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RFI/RI Work Plan for the Road A Chemical Basin 904-111G

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Savannah River Site

RFI/RI Work Plan for the Road A Chemical Basin 904-111G (U)

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Revision 1.1

October 1999

Prepared by:
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Prepared for U.S. Department of Energy Under
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Work Plan for the
Road A Chemical Basin (904-111G)

Revision.1.1, WSRC-RP-98-4032

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Cynthia V. Anderson
Director
Environmental Restoration Division
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Savannah River Field Office
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EXECUTIVE SUMMARY

The Road A Chemical Basin (904-111G) Operable Unit (RdACB OU) is located in the southwestern section of the Savannah River Site (SRS), approximately 0.8 kilometer (km) (0.5 mile [mi]) southwest of the intersection of SRS Road A (South Carolina Route 125) and SRS Road 6. The unit is approximately 3 km (1.9 mi) southeast of the D-Area Powerhouse and approximately 6.4 km (4 mi) from the nearest plant boundary.

The RdACB OU is an inactive liquid waste disposal basin, which received unknown quantities of hazardous and radioactive materials. The exact operation period of the unit is not known, but it is expected that the basin existed as early as 1954. In 1973, the basin was backfilled with native soil. No wastes have been deposited since this time. The area surrounding the basin was regraded between 1973 and 1987. The exact nature of hazardous and, potentially, radioactive wastes disposed at the RdACB OU is not known because an inventory of disposal was not logged for this basin.

The RdACB OU is irregular in shape, with average dimensions of approximately 30 meters (m) (98 feet [ft]) wide by 53 m (174 ft) long. The unit is located in a cleared area adjacent to wooded lands in an area of moderate relief. The perimeter of the unit is protected by a 2.4 m (8.0 ft) high chain-link fence to prevent unauthorized access. A locked gate is located on the south side of the unit.

The RdACB OU is located in the Savannah River Floodplain Swamp Watershed. The dominant vegetative cover in the vicinity of the RdACB OU consists of loblolly, longleaf pine, slash pine, various hardwoods and scrub/shrub species. No endangered species have been identified in the vicinity of the RdACB OU. Surface soils at the RdACB OU are classified as Udorthents, friable substratum. Previous subsurface investigations revealed that the Tobacco Road and Dry Branch Formations of the Barnwell Group underlie the RdACB OU. These formations are generally comprised of sands, clayey sands, and clays.

Previous investigations at the RdACB OU included collecting soil samples in 1989, monitoring groundwater at five Water Table Aquifer wells from 1984 through 1997, performing a soil gas survey in 1992, and performing a radiological survey of surface soils in 1997. The historical soil analytical results from sampling in 1989 indicate soil contamination from volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals. Radionuclide soil screening provided inconclusive results. Groundwater quality data collected from five monitoring wells are also inconclusive. These results provide insufficient data to determine whether primary and secondary release mechanisms have impacted or continue to impact groundwater. Evaluation of data, however, from the previous investigations of the RdACB OU and the current physical state of the unit suggests that contamination from the unit does not currently pose a threat to human health or the environment.

Based upon review of the Conceptual Site Model (CSM) and the results of the preliminary unit evaluation, the following data needs for the RdACB OU have been identified:

- Data to support a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI)/Remedial Investigation (RI)/Baseline Risk Assessment (BRA) and to form the basis for a risk management decision
- Data to support selection and implementation of remedial actions

Specifically, the identified data needs for the RdACB OU are as follows:

- Define the location and lateral and vertical extent of the original basin
- Characterize the lithology beneath and adjacent to the basin
- Identify the geotechnical properties of the confining unit between the water table aquifer and the uppermost confined aquifer
- Characterize the nature and extent of contamination in surface, subsurface, and deep soils beneath and adjacent to the basin
- Identify surface water and seep locations between the OU and the Savannah River, if any
- Determine the 2X average background soil screening concentrations
- Determine the nature and extent of groundwater contamination in the Water Table Aquifer
- Determine the aquifer characteristics and the nature and extent of groundwater contamination in the Gordon Aquifer (uppermost confined aquifer), if any.

