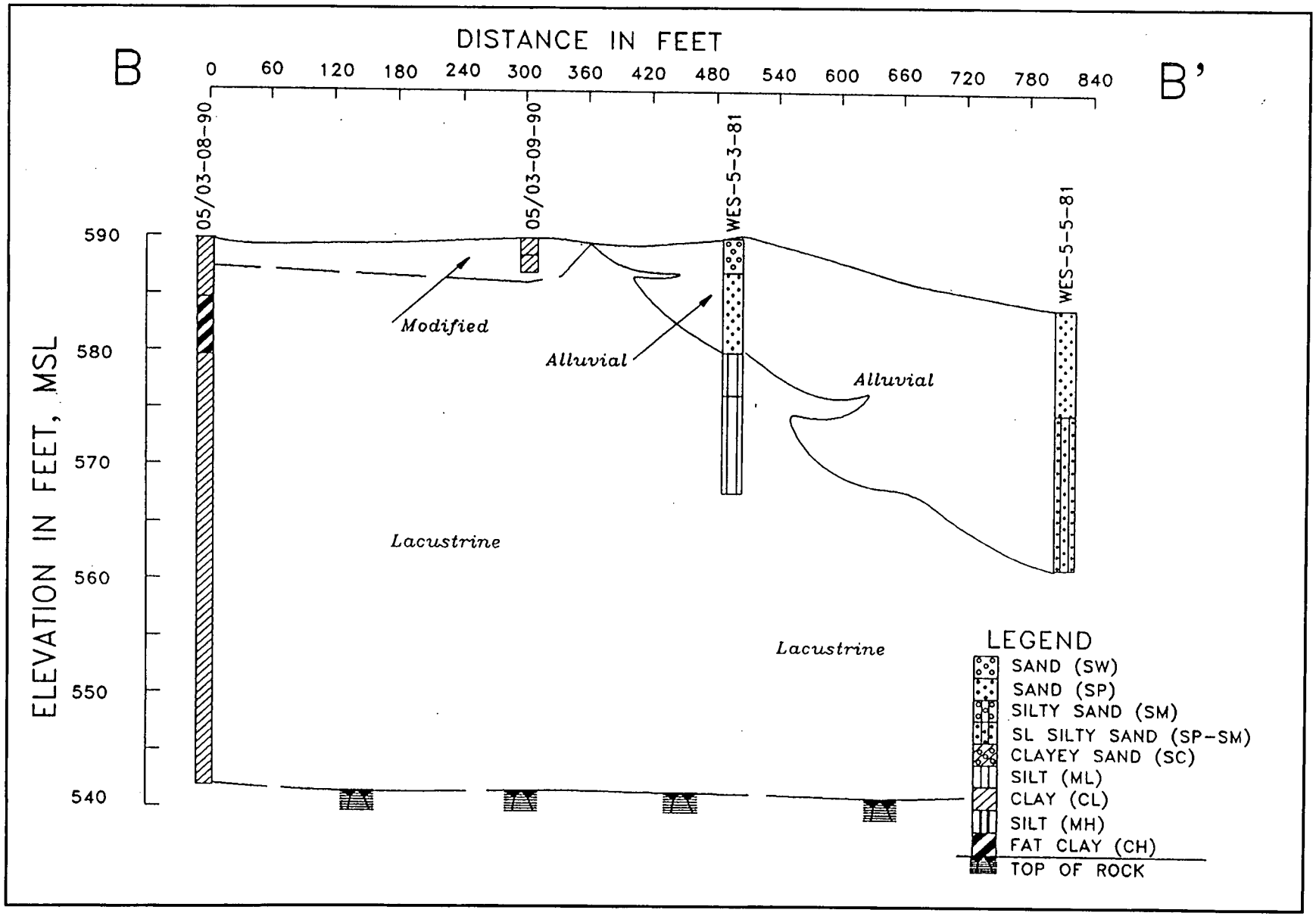


Figure 8. Old Burn Pit geologic section B-B'

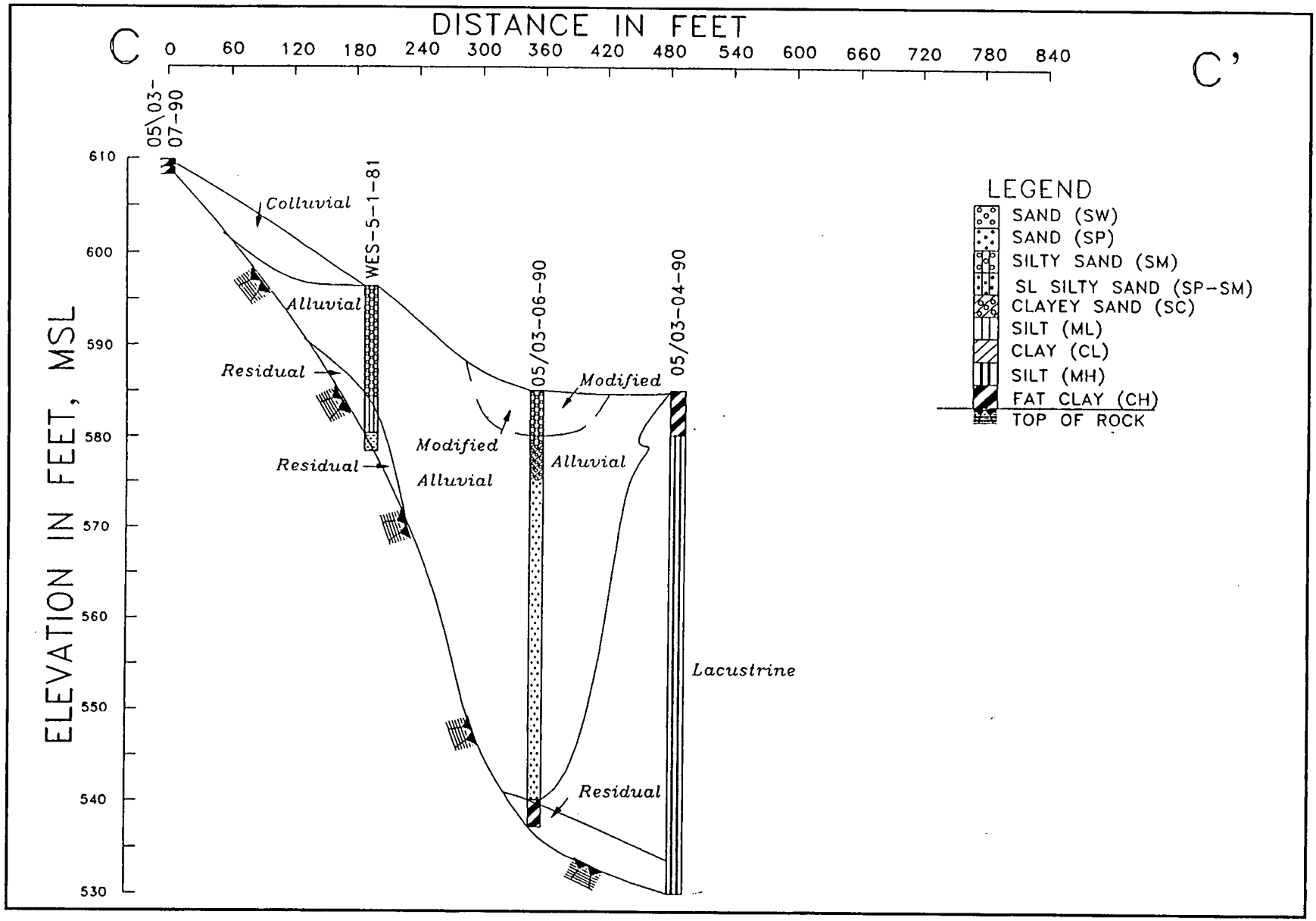


Figure 9. Old Burn Pit geologic section C-C'

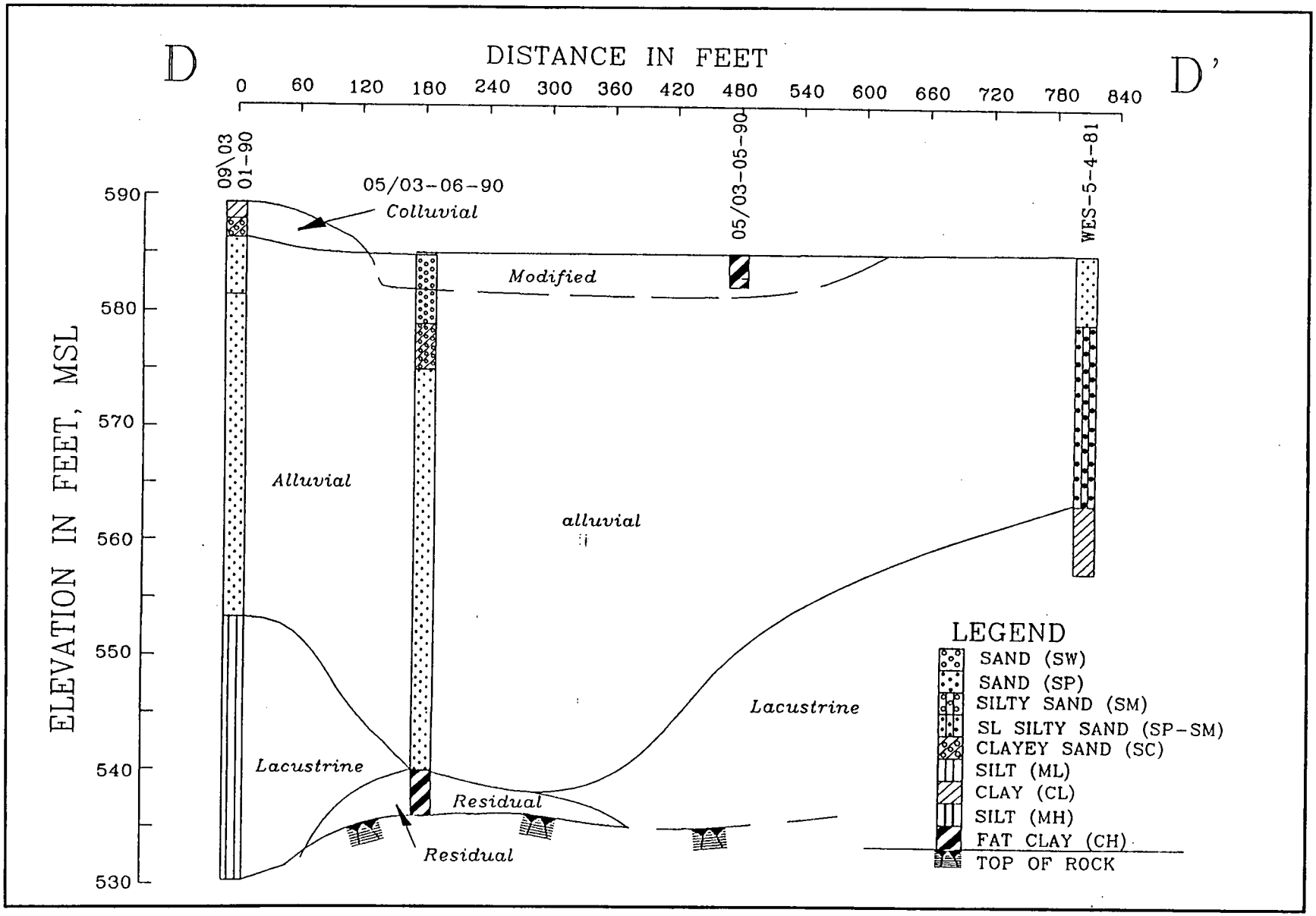


Figure 10. Old Burn Pit geologic section D-D'

Site Soil Characterization

The soil samples from the auger borings were classified in the field according to the USCS. Selected soil samples were analyzed later in the laboratory. The soil types which compose the OBP site are clay (CL and CH), silt (ML and MH) and sand (SC, SW, SM and SP). The gravel portion of the clay (CL) is primarily sandstone fragments.

The soil thickness of the OBP site ranges from zero to almost 60 ft. The areal variability of soil thickness was not adequately characterized because only a few borings penetrated the total soil thickness. Therefore, a soil thickness map was not constructed for this report. The soil data did lend themselves to generating isopleth (equal soil-type thickness penetrated by boring samples) maps. A surface clay and silt map (Figure 11) was prepared by contouring known clay and silt thickness determined by the borings. A net sand map (Figure 12) was prepared to display the total known sand encountered by the borings. Each isochore map contains the limitation of incomplete soil data. Nevertheless the predominant soil-type and depositional environment are suggested. For example, the thicker clay and silt (Figure 11) reflect areas where the lacustrine deposits were penetrated by the borings. The predominant portion of the clays and silts was formed as portion of the clays and silts were formed as lacustrine deposits. Remnants of residual soil also add to the clay and silt thickness. The clay (CH) in boring 6-90 and the silt (ML and MH) at the base of borings WES-5-1-81 and 4-90 represent residual soil, formed from the weathering of shale parent rock material (Figures 9 and 10).

Examination of Figure 12 indicates that the thickest sand interval corresponds to an interpreted outwash channel. The sands (SM, SP, SP-SM, SC and SW) are interpreted as alluvial (outwash) channel sands on geologic sections (Figures 7, 8, 9, and 10). Colluvial infilling of sediments derived from the surrounding hillslopes and is shown on Figures 9 and 10.

An anthropogenic soil unit is depicted on the geologic cross sections as "modified." Anthropogenic refers to soils which have been modified by human activity associated with, in this case, burning activity. The modified soil consists of lacustrine deposits and alluvium containing cultural debris. Examination of boring logs 5-90, 6-90, 8-90 and 9-90 (Appendix B) show soil containing debris such as rusty nails, metal, glass and burnt wood. Examination of boring logs 5-90 and 9-90 show that soil from these borings had a strong odor with a black ash present. The above physical evidence should be correlated with the chemical analysis to describe the area of potential contamination. The modified soil is shown on the cross-sections as a continuous unit with dashed lines denoting uncertain limits. The area and depth of actual contamination will require additional borings for accurate delineation.

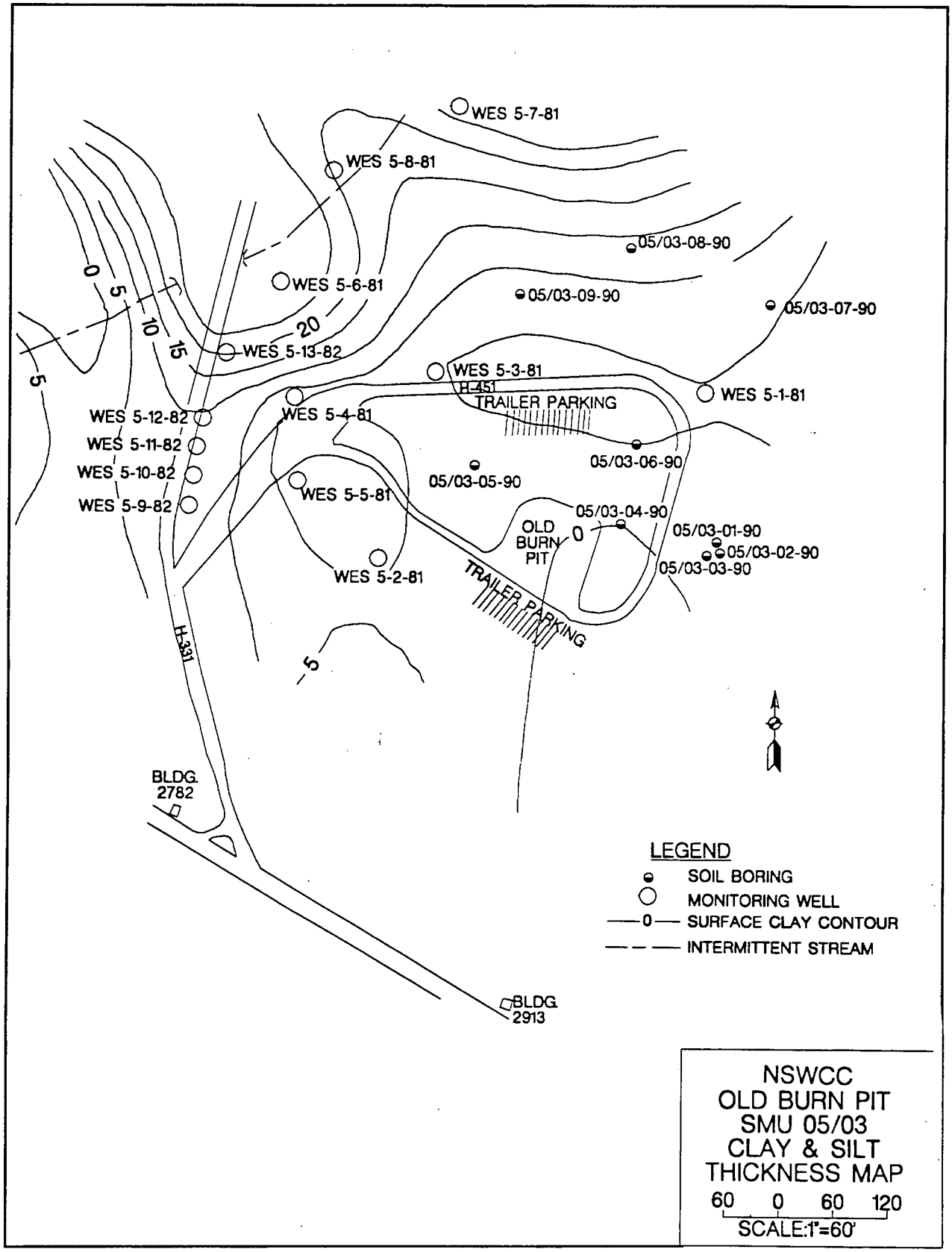


Figure 11. NSWCC, Old Burn Pit SWMU 05/03 clay and silt thickness map

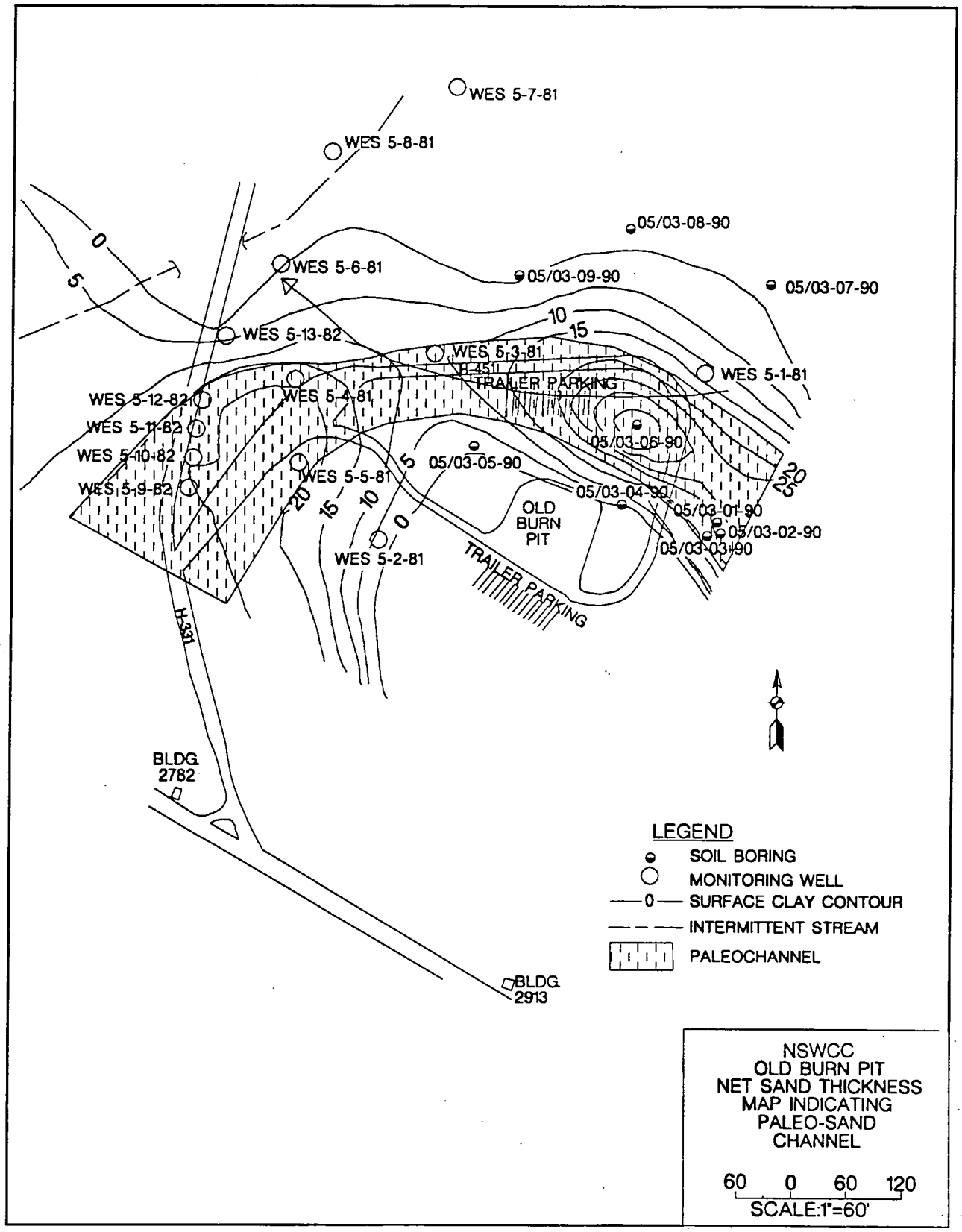


Figure 12. NSWCC Old Burn Pit net sand thickness map indicating paleosand channel

Soil Hydrology

The soil auger borings were left open prior to grouting to measure water levels. Groundwater was encountered at shallow depth (4 to 6 ft) in all but three borings during drilling. Boring 7-90 which was only 1.7 ft deep to top of rock, was a dry hole. Borings 5-90 and 9-90 were terminated due to high HNU readings at 3 ft deep and therefore did not encounter water. The groundwater during the drilling in October 1990 ranged from elevation 585 to 580 ft MSL. Previous investigations (Dunbar 1982 and 1984) found the groundwater elevations ranged from 591 to 561 ft MSL. Dunbar (1982) presents laboratory permeabilities of the order of 2×10^{-5} and 8×10^{-6} cm/sec for silt (ML) and clay (CL) samples from the OBP. These soils are, practically speaking, impermeable. During periods of infiltration, the soil acts as a very slow conduit for groundwater and any contaminants. Figure 11 indicates the areas of thick clay and silts which would tend to prevent contamination seeping into the groundwater regime. Inversely, the area of thickest sands shown on Figure 12 would act as a conduit for groundwater flow. The sands which form the paleochannel (Figure 10) typically have permeabilities of the order of 2×10^{-2} to 5×10^{-3} cm/sec (Freeze and Cherry 1979).

Therefore, based on the available evidence, groundwater moves through the clays and silts very slowly by downward vertical infiltration, then laterally along the soil/rock interface until it reaches fractured rock and enters the rock aquifer system. However, in the paleochannel sand area groundwater moves laterally through the sand body. This helps explain why the contaminated wells found in 1984 indicate a western direction of flow when the groundwater elevations would suggest a northwestern direction of flow. Understanding the presence and orientation of this sand body is important in monitoring the OBP site (Figures 12 and 13).

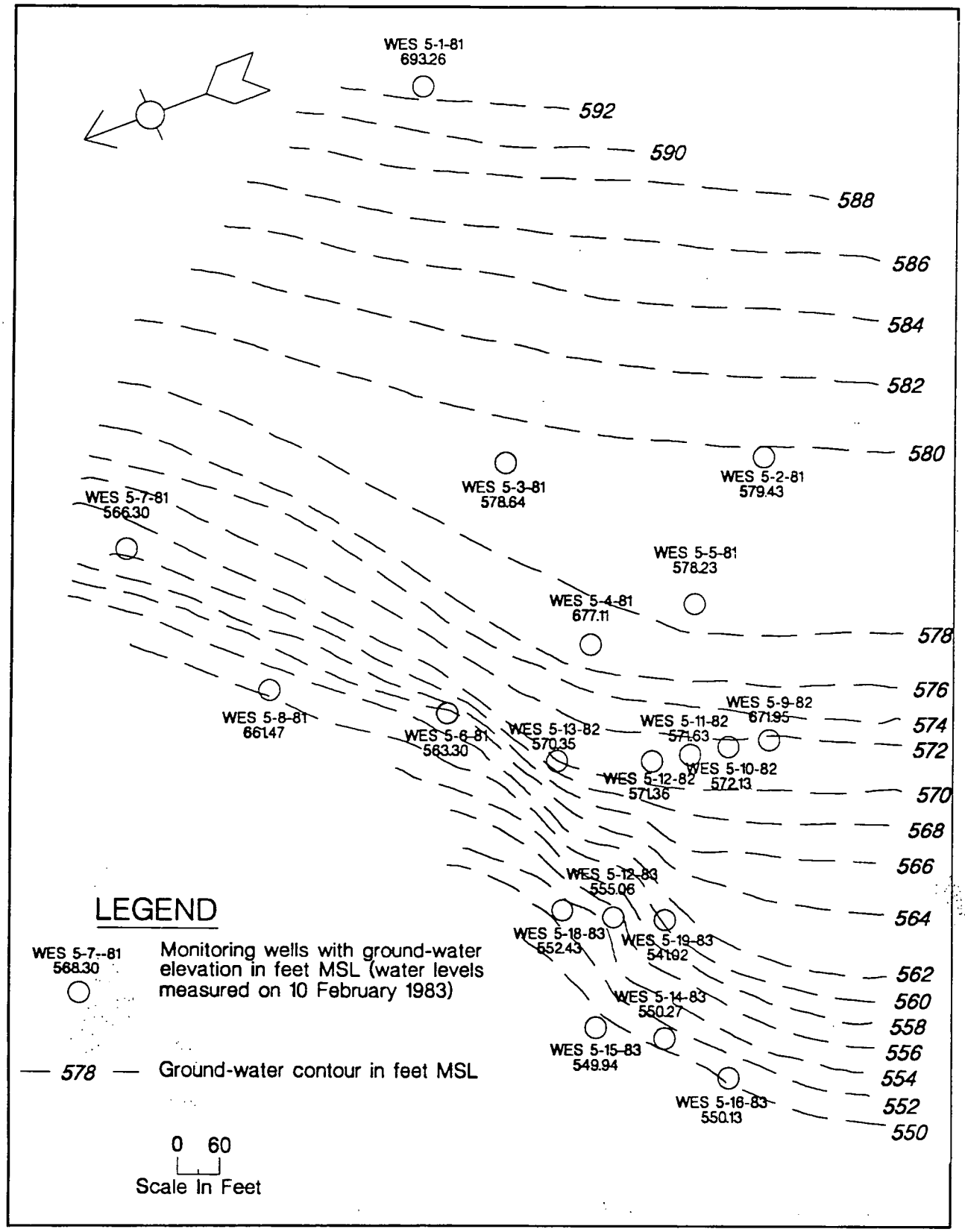


Figure 13. Groundwater contour map of Old Burn Pit

5 Results of Chemical Analyses

Introduction

The objective of the soils sampling program was to determine if contaminants associated with waste disposal activities were released to soils within the boundaries of the OBP. A release is defined as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment (definition set forth in 40 CFR 302.3).

Soil samples were taken at the OBP between 3 October and 18 October 1990. Figure 14 shows the locations of the borings. The depth from which each soil sample was taken is indicated in Figure 15. Soil sample locations were selected on the basis of site features and the results of previous investigations (See Section 2.0 PREVIOUS STUDIES). Soil sample locations were selected with a bias toward areas having the greatest probability of contamination resulting from waste disposal activities at the OBP. Borings 4, 5, and 6 were located within the depression that was used as a burning area. Wood, paper, building materials, and industrial wastes were burned at the site. Ash residues from the burning operations along with metallic objects were buried in a gully to the north of the burn pit. Borings 7, 8, and 9 were located within the ash burial areas. Borings 1, 2, and 3 were located within the SWMU boundary to the southeast of the burning area. Groundwater data from previous studies indicate that the location for borings 1, 2, and 3 is up-gradient from the burning area and not contaminated by waste disposal activities at the waste management unit. Therefore, borings 1, 2, and 3 were selected as "control" or background" samples. Those soil samples were taken to identify characteristic of soils in the vicinity of the OBP site as if no waste disposal activities had occurred at those facilities, but all other influences on soil characteristics had taken place.

To assist in data interpretation and determine sources of error, the results of the analyses of method blanks and equipment rinses are given. Method blanks are determined by following the analytical procedure step by step including all of the reagents and solvents, in the quantity required by the analytical method. Method blanks are a measure of cumulative interferences from the laboratory or the analytical method. Equipment rinses are samples obtained by running analyte-free water over/through sample equipment after it has been cleaned.

