AIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.

1 of 1

Preliminary Characterization of the 100 Area at Argonne National Laboratory

C. Biang and R. Biang

Environmental Assessment Division
Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439

P. Patel

Environment and Waste Management Program
Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439

June 1994

Work sponsored by United States Department of Energy,
Assistant Secretary for Environmental Restoration and Waste Management,
Office of Environmental Restoration, under Contract W-31-109-Eng-38

MASTER

CONTENTS

NOTATION	vii
ACKNOWLEDGMENT	viii
ABSTRACT	1
1 INTRODUCTION	1
1.1 Background	2
1.2 Objective	2
1.3 Approach	3
2 DESCRIPTION OF THE STUDY AREA	4
2.1 Location and Topography	4
2.2 Geology	7
2.2.1 Holocene Deposits	7
2.2.2 Pleistocene Deposits	7
2.2.3 Paleozoic Bedrock	12
2.3 Hydrology	12
2.3.1 Surface Water	12
2.3.2 Groundwater	13
2.4 Description and History of Activities	14
2.4.1 Lime Sludge Pond	14
2.4.2 Building 108 Liquid Retention Pond	17
2.4.3 Coal Yard	18
2.4.4 East Area Burn Pit	19
2.4.5 Eastern Perimeter Area	20
3 FIELD INVESTIGATION	21
3.1 Sampling Locations and Rationale	21
3.2 Sampling Procedures and Equipment	23
3.2.1 Decontamination Procedures	23
3.2.2 Equipment	23
3.3 Sample Documentation and Analysis	23
4 SOIL ANALYTICAL RESULTS	25
4.1 Data Qualifiers	25
4.2 Statistical Analysis Methodology	25
4.3 Lime Sludge Pond	28
4.3.1 Inorganic Analysis	28
4.3.2 Organic Analysis	28
4.4 Building 108 Liquid Retention Pond	29
4.4.1 Inorganic Analysis	29
4.4.2 Organic Analysis	30

CONTENTS (Cont.)

4.5	Coal Yard	31
4.5.1	Inorganic Analysis	31
4.5.2	Organic Analysis	33
4.6	East Area Burn Pit	34
4.6.1	Inorganic Analysis	34
4.6.2	Organic Analysis	35
4.7	Eastern Perimeter Area	36
4.7.1	Inorganic Analysis	36
4.7.2	Organic Analysis	37
5	CONCLUSIONS	38
5.1	Lime Sludge Pond	38
5.2	Building 108 Liquid Retention Pond	39
5.3	Coal Yard	41
5.4	East Area Burn Pit	42
5.5	Eastern Perimeter Area	43
5.6	Recommendations for Further Investigation	44
6	REFERENCES	45
	APPENDIX: Summary of 100 Area Contaminants	49

FIGURES

1	Location of Argonne National Laboratory	5
2	Topographic Map of Argonne National Laboratory	6
3	Pleistocene Geology of the Argonne National Laboratory Site	8
4	Geologic Stratigraphy of the Argonne National Laboratory Site	9
5	Surficial Deposits near the Argonne National Laboratory Site	10
6	Locations of Soil Borings in the 100 Area	15
7	Locations of Background Samples	27

TABLES

1	Composition of Lime Sludge	16
---	----------------------------------	----

TABLES (Cont.)

2	Soil Samples Obtained from Each Area	21
A.1	Background Analytical Summary and Statistics — Concentrations of Surface Soil Inorganic Elements	51
A.2	Summary of Statistical Analysis — Surface Soil Inorganic Background Concentrations Compared with Concentrations in Soil Borings in the 100 Area	52
A.3	Lime Sludge Pond — Summary of Inorganic Element Concentrations	58
A.4	Lime Sludge Pond — Summary of Volatile Organic Compound Concentrations	59
A.5	Lime Sludge Pond — Summary of Semivolatile Organic Compound Concentrations	60
A.6	Lime Sludge Pond — Summary of PCB/Pesticide Compound Concentrations	62
A.7	Building 108 Liquid Retention Pond — Summary of Inorganic Element Concentrations	63
A.8	Building 108 Liquid Retention Pond — Summary of Volatile Organic Compound Concentrations	64
A.9	Building 108 Liquid Retention Pond — Summary of Semivolatile Organic Compound Concentrations	65
A.10	Building 108 Liquid Retention Pond Area — Summary of PCB/Pesticide Compound Concentrations	67
A.11	Coal Yard — Summary of Inorganic Element Concentrations	68
A.12	Coal Yard — Summary of Inorganic Element Concentrations for Surface Water Samples	69
A.13	Coal Yard — Summary of Volatile Organic Compound Concentrations	70
A.14	Coal Yard — Summary of Volatile Organic Compound Concentrations for Surface Water Samples	71
A.15	Coal Yard — Summary of Semivolatile Organic Compound Concentrations	72
A.16	Coal Yard — Summary of Semivolatile Organic Compound Concentrations for Surface Water Samples	74

TABLES (Cont.)

A.17	Coal Yard — Summary of PCB/Pesticide Compound Concentrations	76
A.18	Coal Yard — Summary of PCB/Pesticide Compound Concentrations for Surface Water Samples	77
A.19	Burn Pit — Summary of Inorganic Element Concentrations	78
A.20	Burn Pit — Summary of Volatile Organic Compound Concentrations	79
A.21	Burn Pit — Summary of Semivolatile Organic Compound Concentrations	80
A.22	Burn Pit — Summary of PCB/Pesticide Compound Concentrations	82
A.23	Eastern Perimeter Area — Summary of Inorganic Element Concentrations	83
A.24	Eastern Perimeter Area — Summary of Volatile Organic Compound Concentrations	84
A.25	Eastern Perimeter Area — Summary of Semivolatile Organic Compound Concentrations	85
A.26	Eastern Perimeter Area — Summary of PCB/Pesticide Compound Concentrations	87

NOTATION

The following is a list of acronyms, initialisms, and abbreviations (including units of measure) used in this document.

ACRONYMS, INITIALISMS, AND ABBREVIATIONS

AMEMEP	Office of the Assistant Manager for Environmental Management and Energy Projects
ANL	Argonne National Laboratory
APS	Advanced Photon Source
CLP	Contract Laboratory Program
CMT	Chemical Technology Division
4,4'-DDD	4,4'-dichlorodiphenyldichloroethane
4,4'-DDE	4,4'-dichlorodiphenyltrichloroethane
4,4'-DDT	4,4'-dichlorodiphenyldichloroethene
DOE	U.S. Department of Energy
EAD	Environmental Assessment Division
EPA	U.S. Environmental Protection Agency
ETC	Environmental Testing and Certification Corp.
EWM	Environment and Waste Management Program
FB	field blank
IEPA	Illinois Environmental Protection Agency
MSA	Method of Standard Additions
MSL	above mean sea level
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
SB	soil boring
SDA	spray dryer/absorber
STS	Soil Testing Services, Inc.
SW	surface water
SWMU	solid waste management unit
TSS	total suspended solids
USGS	U.S. Geological Survey
VOC	volatile organic compound

UNITS OF MEASURE

ft	foot (feet)	mi	mile(s)
gal	gallon(s)	min	minute(s)
in.	inch(es)	µg	microgram(s)
kg	kilogram(s)	ppm	part(s) per million
L	liter(s)	yd	yard(s)
mg	milligram(s)	yd ³	cubic yard(s)

ACKNOWLEDGMENT

The authors thank Margaret Ortigara of Argonne National Laboratory for her expert editing of this report and for her assistance in developing a format for data presentation. Her efforts contributed greatly to the overall quality of this report.

PRELIMINARY CHARACTERIZATION OF THE 100 AREA AT ARGONNE NATIONAL LABORATORY

by

C. Biang, R. Biang, and P. Patel

ABSTRACT

This characterization report is based on the results of sampling and an initial environmental assessment of the 100 Area of Argonne National Laboratory. It addresses the current status, projected data requirements, and recommended actions for five study areas within the 100 Area: the Lime Sludge Pond, the Building 108 Liquid Retention Pond, the Coal Yard, the East Area Burn Pit, and the Eastern Perimeter Area. Two of these areas are solid waste management units under the Resource Conservation and Recovery Act (the Lime Sludge Pond and the Building 108 Liquid Retention Pond); however, the Illinois Environmental Protection Agency has determined that no further action is necessary for the Lime Sludge Pond. Operational records for some of the activities were not available, and one study area (the East Area Burn Pit) could not be precisely located. Recommendations for further investigation include sample collection to obtain the following information: (1) mineralogy of major minerals and clays within the soils and underlying aquifer, (2) pH of the soils, (3) total clay fraction of the soils, (4) cation exchange capacity of the soils and aquifer materials, and (5) exchangeable cations of the soils and aquifer material. Various other actions are recommended for the 100 Area, including an electromagnetic survey, sampling of several study areas to determine the extent of contamination and potential migration pathways, and sampling to determine the presence of any radionuclides. For some of the study areas, additional actions are contingent on the results of the initial recommendations.

1 INTRODUCTION

This preliminary characterization report presents an overview of the environmental status of operational areas within the 100 Area at Argonne National Laboratory (ANL). It provides an initial assessment of the presence of contaminants in this area based on data obtained during the sampling conducted in June and July 1993.

This introduction summarizes the purpose of the characterization report and the methods used to accomplish it. Section 2 describes the study area, location, geography,

geology, and hydrology; much of this information is taken from a previous report (Biang et al. 1994). Section 3 discusses the sampling locations, rationale, procedures, equipment, and analytical protocols. The analytical results, information about the data qualifiers, and data interpretation are presented in Section 4. Section 5 contains general conclusions about the 100 Area data with regard to specific areas of the site that exhibit the presence of contamination; recommendations for further investigation are presented. Section 6 provides full reference information for those documents cited in the text. The Appendix includes the data summary tables.

1.1 BACKGROUND

The management of inactive waste sites, such as those within the 100 Area, is addressed in the response to findings of the October 1990 Tiger Team Assessment of the Argonne Illinois Site and is stipulated by U.S. Department of Energy (DOE) Order 5400.1. This order establishes environmental protection program requirements, authorities, and responsibilities for DOE operations to ensure compliance with applicable federal, state, and local environmental protection laws and regulations, executive orders, and internal department policies. Characterization activities in the 100 Area are being implemented under Action Plan AP041. This action plan was developed in response to findings of the Tiger Team and to those identified in the Laboratory's Self-Assessment.

The 100 Area contains a number of waste management operations and several areas that have been designated as solid waste management units (SWMUs) under the Resource Conservation and Recovery Act (RCRA). Activities that may have released contaminants to the soil and groundwater include coal storage, operation of an unlined wastewater lagoon, disposal of lime sludge in an unlined lagoon, dewatering of lime sludge on the bank adjacent to the lagoon, fuel oil storage, open burning in a burn pit, and other waste-handling activities.

1.2 OBJECTIVE

The objective of this report is to provide the Environment and Waste Management Program (EWM) with a preliminary characterization of the environmental status of the 100 Area at ANL. The purpose of this report is to support decisions regarding project phasing, scheduling, and any additional investigations that may be required to characterize the nature and extent of contamination. It provides an overview of the area and evaluates the analytical data with regard to soil contamination present in the 100 Area.

Preliminary characterization activities are also being conducted across the Laboratory to plan an approach for RCRA Corrective Action at a number of locations. EWM will evaluate the status of the 100 Area as part of the early planning phase of the environmental restoration of ANL. This report provides a preliminary, qualitative understanding of the area and will be used to determine the need for further investigation.

1.3 APPROACH

Staff from the Environmental Assessment Division (EAD) at ANL were accompanied by the EWM project manager during an initial site visit on March 16, 1994. They also reviewed available information including (1) historical and operating records, (2) location and sampling maps, (3) sampling data, and (4) project files. The historical records that belong to the Federal Records Center were obtained through the Office of the Assistant Manager for Environmental Management and Energy Projects (AMEMEP), DOE, Chicago. So that the original documents can be retrieved from the Federal Records Center (if necessary), AMEMEP created a Records Management Database Identifier Number that references an accession number assigned by the Federal Records Center. All information cited from these historic records is referenced within this report with the AMEMEP Identifier Number.

On March 30, 1994, the 100 Area supervisor conducted a second site walkover and provided detailed information regarding standard operating and waste management procedures. Further documentation was obtained regarding the disposition of wastes from the 100 Area.

Sampling data were compiled and evaluated to determine the presence and concentration of contaminants and the discernible nature and extent of contamination. Information developed in the data analysis was used to create a preliminary description of the overall environmental status of the 100 Area, to identify any obvious impacts to the immediate surrounding areas, and to identify additional data requirements that may increase current knowledge about the presence of contamination.

2 DESCRIPTION OF THE STUDY AREA

The 100 Area comprises approximately 30 acres in the northeastern corner of the ANL site. It borders Sawmill Creek on the east. The 100 Area contains a number of facilities, including the central boiler house complex for the Laboratory and the site water treatment plant (in use until 1986). Many of the activities associated with these facilities could have resulted in contamination of this area and of adjacent soils and ground- and surface-water systems.

Preliminary sampling and analysis of the soils in the 100 Area began in 1991 and has revealed the existence of elevated levels of heavy metals, polynuclear aromatic hydrocarbons, and other organic compounds (ANL 1992). These substances could have been released from a number of different facilities in the 100 Area, and it is not possible from the amount of information available to determine exactly which activities contributed to this contamination. Many of the contaminants observed in the 100 Area may be a result of leachate from the coal pile formerly stored in this area.

For this characterization report, the 100 Area has been divided into five smaller study areas: the Lime Sludge Pond, the Building 108 Liquid Retention Pond, the Coal Yard, the East Area Burn Pit, and the Eastern Perimeter Area. Samples were obtained from each of these areas, and the results are discussed in the following subsections. As available, an overview of past operations is presented.

2.1 LOCATION AND TOPOGRAPHY

ANL-East is located in the southeastern corner of DuPage County, Illinois, about 27 mi southwest of downtown Chicago (Figure 1). It occupies 1,700 acres within an area bounded by Interstate Highway 55 (I-55) on the north, Lemont Road on the west, Cass Avenue on the east, and the Des Plaines River Valley on the south. The Laboratory is surrounded by the Waterfall Glen Forest Preserve, which was previously part of the Laboratory. In 1973, the preserve was deeded to the DuPage County Forest Preserve District (Golchert et al. 1991).

The Laboratory is in the Wheaton Morainal Country subdivision of the Central Lowland physiographic province (Knowles et al. 1963). The area is characterized by a gently rolling landform dotted with depressions (Figure 2). Because of the relatively impermeable silty clay underlying the site, many depressions are filled with water, forming ponds and wetlands. Two major creeks pass through the Laboratory. Sawmill Creek and its tributaries drain most of the Laboratory area, and an unnamed creek drains a small eastern area of the Laboratory. Both creeks empty into the Des Plaines River to the south.

The Des Plaines River is a prominent feature near the Laboratory. It has dissected glacial deposits and exposed the dolomite bedrock. Bluffs are formed along both riverbanks.

FIGURE 1 Location of Argonne National Laboratory (Source: Golchert and Kolzow 1993)

FIGURE 2 Topographic Map of Argonne National Laboratory (Source: Modified from U.S. Geological Survey [USGS] 1978)

Subparallel young valleys perpendicular to the Des Plaines River Valley are well developed. A few of them originate in the southern part of the Laboratory. The average altitude of the Laboratory is about 725 ft above mean sea level (MSL), while the altitude of the Des Plaines River is about 578 ft MSL near the site (Golchert et al. 1991).

2.2 GEOLOGY

The Laboratory is situated on the Valparaiso Moraine Complex, which consists of a series of recessional moraines trending in a northwest-southeast direction (Figure 3). Underneath the Laboratory, the glacial sediment of the moraine complex ranges from about 40 to 130 ft in thickness and is underlain by dolomite bedrock of Silurian age. The glacial sediment can be divided into two major units (the Wadsworth Till member and the underlying Lemont Drift of the Wedron Formation) and several minor units. All units have been studied by a few investigators since the late 1940s (e.g., Allen et al. 1949; Killey and Trask 1989; Knowles et al. 1963; Zeizel et al. 1962). The results of these studies combined with well log observations (ANL 1949; Soil Testing Services, Inc. [STS] 1966) are summarized in Sections 2.2.1 to 2.2.3. The geologic stratigraphy in descending order is shown in Figure 4.

2.2.1 Holocene Deposits

The deposits of Holocene age were left after the last glaciation in the area retreated. They include the alluvial sediments along streams and organic peat in swamps and ponds. Because most natural drainages at the Laboratory are of an erosional type, alluvial deposits are not well developed. They can be found near the lower reach of Sawmill Creek (Figure 5) and along the Des Plaines River. Peat deposits can be found in the western part of the Laboratory near the 800 Area Landfill and in the Waterfall Glen Nature Preserve north of the Laboratory (Figure 5).

2.2.2 Pleistocene Deposits

Four types of deposits of Pleistocene age have been identified: the Richland Loess, the Glacial River Bottom Deposit, the Wadsworth Till, and the Lemont Drift (Killey and Trask 1989). The total thickness of these deposits varies and is influenced by the topography of underlying bedrock. The thickness can dramatically change over a short distance.

2.2.2.1 Richland Loess

The Richland Loess, discontinuously distributed over the Laboratory, is a windblown deposit composed mainly of silt-sized particles. It is generally less than 5 ft thick (Killey and Trask 1989). The loess is more common in undeveloped areas, where native soil has not been destroyed during Laboratory development.

**FIGURE 3 Pleistocene Geology of the Argonne National Laboratory Site
(Source: William 1973)**

FIGURE 4 Geologic Stratigraphy of the Argonne National Laboratory Site
 (Source: Killey and Trask 1989)

FIGURE 5 Surficial Deposits near the Argonne National Laboratory Site
 (Source: Bretz 1932)

2.2.2.2 Glacial River Bottom Deposit

Because the Des Plaines River was a drainage channel for glacial Lake Chicago (old Lake Michigan) near the end of glaciation, a veneer of river residual gravel accumulated near the river bank of the Des Plaines Valley (Bretz 1932). The gravel is distributed outside the Laboratory's southern boundary (Figure 5) in the Des Plaines River Valley.

2.2.2.3 Wadsworth Till

The Wadsworth Till is a poorly sorted glacial deposit characterized by brown to gray silty clay and clayey silt, intermixed with minor amounts of sand and pebble. Larger-sized dolomite rock fragments are common in the till. The till can be traced across the Laboratory. Its thickness, however, varies from about 20 to 80 ft in different areas (Killey and Trask 1989). Lenses and seams of silt, sand, and gravel are common in the till. They range from a few inches to 4 ft in thickness (Killey and Trask 1989), and most have limited lateral extent. However, a laterally extensive sand and silt layer (the 720 Sand) has been found around the southwestern part of the Laboratory (Killey and Trask 1989). The 720 Sand was so named because it consistently occurred at an altitude between 710 and 730 ft MSL in the Advanced Photon Source (APS) area (Killey and Trask 1989).

The upper part of the Wadsworth Till has been weathered. Iron stains found along fractures in till and weathered brownish till were noted in well logs. The weathered zone varies from 8 to 25 ft (STS 1988; Killey and Trask 1989) from the ground surface.

The silty clay till is calcareous. A size analysis of 47 till samples taken around the APS site was performed; the fine-grained matrix (particles less than 0.08 in. in diameter) of the till averages 16% sand, 45% silt, and 39% clay. Pebble content ranges from 1 to 7% according to field observation (Killey and Trask 1989). The major clay mineral is illite, which accounts for more than 70% of the total clay particles. The second largest group of clay mineral contains kaolinite and chlorite (Killey and Trask 1989).

2.2.2.4 Lemont Drift

Lithologically, the Lemont Drift contains a variety of material, ranging from pebbly clayey till, silty clay, clayey silt, silt, sandy silt, silty sand, to sand and gravel (Killey and Trask 1989; Johnson et al. 1985). Generally, the upper portion of the drift contains interbeds of till and silt or fine sand. The lower portion is dominated by silt, sand, and coarser material. Dolomite rock fragments are common in the drift. Little consistency in the lithologic sequence is found across the Laboratory. The drift may change in texture dramatically over a short distance. Higher contents of silt and dolomite pebble and gravel distinguish it from the overlying Wadsworth Till. Near the bottom of the drift, a layer of gravel or broken rock of dolomite is commonly found. At the Laboratory, the thickness of the Lemont Drift varies from about 11 to 110 ft (ANL 1949).

2.2.3 Paleozoic Bedrock

The bedrock underlying the Lemont Drift includes the Silurian dolomitic rocks of the Racine Formation, the Maquoketa Shale of Ordovician age, and older rocks. The dolomite under the APS site is cherty and characterized by fine vuggy, sucrosic texture and contains some clay partings and fossiliferous zones (Killey and Trask 1989). Near its upper part, the bedrock is fractured or broken (Killey and Trask 1989). Dissolution along joints and fractures may have occurred. The altitude of the top of the dolomite is about 630 ft MSL near the southeastern part of the Laboratory and about 610 ft near the northeast. Bedrock exposures were reported in the lower reach of Sawmill Creek outside the Laboratory and in the Des Plaines River Valley (Figure 5) (Bretz 1932). The dolomite ranges in thickness from about 200 to 225 ft at the supply wells of the Laboratory (Knowles et al. 1963) and is a major aquifer regionally. The dolomite is underlain by a brownish-gray to green dolomitic shale of the Maquoketa Shale and older bedrock.

2.3 HYDROLOGY

2.3.1 Surface Water

Because of the rather impermeable material underneath the Laboratory, surface runoff accumulates in depressions, forming a few small ponds and wetlands. Some of these ponds, such as the Freund Ponds, are man-made. The Freund Ponds, located near the eastern part of the Laboratory, were originally part of a drainage channel. They receive storm water and small amounts of cooling tower blowdown water from nearby buildings. Other ponds obtain their recharge from local runoff and storm water. Their size may change with the amount of precipitation.

Sawmill Creek and its tributaries drain most of the Laboratory area. The creek enters the site near its northeastern corner and flows south in the eastern part of the Laboratory. The creek leaves the Laboratory near its southeastern corner and discharges into the Des Plaines River. Most of the creek discharge comes from local runoff, from developed areas both outside and inside the Laboratory. Also, the Laboratory contributed another 0.91 million gal per day in 1991 of treated laboratory and sanitary wastewater. Upstream of the laboratory wastewater outfall, the average discharge of the creek was about 5.8 million gal per day during 1991. The effluent outfall is located in the southeastern part of the site.

The tributaries of Sawmill Creek flow preferentially from west to east before joining the creek. In the southern part of the Laboratory, several smaller ephemeral drainages drain south to the Des Plaines River Valley. Flow occurs in the spring and rainy seasons.