To fulfill these data needs, a focused Sampling and Analysis Plan has been developed. Geophysical surveys will be performed to determine vertical and horizontal boundaries of the basin and subsequently to define soil sampling intervals. The Sampling and Analysis Plan presents the proposed soil sampling locations within, beneath, and adjacent to the basin designed to characterize secondary sources. Background soil sampling locations are proposed at locations hydraulically and topographically upgradient of the RdACB OU to determine 2X average background soil concentrations for identifying unit-specific constituents. Downslope surface soil sampling will be conducted to determine if contaminants were transported downgradient by deposition, erosion, or sheet flow.

The proposed groundwater characterization includes installing one background and two hydraulically downgradient monitoring wells in the Water Table Aquifer. It also includes installing one background, one side-gradient, and one hydraulically downgradient monitoring well in the Gordon Aquifer, a confined aquifer that underlies the Water Table Aquifer. The Gordon monitoring wells will be installed to determine the local vertical and lateral hydraulic gradient and groundwater quality in the Gordon Aquifer. The new monitoring wells will be sampled in conjunction with the five existing wells. The existing monitoring wells will be refitted with new dedicated pumps and will be redeveloped.

The data obtained under this Work Plan will be integrated with data from previous investigations to support an RFI/RI/BRA, contaminant fate and transport analysis, and selection of remedial options for the RdACB OU.

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List of Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
bls	below land surface
BRA	Baseline Risk Assessment
BTEX	benzene, toluene, ethylbenzene, and xylene
C	Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
CMS	Corrective Measures Study
CPP	Corrugated Polyethylene Pipe
CSM	Conceptual Site Model
DOE	U.S. Department of Energy
DPT	direct push technology
DQO	Data Quality Objective
EM	electromagnetic
EPA	U.S. Environmental Protection Agency
ESC	Expedited Site Characterization
F	Fahrenheit
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	foot
g	gram
GPR	Ground Penetrating Radar
hr	hour
HSWA	Hazardous and Solid Waste Amendments
IDW	investigation-derived waste
in.	inch
kg	kilogram
km	kilometer

LLTSM	Low Level Threat Source Material
m	meter
MCL	Maximum Contaminant Level
µg	microgram
mg	milligram
mi	mile
µrem	microrem
msl	mean sea level
PCB	polychlorinated biphenol
PCE	tetrachloroethylene
pCi	picocurie
PHA	pulse height analysis
ppmv	parts per million per volume
PTSM	principal threat source material
QA	Quality Assurance
QC	Quality Control
RBA	Risk-Based Activity
RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RdACB OU	Road A Chemical Basin Operable Unit
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SAFER	Streamlined Approach for Environmental Restoration
SAP	Sampling and Analysis Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SRS	Savannah River Site
SVOC	semi-volatile organic compound
TAL	target analyte list
TBC	to be considered
TCE	trichloroethylene
TCL	target compound list

USC	unit-specific constituent
VOC	volatile organic compound
WSRC	Westinghouse Savannah River Company

Conversion Table

Metric Unit	English Unit	Conversion Factor
Celsius (C)	Fahrenheit (F)	1.8*
Centimeters (cm)	Inches (in.)	0.394
Kilometers (km)	Miles (mi)	0.621
Meters (m)	Feet (ft)	3.28
Square meters (m^2)	Square feet (ft^2)	10.76

Note: To convert the Metric Unit to English Unit, multiply by the conversion factor provided
* To convert Celsius to Fahrenheit multiply by 1.8 then add 32 to the product

1.0 INTRODUCTION

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI)/Remedial Investigation (RI) Work Plan has been prepared for the Road A Chemical Basin Operable Unit (RdACB OU) (904-111G). This unit is subject to the requirements of both RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This Work Plan presents the initial evaluation of existing unit data, applicable background data, the regulatory framework for the unit investigation, and the evaluations and decisions made during the determination of the scope and objectives of the planned Remedial Investigation/Feasibility Study (RI/FS) activities.