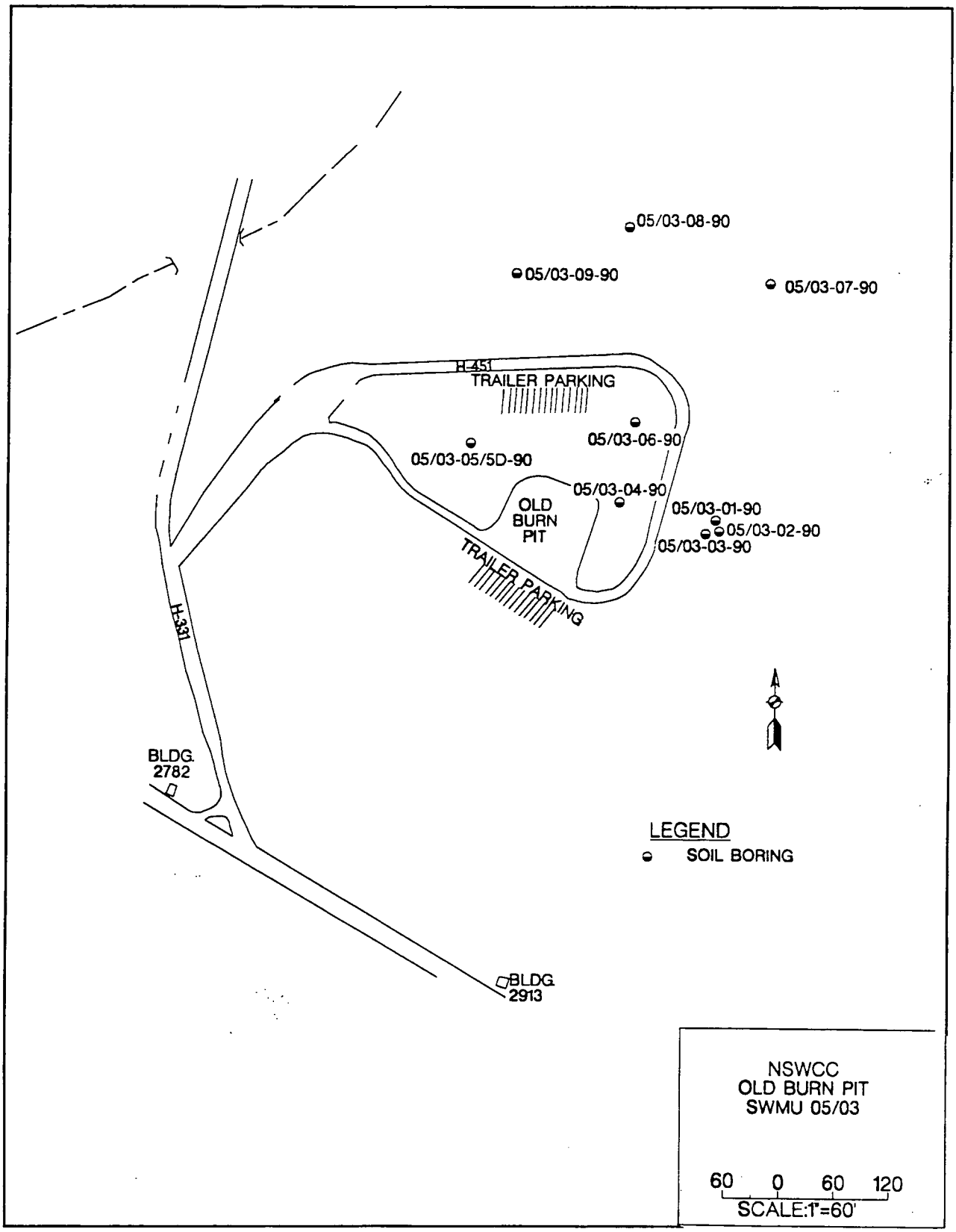
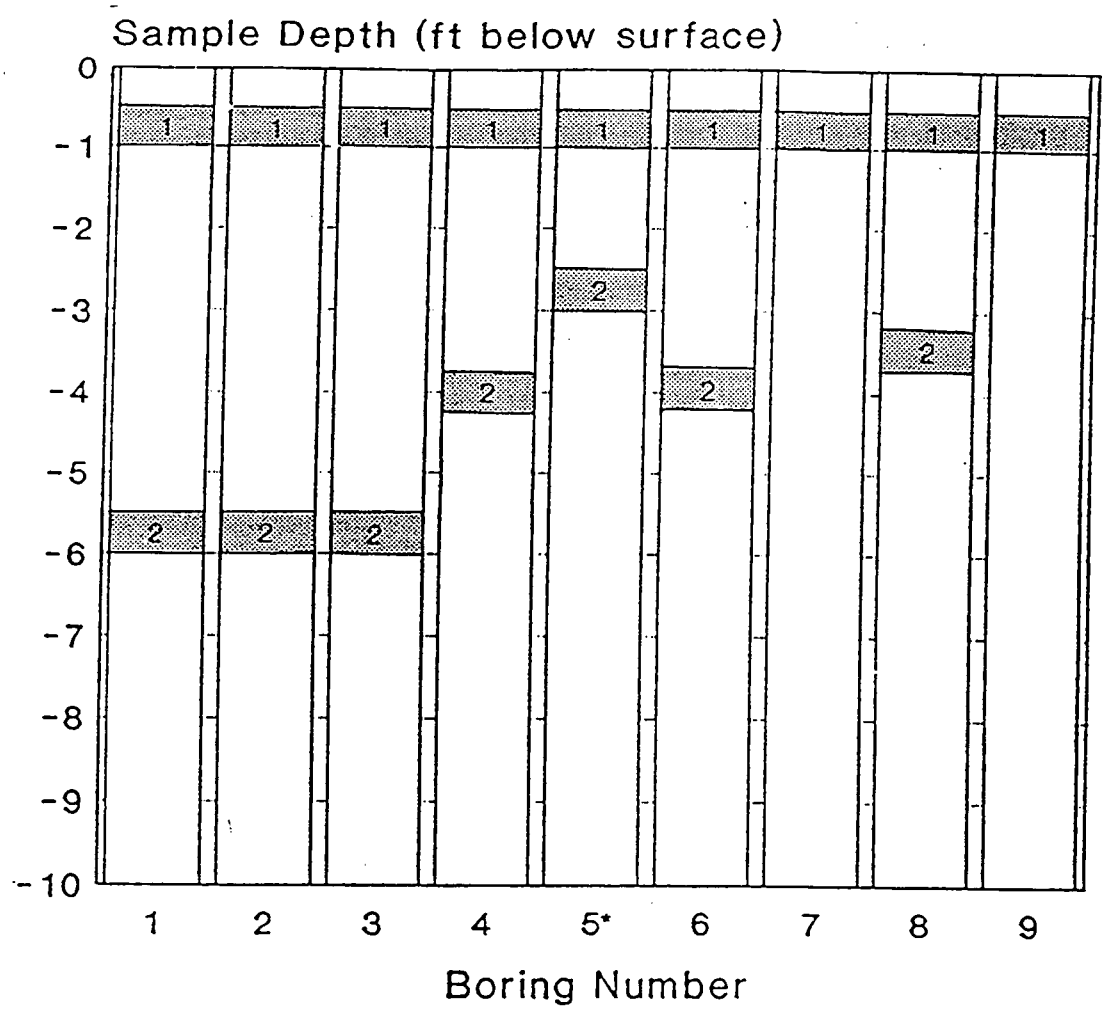


Figure 14. Old Burn Pit - NSWCC, Indiana, SWMU 05/03. Locations of soil borings



5* - includes sample #1, a duplicate of sample #1 (5/#1D) and sample #2.

Old Burn Pit - NWSCC, Indiana
Dates Samples Collected

Boring 1	03 OCT 90	Boring 4	17 OCT 90	Boring 7	19 OCT 90
Boring 2	03 OCT 90	Boring 5	18 OCT 90	Boring 8	04 OCT 90
Boring 3	03 OCT 90	Boring 6	15 OCT 90	Boring 9	10 OCT 90

Figure 15. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Depth of soil samples and dates of collection. Sample numbers are indicated in shaded areas

Analyses of equipment rinses are used to evaluate equipment cleaning procedures and determine if sampling equipment contributed to cross contamination of field samples.

To ensure validity of the chemical data obtained, a chemical data quality control program was followed during the OBP soil sampling and subsequent laboratory analyses. Quality Control Level "C" as explained in the Naval Energy Environmental Support Activity (NEESA) guidance 20.2-047b "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" was followed.

In summary, the NEESA Quality Control Level C plan requires the use of U.S. EPA approved methods when available, a duplication of at least 10 percent of the samples, the collection and analysis of equipment rinse blanks (samples of final equipment rinses) on a daily basis, the collection and analysis of field blanks (samples of water used in decontamination and steam cleaning), and the use of trip blanks with all samples specified for volatile organic analyses. The intent of the plan is to ensure that sources of extraneous contamination can be determined and that decisions made using the data are meaningful and supported. The Chemical Analytical Data Validation Report, which summarizes the chemical data quality control program results, is included in Appendix E.

Because inorganic analytes are naturally occurring crustal elements, the identification of soil contaminants which are also naturally occurring soil constituents required statistical comparisons between control or "uncontaminated" soil concentrations and those of the test soil. The statistical comparisons required the computation of a mean and variance. A maximum of two samples were taken at each boring and in order to have a sufficient number of samples for these computations ($n > 3$), all test samples from borings 4 through 9, inclusive were used, i.e. the control data set was compared to the entire test data set. Values for boring 5, sample 1 and boring 5, sample 1D (duplicate) were averaged prior to computing the statistics of the test data set in order to avoid giving sample number 1 from boring 5, undue weight. As only one sample was taken from each specified elevation within the boring, statistical comparisons of mean constituent concentrations between specific soil boring sample elevations were not possible. Mean concentrations of inorganic constituents from test borings were compared to those of control borings using a one tailed t-test with $p = 0.05$. Means were computed from all test samples for specific analytes and control means for particular analytes, were computed using all samples taken from borings 1, 2, and 3. Assumptions were made that both means were obtained from random samples and that both means were obtained from normal populations. The first hypothesis tested using an F-test was if the variance of the two means being compared were equal, or alternately not equal. Based on the results of the first tests of hypotheses, a common population variance was or was not computed and appropriate degrees of freedom computed. Subsequently, a second hypothesis tested using a t-test was if the test and control mean constituent concentrations were equal or alternately if the test mean was greater than the control mean.

The specific information obtained from each sample is presented and qualitative observations made from that data. Statistical comparisons of constituent concentrations between specific soil boring depths or between samples in the same boring were not possible because only one sample was taken from each specified depth (three or more samples per depth would be required). As indicated on Figure 15, sample 1 was taken at the same depth within each boring and sample 2 was taken at the same depth within borings 1, 2 and 3. However, the scope of this study did not include characterization of soil types by soil depth within borings. Therefore, samples from a particular depth may not correspond to the same soil stratum from one boring location to the next. Thus comparison of a specific sample from boring to boring is not likely to be relevant.

Discussion

Metals

The results of selected metals analyses of OBP soils sampled by boring are given in Table 4. Analyte concentrations in the soils are given as mg/kg (ppm) on a dry weight basis. The contract required detection limit is provided (following the < symbol) where specific metals in the soils were not detected. Table 5 indicates the maximum concentrations of selected inorganic analytes determined for the OBP soils sampled. Statistical analyses of the soil boring sample data are provided in Table 6. The statistical comparisons required the computation of a mean and variance. A maximum of two samples were taken at each boring and in order to have a sufficient number of samples for these computations ($n > 3$), all test samples from borings 4 through 9, inclusive were used, i.e., the control data set was compared to the entire test data set. Values for boring 5, sample 1 and boring 5, sample 1D (duplicate) were averaged prior to computing the statistics of the test data set in order to avoid giving sample number 1 form boring 5 undue weight. The results for specific inorganic constituents are also given graphically in Figures 16 through 37. These bar charts provide constituent concentrations for each sample taken from a boring. The bars are oriented from shallowest sample in the boring, on the left, to deepest sample in the boring, on the right.

As stated previously, borings 1, 2, and 3 were selected to be "control or background" borings. These borings were located within the SWMU boundary to the southeast of the burning area (Figure 14). Table 7 is a comparison of the maximum and mean concentrations of specific metallic analytes from three previously studied NSWCC control locations (Old Rifle Range SWMU 07/09, Ammunition Burning Ground SWMU 03/10, and Rockeye Munitions Facility SWUM 10/15) with those observed at the OBP. These data indicate that the OBP control samples were similar to those of the other NSWCC control areas. Thus selection of borings 1, 2, and 3 as control borings was appropriate.

The following statements give an indication of the chemical nature of the soils from the control borings as compared to those of the test borings: The greatest mean concentration of specific inorganic constituents was obtained

Table 4
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Inorganic Analyses of Soil Samples Collected in the Vicinity of SWMU 05/03. Concentrations are mg/kg (ppm) Dry Weight

SAMPLE / ANALYTE	Sb	As*	Be*	Cd*	Cr*	Cu*	Pb*	Hg*	Ni*	Se	Ag
01#1	< 1.50 W	6.08	1.50	2.40	20.10	14.80	16.00	<0.100	17.7	<0.30 W	< 1.30 D
01#2	< 1.50 N	6.03	1.30	2.00	12.00	9.00	8.40	<0.100	11.0	<0.30	< 1.30 D
02#1	< 1.50 N	5.40	1.40	<0.40 N	20.70	18.90	35.40	0.180	15.2	<0.30 W	< 1.30
02#2	< 1.50 N	5.67	1.50	<0.40 N	14.90	12.40	12.50	<0.100	16.9	<0.30	< 1.30
03#1	< 1.50 N	5.88	1.40	0.50 N	19.50	22.00	41.90	0.249	16.9	<0.30 W	< 1.30
03#2	< 1.50 N	5.67	1.40	<0.40 N	13.90	10.40	11.60	<0.100	14.0	<0.30	< 1.30
04#1	< 1.50 N	4.86	1.40	0.50	25.20 D	19.80 ND	49.80	<0.100	15.7	<0.30	< 1.30
04#2	< 1.50 N	6.43	1.50	0.50	27.20 D	16.50 ND	27.10	<0.100	19.5	<0.30	< 1.30
05#1	11.60 N	6.79	1.40	1.70	32.60 D	91.70 ND	266.00	0.401	18.6	<0.30	2.40
05#1DUP	8.10 N	7.21	1.40	4.69	28.90 D	69.40 ND	198.00	0.475	16.7	0.54	< 1.30
05#2	12.20 N	21.90	4.10	68.50	228.00 D	418.00 ND	1150.00	0.170	65.8	0.39 B	5.79
06#1	4.30 BN	6.24	1.20	1.30	16.40	55.30	278.00	0.117	126.0	<0.30	< 1.30 D
06#2	6.11 N	6.73	1.50	4.60	33.90	181.00	620.00	0.117	14.9	0.31 B	< 1.30 D
07#1	< 1.50 N	5.70	1.30	<0.40	21.50 D	12.10 ND	18.50	<0.100	11.3	0.44 B	< 1.30
08#1	34.30 N	18.20	5.90	46.60	251.00	2010.00	2350.00	1.060	101.0 D	0.57 N	27.20
08#2	44.70 N	26.80	7.99	25.80	504.00	1940.00	2010.00	0.617	208.0 D	1.66 N	24.80
09#1	43.00 N	35.70	6.09	34.20	244.00	982.00	2720.00	0.819	73.9	0.57	2.50 D

NOTE: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.
< - Compound was analyzed for but not detected. Detection limits are given after the < 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 - Spiked sample recovery not within control limits.
D - Duplicate analysis not within control limits.
* - Mean concentrations for test samples significantly greater ($p<0.5$) than control means.

(Continued)

Table 4 (Concluded)

SAMPLE / ANALYTE	Tl	Zn*	Al	Ba*	Ca*	Co*	Fe*	Mg*	Mn	NA*	TP*
01#1	< 0.20	50.7	21300	102.0	1760	7.60	21600	1780	616	58.8	81.6
01#2	< 0.20	52.2	8080	29.7	324 B	4.50	18500	625	295	31.4	130.0
02#1	< 0.20	84.0	17000	91.5	1170	7.59	18600	1690	496	29.2 B	49.8
02#2	< 0.20 B	51.5	21100	63.8	712	7.09	19600	1310	440	48.3 B	104.0
03#1	< 0.20 B	103.0	18300	106.0	1370	8.49	18800	1900	664	42.8 B	83.2
03#2	< 0.20 B	43.5	16400	55.4	332 B	6.00	18900	1090	453	40.3 B	130.0
04#1	0.27 B	79.3	20200	112.0	3640	6.70	19200	1870	455	96.3 B	83.4
04#2	< 0.20	64.7	23600	117.0	2750	7.60	23200	1980	598	90.7 B	89.5
05#1	< 0.20	340.0	16100	184.0	10500	7.19	21500	2000	423	84.5 B	121.0
05#1DUP	< 0.20	252.0	16100	174.0	6110	5.89	21900	1980	429	99.5 B	125.0
05#2	< 0.20	2460.0	13200	627.0	10500	14.40	91400	2150	639	127.0 B	284.0
06#1	< 0.20	250.0	8490	206.0	2630	5.40	19700	866	406	70.4	175.0
06#2	< 0.20	720.0	15700	350.0	10400	7.40	24800	2280	301	392.0	418.0
07#1	< 0.20	34.2	7640	36.4	291	5.10	18800	732	184	50.4 B	41.4
08#1	< 0.20	4140.0	27300	4960.0	26900	23.30	127000	6790	1240	1300.0	1020.0
08#2	< 0.20	3090.0	23400	5040.0	23900	32.90	205000	3790	1190	758.0	801.0
09#1	< 0.20	5080.0	16700	1740.0	19900	23.80	133000	2850	1420	419.0 B	293.0

NOTE: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.
< - Compound was analyzed for but not detected. Detection limits are given after the < 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 - Spiked sample recovery not within control limits.
D - Duplicate analysis not within control limits.
* - Mean concentrations for test samples significantly greater ($p<0.5$) than control means.

Table 5
Old Burn Pit - NWSCC, Indiana. SWMU 05/03. Comparison of Maximum Concentrations of Selected Metal Analytes Determined for Soil Samples. Borings 1, 2, and 3 were Control Borings. All Other Borings (4 Through 9 Inclusive) were Test Borings

	Max. Concentration Determined mg/kg dry weight							
	Boring Number							All Test
Analyte	1,2,3	4	5	6	7	8	9	Samples (4-9)
Sb	<1.5	<1.5	12.2	6.1	<1.5	44.7	43.00	44.7
As	6.08	6.43	21.90	6.73	5.70	26.8	35.7	35.7
Be	1.5	1.5	4.1	1.5	1.3	8.0	6.1	8.0
Cd	2.4	0.5	68.5	4.6	<0.4	46.6	34.2	68.5
Cr	20.7	27.2	228.0	33.9	21.5	504.0	244.0	504.0
Cu	22.0	19.8	418.0	181.0	12.1	2010.0	982.0	2010.0
Pb	41.9	49.8	1150.0	620.0	18.5	2350.0	2720.0	2720.0
Hg	0.25	<0.10	0.44	0.12	<0.10	1.06	0.82	1.06
Ni	17.7	19.5	65.8	126.0	11.3	208.0	73.9	208.0
Se	<0.3	<0.3	0.42	0.3	0.4	1.7	0.57	1.7
Ag	<1.3	<1.3	5.8	<1.3	<1.3	27.2	2.5	27.2
Tl	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	0.3
Zn	103.0	79.3	2460.0	720.0	34.2	4140.0	5080.0	5080.0
Al	21300.0	23600.0	16100.0	15700.0	7640.0	27300.0	16700.0	27300.0
Ba	106.0	117.0	627.0	350.0	36.4	5040.0	1740.0	5040.0
Ca	1760.0	3640.0	10500.0	10400.0	291.0	26900.0	19900.0	26900.0
Co	8.5	7.6	14.4	7.4	5.1	32.9	23.8	32.9
Fe	21600.0	23200.0	91400.0	24800.0	18800.0	205000.0	133000.0	205000.0
Mg	1900.0	1980.0	2150.0	2280.0	732.0	6790.0	2850.0	6790.0
Mn	664.0	598.0	639.0	406.0	184.0	1240.0	1420.0	1420.0
Na	58.8	96.3	127.0	392.0	50.4	1300.0	419.0	1300.0
TP	130.0	89.5	284.0	418.0	41.4	1020.0	293.0	1020.0

Table 6
Old Burn Pit NWSCC, Indiana, SWMU 05/03. Statistical Analysis, Including Mean Analyte Concentration, of Results of Inorganic Analyses of Soil Samples. Statistics were Computed Using all Samples From Each Boring. For Samples with Concentrations Reports as < a Specific Detection Limit, the Detection Limit was used to Compute the Statistics

		Analyte Concentration mg/kg dry weight (ppm)										
Sample	Statistic	Sb(a)	As*	Be*	Cd*	Cr*	Cu*	Pb*	Hg*	Ni*	Se(a)	Ag(a)
Control	mean	(1.5)	5.79	1.417	1.02	16.85	14.58	20.967	0.138	15.3	(0.3)	(1.3)
n=6	max	<1.5	6.08	1.5	2.4	20.7	22.0	41.9	0.249	17.7	<0.3	<1.3
Borings 1,2,3	min	<1.5	5.4	1.3	<0.4	12.0	9.0	8.4	<0.1	11.0	<0.3	<1.3
Boring 4	mean	(1.5)	5.65	1.45	0.5	26.2	18.15	38.45	(0.1)	17.6	(0.3)	(1.3)
n=2	max	<1.5	6.43	1.5	0.5	27.2	19.8	49.8	<0.1	19.5	<0.3	<1.3
	min	<1.5	4.86	1.4	0.5	25.2	16.5	27.1	<0.1	15.7	<0.3	<1.3
Boring 5	mean	11.02	14.45	2.75	35.85	129.37	249.27	691.0	0.3	41.72	0.41	3.82
n=2**	max	12.2	21.9	4.1	68.5	228.0	418.0	1150.0	0.438	65.8	0.42	5.79
	min	8.1	7.0	1.4	3.2	30.75	80.55	232.0	0.17	17.65	0.39	1.85
Boring 6	mean	5.205	6.49	1.35	2.95	25.15	118.2	449.0	0.117	70.5	0.31	(1.3)
n=2	max	6.11	6.73	1.5	4.6	33.9	181.0	620.0	0.117	126.0	0.31	<1.3
	min	4.3	6.24	1.2	1.3	16.4	55.3	278.0	0.117	14.9	<0.3	<1.3
Boring 7	mean	(1.5)	5.7	(1.3)	(0.4)	21.5	12.1	18.5	(0.1)	11.3	0.44	(1.3)
n=1	max	<1.5	5.7	1.3	<0.4	21.5	12.1	18.5	<0.1	11.3	0.44	<1.3
	min	<1.5	5.7	1.3	<0.4	21.5	12.1	18.5	<0.1	11.3	0.44	<1.3
Boring 8	mean	39.5	22.5	6.945	36.2	377.5	1975.0	2180.0	0.839	155.0	1.12	26.0
n=2	max	44.7	26.8	7.99	46.6	504.0	2010.0	2350.0	1.06	208.0	1.66	27.2
	min	34.3	18.2	5.9	25.8	251.0	1940.0	2010.0	0.617	101.0	0.57	24.8
Boring 9	mean	43.0	35.7	6.09	34.2	244.0	982.0	2720.0	0.819	73.9	0.57	2.5
n=1	max	43.0	35.7	6.09	34.2	244.0	982.0	2720.0	0.819	73.9	0.57	2.5
	min	43.0	35.7	6.09	34.2	244.0	982.0	2720.0	0.819	73.9	0.57	2.5

(Continued)

Table 6 (Concluded)

Sample	Statistic	Tl(a)	Zn*	Al	Ba*	Ca*	Co*	Fe*	Mg*	Mn	Na*	TP*
		Analyte Concentration mg/kg dry weight (ppm)										
Control	mean	(0.2)	64.2	17030	74.7	944.7	6.878	19333	1399	494	41.8	96.4
n=6	max	<0.2	103.0	21300	106.0	1760.0	8.49	21600	1900	664	58.8	130.0
Borings 1,2,3	min	<0.2	43.5	8080	29.7	324.0	4.5	18500	625	295	29.2	49.8
Boring 4	mean	**0.235**	**72.0**	**21900**	**115.0**	**3195.0**	**7.15**	**21200**	**1925**	**527**	**93.5**	86.5
n=2	max	0.27	79.3	23600	117.0	3640.0	7.6	23200	1980	598	96.3	89.5
	min	<0.2	64.7	20200	112.0	2750.0	6.7	19200	1870	455	90.7	83.4
Boring 5	mean	(0.2)	**1378.0**	14650	**403.0**	**9403.0**	**10.47**	**56500**	**2070**	**533**	**110.0**	**204.0**
n=2**	max	<0.2	2460.0	16100	627.0	10500.0	14.4	91400	2150	639	127.0	284.0
	min	<0.2	296.0	13200	179.0	8305.0	6.54	21700	1990	426	92.0	123.0
Boring 6	mean	(0.2)	**485.0**	12095	**278.0**	**6515.0**	6.4	**22250**	**1573**	354	**231.0**	**297.0**
n=2	max	<0.2	720.0	15700	350.0	10400.0	7.4	24800	2280	406	392.0	418.0
	min	<0.2	250.0	8490	206.0	2630.0	5.4	19700	866	301	70.4	175.0
Boring 7	mean	(0.2)	34.2	7640	36.4	291.0	5.1	18800	732	184	50.4	41.4
n=1	max	<0.2	34.2	7640	36.4	291.0	5.1	18800	732	184	50.4	41.4
	min	<0.2	34.2	7640	36.4	291.0	5.1	18800	732	184	50.4	41.4
Boring 8	mean	(0.2)	**3615.0**	**25350**	**5000.0**	**25400.0**	**28.1**	**166000**	**5290**	**1215**	**1029.0**	**911.0**
n=2	max	<0.2	4140.0	27300	5040.0	26900.0	32.9	205000	6790	1240	1300.0	1020.0
	min	<0.2	3090.0	23400	4960.0	23900.0	23.3	127000	3790	1190	758.0	801.0
Boring 9	mean	(0.2)	**5080.0**	16700	**1740.0**	**19900.0**	**23.8**	**133000**	**2850**	**1420**	**419.0**	**293.0**
n=1	max	<0.2	5080.0	16700	1740.0	19900.0	23.8	133000	2850	1420	419.0	293.0
	min	<0.2	5080.0	16700	1740.0	19900.0	23.8	133000	2850	1420	419.0	293.0

Table Notes:

(a) - No statistical comparisons between control and "test" borings were conducted for the indicated analyte because no meaningful variance statistic could be computed for the control group.

(mean) - Mean reported in parentheses. All data was reported as ≤ detection limits and detection limit is given in (). Means are computed using both samples from boring including using the detection limit for those samples with results reported as < detection limits.

mean - Mean is indicated in **bold**. Concentration is greater than the corresponding mean concentration for the control group.

* - Concentration of soil analyte reported in all test borings (4-9, inclusive) is significantly different (greater) ($P < .05$) than the concentration of that analyte in the control group.

n - Number of Samples.

** - Data for boring 5 included 05#1, 05#1DUP and 05#2. Values for 05#1 and 05#1 DUP were averaged prior to computing the statistics in this table in order to avoid giving sample number 1 from boring 5 undue weight.