2.3.2 Groundwater

2.3.2.1 Perched Aquifers

Groundwater occurs in the glacial deposit in several ways. It is present in the joints, fissures, and root canals of the weathered Wadsworth Till. It is also present in the silt and sand seams in the Wadsworth Till. If beds of silt, sand, or gravel of the Lemont Drift are underlain by clayey till, these coarse-grained layers would form perched aquifers. In general, two or more perched aquifers may be found in the glacial deposits at Argonne. The areal extent of these aquifers varies, and groundwater flow directions in the aquifers are not fully understood.

Groundwater in the weathered zone of the silty clay till has been noted during several drilling programs (Patton et al. 1990a,b; STS 1988; Killey and Trask 1989). The depth of the water table ranges from a few feet to about 25 ft below the land surface and is consistent with the thickness of the weathering zone in the Wadsworth Till (STS 1988). The groundwater occurs in fissures, root canals, and joints and is recharged directly from precipitation. Because of the small storage capacity of the fissures, the water table fluctuates dramatically with dry and wet seasons. The groundwater flow direction in this zone is not fully understood and is estimated to be controlled by topography and the presence of the sand and silt lenses in this zone. Lateral flow is important. Also, evapotranspiration of the groundwater by vegetation is likely.

Sand and silt seams and lenses are common in the silty clay. Field observations reveal that they are commonly saturated with the groundwater that forms the local perched aquifer. Because the distribution of these seams and lenses varies from place to place, groundwater flow direction in this perched aquifer is difficult to predict.

The 720 Sand in the APS area (Killey and Trask 1989) is one of the sand seams with a relatively large areal extent. However, the altitude of the sand spans about a 20-ft vertical interval. The hydraulic condition of the sand ranges from water table to artesian. The groundwater flow direction is not clear. Eventually, the 720 Sand is recharged by infiltrated precipitation through the silty clay till.

2.3.2.2 Hydraulic Conductivities

Because the permeability in the Lemont Drift is relatively higher than that in the overlying clayey Wadsworth Till, most of the infiltrated water in the Lemont Drift drains downward. Perched aquifers are formed in areas where silt, sand, or coarse-grained drift is interrupted by localized clayey material. Because the lithology of the Lemont Drift varies dramatically over a short distance, the distribution and groundwater flow direction of this kind of perched aquifer are difficult to predict. The aquifer is recharged by vertical infiltrated water through the Wadsworth Till.

2.3.2.3 Basal Glacial Drift Aquifer

The lower part of the Lemont Drift commonly contains a layer of silt, sand, and gravel or disintegrated dolomite rock fragments. This layer forms an unconfined aquifer. The thickness of this aquifer varies with the dramatic lithologic changes of the Lemont Drift. It is inferred that the aquifer has a large lateral extent and is hydraulically connected to the bedrock dolomite aquifer.

2.3.2.4 Silurian Dolomite Aquifer

The dolomite aquifer underlying the Lemont Drift is a major aquifer that provides groundwater in DuPage County, including the Laboratory. Groundwater is present in joints, fractures, and solution-enlarged openings in the bedrock. These openings are extensive, developed, and interconnected, especially in the upper part of the dolomite (Zeizel et al. 1962). As a result, the hydraulic conductivity of the aquifer is high. Yields as high as 1,000 gal/min have been reported (Knowles et al. 1963). Generally, the average yield of the aquifer is lower. At the Laboratory, the thickness of the Silurian aquifer ranges from about 100 to 150 ft.

Many local communities now receive water from Lake Michigan. ANL expects to receive water from Lake Michigan in the future. Four water supply wells are now in use at the Laboratory (Golchert and Kolzow 1993). They are installed about 300 ft deep, tapping the Niagaran dolomite in the eastern part of the Laboratory. Pumping the supply wells caused a drop in the water level of about 18 ft in the dolomite near water supply wells between 1960 and 1990 (Golchert and Kolzow 1993). Evidence exists that the pumping caused an extensive cone of groundwater depression in the dolomite aquifer (Knowles et al. 1963; Golchert and Kolzow 1993) and induced groundwater movement in the dolomite toward the supply wells. Several other small-capacity water wells at the Laboratory are used for laboratory experiments, fire protection, and sanitary facilities.

2.4 DESCRIPTION AND HISTORY OF ACTIVITIES

2.4.1 Lime Sludge Pond

The Lime Sludge Pond is a surface impoundment located just north of Building 129 and adjacent to the boiler plant. It consists of an unlined earthen lagoon approximately 5.0 to 7.0 acres in size (the size has fluctuated over the years depending on discharge and precipitation rates). Figure 6 shows the location and the banks of the pond.

This pond was used as a repository for the lime sludge generated by the lime-soda ash softening system for potable water at the water treatment plant. This activity began in 1949 and continued until 1986 when the Laboratory switched to an ion-exchange system for

FIGURE 6 Locations of Soil Borings in the 100 Area

softening the water used on-site. The pond is estimated to contain approximately 100,000 yd³ of wet lime sludge from the water-softening activities that took place during the 37 years that this practice was followed (Biang et al. 1994).

Some portions of the pond are completely filled in, particularly in the southern sections, while other areas are overlain by shallow, very alkaline (pH 9-10) water (DOE 1988). The Lime Sludge Pond is adjacent to Sawmill Creek, separated by a 15-ft-high berm on the eastern and southern portions of the pond. At its closest point, the pond is less than 150 ft from the creek.

The sludge deposited into the Lime Sludge Pond consists mainly of calcium and magnesium carbonate and aluminum sulfate. Although the lime used in the water treatment process can contain metals and other substances, analysis of the sludge has revealed only trace amounts of such materials. The sludge material has been sampled and characterized in recent years (beginning in 1989 and continuing annually since then). The most recent analyses of the Lime Sludge Pond were submitted in December 1993, when ANL renewed its permit for land application of the lime sludge from the pond (Schletter 1993). The composition of the sludge is presented in Table 1.

Dredging and removal of the lime sludge contained in the pond began in 1990. A backhoe is used to remove the sludge, which is then trucked to agricultural areas for use as a soil sweetener. This activity is expected to continue for several years and has been permitted by the Illinois Environmental Protection Agency (IEPA) (ANL 1992). This dredging and removal process also complies with the requirements of the Argonne-East National

TABLE 1 Composition of Lime Sludge^a

Component	Concentration (mg/kg)
Arsenic	1.6
Barium	58.1
Cadmium	<1.0
Calcium (as CaCO ₃)	306,000
Chromium (total)	10.7
Copper	10.6
Magnesium (as CaCO ₃)	30,000
Mercury	0.06
Nickel	16.1
Selenium	<0.8
Silver	4.2
Zinc	54.3

^a The pH of the lime sludge was 9.2.

Source: Schletter (1993).

Pollutant Discharge Elimination System (NPDES) discharge permit. The results of the 1989 analysis are documented in the RCRA Part B Permit.

Although the substances contained in the lime sludge are not hazardous at the concentrations found and the sludge appears to be fairly well contained, some potential does exist for degradation of local water quality. A potential pathway is the overflow of water and suspended and dissolved solids from the Lime Sludge Pond during heavy precipitation events. The head differential between the surface of the pond and Sawmill Creek is approximately 10 ft. Until 1986, the pond overflowed directly into Sawmill Creek. In addition, a standpipe at the northeastern corner of the pond carried clarified water from the pond to Sawmill Creek. The berm separating the Lime Sludge Pond from Sawmill Creek prevents the sludge itself from entering this water course, but known failures and leaks of this berm have resulted in discharge of sludge material and water into the creek (Biang et al. 1994). Any overflow of alkaline water could adversely affect the biota of Sawmill Creek and downstream waters. In fact, a number of NPDES exceedances of pH have occurred at the outfall of the Lime Sludge Pond into Sawmill Creek. The potential for further contaminant migration from the Lime Sludge Pond into Sawmill Creek and groundwater beneath the unlined pond prompted the removal of the sludge.

The bank along the southwestern edge of the Lime Sludge Pond (Figure 6) is a curved area approximately 20 yd wide and 50 yd long and is about 10 ft above the surface of the sludge pond. This bank was used as an initial storage area for the sludge produced by ANL's water treatment system. The sludge was held on this bank to allow the lime wastes to drain excess water into the adjacent sludge pond. In 1990, the sludge dumped on the bank of the pond was removed and taken to the 800 Area Landfill. Some traces of the white sludge material are still present.

2.4.2 Building 108 Liquid Retention Pond

The Building 108 Liquid Retention Pond was originally an unlined pond approximately 110 yd long by 40 yd wide. The pond was built in the early 1950s and used until May 1990 to collect water released from the boiler house (consisting of cooling water used during the combustion process, boiler blowdown water, and boiler scrubber effluent); rinse water from the water treatment plant; and runoff from the coal storage pile. It was discharged to Sawmill Creek (DOE 1990).

In 1988, the state of Illinois issued a Notice of Violation for the boiler house discharge. The pond was dredged in May 1990 to comply with state requirements (DOE 1990). The pond area was then enlarged and double-lined for future use as a treatment facility for boiler house discharge water and runoff water from the coal pile. The water is pumped to the Sanitary Wastewater Treatment Plant for treatment.

Before dredging and removal activities were initiated, the sludge contained in the retention pond was analyzed. The results of this analysis indicated that the sludge was nonhazardous and thus could be disposed of as Special Waste in the 800 Area Landfill (DOE

1990). It contained low levels of metals, including arsenic (2.3 ppm), barium (46.1 ppm), chromium (6.94 ppm), and lead (16.4 ppm); volatile organic compounds; and other organic compounds. It was also highly alkaline, with a pH of 11.78 (IT Corporation 1990).

Specific analysis of the runoff from the coal pile has not been conducted. Potential contaminants include metals, organic and inorganic compounds, polychlorinated biphenyls (PCBs), and suspended solids. Although this acidic runoff could be neutralized by carbonate soil, the coal pile runoff is likely to be acidic (Nelson 1989).

Runoff from the coal pile (either directly or via the equalization pond) and effluent from the boiler house have been responsible for a number of NPDES exceedances for discharges into Sawmill Creek by the ANL site. These exceedances have been for pH, iron, and total suspended solids (TSS) (DOE 1990).

The potential pathways for contaminants to impact surface soil and groundwater include leaks and overflowing conditions. This is especially true in years before dredging was initiated because sedimentation in the pond from about 40 years of operation would have reduced the pond's capacity. Also, the absence of a liner in the original retention pond could have caused contamination of underlying soil layers. No documentation of leaks or overflows was found.

Contaminants may have infiltrated into the groundwater as a result of leaks and overflows. Because the locations of the Lime Sludge Pond and the Building 108 Liquid Retention Pond were once part of Sawmill Creek (see Figure 2), the associated sediments may be relatively more permeable than the clayey till found in the 100 Area. This provides a possible explanation for the presence of semivolatile contaminants that were found in SB16-2 that are the same in SB5-4, SB6-6, SB17-2, and SB18-2.

2.4.3 Coal Yard

A large pile of high-sulfur coal was stockpiled in the 100 Area until January 1994, when the last of the coal was burned. Use of this coal was discontinued because air emissions would sometimes exceed permitted concentrations if the air pollution control equipment malfunctioned.

Environmental issues that were addressed by removal of the coal pile include protection of the surface soil and surface water. In the past, leaching of the coal pile may have contributed metals and polynuclear aromatic hydrocarbons as surface soil contaminants (Nelson 1989). To address this concern, runoff was collected and transported to the Sanitary Wastewater Treatment Plant. However, an emergency overflow discharge pipe near the creek directed high volumes of runoff that occurred during times of heavy rain and rapid snowmelt directly to Sawmill Creek only 100 ft away (Golchert and Kolzow 1993).

The Building 108 boiler complex, which houses the central boiler house for the Laboratory, also contains a boiler house ash silo and a spent sorbent silo. The boiler complex

currently consists of five boilers: one fired by coal and four fired by natural gas. The ash silo is a cylindrical concrete structure, 40 ft high and 15 ft in diameter, overlain with brick. This silo has been in use since 1965. Another ash silo was used from 1949 to 1973 to contain ash produced from the four original coal-fired boilers until these boilers were converted to oil-burning units in 1973 (IT Corporation 1990). The current boiler house ash silo collects both the bottom ash and the fly ash produced during coal combustion in the single coal-fired boiler still in use today. The ash is first collected by the economizer and cyclone separators and is then carried to the top of the ash silo where it is dropped into the silo. The ash is eventually carried by truck from the silo for disposal at the rate of approximately 90 yd³ per week (IT Corporation 1990). Specific details of the composition of this ash are not readily available, but coal ash usually contains many of the same elements and compounds present in the coal itself. Heavy metals and polynuclear aromatic hydrocarbons are likely the substances of greatest concern (Nelson 1989).

No documentation of spills or releases has been found either from the currently active silo or from the older, retired silo. In general, precautions have been used, such as wetting the ash before loading it into trucks, transporting the ash in covered trucks, and installing a concrete foundation at the point of loading, all of which limit the potential for contamination of adjacent areas with ash particles.

The boiler house spent sorbent silo was built in 1981 when one of the converted oil/gas boilers was converted back to coal (DOE 1988). This silo collected sorbent used to remove SO₂ from the flue gases produced during the combustion of coal. The spent sorbent collected by the silo was a lime slurry mixed with recycled sorbent; this mixture was atomized into the flue gas spray dryer/absorber (SDA) chamber of the coal-fired boiler and then collected in the SDA hopper and four baghouse filter modules. From these modules, it was carried to the top of the silo. The spent sorbent silo, which is constructed of steel, is 46 ft high, 18 ft in diameter, and has a capacity of 260 tons of spent sorbent. The spent sorbent material was classified as a Special Waste approved for landfill disposal under an IEPA permit. Hazardous constituents were not present in the sorbent material.

2.4.4 East Area Burn Pit

The East Area Burn Pit was located west of Building 40 and north of Eastwood Extension between Railroad Drive and Sawmill Creek. No drawings have been located to indicate the exact location or dimensions of this SWMU. The approximate location is shown in Figure 6.

The burn pit was a belowgrade structure, with steel rails used in the floor and walls. The dimensions are estimated to have been 20 by 20 ft. The burn pit operated from the late 1940s until the late 1960s, when it was decommissioned. The steel rails were removed during decommissioning, and the pit was backfilled (IT Corporation 1990). No records of waste disposal in this area are available. According to information from employees, the burn pit received combustible wastes from garbage trucks and other vehicles. Paper products and combustible chemical wastes such as oils and solvents were burned. The trash burn pit also

received waste from Site A (Novak and Owen 1951). After waste was deposited in the burn pit, it was ignited and allowed to burn. Noncombustibles and ash that remained were then removed from the pit and taken to the 319 Area Landfill.

The exact nature of materials burned in this trash pit is unknown. Radioactive materials were reportedly excluded from the pit; however, several reported incidents of placement of radioactive materials into nonradioactive waste receptacles in the East Area buildings indicate the potential for radioactive contamination in the area (Novak 1949a,b; Novak and Owen 1951). No decommissioning records for this site are available; thus, it is not known whether sampling for any radioactive contamination was performed during decommissioning. Several types of combustible chemical waste may have been burned in this pit. Residues from combustion and products of incomplete combustion may remain in this area. Spills of materials in the area during transfer of wastes into the pit could also have contributed to potential contamination. Because the pit was belowgrade, the potential for subsurface contamination also exists.

Because of the proximity of Sawmill Creek, contaminated surface soils near the East Area Burn Pit could have entered the creek during rainstorms or flooding. Subsurface soil in the area of the burn pit could also have been contaminated as a result of contaminant migration from the pit into the surrounding soil. Subsurface contaminant migration away from this area is probably limited by the low hydraulic conductivity of the soil in the East Area.

2.4.5 Eastern Perimeter Area

The Eastern Perimeter Area was selected for sampling to provide an indication of ambient concentrations of contaminants present in this portion of the 100 Area. The sampling locations are upgradient or equigradient with other sample areas. Therefore, the samples provide a qualitative basis for determining the presence of contaminant sources with the potential to impact the 100 Area. Because this area is removed from areas of activity, it was not expected to contain any elevated concentrations of contaminants. The results are evaluated in Section 4.7.

3 FIELD INVESTIGATION

The 100 Area contains a number of facilities, including the central boiler house complex, coal storage and handling facilities, the East Area Burn Pit, and the site water treatment plant. Many of the activities associated with these facilities could have resulted in contamination of this area, as well as contamination of adjacent soils and ground- and surface-water systems. These activities include storage of coal in a bermed storage yard, operation of an unlined wastewater lagoon, past operation of an unlined lime sludge lagoon, past operation of several large, aboveground fuel oil storage tanks, and past operation of a burn pit used for open burning.

3.1 SAMPLING LOCATIONS AND RATIONALE

The notation for sample identification comprises three segments. First, two letters signify the type of sample (SB for soil boring, SW for surface water, and FB for field blank). Next, a number indicates the sampling location (as shown in Figure 6). Finally, the number preceded by a hyphen identifies the depth at which the sample was obtained. For example, SB9-4 is the sample notation for soil boring number 9, obtained from a depth of 4 ft. Table 2 shows the samples obtained from the five designated areas within the 100 Area.

A total of 32 soil borings were completed. Two surface water samples were collected in the Coal Yard. Field blanks were collected for quality assurance/quality control (QA/QC) purposes.

TABLE 2 Soil Samples Obtained from Each Area^a

Lime Sludge Pond	Building 108 Liquid Retention Pond	Coal Yard	East Area Burn Pit	Eastern Perimeter Area
SB7-4	SB4-2	SB19-7	SB9-4	SB1-2
SB8-7	SB5-4	SB21-6	SB11-3	SB2-2
SB10-4	SB6-6	SB22-5	SB15-7	SB3-2
SB12-7	SB17-2	SB23-4	SB30-3	
SB13-7	SB18-2	SB24-3	SB31-3	
SB14-3		SB25-5	SB32-1	
SB16-2		SB26-4	SB33-4	
		SB27-3		
		SB28-2		
		SB29-2		

^a Samples numbers may not be consecutive, and some have been deleted from the sequence.

Subsurface soil samples were obtained from the berm surrounding the Lime Sludge Pond. This berm comprises packed gravel and soil and is covered with vegetation. Because the berm had no suspected or visible areas of contamination, the sample locations were selected to encircle the pond. The sampling depths were varied to determine the presence of contaminants in shallow and deeper layers. The soils encountered were clay or silty clay containing stones and sometimes gravel. FB1 (QA/QC sample) was collected near location SB8.

Three samples were obtained adjacent to the Building 108 Liquid Retention Pond to detect pond leakage and migration that may have occurred before the pond was lined. The soil was extremely compacted clayey silt and rocks, limiting the depth that could be reached with the available equipment. Two samples (SB17 and SB18) were obtained farther from the pond to detect any lateral migration of contaminants.

The Coal Yard area was sampled at various locations. Shortly before this sampling event, an existing channel between Sawmill Creek and the Coal Yard was deepened. The soil removed from the channel was placed on the berm. Because the soil from the channel had probably received runoff from the Coal Yard, it is likely that the berm contains contaminants similar to those found in other areas of the Coal Yard. SB19 was collected from the northern edge of the berm that surrounds the yard. The elevation at this location is about 6 to 8 ft higher than that at the Coal Yard. Soil borings 21 through 23 and 29 are located in the berm near the northeastern edge of the Coal Yard. The elevation of this berm is about 4 ft higher than that of the Coal Yard. These locations were chosen to detect lateral migration of contaminants toward Sawmill Creek. Soil borings 24, 25, and 28 were collected from the former storage location of the high-sulfur coal pile. These locations were chosen to determine the extent to which contaminants leached from the coal into the soil. All samples were clayey soil mixed with coal particles. FB3 was collected by using previously decontaminated equipment that was taken into the field but not used for sampling.

Two surface water samples were collected in the Coal Yard. SW1 was collected from standing water at the southernmost point of the Coal Yard, and SW2 was collected near the acid pile runoff collection ditch. The water was sampled to detect surface contamination in the Coal Yard.

Soil samples were collected from the East Area Burn Pit area at depths of 1 to 7 ft. Deeper samples were not obtained because of the presence of clay, the lack of visual evidence of contamination, and the absence of groundwater. Because of the nature of activities in this area, most of the contamination is expected to be limited to the top few feet of soil or fill. Rocks and other obstructions were encountered throughout this area. Because the exact location of the burn pit has not been identified, sample locations were chosen that would represent a wide area. FB2 was obtained before sampling.

Samples from the Eastern Perimeter Area were obtained near the steam pipe southwest of Building 108 (SB1-2), near the aboveground storage tanks (SB2-2), and near Building 130 (SB3-2). The Eastern Perimeter Area was selected for sampling to provide an indication of ambient concentrations of contaminants present in this portion of the 100 Area.

The inferred groundwater flow direction is toward Sawmill Creek. Based on this inference, the sampling locations are upgradient with other sample areas. Therefore, the samples provide a qualitative basis for determining the presence of contaminant sources with the potential to impact the 100 Area.

3.2 SAMPLING PROCEDURES AND EQUIPMENT

3.2.1 Decontamination Procedures

All stainless-steel hand augers, trowels, and pans were decontaminated before use in the field. Decontamination, which consisted of washing the equipment with soap and warm water followed by air drying, was conducted in the Building 200 sample preparation room. To check equipment for residual contamination, field blanks were collected for the hand auger, trowel, and pan set. Deionized water supplied by the Laboratory was poured over this equipment, collected in appropriate sample bottles, and analyzed for all parameters.

3.2.2 Equipment

Before samples were collected, all equipment was decontaminated, including augers, trowels, and pans. Sample containers and preservatives were supplied by Environmental Testing and Certification Corp. (ETC) in New Jersey. Only these unused, precleaned containers were used for sample collection. All soil samples were obtained by using a hand auger and a Digger-Mobile (Digger). The Digger is a small, gas-powered auger that is raised and lowered manually by a lever; it was used to advance the borehole to a desired depth. A stainless-steel hand auger was used to collect the sample. Because of the presence of a shallow rocky layer, the depth that could be reached was limited. Both solid-stem and hollow-stem augers were used according to the type of soil encountered. Before drilling each boring, the location was cleared for underground utilities by ANL. Upon completion of drilling and sampling activities at each location, the boreholes were backfilled with bentonite and soil cuttings.

3.3 SAMPLE DOCUMENTATION AND ANALYSIS

Protocols for documenting, packaging, and transporting samples were as follows:

- Preserved samples properly and secured seals,
- Securely attached proper identification labels to each sample container,
- Packaged samples appropriately and packed them to prevent damage, and
- Accurately completed chain-of-custody forms.