The development of this Work Plan is based upon the Streamlined Approach for Environmental Restoration (SAFER) and Expedited Site Characterization (ESC). These environmental management approaches produce cost-effective results consistent with standard engineering practice. They provide the framework for rapid waste unit characterization and regulatory document development and approval. These management approaches are described in the following paragraphs.

SAFER is an iterative or phased approach to guide the process from preliminary investigation to remediation. Through the development of a Conceptual Site Model (CSM) and Data Quality Objectives (DQOs), SAFER ensures that data of sufficient quality and quantity are collected. As a result, decisions can be proven technically valid and legally defensible.

ESC incorporates SAFER to optimize field activities to produce a product that is both cost- and time-effective. It identifies the minimum data required to produce unit characterization results that are acceptable to the public. ESC uses a technical team, which maximizes the use of existing data to identify unit-specific constituents (USCs). The technical team continually reviews and modifies the Sampling and Analysis Plan (SAP) based on real-time data acquired during sampling.

This Work Plan presents an investigation designed to determine the nature and extent of contamination originating from the RdACB OU and to prepare for a human health and ecological Baseline Risk Assessment (BRA).

1.1 RFI/RI Work Plan Organization

This Work Plan is organized into nine sections, corresponding to the format described in *Regulatory Document Formats (U)* (WSRC 1996b). All figures and tables are located at the end of the section in which they are first referenced. Section 1, "Introduction," outlines the regulatory framework guiding the Work Plan and presents an overview of the location, history, and environmental setting of the RdACB OU. Section 2, "Preliminary Unit Evaluation," details the unit history and waste composition, physical setting, demography and land use, climate, ecological setting, regional and unit-specific geology, and hydrogeology. It also presents previous investigations conducted at the RdACB OU. Section 3, "Data Quality Objectives," discusses the DQOs associated with the unit, outlines contaminant transport and receptor mechanisms in the CSM, identifies the preliminary remedial alternatives, and establishes the data needs to support the CSM and preliminary remedial alternatives. Section 4, "Unit Assessment," outlines the environmental sampling needed to fill identified data gaps and confirm existing data. Section 5, "Schedule," addresses Savannah River Site (SRS) schedule deadlines for field activities, milestones, and deliverables. Sections 6, 7, and 8 provide information on the Safety, Health, and Emergency Response Plan; Quality Assurance/Quality Control Plan; and Data Management Plan, respectively. Section 9 lists references used to prepare the document. Appendices provide detailed supporting information.

1.2 Regulatory Background

1.2.1 RCRA Facility Investigation (RFI) Program

The United States Department of Energy (DOE) Savannah River Operations Office manages waste materials that are regulated under RCRA, a comprehensive law that requires the stringent management of hazardous waste. In 1984, the original RCRA requirements were augmented by the Hazardous and Solid Waste Amendments (HSWA).

Certain activities require operation or post-closure permits issued in accordance with RCRA and HSWA. SRS has received a RCRA permit from the South Carolina Department of Health and Environmental Control (SCDHEC). The permit mandates that SRS establish and implement an RFI program to fulfill the requirements of RCRA Section 3004(u). Solid Waste Management Units were identified by the United States Environmental Protection Agency (EPA) Region IV through the RCRA Facility Assessment process and are therefore subject to the RFI process.

1.2.2 CERCLA Remedial Investigation Program

SRS was included on the National Priorities List on December 21, 1989, and is subject to the provisions of CERCLA. In accordance with Section 120 of CERCLA, DOE negotiated a three-party Federal Facility Agreement (FFA) with the EPA and SCDHEC to develop a single comprehensive cleanup strategy at SRS.

Public participation requirements are listed in Sections 113 and 117 of CERCLA. These requirements include establishing an Administrative Record File that permits the public to be informed about the selection of cleanup alternatives. Additionally, this file provides a medium through which the public can review and comment on the selected cleanup alternatives.

This unit-specific Work Plan will become part of the Administrative Record File. Repositories containing information from these files have been established at DOE's Public Reading Room, located at the University of South Carolina in Aiken, South Carolina; the Thomas Cooper Library in Columbia, South Carolina; the Reese Library in Augusta, Georgia; and the Asa H. Gordon Library in Savannah, Georgia.