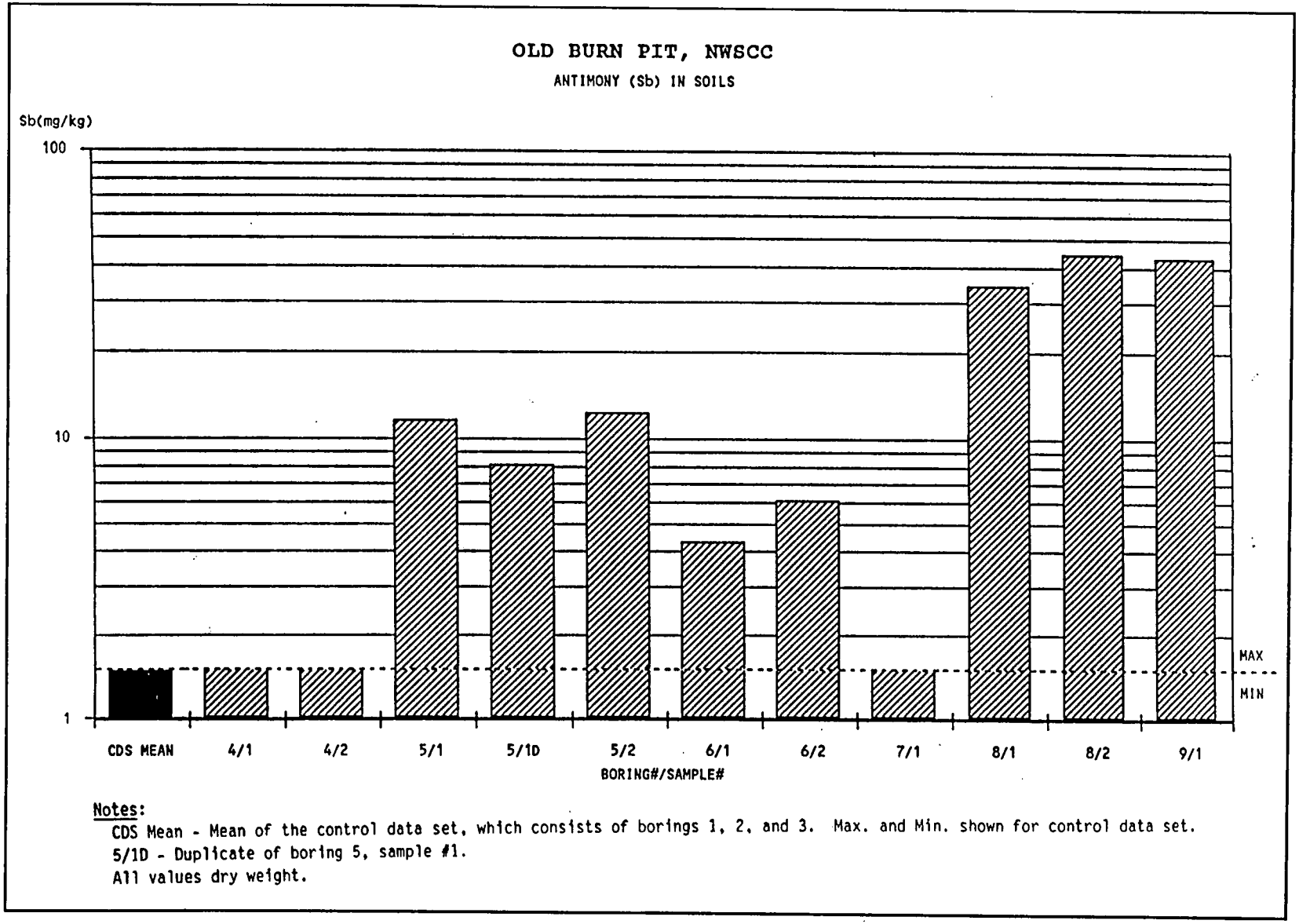
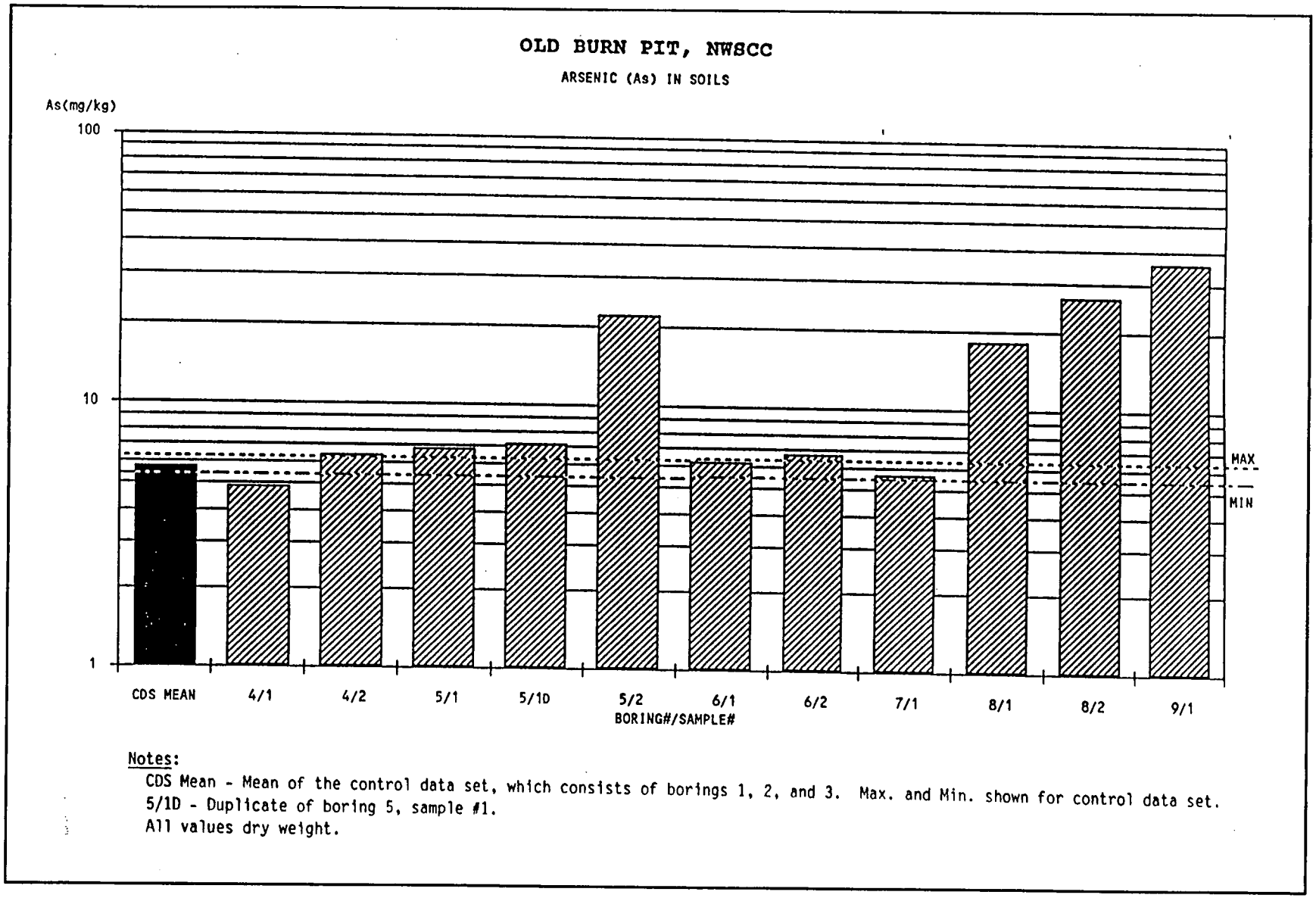
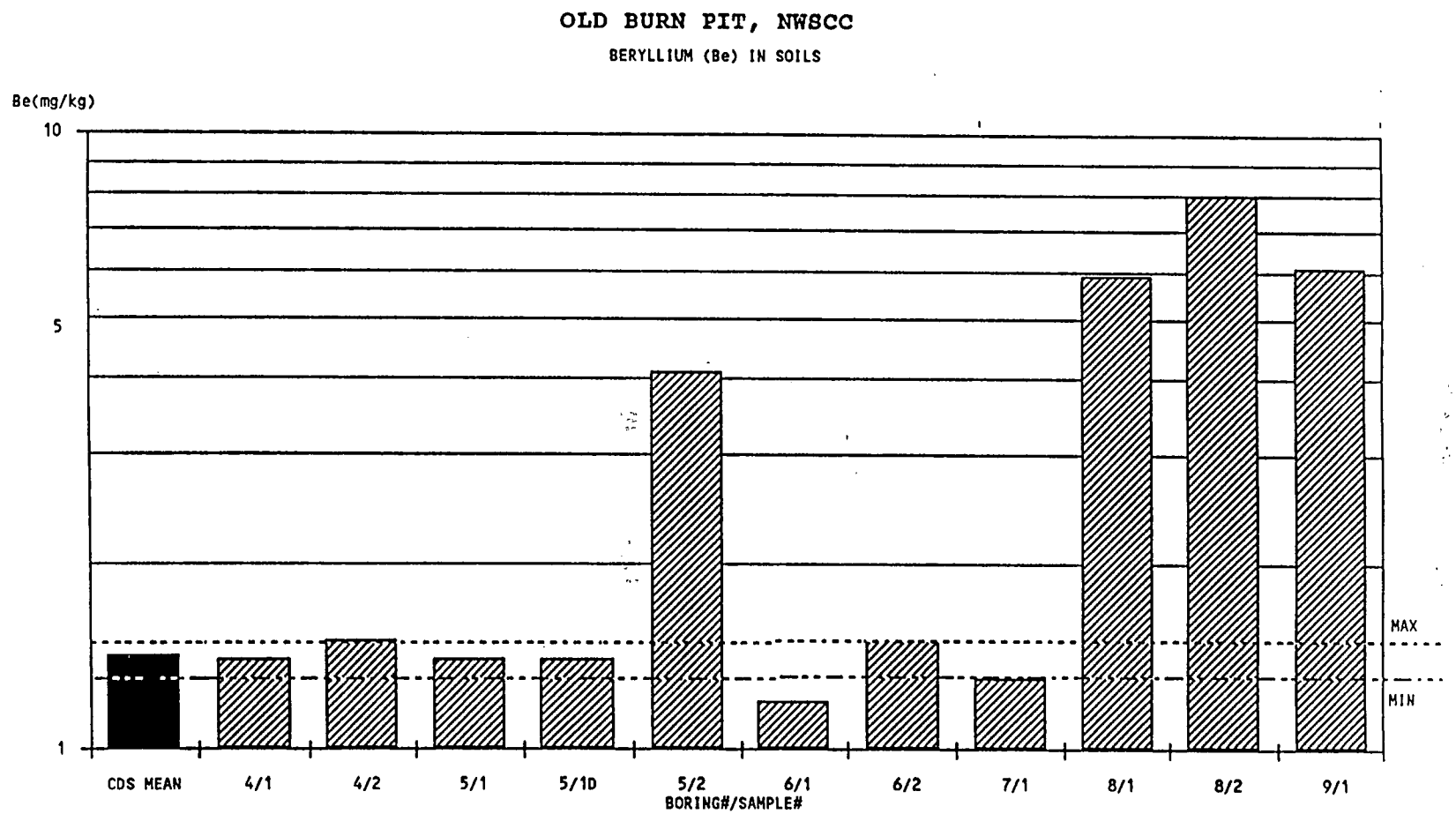


Figure 16. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Antimony concentrations in individual soil samples. All samples are shown in depth sequence for each boring



Notes:
CDS Mean - Mean of the control data set, which consists of borings 1, 2, and 3. Max. and Min. shown for control data set.
5/1D - Duplicate of boring 5, sample #1.
All values dry weight.

Figure 17. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Arsenic concentrations in individual soil samples. All samples are shown in depth sequence for each boring



Notes:
CDS Mean - Mean of the control data set, which consists of borings 1, 2, and 3. Max. and Min. shown for control data set.
5/1D - Duplicate of boring 5, sample #1.
All values dry weight.

Figure 18. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Beryllium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

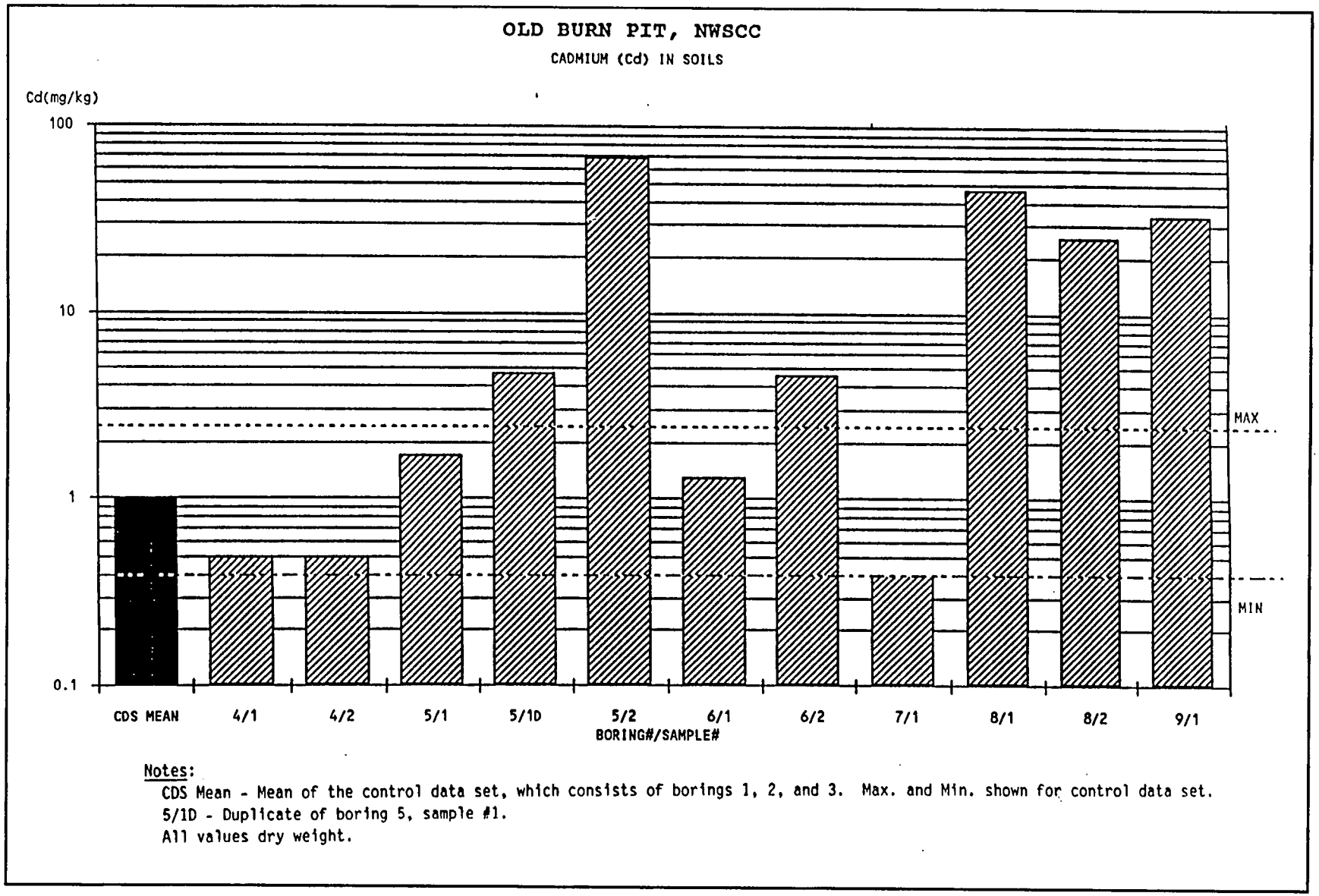


Figure 19. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Cadmium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

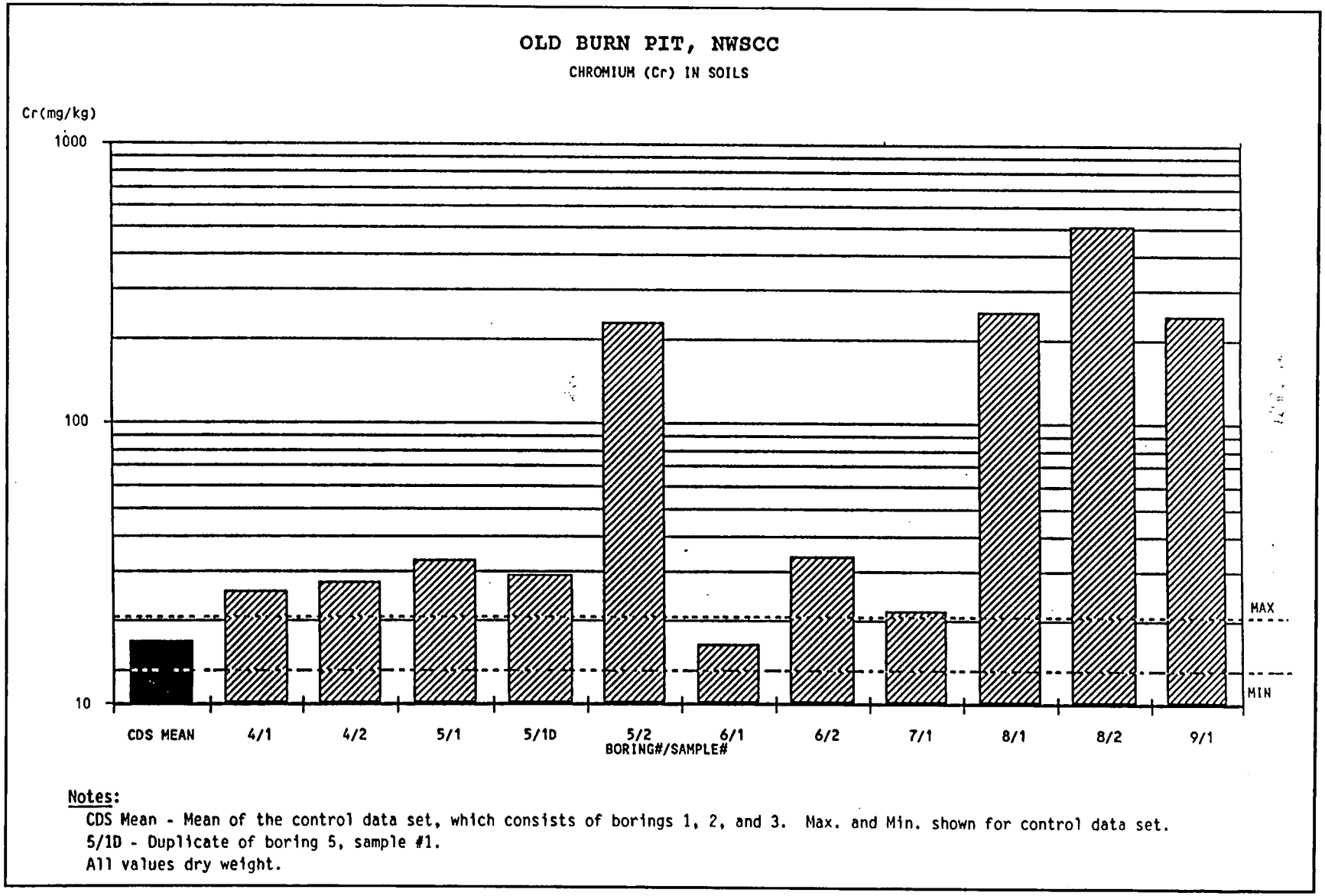


Figure 20. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Chromium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

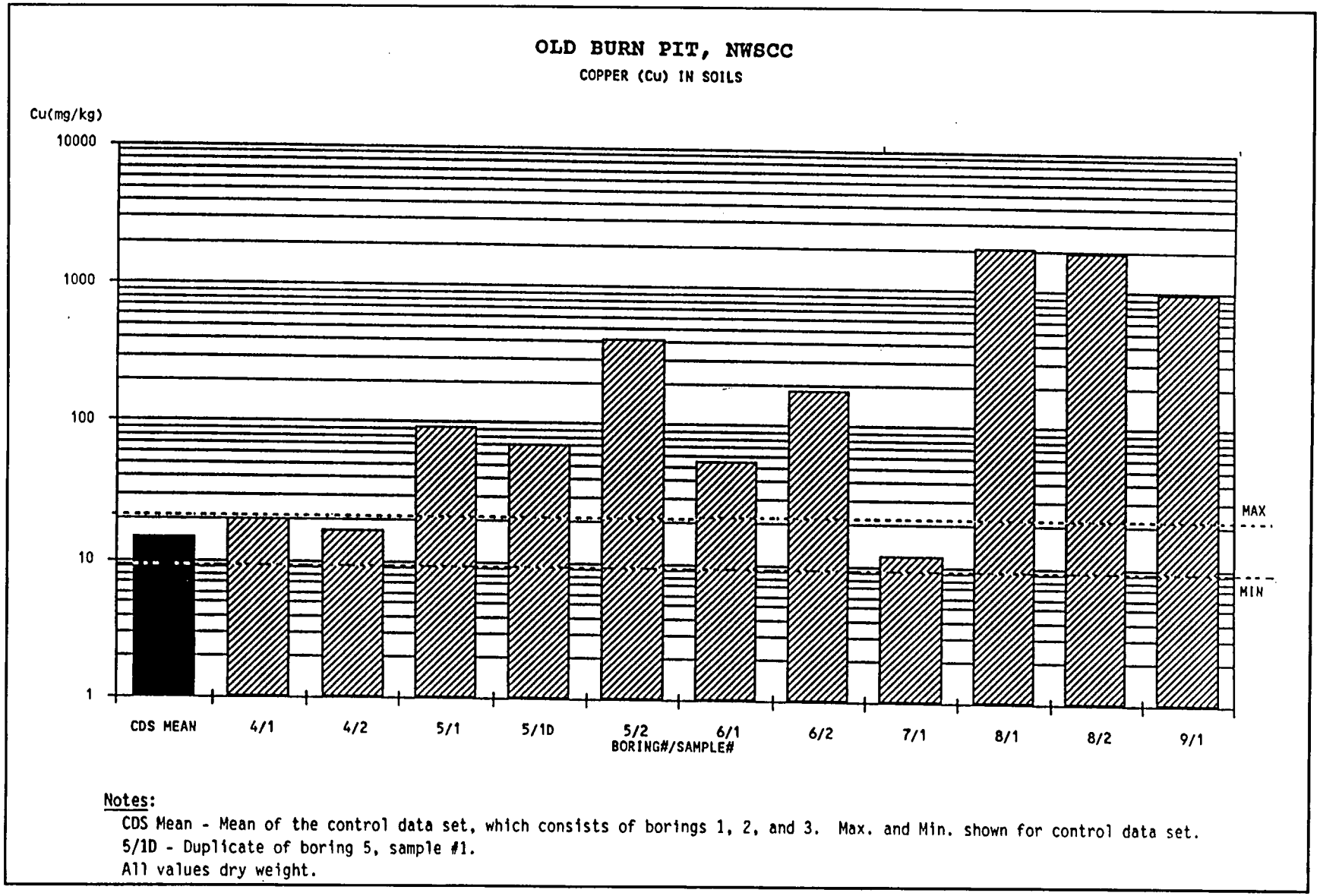
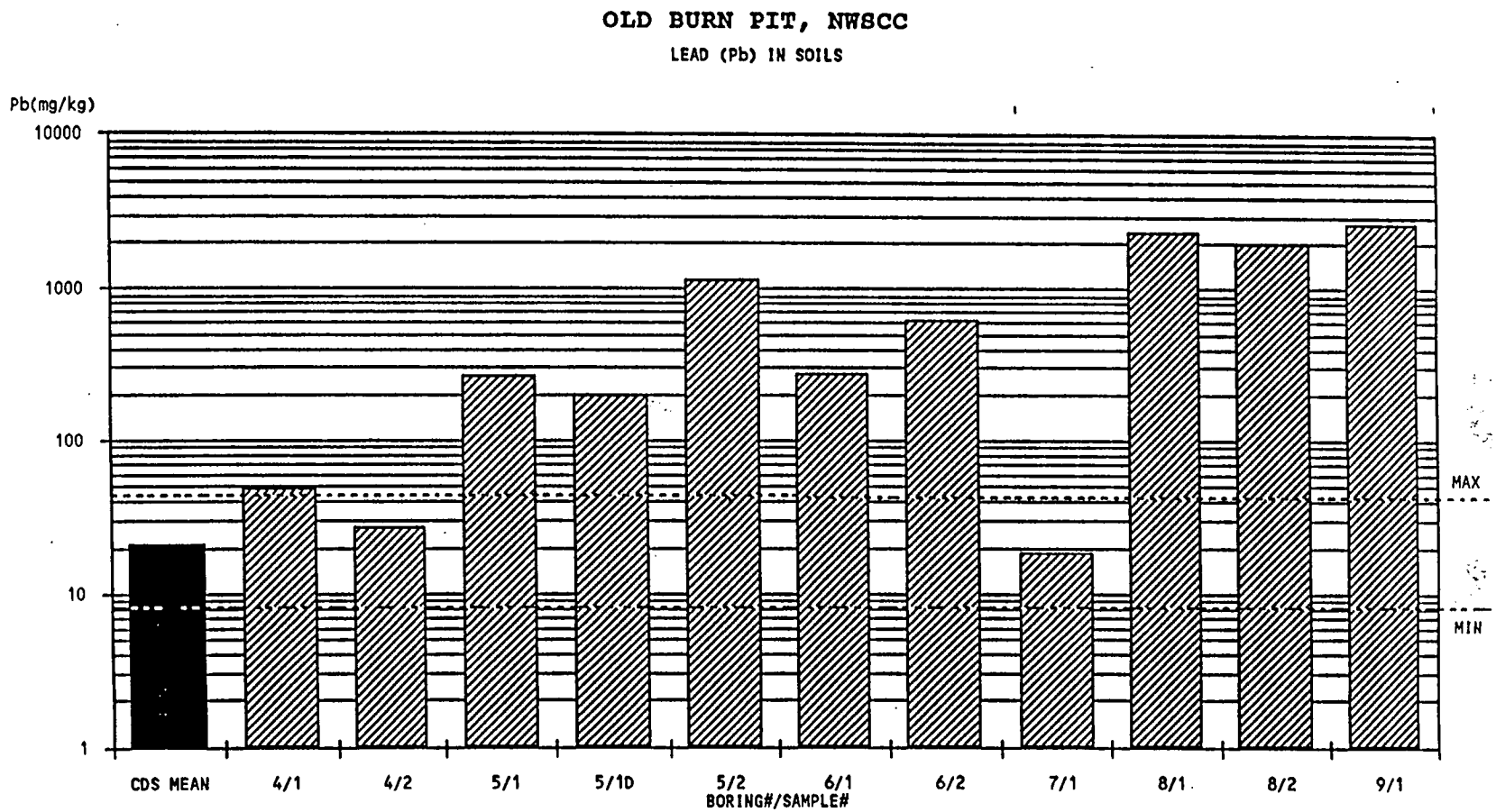
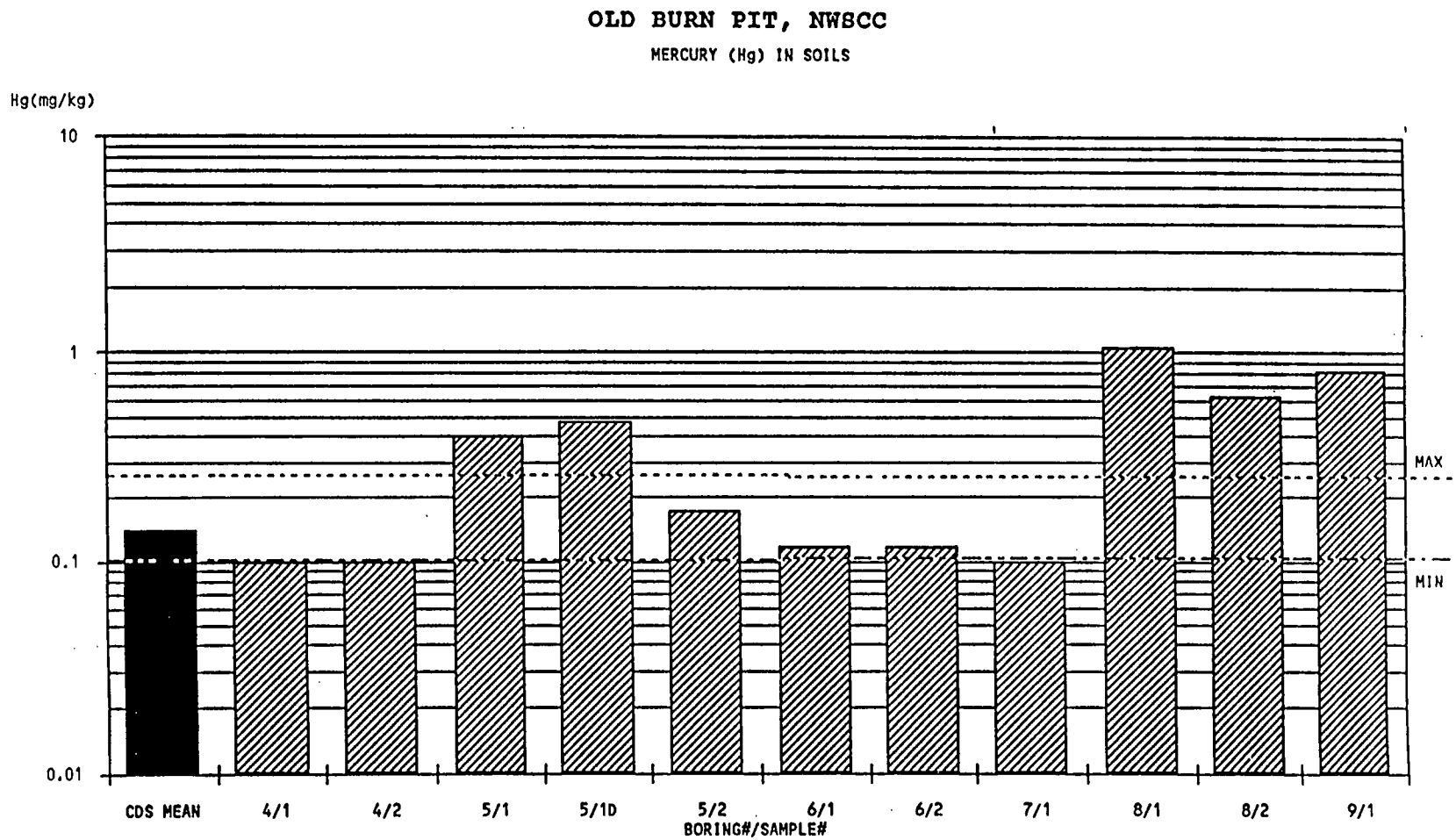


Figure 21. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Copper concentrations in individual soil samples. All samples are shown in depth sequence for each boring



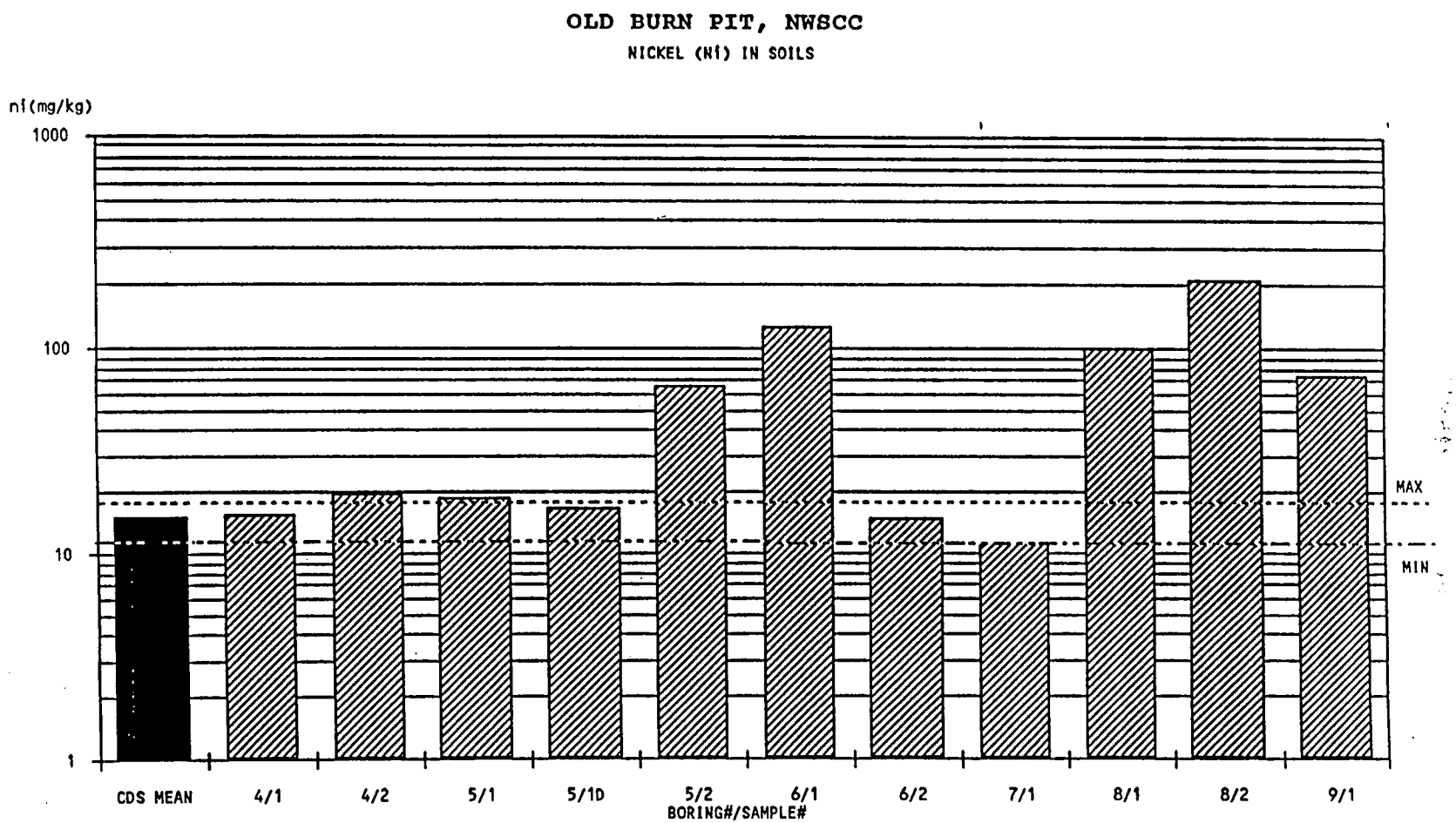
Notes:
CDS Mean - Mean of the control data set, which consists of borings 1, 2, and 3. Max. and Min. shown for control data set.
5/1D - Duplicate of boring 5, sample #1.
All values dry weight.