Sampling and analysis were conducted in accordance with EPA Contract Laboratory Program (CLP) QA/QC protocols (March 1990). The analytical methods for analyzing total petroleum hydrocarbons were those contained in the EPA publication *Test Methods for Evaluating Solid Waste*, SW-846, 3rd edition (EPA 1990). At the completion of the fieldwork, the soil samples were submitted to ETC for analysis of volatile organic compounds, semivolatile organic compounds, pesticides, PCBs, and total metals (including cyanide). An analytical data package with complete QA/QC forms and raw data in CLP format was completed.

The Chemical Technology Division (CMT) of ANL was contracted to perform data validation. All data were validated in accordance with the U.S. Environmental Protection Agency (EPA) Region II Data Validation Guidelines. Region II guidelines and checklists were selected because of the comprehensive and conservative QA/QC requirements. As a result of the rigorous documentation, numerous data qualifiers (flags) were assigned to the data by the analytical laboratory and the data validation chemist. CMT validated the data by using the raw data package and assigning data qualifiers where applicable. Data qualifiers are designated for various reasons, for example, if QC criteria are out of specification or if the precision and accuracy of individual analytical determinations are deficient.

Some of the semivolatile organic compound and pesticide/PCB samples exceeded the prescribed holding time of seven days. Although the exceedance was generally limited to several days, some change in contaminant concentrations is possible and it increases the degree of uncertainty about those samples with undetected contaminants. Therefore, the data qualifier J (reported value was detected below the method detection limit) was affixed to indicate that the contaminant may have been present. These data carry a higher degree of uncertainty and should be used carefully. The samples that exceeded the seven-day holding time for semivolatile organic compounds and pesticides/PCBs follow:

- Lime Sludge Pond Area — SB7-4, SB8-7, SB10-4, SB12-7, SB13-7, SB14-4, SB16-2;
- Building 108 Liquid Retention Pond — SB5-4, SB6-6, SB17-2, SB18-2;
- Coal Yard — SB19-7, SB21-6, SB22-5, SB23-4, SB24-3, SB25-5, SB26-4, SB27-3, SB29-2; and
- East Area Burn Pit — SB9-4, SB11-3, SB15-7, SB30-3, SB31-3, SB32-1, SB33-4.

Because of the preliminary nature of this characterization study, the compounds in these samples with the data qualifiers UJ were considered to be present. Further discussion of the data analysis of organic compounds is presented in Section 4.

4 SOIL ANALYTICAL RESULTS

4.1 DATA QUALIFIERS

The data qualifiers used in the report and summary tables are defined as follows:

- U Element was undetected above the detection limit reported;
- J Reported value was detected below the method detection limit;
- B Respective analyte was also detected in the corresponding laboratory blank;
- E Reported value was estimated because of the presence of interference;
- S Reported inorganic value was determined by the Method of Standard Additions (MSA);
- * Laboratory duplicate analysis (inorganic) was not within control limits;
- N Spiked sample recovery (inorganic) was not within control limits;
- D Reported value is a result of dilution;
- P Reported pesticide or PCB values have a quantitative difference of more than 20% between two gas chromatography columns;
- W Reported value indicates that its internal spike recovery was out of QC limits; and
- R The data are unusable.

The data were validated, and many of the data have QC qualifier flags associated with them. Many of the data received the qualifier "J," which is a value that has a high degree of uncertainty associated with it. Some of these data were used in the t-test analysis for comparison with background values, and some failed this comparison. Because of the uncertainty associated with those values, the samples should not automatically be considered contaminated. Additional samples should be taken before establishing the area contaminated.

4.2 STATISTICAL ANALYSIS METHODOLOGY

The t-test method of statistical analysis was performed for comparison of surface soil inorganic analytical data with background surface soil inorganic analytical data. ANL

provided the inorganic analytical data for 11 background samples. The locations of these background samples are shown in Figure 7. All background samples were collected from a depth of 0.5 to 3 ft. Only those samples from the 100 Area collected to a depth of 3 ft were compared statistically to background values. A summary of the background analysis, the arithmetic mean, the standard deviation, and the standard error of mean for each compound in the background population is presented in Table A.1 in the Appendix. (All data summary tables are provided in the Appendix.) The sample concentrations, the t statistic of each sample constituent, and the t-test results (pass or fail) are presented in Table A.2.

The t-test method was chosen at the recommendation of the Illinois Office of Chemical Safety and is useful for establishing the potential that a given sample could be a member of a population with specified characteristics. Assuming the background sample observations were randomly collected from a normal population, the t statistic is calculated by:

$$t = \frac{X - U_0}{S_E} ,$$

where

t = test statistic,

X = sample concentration,

U_0 = hypothetical mean of the population, and

S_E = standard error of mean.

The standard error of mean may be estimated by:

$$S_E = S \sqrt{\frac{1}{n}} ,$$

where S = standard deviation of the observations, and n = number of observations.

To test the hypothesis that an inorganic sample concentration from the 100 Area is less than the mean of the background population, the desired level of significance and the degrees of freedom must be specified. The desired level of significance determines the degree of confidence that may be attached to the result of the test. A significance of 5% was chosen for this test. A 5% significance level offers a 95% confidence level in the result, or a 95% chance that the calculated results reflect the actual conditions. The degrees of freedom are the number of observations minus one. Therefore, this test has 12 sample observations or 11 degrees of freedom. The significance level and the degrees of freedom are used to obtain

FIGURE 7 Locations of Background Samples

a critical value of t , which determines the regions of rejection and acceptance for the hypothesis. The significance level of 5% and the degrees of freedom of 11 result in a critical value of 1.796. All values of t greater than 1.796 will fail the original hypothesis and indicate that the sample is not likely a member of the background population. All values of t less than 1.796 will pass the original hypothesis and indicate that the sample is likely a member of the background population. The sample concentrations, the t statistic of each sample constituent, and the t -test results (pass or fail) are presented in Table A.2.

4.3 LIME SLUDGE POND

4.3.1 Inorganic Analysis

Seven samples were taken from borings that were made around the Lime Sludge Pond (Figure 6). The sample depths ranged from 2 to 7 ft. The samples were analyzed for total metals, and the data were validated. Two samples, SB14-3 and SB16-2, were analyzed by using the t -test statistical method, and the results are presented in Table A.2. The inorganic data from all these borings are summarized in Table A.3.

Calcium, magnesium, and sodium were detected above the background samples and thus failed the t -test in both borings. Calcium, magnesium, and sodium were above background in all the samples taken from around the Lime Sludge Pond. Calcium concentrations ranged from 34,200 mg/kg in SB13-7 to 119,000 mg/kg in SB16-2. Magnesium concentrations ranged from 20,100 mg/kg in SB12-7 to 71,100 mg/kg in SB16-2. Calcium and magnesium were found in the lime sludge at typical concentrations of 306,000 mg/kg and 30,000 mg/kg, respectively. Sodium concentrations ranged from 140 mg/kg in SB7-4 to 590 mg/kg in SB10-4; however, sodium was also found in the field blanks for all samples.

Lead was above background in SB16-2 at a concentration of 34.5 mg/kg; however, this level is within the normal concentration range for lead (15 to 70 mg/kg) in the state of Illinois (Boerngen et al. 1981). Selenium in SB16-2 (1.0 mg/kg) and thallium in SB14-3 (1.0 mg/kg) were found above background; however, both selenium and thallium were found in the blanks.

4.3.2 Organic Analysis

4.3.2.1 Volatile Organic Analysis

The complete data for the volatile organic analysis are presented in Table A.4. Concentrations of methylene chloride were detected in two borings, SB13-7 (34 μ g/kg) and SB14-3 (76 μ g/kg). Methylene chloride was also detected in the blank associated with the samples from SB14-3. Acetone was detected in the sample from SB14-3 at a concentration of 30 μ g/kg. The presence of both methylene chloride and acetone can most likely be

attributed to analytical laboratory contamination. No other volatile organic compounds (VOCs) were detected in any samples collected in this area.

4.3.2.2 Semivolatile Organic Analysis

Seven soil samples were analyzed for semivolatile organic compounds. A complete list of the data is presented in Table A.5. Di-n-butylphthalate and bis(2-ethylhexyl) phthalate were detected in the sample from SB7-4; however, these two compounds were also detected in the associated blank. These two compounds are common laboratory contaminants.

Naphthalene, 2-methylnaphthalene, acenaphthylene, dibenzofuran, fluorene, phenanthrene, anthracene, carbazole, fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene were all detected in the sample from SB16-2. These compounds were at concentrations below the method detection limit for that sample and have a high degree of uncertainty associated with them. Some were estimated because of the presence of interferences.

On the basis of the location of this boring and the types of contaminants found in the soil samples, the source of contamination for SB16-2 is probably the Building 108 Liquid Retention Pond located directly south of this boring. These compounds are associated with coal and coal tar and have low solubilities. Because of this low solubility, it is very unlikely that these compounds will migrate far from the source area. The extent of these contaminants cannot be determined on the basis of these data. It is recommended that additional samples be collected in this area and from different depths.

4.3.2.3 PCB/Pesticide Analysis

PCB/pesticide analyses were performed on all samples collected from the Lime Sludge Pond area. A complete listing of the results is presented in Table A.6. No PCBs or pesticides were detected in any samples collected from this area.

4.4 BUILDING 108 LIQUID RETENTION POND

4.4.1 Inorganic Analysis

Five samples were taken from borings that were made around the Building 108 Liquid Retention Pond (Figure 6). The sample depths ranged from 2 to 6 ft. The samples were analyzed for total metals, and the data were validated. Three samples, SB4-2, SB17-2, and SB18-2, were analyzed by using the t-test statistical method, and the results are presented in Table A.2. The inorganic data from the borings in this area are summarized in Table A.7.

Calcium, magnesium, and sodium were above background levels in all the samples collected from around the Building 108 Liquid Retention Pond and thus failed the t-test in the three borings. Calcium concentrations ranged from 45,600 mg/kg in SB17-2 to 97,900 mg/kg in SB6-6. Magnesium concentrations ranged from 26,200 mg/kg in SB4-2 to 57,400 mg/kg in SB6-6. Because this pond received rinse water from the water treatment plant, it is highly possible that the calcium and magnesium came from there. Sodium concentrations ranged from 189 mg/kg in SB17-2 to 230 mg/kg in both SB4-2 and SB6-6; however, sodium was also found in the field blanks for all samples.

Cadmium was above background in SB4-2, SB17-2, and SB18-2 at concentrations of 0.96, 0.77, and 1.1 mg/kg, respectively. These samples failed the t-test and were above the average background concentration of 0.25 mg/kg. Cadmium was also found in the blank associated with the samples from SB4-2 and SB17-2.

Zinc was found in SB4-2 (84.2 mg/kg), which failed the t-test. However, even though this sample failed the t-test, the value still falls within the background range for zinc found on the ANL site of 37.7 to 111 mg/kg.

4.4.2 Organic Analysis

4.4.2.1 Volatile Organic Analysis

The complete data for the volatile organic analysis are presented in Table A.8. Concentrations of methylene chloride were detected in one boring, SB18-2 (42 µg/kg). Methylene chloride was also detected in the blank associated with this sample. Acetone was detected in the samples from SB6-6 (42 µg/kg) and SB18-2 (4.0 µg/kg). The concentration of acetone detected in SB18-2 was below the method detection limit. The presence of both methylene chloride and acetone in these low concentrations can most likely be attributed to analytical laboratory contamination.

Concentrations of 2-butanone (7.0 µg/kg), tetrachloroethene (11.0 µg/kg), and toluene (6.0 µg/kg) were detected in the soil sample from SB6-6. These concentrations are all below the method detection limit for these compounds, and tetrachloroethene and toluene were also detected in the blank associated with this sample. No other VOCs were detected in any samples collected in this area.

4.4.2.2 Semivolatile Organic Analysis

Five soil samples were analyzed for semivolatile organic compounds. A complete list of the data is presented in Table A.9. Naphthalene, 2-methylnaphthalene, acenaphthylene, dibenzofuran, fluorene, phenanthrene, anthracene, carbazole, fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene were all detected in the samples from SB5-4, SB6-6, SB17-2, and SB18-2.

These compounds were at concentrations below the method detection limit for the samples and have a high degree of uncertainty associated with them. All these compounds are associated with coal and coal tars and have low solubilities. It is very unlikely that these compounds will migrate far from the source area. It is difficult to determine the exact extent of these contaminants from these data; however, on the basis of semivolatile data from the Lime Sludge Pond, this contamination has extended north to SB16-2. The sample from SB16-2 had the same contaminants. The migration of these contaminants could be a result of pond overflow and normal runoff after heavy storms. It is difficult to determine the migration pathways on the basis of one shallow boring.

Before 1990, the Building 108 Liquid Retention Pond was unlined and received liquid from a number of sources including the Coal Yard. It is very likely that the underlying soils were contaminated during the 40 years this pond was unlined and in service. It is recommended that this area be investigated further to determine the extent of this contamination. It is recommended that two borings, 15 to 20 ft deep, be drilled adjacent to the berm area of the pond to investigate vertical migration of contaminants. These borings should be placed laterally and downgradient of the pond.

4.4.2.3 PCB/Pesticide Analysis

PCB/pesticide analyses were performed on all samples collected from the Building 108 Liquid Retention Pond area. A complete listing of the results is presented in Table A.10. Aroclor-1260 was detected in samples collected from SB17-2 (220 µg/kg) and SB18-2 (200 µg/kg). These reported values have a quantitative difference of more than 20% between two gas chromatography columns and should not be used as an accurate value. These concentrations exceed the EPA's Subpart S cleanup standards for PCBs of 90 µg/kg. No other PCBs were detected in the samples from this area.

The pesticide 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDE) was found in sample SB17-2 (10 µg/kg); 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD) was also found in SB17-2 (13 µg/kg), and 4,4'-dichlorodiphenyldichloroethene (4,4'-DDT) was found in SB5-4 (7.2 µg/kg) and SB17-2 (8.5 µg/kg). Endrin ketone was detected in samples from SB5-4 (6.4 µg/kg), SB6-6 (15 µg/kg), and SB17-2 (29 µg/kg). Gamma-chlordane was detected in SB4-2 (2.2 µg/kg), SB17-2 (3.5 µg/kg), and SB18-2 (3.9 µg/kg). All but one compound were below the method detection limit. Therefore, the data have a high degree of uncertainty and should not be considered accurate.

4.5 COAL YARD

4.5.1 Inorganic Analysis

Ten samples were collected with an auger from borings that were made around the Coal Yard area (Figure 6). The sample depths ranged from 2 to 7 ft. The samples were

analyzed for total metals, and the data were validated. Four samples, SB24-3, SB27-3, SB28-2, and SB29-2, were analyzed by using the t-test statistical method, and the results are presented in Table A.2. The inorganic data from all the borings are summarized in Table A.11.

Arsenic was found in SB24-3 (16.1 mg/kg) and SB27-3 (30.7 mg/kg), and both failed the t-test. Even though SB24-3 failed the t-test, the value still falls within the background range for arsenic found on ANL of 8.4 to 17.1 mg/kg.

Barium was found in SB28-2 (112 mg/kg) and failed the t-test. The value was reported as found below the method detection limit and was estimated because of the presence of interferences. Even though SB28-2 failed the t-test, the value still falls within the background range for barium found on ANL of 47.6 to 172 mg/kg.

Beryllium was found in SB29-2 (1.4 mg/kg) and failed the t-test. The value was reported as below the method detection limit. Even though this value failed the t-test, it still falls within the background range for beryllium found on ANL of 0.79 to 1.9 mg/kg.

Cadmium was above background in SB27-3, SB28-2, and SB29-2 at concentrations of 0.77, 1.0, and 2.5 mg/kg, respectively. These samples failed the t-test and were above the average background concentration of 0.25 mg/kg. Cadmium was also found in the blank associated with the samples from SB27-3 and SB28-2.

Calcium, magnesium, and sodium were detected above the background samples in SB28-2 and thus failed the t-test. The calcium concentration was 40,500 mg/kg; the magnesium concentration was 23,200 mg/kg; and the sodium concentration was 225 mg/kg. Sodium was found above background in SB29-2 at a level of 327 mg/kg. Sodium was also found in the field blanks associated with these two samples.

Copper (41.7 mg/kg), iron (39,900 mg/kg), lead (43.8 mg/kg), selenium (0.72 mg/kg), thallium (0.97 mg/kg), and zinc (110 mg/kg) were all detected in the sample collected from SB27-3. These all failed the t-test; however, the copper and thallium values were within the background range for these metals at ANL (copper: 10.5 to 45.5 mg/kg and thallium: 0.62 to 1.4 mg/kg). Zinc (283 mg/kg) was also detected in the sample collected from SB29-2.

These metals are all associated with coal and are probably a result of leaching of the coal over the years that it has been stockpiled in this area. It is recommended that this area be further investigated to determine the extent to which these metals have migrated. Because of the geology of this area, the metals would not migrate far from the source area; the clays found in this area would retard the migration of these metals. These metals are not a significant concern for migration in the area.

Two surface water samples were collected from the west side of the Coal Yard (Figure 6) and analyzed for inorganic compounds. The inorganic data are summarized in Table A.12. Aluminum, calcium, magnesium, manganese, nickel, and sodium were all detected in both surface water samples. These elements were detected at the following

concentrations for SW1 and SW2, respectively: aluminum at 3,210 and 5,320 µg/L; calcium at 365,000 and 217,000 µg/L; magnesium at 136,000 and 94,600 µg/L; manganese at 958 and 1,130 µg/L; nickel at 71.8 and 131 µg/L; and sodium at 25,300 and 13,800 µg/L.

4.5.2 Organic Analysis

4.5.2.1 Volatile Organic Analysis

The complete volatile organic analysis data for this area are presented in Table A.13. Acetone was detected in 8 of the 10 samples collected from this area. The concentrations ranged from 5 µg/kg in SB19-7 to 73 µg/kg in SB25-5.

2-Butanone was detected in three samples: SB25-5 (12 µg/kg), SB27-3 (10 µg/kg), and SB28-2 (6 µg/kg). Carbon disulfide was detected in the sample from SB27-3 (3 µg/kg). These two compounds were at concentrations below the method detection limit for those samples. The exact source of these two compounds cannot be determined; however, both compounds are found in tires, and this area is underlain by shredded tires. No other VOCs were detected in any samples collected in this area.

Two surface water samples were collected from the west side of the Coal Yard (Figure 6) and analyzed for volatile organic compounds. The volatile organic data are summarized in Table A.14. No volatile organic compounds were detected in the surface water samples.

4.5.2.2 Semivolatile Organic Analysis

Ten soil samples were analyzed for semivolatile organic compounds in the Coal Yard area. A complete list of the data is presented in Table A.15. The following compounds were detected in all the borings except SB26-4: 2,4-dimethylphenol, naphthalene, 2-methylnaphthalene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz(a)anthracene, chrysene, bis(2-ethylhexyl)phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene. These compounds were at concentrations below the method detection limit for those samples, and all have a high degree of uncertainty associated with them. SB26-4 had no detectable compounds.

Samples taken from SB28-2 indicated the presence of phenanthrene (1,600 µg/kg), fluoranthene (370 µg/kg), and pyrene (610 µg/kg). Samples taken from SB29-2 indicated the presence of 2-methylnaphthalene (2,300 µg/kg) and acenaphthene (540 µg/kg).

All the compounds mentioned above are associated with coal and coal tars and have low solubilities. It is very unlikely that these compounds will migrate far from the source area. It is difficult to determine the exact extent of these contaminants from these data. It is very likely that the underlying soils were contaminated during the more than 40 years the

Coal Yard has been in service. Contaminants found in the berm east of the Coal Yard are probably a result of the periodic scraping and moving of Coal Yard soil to build up the berm. It is recommended that this area be further investigated to determine the extent of this contamination.

Two surface water samples were collected from the west side of the Coal Yard (Figure 6) and analyzed for semivolatile organic compounds. The semivolatile organic data are summarized in Table A.16. No semivolatile organic compounds were detected in the surface water samples.

4.5.2.3 PCB/Pesticide Analysis

PCB/pesticide analyses were performed on all samples collected from the Coal Yard area. A complete listing of the results is presented in Table A.17. Aroclor-1260 was detected in the sample collected from SB19-7 (59 µg/kg). This compound was at a concentration below the method detection limit for the sample and has a high degree of uncertainty associated with it. It also has a quantitative difference of more than 20% between two gas chromatography columns. This concentration does not exceed the EPA's Subpart S cleanup standards for PCBs of 90 µg/kg. No other PCBs were detected in the samples from this area.

The pesticides 4,4'-DDE (56 µg/kg) and 4,4'-DDD (23 µg/kg) were found in SB21-6. Endrin ketone was detected in the sample from SB24-3 (11 µg/kg), SB28-2 (21 µg/kg), and SB29-2 (150 µg/kg). These compounds were at concentrations below the method detection limit for those samples, and all have a high degree of uncertainty associated with them.

Two surface water samples were collected from the west side of the Coal Yard (Figure 6) and analyzed for pesticides and PCBs. The pesticide and PCB data are summarized in Table A.18. No pesticides or PCBs were detected in the surface water samples.

4.6 EAST AREA BURN PIT

4.6.1 Inorganic Analysis

The seven samples collected in the East Area Burn Pit area were analyzed for metals (Figure 6). The validated analytical results are summarized in Table A.19. A t-test statistical analysis of the data from SB11-3, SB30-3, SB31-3, and SB32-1 is provided in Table A.2.

Antimony and selenium were not detected in any of the samples, including the background sample. Mercury was detected at or above background in three samples, with a maximum concentration of 3.9 mg/kg in SB31-3 and SB32-1. These two samples also failed the t-test analysis. The reported values, however, were present below the method detection limit for this compound and have a high degree of uncertainty associated with them. The

maximum arsenic concentration was found below the method detection limit in SB11-3 at 65.9 mg/kg. This metal also failed the t-test analysis.

Silver was detected in five samples ranging in concentration from 0.79 to 17.4 mg/kg. Silver failed the t-test analysis in SB30-3, SB31-3, and SB32-1. All of these values were present below the method detection limit for this compound, and the spiked sample recovery was not within the control limits.

All of the samples had concentrations exceeding background for arsenic, barium, chromium, copper, lead, nickel, silver, and zinc. The highest concentrations of these contaminants were contained in SB33-4 (29.8, 273, 40.4, 923, 262, 79.6, 17.4, and 1,050 mg/kg, respectively). Most values for copper, lead, silver, and zinc were present below the method detection limits. The value for zinc was also qualified as estimated concentration because of interference.

4.6.2 Organic Analysis

4.6.2.1 Volatile Organic Analysis

Complete data for volatile organic compounds are presented in Table A.20. Concentrations below the method detection limit for 1,2-dichloropropane (8.0 µg/kg) and toluene (18.0 µg/kg) were contained in background samples. None of the samples contained toluene in concentrations exceeding background.