1.3 Summary of Unit Description

The RdACB OU is located in the southwestern section of SRS, approximately 0.8 kilometers (km) (0.5 miles [mi]) southwest of the intersection of SRS Road A (South Carolina Route 125) and SRS Road 6 (Figure 1-1). The unit is approximately 3 km (1.9 mi) southeast of the D-Area Powerhouse and approximately 6.4 km (4 mi) from the nearest plant boundary. The RdACB OU is an inactive liquid waste disposal basin, which received unknown quantities of hazardous and radioactive materials (Figure 1-2). The exact operation period of the unit is not known, but it is expected that the basin existed as early as 1954. In 1973, the basin was backfilled with native soil. No wastes have been deposited since this time. The area surrounding the basin was regraded between 1973 and 1987. The exact nature of hazardous and, potentially, radioactive wastes disposed at the RdACB OU is not known because an inventory of disposal was not logged for this basin. Additional details concerning the history of the RdACB OU are presented in Section 2.2.1.

The RdACB OU is irregular in shape, with average dimensions of approximately 30 meters (m) (98 feet [ft]) wide by 53 m (174 ft) long (Figure 1-2). The unit is located in a cleared area adjacent to wooded lands in an area of moderate relief. Previous subsurface investigations revealed that the Tobacco Road and Dry Branch Formations of the Barnwell Group underlie the

RdACB OU. Soils at the RdACB OU are classified as Udorthents, friable substratum. Unit geology and unit soils are discussed in detail in Sections 2.2.6.2 and 2.2.7, respectively. Groundwater beneath the unit is approximately 10.7 m (35 ft) below land surface (bls) and is identified as the Upper Three Runs Aquifer Unit. Unit hydrogeology is discussed in Section 2.2.8.2.

FIGURES

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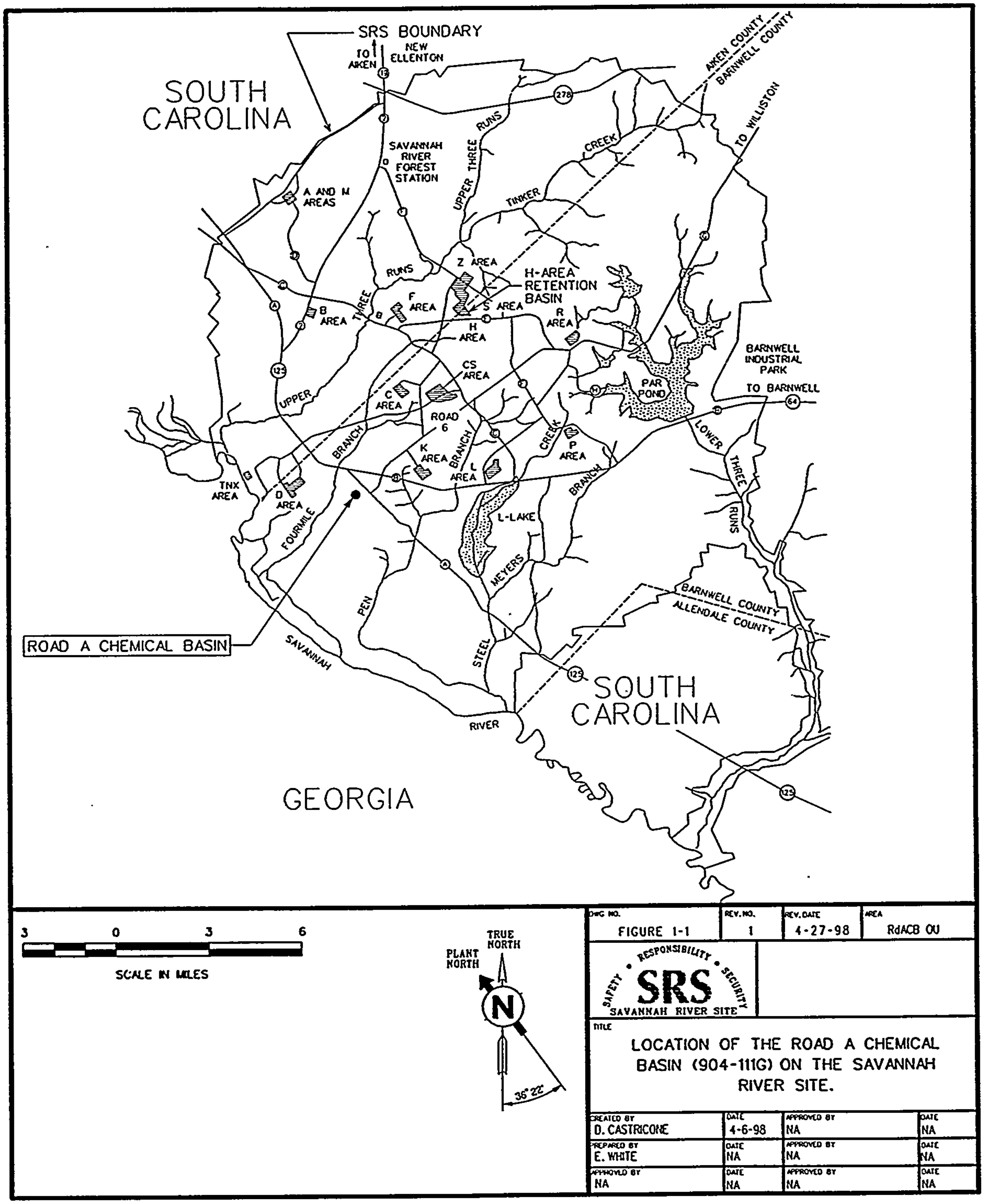