Figure 22. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Lead concentrations in individual soil samples. All samples are shown in depth sequence for each boring



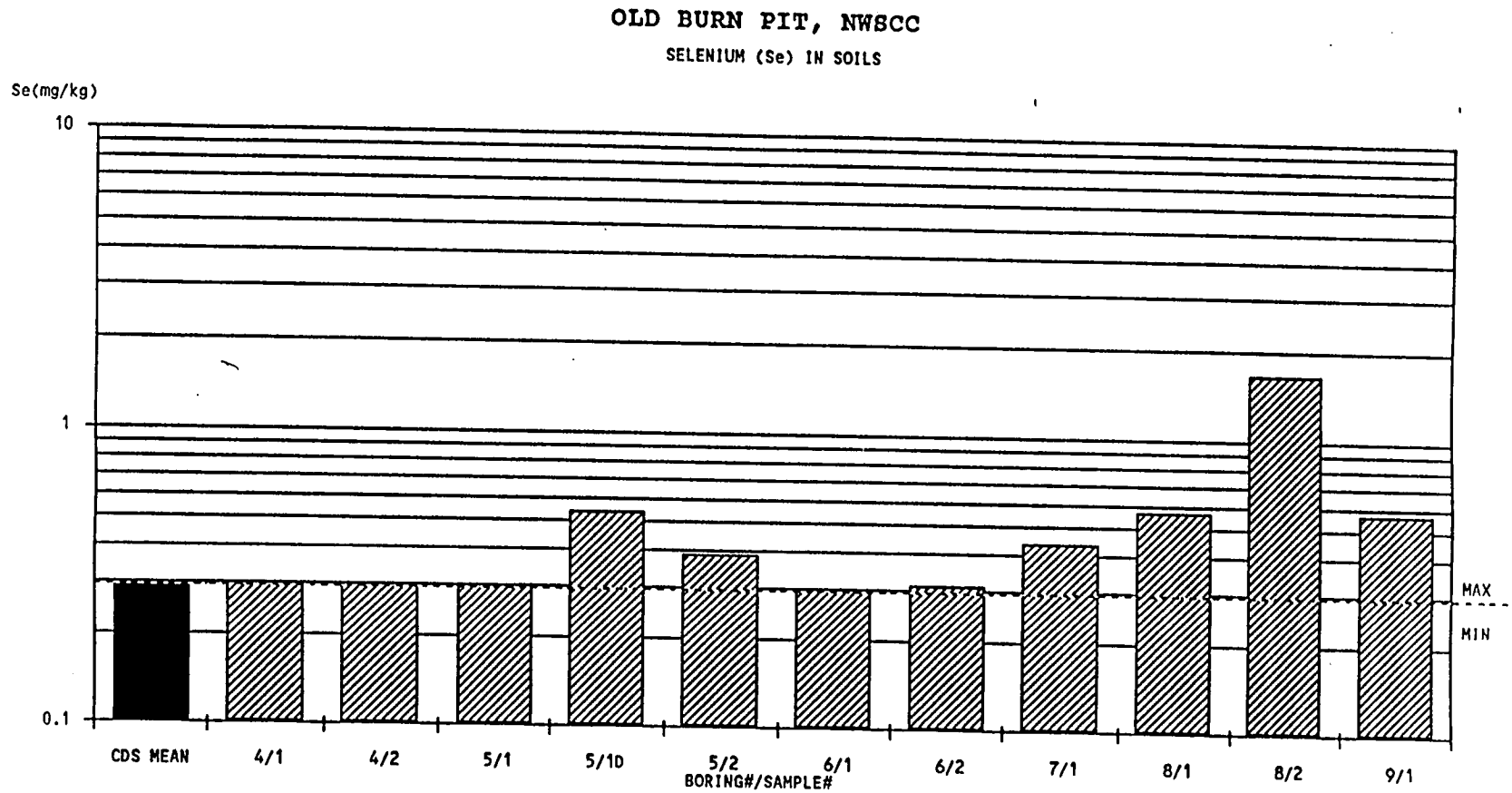
Notes:
CDS Mean - Mean of the control data set, which consists of borings 1, 2, and 3. Max. and Min. shown for control data set.
5/1D - Duplicate of boring 5, sample #1.
All values dry weight.

Figure 23. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Mercury concentrations in individual soil samples. All samples are shown in depth sequence for each boring



Notes:
CDS Mean - Mean of the control data set, which consists of borings 1, 2, and 3. Max. and Min. shown for control data set.
5/1D - Duplicate of boring 5, sample #1.
All values dry weight.

Figure 24. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Nickel concentrations in individual soil samples. All samples are shown in depth sequence for each boring



Notes:
CDS Mean - Mean of the control data set, which consists of borings 1, 2, and 3. Max. and Min. shown for control data set.
5/1D - Duplicate of boring 5, sample #1.
All values dry weight.

Figure 25. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Selenium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

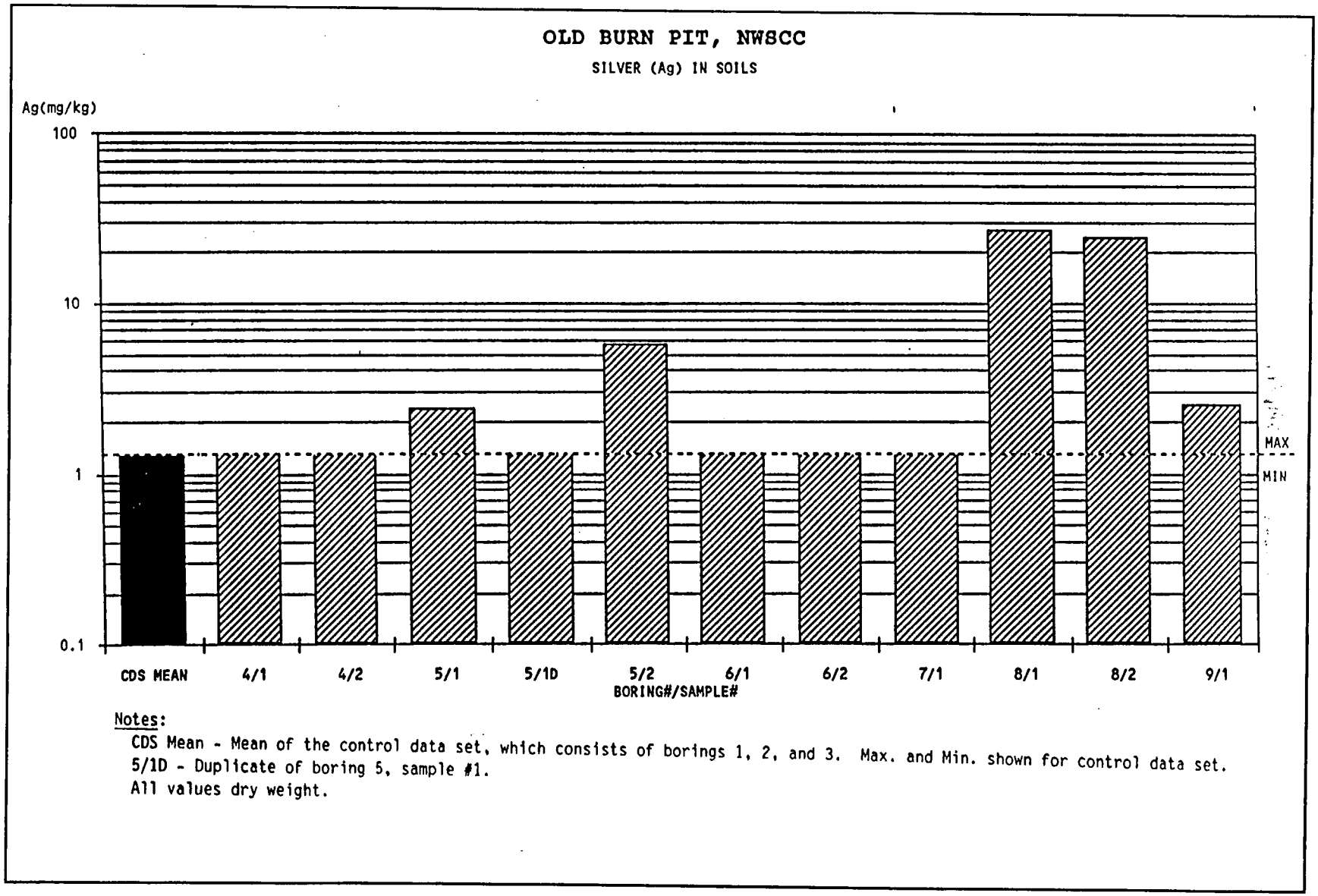


Figure 26. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Silver concentrations in individual soil samples. All samples are shown in depth sequence for each boring

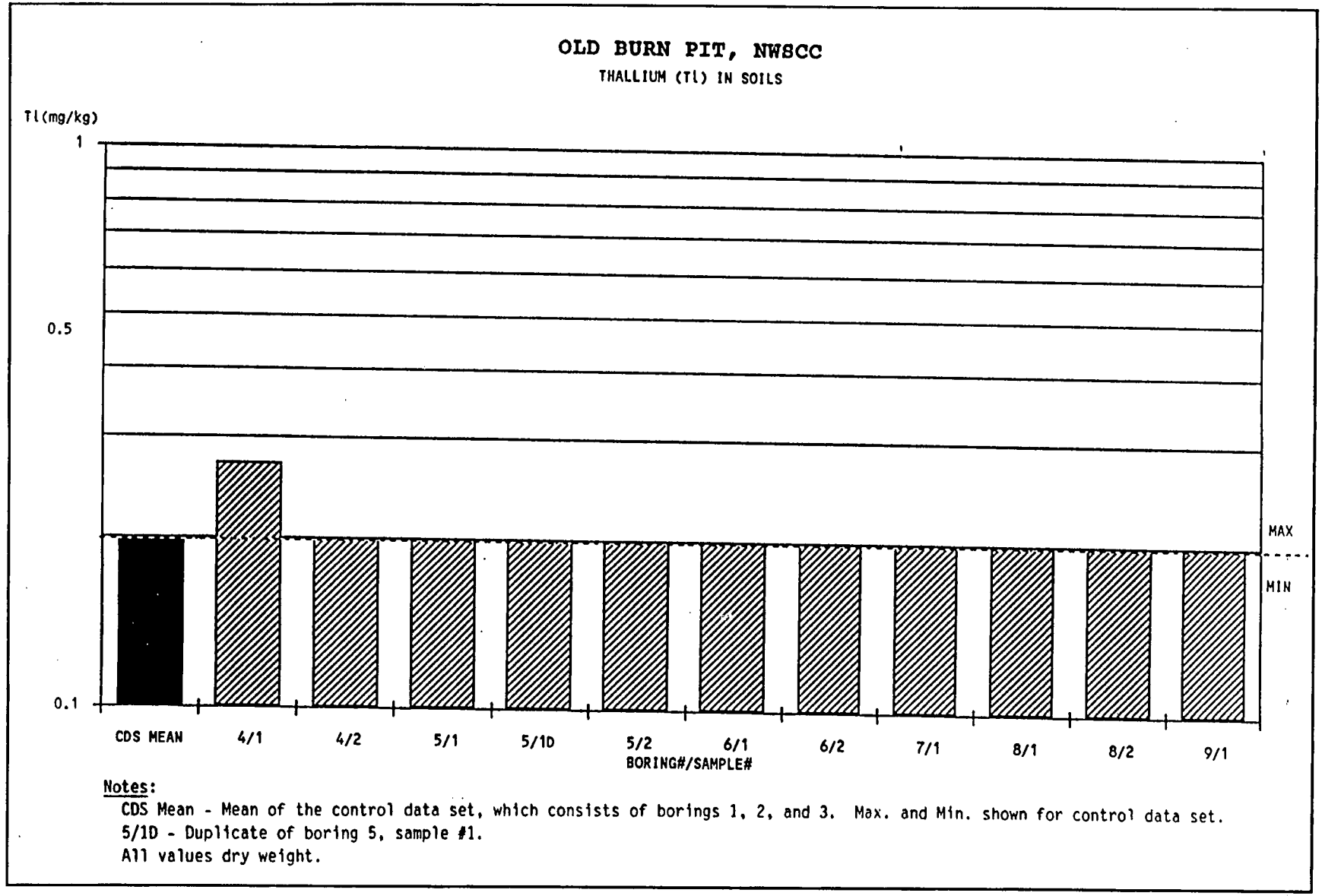


Figure 27. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Thallium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

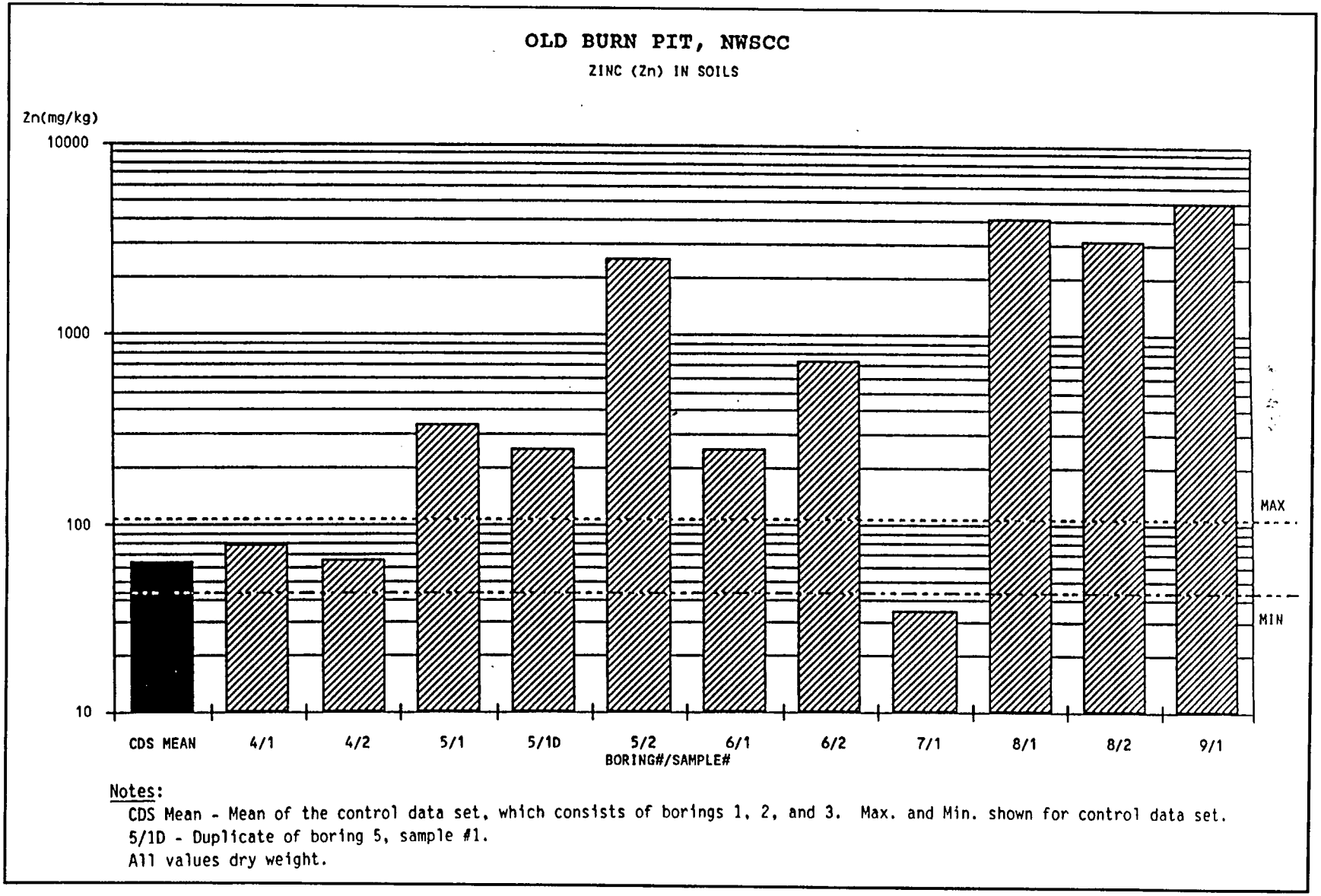
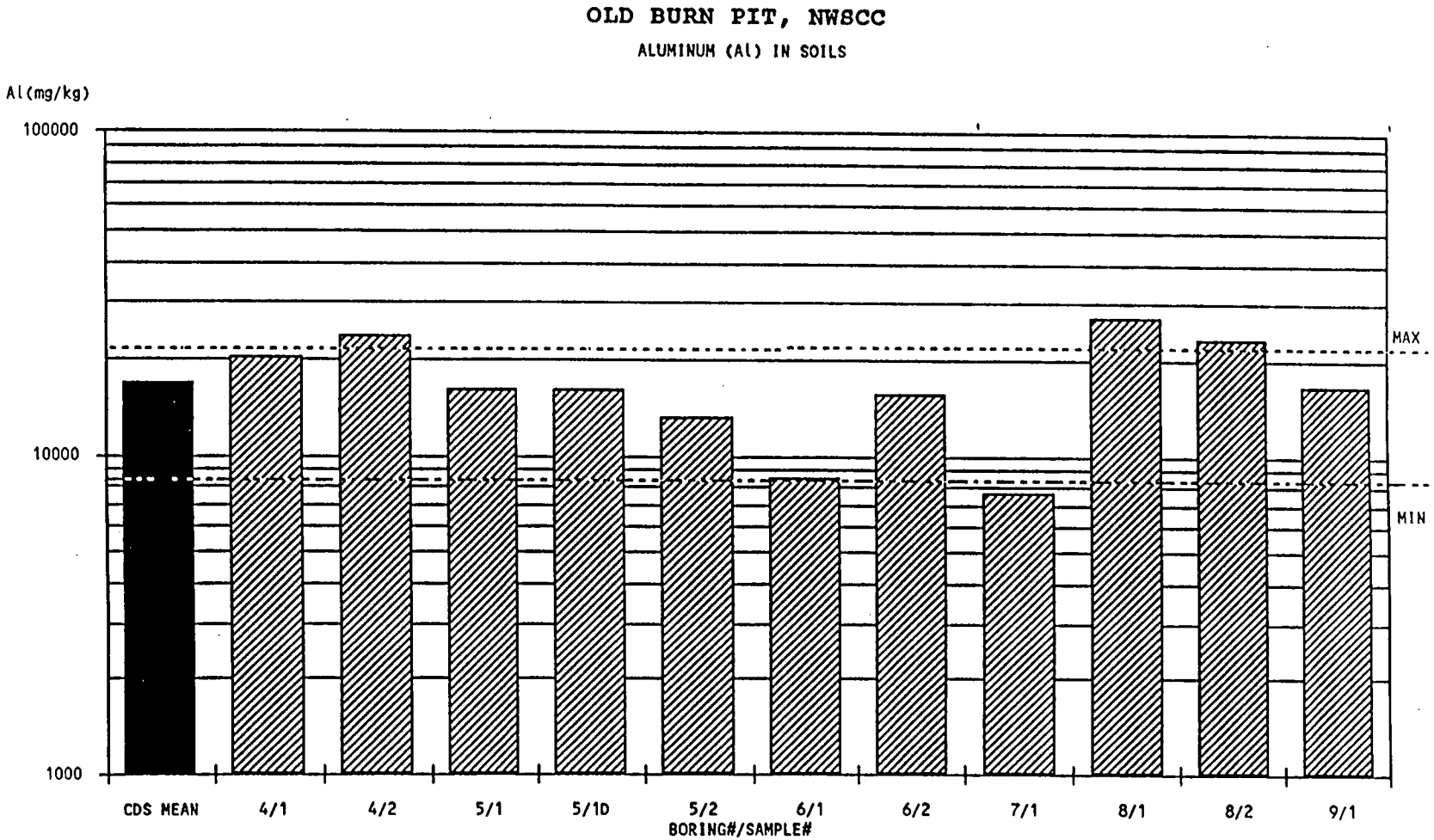


Figure 28. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Zinc concentrations in individual soil samples. All samples are shown in depth sequence for each boring



Notes:
CDS Mean - Mean of the control data set, which consists of borings 1, 2, and 3. Max. and Min. shown for control data set.
5/1D - Duplicate of boring 5, sample #1.
All values dry weight.

Figure 29. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Aluminum concentrations in individual soil samples. All samples are shown in depth sequence for each boring

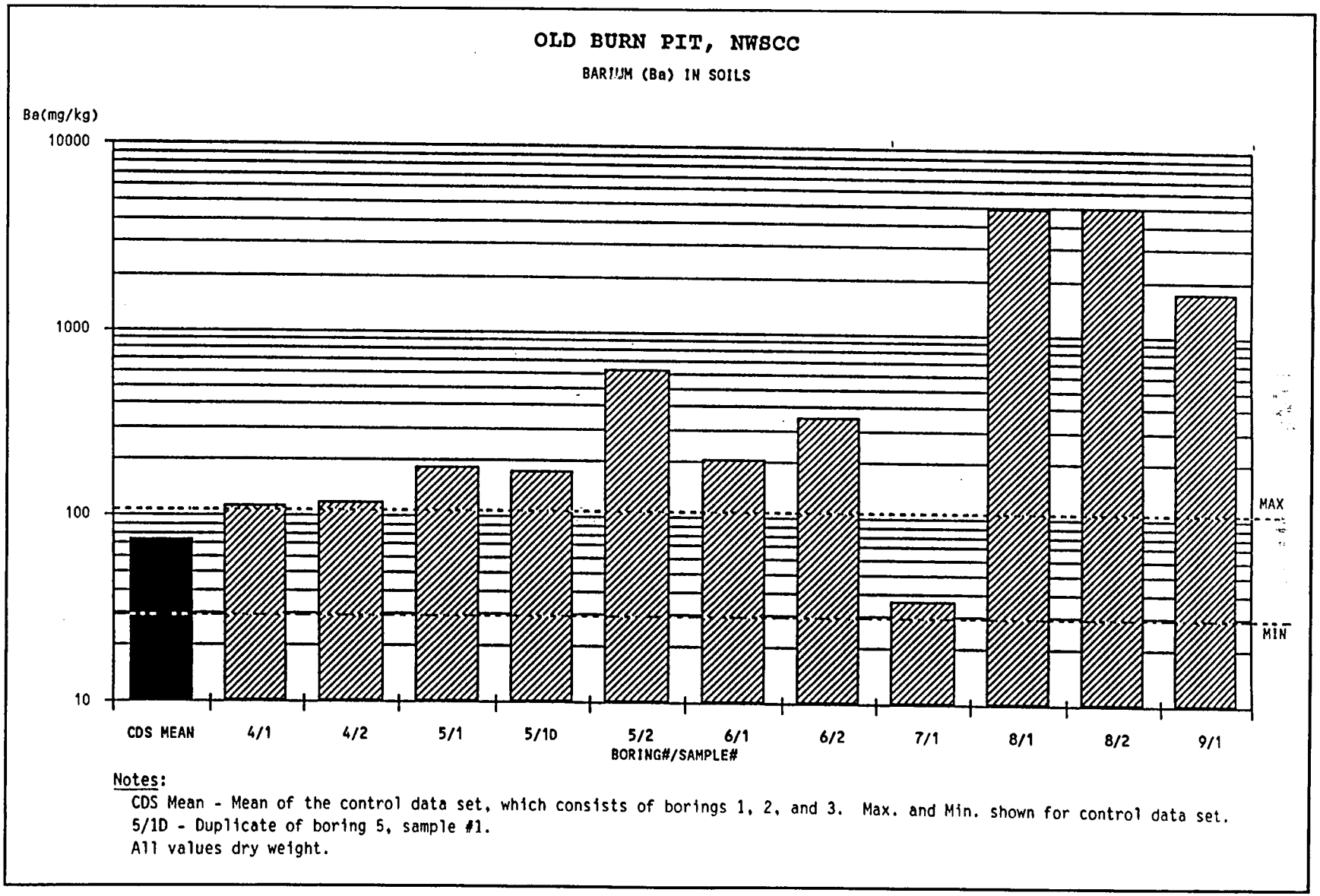


Figure 30. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Barium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

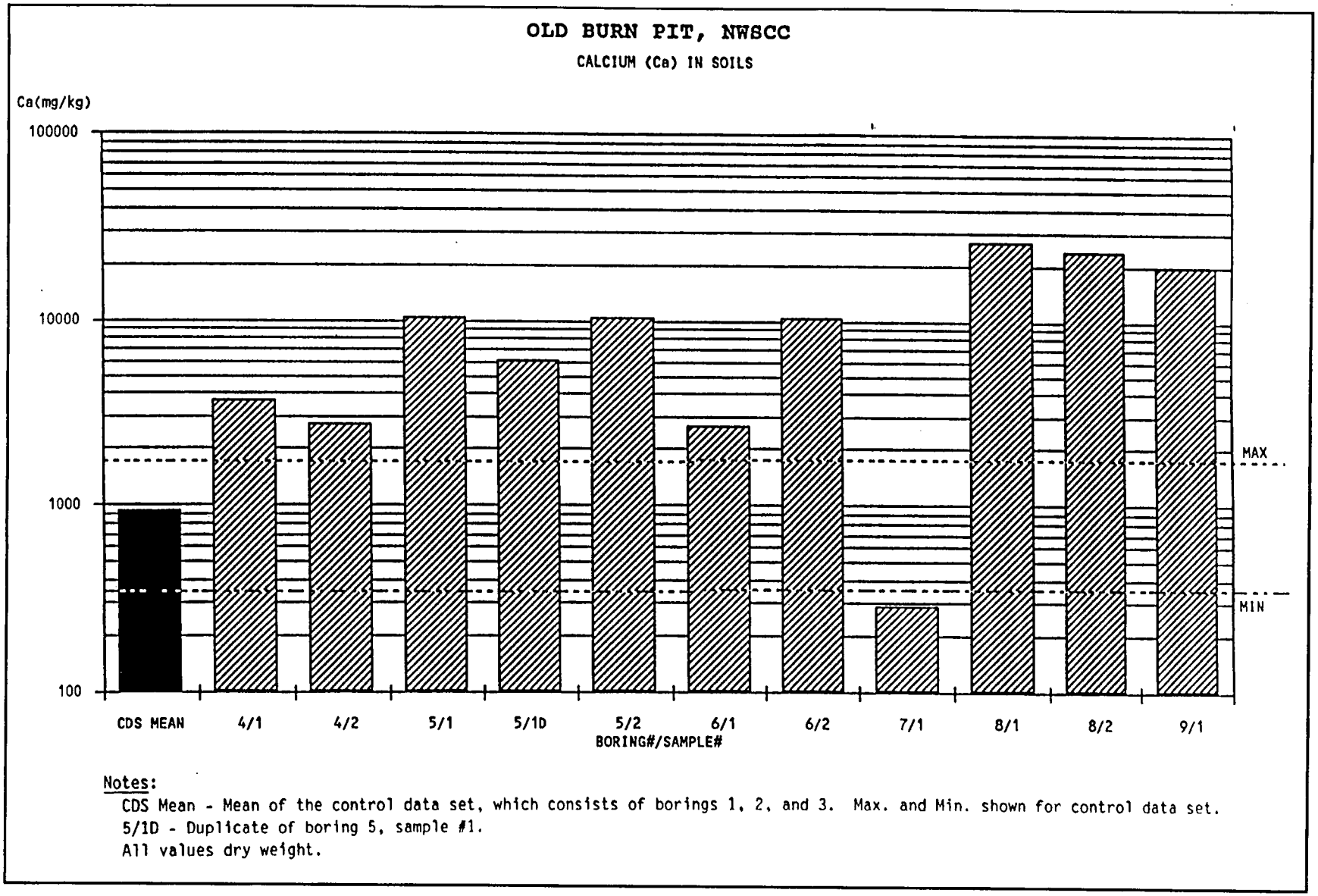


Figure 31. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Calcium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

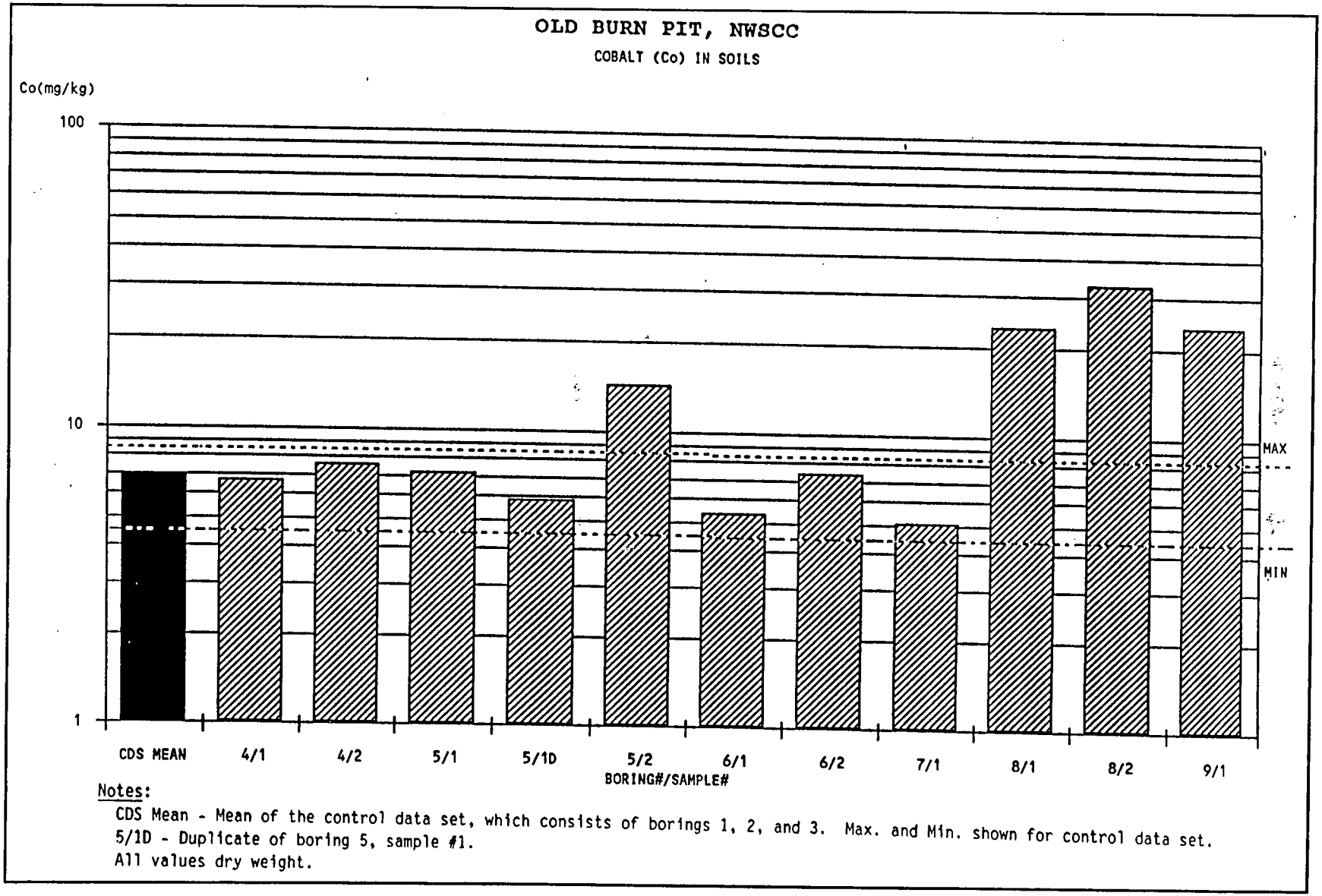


Figure 32. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Cobalt concentrations in individual soil samples. All samples are shown in depth sequence for each boring