Methylene chloride was detected in two samples, with a maximum of 11.0 µg/kg (SB30-3). Both values were below the method detection limits for those samples. Acetone was present in three samples, with a maximum of 20.0 µg/kg in SB32-1. The presence of both methylene chloride and acetone can most likely be attributed to analytical laboratory contamination. Tetrachloroethene was found in five samples; four of those samples were values below the method detection limit. The highest concentration of tetrachloroethene was present in SB9-4 at 15 µg/kg. No other VOCs were detected in any samples collected in this area.

4.6.2.2 Semivolatile Organic Analysis

Complete data for semivolatile organic compounds are contained in Table A.21. Di-n-butylphthalate was present in the background sample at 170.0 µg/kg. Anthracene, di-n-butylphthalate, and dibenz(a,h)anthracene were found above background concentrations in one sample. Phenanthrene, fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene were detected only in SB15-7 and SB32-1. Bis(2-ethylhexyl)phthalate was present in five samples, with a maximum concentration of 740.0 µg/kg in SB32-1, found below the method detection limit for that compound.

All the compounds mentioned above, except for di-n-butylphthalate, are associated with coal and coal tars and have low solubilities. It is very likely that these compounds migrated to this area as windblown dust and particles from the Coal Yard. The exact extent of these contaminants is difficult to determine from these data. It is recommended that this area be further investigated to determine the extent of this contamination.

4.6.2.3 PCB/Pesticide Analysis

Analyses for PCBs and pesticides from the East Area Burn Pit area are provided in Table A.22. The only compound detected in the background sample was 4,4'-DDD at a concentration of 11.0 µg/kg. This concentration was below the method detection limit for that compound. One sample, SB9-4, contained 4,4'-DDE (21.0 µg/kg) and 4,4'-DDT (35.0 µg/kg), both in concentrations below the method detection limits.

Aroclor-1254 was present in SB33-4 at a concentration below the method detection limit. Aroclor-1260 was present in six samples, with a maximum in SB15-7 (1,500.0 µg/kg). This sample was given a qualifier (J), which indicates a QA/QC deficiency, and exceeds the EPA's Subpart S cleanup standard of 90 µg/kg. Endrine ketone was found in two samples. The maximum concentration of 22.0 µg/kg in SB9-4 was below the method detection limit, and the quantitative difference between columns exceeded 20%.

4.7 EASTERN PERIMETER AREA

4.7.1 Inorganic Analysis

Three samples were taken from borings that were made in the Eastern Perimeter Area (Figure 6). The sample depth for all three samples was 2 ft. The samples were analyzed for total metals, and the data were validated. All three samples were analyzed by using the t-test statistical method, and the results are presented in Table A.2. The inorganic data from these borings are summarized in Table A.23.

Barium, copper, iron, and sodium were detected above the background samples and thus failed the t-test in SB2-2. Even though barium, copper, and iron failed the t-test, all values were within the background concentration ranges presented in Table A.1. The sodium concentration (145 mg/kg) in this boring was below the method detection limit, and sodium was also found in the field blank.

Lead was above background in SB3-2 at a concentration of 50.7 mg/kg; however, this level is within the normal concentration range for lead (15 to 70 mg/kg) in the state of Illinois. Arsenic (28.2 mg/kg) also failed the t-test and was outside the background range. Copper (54.4 mg/kg) and zinc (179 mg/kg) also failed the t-test for this sample, but both values were below the method detection limit and these values have a high degree of uncertainty associated with them. Iron (52,100 mg/kg) failed the t-test and was outside the normal background range.

4.7.2 Organic Analysis

4.7.2.1 Volatile Organic Analysis

The complete data for the volatile organic analysis are presented in Table A.24. Acetone was detected in the sample from SB3-2 (120 µg/kg) and SB1-2 (2 µg/kg). The presence of acetone may be attributed to analytical laboratory contamination. Carbon disulfide was detected in SB3-2 at a concentration of 1 µg/kg. This value was below the method detection limit and has a high degree of uncertainty associated with it. 2-butanone was also detected in SB3-2 at a concentration of 350 µg/kg. This value was estimated because of the presence of interferences. No other VOCs were detected in any samples collected in this area.

4.7.2.2 Semivolatile Organic Analysis

The complete data for the semivolatile organic analysis are presented in Table A.25. No semivolatile organic compounds were detected in the samples collected in this area.

4.7.2.3 PCB/Pesticide Analysis

Analyses for PCBs and pesticides from the Eastern Perimeter Area are provided in Table A.26. Only one pesticide was identified in the samples from this area. Methoxychlor was reported in SB3-2 (72 µg/kg). This reported value has a quantitative difference of more than 20% between two gas chromatography columns and should not be used as an accurate value. No other pesticides or PCBs were detected in the samples collected in this area.

5 CONCLUSIONS

The soils and groundwater of the 100 Area have not been fully characterized to determine the in-situ geochemical processes that affect contaminant migration. Precipitation/dissolution and adsorption/desorption reactions control contaminant migration of inorganic and organic solutes in soil and groundwater. These processes affect the mobility of heavy metals and organic compounds that have been released from the source areas. Data need to be collected to characterize the soil/rock chemistry at the site. These data are needed to establish the dominant processes occurring and to explain observed trends, such as semivolatile contamination in SB16-2.

To fully understand the processes that control the migration of contaminants at the site, the following data must be collected:

- Mineralogy of major minerals and clays within the soils and underlying aquifer,
- pH of the soils,
- Total clay fraction of the soils,
- Cation exchange capacity of the soils and aquifer material, and
- Exchangeable cations of the soils and aquifer material.

These data are required to help develop a conceptual model of the site to determine how the soil/water system interacts with the contaminants to produce the observed soil composition.

5.1 LIME SLUDGE POND

The Lime Sludge Pond is a surface impoundment that consists of an unlined earthen lagoon approximately 5.0 to 7.0 acres in size (the size has fluctuated over the years depending on discharge and precipitation rates). This pond was used as a repository for the lime sludge generated by the lime-soda ash softening system for potable water at the water treatment plant.

The sludge deposited into this pond consists mainly of calcium and magnesium carbonate and aluminum sulfate. Although the lime used in the water treatment process can contain metals and other substances, analysis of the sludge has revealed only trace amounts of such materials. The substances contained in the lime sludge are not toxic at the concentrations found, and the sludge appears to be fairly well contained; however, some potential does exist for contamination of adjacent soil and water. A potential pathway is the overflow of water and suspended and dissolved solids from the Lime Sludge Pond during heavy precipitation events.

Data analysis indicates that calcium, magnesium, and sodium are all above background levels in the samples taken from the berm area around the pond. This is not unexpected because the pond has overflowed in the past, carrying with it those inorganic elements. Lead was found above ANL background in one sample; however, it is within normal range for lead in the state of Illinois.

Methylene chloride and acetone were detected in very low concentrations in the two soil samples. Methylene chloride was also detected in one blank. The presence of these two VOCs can most likely be attributed to laboratory contamination.

The only semivolatile compounds detected were in the sample from SB16-2. On the basis of the location of this boring, the source of this contamination is probably the Building 108 Liquid Retention Pond located directly south of this boring. These compounds are associated with coal and coal tar and have low solubilities. Because of this low solubility, it is very unlikely that these compounds will migrate far from the source area. It is impossible to determine the extent or the migration pathways of these contaminants from these data. It is recommended that additional samples be collected in areas between the Sludge Pond and the Building 108 Liquid Retention Pond and from different depths to determine the extent of the contamination. These additional data will help in determining the possible migration pathways.

No PCBs or pesticides were detected in any samples collected from this area. On the basis of these results, it is not necessary to analyze additional samples for PCBs or pesticides.

The IEPA has designated the Lime Sludge Pond for no further action (IEPA 1993). Therefore, no action is recommended.

5.2 BUILDING 108 LIQUID RETENTION POND

The Building 108 Liquid Retention Pond was originally an unlined pond approximately 110 yd long by 40 yd wide. The pond was built in the early 1950s and used until May 1990 to collect water released from the boiler house (consisting of cooling water used during the combustion process, boiler blowdown water, and boiler scrubber effluent); rinse water from the water treatment plant; and runoff from the coal storage pile (DOE 1990).

The pond was dredged in May 1990 and was then enlarged and double-lined for future use as a treatment facility for boiler house discharge water and runoff water from the coal pile. The water is sent to the Sanitary Wastewater Treatment Plant for treatment.

Before dredging and removal activities were initiated, the sludge contained in the retention pond was analyzed. The results of this analysis indicated that the sludge was nonhazardous and thus could be disposed of as Special Waste in the 800 Area Landfill. It contained low levels of metals, including arsenic (2.3 ppm), barium (46.1 ppm), chromium

(6.94 ppm), and lead (16.4 ppm); volatile organic compounds; and other organic compounds. It was also highly alkaline, with a pH of 11.78 (IT Corporation 1990).

Specific analysis of the runoff from the coal pile has not been conducted. Potential contaminants include metals, organic and inorganic compounds, PCBs, and suspended solids. In addition, the coal pile runoff is likely to be acidic.

The potential pathways for contaminants to impact surface soil and groundwater include leaks and overflowing conditions. This is especially true in years before dredging was initiated because sedimentation in the pond from about 40 years of operation would have reduced the pond's capacity. Also, the absence of a liner in the original retention pond could have caused contamination of underlying soil layers. Infiltration of contaminants from leaks and overflow of contaminants into the underlying soils and groundwater is possible; however, the relatively low permeability of the soils underlying this part of the Laboratory would limit migration of contaminants in the soil. Further investigation of this area is recommended to determine the extent of contamination of underlying and surrounding soil.

Data analysis indicates that calcium, magnesium, and sodium are all above background levels in the samples taken from the area east of the pond. Cadmium was found above ANL background levels in three samples; however, it is also detected in the blank.

Methylene chloride and acetone were detected in very low concentrations. Methylene chloride was also detected in one of the blanks. The presence of these two VOCs can most likely be attributed to laboratory contamination.

Semivolatile organic compounds were detected in four samples from this area and in SB16-2. The source of this contamination is probably the Building 108 Liquid Retention Pond and possibly the Coal Yard, which are located directly adjacent to these borings. These compounds are associated with coal and coal tar and have low solubilities. Because of this low solubility, it is very unlikely that these compounds will migrate far from the source area. From these data, it is impossible to determine the extent of these contaminants or the migration pathways. The migration of these contaminants could be a result of pond overflow and normal runoff after heavy storms. It is difficult to determine the migration pathways from one shallow boring. It is recommended that additional samples be collected in this area and from different depths to determine the extent of the contamination. It is recommended that two borings, 15 to 20 ft in depth, be drilled adjacent to the berm area of the pond to investigate vertical migration of contaminants. These borings should be located laterally and downgradient of the pond.

Very low concentrations of pesticides were detected in the samples collected near the retention pond; however, all but one compound were below the method detection limit. Thus, the data have a high degree of uncertainty and should not be considered accurate. Aroclor-1260 was detected in two samples, but the reported values have a quantitative difference of more than 20% between two gas chromatography columns and should not be used as accurate values. On the basis of these results, it is not necessary to analyze additional samples for PCBs or pesticides.

5.3 COAL YARD

A large pile of high-sulfur coal was stockpiled in the 100 Area until January 1994, when the last of this coal was burned. To address this concern, runoff was collected and transported to the Sanitary Wastewater Treatment Plant. However, an emergency overflow discharge pipe directed high volumes of runoff that occurred during times of heavy rain and rapid snowmelt directly to Sawmill Creek only 100 ft away (Golchert and Kolzow 1993).

Arsenic, barium, beryllium, cadmium, copper, iron, lead, selenium, and zinc were all detected in one or more of the soil samples analyzed from the Coal Yard area. These metals are all associated with coal and are probably a result of leaching of the coal over the years that it has been stockpiled in this area. Because of the geology of this area, these metals should not migrate far from the source area. The clays found in this area would retard the migration of these metals. It is recommended that this area be further investigated to determine the extent that these metals have migrated.

Acetone, 2-butanone, and carbon disulfide were found in very low concentrations in a few samples collected from the Coal Yard area. The acetone is quite possibly the result of laboratory contamination. The 2-butanone and carbon disulfide were at concentrations below the method detection limit for those samples. The exact source of these two compounds cannot be determined; however, these two compounds are found in tires and this area is underlain by shredded tires. On the basis of these results, it is not necessary to analyze additional samples for VOCs.

The following semivolatile organic compounds were detected in all the borings except SB26-4: 2,4 dimethylphenol, naphthalene, 2-methylnaphthalene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz(a)anthracene, chrysene, bis(2-ethylhexyl)phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene. These compounds were at concentrations below the method detection limit for those samples, and all have a high degree of uncertainty associated with them. SB26-4 had no detectable compounds.

All the compounds mentioned above are associated with coal and coal tars and have low solubilities. Because of these low solubilities, it is very unlikely that these compounds will migrate far from the source area. It is difficult to determine the exact extent of these contaminants from the uncertainty associated with this data. It is very likely that the underlying soils were contaminated during the 40 years the Coal Yard pond has been in service. Contaminants found in the berm area are probably a result of the periodic scraping and moving of Coal Yard soil to build up the berm. It is recommended that the Coal Yard be further investigated to determine the extent of semivolatile contamination.

Very low concentrations of pesticides were detected in the samples collected around the Coal Yard; however, all compounds were below the method detection limit. Therefore, the data have a high degree of uncertainty and should not be considered accurate. Aroclor-1260 was detected in one sample, but the reported value has a quantitative difference of more than 20% between two gas chromatography columns and should not be used as an

accurate value. This concentration does not exceed the EPA's Subpart S cleanup standards for PCBs of 90 $\mu\text{g/kg}$. No other PCBs were detected in the samples from this area. On the basis of these results, it is not necessary to analyze additional samples for PCBs or pesticides.

5.4 EAST AREA BURN PIT

The East Area Burn Pit was a belowgrade structure, with steel rails used in the floor and walls. The burn pit operated from the late 1940s until the late 1960s, when it was decommissioned. No records of waste disposal in this area are available. According to information from employees, the burn pit received combustible wastes from garbage trucks and other vehicles. Paper products and combustible chemical wastes such as oils and solvents were burned. The trash burn pit also received waste from Site A (Novak and Owen 1951). After waste was deposited in the burn pit, it was ignited and allowed to burn. Noncombustibles and ash that remained were then removed from the pit and taken to the 319 Area Landfill.

Because of the proximity of Sawmill Creek, contaminated surface soils near the burn pit could have entered the creek during rainstorms or flooding. Because the pit was belowgrade, the potential for subsurface contamination also exists. Subsurface soil in the area of the burn pit could also have been contaminated as a result of contaminant migration from the pit into the surrounding soil. Subsurface contaminant migration away from this area is probably limited by the low hydraulic conductivity of the soil in the East Area.

All the samples had concentrations exceeding background for arsenic, barium, chromium, copper, lead, nickel, and zinc. Values for copper, lead, silver, and zinc were present below the method detection limits. The value for zinc was also qualified as an estimated concentration because of interference.

Several VOCs were present in the samples collected in and around the burn pit area. Most of these compounds were present below the method detection limit for those samples and have a high degree of uncertainty associated with them.

Di-n-butylphthalate was present in the background sample at 170.0 $\mu\text{g/kg}$. Anthracene, di-n-butylphthalate, and dibenz(a,h)anthracene were found above background concentrations in one sample. Phenanthrene, fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene were detected only in SB15-7 and SB32-1. Bis(2-ethylhexyl)phthalate was present in five samples with a maximum concentration of 740.0 $\mu\text{g/kg}$ in SB32-1, found below the method detection limit for that compound.

All the compounds mentioned above, except for di-n-butylphthalate, are associated with coal and coal tars and have low solubilities. It is very likely that these compounds migrated to this area as windblown dust and particles from the Coal Yard over the years when the pit was active. It is difficult to determine the exact extent of these contaminants or the migration pathways because of the uncertainty associated with these data. It is

recommended that additional samples be collected in this area and from different depths to determine the extent of the contamination and to investigate possible pathways.

Very low concentrations of pesticides were detected in the samples collected around the burn pit; however, all compounds were below the method detection limit. Therefore, the data have a high degree of uncertainty and should not be considered accurate.

Aroclor-1254 was detected in one sample, but the reported value was below the method detection limit. Aroclor-1260 was present in six samples, but all were below the method detection limit. No other PCBs were detected in the samples from this area. On the basis of these results and the possibility that oils could have been used to ignite the fires, it is necessary to analyze any additional samples for PCBs.

Because of the history of the site, it is highly recommended that all additional samples collected from the burn pit area also be analyzed for radionuclides, including alpha, beta, and gamma scans. Because the exact location of the East Area Burn Pit has not been identified, it is recommended that an electromagnetic survey be conducted to delineate the subsurface.

5.5 EASTERN PERIMETER AREA

The Eastern Perimeter Area was selected for sampling to provide an indication of ambient concentrations of contaminants present in this portion of the 100 Area. The sampling locations are upgradient or equigradient with other sample areas. Therefore, the samples provide a qualitative basis for determining the presence of contaminant sources with the potential to impact the 100 Area. Because the Eastern Perimeter Area is removed from areas of activity, it was not expected to contain any elevated concentrations of contaminants.

Barium, copper, iron, and sodium were detected above the background samples and thus failed the t-test in one sample. Even though barium, copper, and iron failed the t-test, all were within the background concentration ranges. The sodium concentration (145 mg/kg) in this same boring was below the method detection limit and was also found in the field blank.

Lead was above background in SB3-2 at a concentration of 50.7 mg/kg; however, this level is within the normal concentration range for lead (15 to 70 mg/kg) in the state of Illinois. Arsenic (28.2 mg/kg) also failed the t-test and was outside the background range. Copper (54.4 mg/kg) and zinc (179 mg/kg) also failed the t-test for this sample, but both values were below the method detection limit for this sample and these values have a high degree of uncertainty associated with them. Iron (52,100 mg/kg) failed the t-test and was outside the normal background range.

Acetone, 2-butanone, and carbon disulfide were found in very low concentrations in a few samples collected from this area. Acetone was detected in the sample from SB3-2 (120 µg/kg) and in SB1-2 (2 µg/kg). The presence of acetone may be attributed to analytical

laboratory contamination. Carbon disulfide was detected in SB3-2 at a concentration of 1 µg/kg. This value was below the method detection limit and has a high degree of uncertainty associated with it. 2-butanone was also detected in SB3-2 at a concentration of 350 µg/kg. This value was estimated because of the presence of interferences. The exact source of the carbon disulfide and the 2-butanone cannot be determined; however, these two compounds are found in tires and the 100 Area is underlain by shredded tires. Moreover, the Laboratory has a permit to burn tires. No other VOCs were detected in any samples collected in this area.

No semivolatile organic compounds were detected in the samples collected in this area.

Only one pesticide was identified in the samples from this area. Methoxychlor was reported in SB3-2 (72 µg/kg). This reported value has a quantitative difference of more than 20% between two gas chromatography columns and should not be used as an accurate value.

On the basis of the low concentrations of most inorganic and all organic compounds found in this area, no further investigation is necessary.

5.6 RECOMMENDATIONS FOR FURTHER INVESTIGATION

The following data should be collected to understand the processes that control contaminant migration in the 100 Area:

- Mineralogy of major minerals and clays within the soils and underlying aquifer,
- pH of the soils,
- Total clay fraction of the soils,
- Cation exchange capacity of the soils and aquifer materials, and
- Exchangeable cations of the soils and aquifer material.

Additional samples should be obtained from the vicinity of the Building 108 Liquid Retention Pond to determine the nature and extent of contamination. Further investigation of the Coal Yard is recommended to determine the extent of migration of metals and semivolatile organic compound contamination. An electromagnetic survey should be completed to identify the exact location of the East Area Burn Pit. Additional samples should be obtained from varying depths in the burn pit area to determine the extent of contamination and potential migration pathways. Samples should be analyzed for semivolatile organic compounds, PCBs, metals, and radionuclides.

6 REFERENCES

Allen, W.B., et al., 1949, *Geology and Ground-Water Hydrology of the Argonne National Laboratory Area, DuPage County, Illinois*, U.S. Geological Survey open-file report, Denver, Colo.

ANL — see Argonne National Laboratory.

Argonne National Laboratory, 1949, "Argonne National Laboratory Test Boring Data," Drawing Nos. 1449-501-TB1 through 1449-501-TB21, Argonne National Laboratory, Argonne, Ill.

Argonne National Laboratory, 1992, *Environmental Restoration and Waste Management Baselines of EM-40 Remediation and D&D Projects*, Environment and Waste Management Program, Argonne National Laboratory, Argonne, Ill.

Biang, C., et al., 1994, *Assessment of the Environmental Status of the Solid Waste Management Units at Argonne National Laboratory*, Argonne National Laboratory, prepared by the Environmental Assessment Division for the Environment and Waste Management Program, Argonne, Ill., March.

Boerngen, J.G., and H.T. Shacklette, 1981, *Chemical Analyses of Soil and Other Surficial Materials of the Conterminous United States*, U.S. Department of the Interior, Geological Survey, Open-File Report 81-197.

Bretz, J.H., 1932, "Surficial Geology of the Sag Bridge Quadrangle," Illinois State Geological Survey Division, Chicago Areal Geologic Maps, Map No. 13 - Sag Bridge, Scale 1:24,000.

DOE — see U.S. Department of Energy.

EPA — see U.S. Environmental Protection Agency.

Golchert, N.W., and R.G. Kolzow, 1993, *Argonne National Laboratory-East Site Environmental Report for Calendar Year 1993*, ANL-93/5, Argonne National Laboratory, Argonne, Ill.

Golchert, N.W., et al., 1991, *Argonne National Laboratory-East Site Environmental Report for Calendar Year 1990*, ANL-91/3, Argonne National Laboratory, Argonne, Ill.

IEPA — see Illinois Environmental Protection Agency.

Illinois Environmental Protection Agency, 1993, *RCRA Facility Assessment, Argonne National Laboratory*, Springfield, Ill., Dec.

IT Corporation, 1990, *Draft RCRA Part B Permit Application, Argonne National Laboratory, Argonne, Ill.*, Project No. 312151, prepared for Argonne National Laboratory by IT Corporation, Itasca, Ill., Nov.

Johnson, W.H., et al., 1985, *Depositional Environments and Correlation Problems of the Wedron Formation (Wisconsinan) in Northeastern Illinois*, Nineteenth Annual Meeting, North-Central Section of the Geological Society of America, Northern Illinois University, DeKalb, Ill., April 25-27.