Figure 1-1. Location of the Road A Chemical Basin (904-111G) on the Savannah River Site

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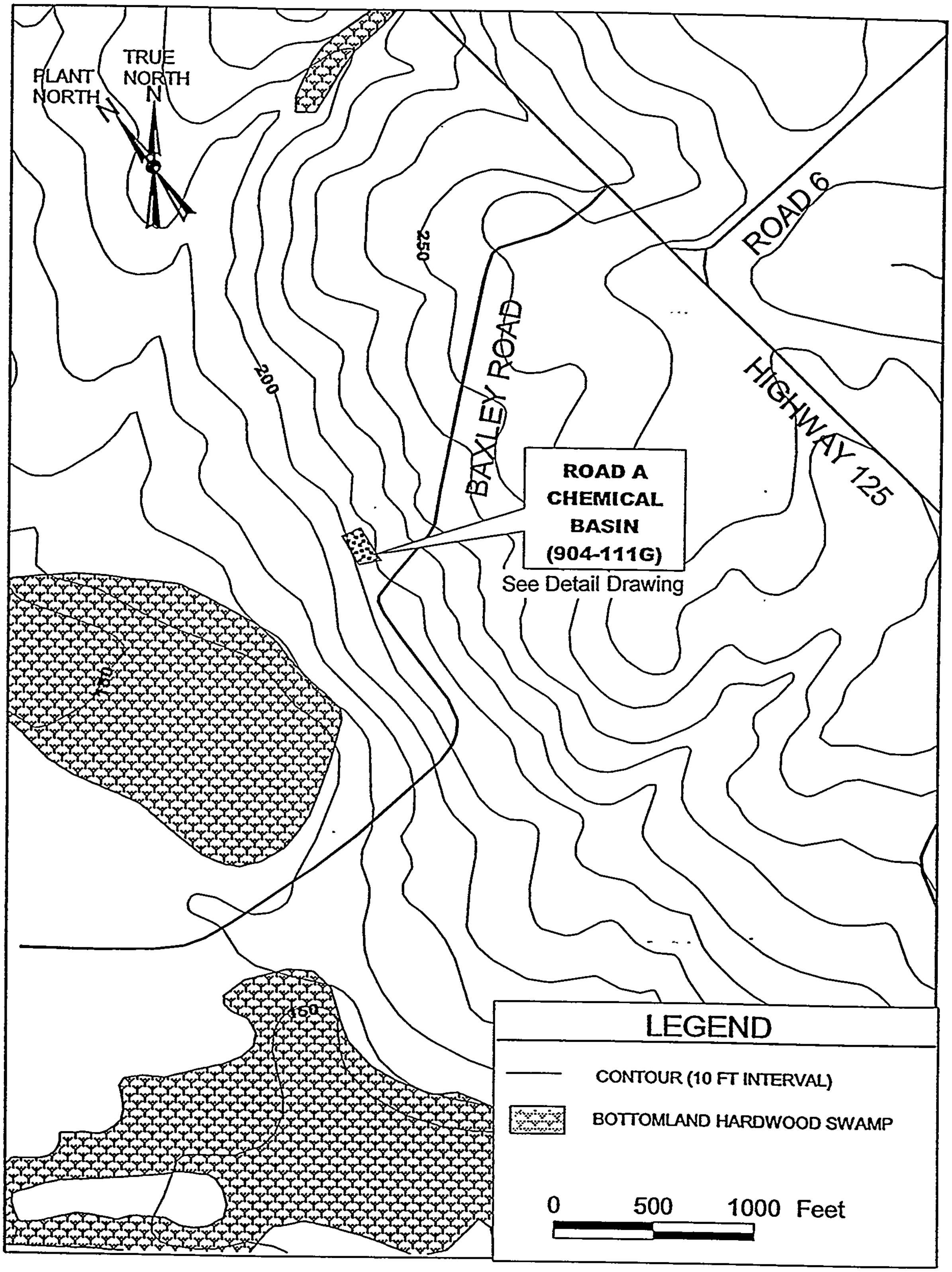
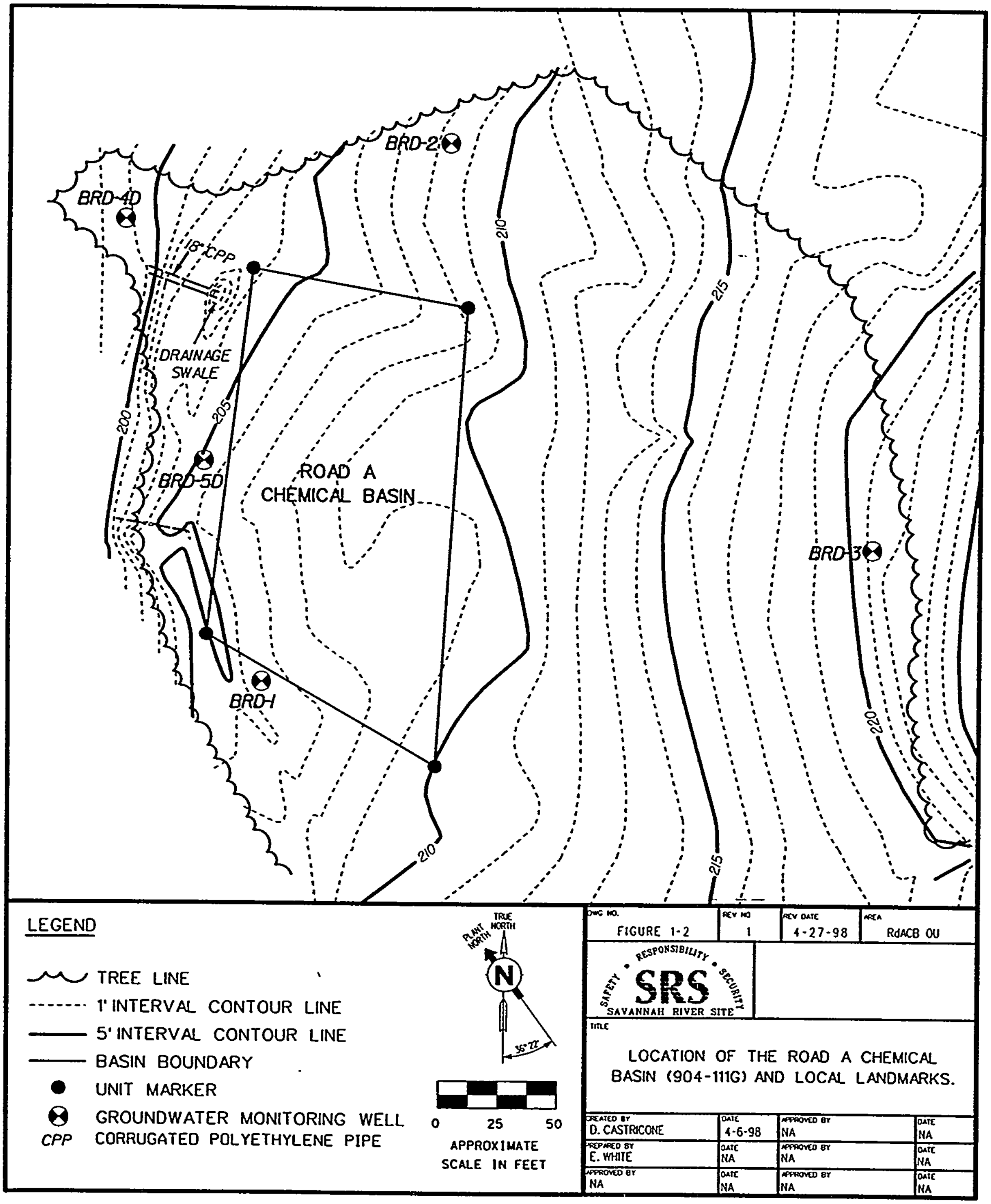