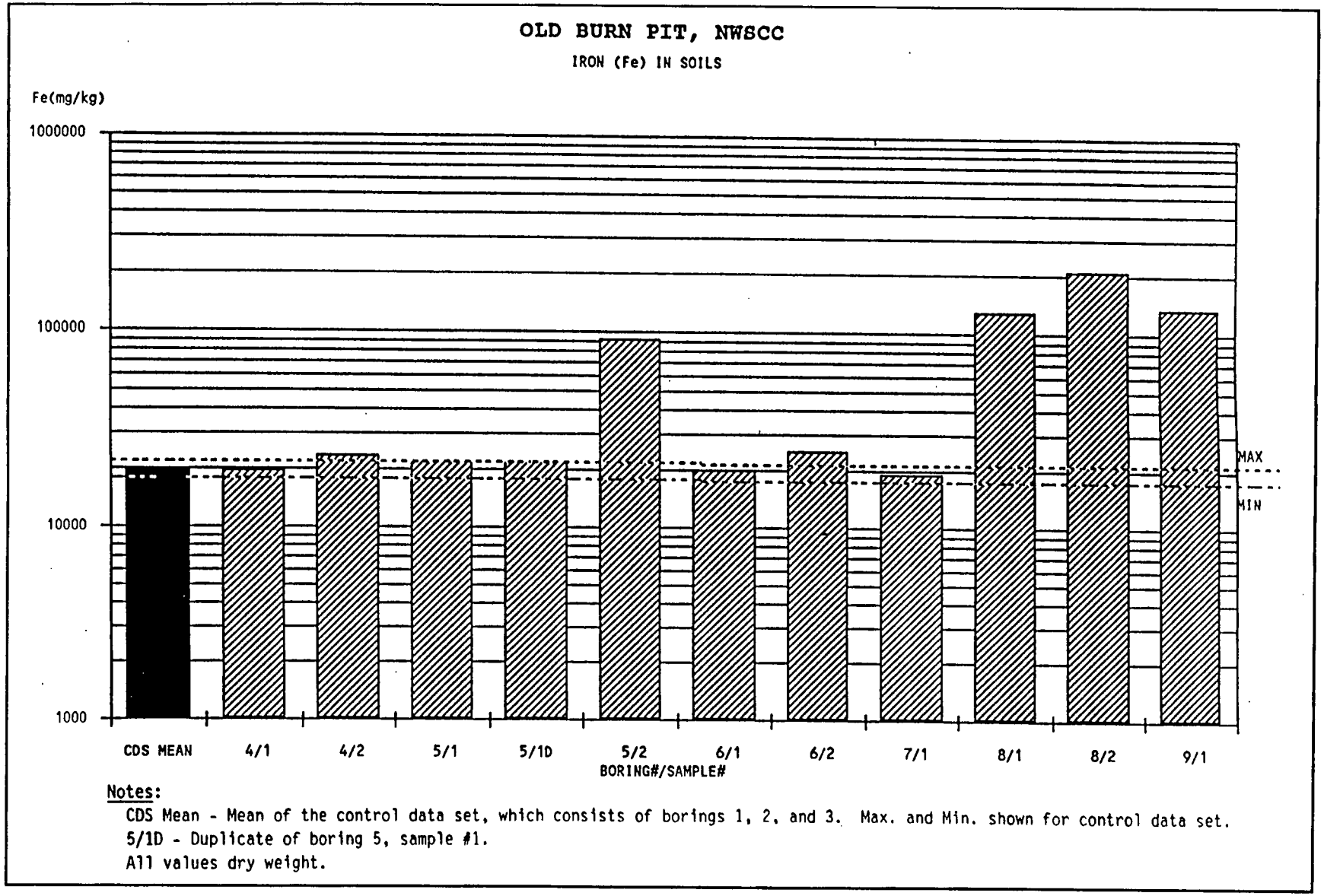


Figure 33. Old Burn Pit - NWSCC, Indiana SWMU 05/03. Iron concentrations in individual soil samples. All samples are shown in depth sequence for each boring

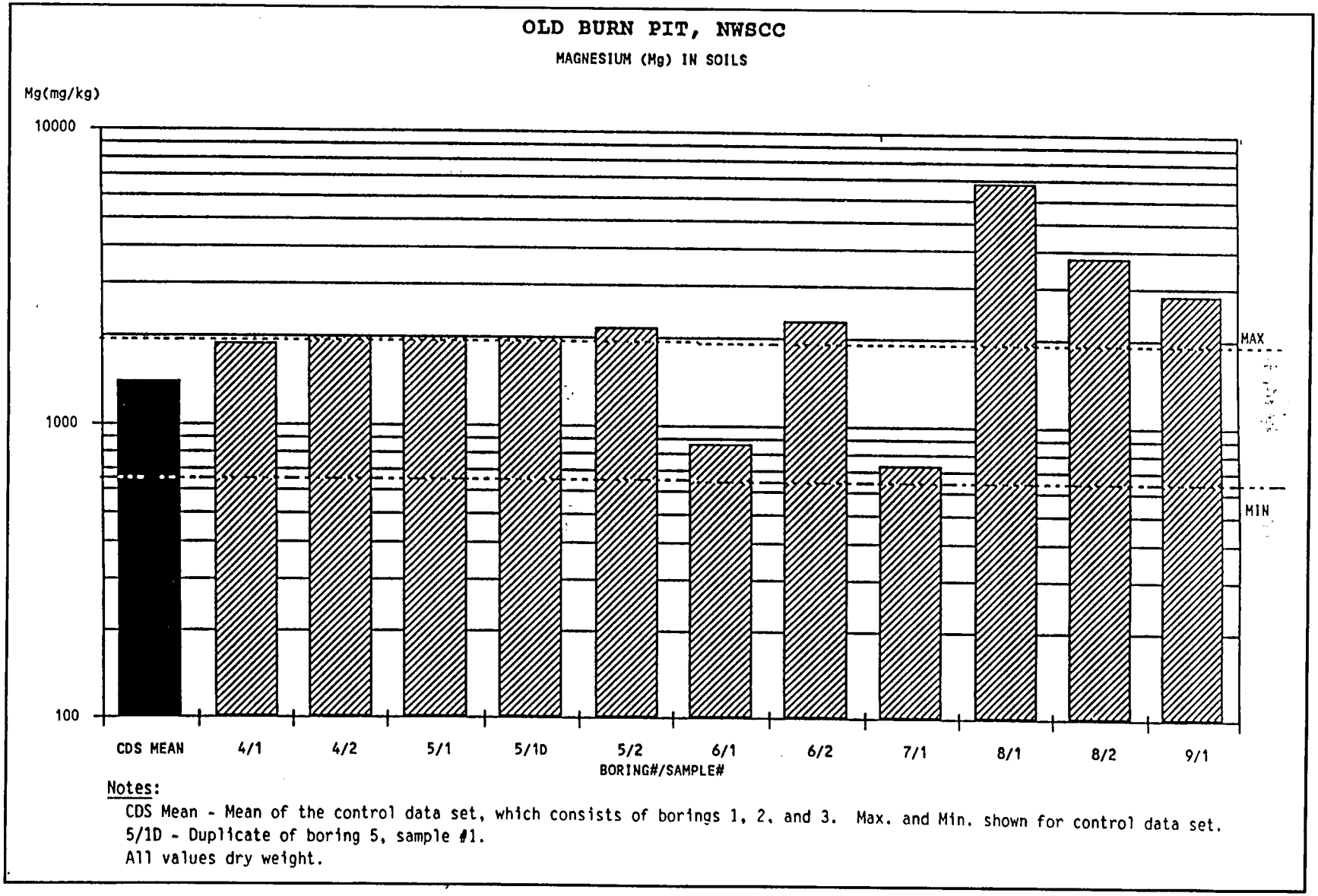


Figure 34. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Magnesium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

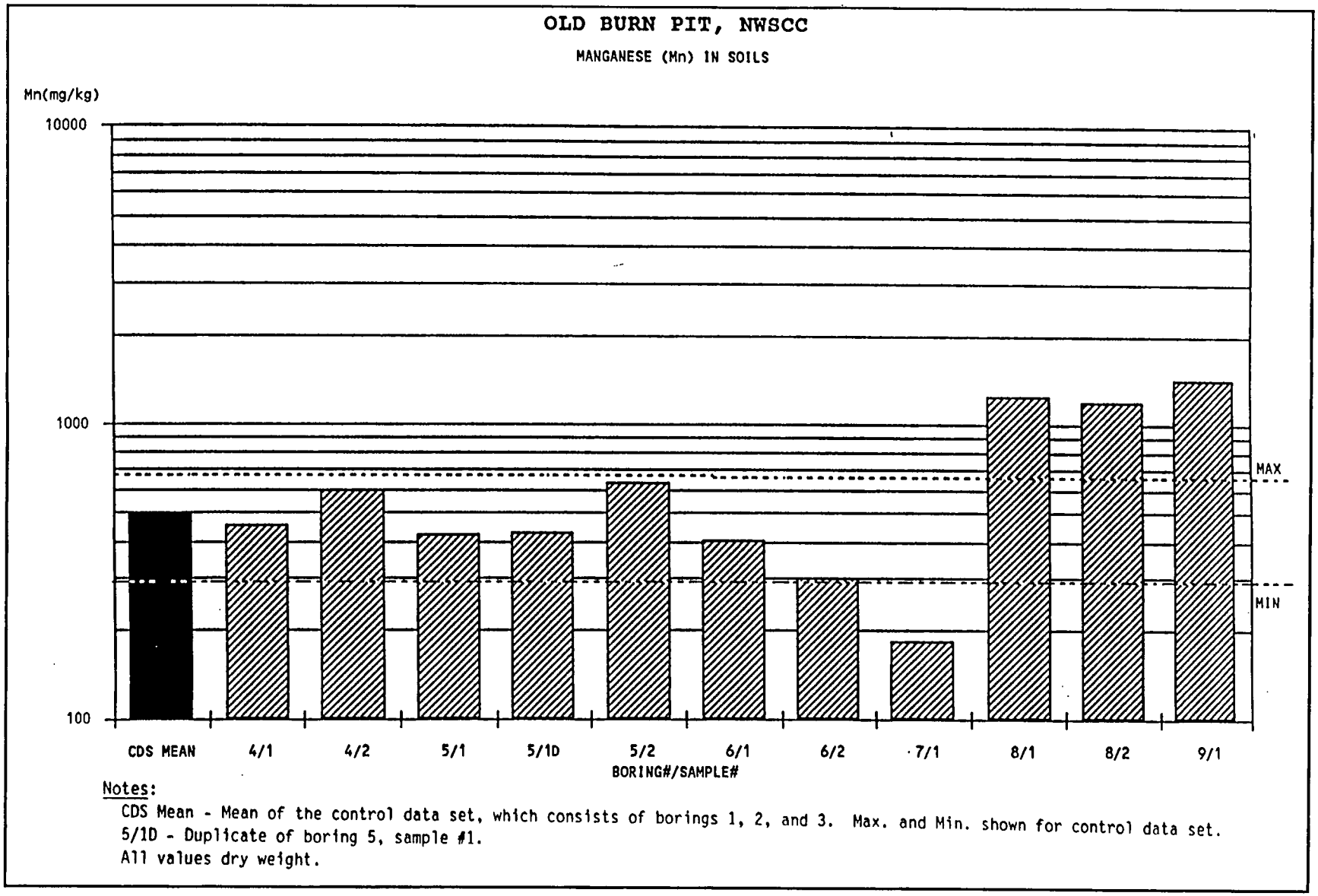


Figure 35. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Manganese concentrations in individual soil samples. All samples are shown in depth sequence for each boring

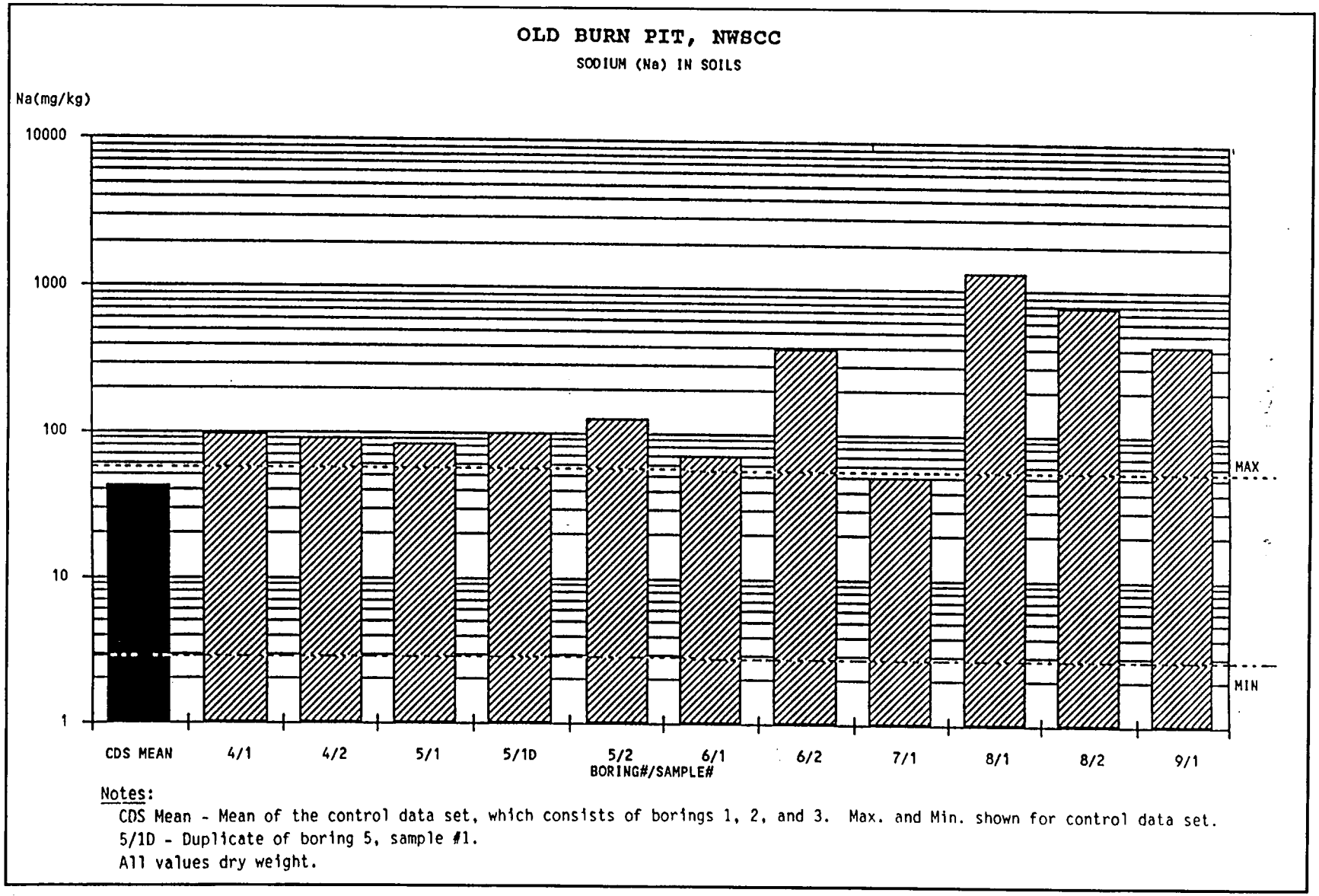


Figure 36. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Sodium concentrations in individual soil samples. All samples are shown in depth sequence for each boring

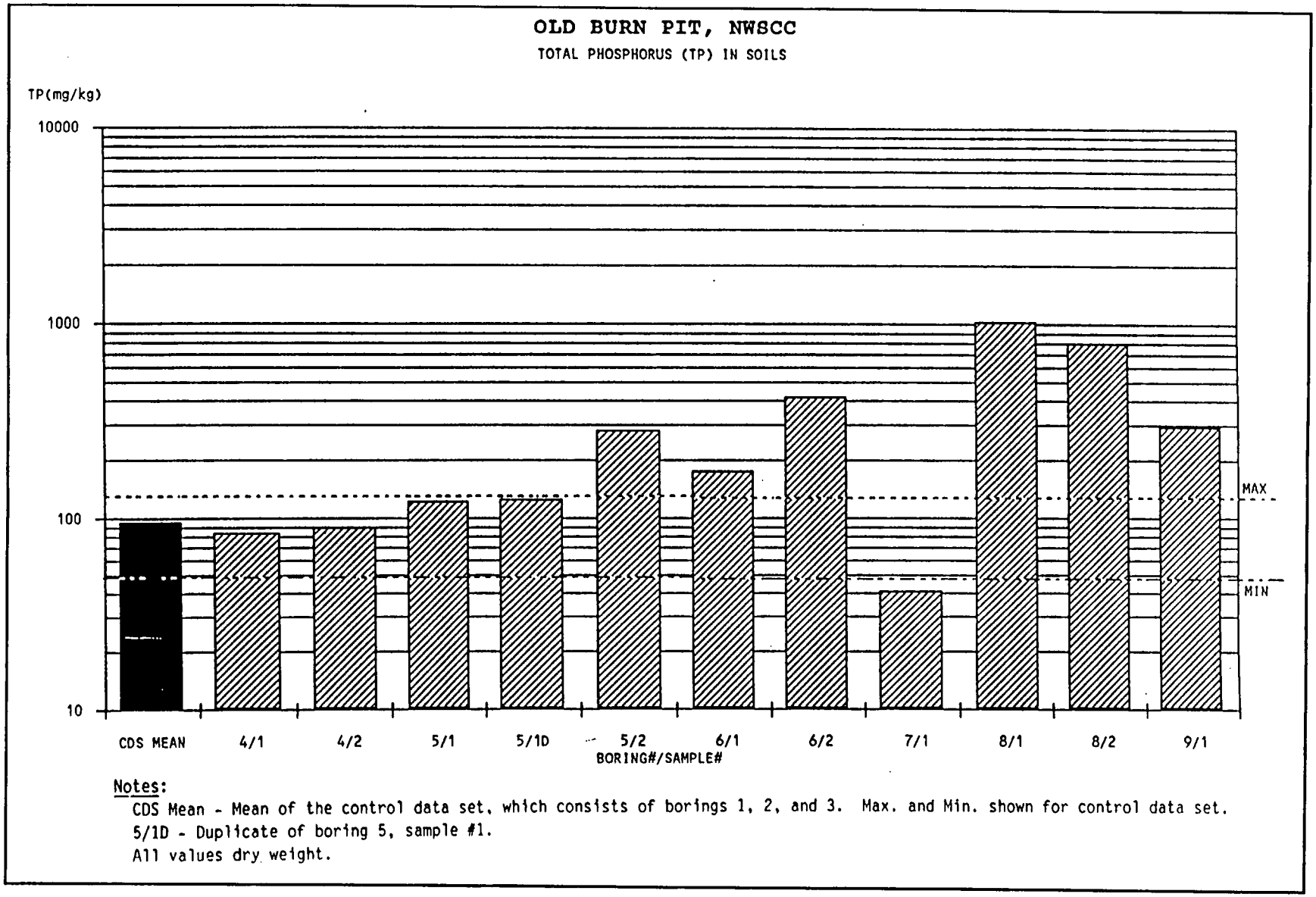


Figure 37. Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Total phosphorus concentrations in individual soil samples. All samples are shown in depth sequence for each boring

Table 7
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Comparison of Maximum and Mean Concentrations of Selected Inorganic Analytes Determined for Soil Samples From Three Other Naval Weapons Support Center Locations

Analyte	Maximum and Mean Concentration Determined mg/kg dry weight							
	Rockeye Munitions Control Area C		Old Rifle Range Control Samples		Ammunition Burning Ground Control Samples		Old Burn Pit Control Samples	
	max	mean	max	mean	max	mean	max	mean
Sb	<1.50	<1.50	0.4	0.3	<1.50	<1.50	<1.50	<1.50
As	4.30	3.27	18.0	9.5	35.4	18.7	6.1	5.8
Be	0.60	0.53	6.1	2.9	9.1	4.7	1.5	1.4
Cd	1.90	1.48	0.5	0.5	0.7	0.5	2.4	1.0
Cr	19.1	15.3	68.8	34.2	45.7	32.8	20.7	16.9
Cu	11.2	7.8	24.3	13.9	18.5	12.7	22.0	14.6
Pb	28.9	21.7	60.7	27.1	52.1	31.8	41.9	21.0
Hg	-	-	<0.10	<0.10	0.30	0.10	0.25	0.14
Ni	13.9	11.9	60.8	19.8	37.1	23.5	17.7	15.3
Se	-	-	0.4	0.3	0.7	0.4	<0.3	<0.3
Ag	-	-	1.9	1.3	<1.3	<1.3	<1.3	<1.3
Tl	-	-	0.4	0.2	0.3	0.2	<0.2	<0.2
Zn	56.2	41.9	190.0	59.4	115.0	80.3	103.0	64.2
Al	11300.0	9500.0	38100.0	18480.0	12200.0	10673.0	21300.0	17030.0
Ba	81.3	67.7	460.0	149.9	135.0	81.2	106.0	74.7
Ca	-	-	-	-	-	-	1760.0	944.7
Co	19.8	17.4	18.0	11.7	29.0	18.4	8.5	6.9
Fe	17600.0	12073.0	95700.0	35007.0	113000.0	65655.0	21600.0	19333.0
Mg	1260.0	1037.0	4740.0	2070.0	1080.0	869.0	1900.0	1399.0
Mn	-	-	2390.0	1009.8	1730.0	1147.0	664.0	494.0
Na	-	-	153.0	74.0	50.0	48.9	58.8	41.8
TP	-	-	246.0	73.2	187.0	137.0	130.0	96.4
Sn	<7.60	<7.60	9.00	<7.70	<7.60	< 7.60	-	-

Table Notes:
Rockeye Munitions Facility SWMU 10/15 - Area C. Area C samples were surface scrapes, n=32.
Old Rifle Range - SWMU 07/09 - Control Subsurface (Borings) 12, 11, and 1A, n=15.
Ammunition Burning Ground - SWMU 03/10 - Control Subsurface (Borings) 1, 2, and 3, n=9.
Old Burn Pit - SWMU 05/03 - Control Subsurface (Borings 1, 2, and 3, n=6).
Mean - where n= 1 the observed concentration was used; where samples had concentrations less than the detection limit, the detection limit was used to compute the mean.
- no data for this parameter.

(Continued)

Table 7 (Concluded)

Data Sources:

U.S. Army Corps of Engineers, Waterways Experiment Station, 1991. RFI Phase II, Old Rifle Range Report for: SWMU 07/09, Naval Weapons Support Center, Crane Indiana. Prepared for Northern Division, Naval Facilities Engineering Command, U.S. Naval Base, Bldg. 77 Low, Philadelphia Pennsylvania. Final Draft.

U.S. Army Corps of Engineers, Waterways Experiment Station, 1991. RFI Phase III, Part I, Soils, Ammunition Burning Ground: SWMU 03/10, Naval Weapons Support Center, Crane Indiana. Prepared for Northern Division, Naval Facilities Engineering Command, U.S. Naval Base, Bldg. 77 Low, Philadelphia Pennsylvania. Internal Draft.

U.S. Army Corps of Engineers, Waterways Experiment Station, 1991. RFI Phase III, Soils, Rockeye Munitions Facility SWMU 10/15, Naval Weapons Support Center, Crane Indiana. Prepared for Northern Division, Naval Facilities Engineering Command, U.S. Naval Base, Bldg. 77 Low, Philadelphia Pennsylvania. Internal Draft.

from "non-control" borings 4 through 9 (Table 6); similarly, with the exception of thallium and cadmium, the maximum inorganic constituent concentrations were determined from borings 8 and 9 (Table 5); the minimum concentrations, determined, or concentrations equal to the minimum, for all inorganic constituents, with the exception of arsenic, zinc, aluminum, calcium, manganese and total phosphorus were obtained from the control borings. The minimum concentrations determined, or concentrations equal to the minimum, for zinc, aluminum, calcium, manganese, total phosphorus, antimony, beryllium, cadmium, mercury, and silver were detected in boring 7. Concentrations of antimony, mercury, selenium, and silver equal to the minimum were found in boring 4. Boring 4 contained the minimum concentration of arsenic.

The mean concentrations of inorganic analytes in soil samples from borings 8 and 9 indicate that a release of metal constituents has probably occurred in those locations. Soils from boring 8 contained all inorganic analytes tested for, with the exception of thallium, at mean concentrations which were greater than mean concentrations in the soil samples from the control borings (borings 1, 2, and 3). Soils from boring 9 contained all inorganic analytes tested for except aluminum and thallium at mean concentrations which were greater than the mean concentrations in the soil samples from the control borings (borings 1, 2, and 3).

The OBP borings 4, 5, and 6 also produced soil samples with mean metals concentrations that were frequently greater than those determined for the control borings (borings 1, 2, and 3). Generally, the mean metals concentrations reported from soils from borings 4, 5, and 6 were less than those reported for borings 8 and 9 (Table 6).

As indicated in Table 6, the concentrations of the following inorganic analytes in the test borings (borings 4 through 9, inclusive) were significantly greater ($P < .05$) than corresponding mean concentrations for the control samples (borings 1, 2, and 3): arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, zinc, barium, calcium, cobalt, iron, magnesium, sodium and total phosphorus. This means that for those inorganic analytes, the probability (P) of obtaining a mean soil sample which has greater concentrations of the specified constituents than the control is more than 95 percent.

For the inorganic analyte manganese, the mean concentrations of the test borings were not significantly greater than corresponding control sample means. It should be noted that the variance for manganese in the test borings was approximately 10 times that of the control borings. Borings 8 and 9 had mean concentrations of manganese that were significantly greater than the control means, borings 4 and 5 had mean concentrations which were slightly greater than those of the control borings, and borings 6 and 7 actually had mean concentrations which were less than those of the control borings. Although a large difference between the mean concentrations of manganese for control and "test" borings may exist, this difference is not statistically significant. Thallium was present in borings 4 through 9 in concentrations comparable to or less than the control borings as were selenium, silver and antimony in borings 4 and 7 (Table 4). In no case was the mean concentration of the test borings (4 through 9, inclusive) significantly ($P < .05$) greater than the

respective mean concentration for the controls (Table 6) for these analytes. The maximum concentration reported for thallium was present in boring 4 (0.3 mg/kg) and maximum concentrations for selenium, silver and antimony were 1.7 mg/kg, 27.2 mg/kg, and 44.7 mg/kg, respectively. The maximum concentrations for selenium, silver and antimony were found in soils from boring 8. Although there was not a statistically significant difference between the test borings and the control borings for selenium, silver and antimony, the soil samples from borings 8 and 9 contained detectable levels of selenium and silver and significant levels of antimony. Based on these soils data, the waste disposal operations at SWMU 05/03 have not left thallium as a residue in the soils or contributed thallium as a contaminant to nearby soils, however, it is likely that a release of selenium, silver and antimony has occurred in the vicinity of borings 8 and 9.

Figures 6 through 37 illustrate the metals concentrations for the soil borings. For those borings which had two samples, the deeper samples, in most cases, had higher concentrations of metals than the more shallow samples. The factors contributing to the patterns of metals concentrations in the soils, or the lack of them, cannot be determined from available data.

Soils from borings 5, 6, 8, and 9 contained mean total phosphorus concentrations that were greater than those found in the control boring soils and there was a statistically significant difference in the test samples and the control samples for total phosphorus. Mean total phosphorus concentrations reported were 204, 297, 911, and 293 mg/kg in soils from borings 5, 6, 8, and 9, respectively. Based on these soils data, the waste disposal activities at the OBP have produced observable total phosphorus residues in the soils of that area. As with the metals constituents discussed previously, the soils at borings 8 and 9 had contaminant concentrations, in this case total phosphorus, that were much higher than the control borings and most other borings tested.

In summary, maximum concentrations of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, aluminum, barium, calcium, cobalt, iron, magnesium, manganese, sodium, and total phosphorus were generally higher in soils from borings 4 through 9 than soils from the control borings 1, 2, and 3. Highest concentrations of these inorganic constituents were usually found in either boring 8 or 9. For inorganic analytes arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, zinc, barium, calcium, cobalt, iron, magnesium, sodium, and total phosphorus, the mean concentrations for test soils was significantly greater ($P < .05$) than the control soil. Based on these soils data, a release of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, aluminum, barium, calcium, cobalt, iron, magnesium, manganese, sodium, and total phosphorus is likely to have occurred at specific locations within the OBP.