Killey, M.M., and C.B. Trask, 1989, *Geotechnical Site Investigation 7-GeV Advanced Photon Source, Argonne National Laboratory*, Illinois State Geological Survey, Champaign-Urbana, Ill., Feb. 27.

Knowles, D.B., et al., 1963, *Ground-Water Conditions at Argonne National Laboratory, Illinois 1948-60*, U.S. Geological Survey Water-Supply Paper 1669-O, Denver, Colo.

Nelson, C.R., 1989, *Chemistry of Coal Weathering*, Elsevier, New York, N.Y.

Novak, J.R., 1949a, interoffice memo from Novak (Health Physics, Site D, Argonne National Laboratory) to J.E. Rose (Health Physics, Site B), "Weekly Report on Activities of Health Physics at Site D for the Week Ending October 7, 1949," DOE/AMEMEP Records Management Database Identifier No. EMD 920114.0142, Oct. 10.

Novak, J.R., 1949b, interoffice memo from Novak (Health Physics, Site D, Argonne National Laboratory) to J.E. Rose (Health Physics, Site B), "Weekly Report on Activities of Health Physics at Site D for Week Ending November 5, 1949," DOE/AMEMEP Records Management Database Identifier No. EMD 920114.0143, Nov. 10.

Novak, J.R., and R.K. Owen, 1951, interoffice memo from Novak and Owen (Radiological Physics, Argonne National Laboratory) to J.E. Rose (Radiological Physics), "Weekly Report of Activities at Site D for Week Ending 3-10-51," DOE/AMEMEP Records Management Database Identifier No. EMD 911001.0008, March 12.

Patton, T.L., et al., 1990a, *Hydrological Conditions at the 317/319 Area at Argonne National Laboratory*, ANL/EAIS/TM-28, Argonne National Laboratory, Argonne, Ill.

Patton, T.L., et al., 1990b, *Hydrological Conditions at the 800 Area at Argonne National Laboratory*, ANL/EAIS/TM-29, Argonne National Laboratory, Argonne, Ill.

Schletter, R.M., 1993, personal communication from Schletter (Argonne National Laboratory, Department Manager, Environment and Waste Management Program) to D.C. Parzyck (Argonne National Laboratory, Environmental, Safety and Health/Quality Assurance Oversight), "Application Permit for Land Application of Lime Sludge," Sept. 29.

Soil Testing Services, Inc., 1966, *Subsurface Investigation and Testing Results for the Proposed Argonne Advanced Research Reactor to Be Built at the Argonne National Laboratory in Lemont, Illinois*, Northbrook, Ill.

Soil Testing Services, Inc., 1988, *Subsurface Exploration and Geotechnical Engineering Evaluation for the Proposed 7-GeV Advanced Photon Source (APS) to Be Constructed at the Argonne National Laboratory, DuPage County, Illinois*, Vols. I and II, STS Consultants Ltd., Northbrook, Ill., Project #25229.

STS — see Soil Testing Services, Inc.

U.S. Department of Energy, 1988, *Environmental Survey — Preliminary Report, Argonne National Laboratory, Argonne, Illinois*, DOE/EH/OEV-17-P, prepared by Argonne National Laboratory, Argonne, Ill., for U.S. Department of Energy, Environment, Safety, and Health Office of Environmental Audit.

U.S. Department of Energy, 1990, *Site-Specific Plan for Environmental Restoration and Waste Management, Chapter III — ANL East*, U.S. Department of Energy, Chicago Operations Office, Argonne, Ill.

U.S. Environmental Protection Agency, 1990, *Test Methods for Evaluating Solid Waste*, SW-846, 3rd edition, Office of Solid Waste and Emergency Response, Washington, D.C., Dec.

U.S. Geological Survey, 1978, "USGS 7.5-Minute Series Topographic Map, Sag Bridge Quadrangle, Illinois," Denver, Colo.

USGS — see U.S. Geological Survey.

William, H.B., 1973, "Geology along the Illinois Waterway: A Basis for Environmental Planning," Circular 487, Illinois Geological Survey, Urbana, Ill.

Zeizel, A.J., et al., 1962, *Ground-Water Resources of DuPage County, Illinois*, Cooperative Ground-Water Report, Illinois State Geological Survey, Champaign-Urbana, Ill.

APPENDIX:
SUMMARY OF 100 AREA CONTAMINANTS

TABLE A.1 Background Analytical Summary and Statistics — Concentrations of Surface Soil Inorganic Elements^a

Element	Concentration (mg/kg)												U	S	S _E
	BG01	BG02	BG03	BG04	BGF04F	BG05	BG06	BG07	BG08	BG09	BG10	BG1-4 ^b			
Aluminum	14,500	18,900	15,700	16,300	23,300	12,800	15,200	22,300	14,700	17,800	24,300	2,240	16,503	5,837	1,685
Antimony	19.6	34.8	24.5	20.0	17.5	12.8	11.9	19.6	18.8	10.4	21.2	6.6UN	17.59	8.47	2.45
Arsenic	10.6	14.7	15.7	16.8	17.1	9.1	9.5	8.4	11.8	10.5	11.3	2.3B	11.48	4.19	1.21
Barium	75.8	60.8	47.6	62.6	74.1	101	172	93.6	60.9	86.0	137	6.1BE	81.46	42.59	12.29
Beryllium	0.93	1.3	1.0	1.2	1.9	0.79	1.1	1.3	0.81	0.97	1.4	0.46B	1.10	0.36	0.10
Cadmium	0.12	0.12	0.13	0.22	0.26	0.17	0.51	0.16	0.12	0.12	0.12	0.97B	0.25	0.25	0.07
Calcium	1,440	1,900	1,560	3,070	3,160	2,020	1,990	1,440	1,390	1,190	3,000	111,000*	11,096	31,469	9,084
Chromium	22.4	31.9	22.0	44.9	35.8	19.3	22.9	33.8	21.2	25.5	31.2	5.9*	26.40	9.93	2.87
Cobalt	14.6	15.2	19.2	18.5	18.7	14.6	13.5	12.4	11.2	14.2	12.4	3.5B	14.00	4.21	1.22
Copper	21.0	37.8	27.3	39.5	45.5	13.6	19.9	22.0	20.9	17.4	19.6	10.5E	24.58	10.84	3.13
Iron	24,500	34,100	29,300	32,500	39,500	19,100	24,100	28,200	22,700	23,000	28,800	10,500	26,358	7,542	2,177
Lead	22.6	26.4	27.3	29.9	32.5	26.7	29.3	24.6	36.4	26.8	23.1	12.4*	26.50	5.90	1.70
Magnesium	3,220	5,580	3,490	5,060	5,980	2,980	3,170	5,280	3,190	3,740	5,550	65,300E	9,378	17,646	5,094
Manganese	826	475	577	586	859	1170	1470	358	546	689	593	392E	711.75	327.41	94.52
Mercury	0.11	0.09	0.22	0.12	0.10	0.08	0.1	0.42	0.1	0.09	0.09	0.13	0.14	0.10	0.03
Nickel	20.8	36.0	22.0	38.0	44.3	15.2	19.8	28.9	18.0	19.3	22.7	9.3B	24.53	10.26	2.96
Potassium	1,330	2,950	1,370	2,110	3,540	1,200	1,280	3,450	1,460	2,190	1,780	496BE	1,929	952	274
Selenium	0.64	0.63	0.64	0.64	0.64	0.63	0.66	0.64	0.64	0.64	0.64	0.74UNW	0.59	0.18	0.05
Silver	0.58	0.58	0.53	0.50	0.57	0.53	0.58	0.57	0.55	0.51	0.59	0.79U	0.51	0.16	0.05
Sodium	59.1	2.5	51	45.6	59.6	23.6	41.4	58.7	41.4	55.5	57.2	319B	67.88	80.89	23.35
Thallium	0.64	0.93	0.95	1.4	1.3	0.63	0.73	0.64	0.64	0.64	0.64	0.62U	0.81	0.28	0.08
Vanadium	38.1	45.9	38.1	43.1	57.0	40.5	48.0	51.2	39.1	46.3	61.7	8.0B	43.08	13.32	3.85
Zinc	54.4	93.4	71.1	88.5	111	50.1	65.5	71.7	66.6	64.0	73.5	37.7E	70.63	19.85	5.73

^a U = Mean of Population; S = Standard Deviation; S_E = Standard Error of Mean.

^b Background Sample from East Area wastewater treatment plant assessment.

TABLE A.2 Summary of Statistical Analysis — Surface Soil Inorganic Background Concentrations Compared with Concentrations in Soil Borings in the 100 Area^a

Compound	Cleanup Objective ^b (mg/L)	SB1-2 (mg/kg)	t-stat	Pass/Fail	SB2-2 (mg/kg)	t-stat	Pass/Fail	SB3-2 (mg/kg)	t-stat	Pass/Fail
Aluminum	NS	14,700	-1.07	Pass	18,500	1.18	Pass	12,400	-2.44	Pass
Antimony	0.006	7.4UNJ	-4.16	Pass	7.6UNJ	-4.08	Pass	7.4UNJ	-4.16	Pass
Arsenic	0.05	10.9	-0.48	Pass	7.7	-3.12	Pass	28.2	13.82	Fail
Barium	2	85.0EJ	0.29	Pass	123EJ	3.38	Fail	43.1BEJ	-3.12	Pass
Beryllium	0.004	0.83B	-2.70	Pass	1.0B	-1.00	Pass	0.70B	-4.00	Pass
Cadmium	0.005	0.68U	-3.57	Pass	0.69U	-3.57	Pass	0.68U	-3.57	Pass
Calcium	TDS	2,820	-0.91	Pass	4,640	-0.71	Pass	1,500	-1.06	Pass
Chromium	0.1	18.4J	-9.20	Pass	28.3J	-9.20	Pass	16.2J	-9.20	Pass
Cobalt	1	R ^d	—	—	R	—	—	R	—	—
Copper	0.65	18.6EJ	-1.91	Pass	31.7EJ	2.27	Fail	54.4EJ	9.53	Fail
Iron	5	29,100	1.26	Pass	34,300	3.65	Fail	52,100	11.82	Fail
Lead	0.0075	19.6	-4.06	Pass	16.8	-5.71	Pass	50.7	14.24	Fail
Magnesium	TDS	3,840	-1.09	Pass	8,480	-0.18	Pass	3,050	-1.24	Pass
Manganese	0.15	588EJ	-1.31	Pass	707EJ	-0.05	Pass	470EJ	-2.56	Pass
Mercury	0.002	0.06B	-2.67	Pass	0.05B	-3.00	Pass	0.09	-1.67	Pass
Nickel	0.1	R	—	—	R	—	—	R	—	—
Potassium	TDS	751BEJ	-4.29	Pass	2,130EJ	0.73	Pass	1,110BEJ	-2.98	Pass
Selenium	0.05	0.68UNJ	-11.80	Pass	0.69UNWJ	-11.80	Pass	0.68UNJ	-11.80	Pass
Silver	0.05	0.63U	-10.20	Pass	0.65U	-10.20	Pass	0.63U	-10.20	Pass
Sodium	TDS	65.6BJ	-0.10	Pass	145BJ	3.30	Fail	51.4BJ	-0.71	Pass
Thallium	2	0.82U	-10.13	Pass	0.84U	-10.13	Pass	0.82U	-10.13	Pass
Vanadium	0.049	36.8J	-1.63	Pass	35.6J	-1.94	Pass	30.7J	-3.22	Pass
Zinc	5	45.5EJ	-4.39	Pass	62.5EJ	-1.42	Pass	179EJ	18.91	Fail

TABLE A.2 (Cont.)

Compound	Cleanup Objective ^b (mg/L)	SB4-2 (mg/kg)	t-stat	Pass/Fail	SB11-3 (mg/kg)	t-stat	Pass/Fail	SB14-3 (mg/kg)	t-stat	Pass/Fail
Aluminum	NS	10,400	-3.62	Pass	15,200	-0.77	Pass	10,400	-3.62	Pass
Antimony	0.006	7.4UNJ	-7.18	Pass	7.9UNJ	-7.18	Pass	6.8UNJ	-7.18	Pass
Arsenic	0.05	10	-1.22	Pass	65.9J	44.98	Fail	12.4NJ	0.76	Pass
Barium	2	57.5EJ	-1.95	Pass	80.3EJ	-0.09	Pass	55.9	-2.08	Pass
Beryllium	0.004	0.89B	-2.10	Pass	1.0BJ	-1.00	Pass	0.88B	-2.20	Pass
Cadmium	0.005	0.96B	10.14	Fail	1.8	22.14	Fail	0.62U	-3.57	Pass
Calcium	TDS	50,600	4.35	Fail	5,010	-0.67	Pass	81,000	7.69	Fail
Chromium	0.1	15.9J	-3.66	Pass	21.5	-1.71	Pass	20.5J	-2.06	Pass
Cobalt	1	R	—	—	15.8	1.48	Pass	9.6B	-3.61	Pass
Copper	0.65	29.5EJ	1.57	Pass	82.4EJ	18.47	Fail	26.7	0.68	Pass
Iron	5	25,000	-0.62	Pass	143,000	53.57	Fail	23,400	-1.36	Pass
Lead	0.0075	28.3	1.06	Pass	77.9	30.24	Fail	18.4	-4.76	Pass
Magnesium	TDS	26,200	3.30	Fail	4,640	-0.93	Pass	46,900	7.73	Fail
Manganese	0.15	579EJ	-1.40	Pass	1,120	4.32	Fail	470ENJ	-2.56	Pass
Mercury	0.002	0.05B	-3.00	Pass	0.09BNJ	-1.67	Pass	0.05B	-3.00	Pass
Nickel	0.1	R	—	—	57	10.97	Fail	23.9	-0.21	Pass
Potassium	TDS	1,600EJ	-1.20	Pass	2,040	0.40	Pass	1,930	0.00	Pass
Selenium	0.05	0.67UNWJ	-11.80	Pass	0.73UNWJ	-11.80	Pass	0.62UNJ	-11.80	Pass
Silver	0.05	0.62U	-10.20	Pass	0.68UJ	-10.20	Pass	0.57U	-10.20	Pass
Sodium	TDS	230BJ	6.94	Fail	50.3B	-0.75	Pass	250B	7.80	Fail
Thallium	2	0.82U	-0.89	Pass	1.2BNJ	4.88	Fail	1.0BJ	2.38	Fail
Vanadium	0.049	24.0J	-4.96	Pass	51	2.06	Fail	27.0J	-4.18	Pass
Zinc	5	84.2EJ	2.37	Fail	187	20.31	Fail	64.2EJ	-1.12	Pass

TABLE A.2 (Cont.)

Compound	Cleanup Objective ^b (mg/L)	SB16-2 (mg/kg)	t-stat	Pass/Fail	SB17-2 (mg/kg)	t-stat	Pass/Fail	SB18-2 (mg/kg)	t-stat	Pass/Fail
Aluminum	NS	5,070	-6.78	Pass	12,500	-2.38	Pass	10,200	-3.74	Pass
Antimony	0.006	6.7UNJ	-7.18	Pass	6.9UNJ	-7.18	Pass	6.9UNJ	-7.18	Pass
Arsenic	0.05	13.2NJ	1.42	Pass	9.1	-1.97	Pass	7.7	-3.12	Pass
Barium	2	39.8B	-3.39	Pass	80.6EJ	-0.07	Pass	43.5BEJ	-3.09	Pass
Beryllium	0.004	0.76B	-3.40	Pass	0.85B	-2.50	Pass	0.79B	-3.10	Pass
Cadmium	0.005	0.61U	-3.57	Pass	0.77B	7.43	Fail	1.1	12.14	Fail
Calcium	TDS	119,000	11.88	Fail	45,600	3.80	Fail	62,600	5.67	Fail
Chromium	0.1	13.1J	-4.63	Pass	20.6J	-2.02	Pass	16.3J	-3.52	Pass
Cobalt	1	4.8B	-7.54	Pass	R	—	—	R	—	—
Copper	0.65	16.9	-2.45	Pass	31.6EJ	2.24	Fail	29.6EJ	1.60	Pass
Iron	5	13,600	-5.86	Pass	27,800	0.66	Pass	26,700	0.16	Pass
Lead	0.0075	34.5	4.71	Fail	22.1	-2.59	Pass	15.2	-6.65	Pass
Magnesium	TDS	71,100	12.12	Fail	28,000	3.66	Fail	35,900	5.21	Fail
Manganese	0.15	375ENJ	-3.56	Pass	484EJ	-2.41	Pass	501EJ	-2.23	Pass
Mercury	0.002	0.04U	-4.67	Pass	0.05B	-3.00	Pass	0.05U	-3.00	Pass
Nickel	0.1	10.3	-4.81	Pass	R	—	—	R	—	—
Potassium	TDS	949B	-3.57	Pass	2,210EJ	1.02	Pass	2,130EJ	0.73	Pass
Selenium	0.05	1.0BNJ	8.20	Fail	0.63UNJ	-11.80	Pass	0.63UNWJ	-11.80	Pass
Silver	0.05	0.57U	-10.20	Pass	0.59U	-10.20	Pass	0.59U	-10.20	Pass
Sodium	TDS	226B	6.77	Fail	189BJ	5.19	Fail	211BJ	6.13	Fail
Thallium	2	0.74UWJ	-10.13	Pass	0.77US	-0.89	Pass	0.77UWJ	-0.89	Pass
Vanadium	0.049	14.8J	-7.35	Pass	27.3J	-4.10	Pass	24.1J	-4.93	Pass
Zinc	5	53.1EJ	-3.06	Pass	73.9EJ	0.57	Pass	64.7EJ	-1.03	Pass

TABLE A.2 (Cont.)

Compound	Cleanup Objective ^b (mg/L)	SB24-3 (mg/kg)	t-stat	Pass/Fail	SB27-3 (mg/kg)	t-stat	Pass/Fail	SB28-2 (mg/kg)	t-stat	Pass/Fail
Aluminum	NS	9,870	-3.94	Pass	8,790	-4.58	Pass	7,500	-5.34	Pass
Antimony	0.006	7.1UNJ	-7.18	Pass	7.0UNJ	-7.18	Pass	6.7UNJ	-7.18	Pass
Arsenic	0.05	16.1	3.82	Fail	30.7	15.88	Fail	10.7	-4.64	Pass
Barium	2	52.8EJ	-2.33	Pass	63.4EJ	-1.47	Pass	112EJ	2.48	Fail
Beryllium	0.004	0.71B	-3.90	Pass	0.62B	-4.80	Pass	0.89B	-2.10	Pass
Cadmium	0.005	0.65U	-3.57	Pass	0.77B	7.43	Fail	1.0B	10.71	Fail
Calcium	TDS	26,400	1.68	Pass	12,700	0.18	Pass	40,500	3.24	Fail
Chromium	0.1	15.6J	-3.76	Pass	14.8J	-4.04	Pass	18.1J	-2.89	Pass
Cobalt	1	R	—	—	R	—	—	R	—	—
Copper	0.65	32.5EJ	2.53	Pass	41.7EJ	5.47	Fail	25.4EJ	0.26	Pass
Iron	5	30,100	1.72	Pass	39,900	6.22	Fail	24,400	-0.90	Pass
Lead	0.0075	29.5	1.76	Pass	43.8	10.18	Fail	20.7	-3.41	Pass
Magnesium	TDS	16,500	1.40	Pass	9,310	-0.01	Pass	23,200	2.71	Fail
Manganese	0.15	692EJ	-0.21	Pass	454EJ	-2.73	Pass	436EJ	-2.92	Pass
Mercury	0.002	0.05UJ	-4.67	Pass	0.05UJ	-4.67	Pass	0.06B	-2.67	Pass
Nickel	0.1	R	—	—	R	—	—	R	—	—
Potassium	TDS	1,340EJ	-2.15	Pass	1,250EJ	-2.47	Pass	1,390EJ	-1.96	Pass
Selenium	0.05	0.65UNJ	-11.80	Pass	0.72BNWJ	2.60	Fail	0.62UNWJ	-11.80	Pass
Silver	0.05	0.60U	-10.20	Pass	0.59U	-10.20	Pass	0.57U	-10.20	Pass
Sodium	TDS	97.9BJ	1.29	Pass	81.1BJ	0.57	Pass	225BJ	6.73	Fail
Thallium	2	0.78U	-10.13	Pass	0.97B	2.00	Fail	0.75U	-10.13	Pass
Vanadium	0.049	25.9J	-4.46	Pass	25.5J	-4.57	Pass	22.0J	-5.48	Pass
Zinc	5	68.1EJ	-0.44	Pass	110EJ	6.87	Fail	55.2EJ	-2.69	Pass

TABLE A.2 (Cont.)

Compound	Cleanup Objective ^b (mg/L)	SB29-2 (mg/kg)	t-stat	Pass/Fail	SB30-3 (mg/kg)	t-stat	Pass/Fail	SB31-3 (mg/kg)	t-stat	Pass/Fail
Aluminum	NS	3,840	-7.51	Pass	11,300	-3.09	Pass	15,600	-0.54	Pass
Antimony	0.006	7.4UNJ	-7.18	Pass	7.4UNJ	-7.18	Pass	7.4UNJ	-7.18	Pass
Arsenic	0.05	7.2NJ	-3.54	Pass	27.7NJ	13.40	Fail	12.9NJ	1.17	Pass
Barium	2	35.8B	-3.72	Pass	64.3	-1.40	Pass	157	6.15	Fail
Beryllium	0.004	1.4J	3.00	Fail	0.80BJ	-3.00	Pass	0.87BJ	-2.30	Pass
Cadmium	0.005	2.5J	32.14	Fail	3.1J	40.71	Fail	4.3J	57.86	Fail
Calcium	TDS	15,200	0.45	Pass	39,000	3.07	Fail	16,900	0.64	Pass
Chromium	0.1	9.8J	-5.78	Pass	16.2	-3.55	Pass	29.6	1.11	Pass
Cobalt	1	5.0B	-7.38	Pass	10.8B	-2.62	Pass	12.2	-1.48	Pass
Copper	0.65	15.7NJ	-2.84	Pass	58.5NJ	10.84	Fail	792NJ	245.18	Fail
Iron	5	19,500EJ	-3.15	Pass	88,000EJ	28.31	Fail	29,100EJ	1.26	Pass
Lead	0.0075	25.4J	-0.65	Pass	61.5NJ	20.59	Fail	129NJ	60.29	Fail
Magnesium	TDS	8,720	-0.13	Pass	24,900	3.05	Fail	11,600	0.44	Pass
Manganese	0.15	276J	-4.61	Pass	659J	-0.56	Pass	663J	-0.52	Pass
Mercury	0.002	0.05UJ	-4.67	Pass	0.05UJ	-4.67	Pass	3.9J	125.33	Fail
Nickel	0.1	18.8	-1.94	Pass	33.2	2.93	Fail	45.1	6.95	Fail
Potassium	TDS	556BEJ	-4.98	Pass	1,360EJ	-2.07	Pass	1,350EJ	-2.11	Pass
Selenium	0.05	0.68UNJ	-11.80	Pass	0.68UNWJ	-11.80	Pass	0.67UNWJ	-11.80	Pass
Silver	0.05	0.70BNJ	3.80	Fail	0.79BNJ	5.60	Fail	5.7NJ	103.80	Fail
Sodium	TDS	327B	11.10	Fail	120B	2.23	Fail	152B	3.60	Fail
Thallium	2	0.82UW	-10.13	Pass	0.82UBWJ	-10.13	Pass	0.82U	-10.13	Pass
Vanadium	0.049	18	-6.51	Pass	32.5	-2.75	Pass	37.6	-1.42	Pass
Zinc	5	283EJ	37.06	Fail	131EJ	10.54	Fail	356EJ	49.80	Fail

TABLE A.2 (Cont.)

Compound	Cleanup Objective ^b (mg/L)	SB32-1 (mg/kg)	t-stat	Pass/Fail
Aluminum	NS	9,380	-4.23	Pass
Antimony	0.006	7.0UNJ	-7.18	Pass
Arsenic	0.05	12.9NJ	1.17	Pass
Barium	2	252	13.88	Fail
Beryllium	0.004	0.71BJ	-3.90	Pass
Cadmium	0.005	2.6J	33.57	Fail
Calcium	TDS	64,100	5.83	Fail
Chromium	0.1	34.1	2.68	Fail
Cobalt	1	10.6B	-2.79	Pass
Copper	0.65	152NJ	40.71	Fail
Iron	5	53,400EJ	12.42	Fail
Lead	0.0075	121NJ	55.59	Fail
Magnesium	TDS	36,600	5.34	Fail
Manganese	0.15	675J	-0.39	Pass
Mercury	0.002	3.9J	125.33	Fail
Nickel	0.1	35	3.54	Fail
Potassium	TDS	1,310EJ	-2.25	Pass
Selenium	0.05	0.64UNJ	-11.80	Pass
Silver	0.05	6.2NJ	113.80	Fail
Sodium	TDS	126B	2.49	Fail
Thallium	2	0.78UWJ	-10.13	Pass
Vanadium	0.049	23.8	-5.01	Pass
Zinc	5	368EJ	51.90	Fail

^a NS = no standard; TDS = total dissolved solids; R = data are unusable. (Note: Analyte may or may not be present.)

^b Cleanup Objectives, as TCLP (Toxicity Characteristic Leaching Procedure) are established by the IEPA Office of Chemical Safety based on 35 IAC 620, Subpart F.

TABLE A.3 Lime Sludge Pond — Summary of Inorganic Element Concentrations

Element	Concentration (mg/kg)						
	SB7-4	SB8-7	SB10-4	SB12-7	SB13-7	SB14-3	SB16-2
Aluminum	10,400	11,000	13,000	12,100	9,130	10,400	5,070
Antimony	7.2UNJ	7.1UNJ	7.1UNJ	7.1UNJ	7.1UNJ	6.8UNJ	6.7UNJ
Arsenic	12.1J	8.9NJ	11.8NJ	12.1NJ	17.2NJ	12.4NJ	13.2NJ
Barium	42.0BEJ	53.2	58	70.4	48.4	55.9	39.8B
Beryllium	0.73BJ	0.83B	0.91B	0.89B	1.1B	0.88B	0.76B
Cadmium	0.66U	0.65U	0.65U	0.65U	0.65U	0.62U	0.61U
Calcium	58,500	86,100	53,400J	34,200	95,400	81,000	119,000
Chromium	16.9	19.1J	18.5	21.3J	16.2J	20.5J	13.1J
Cobalt	12.8	10.8B	12.1	11.9	8.6B	9.6B	4.8B
Copper	32.8EJ	28.9	22.7	29.7	26.2	26.7	16.9
Iron	31,500	24,800	23,000	26,300	20,800	23,400	13,600
Lead	18.3	11.9	19	17.9	22.5	18.4	34.5
Magnesium	32,400	48,000	33,500	20,100B	55,400	46,900	71,100
Manganese	640	542ENJ	413ENJ	496ENJ	413ENJ	470ENJ	375ENJ
Mercury	0.05BNJ	0.05U	0.05B	0.08B	0.05U	0.05B	0.04U
Nickel	32.4	28.1	21.4	29.7	21.5	23.9	10.3
Potassium	1,670	2,480	1,830	1,640	1,890	1,930	949B
Selenium	0.66UNJ	0.72BNJ	0.65UNJ	0.65UNJ	0.65UNJ	0.62UNJ	1.0BNJ
Silver	0.67BJ	0.60U	0.61U	0.61U	0.60U	0.57U	0.57U
Sodium	140B	195B	590B	135B	298B	250B	226B
Thallium	0.80UNJ	0.93BJ	0.79UJ	0.79UJ	0.81BJ	1.0BJ	0.74UWJ
Vanadium	23.9	26.9J	30.4J	32.8J	24.2J	27.0J	14.8J
Zinc	75.4	79.4EJ	70.5EJ	91.4EJ	85.8EJ	64.2EJ	53.1EJ

TABLE A.4 Lime Sludge Pond — Summary of Volatile Organic Compound Concentrations

Compound	Concentration (µg/kg)						
	SB7-4	SB8-7	SB10-4	SB12-7	SB13-7	SB14-3	SB16-2
Chloromethane	12U	12U	12U	12U	12U	11U	11U
Bromomethane	12U	12U	12U	12U	12U	11U	11U
Vinyl chloride	12U	12U	12U	12U	12U	11U	11U
Chloroethane	12U	12U	12U	12U	12U	11U	11U
Methylene chloride	5BJ	13U	33B	21U	34	76B	16U
Acetone	12U	12U	12U	12U	12U	30	11U
Carbon disulfide	12U	12U	12U	12U	12U	11U	11U
1,1-Dichloroethene	12U	12U	12U	12U	12U	11U	11U
1,1-Dichloroethane	12U	12U	12U	12U	12U	11U	11U
1,2-Dichloroethene (total)	12U	12U	12U	12U	12U	11U	11U
Chloroform	12U	12U	12U	12U	12U	11U	11U
1,2-Dichloroethane	12U	12U	12U	12U	12U	11U	11U
2-Butanone	12U	12U	12U	12U	12U	11U	11U
1,1,1-Trichloroethane	12U	12U	12U	12U	12U	11U	11U
Carbon tetrachloride	12U	12U	12U	12U	12U	11U	11U
Bromodichloromethane	12U	12U	12U	12U	12U	11U	11U
1,2-Dichloropropane	12U	12U	12U	12U	12U	11U	11U
cis-1,3-Dichloropropene	12U	12U	12U	12U	12U	11U	11U
Trichloroethene	12U	12U	12U	12U	12U	11U	11U
Dibromochloromethane	12U	12U	12U	12U	12U	11U	11U
1,1,2-Trichloroethane	12U	12U	12U	12U	12U	11U	11U
Benzene	2J	12U	12U	12U	12U	11U	11U
trans-1,3-Dichloropropene	12U	12U	12U	12U	12U	11U	11U
Bromoform	12U	12U	12U	12U	12U	11U	11U
4-Methyl-2-pentanone	12U	12U	12U	12UJ	12UJ	11U	11U
2-Hexanone	12U	12U	12U	12UJ	12UJ	11U	11U
Tetrachloroethene	5J	12U	12U	12UJ	12UJ	11U	11U
1,1,2,2-Tetrachloroethane	12U	12U	12U	12UJ	12UJ	11U	11U
Toluene	5J	12U	12U	12UJ	12UJ	17U	11U
Chlorobenzene	2J	12U	12U	12UJ	12UJ	11U	11U
Ethylbenzene	12U	12U	12U	12UJ	12UJ	11U	11U
Styrene	12U	12U	12U	12UJ	12UJ	11U	11U
Xylene (total)	12U	12U	12U	12UJ	12UJ	11U	11U

TABLE A.5 Lime Sludge Pond — Summary of Semivolatile Organic Compound Concentrations

Compound	Concentration (µg/kg)						
	SB7-4	SB8-7	SB10-4	SB12-7	SB13-7	SB14-3	SB16-2
Phenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
bis(2-Chloroethyl)ether	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2-Chlorophenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
1,3-Dichlorobenzene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
1,4-Dichlorobenzene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
1,2-Dichlorobenzene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2-Methylphenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2,2'-oxybis(1-Chloropropane)	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
4-Methylphenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
N-Nitroso-di-n-propylamine	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Hexachloroethane	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Nitrobenzene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Isophorone	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2-Nitrophenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2,4-Dimethylphenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
bis(2-Chloroethoxy)methane	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2,4-Dichlorophenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
1,2,4-Trichlorobenzene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Naphthalene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	6,200J
4-Chloroaniline	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Hexachlorobutadiene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
4-Chloro-3-methylphenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2-Methylnaphthalene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,800J
Hexachlorocyclopentadiene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2,4,6-Trichlorophenol	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2,4,5-Trichlorophenol	940U	930UJ	930UJ	930UJ	920UJ	880UJ	8,700UJ
2-Chloronaphthalene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2-Nitroaniline	940U	930UJ	930UJ	930UJ	920UJ	880UJ	8,700UJ
Dimethyl phthalate	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Acenaphthylene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
2,6-Dinitrotoluene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
3-Nitroaniline	940U	930UJ	930UJ	930UJ	920UJ	880UJ	8,700UJ
Acenaphthene	390U	380UJ	380UJ	380UJ	380UJ	78J	23,000J

TABLE A.5 (Cont.)

Compound	Concentration (µg/kg)						
	SB7-4	SB8-7	SB10-4	SB12-7	SB13-7	SB14-3	SB16-2
2,4-Dinitrophenol	940U	930UJ	930UJ	930UJ	920UJ	880UJ	8,700UJ
4-Nitrophenol	940U	930UJ	930UJ	930UJ	920UJ	880UJ	8,700UJ
Dibenzofuran	390U	380UJ	380UJ	380UJ	380UJ	43J	19,000J
2,4-Dinitrotoluene	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Diethylphthalate	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
4-Chlorophenyl phenyl ether	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Fluorene	390U	380UJ	380UJ	380UJ	380UJ	76J	33,000J
4-Nitroaniline	940U	930UJ	930UJ	930U	920UJ	880UJ	8,700UJ
4,6-Dinitro-2-methylphenol	940U	930UJ	930UJ	930U	920UJ	880UJ	8,700UJ
N-Nitrosodiphenylamine ^a	390U	380UJ	380UJ	380U	380UJ	360UJ	3,600UJ
4-Bromophenyl-phenylether	390U	380UJ	380UJ	380U	380UJ	360UJ	3,600UJ
Hexachlorobenzene	390U	380UJ	380UJ	380U	380UJ	360UJ	3,600UJ
Pentachlorophenol	940U	930UJ	930UJ	930U	920UJ	880UJ	8,700UJ
Phenanthrene	390U	380UJ	380UJ	40J	150J	460J	130,000EJ
Anthracene	390U	380UJ	380UJ	380UJ	380UJ	120J	49,000J
Carbazole	390U	380UJ	380UJ	380UJ	380UJ	360U	30,000J
Di-n-butylphthalate	1,000B	380UJ	380UJ	380UJ	380UJ	360U	3,600UJ
Fluoranthene	390U	380UJ	380UJ	50J	210J	570J	130,000EJ
Pyrene	390U	380UJ	380UJ	52J	170J	440J	190,000EJ
Butylbenzylphthalate	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
3,3'-Dichlorobenzidine	390U	380UJ	380UJ	380UJ	380UJ	360UJ	3,600UJ
Benz(a)anthracene	390U	380UJ	380UJ	380UJ	120J	280J	140,000EJ
Chrysene	390U	380UJ	380UJ	380UJ	130J	300J	150,000EJ
bis(2-Ethylhexyl)phthalate	2,000B	380UJ	380UJ	450UJ	630UJ	2,300UJ	4,900U
Di-n-octyl phthalate	390U	380UJ	380UJ	380UJ	380U	360UJ	3,600UJ
Benzo(b)fluoranthene	390U	380UJ	380UJ	380UJ	120J	360J	150,000EJ
Benzo(k)fluoranthene	390U	380UJ	380UJ	380UJ	99J	150J	58,000J
Benzo(a)pyrene	390U	380UJ	380UJ	380UJ	110J	250J	110,000EJ
Indeno(1,2,3-cd)pyrene	390U	380UJ	380UJ	380UJ	200J	370J	130,000EJ
Dibenz(a,h)anthracene	390U	380UJ	380UJ	380UJ	380UJ	360U	29,000J
Benzo(g,h,i)perylene	390U	380UJ	380UJ	380UJ	160J	310J	98,000J

^a Cannot be separated from diphenylamine.

TABLE A.6 Lime Sludge Pond — Summary of PCB/Pesticide Compound Concentrations

Compound	Concentration (µg/kg)						
	SB7-4	SB8-7	SB10-4	SB12-7	SB13-7	SB14-3	SB16-2
Pesticides							
alpha-BHC	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
beta-BHC	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
delta-BHC	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
gamma-BHC (Lindane)	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
Heptachlor	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
Aldrin	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
Heptachlor epoxide	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
Endosulfan I	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
Dieldrin	3.9UJ	3.8UJ	3.8UJ	3.8UJ	4.4PJ	3.6UJ	36UJ
4,4'-DDE	3.9UJ	3.8UJ	3.8UJ	12J	3.8UJ	3.6JP	36UJ
Endrin	3.9UJ	3.8UJ	4.3J	3.8UJ	3.8UJ	3.6UJ	260PJ
Endosulfan II	3.9UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.6UJ	36UJ
4,4'-DDD	3.9UJ	3.8UJ	3.8UJ	4.1PJ	3.8UJ	3.6UJ	36UJ
Endosulfan sulfate	3.9UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.6UJ	36UJ
4,4'-DDT	3.9UJ	3.8UJ	3.9J	14PJ	3.8UJ	3.6UJ	36UJ
Methoxychlor	20UJ	20UJ	20UJ	20UJ	20UJ	19UJ	180UJ
Endrin ketone	3.9UJ	3.8UJ	3.8UJ	3.8UJ	9.7J	3.6UJ	460PJ
Endrin aldehyde	3.9UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.6UJ	36UJ
alpha-Chlordane	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
gamma-Chlordane	2.0UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	18UJ
Toxaphene	200UJ	200UJ	200UJ	200UJ	200UJ	190UJ	1,800UJ
PCBs							
Aroclor-1016	39UJ	38UJ	38UJ	38UJ	38UJ	36UJ	360UJ
Aroclor-1221	79UJ	78UJ	78UJ	78UJ	78UJ	74UJ	730UJ
Aroclor-1232	39UJ	38UJ	38UJ	38UJ	38UJ	36UJ	360UJ
Aroclor-1242	39UJ	38UJ	38UJ	38UJ	38UJ	36UJ	360UJ
Aroclor-1248	39UJ	38UJ	38UJ	38UJ	38UJ	36UJ	360UJ
Aroclor-1254	39UJ	38UJ	38UJ	38UJ	38UJ	36UJ	360UJ
Aroclor-1260	39UJ	38UJ	38UJ	38UJ	38UJ	36UJ	360UJ

TABLE A.7 Building 108 Liquid Retention Pond — Summary of Inorganic Element Concentrations

Element	Concentration (mg/kg)				
	SB4-2	SB5-4	SB6-6	SB17-2	SB18-2
Aluminum	10,400	9,800	9,030	12,500	10,200
Antimony	7.4UNJ	7.0UNJ	6.8UNJ	6.9UNJ	6.9UNJ
Arsenic	10	11.3J	6.1	9.1	7.7
Barium	57.5EJ	52.5EJ	32.1BEJ	80.6EJ	43.5BEJ
Beryllium	0.89B	0.69BJ	0.69B	0.85B	0.79B
Cadmium	0.96B	0.64U	0.62U	0.77B	1.1
Calcium	50,600	83,000	97,900	45,600	62,600
Chromium	15.9J	17.3	16.1J	20.6J	16.3J
Cobalt	R	10.1B	R	R	R
Copper	29.5EJ	34.5EJ	21.2EJ	31.6EJ	29.6EJ
Iron	25,000	28,800	18,000	27,800	26,700
Lead	28.3	17	11	22.1	15.2
Magnesium	26,200	42,700	57,400	28,000	35,900
Manganese	579EJ	489	416EJ	484EJ	501EJ
Mercury	0.05B	0.05UNJ	0.04UJ	0.05B	0.05U
Nickel	R	24.5	R	R	R
Potassium	1,600EJ	1,540	1,920EJ	2,210EJ	2,130EJ
Selenium	0.67UNWJ	0.64UNWJ	0.62UNWJ	0.63UNJ	0.63UNWJ
Silver	0.62U	0.60UJ	0.58U	0.59U	0.59U
Sodium	230BJ	203B	230BJ	189BJ	211BJ
Thallium	0.82U	0.78UNWJ	1.5B	0.77US	0.77UWJ
Vanadium	24.0J	21.9	18.2J	27.3J	24.1J
Zinc	84.2EJ	66.6	45.7EJ	73.9EJ	64.7EJ

TABLE A.8 Building 108 Liquid Retention Pond — Summary of Volatile Organic Compound Concentrations

Compound	Concentration (µg/kg)				
	SB4-2	SB5-4	SB6-6	SB17-2	SB18-2
Chloromethane	15U	12U	11U	11U	11U
Bromomethane	15U	12U	11U	11U	11U
Vinyl chloride	15U	12U	11U	11U	11U
Chloroethane	15U	12U	11U	11U	11U
Methylene chloride	15U	12U	11U	11U	42B
Acetone	15U	12U	42	11U	4J
Carbon disulfide	15U	12U	11U	11U	11U
1,1-Dichloroethene	15U	12U	11U	11U	11U
1,1-Dichloroethane	15U	12U	11U	11U	11U
1,2-Dichloroethene (total)	15U	12U	11U	11U	11U
Chloroform	15U	12U	11U	11U	11U
1,2-Dichloroethane	15U	12U	11U	11U	11U
2-Butanone	15U	12U	7J	11U	11U
1,1,1-Trichloroethane	15U	12U	11U	11U	11U
Carbon tetrachloride	15U	12U	11U	11U	11U
Bromodichloromethane	15U	12U	11U	11U	11U
1,2-Dichloropropane	15U	12U	11U	11U	11U
cis-1,3-Dichloropropene	15U	12U	11U	11U	11U
Trichloroethene	15U	12U	11U	11U	11U
Dibromochloromethane	15U	12U	11U	11U	11U
1,1,2-Trichloroethane	15U	12U	11U	11U	11U
Benzene	15U	12U	11U	11U	11U
trans-1,3-Dichloropropene	15U	12U	11U	11U	11U
Bromoform	15U	12U	11U	11U	11U
4-Methyl-2-pentanone	15U	12U	11U	11UJ	11UJ
2-Hexanone	15U	12U	11U	11UJ	11UJ
Tetrachloroethene	15U	9J	11BJ	11UJ	11UJ
1,1,2,2-Tetrachloroethane	15U	12U	11U	11UJ	11UJ
Toluene	15U	3J	6BJ	11UJ	11UJ
Chlorobenzene	15U	12U	11U	11UJ	11UJ
Ethylbenzene	15U	12U	11U	11UJ	11UJ
Styrene	15U	12U	11U	11UJ	11UJ
Xylene (total)	15U	12U	11U	11UJ	11UJ

TABLE A.9 Building 108 Liquid Retention Pond — Summary of Semivolatile Organic Compound Concentrations

Compound	Concentration (µg/kg)				
	SB4-2	SB5-4	SB6-6	SB17-2	SB18-2
Phenol	400U	380UJ	370UJ	370UJ	370UJ
bis(2-Chloroethyl)ether	400U	380UJ	370UJ	370UJ	370UJ
2-Chlorophenol	400U	380UJ	370UJ	370UJ	370UJ
1,3-Dichlorobenzene	400U	380UJ	370UJ	370UJ	370UJ
1,4-Dichlorobenzene	400U	380UJ	370UJ	370UJ	370UJ
1,2-Dichlorobenzene	400U	380UJ	370UJ	370UJ	370UJ
2-Methylphenol	400U	380UJ	370UJ	370UJ	370UJ
2,2'-oxybis(1-Chloropropane)	400U	380UJ	370UJ	370UJ	370UJ
4-Methylphenol	400U	380UJ	370UJ	370UJ	370UJ
N-Nitroso-di-n-propylamine	400U	380UJ	370UJ	370UJ	370UJ
Hexachloroethane	400U	380UJ	370UJ	370UJ	370UJ
Nitrobenzene	400U	380UJ	370UJ	370UJ	370UJ
Isophorone	400U	380UJ	370UJ	370UJ	370UJ
2-Nitrophenol	400U	380UJ	370UJ	370UJ	370UJ
2,4-Dimethylphenol	400U	380UJ	370UJ	370UJ	370UJ
bis(2-Chloroethoxy)methane	400U	380UJ	370UJ	370UJ	370UJ
2,4-Dichlorophenol	400U	380UJ	370UJ	370UJ	370UJ
1,2,4-Trichlorobenzene	400U	380UJ	370UJ	370UJ	370UJ
Naphthalene	400U	150J	370UJ	370UJ	43J
4-Chloroaniline	400U	380UJ	370UJ	370UJ	370UJ
Hexachlorobutadiene	400U	380UJ	370UJ	370UJ	370UJ
4-Chloro-3-methylphenol	400U	380UJ	370UJ	370UJ	370UJ
2-Methylnaphthalene	400U	56J	370UJ	370UJ	95J
Hexachlorocyclopentadiene	400U	380UJ	370UJ	370UJ	370UJ
2,4,6-Trichlorophenol	400U	380UJ	370UJ	370UJ	370UJ
2,4,5-Trichlorophenol	960U	920UJ	890UJ	900UJ	900UJ
2-Chloronaphthalene	400U	380UJ	370UJ	370UJ	370UJ
2-Nitroaniline	960U	920UJ	890UJ	900UJ	900UJ
Dimethyl phthalate	400U	380UJ	370UJ	370UJ	370UJ
Acenaphthylene	400U	380UJ	370UJ	370UJ	370UJ
2,6-Dinitrotoluene	400U	380UJ	370UJ	370UJ	370UJ
3-Nitroaniline	960U	920UJ	890UJ	900UJ	900UJ
Acenaphthene	400U	210J	85J	66J	58J
2,4-Dinitrophenol	960U	920UJ	890UJ	900UJ	900UJ
4-Nitrophenol	960U	920UJ	890UJ	900UJ	900UJ
Dibenzofuran	400U	220J	54J	45J	48J
2,4-Dinitrotoluene	400U	380UJ	370UJ	370UJ	370UJ
Diethylphthalate	400U	380UJ	370UJ	370UJ	370UJ
4-Chlorophenyl phenyl ether	400U	380UJ	370UJ	370UJ	370UJ
Fluorene	400U	340J	140J	89J	58J
4-Nitroaniline	960U	920UJ	890UJ	900UJ	900UJ
4,6-Dinitro-2-methylphenol	960U	920UJ	890UJ	900UJ	900UJ
N-Nitrosodiphenylamine ^a	400U	380UJ	370UJ	370UJ	370UJ
4-Bromophenyl-phenylether	400U	380UJ	370UJ	370UJ	370UJ
Hexachlorobenzene	400U	380UJ	370UJ	370UJ	370UJ
Pentachlorophenol	960U	920UJ	890UJ	900UJ	900UJ

TABLE A.9 (Cont.)