Method blank. The results of analysis of method blanks used in association with the inorganic analyses of OBP soils are provided in Table 8. The concentrations of constituents in the method blanks were 100 to 1,000 times (or more) less than the concentrations determined for the soil samples. These

Table 8
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Inorganic Analyses of Method Blanks Associated with Analyses of Soil Samples. Concentrations are mg/kg (ppm) Dry Weight. Detectable Concentrations are Shown in *Bold*

Method Blank ID**/Analyte	Sb	As	Be	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag
MB/Boring 1	<0.003U	<0.002U	<0.002UN	**0.008**	<0.011U	**0.009B**	<0.025U	<0.100U	<0.005U	<0.300U	<0.013U*
MB/Borings 2,3	<0.003UN	<0.002U	<0.002UN	<0.004UN	**0.023**	<0.005U	<0.025U	<0.100U	<0.005U	<0.003U	<0.013U
MB/Borings 4,5,7	<0.003UN	<0.002U	<0.002UN	<0.004U	**0.051***	<0.005U*N	<0.025U	<0.100U	<0.005U	<0.003U	<0.013U
MB/Borings 9,6	<0.003UN	<0.002U	<0.002UN	<0.004U	**0.130**	<0.006U	<0.025U	<0.100U	<0.011U	<0.003U	<0.013U*
MB/Borings 8	**0.0032BN**	<0.002U	<0.002UN	<0.004U	<0.011U	<0.006U	<0.025U	<0.100U	<0.011U*	<0.003UN	<0.013U

Method Blank ID**/Analyte	Tl	Zn	Al	Ba	Ca	Co	Fe	Mg	Mn	Na	TP
MB/Boring 1	<0.002U	<0.005U	**0.126B**	<0.010U	**0.120B**	**0.009B**	**0.256**	<0.130U	<0.005U	**0.072B**	<0.050U
MB/Borings 2,3	<0.002U	**0.038**	**0.047B**	<0.010U	<0.050U	<0.005U	**0.172**	<0.130U	<0.005U	<0.060U	<0.050U
MB/Borings 4,5,7	<0.002U	**0.011B**	**0.051B**	<0.010U	**0.087B**	<0.005U	**0.177B**	<0.130U	<0.005U	**0.227B**	<0.050U
MB/Borings 9,6	<0.002U	**0.015B**	**0.112B**	<0.010U	**0.245B**	<0.030U	**0.686**	<0.130U	<0.005U	**0.228B**	<0.050U
MB/Borings 8	<0.002U	**0.028**	**0.203**	<0.010U	**0.138B**	<0.030U	**0.200**	<0.130U	<0.005U	**0.324B**	<0.050U

Note:

U Analyte was analyzed for but not detected.

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 Spiked sample recovery not within control limits.

* Duplicate analysis not within control limits.

** Sample ID - MB (Method Blank)/Boring Numbers associated with that method blank. See Figure 5.1 for boring locations.

Equipment rinses. Some inorganic analytes were found in all equipment rinses analyzed (Table 9). However, the concentrations of inorganic constituents in the rinses were not great enough to change the interpretation of data as previously discussed.

Table 9
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Inorganic Analysis of Water Collected From Final Equipment Rinses. Results are in mg/1 (ppm). Results in *Bold* are Concentrations Greater Than Detection Limits. Detection Limits are Given After the < Symbol

Sample ID Analyte/Boring	RINSE 10/02/90	RINSE 10/03/90	RINSE 10/04/90	RINSE 10/17/90	RINSE 10/19/90
Sb	<0.003U	**0.003B**	<0.003U	<0.003U	<0.003U
As	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U
Be	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U
Cd	<0.004U	<0.004U	<0.004U	<0.004U	<0.004U
Cr	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
Cu	<0.006U	<0.006U	<0.006U	<0.006U	<0.006U
Pb	**0.0031B**	**0.0053**	<0.003U	<0.003U	<0.003U
Hg	**0.0002**	**0.0005**	**0.0005**	<0.002U	<0.0002U
Ni	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
Se	<0.003U	<0.003U	<0.003U	<0.003U	<0.003U
Ag	<0.013U	<0.013U	<0.013U	<0.013U	<0.013U
Tl	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U
Zn	<0.008U	**0.0350**	**0.130**	**0.0370**	**0.0170**
Al	<0.038U	**0.2740**	<0.038U	**0.197B**	**0.172B**
Ba	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
Ca	<0.060U	**1.68B**	**0.187B**	**6.27**	**6.00**
Co	<0.030U	<0.030U	<0.030U	<0.030U	<0.030U
Fe	<0.010U	**0.081B**	**0.156**	**0.050B**	**0.027B**
Mg	<0.130U	**0.390B**	<0.130U	**1.31B**	**1.17B**
Mn	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
Na	**0.399B**	**0.792U**	**0.394**	**1.92B**	**1.91B**
TP	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U

Note:
U - Analyte was analyzed for but not detected
B - Reported value is less than the Contract Required Detection Limit (CRDL) but greater than the Instrument Detection Limit

Volatile organics (EPA Method 8240). The results of analyses of OBP soils for volatile organic compounds (EPA Method 8240 in *Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods SW-846*, Third Edition, November 1986 with December 1988 revisions) are given in Table 10. Methylene chloride and acetone were found in almost all soil samples taken, including the "control" borings and all associated method blanks (Table 11). These results indicate that methylene chloride and acetone are likely contaminants from the laboratory environment rather than processes associated with the field conditions. In addition to the above contaminants, boring 8 (sample 2) contained chloroform, another possible contaminant, which may have been derived from the initial washing with potable water. The following volatile organic compounds, with the exception of those considered to be laboratory contaminants, were found in the soil samples:

Volatile Organic	Boring/Sample
vinyl chloride	4/No. 2 (J)
cis-1,2-Dichloroethene	4/No. 2 and 6/No. 1
trichloroethene	6/No.1 (J) and 8/No. 1

The reported concentrations of vinyl chloride in boring 4, sample 2 and trichloroethene in boring 6, sample 1 were "J" values, detected by the analytical instrumentation but not in sufficient amounts to statistically quantify. Therefore, those concentrations are estimated. Soil from boring 8 (sample 2) contained 1,1,2,2-tetrachloroethane as did the method blank from boring 8 and the method blank from the deionized water. The concentration of this volatile in the test sample did not exceed the concentration in the method blank by a factor of 10. As this concentration is not greater than 10 times the concentration detected in the method blank it should be considered a negative result (i.e., not detected in the test sample) (*EPA/540/1-89/002, Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A, Interim Final, p. 5-16*). The only other volatile organic which was detected was cis-1,2-dichloroethene. Because this analytes was detected in only two of the samples, there is insufficient data to relate specific waste disposal activity to the occurrence of cis-1,2-dichloroethene.

Volatile organic compounds that were tentatively identified during the volatile organic soils analysis are provided in Table 12. Very few tentatively identified volatile organic compounds were detected, however, a release of these compounds may have occurred at the OBP.

Method blanks. Acetone and methylene chloride were reported in the method blanks for the volatile organic analyses (Table 11) and indicate a laboratory contamination source for these constituents. The method blank for the deionized water contained 1,1,2,2-tetrachloroethane. These method blank analysis results were considered in the interpretation of the volatile organic soils analyses.

Table 10
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of EPA Method 8240[1] (Volatile Organics) Soil Analyses. Concentrations are mg/kg (ppm) Dry Weight. Samples with Detectable Concentrations of Organic Analytes are Boxed. Analytes are Given as Abbreviations; see Appendix A for Full Compound Names

ANALYTE / SAMPLE	01#1	01#2	02#1	02#2	03#1	03#2	04#1	04#2	05#1	05#1DUP	06#1
ClMETH	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.012	< 0.011	< 0.011	< 0.011
BrMETH	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.012	< 0.011	< 0.011	< 0.011
VNLCL	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	0.0002 J	< 0.011	< 0.011	< 0.011
ClETHA	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.012	< 0.011	< 0.011	< 0.011
MECL	0.014 B	0.081 B	0.023 B	0.018 B	0.017 B	0.081 B	0.03 B	0.027 B	0.011 B	0.054 B	< 0.0057
11DClETE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
11DClETA	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
t-DClETE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
c-DClETE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	0.03	< 0.0055	< 0.0057	0.02
CHCL3	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
12DClETA	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
111TCA	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
CCL4	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
BrDClME	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
12DClPR	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
t13ClPRE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
TCE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	0.0043 J
DBrClME	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
c13ClPRE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
112TCA	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
BENZENE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
CHBr3	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
1122TClA	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
TEClETE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
TOLUENE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
ClBEN	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
ETBEN	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
ACETONE	0.16 B	0.034 BJ	0.16 B	0.27 B	0.17 B	1 B	0.05 BJ	0.002 BJ	0.09 BJ	0.022 BJ	0.0046 J
BUTANO	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.12	< 0.11	< 0.11	< 0.12
CS2	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
2HEXANO	< 0.053	< 0.057	< 0.057	< 0.057	< 0.056	< 0.055	< 0.055	< 0.059	< 0.055	< 0.057	< 0.057
4Me2PE	< 0.053	< 0.057	< 0.057	< 0.057	< 0.056	< 0.055	< 0.055	< 0.059	< 0.055	< 0.057	< 0.057
STYRENE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057
VNACETA	< 0.053	< 0.057	< 0.057	< 0.057	< 0.056	< 0.055	< 0.055	< 0.059	< 0.055	< 0.057	< 0.057
T-XYLENE	< 0.0053	< 0.0057	< 0.0057	< 0.0057	< 0.0056	< 0.0055	< 0.0055	< 0.0059	< 0.0055	< 0.0057	< 0.0057

Note: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.
J - Indicates an estimated value below the statistical quantitation limits.
< - Indicates compound was analyzed for but not detected. Detection limits are given after the < symbol.
B - Indicates analyte is found in the associated blank as well as in the sample.
1 - EPA Method 8240 -in TEST METHODS FOR EVALUATING ORGANIC AND INORGANIC WASTE, PHYSICAL/CHEMICAL METHODS, SW846, Third Edition, November 1986, with December 1988 revisions.

(Continued)

Table 10 (Concluded)

ANALYTE / SAMPLE	06#2	07#1	08#1	08#2	09#1
ClMETH	< 0.011	< 0.011	< 0.012	< 0.052	< 0.012
BrMETH	< 0.011	< 0.011	< 0.012	< 0.052	< 0.012
VNLCL	< 0.011	< 0.011	< 0.012	< 0.052	< 0.012
ClETHA	< 0.011	< 0.011	< 0.012	< 0.052	< 0.012
MECL	< 0.0054	0.036 B	0.02 B	0.3 B	0.029 B
11DClETE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
llDClETA	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
t-DClETE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
c-DClETE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
CHCL3	< 0.0054	< 0.0056	< 0.006	0.95	< 0.0058
12DClETA	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
111TCA	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
CCL4	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
BrDClME	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
12DClPR	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
t13ClPRE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
TCE	< 0.0054	< 0.0056	0.031	< 0.026	< 0.0058
DBrClME	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
c13ClPRE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
112TCA	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
BENZENE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
CHBr3	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
1122TClA	< 0.0054	< 0.0056	< 0.006	0.022 B	< 0.0058
TEClETE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
TOLUENE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
ClBEN	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
ETBEN	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
ACETONE	0.32	0.48 B	0.13 B	< 0.52	0.019 J
BUTANO	< 0.11	< 0.11	< 0.12	< 0.52	< 0.12
CS2	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
2HEXANO	< 0.054	< 0.056	< 0.06	< 0.26	< 0.058
4Me2PE	< 0.054	< 0.056	< 0.06	< 0.26	< 0.058
STYRENE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058
VNACETA	< 0.054	< 0.056	< 0.06	< 0.26	< 0.058
T-XYLENE	< 0.0054	< 0.0056	< 0.006	< 0.026	< 0.0058

Note: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.

J - Indicates an estimated value below the statistical quantitation limits.

< - Indicates compound was analyzed for but not detected. Detection limits are given after the < symbol.

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

1 - EPA Method 8240 -in TEST METHODS FOR EVALUATING ORGANIC AND INORGANIC WASTE, PHYSICAL/CHEMICAL METHODS, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 11
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Volatile Organic[1] Analyses of Method Blanks Associated with Soils Analyses. Concentrations are mg/kg (ppm) Dry Weight. Samples with Detectable Concentrations of Organic Analyte are Shown in *Bold*. Analytes are Given as Abbreviations; see Appendix A for Full Compound Names

Method Blanks	MB-1	MB-2	MB-3	MB-4	MB-5	MB-6	MB-7	MB-8	MB-9	MB-10
Analyte/Boring#	1	2,3	2,3	4,5,7	4,5,7	4,5,7	8	8	6,9	6,9
CLMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
BrMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
VNLCL	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
C1ETHA	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
MECL	**0.0008J**	**0.0008J**	**0.003J**	**0.0072**	**0.0092**	**0.0044J**	**0.003J**	**0.024**	**0.017**	<0.005U
11DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
11DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHCL3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
12DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
111tCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CCL4	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BrDC1ME	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
12DC1PR	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TCE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
DBrC1ME	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
112TCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BENZENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHBr3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
1122TC1A	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	**0.0012J**	<0.005U	<0.005U
TECLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TOLUENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
C1BEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ETBEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ACETONE	**0.012J**	**0.012J**	**0.0085J**	**0.017J**	**0.0042J**	**0.0056J**	**0.0085J**	**0.043J**	<0.10U	<0.10U
BUTANO	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U
CS2	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
2 HEXANO	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
4 Me2PE	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
STYRENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
VNACETA	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
T-Xylene	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U

Note: See Page 2 for Table Notes.

(Continued)

Table 11 (Concluded)

Note:

MB - Method Blank for the borings indicated.

J - Indicates an estimated value below the statistical quantification limits

U - Indicates compound was analyzed for but not detected. Detection limits are given after the < symbol.

1 - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 12
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Volatile Organic Compounds[1] Tentatively Identified From Soil Samples. Estimated Concentrations are mg/kg (ppm) Dry Weight

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
1#1 (7674)	methylcyclopentane	6.54	96377	18.0
1#2 (7675)	methylcyclopentane	6.54	96377	20.0
3#1 (7695)	unknown	5.49		13.0
3#2 (7696)	4-methyl-1-pentene	6.68	691372	7.4
5#1dup. (7913)	unknown	7.36		29.0
	beta-pinene	18.78	127913	36.0
8#1 (7809)	3-methylpentane	5.70	96140	58.0

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers
Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.
1 - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Equipment rinse. Acetone and methylene chloride were reported in most of the sampling equipment rinses (Table 13). As acetone and methylene chloride were detected in the method blanks associated with the analyses of these rinses, these constituents are believed to be laboratory contaminants. Chloroform was detected in four equipment rinses (rinses for borings 2, 4, 7, and 8). This volatile organic compound may have been derived from the initial washing with potable water. Chloroform was detected in only one of the OBP soils samples.

In addition to chloroform, other volatile organics were found in equipment rinses but at concentrations which were below statistical quantification limits ("J" values). The volatile organic, 2-butanone, was found in three equipment rinses (rinses for borings 2, 4, 7, 8, and in the deionized water). This volatile organic was not detected in any of the soil samples, therefore, cross contamination of soil samples with 2-butanone was not a problem. Bromodichloromethane was reported from the one equipment rinse for boring 4 and the tank water sample and 2-hexanone was reported from the equipment rinses for borings 4 and 7. The volatile organic 1,1,2,2- tetrachloroethane was detected

Table 13
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Volatile Organics Analyses of Method Blanks, Trip Blanks, and Equipment Rinses Associated with Soil Analyses. Concentrations are mg/1 (ppm). Samples with Detectable Concentrations of Organic Analyte are Shown in *Bold*. Analytes are Given as Abbreviations; see Appendix A for Full Compound Names

Sample ID	R#2	TB-2,3	MB-1	R#4	R#7	TB-5,7	MB-2	MB-3	R#8	TB-8	MB-4	MB-5
Analyte/Boring	2	2,3	2	4	7	5,7	4,5,7	4,5,7	8	8	8	8
CLMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
BrMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
VNLCL	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
C1ETHA	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
MECL	<0.005U	<0.005U	**0.0052**	<0.005U	**0.0032BJ**	**0.0061B**	**0.030**	**0.002J**	**0.0053B**	**0.0020BJ**	**0.0052**	**0.0037J**
11DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
11DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHCL3	**0.0036J**	<0.005U	<0.005U	**0.012**	**0.017**	<0.005U	<0.005U	<0.005U	**0.0045J**	<0.005U	<0.005U	<0.005U
12DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
111tCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CCL4	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BrDC1ME	<0.005U	<0.005U	<0.005U	**0.0018J**	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
12DC1PR	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TCE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
DBrC1ME	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
112TCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	**0.0006J**
BENZENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHBr3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
1122TC1A	<0.005U	<0.005U	**0.0022J**	<0.005U	<0.005U	<0.005U	<0.005U	**0.0011J**	<0.005U	<0.005U	<0.005U	<0.005U
TECLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TOLUENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
C1BEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ETBEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ACETONE	**0.011J**	<0.10U	<0.10U	**0.070BJ**	**0.024BJ**	**0.023BJ**	**0.011J**	**0.019J**	**0.013J**	**0.012J**	<0.10U	<0.10U
BUTANO	**0.018J**	<0.10U	<0.10U	**0.061J**	**0.030J**	<0.10U	<0.10U	<0.10U	**0.023J**	<0.10U	<0.10U	<0.10U
CS2	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
2 HEXANO	<0.050U	<0.050U	<0.050U	**0.0093BJ**	**0.0062BJ**	<0.050U	**0.0019J**	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
4 Me2PE	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
STYRENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
VNACETA	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
T-Xylene	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U

Note: See Page 3 for Table Notes.

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Table 13 (Continued)

Sample ID	TB-6,9	MB-6,9	Deion. H20	H20 FROM TANK	TB-H20	MB-H20
Analyte/Boring	6,9	6,9			1	
CLMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
BrMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
VNLCL	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
C1ETHA	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
MECL	0.0028BJ	0.011	<0.005U	<0.005U	0.0011BJ	0.0052
11DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
11DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHCL3	<0.005U	<0.005U	0.013	0.063	<0.005U	<0.005U
12DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
111tCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CCL4	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BrDC1ME	<0.005U	<0.005U	<0.005U	0.0018J	<0.005U	<0.005U
12DC1PR	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TCE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
DBrC1ME	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
112TCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BENZENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHBr3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
1122TC1A	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.0022J
TECLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TOLUENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
C1BEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ETBEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ACETONE	0.0059BJ	0.0041J	0.013J	<0.10U	<0.10U	<0.10U
BUTANO	<0.10U	<0.10U	0.018J	<0.10U	<0.10U	<0.10U
CS2	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
2 HEXANO	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
4 Me2PE	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
STYRENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
VNACETA	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
T-Xylene	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U

Note: See Page 3 for Table Notes.

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Table 13 (Concluded)

Notes for Table 5 .

J - Indicates an estimated value below the statistical quantification limits
U - Indicates compound was analyzed for but not detected. Detection limits are given after the < symbol.
* - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Rinse, Method Blank, and Trip Blank Identifications are as follows:

R#2 - Rinse water collected following final decontamination rinse after sampling Boring #2.
TB-2,3 - Trip Blank transported to the lab in a cooler containing samples from Borings #2 and #3 (collected on 10/04/90)
MB-1 - Method Blank associated with the analysis of Boring #2 equipment rinse.
R#4 - Rinse water collected following final decontamination rinse after sampling Boring #4.
R#7 - Rinse water collected following final decontamination rinse after sampling Boring #7.
TB-5,7 - Trip blank transported to the lab in a cooler containing the samples from Borings #5 and #7 (collected on 10/22/90).
MB-2 and MB-3 - Method Blanks associated with the analysis of the equipment rinse from Borings #4 and #7 and the Trip Blank for Borings #5 and #7 (2 method blanks as indicated above).
R#8 - Rinse water collected following final decontamination rinse after sampling Boring #8.
TB-8 - Trip Blank transported to the lab in a cooler containing samples from Boring #8 (collected on 10/05/90).
MB-4 and MB-5 - Method Blanks associated with the analysis of the equipment rinse from Boring #8 (2 method blanks as indicated above).
TB-6,9 - Trip Blank transported to the lab in a cooler containing samples from Borings #6 and #9 (collected on 10/17/90).
MB-6,9 - Method Blank associated with the analysis of the equipment rinse from Borings #6 and #9.
TB-H2O - Trip Blank transported to the lab in a cooler containing samples from samples from Boring #1, deionized water and the water from the tank (collected on 10/03/90).
MB-H2O - Method Blank associated with the analysis of the deionized water, the water from the tank and TB-H2O (Trip Blank).

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in the method blank for the deionized water. The soil samples tested and reported in Table 10 contained no bromodichloromethane or 2-hexanone, and only boring 8 (sample 2) contained 1,1,2,2-tetrachloroethane, thus, sample cross contamination with this compound as a result of sampling equipment did not occur.

Method blanks analyzed in association with equipment rinses were reported to contain 2-hexanone (method blanks for borings 4, 5 and 7), 1,1,2,2-tetrachloroethane (method blanks for boring 2, borings 4, 5, and 7), and 1,1,2-trichloroethane (method blank for boring 8).

The volatile organic compounds found in the rinses may have been derived from the initial washings with potable water and subsequent washings with methanol and hexane. These equipment rinse results were considered in the interpretation of volatile organic soils analyses.

Semivolatile Organics (EPA Method 8270). The results of analyses of OBP soils for semivolatile organic compounds (EPA Method 8270 in *Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods SW846*, Third Edition, November 1986 with December 1988 revisions) are given in Table 14. Diethylphthalate was detected in soil samples from borings 4, 5, 6, and 9 and in the method blank associated with borings 6 and 9. Bis(2-ethylhexyl)phthalate was detected in borings 4, 5, 6, 7, 8 and 9 and the method blanks for two and three dibutylphthalate was found in borings 5, 6, 7, and 9 and in the method blanks associated with borings 2, 3, 4, 5, and 7. Because these compounds were found in the method blanks as well as the samples, it is likely that they are contaminants from the laboratory environment rather than processes associated with the waste disposal activities. The method blank for borings 2 and 3 contained di-N- octylphthalate, however, this compound was not detected in any control or test samples.

Soil samples from borings 5, 6, 8, and 9 contained semivolatile organic compounds (Table 14), however, with the exception of flouranthene (7.8 mg/kg) and pyrene (12.0 mg/kg) in boring 8 (sample 2), all other semivolatile organic compounds were found in concentrations that were below the statistical quantitation limits ("J" values). Soil samples from boring 5 contained only five semivolatile organic analytes (other than those considered to be lab contaminants), whereas, soil samples from borings 6, 8, and 9 were very similar in terms of the suite of semivolatile organic compounds found at those sites and different from soils from other borings (Table 15).

Table 16 provides a list of tentatively identified semivolatile organic compounds detected in OBP soil samples. A release of tentatively identified semivolatile organic compounds may have occurred at the OBP.

In summary, a release of semivolatile organic compounds produced by waste disposal activities at the OBP is evident. Borings 5, 6, 8, and 9 produced soils with semivolatile organic analytes. The most frequent type of semivolatile organic compound present was polycyclic aromatic hydrocarbons (PAHs). With the exception of concentrations of fluoranthene and pyrene in boring 8 (sample 2) the compounds were found in concentrations that were

Table 14
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of EPA Method 8270[1] (Semivolatile Organics) Soil Analyses. Concentrations are mg/kg (ppm) Dry Weight. Samples with Detectable Concentrations of Organic Analyte are Shown Boxed. Analytes are Given as Abbreviations; see Appendix A for Full Compound Names

ANALYTE / SAMPLE	01#1	01#2	02#1	02#2	03#1	03#2	04#1	04#2	05#1	05#1DUP	05#2
PHENOL	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
2ClPHEN	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
2NIPHE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
24DMePHE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
24DClPHE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
4Cl3MePH	< 1.4	< 1.4	< 1.4	< 1.5	< 1.4	< 1.5	< 1.5	< 3.2	< 3	< 1.5	< 3
246TClPH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
24DNPH	< 3.5	< 3.6	< 3.4	< 3.6	< 3.6	< 3.6	< 3.8	< 8	< 7.5	< 3.8	< 4.5
4NPHE	< 3.5	< 3.6	< 3.4	< 3.6	< 3.6	< 3.6	< 3.8	< 8	< 7.5	< 3.8	< 4.5
2M46DNPH	< 3.5	< 3.6	< 3.4	< 3.6	< 3.6	< 3.6	< 3.8	< 8	< 7.5	< 3.8	< 4.5
PClPHE	< 3.5	< 3.6	< 3.4	< 3.6	< 3.6	< 3.6	< 3.8	< 8	< 7.5	< 3.8	< 4.5
BENZOAC	< 3.5	< 3.6	< 3.4	< 3.6	< 3.6	< 3.6	< 3.8	< 8	< 7.5	< 3.8	< 4.5
2MEPHE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
4MEPHE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
245TClPH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
BZLAL	< 1.4	< 1.4	< 1.4	< 1.5	< 1.4	< 1.5	< 0.77	< 3.2	< 3	< 1.5	< 3
NNDMeAM	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
BClIPrE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
NNDNPAM	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
NITROBEN	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
ISOPHOR	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
BClEtoME	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
26DNTOL	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
24DNTOL	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
12DPHYD	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 3.8	< 1.6	< 1.5	< 0.76	< 1.5
BENZIDI	< 3.5	< 3.6	< 3.4	< 3.6	< 3.6	< 3.6	< 1.5	< 8	< 7.5	< 3.8	< 7.5
33DClBEZ	< 1.4	< 1.4	< 1.4	< 1.5	< 1.4	< 1.5	< 0.77	< 3.2	< 3	< 1.5	< 3
BClEtE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
13DClB	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
14DClB	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
12DClB	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
HClETA	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
124TClB	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5

Note: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.
J - Estimated value below the statistical limits.
< - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
B - Analyte is found in the associated blank as well as in the sample.
1 - EPA Method 8270 -in TEST METHODS FOR EVALUATING ORGANIC AND INORGANIC WASTE, PHYSICAL/CHEMICAL METHODS, SW846, Third Edition, November 1986, with December 1988 revisions.

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Table 14 (Continued)

ANALYTE / SAMPLE	01#1	01#2	02#1	02#2	03#1	03#2	04#1	04#2	05#1	05#1DUP	05#2
NAPHTH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.071	< 0.73	< 0.77	< 1.6	< 1.5	0.043 J	0.096 J
HClBU	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
HClCYPD	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
2ClNAPH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
ACENAY	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
DMePHTH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
ACENAP	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
FLUORE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
DEtPHTH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	0.089 BJ	0.12 BJ	0.1 J	0.073 J	< 1.5
4ClPHPHE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
NNDPHAM	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
4BrPHET	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
HClBEN	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
PHENAN	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	0.098 J
ANTRAC	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
DBuPHTH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	0.064 BJ
FLANTHE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	0.046 J
PYRENE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	0.057 J
BuBePHTH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
CHRYSE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
BAANTHR	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
B2EHPH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	0.087 BJ	< 1.6	< 1.5	0.043 J	2.3
DNOcPHT	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
BBFLANT	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
BKFLANT	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
BAPYRE	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
1123PYR	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
DBAHANT	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
B-GHI-PY	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
ANILINE	< 1.4	< 1.4	< 1.4	< 1.5	< 1.4	< 1.5	< 1.5	< 3.2	< 3	< 1.5	< 3
4ClANIL	< 1.4	< 1.4	< 1.4	< 1.5	< 1.4	< 1.5	< 1.5	< 3.2	< 3	< 1.5	< 3
DBENZOFU	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	< 1.5
2MeNAPH	< 0.7	< 0.72	< 0.69	< 0.73	< 0.71	< 0.73	< 0.77	< 1.6	< 1.5	< 0.76	0.074 J
2NANIL	< 3.5	< 3.5	< 3.4	< 3.6	< 3.6	< 3.6	< 3.8	< 8	< 7.5	< 3.8	< 7.5
3NANIL	< 3.5	< 3.5	< 3.4	< 3.6	< 3.6	< 3.6	< 3.8	< 8	< 7.5	< 3.8	< 7.5
4NANIL	< 3.5	< 3.5	< 3.4	< 3.6	< 3.6	< 3.6	< 3.8	< 8	< 7.5	< 3.8	< 7.5

Note: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and5. 2.
J - Estimated value below the statistical limits.
< - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
B - Analyte is found in the associated blank as well as in the sample.
1 - EPA Method 8270 - in TEST METHODS FOR EVALUATING ORGANIC AND INORGANIC WASTE, PHYSICAL/CHEMICAL METHODS, SW846, Third Edition, November 1986, with December 1988 revisions.

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Table 14 (Continued)

ANALYTE / SAMPLE	06#1	06#2	07#1	08#1	08#2	09#1
PHENOL	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
2ClPHEN	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
2NIPHE	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
24DMePHE	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
24DClPHE	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
4Cl3MePH	< 1.5	< 3	< 1.6	< 16	< 16	< 4.6
246TClPH	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
24DNPH	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12
4NPHE	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12
2M46DNPH	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12
PClPHE	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12
BENZOAC	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12
2MEPHE	< 0.76	0.12 J	< 0.78	< 8.1	< 7.8	< 2.3
4MEPHE	< 0.76	0.33 J	< 0.78	< 8.1	< 7.8	< 2.3
245TClPH	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
BZLAL	< 1.5	< 3	< 1.6	< 16	< 16	< 4.6
NNDMeAM	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
BClIPrE	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
NNDNPAM	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
NITROBEN	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
ISOPHOR	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
BClEtoME	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
26DNTOL	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
24DNTOL	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
12DPHYD	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
BENZIDI	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12
33DClBEZ	< 1.5	< 3	< 1.6	< 16	< 16	< 4.6
BClEtE	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
13DClB	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
14DClB	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
12DClB	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
HClETA	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
124TClB	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3

Note: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.
J - Estimated value below the statistical limits.
< - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
B - Analyte is found in the associated blank as well as in the sample.
1 - EPA Method 8270 -in TEST METHODS FOR EVALUATING ORGANIC AND INORGANIC WASTE, PHYSICAL/CHEMICAL METHODS, SW846, Third Edition, November 1986, with December 1988 revisions.

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Table 14 (Concluded)

ANALYTE / SAMPLE	06#1	06#2	07#1	08#1	08#2	09#1
NAPHTH	0.14 J	0.49 J	< 0.78	0.29 J	0.94 J	0.14 J
HClBU	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
HClCYPD	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
2ClNAPH	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
ACENAY	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
DMePHTH	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
ACENAP	< 0.76	0.053 J	< 0.78	0.19 J	0.63 J	< 2.3
FLUORE	< 0.76	0.061 J	< 0.78	0.18 J	0.87 J	< 2.3
DEtPHTH	0.08 BJ	0.15 BJ	< 0.78	< 8.1	< 7.8	0.21 BJ
4ClPHPHE	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
NNDPHAM	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
4BrPHET	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
HClBEN	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
PHENAN	0.16 J	0.34 J	< 0.78	2.7 J	7.4 J	0.37 J
ANTRAC	< 0.76	0.095 J	< 0.78	0.48 J	1.5 J	< 2.3
DBuPHTH	0.04 J	0.34 J	0.05 BJ	< 8.1	< 7.8	0.2 J
FLANTHE	0.11 J	0.18 J	< 0.78	5.1 J	7.8	0.42 J
PYRENE	0.098 J	0.37 J	< 0.78	7.4 J	12	0.69 J
BuBePHTH	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
CHRYSE	0.093 J	0.14 J	< 0.78	3.9 J	6.1 J	0.47 J
BAANTHR	0.048 J	0.091 J	< 0.78	2.7 J	4.4 J	0.25 J
B2EHPH	0.6 J	1.9 J	0.074 BJ	0.94 BJ	2.1 BJ	0.8 J
DNOcPHT	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
BBFLANT	0.046 J	0.044 J	< 0.78	3.5 J	5 J	0.24 J
BKFLANT	0.042 J	0.038 J	< 0.78	1.9 J	2.6 J	0.2 J
BAPYRE	0.043 J	0.039 J	< 0.78	2.3 J	3.5 J	0.25 J
I123PYR	< 0.76	< 1.5	< 0.78	1.4 J	1.6 J	0.11 J
DBAHANT	< 0.76	< 1.5	< 0.78	< 8.1	< 7.8	< 2.3
B-GHI-PY	< 0.76	< 1.5	< 0.78	1.2 J	1.6 J	0.33 J
ANILINE	< 1.5	< 3	< 1.6	< 16	< 16	< 4.6
4ClANIL	< 1.5	< 3	< 1.6	< 8.1	< 7.8	< 4.6
DBENZOFU	0.039 J	0.053 J	< 0.78	0.13 J	0.52 J	< 2.3
2MeNAPH	0.052 J	0.32 J	< 0.78	0.36 J	0.32 J	0.16 J
2NANIL	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12
3NANIL	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12
4NANIL	< 3.8	< 7.5	< 3.9	< 40	< 39	< 12

Note: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.

J - Estimated value below the statistical limits.

< - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

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

1 - EPA Method 8270 -in TEST METHODS FOR EVALUATING ORGANIC AND INORGANIC WASTE, PHYSICAL/CHEMICAL METHODS, SW846, Third Edition, November 1986, with December 1988 revisions.

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Table 15
Old Burn Ground - NWSCC, Indiana, SWMU 05/03. Summary of Semivolatile Organic Analytes (EPA Method 8270 Compounds) Found in Soil Analyses. Semivolatile Analytes also Found in Method Blanks are not Included. A (J) is Indicated After the Compound Name Where the Analytes was Detected at Concentrations Below the Statistical Quantitation Limits

Boring 5	Boring 6	Boring 8	Boring 9
Naphthalene (J)	2-Methylphenol (J)	Naphthalene (J)	Naphthalene (J)
Phenanthrene (J)	4-Methylphenol (J)	Acenaphthene (J)	Phenanthrene (J)
Fluoranthene (J)	Naphthalene (J)	Fluorene (J)	Fluoranthene (J)
Pyrene (J)	Acenaphthene (J)	Phenanthrene (J)	Pyrene (J)
2-Methylnaphthalene (J)	Fluorene (J)	Anthracene (J)	Chrysene (J)
	Phenanthrene (J)	Fluoranthene (J)	Benzo(a)Anthracene (J)
	Anthracene (J)	Pyrene (J)	Benzo(b)Fluoranthene (J)
	Dibutylphthalate (J)	Chrysene (J)	Benzo(k)Fluoranthene (J)
	Fluoranthene (J)	Benzo(a)Anthracene (J)	Benzo(a)Pyrene (J)
	Pyrene (J)	Benzo(b)Fluoranthene (J)	Indeno (1,2,3-C,D)Pyrene (J)
	Benzo(a)Anthracene (J)	Benzo(k)Fluoranthene (J)	Benzo(G,H,I)Perylene (J)
	Benzo(b)Fluoranthene (J)	Benzo(a)Pyrene (J)	2-Methylnaphthalene (J)
	Benzo(k)Fluoranthene (J)	Indeno (1,2,3-C,D)Pyrene (J)	
	Benzo(a)Pyrene (J)	Benzo(G,H,I)Perylene (J)	
	Dibenzofuran (J)	Dibenzofuran (J)	
	2-Methylnaphthalene (J)	2-Methylnaphthalene (J)	

Table 16
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Semivolatile Organic Compounds[1] Tentatively Identified From Soil Samples. Estimated Concentrations are mg/kg (ppm) Dry Weight

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
1#1 (7670)	unknown	5.16		23,000
	2,5-dimethyl-1,5-heptadiene-3,4-dial	6.94	22607165	2,200
	1-(3-ethyloxiranyl)ethanone	7.60	17257817	5,300
	unknown	7.88		5,500
	unknown	8.27		14,000
	ethenylester, cyclohexane carboxylic acid	8.79	4840760	1,500
1#2 (7671)	unknown	5.10		26,000
	2,5-dimethyl-1,5-heptadiene-3,4-dial	6.97	22607165	3,100
	1-(3-ethyloxiranyl)ethanone	7.62	17257817	7,100
	unknown	7.93		8,200
	ethenylester, cyclohexane carboxylic acid	8.26	4840760	16,000
	unknown	8.79		2,200
	dicyclohexylpropanedinitrate	8.87	74764286	920
2#1 (7685)	unknown	5.08		26,000
	2,5-dimethyl-1,5-heptadiene-3,4-dial	6.93	22607165	3,200
	1-(3-ethyloxiranyl)ethanone	7.58	17257817	7,600
	1-(3-ethyloxiranyl)ethanone	7.90	17257806	9,100
	cyclohexanecarboxylic acid etheryl ester	8.24	4840760	17,000
	dicyclohexylpropanedinitrate	8.76	74764286	2,300
	4-methyl-4H-1,2,4-triazole	8.85	10570408	1,000
2#2 (7686)	unknown	4.92		25,000
	2,5-dimethyl-1,5-heptadiene-3,4-dial	6.78	22607165	1,700
	1-(3-ethyloxiranyl)ethanone	7.40	17257817	3,600
	2,3,3,4-tetramethylpentane	7.68	16747389	4,800
	dicyclohexylpropanedinitrite	8.01	74764286	8,900
	2,3,4,5-tetrahydropyridine	8.58	505180	860
3#1 (7687)	unknown	5.05	22607165	17,000
	2,5-dimethyl-1,5-heptadiene-3,4-dial	6.92	22607165	1,800
	4,4-dimethoxy-2-butanone	7.49	5436215	1,800
	unknown	7.87		4,200
	unknown	8.26		1,100
	4-methyl-4H-1,2,4-triazole	8.77	10570408	1,500

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers
Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.
[1] - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

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Table 16 (Continued)

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)	
3#2	unknown	4.86		28,000	
(7688)	(2,5-dimethyl-1,5-heptadiene-3,4-dial	6.79	22607165	2,700	
	1-(3-ethyloxiranyl)ethanone	7.39	17257817	6,000	
	2,3,3,4-tetramethylpentane	7.69	16747389	7,500	
	dicyclohexylpropanedinitrite	8.01	74764286	7,500	
	cyclohexanecarboxylic acid ethenyl	8.58	4840760	14,000	
4#1	unknown	4.73		24,000	
(7898)	ethylester thiocyanic acid	6.32	542905	1,400	
	1-(3-ethyloxiranyl)ethanone	7.15	17257817	1,200	
	1-(3-ethyloxiranyl)ethanone	7.43	17257817	1,800	
	dicyclohexylpropanedinitrate	7.71	74764286	2,300	
	unknown	9.77		4,200	
4#2	unknown	4.81		31,000	
(7899)	1,1-dimethoxy-2-butene	7.17	21962243	1,000	
	ethyl hexyl ispropyl	7.43	18636652	1,300	
	4-methyl-4H,1,2,4-triazole	7.72	10570408	2,100	
5#1	unknown	4.79		26,000	
(7900)	ethylester thiocyanic acid	6.34	542905		870
	1,1-dimethoxy-2-butene	7.17	21962243	1,100	
	hexyl isopropyl ether	7.42	18636652	1,400	
	3-hexen-2-one	7.71	763939	2,500	
5#1dup.	unknown	4.80		27,000	
(7901)	ethylester thiocyanic acid	6.44	542905	1,100	
	2,5-dimethyl-1,5-heptadiene 3,4-dial	6.62	22607165	2,200	
	1,1-dimethoxy-2-butene	7.212	1962243	3,100	
	hexyl isopropyl ether	7.49	18636652	3,900	
	3-hexen-2-one	7.80	763939	5,800	
	unknown	9.75		1,200	
5#2	unknown	4.88		28,000	
6#1	unknown	4.74		24,000	
(7879)	1-(3-ethyloxiranyl)ethanone	7.43	17257817	1,100	
	2-methyl-2-octen-4-one	7.72	19860710	1,100	
	unknown	9.77		3,700	

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers
Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.
1 - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

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Table 16 (Concluded)

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
6#2	unknown	4.70		15,000
(7880)	unknown	9.75		2,200
	sulfur, mol.	30.95	10544500	5,900
	3,8-dihydro-1,2,3,3,8,8-hexamethyl-cyclopent(a)indene	31.90	17384724	2,300
	tetratetracontane	36.26	7048228	1,700
	tetracosane	37.66	646311	1,500
7#1	unknown	5.00		27,000
	ethylester, thiocyanic acid	6.50	542905	1,100
	1-(3-ethyloxiranyl) ethanone	7.57	17257817	1,100
	3-hexen-2-one	7.86	763939	1,800
8#1	unknown	4.83		170,000
(7721)				
8#2	unknown	4.79		61,000
(7722)				
9#1				
(7878)	unknown	4.76		16,000
	unknown	9.78		3,800

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers
Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.
1 - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

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detected by the analytical instrumentation but not in sufficient amounts to statistically quantify ("J" values). The highest concentrations of flouranthene and pyrene reported for boring 8 were 7.80 mg/kg and 12.0 mg/kg, respectively.

Method blanks. As discussed previously, method blanks analyzed for semivolatile organic compounds contained several phthalates including diethyl phthalate, dibutyphthalate, bis(2-ethylhexyl) phthalate, and di-N- octylphthalate at estimated concentrations below the instrument detection limits ("J" values) (Table 17). These method blank analysis results were considered in the interpretation of the semivolatile organic soils analyses.

Equipment rinses. Equipment rinses were collected following the taking of soil samples at borings 2, 4, 7, and 8 and were analyzed for semivolatile organic analytes. Deionized water and the tank water were also analyzed for semivolatile organic analytes. The rinses analyzed contained at least two of four phthalates including diethyl phthalate, dibutylphthalate, bis(2-ethylhexyl) phthalate, and di-N- octylphthalate and the rinses associated with borings 4 and 7 contained the compound 1,4-dichlorobenzene (Table 18). The deionized water and water from the tank also contained diethyl phthalate. Because the phthalates and 1,4-dichlorobenzene were also found in the method blanks analyzed with the rinses, the deionized water or the tank water, they are likely the result of a laboratory contamination and not the result of actual occurrence of those materials in the equipment rinses.

The results of analyses of equipment rinses for semivolatile organic compounds 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 OBP soils for semivolatile organic compounds.

Pesticides, Herbicides, and PCBs. The results of analyses of OBP soils for selected pesticide, herbicide, and PCB compounds are given in Table 19. The pesticides and herbicides found in the tested soils and not in associated method blanks are summarized in Table 20. Pesticides and herbicides were found in soils from borings 4, 5, 7, and 9 as well as in the control borings 1, 2, and 3. With the exception of concentrations of dieldrin in soils from borings 2 and 4, PPDDT in the soils from boring 4, PPDDE in boring 5, and A-endosulfan in the soils from boring 9, the other pesticides and herbicides were found in concentrations that were detected by the analytical instrumentation but not in sufficient amounts to statistically quantify. The maximum concentrations of dieldrin were 0.014 mg/kg and 0.0015 mg/kg for borings 2 and 4, respectively, the maximum concentration of PPDDT was 0.013 mg/kg (boring 4), and the maximum concentration of PPDDE was 0.017 mg/kg (boring 5). The maximum concentration of A-endosulfan was 0.014 mg/kg (boring 9). No PCBs were detected in any of the OBP soils. Based on the soil analyses performed, releases of pesticides and herbicides have occurred in the OBP area. However, it cannot be determined from available information if the pesticide and herbicide residues detected area the result of recent or past waste disposal activities or insect and vegetation control activities by NSWCC or others.

Table 17
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of EPA Method 8270[1] (Semivolatile Organics) Analyses of Method Blanks. Concentrations are mg/kg (ppm) Dry Weight. Samples with Detectable Concentrations of Analyte are Shown in *Bold*. Analytes are Given as Abbreviations; see Appendix A for Compound Names

Method blank	MB1	MB2	MB3	MB4	MB5	MB6	MB7
ANALYTE/Boring	1	2,3	2,3	4,5,7	4,5,7	8	6,9
PHENOL	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
2C1PHEN	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
2NIPHE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
24DMePHE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
24DC1PHE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
4C13MePHE	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U
246TC1PH	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
24DNPH	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U
4NPHE	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U
2M46DNPH	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U
PC1PHE	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U
BENZOAC	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U
2MEPHE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
4MEPHE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
245TC1PH	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
BZLAL	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U
NNDMEAM	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
BC1IPRE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
NNDNPAM	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
NITROBEN	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
ISOPHOR	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
BC1EtoME	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U

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Table 17 (Continued)

Method blank	MB1	MB2	MB3	MB4	MB5	MB6	MB7
ANALYTE/Boring	1	2,3	2,3	4,5,7	4,5,7	8	6,9
BENZIDI	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U
33DC1BEZ	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U
BC1ETE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
13DC1B	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
14DC1B	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
12DC1B	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
HC1ETA	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
124TC1B	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
NAPHTH	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
HC1Bu	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U

Note: See Page 4 for Table Notes.

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Table 17 (Continued)

Method blank	MB1	MB2	MB3	MB4	MB5	MB6	MB7
ANALYTE/Boring	1	2,3	2,3	4,5,7	4,5,7	8	6,9
HC1CYPD	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
2C1NAPH	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
ACENAY	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
DMePHTH	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
ACENAP	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
FLUORE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
DEtPHTH	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	**0.15J**
4C1PHPHE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
NNDPHAM	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
4BrPHET	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
HCLBEN	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
PHENAN	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
ANTRAC	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
DBuPHTH	<0.67U	**0.10J**	<0.67U	<0.67U	**0.028J**	<0.67U	<0.67U
FLANTHE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
PYRENE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
BuBePHTH	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
CHRYSE	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
BAANTHR	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
B2EHPH	<0.67U	**0.50J**	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
DNOcPHT	<0.67U	**0.60J**	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
BBFLANT	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U

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Table 17 (Concluded)

Method blank	MB1	MB2	MB3	MB4	MB5	MB6	MB7
ANALYTE/Boring	1	2,3	2,3	4,5,7	4,5,7	8	6,9
DBAHANT	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
B-GHI-PYR	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
ANILINE	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U
4CLANIL	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U	<1.30U
DBENZOFU	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
2MeNAPH	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U	<0.67U
2NANIL	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U
3NANIL	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U
4NANIL	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U	<3.30U

Note: MB - Method Blank for the borings indicated.
J - Estimated value below the statistical quantitation limits
U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
1 - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

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Table 18
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Semivolatile Organic) Analyses of Sampling Equipment Rinses and Associated Method Banks. Concentrations are mg/1 (ppm). Samples with Detectable Concentrations of Organic Analyte are Shown in Bold. Analytes are Given as Abbreviations; see Appendix A for Full Compound Names

Analyte/ID	R-2	MB/R-2	R-4	R-7	MB/R-4,7	R-8	MB/R-8	DI-H2O	TANK	MB/H2O/TANK
PHENOL	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
2C1PHENOL	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
2NIPHE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
24DMePHE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
24DC1PHE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
4C13MePHE	<0.042U	<0.020U	<0.020U	<0.020U	<0.020U	<0.042U	<0.020U	<0.040U	<0.046U	<0.020U
246TC1PH	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
24DNPH	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.10U	<0.050U	<0.10U	<0.12U	<0.050U
4NPHE	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.10U	<0.050U	<0.10U	<0.12U	<0.050U
2M46DNPH	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.10U	<0.050U	<0.10U	<0.12U	<0.050U
PC1PHE	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.10U	<0.050U	<0.10U	<0.12U	<0.050U
BENZOAC	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.10U	<0.050U	<0.10U	<0.12U	<0.050U
2MEPHE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
4MEPHE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
245TC1PH	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
BZLAL	<0.042U	<0.020U	<0.020U	<0.020U	<0.020U	<0.042U	<0.020U	<0.040U	<0.046U	<0.020U
NNDMEAM	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
BC1IPRE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
NNDNPAM	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
NITROBEN	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
ISOPHOR	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
BC1EtoME	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
26DNTOL	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U

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Table 18 (Continued)

Analyte/ID	R-2	MB/R-2	R-4	R-7	MB/R-4,7	R-8	MB/R-8	DI-H2O	TANK	MB/H2O/TANK
BENZIDI	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.10U	<0.050U	<0.10U	<0.12U	<0.050U
33DC1BEZ	<0.042U	<0.020U	<0.020U	<0.020U	<0.020U	<0.042U	<0.020U	<0.040U	<0.046U	<0.020U
BC1ETE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
13DC1B	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.040U	<0.023U	<0.010U
14DC1B	<0.021U	<0.010U	**0.001BJ**	**0.001BJ**	**0.001J**	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
12DC1B	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
HC1ETA	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
124TCLB	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
NAPHTH	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U

Note: See Page 4 for Table Notes.

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Table 18 (Continued)

Analyte/ID	R-2	MB/R-2	R-4	R-7	MB/R-4,7	R-8	MB/R-8	DI/H2O	TANK	MB/H2O/TANK
HC1Bu	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
HC1CYPD	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
2C1NAPH	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
ACENAY	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
DMePHTH	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
ACENAP	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
FLUORE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
DEtPHTH	**0.002BJ**	**0.002J**	**0.002BJ**	**0.001BJ**	**0.002J**	**0.002BJ**	**0.002J**	**0.003BJ**	**0.002BJ**	**0.002J**
4C1PHPHE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
NNDPHAM	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
4BrPHET	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
HCLBEN	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
PHENAN	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
ANTRAC	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
DBuPHTH	<0.021U	<0.010U	<0.010U	**0.001BJ**	**0.001J**	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
FLANTHE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
PYRENE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
BuBePHTH	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
CHRYSE	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
BAANTHR	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
B2EHPH	<0.021U	**0.001J**	**0.001BJ**	**0.001BJ**	**0.002J**	**0.003BJ**	**0.001J**	<0.020U	<0.023U	**0.001J**
DNOcPHT	**0.005J**	<0.010U	**0.001BJ**	**0.002BJ**	**0.001J**	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
BBFLANT	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U

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Table 18 (Concluded)

Analyte/ID	R-2	MB/R-2	R-4	R-7	MB/R-4,7	R-8	MB/R-8	DI/H2O	TANK	MB/H2O/TANK
I123PYR	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
DBAHANT	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
B-GHI-PYR	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
ANILINE	<0.042U	<0.020U	<0.020U	<0.020U	<0.020U	<0.042U	<0.020U	<0.040U	<0.046U	<0.020U
4CLANIL	<0.042U	<0.020U	<0.020U	<0.020U	<0.020U	<0.042U	<0.020U	<0.040U	<0.046U	<0.020U
DBENZOFOU	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
2MeNAPH	<0.021U	<0.010U	<0.010U	<0.010U	<0.010U	<0.021U	<0.010U	<0.020U	<0.023U	<0.010U
2NANIL	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.010U	<0.050U	<0.10U	<0.12U	<0.050U
3NANIL	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.010U	<0.050U	<0.10U	<0.12U	<0.050U
4NANIL	<0.10U	<0.050U	<0.050U	<0.050U	<0.050U	<0.010U	<0.050U	<0.10U	<0.12U	<0.050U

Note: Sample ID - R-2 - Rinse performed following sampling at boring 2. MB/R-2 - method blank associated with analysis of R-2.

J - Estimated value below the statistical quantification limits

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

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

1 - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

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Table 19
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Analyses of Soils for Selected Pesticides, Herbicides, and PCBs

ANALYTE	E	01#1	01#2	02#1	02#2	03#1	2	04#1	04#2	05#1	05#1DUP	05#2	06#1
Aldrin		< 0.0029	< 0.003	< 0.003	< 0.003	< 0.003	.0029	< 0.0031	< 0.003	< 0.0029	< 0.0031	< 0.003	< 0.0031
A-BHC		< 0.0022	< 0.0023	< 0.0023	< 0.0022	< 0.0022	< 0.0022	< 0.0023	< 0.0023	< 0.0022	< 0.0023	< 0.0023	< 0.0023
B-BHC		< 0.0043	< 0.0045	< 0.0045	< 0.0044	< 0.0045	< 0.0044	< 0.0046	< 0.0046	< 0.0043	< 0.0046	< 0.0045	< 0.0046
G-BHC		< 0.0029	< 0.003	< 0.003	< 0.003	< 0.003	< 0.0029	< 0.0031	< 0.003	< 0.0029	< 0.0031	< 0.003	< 0.0031
D-BHC		< 0.0065	< 0.0068	< 0.0068	< 0.0067	< 0.0067	< 0.0065	< 0.0069	< 0.0069	< 0.0065	< 0.0069	< 0.0068	< 0.0069
PPDDD		< 0.008	< 0.0083	< 0.0083	< 0.0081	< 0.0082	< 0.008	0.0008 BJ	< 0.0084	< 0.008	< 0.0084	< 0.0069	0.0053 BJ
PPDDE		0.0029 BJ	< 0.003	< 0.003	0.01 B	< 0.003	< 0.0029	< 0.0031	0.0026 BJ	< 0.0031	< 0.0031	0.017	< 0.0031
PPDDT		0.0061 J	< 0.0091	0.0028 J	< 0.0089	0.0004 J	0.00039 J	< 0.0093	0.013	0.0046 BJ	0.0046 BJ	0.022 B	< 0.0092
Heptachlor		< 0.0022	0.00027 BJ	< 0.0023	< 0.0022	0.00025 BJ	0.00032 BJ	0.00054 BJ	0.00029 BJ	0.00064 BJ	0.00064 BJ	0.00065 BJ	< 0.0023
Dieldrin		0.0044 J	< 0.0015	0.0011 J	0.014	< 0.0015	< 0.0015	0.0015	< 0.0014	0.0026 J	0.0026 J	< 0.0015	< 0.0015
A-Endosulfan		< 0.01	< 0.011	< 0.011	0.0036 BJ	< 0.01	< 0.01	< 0.011	< 0.01	< 0.011	< 0.011	0.0042 J	< 0.011
B-Endosulfan		< 0.0029	< 0.003	< 0.003	< 0.003	< 0.003	< 0.0029	< 0.0031	< 0.0029	< 0.0031	< 0.003	< 0.003	< 0.0031
ENDOSU		< 0.048	< 0.05	< 0.05	< 0.049	< 0.049	< 0.048	< 0.051	< 0.05	< 0.048	< 0.051	< 0.05	< 0.05
Endrin		< 0.0043	< 0.0045	< 0.0045	< 0.0044	< 0.0045	< 0.0044	< 0.0046	< 0.0046	< 0.0043	< 0.0046	< 0.0045	< 0.0046
Endrin Aldehyde		< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	< 0.018	< 0.018	< 0.017	< 0.018	< 0.017	< 0.018
HPTCLE		< 0.06	< 0.063	< 0.063	< 0.061	< 0.062	< 0.06	< 0.064	< 0.063	< 0.06	< 0.064	< 0.063	< 0.063
Methoxychlor		< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	< 0.13	0.0019 BJ	0.00091 BJ	< 0.13	< 0.13	< 0.13	< 0.13
Toxaphene		< 0.17	< 0.18	< 0.18	< 0.18	< 0.18	< 0.17	< 0.19	< 0.18	< 0.17	< 0.18	< 0.18	< 0.18
PCB-1016		< 0.047	< 0.049	< 0.049	< 0.048	< 0.048	< 0.047	< 0.05	< 0.05	< 0.047	< 0.05	< 0.05	< 0.05
PCB-1221		< 0.047	< 0.049	< 0.049	< 0.048	< 0.048	< 0.047	< 0.05	< 0.05	< 0.047	< 0.05	< 0.05	< 0.05
PCB-1232		< 0.047	< 0.047	< 0.049	< 0.048	< 0.048	< 0.047	< 0.05	< 0.05	< 0.047	< 0.05	< 0.05	< 0.05
PCB-1242		< 0.047	< 0.049	< 0.049	< 0.048	< 0.048	< 0.047	< 0.05	< 0.05	< 0.047	< 0.05	< 0.05	< 0.05
PCB-1248		< 0.047	< 0.049	< 0.049	< 0.048	< 0.048	< 0.047	< 0.05	< 0.05	< 0.047	< 0.05	< 0.05	< 0.05
PCB-1254		< 0.094	< 0.098	< 0.098	< 0.096	< 0.097	< 0.094	< 0.1	< 0.099	< 0.094	< 0.1	< 0.1	< 0.099
PCB-1260		< 0.094	< 0.098	< 0.098	< 0.096	< 0.097	< 0.094	< 0.1	< 0.099	< 0.094	< 0.1	< 0.1	< 0.099
Diazinon		< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.12	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11
Ethyl Parathion		< 0.032	< 0.034	< 0.034	< 0.033	< 0.033	< 0.032	< 0.034	< 0.034	< 0.032	< 0.034	< 0.034	< 0.034
Ethyl Trithion		< 0.035	< 0.036	< 0.036	< 0.036	< 0.036	< 0.035	< 0.037	< 0.036	< 0.034	< 0.036	< 0.036	< 0.036
Ethion		< 0.028	< 0.029	< 0.029	< 0.029	< 0.029	< 0.028	< 0.03	< 0.029	< 0.028	< 0.03	< 0.029	< 0.03
Malathion		< 0.06	< 0.062	< 0.062	< 0.061	< 0.061	< 0.06	< 0.063	< 0.062	< 0.059	< 0.063	< 0.062	< 0.063
Methyl Parathion		< 0.065	< 0.068	< 0.068	< 0.066	< 0.067	< 0.065	< 0.069	< 0.068	< 0.065	< 0.068	< 0.068	< 0.068
2,4-D		< 0.43	< 0.46	< 0.44	< 0.44	< 0.45	< 0.44	< 0.43	< 0.44	< 0.41	< 0.43	< 0.43	< 0.47
2,4-DP		< 0.23	< 0.25	< 0.24	< 0.24	< 0.24	< 0.24	< 0.23	< 0.24	< 0.22	< 0.23	< 0.23	< 0.25
2,4,5-T		< 0.072	< 0.076	< 0.074	< 0.074	< 0.074	< 0.073	< 0.071	< 0.072	< 0.069	< 0.071	< 0.071	< 0.078
2,4,5-TP		< 0.061	< 0.065	< 0.063	< 0.063	< 0.063	< 0.062	< 0.06	< 0.061	< 0.058	< 0.061	< 0.06	< 0.066
a-CHLORDANE		0.0013 BJ	0.0013 BJ	0.0015 BJ	0.0018 BJ	0.001 BJ	0.00061 BJ	0.0011 BJ	< 0.0038	0.0011 BJ	< 0.0038	0.0035 BJ	< 0.0038
g-CHLORDANE		0.00077 B	< 0.0038	< 0.0038	0.0029 BJ	< 0.0037	< 0.0036	< 0.0039	< 0.0038	< 0.0036	< 0.0038	< 0.0038	< 0.0038

NOTE: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.
J - Estimated value below the statisical quantitation limits.
< - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
B - Analyte is found in the associated blank as well as in the sample.

(Continued)

Table 19 (Concluded)

ANALYTE /	06#2	07#1	08#1	08#2	09#1
Aldrin	< 0.0031	< 0.0031	< 0.033 D	< 0.031 D	< 0.0031
A-BHC	< 0.0023	< 0.0023	< 0.024 D	< 0.024 D	< 0.0023
B-BHC	< 0.0046	< 0.0047	< 0.049 D	< 0.047 D	< 0.0047
G-BHC	< 0.0031	< 0.0031	< 0.033 D	< 0.031 D	< 0.0031
D-BHC	< 0.0069	< 0.007	< 0.073 D	< 0.071 D	< 0.007
PPDDD	< 0.0084	< 0.0086	< 0.09 D	< 0.086 D	< 0.0086
PPDDE	0.0033 B	0.00019 BJ	< 0.033 D	< 0.031 D	0.0066 B
PPDDT	< 0.0092	0.0013 BJ	< 0.098 D	< 0.094 D	< 0.0094
Heptachlor	< 0.0023	0.00018 BJ	< 0.024 D	< 0.024 D	< 0.0023
Dieldrin	< 0.0015	< 0.0016	< 0.016 D	< 0.016 D	< 0.0016
A-Endosulfan	< 0.011	< 0.011	< 0.11 D	< 0.11 D	0.014
B-Endosulfan	< 0.0031	< 0.0031	< 0.033 D	< 0.031 D	< 0.0031
ENDOSU	< 0.051	< 0.051	< 0.54 D	< 0.52 D	< 0.052
Endrin	< 0.0046	< 0.0047	0.015 BD	< 0.047 D	0.013 BJ
Endrin Aldehyde	< 0.018	< 0.018	< 0.19 D	< 0.18 D	< 0.018
HPTCLE	< 0.064	0.00006 J	< 0.68 D	< 0.65 D	< 0.065
Methoxychlor	< 0.13	< 0.14	< 1.4 D	< 1.4 D	< 0.14
Toxaphene	< 0.18	< 0.19	< 1.95 D	< 1.88 D	< 0.19
PCB-1016	< 0.05	< 0.051	< 0.53 D	< 0.51 D	< 0.051
PCB-1221	< 0.05	< 0.051	< 0.53 D	< 0.51 D	< 0.051
PCB-1232	< 0.05	< 0.051	< 0.53 D	< 0.51 D	< 0.051
PCB-1242	< 0.05	< 0.051	< 0.53 D	< 0.51 D	< 0.051
PCB-1248	< 0.05	< 0.051	< 0.53 D	< 0.51 D	< 0.051
PCB-1254	< 0.1	< 0.1	< 1.1 D	< 1 D	< 0.01
PCB-1260	< 0.1	< 0.1	< 1.1 D	< 1 D	< 0.01
Diazinon	< 0.11	< 0.12	< 0.12 D	< 0.12	< 0.12
Ethyl Parathion	< 0.034	< 0.035	< 0.036 D	< 0.035	< 0.035
Ethyl Trithion	< 0.037	< 0.037	< 0.039 D	< 0.038	< 0.037
Ethion	< 0.03	< 0.03	< 0.032 D	< 0.03	< 0.03
Malathion	< 0.063	< 0.064	< 0.067 D	< 0.064	< 0.064
Methyl Parathion	< 0.069	< 0.07	< 0.073 D	< 0.07	< 0.07
2,4-D	< 0.5	< 0.46	< 0.48	< 0.4	< 0.45
2,4-DP	< 0.27	< 0.25	< 0.26	< 0.22	< 0.24
2,4,5-T	< 0.084	< 0.076	< 0.081	< 0.067	< 0.075
2,4,5-TP	< 0.071	< 0.065	< 0.069	< 0.057	< 0.064
a-CHLORDANE	< 0.0038	0.003 BJ	< 0.041 D	< 0.039 D	< 0.0039
g-CHLORDANE	< 0.0038	< 0.0039	< 0.041 D	< 0.039 D	< 0.0039

NOTE: Sample ID is as follows - 01#1, boring 1/sample 1. See Figures 5.1 and 5.2.