Compound	Concentration (µg/kg)				
	SB4-2	SB5-4	SB6-6	SB17-2	SB18-2
Phenanthrene	400U	1,800J	1,300J	910J	890J
Anthracene	400U	560J	300J	220J	210J
Carbazole	400U	240J	91J	150J	370UJ
Di-n-butylphthalate	400U	380UJ	370UJ	370UJ	370UJ
Fluoranthene	160J	1,600J	1,600J	1,400J	2,000J
Pyrene	120J	2,100J	2,000J	1,100J	1,300J
Butylbenzylphthalate	400U	380UJ	370UJ	370UJ	370U
3,3'-Dichlorobenzidine	400U	380UJ	370UJ	370UJ	370U
Benz(a)anthracene	400U	820J	770J	660J	920J
Chrysene	400U	830J	770J	740J	1,000J
bis(2-Ethylhexyl)phthalate	400U	570UJ	370UJ	370UJ	370U
Di-n-octyl phthalate	400U	380UJ	370UJ	370UJ	370U
Benzo(b)fluoranthene	120J	1000J	760J	600J	910J
Benzo(k)fluoranthene	400U	400J	550J	440J	550J
Benzo(a)pyrene	400U	820J	600J	520J	770J
Indeno(1,2,3-cd)pyrene	400U	880J	570J	730J	1,200J
Dibenz(a,h)anthracene	400U	120J	140J	170J	200J
Benzo(g,h,i)perylene	400U	720	410J	580J	880J

^a Cannot be separated from diphenylamine.

**TABLE A.10 Building 108 Liquid Retention Pond
Area — Summary of PCB/Pesticide Compound Concentrations**

Compound	Concentration (µg/kg)				
	SB4-2	SB5-4	SB6-6	SB17-2	SB18-2
Pesticides					
alpha-BHC	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
beta-BHC	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
delta-BHC	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
gamma-BHC (Lindane)	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
Heptachlor	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
Aldrin	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
Heptachlor epoxide	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
Endosulfan I	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
Dieldrin	4.0U	3.8UJ	3.7UJ	3.7UJ	3.7UJ
4,4'-DDE	4.0U	3.8UJ	3.7UJ	12PJ	3.7UJ
Endrin	4.0U	3.8UJ	3.7UJ	3.7UJ	3.7UJ
Endosulfan II	4.0U	3.8UJ	3.7UJ	3.7UJ	3.7UJ
4,4'-DDD	4.0U	3.8UJ	3.8UJ	21J	3.7UJ
Endosulfan sulfate	4.0U	3.8UJ	3.8UJ	3.7UJ	3.7UJ
4,4'-DDT	4.0U	7.2PJ	15J	16PJ	3.7UJ
Methoxychlor	20U	20UJ	19UJ	19UJ	19UJ
Endrin ketone	4.0U	6.4J	14J	3.7UJ	3.7UJ
Endrin aldehyde	4.0U	3.8UJ	3.7UJ	3.7UJ	3.7UJ
alpha-Chlordane	2.0U	2.0UJ	1.9UJ	1.9UJ	1.9UJ
gamma-Chlordane	2.2	2.0UJ	1.9UJ	4.0UJ	3.9UJ
Toxaphene	200U	200UJ	190UJ	190UJ	190UJ
PCBs					
Aroclor-1016	40U	38UJ	37UJ	37UJ	37UJ
Aroclor-1221	81U	77UJ	74UJ	75UJ	75UJ
Aroclor-1232	40U	38UJ	37UJ	37UJ	37UJ
Aroclor-1242	40U	38UJ	37UJ	37UJ	37UJ
Aroclor-1248	40U	38UJ	37UJ	37UJ	37UJ
Aroclor-1254	40U	38UJ	37UJ	37UJ	37UJ
Aroclor-1260	71P	38UJ	37UJ	220UJ	200PJ

TABLE A.11 Coal Yard — Summary of Inorganic Element Concentrations

Element	Concentration (mg/kg)									
	SB19-7	SB21-6	SB22-5	SB23-4	SB24-3	SB25-5	SB26-4	SB27-3	SB28-2	SB29-2
Aluminum	7,750	8,860	23,500	8,550	9,870	7,200	9,500	8,790	7,500	3,840
Antimony	6.9UNJ	7.0UNJ	7.7UNJ	7.1UNJ	7.1UNJ	7.1UNJ	7.0UNJ	7.0UNJ	6.7UNJ	7.4UNJ
Arsenic	7	9.6	5.6NJ	8.1NJ	16.1	13.5	14.8	30.7	10.7	7.2NJ
Barium	40.1BEJ	42.7BEJ	193	30.6B	52.8EJ	42.6BEJ	39.1BEJ	63.4EJ	112EJ	35.8B
Beryllium	0.66B	0.74B	1.2BJ	0.64BJ	0.71B	0.78B	0.66B	0.62B	0.89B	1.4J
Cadmium	0.63U	1.2	0.71UJ	1.1BJ	0.65U	0.65U	1.6	0.77B	1.0B	2.5J
Calcium	57,400	77,500	4220	90,500	26,400	30,400	48,400	12,700	40,500	15,200
Chromium	15.7J	14.7J	27.7	13.5	15.6J	13.5J	15.6J	14.8J	18.1J	9.8J
Cobalt	R	R	6.5B	10.0B	R	R	R	R	R	5.0B
Copper	26.0EJ	29.6EJ	25.2NJ	27.1NJ	32.5EJ	27.1EJ	33.1EJ	41.7EJ	25.4EJ	15.7NJ
Iron	19,200	26,400	26,100EJ	23,300EJ	30,100	24,700	31,900	39,900	24,400	19,500EJ
Lead	17.2	50.8	11.4J	18.3J	29.5	23	36.9	43.8	20.7	25.4J
Magnesium	31,400	43,800	5,680	44,800	16,500	18,600	31,200	9,310	23,200	8,720
Manganese	458EJ	538EJ	101J	437J	692EJ	436EJ	568EJ	454EJ	436EJ	276J
Mercury	0.04J	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.05UJ	0.06B	0.05UJ
Nickel	R	R	24.3	22.3	R	R	R	R	R	18.8
Potassium	1,690EJ	1,500EJ	1,440EJ	2,030EJ	1,340EJ	1,070BEJ	1,680EJ	1,250EJ	1,390EJ	556BEJ
Selenium	0.63UNJ	0.64UNWJ	0.70UNWJ	0.65UNWJ	0.65UNJ	0.65UNJ	0.64UNJ	0.72BNWJ	0.62UNWJ	0.68UNJ
Silver	0.58U	0.60U	0.65UNJ	0.92BNJ	0.60U	0.60U	0.59U	0.59U	0.57U	0.70BNJ
Sodium	129BJ	143BJ	81.5B	153B	97.9BJ	210BJ	161BJ	81.1BJ	225BJ	327B
Thallium	0.76UWJ	0.78UWJ	0.86U	0.78UWJ	0.78U	0.79U	0.98B	0.97B	0.75U	0.82UW
Vanadium	19.5J	20.8J	40.2	19	25.9J	22.5J	23.1J	25.5J	22.0J	18
Zinc	52.9EJ	72.0EJ	80.7EJ	62.9EJ	68.1EJ	61.2EJ	66.7EJ	110EJ	55.2EJ	283EJ

**TABLE A.12 Coal Yard — Summary
of Inorganic Element Concentrations
for Surface Water Samples**

Element	Concentration (µg/L)	
	SW1	SW2
Aluminum	3,210	5,320
Antimony	30.6U	30.6U
Arsenic	3.5U	3.5U
Barium	16.6B	18.8B
Beryllium	2.1B	3.5B
Cadmium	7.2	4.9B
Calcium	365,000	217,000
Chromium	6.4B	5.0B
Cobalt	37.4B	74.3
Copper	R	R
Iron	734EJ	2,060EJ
Lead	6.2*J	5.5*J
Magnesium	136,00	94,600
Manganese	958	1,130
Mercury	0.10U	0.10U
Nickel	71.8	131
Potassium	1,910BJ	1,620BJ
Selenium	2.8UNJ	2.8UNWJ
Silver	2.6U	2.6U
Sodium	25,300	13,800
Thallium	3.4UJ	3.4UJ
Vanadium	2.2U	2.2U
Zinc	1,240EJ	1,300EJ

TABLE A.13 Coal Yard — Summary of Volatile Organic Compound Concentrations

Compound	Concentration (µg/kg)									
	SB19-7	SB21-6	SB22-5	SB23-4	SB24-3	SB25-5	SB26-4	SB27-3	SB28-2	SB29-2
Chloromethane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
Bromomethane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
Vinyl chloride	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
Chloroethane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
Methylene chloride	68B	12U	13U	12U	12U	33UJ	16U	14UJ	11U	12U
Acetone	5J	12U	24	22	26J	73J	6J	70	12	12U
Carbon disulfide	11U	12U	13U	12U	12UJ	12UJ	12U	3J	11U	12U
1,1-Dichloroethene	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
1,1-Dichloroethane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
1,2-Dichloroethene (total)	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
Chloroform	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
1,2-Dichloroethane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11U	12U
2-Butanone	11U	12U	13U	12U	12UJ	12J	12U	10J	6J	12U
1,1,1-Trichloroethane	11U	12U	13U	12U	12UJ	R	12U	11UJ	11UJ	12U
Carbon tetrachloride	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
Bromodichloromethane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
1,2-Dichloropropane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
cis-1,3-Dichloropropene	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
Trichloroethene	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
Dibromochloromethane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
1,1,2-Trichloroethane	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
Benzene	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
trans-1,3-Dichloropropene	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
Bromoform	11U	12U	13U	12U	12UJ	12UJ	12U	11UJ	11UJ	12U
4-Methyl-2-pentanone	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U
2-Hexanone	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U
Tetrachloroethene	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U
1,1,2,2-Tetrachloroethane	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U
Toluene	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U
Chlorobenzene	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U
Ethylbenzene	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U
Styrene	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U
Xylene (total)	11UJ	12U	13U	12U	R	R	12U	R	11UJ	12U

**TABLE A.14 Coal Yard — Summary of
Volatile Organic Compound Concentrations
for Surface Water Samples**

Compound	Concentration (µg/L)	
	SW1	SW2
Chloromethane	10U	10U
Bromomethane	10U	10U
Vinyl chloride	10U	10U
Chloroethane	10U	10U
Methylene chloride	10UJ	10U
Acetone	10U	7J
Carbon disulfide	10U	10U
1,1-Dichloroethene	10U	10U
1,1-Dichloroethane	10U	10U
1,2-Dichloroethene (total)	10U	10U
Chloroform	10U	10U
1,2-Dichloroethane	10U	10U
2-Butanone	10U	10U
1,1,1-Trichloroethane	10U	10U
Carbon tetrachloride	10U	10U
Bromodichloromethane	10U	10U
1,2-Dichloropropane	10U	10U
cis-1,3-Dichloropropene	10U	10U
Trichloroethene	10U	10U
Dibromochloromethane	10U	10U
1,1,2-Trichloroethane	10U	10U
Benzene	10U	10U
trans-1,3-Dichloropropene	10U	10U
Bromoform	10U	10U
4-Methyl-2-pentanone	10U	10U
2-Hexanone	10U	10U
Tetrachloroethene	10U	10U
1,1,2,2-Tetrachloroethane	10U	10U
Toluene	10UJ	10U
Chlorobenzene	10U	10U
Ethylbenzene	10U	10U
Styrene	10U	10U
Xylene (total)	10U	10U

TABLE A.15 Coal Yard — Summary of Semivolatile Organic Compound Concentrations

Compound	Concentration (µg/kg)									
	SB19-7	SB21-6	SB22-5	SB23-4	SB24-3	SB25-5	SB26-4	SB27-3	SB28-2	SB29-2
Phenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
bis(2-Chloroethyl)ether	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
2-Chlorophenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
1,3-Dichlorobenzene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
1,4-Dichlorobenzene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
1,2-Dichlorobenzene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
2-Methylphenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
2,2'-oxybis(1-Chloropropane)	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
4-Methylphenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
N-Nitroso-di-n-propylamine	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Hexachloroethane	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Nitrobenzene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
Isophorone	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
2-Nitrophenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
2,4-Dimethylphenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	74J	400UJ
bis(2-Chloroethoxy)methane	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
2,4-Dichlorophenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
1,2,4-Trichlorobenzene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
Naphthalene	370UJ	45J	420UJ	380UJ	660J	480J	380UJ	48J	1,200J	1,000J
4-Chloroaniline	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
Hexachlorobutadiene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
4-Chloro-3-methylphenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360UJ	400UJ
2-Methylnaphthalene	370UJ	110J	58J	380UJ	1,400J	870J	380UJ	82J	2,000J	2,300
Hexachlorocyclopentadiene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
2,4,6-Trichlorophenol	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
2,4,5-Trichlorophenol	900UJ	920UJ	1,000UJ	920UJ	920UJ	920UJ	920UJ	910UJ	880U	960UJ
2-Chloronaphthalene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
2-Nitroaniline	900UJ	920UJ	1,000UJ	920UJ	920UJ	920UJ	920UJ	910UJ	880U	960UJ
Dimethyl phthalate	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Acenaphthylene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
2,6-Dinitrotoluene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
3-Nitroaniline	900UJ	920UJ	1,000UJ	920UJ	920UJ	920UJ	920UJ	910UJ	880U	960UJ
Acenaphthene	73J	380UJ	420UJ	380UJ	150J	66J	380UJ	370UJ	120J	540
2,4-Dinitrophenol	900UJ	920UJ	1,000UJ	920UJ	920UJ	920UJ	920UJ	910UJ	880U	960UJ
4-Nitrophenol	900UJ	920UJ	1,000UJ	920UJ	920UJ	920UJ	920UJ	910UJ	880U	960UJ

TABLE A.15 (Cont.)

Compound	Concentration (µg/kg)									
	SB19-7	SB21-6	SB22-5	SB23-4	SB24-3	SB25-5	SB26-4	SB27-3	SB28-2	SB29-2
Dibenzofuran	370UJ	41J	420UJ	380UJ	360J	130J	380UJ	370UJ	360J	2,100J
2,4-Dinitrotoluene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Diethylphthalate	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
4-Chlorophenyl phenyl ether	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Fluorene	65J	380UJ	420UJ	380UJ	110J	57J	380UJ	370UJ	180J	400UJ
4-Nitroaniline	900UJ	920UJ	1,000UJ	920UJ	920UJ	920UJ	920UJ	910UJ	880U	920UJ
4,6-Dinitro-2-methylphenol	900UJ	920UJ	1,000UJ	920UJ	920UJ	920UJ	920UJ	910UJ	880U	960UJ
N-Nitrosodiphenylamine ^a	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
4-Bromophenyl-phenylether	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Hexachlorobenzene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Pentachlorophenol	900UJ	920UJ	1,000UJ	920UJ	920UJ	920UJ	920UJ	910UJ	880U	9,60UJ
Phenanthrene	650J	140J	100J	380UJ	1,100J	460J	380UJ	90J	1,600	5,700J
Anthracene	130J	380UJ	420UJ	380UJ	110J	380UJ	380UJ	370UJ	140J	870J
Carbazole	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Di-n-butylphthalate	370UJ	380UJ	88J	110J	380UJ	380UJ	380UJ	370UJ	140BJ	400UJ
Fluoranthene	850J	110J	420UJ	87J	200J	81J	380UJ	370UJ	370	930J
Pyrene	1,500J	120J	420UJ	100J	410J	150J	380UJ	370UJ	610	1,100J
Butylbenzylphthalate	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
3,3'-Dichlorobenzidine	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Benz(a)anthracene	460J	380UJ	420UJ	380UJ	180J	380UJ	380UJ	370UJ	250J	700J
Chrysene	510J	380UJ	420UJ	380UJ	180J	380UJ	380UJ	370UJ	320J	800J
bis(2-Ethylhexyl)phthalate	370UJ	380UJ	1,000J	170J	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Di-n-octyl phthalate	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Benzo(b)fluoranthene	560J	120J	420UJ	65J	160J	94J	380UJ	370UJ	360U	400UJ
Benzo(k)fluoranthene	410J	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Benzo(a)pyrene	310J	380UJ	420UJ	380UJ	96J	380UJ	380UJ	370UJ	150J	470J
Indeno(1,2,3-cd)pyrene	410J	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Dibenz(a,h)anthracene	370UJ	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	360U	400UJ
Benzo(g,h,i)perylene	330J	380UJ	420UJ	380UJ	380UJ	380UJ	380UJ	370UJ	280J	400UJ

^a Cannot be separated from diphenylamine.

**TABLE A.16 Coal Yard — Summary of
Semivolatile Organic Compound Concentrations
for Surface Water Samples**

Compound	Concentration (µg/L)	
	SW1	SW2
Phenol	12U	10U
bis(2-Chloroethyl)ether	12U	10U
2-Chlorophenol	12U	10U
1,3-Dichlorobenzene	12U	10U
1,4-Dichlorobenzene	12U	10U
1,2-Dichlorobenzene	12U	10U
2-Methylphenol	12U	10U
2,2'-oxybis(1-Chloropropane)	12U	10U
4-Methylphenol	12U	10U
N-Nitroso-di-n-propylamine	12U	10U
Hexachloroethane	12U	10U
Nitrobenzene	12U	10U
Isophorone	12U	10U
2-Nitrophenol	12U	10U
2,4-Dimethylphenol	12U	10U
bis(2-Chloroethoxy)methane	12U	10U
2,4-Dichlorophenol	12U	10U
1,2,4-Trichlorobenzene	12U	10U
Naphthalene	12U	10U
4-Chloroaniline	12U	10U
Hexachlorobutadiene	12U	10U
4-Chloro-3-methylphenol	12U	10U
2-Methylnaphthalene	12U	10U
Hexachlorocyclopentadiene	12U	10U
2,4,6-Trichlorophenol	12U	10U
2,4,5-Trichlorophenol	30U	26U
2-Chloronaphthalene	12U	10U
2-Nitroaniline	30U	26U
Dimethyl phthalate	12U	10U
Acenaphthylene	12U	10U
2,6-Dinitrotoluene	12U	10U
3-Nitroaniline	30U	26U
Acenaphthene	12U	10U
2,4-Dinitrophenol	30U	26U
4-Nitrophenol	30U	26U
Dibenzofuran	12U	10U
2,4-Dinitrotoluene	12U	10U
Diethylphthalate	12U	10U
4-Chlorophenyl phenyl ether	12U	10U
Fluorene	12U	10U
4-Nitroaniline	30U	26U
4,6-Dinitro-2-methylphenol	30U	26U
N-Nitrosodiphenylamine ^a	12U	10U
4-Bromophenyl-phenylether	12U	10U

TABLE A.16 (Cont.)

Compound	Concentration (µg/L)	
	SW1	SW2
Hexachlorobenzene	12U	10U
Pentachlorophenol	30U	26U
Phenanthrene	12U	10U
Anthracene	12U	10U
Carbazole	12U	10U
Di-n-butylphthalate	12U	10U
Fluoranthene	12U	10U
Pyrene	12U	10U
Butylbenzylphthalate	12U	10U
3,3'-Dichlorobenzidine	12U	10U
Benz(a)anthracene	12U	10U
Chrysene	12U	10U
bis(2-Ethylhexyl)phthalate	12U	10U
Di-n-octyl phthalate	12U	10U
Benzo(b)fluoranthene	12U	10U
Benzo(k)fluoranthene	12U	10U
Benzo(a)pyrene	12U	10U
Indeno(1,2,3-cd)pyrene	12U	10U
Dibenz(a,h)anthracene	12U	10U
Benzo(g,h,i)perylene	12U	10U

^a Cannot be separated from diphenylamine.

TABLE A.17 Coal Yard — Summary of PCB/Pesticide Compound Concentrations

Compound	Concentration (µg/kg)									
	SB19-7	SB21-6	SB22-5	SB23-4	SB24-3	SB25-5	SB26-4	SB27-3	SB28-2	SB29-2
Pesticides										
alpha-BHC	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
beta-BHC	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
delta-BHC	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
gamma-BHC (Lindane)	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
Heptachlor	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
Aldrin	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
Heptachlor epoxide	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
Endosulfan I	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
Dieldrin	3.7UJ	3.8UJ	4.2UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.7UJ	3.6U	20UJ
4,4'-DDE	3.7UJ	56J	4.2UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.7UJ	3.6U	59J
Endrin	3.7UJ	3.8UJ	4.2UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.7UJ	3.6U	20UJ
Endosulfan II	3.7UJ	3.8UJ	4.2UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.7UJ	3.6U	20UJ
4,4'-DDD	3.7UJ	23PJ	4.2UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.7UJ	3.6U	20UJ
Endosulfan sulfate	3.7UJ	3.8UJ	4.2UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.7UJ	3.6U	20UJ
4,4'-DDT	3.7UJ	3.8UJ	4.2UJ	3.8UJ	8.2J	3.8UJ	3.8UJ	3.7UJ	4.6P	290PJ
Methoxychlor	19UJ	20UJ	22UJ	20UJ	20UJ	20UJ	20UJ	19UJ	19U	100UJ
Endrin ketone	3.7UJ	3.8UJ	4.2UJ	3.8UJ	11PJ	3.8UJ	3.8UJ	3.7UJ	21	150J
Endrin aldehyde	3.7UJ	3.8UJ	4.2UJ	3.8UJ	3.8UJ	3.8UJ	3.8UJ	3.7UJ	3.6U	20UJ
alpha-Chlordane	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
gamma-Chlordane	1.9UJ	2.0UJ	2.2UJ	2.0UJ	2.0UJ	2.0UJ	2.0UJ	1.9UJ	1.9U	10UJ
Toxaphene	190UJ	200UJ	220UJ	200UJ	200UJ	200UJ	200UJ	190UJ	190U	1,000UJ
PCBs										
Aroclor-1016	37UJ	38UJ	42UJ	38UJ	38UJ	38UJ	38UJ	37UJ	36U	200UJ
Aroclor-1221	75UJ	77UJ	85UJ	77UJ	77UJ	77UJ	77UJ	76UJ	74U	400UJ
Aroclor-1232	37UJ	38UJ	42UJ	38UJ	38UJ	38UJ	38UJ	37UJ	36U	200UJ
Aroclor-1242	37UJ	38UJ	42UJ	38UJ	38UJ	38UJ	38UJ	37UJ	36U	200UJ
Aroclor-1248	37UJ	38UJ	42UJ	38UJ	38UJ	38UJ	38UJ	37UJ	36U	200UJ
Aroclor-1254	37UJ	38UJ	42UJ	38UJ	38UJ	38UJ	38UJ	37UJ	36U	200UJ
Aroclor-1260	59PJ	38UJ	42UJ	38UJ	38UJ	38UJ	38UJ	37UJ	36U	200UJ

**TABLE A.18 Coal Yard — Summary of
PCB/Pesticide Compound
Concentrations for Surface Water
Samples**

Compound	Concentration (µg/L)	
	SW1	SW2
Pesticides		
alpha-BHC	0.055U	0.052U
beta-BHC	0.055U	0.052U
delta-BHC	0.055U	0.052U
gamma-BHC	0.055U	0.052U
(Lindane)		
Heptachlor	0.055U	0.052U
Aldrin	0.055U	0.052U
Heptachlor epoxide	0.055U	0.052U
Endosulfan I	0.055U	0.052U
Dieldrin	0.11U	0.10U
4,4'-DDE	0.11U	0.10U
Endrin	0.11U	0.10U
Endosulfan II	0.11U	0.10U
4,4'-DDD	0.11U	0.10U
Endosulfan sulfate	0.11U	0.10U
4,4'-DDT	0.11U	0.10U
Methoxychlor	0.55U	0.52U
Endrin ketone	0.11U	0.10U
Endrin aldehyde	0.11U	0.10U
alpha-Chlordane	0.055U	0.052U
gamma-Chlordane	0.055U	0.052U
Toxaphene	5.5U	5.2U
PCBs		
Aroclor-1016	1.1U	1.0U
Aroclor-1221	2.2U	2.1U
Aroclor-1232	1.1U	1.0U
Aroclor-1242	1.1U	1.0U
Aroclor-1248	1.1U	1.0U
Aroclor-1254	1.1U	1.0U
Aroclor-1260	1.1U	1.0U

TABLE A.19 Burn Pit — Summary of Inorganic Element Concentrations

Element	Concentration (mg/kg)						
	SB9-4	SB11-3	SB15-7	SB30-3	SB31-3	SB32-1	SB33-4
Aluminum	4,770	15,200	8,240	11,300	15,600	9,380	16,100
Antimony	7.7UNJ	7.9UNJ	7.0UNJ	7.4UNJ	7.4UNJ	7.0UNJ	7.6UNJ
Arsenic	12.4J	65.9J	9.0NJ	27.7NJ	12.9NJ	12.9NJ	29.8NJ
Barium	30.6BEJ	80.3EJ	43.4B	64.3	157	252	273
Beryllium	0.36B	1.0BJ	0.66BJ	0.80BJ	0.87BJ	0.71BJ	1.0BJ
Cadmium	0.71U	1.8	2.1J	3.1J	4.3J	2.6J	8.3J
Calcium	24,000	5,010	89,200	39,000	16,900	64,100	44,100
Chromium	7.8	21.5	16.7	16.2	29.6	34.1	40.4
Cobalt	5.9B	15.8	7.7B	10.8B	12.2	10.6B	16.2
Copper	19.9EJ	82.4EJ	62.9NJ	58.5NJ	792NJ	152NJ	923NJ
Iron	21,700	143,000	40,000EJ	88,000EJ	29,100EJ	53,400EJ	83,300EJ
Lead	33.9	77.9	24.4J	61.5NJ	129NJ	121NJ	262NJ
Magnesium	15,600	4,640	50,100	24,900	11,600	36,600	24,600
Manganese	443	1,120	533J	659J	663J	675J	1,100J
Mercury	0.09BNJ	0.09BNJ	0.06BJ	0.05UJ	3.9J	3.9J	2.9J
Nickel	14.8	57	23.6	33.2	45.1	35	79.6
Potassium	678B	2,040	1,550EJ	1,360EJ	1,350EJ	1,310EJ	1,950EJ
Selenium	0.71UNWJ	0.73UNWJ	0.64UNWJ	0.68UNWJ	0.67UNWJ	0.64UNJ	0.69UNWJ
Silver	0.66UJ	0.68UJ	1.4BNJ	0.79BNJ	5.7NJ	6.2NJ	17.4NJ
Sodium	71.8B	50.3B	182B	120B	152B	126B	187B
Thallium	0.86UNWJ	1.2BNJ	0.89B	0.82UBWJ	0.82U	0.78UWJ	0.84UWJ
Vanadium	13.3	51	20.5	32.5	37.6	23.8	39.2
Zinc	70.7	187	105EJ	131EJ	356EJ	368EJ	1,050EJ

TABLE A.20 Burn Pit — Summary of Volatile Organic Compound Concentrations

Compound	Concentration (µg/kg)						
	SB9-4	SB11-3	SB15-7	SB30-3	SB31-3	SB32-1	SB33-4
Chloromethane	13U	13U	11U	12U	12U	12U	12U
Bromomethane	13U	13U	11U	12U	12U	12U	12U
Vinyl chloride	13U	13U	11U	12U	12U	12U	12U
Chloroethane	13U	13U	11U	12U	12U	12U	12U
Methylene chloride	13U	5BJ	11U	11J	12U	12U	12U
Acetone	13U	13U	12	12	12U	20	12U
Carbon disulfide	13U	13U	11U	12U	12U	12U	12U
1,1-Dichloroethene	13U	13U	11U	12U	12U	12U	12U
1,1-Dichloroethane	13U	13U	11U	12U	12U	12U	12U
1,2-Dichloroethene (total)	13U	13U	11U	12U	12U	12U	12U
Chloroform	13U	13U	11U	12U	12U	12U	12U
1,2-Dichloroethane	13U	13U	11U	12U	12U	12U	12U
2-Butanone	13U	13U	11U	12U	12U	12U	12U
1,1,1-Trichloroethane	13U	13U	11U	12U	12U	12U	12U
Carbon tetrachloride	13U	13U	11U	12U	12U	12U	12U
Bromodichloromethane	13U	13U	11U	12U	12U	12U	12U
1,2-Dichloropropane	13U	13U	11U	12U	12U	12U	12U
cis-1,3-Dichloropropene	13U	13U	11U	12U	12U	12U	12U
Trichloroethene	13U	13U	11U	12U	12U	12U	12U
Dibromochloromethane	13U	13U	11U	12U	12U	12U	12U
1,1,2-Trichloroethane	13U	13U	11U	12U	12U	12U	12U
Benzene	13U	13U	11U	12U	12U	12U	12U
trans-1,3-Dichloropropene	13U	13U	11U	12U	12U	12U	12U
Bromoform	13U	13U	11U	12U	12U	12U	12U
4-Methyl-2-pentanone	13U	13U	11U	12U	12U	12U	12U
2-Hexanone	13U	13U	11U	12U	12U	12U	12U
Tetrachloroethene	15	13U	4J	3J	2J	5J	12U
1,1,2,2-Tetrachloroethane	13U	13U	11U	12U	12U	12U	12U
Toluene	8J	4J	2J	2J	1J	12U	12U
Chlorobenzene	13U	13U	11U	12U	12U	12U	12U
Ethylbenzene	13U	13U	11U	12U	12U	12U	12U
Styrene	13U	13U	11U	12U	12U	12U	12U
Xylene (total)	13U	13U	11U	12U	12U	12U	12U

TABLE A.21 Burn Pit — Summary of Semivolatile Organic Compound Concentrations

Compound	Concentration (µg/kg)						
	SB9-4	SB11-3	SB15-7	SB30-3	SB31-3	SB32-1	SB33-4
Phenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
bis(2-Chloroethyl)ether	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2-Chlorophenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
1,3-Dichlorobenzene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
1,4-Dichlorobenzene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
1,2-Dichlorobenzene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2-Methylphenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2,2'-oxybis(1-Chloropropane)	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
4-Methylphenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
N-Nitroso-di-n-propylamine	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Hexachloroethane	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Nitrobenzene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Isophorone	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2-Nitrophenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2,4-Dimethylphenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
bis(2-Chloroethoxy)methane	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2,4-Dichlorophenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
1,2,4-Trichlorobenzene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Naphthalene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
4-Chloroaniline	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Hexachlorobutadiene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
4-Chloro-3-methylphenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2-Methylnaphthalene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Hexachlorocyclopentadiene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2,4,6-Trichlorophenol	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2,4,5-Trichlorophenol	1,000UJ	1,000UJ	910UJ	960UJ	960UJ	920UJ	990UJ
2-Chloronaphthalene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2-Nitroaniline	1,000UJ	1,000UJ	910UJ	960UJ	960UJ	920UJ	990UJ
Dimethyl phthalate	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Acenaphthylene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2,6-Dinitrotoluene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
3-Nitroaniline	1,000UJ	1,000UJ	910UJ	960UJ	960UJ	920UJ	990UJ
Acenaphthene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ

TABLE A.21 (Cont.)

Compound	Concentration (µg/kg)						
	SB9-4	SB11-3	SB15-7	SB30-3	SB31-3	SB32-1	SB33-4
2,4-Dinitrophenol	1,000UJ	1,000UJ	910UJ	960UJ	960UJ	920UJ	990UJ
4-Nitrophenol	1,000UJ	1,000UJ	910UJ	960UJ	960UJ	920UJ	990UJ
Dibenzofuran	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
2,4-Dinitrotoluene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Diethylphthalate	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
4-Chlorophenyl phenyl ether	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Fluorene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
4-Nitroaniline	1,000UJ	1,000UJ	910UJ	960UJ	960UJ	920UJ	990UJ
4,6-Dinitro-2-methylphenol	1,000UJ	1,000UJ	910UJ	960UJ	960UJ	920UJ	990UJ
N-Nitrosodiphenylamine ^a	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
4-Bromophenyl-phenylether	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Hexachlorobenzene	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Pentachlorophenol	1,000UJ	1,000UJ	910UJ	960UJ	960UJ	920UJ	990UJ
Phenanthrene	420UJ	430UJ	560J	400UJ	400UJ	120J	410UJ
Anthracene	420UJ	430UJ	150J	400UJ	400UJ	380UJ	410UJ
Carbazole	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Di-n-butylphthalate	1,100UJ	430UJ	140J	140J	130J	140J	270J
Fluoranthene	420UJ	430UJ	1,100J	400UJ	400UJ	190J	410UJ
Pyrene	420UJ	430UJ	1,000J	400UJ	400UJ	200J	410UJ
Butylbenzylphthalate	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
3,3'-Dichlorobenzidine	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Benz(a)anthracene	420UJ	430UJ	680J	400UJ	400UJ	110J	410UJ
Chrysene	420UJ	430UJ	800J	400UJ	400UJ	120J	410UJ
bis(2-Ethylhexyl)phthalate	1,800UJ	24,000UJ	120J	450J	190J	740J	620J
Di-n-octyl phthalate	420UJ	430UJ	370UJ	400UJ	400UJ	380UJ	410UJ
Benzo(b)fluoranthene	420UJ	430UJ	830J	400UJ	400UJ	110J	410UJ
Benzo(k)fluoranthene	420UJ	430UJ	530J	400UJ	400UJ	56J	410UJ
Benzo(a)pyrene	420UJ	430UJ	590J	400UJ	400UJ	81J	410UJ
Indeno(1,2,3-cd)pyrene	420UJ	430UJ	620J	400UJ	400UJ	77J	410UJ
Dibenz(a,h)anthracene	420UJ	430UJ	140J	400UJ	400UJ	380U	410UJ
Benzo(g,h,i)perylene	420UJ	430UJ	540J	400UJ	400UJ	77J	410UJ

^a Cannot be separated from diphenylamine.

TABLE A.22 Burn Pit — Summary of PCB/Pesticide Compound Concentrations

Compound	Concentration (µg/kg)						
	SB9-4	SB11-3	SB15-7	SB30-3	SB31-3	SB32-1	SB33-4
Pesticides							
alpha-BHC	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
beta-BHC	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
delta-BHC	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
gamma-BHC	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
(Lindane)							
Heptachlor	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
Aldrin	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
Heptachlor epoxide	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
Endosulfan I	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
Dieldrin	4.2UJ	4.3UJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
4,4'-DDE	21J	4.3UJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
Endrin	4.2UJ	4.3UJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
Endosulfan II	4.2UJ	4.3UJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
4,4'-DDD	11PJ	4.3UJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
Endosulfan sulfate	4.2UJ	4.3UJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
4,4'-DDT	35PJ	4.3UJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
Methoxychlor	22UJ	22UJ	97UJ	20UJ	100UJ	98UJ	21UJ
Endrin ketone	22PJ	13PJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
Endrin aldehyde	4.2UJ	4.3UJ	19UJ	4.0UJ	20UJ	19UJ	4.1UJ
alpha-Chlordane	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
gamma-Chlordane	2.2UJ	2.2UJ	9.7UJ	2.0UJ	10UJ	9.8UJ	2.1UJ
Toxaphene	220UJ	220UJ	970UJ	200UJ	1,000UJ	980UJ	210UJ
PCBs							
Aroclor-1016	42UJ	43UJ	190UJ	40UJ	200UJ	190UJ	41UJ
Aroclor-1221	85UJ	87UJ	380UJ	81UJ	400UJ	390UJ	83UJ
Aroclor-1232	42UJ	43UJ	190UJ	40UJ	200UJ	190UJ	41UJ
Aroclor-1242	42UJ	43UJ	190UJ	40UJ	200UJ	190UJ	41UJ
Aroclor-1248	42UJ	43UJ	190UJ	40UJ	200UJ	190UJ	41UJ
Aroclor-1254	42UJ	43UJ	190UJ	40UJ	200UJ	190UJ	56PJ
Aroclor-1260	180J	120J	1,500J	130J	470J	370J	41UJ

**TABLE A.23 Eastern Perimeter Area —
Summary of Inorganic Element Concentrations**

Element	Concentration (mg/kg)		
	SB1-2	SB2-2	SB3-2
Aluminum	14,700	18,500	12,400
Antimony	7.4UNJ	7.6UNJ	7.4UNJ
Arsenic	10.9	7.7	28.2
Barium	85.0EJ	123EJ	43.1BEJ
Beryllium	0.83B	1.0B	0.70B
Cadmium	0.68U	0.69U	0.68U
Calcium	2,820	4,640	1,500
Chromium	18.4J	28.3J	16.2J
Cobalt	R	R	R
Copper	18.6EJ	31.7EJ	54.4EJ
Iron	29,100	34,300	52,100
Lead	19.6	16.8	50.7
Magnesium	3,840	8,480	3,050
Manganese	588EJ	707EJ	470EJ
Mercury	0.06B	0.05B	0.09
Nickel	R	R	R
Potassium	751BEJ	2,130EJ	1,110BEJ
Selenium	0.68UNJ	0.69UNWJ	0.68UNJ
Silver	0.63U	0.65U	0.63U
Sodium	65.6BJ	145BJ	51.4BJ
Thallium	0.82U	0.84U	0.82U
Vanadium	36.8J	35.6J	30.7J
Zinc	45.5EJ	62.5EJ	179EJ

TABLE A.24 Eastern Perimeter Area — Summary of Volatile Organic Compound Concentrations

Compound	Concentration (µg/kg)		
	SB1-2	SB2-2	SB3-2
Chloromethane	12U	12U	12U
Bromomethane	12U	12U	12U
Vinyl chloride	12U	12U	12U
Chloroethane	12U	12U	12U
Methylene chloride	12U	12U	12U
Acetone	2J	12U	120
Carbon disulfide	12U	12U	1J
1,1-Dichloroethene	12U	12U	12U
1,1-Dichloroethane	12U	12U	12U
1,2-Dichloroethene (total)	12U	12U	12U
Chloroform	12U	12U	12U
1,2-Dichloroethane	12U	12U	12U
2-Butanone	12U	12U	350E
1,1,1-Trichloroethane	12U	12U	12U
Carbon tetrachloride	12U	12U	12U
Bromodichloromethane	12U	12U	12U
1,2-Dichloropropane	12U	12U	12U
cis-1,3-Dichloropropene	12U	12U	12U
Trichloroethene	12U	12U	12U
Dibromochloromethane	12U	12U	12U
1,1,2-Trichloroethane	12U	12U	12U
Benzene	12U	12U	12U
trans-1,3-Dichloropropene	12U	12U	12U
Bromoform	12U	12U	12U
4-Methyl-2-pentanone	12U	12U	12U
2-Hexanone	12U	12U	12U
Tetrachloroethene	12U	12U	12U
1,1,2,2-Tetrachloroethane	12U	12U	12U
Toluene	12U	12U	12U
Chlorobenzene	12U	12U	12U
Ethylbenzene	12U	12U	12U
Styrene	12U	12U	12U
Xylene (total)	12U	12U	12U

TABLE A.25 Eastern Perimeter Area — Summary of Semivolatile Organic Compound Concentrations

Compound	Concentration (µg/kg)		
	SB1-2	SB2-2	SB3-2
Phenol	400U	410U	400U
bis(2-Chloroethyl)ether	400U	410U	400U
2-Chlorophenol	400U	410U	400U
1,3-Dichlorobenzene	400U	410U	400U
1,4-Dichlorobenzene	400U	410U	400U
1,2-Dichlorobenzene	400U	410U	400U
2-Methylphenol	400U	410U	400U
2,2'-oxybis(1-Chloropropane)	400U	410U	400U
4-Methylphenol	400U	410U	400U
N-Nitroso-di-n-propylamine	400U	410U	400U
Hexachloroethane	400U	410U	400U
Nitrobenzene	400U	410U	400U
Isophorone	400U	410U	400U
2-Nitrophenol	400U	410U	400U
2,4-Dimethylphenol	400U	410U	400U
bis(2-Chloroethoxy)methane	400U	410U	400U
2,4-Dichlorophenol	400U	410U	400U
1,2,4-Trichlorobenzene	400U	410U	400U
Naphthalene	400U	410U	400U
4-Chloroaniline	400U	410U	400U
Hexachlorobutadiene	400U	410U	400U
4-Chloro-3-methylphenol	400U	410U	400U
2-Methylnaphthalene	400U	410U	400U
Hexachlorocyclopentadiene	400U	410U	400U
2,4,6-Trichlorophenol	400U	410U	400U
2,4,5-Trichlorophenol	960U	990U	960U
2-Chloronaphthalene	400U	410U	400U
2-Nitroaniline	960U	990U	960U
Dimethyl phthalate	400U	410U	400U
Acenaphthylene	400U	410U	400U
2,6-Dinitrotoluene	400U	410U	400U
3-Nitroaniline	960U	990U	960U
Acenaphthene	400U	410U	400U
2,4-Dinitrophenol	960U	990U	960U
4-Nitrophenol	960U	990U	960U
Dibenzofuran	400U	410U	400U
2,4-Dinitrotoluene	400U	410U	400U
Diethylphthalate	400U	410U	400U
4-Chlorophenyl phenyl ether	400U	410U	400U
Fluorene	400U	410U	400U
4-Nitroaniline	960U	990U	960U
4,6-Dinitro-2-methylphenol	960U	990U	960U
N-Nitrosodiphenylamine ^a	400U	410U	400U
4-Bromophenyl-phenylether	400U	410U	400U
Hexachlorobenzene	400U	410U	400U

TABLE A.25 (Cont.)

Compound	Concentration ($\mu\text{g/kg}$)		
	SB1-2	SB2-2	SB3-2
Pentachlorophenol	960U	990U	960U
Phenanthrene	400U	410U	400U
Anthracene	400U	410U	400U
Carbazole	400U	410U	400U
Di-n-butylphthalate	400U	410U	400U
Fluoranthene	400U	410U	400U
Pyrene	400U	410U	400U
Butylbenzylphthalate	400U	410U	400U
3,3'-Dichlorobenzidine	400U	410U	400U
Benz(a)anthracene	400U	410U	400U
Chrysene	400U	410U	400U
bis(2-Ethylhexyl)phthalate	400U	410U	400U
Di-n-octyl phthalate	400U	410U	400U
Benzo(b)fluoranthene	400U	410U	400U
Benzo(k)fluoranthene	400U	410U	400U
Benzo(a)pyrene	400U	410U	400U
Indeno(1,2,3-cd)pyrene	400U	410U	400U
Dibenz(a,h)anthracene	400U	410U	400U
Benzo(g,h,i)perylene	400U	410U	400U

^a Cannot be separated from diphenylamine.

**TABLE A.26 Eastern Perimeter Area —
Summary of PCB/Pesticide Compound
Concentrations**

Compound	Concentration (µg/kg)		
	SB1-2	SB2-2	SB3-2
Pesticides			
alpha-BHC	2.0U	2.1U	2.0U
beta-BHC	2.0U	2.1U	2.0U
delta-BHC	2.0U	2.1U	2.0U
gamma-BHC	2.0U	2.1U	2.0U
(Lindane)			
Heptachlor	2.0U	2.1U	2.0U
Aldrin	2.0U	2.1U	2.0U
Heptachlor epoxide	2.0U	2.1U	2.0U
Endosulfan I	2.0U	2.1U	2.0U
Dieldrin	4.0U	4.1U	4.0U
4,4'-DDE	4.0U	4.1U	4.0U
Endrin	4.0U	4.1U	4.0U
Endosulfan II	4.0U	4.1U	4.0U
4,4'-DDD	4.0U	4.1U	4.0U
Endosulfan sulfate	4.0U	4.1U	4.0U
4,4'-DDT	4.0U	4.1U	4.0U
Methoxychlor	20U	21U	72P
Endrin ketone	4.0U	4.1U	4.0U
Endrin aldehyde	4.0U	4.1U	4.0U
alpha-Chlordane	2.0U	2.1U	2.0U
gamma-Chlordane	2.2	2.1U	2.0U
Toxaphene	200U	210U	200U
PCBs			
Aroclor-1016	40U	41U	40U
Aroclor-1221	81U	83U	81U
Aroclor-1232	40U	41U	40U
Aroclor-1242	40U	41U	40U
Aroclor-1248	40U	41U	40U
Aroclor-1254	40U	41U	40U
Aroclor-1260	71P	41U	40U

DATE

FILMED

8 / 11 / 94

END