J - Estimated value below the statisical quantitation limits.

< - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

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

D - Duplicate analysis not within control limits.

Table 20
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Summary of Results of Soil Analyses for Pesticides, Herbicides, and PCBs. A (J) is Indicated After the Compound Name Where the Analyte was Detected at Concentrations Below the Statistical Quantitation Limits. Pesticides, Herbicides and PCB's also Found in the Method Blanks are not Included

Boring 1	Boring 2	Boring 3	Boring 4	Boring 5
PPDDT (J)	PPDDT (J)	PPDDT (J)	PPDDT	PPDD E
Dieldrin (J)	Dieldrin (J)			Dieldrin
				Dieldrin (J)

Boring 7	Boring 9
Heptachlor Epoxide (J)	A-Endosulfan

Method blanks. Method blanks analyzed for pesticides, herbicides and PCBs contained at least two of the following: D-BHC, PPDDD, PPDDE, heptachlor, endosulfan sulfate, endrin, methoxychlor, a-chlordane, and g-chlordane at estimated concentrations below the instrument detection limits (below statistical quantitation limits - "J" values) (Table 21). The method blank associated with borings 4, 5, and 7 also contained aldrin, PPDDT, and endrin aldehyde. These method blank analysis results were considered in the interpretation of the soils analyses for pesticides, herbicides, and PCBs.

Equipment rinses. Equipment rinses for borings 2, 4, 7, 8, and the tank water sample contained no pesticides, herbicides, or PCBs with the exception of a-chlordane in the rinses for borings 4, 7, 8, and the tank water (Table 22). However, the method blanks associated with the rinses for borings 2, 4, 7, 8 and the method blank for the deionized water and tank water contained at least five of the following compounds: aldrin, D-BHC, PPDDD, PPDDE, heptachlor, A-endosulfan, endosulfan sulfate, endrin, methoxychlor, a-chlordane, and g-chlordane. The deionized water contained only heptachlor, A-endosulfan, and g-chlordane. In all cases the concentrations were below the instrument detection limits (below statistical quantitation limits - "J" values) (Table 22). These results likely indicate sample contamination from the laboratory environment rather than processes associated with the field conditions.

Conclusions

Metals. The soils analyses conducted indicated that the waste disposal activities at the OBP have released residues of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, aluminum, barium, calcium, cobalt, iron, magnesium, manganese, sodium, and total phosphorus to soils. This conclusion is based on comparison of soils from "test" borings with those of control borings (those removed from influences of the waste disposal activities). Release of thallium is not evident based on similar comparison methods.

Soil samples from borings 8 and 9 had particularly high mean concentrations of metal constituents when compared to control soils as well as when compared to soils from the other test borings. Borings 4, 5, and 6 also produced soil samples with mean metals concentrations that were frequently higher than those determined for the control borings, however, those concentrations were generally not as high as those reported for borings 8 and 9. Mean concentrations of metals in boring 7, with the exception of chromium, selenium, and sodium were actually lower than the concentrations in the control borings.

Volatile organics. Volatile organic compounds (as determined by EPA method 8240) were detected in only three OBP borings (4 samples). Only three volatile organic compounds were detected. A clear pattern of contamination (release) of OBP soils with volatile organic compounds, which can be attributed to waste disposal activities in that area, is not evident.

Semivolatile organics. Soil samples from borings 5, 6, 8, and 9 contained semivolatile organic compounds. Therefore, a release of semivolatile organic compounds at the OBP is evident. The most frequent type of semivolatile organic compound present was polycyclic aromatic hydrocarbons (PAHs). With the exception of concentrations of fluoranthene and pyrene in boring 8 (sample 2) the compounds were found in concentrations that were detected by the analytical instrumentation but not in sufficient amounts to statistically quantify ("J" values). The highest concentrations of flouranthene and pyrene reported for boring 8 were 7.80 mg/kg and 12.0 mg/kg, respectively.

Borings 6, 8, and 9 were very similar in terms of the suite of semivolatile organic compounds found at those sites and different from soils from other borings. Soils from borings 6, 8, and 9 contain greater numbers of different semivolatile organic compounds than the other borings tested.

Pesticides. Pesticides and herbicides were found in soils from borings 4, 5, 7, 8, and 9 as well as in the control borings 1, 2, and 3. With the exception of concentrations of dieldrin in soils from borings 2 and 4, PPDDT in boring 4, PPDDE in boring 5, and A-endosulfan in the soils from boring 9, the other pesticides and herbicides were found in concentrations that were detected by the analytical instrumentation but not in sufficient amounts to statistically quantify. No PCBs were detected in any of the OBP soils. Based on the soil analyses performed, releases of pesticides and herbicides have occurred in the OBP area. However, it cannot be determined from available information if the pesticides and herbicide residues detected are the result of recent or past waste disposal activities or insect and vegetation control activities by NSWCC or others.

Table 21
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Analyses of Method Blanks Associated with Analyses of Soils for Pesticides, Herbicides, and PCB. Concentrations and Detection Limits are mg/kg (ppm) Dry Weight. Samples with Detectable Concentrations of Analyte are Shown in *Bold*

Method Blank ANALYTE/Boring	MB 1	MB1 2,3	MB2 2,3	MB 4,5,7	MB 6,9	MB 8
ALDRIN	<0.0027U	<0.0027U	-	**0.00016J**	<0.0027U	<0.0027U
A-BHC	<0.0020U	<0.0020U	-	<0.0020U	<0.0020U	<0.0020U
B-BHC	<0.0040U	<0.0040U	-	<0.0040U	<0.0040U	<0.0040U
G-BHC	<0.0027U	<0.0027U	-	<0.0027U	<0.0027U	<0.0027U
D-BHC	**0.0011J**	**0.0011J**	-	<0.0060U	**0.0013J**	**0.0013J**
PPDDD	**0.0011J**	**0.0011J**	-	**0.0019J**	**0.0013J**	**0.0012J**
PPDDE	**0.00043J**	**0.00043J**	-	**0.00075J**	**0.00044J**	**0.00044J**
PPDDT	<0.0080U	<0.0080U	-	**0.00029J**	<0.0080U	<0.0080U
Heptachlor	**0.00039J**	**0.00039J**	-	**0.0004J**	**0.00076J**	**0.00067J**
Dieldrin	<0.0013U	<0.0013U	-	<0.0013U	<0.0013U	<0.0013U
A-Endosulfan	<0.0094U	<0.0094U	-	<0.0094U	<0.0094U	<0.0094U
B-Endosulfan	<0.0027U	<0.0027U	-	<0.0027U	<0.0027U	<0.0027U
ENDOSU	**0.00094J**	**0.00094J**	-	**0.0018J**	<0.044U	<0.044U
Endrin	**0.0005J**	**0.0005J**	-	**0.00071J**	**0.00049J**	**0.00053J**
Endrin Aldehyde	<0.015U	<0.015U	-	**0.00097J**	<0.015U	<0.015U
HPTCLE	<0.056U	<0.056U	-	<0.056U	<0.056U	<0.056U
Methoxychlor	**0.0028J**	**0.0028J**	-	**0.0070J**	<0.012U	<0.12U
Toxaphene	<0.16U	<0.16U	-	<0.016U	<0.16U	<0.161U
PCB-1016	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.044U
PCB-1221	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.044U
PCB-1232	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.044U
PCB-1242	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.044U
PCB-1248	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.044U
PCB-1254	<0.087U	<0.087U	-	<0.087U	<0.087U	<0.087U
PCB-1260	<0.087U	<0.087U	-	<0.087U	<0.087U	<0.087U
Diazinon	<0.10U	<0.10U	-	<0.10U	<0.10U	<0.10U
Ethyl Parathion	<0.030U	<0.030U	-	<0.030U	<0.030U	<0.030U
Ethyl Trithion	<0.032U	<0.032U	-	<0.032U	<0.032U	<0.032U
Ethion	<0.026U	<0.026U	-	<0.026U	<0.026U	<0.026U
Malathion	<0.055U	<0.055U	-	<0.055U	<0.055U	<0.055U
Methyl Parathion	<0.060U	<0.060U	-	<0.060U	<0.060U	<0.060U
2,4-D	<0.24U	<0.24U	-	<0.24U	<0.24U	<0.24U
2,4-DP	<0.13U	<0.13U	-	<0.13U	<0.13U	<0.13U
2,4,5-T	<0.04U	<0.04U	-	<0.04U	<0.04U	<0.04U
2,4,5-TP	<0.034U	<0.034U	-	<0.034U	<0.03U	<0.034U
a-chlordane	**0.0012J**	**0.0012J**	-	**0.0010J**	<0.0034	**0.0015J**
g-chlordane	**0.00055J**	**0.00055J**	-	**0.0007J**	<0.0034	**0.0007J**

Note: MB - Method Blank for the borings indicated.
J - Estimated value below the statistical quantitation limits
U - Compound was analyzed for but not detected. D etection limits are given after the < symbol.
(-) - No analysis conducted.

Table 22
Old Burn Pit - NWSCC, Indiana, SWMU 05/03. Results of Analyses of Method Blanks Associated with Analyses of Soils for Pesticides, Herbicides, and PCBs. Concentrations and Detection Limits are mg/1 (ppm). Samples with Detectable Concentrations of Analytes are Shown in *Bold*

ANALYTE/ID	RINSE-2	MB/R2	RINSE-4	RINSE-7	MB/R-4,7	RINSE-8	MB/R-8	DIH2O	TANK	MB/H2O,TANK
ALDRIN	<0.00009U	**0.00003J**	<0.00004U	<0.00004U	<0.00004U	<0.00006U	**0.00003J**	<0.00008U	<0.00009U	**0.00003J**
A-BHC	<0.00007U	<0.00003U	<0.00003U	<0.00003U	<0.00003U	<0.00006U	<0.00003U	<0.00006U	<0.00007U	<0.00003U
B-BHC	<0.00010U	<0.00006U	<0.00006U	<0.00006U	<0.00006U	<0.00010U	<0.00006U	<0.00012U	<0.00010U	<0.00006U
G-BHC	<0.00009U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00008U	<0.00004U	<0.00008U	<0.00009U	<0.00004U
D-BHC	<0.00020U	**0.00002J**	<0.00009U	<0.00009U	**0.00003J**	<0.00020U	**0.00002J**	<0.00018U	<0.00020U	**0.00002J**
PPDDD	<0.00020U	**0.00003J**	<0.00010U	<0.00010U	**0.00004J**	<0.00020U	**0.00003J**	<0.00022U	<0.00020U	**0.00003J**
PPDDE	<0.00009U	**0.00001J**	<0.00004U	<0.00004U	**0.00002J**	<0.00008U	**0.00001J**	<0.00008U	<0.00009U	**0.00001J**
PPDDT	<0.00030U	<0.00010U	<0.00011U	<0.00012U	<0.00012U	<0.00030U	<0.00010U	<0.00024U	<0.00030U	<0.00010U
Heptachlor	<0.00007U	**0.00002J**	<0.00003U	<0.00003U	<0.00003U	<0.00006U	**0.00002J**	**0.00004BJ**	<0.00007U	**0.00002J**
Dieldrin	<0.00004U	<0.00002U	<0.00002U	<0.00002U	<0.00002U	<0.00004U	<0.00002U	<0.00004U	<0.00004U	<0.00002U
A-Endosulfan	<0.00030U	**0.00002J**	<0.00013U	<0.00013U	<0.00014U	<0.00030U	**0.00002J**	**0.00002BJ**	<0.00030U	**0.000022J**
B-Endosulfan	<0.00009U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00008U	<0.00004U	<0.00008U	<0.00009U	<0.00004U
ENDOSU	<0.00150U	**0.00002J**	<0.00063U	<0.00063U	**0.00003J**	<0.00140U	**0.00002J**	<0.00130U	<0.00150U	**0.00002J**
Endrin	<0.00010U	**0.00001J**	<0.00006U	<0.00006U	**0.00002J**	<0.00010U	**0.00001J**	<0.00010U	<0.00010U	**0.00001J**
Endrin Aldehyde	<0.00050U	<0.00020U	<0.00022U	<0.00022U	<0.00020U	<0.00050U	<0.00020U	<0.00050U	<0.00050U	<0.00020U
HPTCLE	<0.00190U	<0.00080U	<0.00029U	<0.00080U	<0.00080U	<0.00170U	<0.00080U	<0.00170U	<0.00190U	<0.00080U
Methoxychlor	<0.00400U	**0.00002J**	<0.00170U	<0.00170U	<0.00180U	<0.00370U	**0.00009J**	<0.00350U	<0.00400U	**0.00009J**
Toxaphene	<0.00550U	<0.00240U	<0.00230U	<0.00230U	<0.00230U	<0.00500U	<0.00240U	<0.00480U	<0.00550U	<0.00240U
PCB-1016	<0.00150U	<0.00070U	<0.00060U	<0.00060U	<0.00060U	<0.00140U	<0.00070U	<0.00130U	<0.00150U	<0.00070U
PCB-1221	<0.00150U	<0.00070U	<0.00060U	<0.00060U	<0.00060U	<0.00140U	<0.00070U	<0.00130U	<0.00150U	<0.00070U
PCB-1232	<0.00150U	<0.00070U	<0.00060U	<0.00060U	<0.00060U	<0.00140U	<0.00070U	<0.00130U	<0.00150U	<0.00070U
PCB-1242	<0.00150U	<0.00070U	<0.00060U	<0.00060U	<0.00060U	<0.00140U	<0.00070U	<0.00130U	<0.00150U	<0.00070U
PCB-1248	<0.00150U	<0.00070U	<0.00060U	<0.00060U	<0.00060U	<0.00140U	<0.00070U	<0.00130U	<0.00150U	<0.00070U
PCB-1254	<0.00300U	<0.00130U	<0.00120U	<0.00120U	<0.00120U	<0.00130U	<0.00130U	<0.00260U	<0.00300U	<0.00130U
PCB-1260	<0.00300U	<0.00130U	<0.00120U	<0.00120U	<0.00120U	<0.00130U	<0.00130U	<0.00260U	<0.00300U	<0.00130U
Diazinon	<0.00450U	<0.00200U	<0.00190U	<0.00190U	<0.00200U	<0.00200U	<0.00200U	<0.00400U	<0.00450U	<0.00200U

Note: See Page 2 for Table Notes.

(Continued)

Table 22 (Concluded)

ANALYTE/ID	RINSE-2	MB/R2	RINSE-4	RINSE-7	MB/R-4,7	RINSE-8	MB/R-8	DIH2O	TANK	MB/H2O,TANK
Ethyl Parathion	<0.00140U	<0.00060U	<0.00060U	<0.00160U	<0.00060U	<0.00060U	<0.00060U	<0.00120U	<0.00140U	<0.00060U
Ethyl Trithion	<0.00140U	<0.00060U	<0.00060U	<0.00060U	<0.00060U	<0.00060U	<0.00060U	<0.00130U	<0.00140U	<0.00060U
Ethion	<0.00120U	<0.00050U	<0.00050U	<0.00050U	<0.00050U	<0.00050U	<0.00050U	<0.00100U	<0.00120U	<0.00050U
Malathion	<0.00250U	<0.00110U	<0.00100U	<0.00110U	<0.00110U	<0.00230U	<0.00110U	<0.00220U	<0.00250U	<0.00110U
Methyl Parathion	<0.00270U	<0.00120U	<0.00110U	<0.00120U	<0.00120U	<0.00250U	<0.00120U	<0.00240U	<0.00270U	<0.00240U
2,4-D	-	-	-	-	-	-	-	-	-	-
2,4-DP	-	-	-	-	-	-	-	-	-	-
2,4,5-T	-	-	-	-	-	-	-	-	-	-
2,4,5-TP	-	-	-	-	-	-	-	-	-	-
a-Chlordane	<0.00010U	0.00006J	0.000006B	0.00001B	0.00002J	0.00003BJ	0.00006J	0.00003BJ	0.00002BJ	0.00006J
g-Chlordane	<0.00010U	0.00002J	<0.00005U	<0.00005U	0.00002J	<0.00010U	0.00002J	<0.00100U	<0.00010U	0.00002J

Note: MB - Method Blank for the borings indicated.
J - Estimated value below the statistical quantitation limits
U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
(-) - No analysis conducted.
B - Analyte is found in the method blank as well as in the sample.

6 Summary

A Phase II Soils Investigation was done at the OBP. The intent of this investigation was to determine if any lasting effects from releases of hazardous substances could be detected in the soils of the OBP and to investigate the physical properties exhibited by the surface earth materials at the OBP. Nine soil borings were drilled. These borings were used to collect soil samples for physical characterization and chemical identification. Physical characterization of soil samples consisted of grain size, organic content, natural water content, and a combined visual and analytical description. Chemical identification consisted of the testing for the presence of organic, inorganic, pesticide, herbicide, PCB, semi-volatile compound and volatile organic compound analysis.

The OBP is located on the Crawford Upland, a rugged, dissected plateau formed by differential erosion of Pennsylvanian and Mississippian Age sedimentary rocks. Most of the OBP is situated in the dissected alluvial valley of Culpepper Branch. The geology of the OBP site was characterized using 19 groundwater monitoring wells (Dunbar 1982 and 1984), 9 auger soil borings, field observations, and physical soil test data. The unconsolidated sediments of the OBP site were formed by several processes. Residual soils formed by weathering of the underlying parent rock. During the Pleistocene the OBP was filled with lacustrine (lake deposits) and alluvial (outwash) deposits which are facies included in the Atherton formation (Grey, Wayne, and Wier 1970). Colluvium was derived from the hillslopes, and soil reworked by man associated with the burning activity.

The soil types at the OBP site are clay (CL and CH), silt (ML and MH) and sand (SC, SW, SM and SP). The gravel portion of the clay (CL) is primarily sandstone fragments. The soil thickness of the OBP site ranges from zero to almost 60 ft. The areal variability of soil thickness was not adequately characterized because only a few borings penetrated the total soil thickness. The soil data was sufficient to lend itself to generate isopleth (equal soil-type thickness penetrated by boring samples) maps. A net sand map was prepared to display the total known sand encountered by the borings. The thickest sand (SM, SP, SP-SM, SC and SW) corresponds to an interpreted outwash channel.

An anthropogenic, "modified," soil unit was found at the OBP. Anthropogenic soils refer to soils which have been modified by human activity and are associated with soils containing cultural debris such as rusty nails, metal, glass, and burnt wood. Borings 5, 6, 7, 8, and 9 encountered soil containing cultural

debris. In borings 5 and 9 a layer of black ash with a strong odor was found. The above physical evidence can be correlated with the chemical analysis to describe the area of potential contamination. The area and depth of actual contamination will require additional borings for accurate delineation.

The soil auger borings were left open prior to grouting to measure water levels. Groundwater was encountered at a shallow depth (4 to 6 ft) in all but three borings during drilling. Boring 7-90 was a dry hole. Borings 5-90 and 9-90, which were terminated due to high HNU readings at a depth of 3 ft, did not encounter water. Dunbar, 1982 presents laboratory permeabilities of the order of 2×10^{-5} and 8×10^{-6} cm/sec for silt (ML) and clay (CL) samples from the OBP. These soils are, practically speaking, impermeable. During periods of infiltration, this soil may act as a very slow conduit for groundwater and any associated contaminants. The area of thickest sands, the paleochannel, could act as a conduit for groundwater flow. The sands which form the paleochannel could have permeabilities of the order of 2×10^{-2} to 5×10^{-3} cm/sec. In the paleochannel sand area groundwater moves laterally through the sand body, possibly explaining why the contaminated wells found in 1984 indicate a westernly component of groundwater flow when the groundwater elevations would suggest a northwestern direction of flow. Understanding the presence and orientation of this sand body is important in monitoring the OBP site.

To determine what effects the activities at the OBP may have had on the soils of the site, 16 soil samples were taken for chemical analysis. Historical records indicate that the analytes of concern at the site are inorganic, volatile organic and semivolatile organic compounds. Explosive compounds were not of concern at this site. Nine soil borings were drilled. From each boring samples were taken. These samples were taken from the 3 in. to 6 in. interval and from the recognizably contaminated layer if found in the soil. Then a soil sample was taken from above either the top of rock or the groundwater table. The study was structured to test for the presence of inorganic and organic compounds. Borings 1,2, and 3 were located within the SWMU boundary to the southeast of the burn area. These borings were selected as "control or background sample." Background samples are taken to identify characteristics of soils where no waste disposal activities had occurred, but all other influences on the soil character had taken place. Borings 4, 5 and 6 were located within the depression which was used as a burning area. Borings 7, 8, and 9 were located within the ash burial areas. The chemical parameters tested for were inorganics, volatile organics, semivolatile organics, and pesticides, herbicides and PCBs.

Data from the inorganic soils analysis indicated that the waste disposal activities have released inorganic chemical residues to the soils of the OBP. Inorganic analytes are naturally occurring crustal elements. To identify inorganic soil contaminants, statistical comparisons between control concentrations and the test soil concentrations are done. The maximum inorganic constituent concentrations were determined from borings 8 and 9. Borings 4, 5, and 6 also produced soil samples with inorganic concentrations which were frequently significantly greater than the control mean levels, but less then those levels seen in borings 8 and 9. Based on the inorganic analytical data a release of antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury,

nickel, selenium, silver, zinc, aluminum, barium, calcium, cobalt, iron, magnesium, manganese, sodium, and total phosphorus to the soils has occurred at specific locations within the OBP.

Samples from three borings 4, 6, and 8 contained concentrations of volatile organic compounds. Two borings, 5 and 9, were stopped at shallow depths because of high levels of detected volatile organics. A clear pattern of contamination of the OBP soils with volatile organic compounds which can be attributed to the waste disposal activities at the site is not evident.

Semivolatile organic compounds were detected in soil samples from borings 5, 6, 8, and 9. Borings 6, 8, and 9 were very similar in terms of the suite of semivolatile organic compounds found at those sites and different from soils from other borings. The most frequent type of semivolatile organic compound present was polycyclic aromatic hydrocarbons (PAHs). With the exception of concentrations of fluoranthene and pyrene (7.80 mg/kg and 12.0 mg/kg respectively) found in boring 8, the semivolatile organic compounds were found in "J" value concentrations. Many tentatively identified semivolatile organic compounds (TICs) were detected in the soils samples from the OBP. TICs are semivolatile organic compounds not listed as target compounds in the EPA's 8270 method, but detectable by the instrumentation. These compounds could have resulted from the burning activities carried on at the site.

Pesticides and herbicides were found in the soil samples from all borings except 6 and 8. The concentration levels of these compounds detected in the soils were mostly "J" value levels. The exceptions are concentrations of dieldrin (014 mg/kg, and 0015 mg/kg in soils from borings 2 and 4), PPDDT (0.013 mg/kg) in boring 4, PPDDE (0.017 mg/kg) in boring 5, and A-endosulfan (0.014 mg/kg) in soils from boring 9. It cannot be determined if these residues resulted from the burning operation or from normal insect and vegetation control activities at NSWCC.

No PCBs were detected in the soils from the area.

In summary a clear case for the presence of both inorganic and semivolatile organic compound contamination in the soils of the OBP has been made. A less firm conclusion about the presence of volatile organic and pesticides/herbicides contamination in the OBP soils can be made. No PCBs were detected in the soil samples from the OBP. Inorganic and organic compounds in the soils of the burning area and the ash dump are possibly acting as a source for groundwater contamination detected at the site. The presence of sandy lenses of soil may be influencing the migration of chemical contamination. In a homogeneous soil medium, contaminants will migrate in a uniform and equal pattern. The permeable sandy soil horizons present a preferential groundwater flow path. Therefore, contaminants moving in and with the groundwater would be expected to move more quickly within the sandy horizons than through the clay and silt horizons. This could explain the difference between the predicted direction of contaminant flow and the observed direction of contaminant flow.

7 Conclusions

The presence of contamination in the soils of the OBP is verified. Contamination is indicated by both inorganic and semivolatile organic parameters. Volatile organic contaminants are probably present in the soils at the site. A pattern to the presence of other contaminants (pesticides/herbicides) could not be verified using the existing data. No PCBs were detected in the soils of the OBP.

The direction of groundwater flow, and therefore, the contaminant flow, is influenced by the presence of sandy horizons in the soil.

8 Recommendations

Additional study is recommended. A RCRA Facilities Investigation, Phase III, Soils study should be planned. This study should include testing for both physical and chemical parameters. The physical parameters should include grain size, permeability, ion exchange, and clay particle identification. The chemical detection parameters for all soils tested should include inorganic and semivolatile organic compounds. In order to determine the full extent of the contamination, the investigation should have a broader scope than did the Phase II Study. The surface soils within the bounds of the OBP area need to be sampled to determine the lateral extent and volume of waste dumped here. Historical records, including aerial photographs and topographic maps (particularly ones postulating the operation at the OBP) could prove to be very helpful. The bottom sediments in the unnamed stream need to be sampled in a downstream direction and chemically tested to determine the lateral extent to which the contamination may have been spread by the stream.

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Appendix A
Compound Names

Table A-1. EPA method 8240, Volatile compounds, (Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods, SW-846, Third Edition, November 1986, with December 1988 revisions). Abbreviations used in report tables along with full analyte names.

ClMETH - Chloromethane
BrMETH - Bromomethane
VnlCl - Vinyl Chloride
ClETHA - Chloroethane
MeCl - Methylene Chloride
11DClETE - 1,1-Dichloroethene
11DClETA - 1,1-Dichloroethane
t-DClETE - Trans-1,2-Dichloroethene
c-DClETE - cis-1,2-Dichloroethene
CHCl3 - Chloroform
12DClETA - 1,2-Dichloroethane
111TCA - 1,1,1-Trichloroethane
CCl4 - Carbon Tetrachloride
BrDClMe - Bromodichloromethane
12DClPR - 1,2-Dichloropropane
t13ClPRE - Trans-1,3-Dichloropropene
TCE - Trichloroethene
DBrClMe - Dibromochloromethane
c13ClPRE - Cis-1,3-Dichloropropene
112TCA - 1,1,2-Trichloroethane
BENZENE - Benzene
CHBR3 - Bromoform
1122TClA - 1,1,2,2,-Tetrachloroethane
TEClETE - Tetrachloroethene
TOLUENE - Toluene
ClBEN - Chlorobenzene
ETBEN - Ethylbenzene
ACETONE - Acetone
BUTANO - 2-Butanone
CS2 - Carbondisulfide
2HEXANO - 2-Hexanone
4Me2PE - 4-Methyl-2-Pentanone
STYRENE - Styrene
VnACETA - Vinyl Acetate
T-XYLENE - T-Xylene

Table A-2. EPA method 8270 semivolatile compounds, (Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods, SW-846, Third Edition, November 1986, with December 1988 revisions). Abbreviations used in report tables along with full analyte names.

PHENOL - Phenol
2ClPHEN - 2-Chlorophenol
2NIPHE - 2-Nitrophenol
24DMePHE - 2,4-Dimethylphenol
24DClPHE - 2,4-Dichlorophenol
4Cl3MePH - 4-Chloro-3-Methylphenol
246TClPH - 2,4,6-Trichlorophenol
24DNPH - 2,4-Dinitrophenol
4NPHE - 4-Nitrophenol
2M46DNPH - 2-Methyl-4,6-Dinotrophenol
PClPHE - Pentachlorophenol
BENZOAC - Benzoic Acid
2MEPHE - 2-Methylphenol
4MEPHE - 4-Methylphenol
245TClPH - 2,4,5-Trichlorophenol
BZLAL - Benzyl Alcohol
NNDMEAM - N-Nitrosodimethylamine
BClIPrE - Bis(2-Chloroisopropyl)Ether
NNDNPAM - N-Nitroso-Di-N-Propylamine
NITROBEN - Nitrobenzene
ISOPHOR - Isophorone
BClEtoME - Bis(2-Chloroethoxy)Methane
26DNTOL - 2,6-Dinitrotoluene
24DNTOL - 2,4-Dinitrotoluene
12DPHYD - 1,2-Diphenylhydrazine
BENZIDI - Benzidine
33DClBEZ - 3,3'Dichlorobenzidine
BClEtE - Bis(2-Chloroethyl)Ether
13DClB - 1,3-Dichlorobenzene
14DCLB - 1,4-Dichlorobenzene
12DClB - 1,2-Dichlorobenzene
HClETA - Hexachloroethane
124TClB - 1,2,4-Trichlorobenzene
NAPHTH - Naphthalene
HClBU - Hexachlorobutadiene
HClCYPD - Hexachlorocyclopentadiene
2ClNAPH - 2-Chloronaphthalene
ACENAY - Acenaphthylene
DMePHTH - Dimethyl Phthalate
ACENAP - Acenaphthene
FLUORE - Fluorene
DEtPHTH - Diethyl Phthalate
4ClPHPHE - 4-Chlorophenyl Phenyl Ether
NNDPHAM - N-Nitrosodiphenyl Amine
4BrPHET - 4-Bromophenyl Ether
HClBEN - Hexachlorobenzene
PHENAN - Phenanthrene
ANTRAC - Anthracene
DBuPHTH - Dibutylphthalate
FLANTHE - Fluoranthene
PYRENE - Pyrene
BuBePHTH - Butylbenzylphthalate
CHRYSE - Chrysene
BAANTHR - Benzo(a)Anthracene
B2EHPH - Bis(2-Ethylhexyl)Phthalate
DNOcPHT - Di-N-Octylphthalate
BBFLANT - Benzo(b)Fluoranthene
BKFLANT - Benzo(k)Fluoranthene
BAPYRE - Benzo(a)Pyrene
I123PYR - Indeno(1,2,3-C,D)Pyrene
B-GHI-PY - Benzo(G,H,I)Perylene
ANILINE - Aniline
4ClANIL - 4-Chloroaniline
DBENZOFU - Dibenzofuran
2MeNAPH - 2-Methylnaphthalene
2NANIL - 2-Nitroaniline
3NANIL - 3-Nitroaniline
4NANIL - 4-Nitroaniline