Figure 1-2. Location of the Road A Chemica



Basin (904-111G) on the Savannah River Site

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2.0 PRELIMINARY UNIT EVALUATION

2.1 Introduction

This section describes the preliminary unit evaluation of the RFI/RI for the RdACB OU. This preliminary evaluation is based on the *Environmental Information Document for the Road A Chemical Basin* (Pickett et al. 1987), the draft *Preliminary Characterization Summary/Preliminary Risk Assessment Report for the Road A Chemical Basin* (CH_2M Hill 1990), and the *Predecisional, Revision 0, Phase II, RCRA Facility Investigation Work Plan for the Road A Chemical Basin (U)* (WSRC 1992). In addition, the unit evaluation presents the results of a unit reconnaissance, a soil gas survey, and groundwater well monitoring and sampling data.

Using the concept of the SAFER, the available information for the RdACB OU was reviewed and evaluated to determine the nature of contaminants potentially placed in the RdACB OU, as well as the probability of secondary source contamination. Based upon this review, a preliminary list of applicable or relevant and appropriate requirements (ARARs) and "to be considered" (TBC) factors was developed to establish preliminary objectives.

2.2 Unit Characteristics

The following sections present known unit characteristics, including unit history and waste composition, physical setting, demography and land use, climate, ecological setting, regional and unit-specific geology, and hydrogeology.

2.2.1 Unit History and Waste Composition

Little information is available on the operational history of the RdACB OU. The disposal history of wastes in the RdACB OU, including the exact dates of operation and the quantities of materials disposed in the unit, was not recorded, however, evidence suggests that the basin was in operation as early as 1954. The RdACB OU received uranium process liquids, primarily caustics from the 300-M Area from an unknown time until 1974 (Pirkle and Masdea 1993). An Environmental Information Document and the draft Preliminary Characterization Summary/Preliminary Risk Assessment Report indicate that the contents of the basin included miscellaneous radioactive waste and chemical aqueous wastes (Pickett et al. 1987; CH_2M Hill 1990). The RdACB OU consists of an inactive waste disposal basin, which received unknown quantities of hazardous and radioactive materials (Figure 1-2). In 1973, the basin was backfilled with native soil. No wastes have been disposed in the unit since this time. Photographs taken in 1973, shortly before the unit closure, show a surface depression containing standing water (Pickett et al. 1987). These photographs are included in Appendix A. The photographs also show signs labeled "Keep Out–Dangerous Chemicals" at each end of the unit. However, these warning signs were removed after the unit was backfilled. Figures A-1 and A-2 in Appendix A show standing water contained within the RdACB OU prior to closure and backfilling in 1973. No information is available concerning closure and backfilling of the RdACB, or disposition of standing surface water contained within the basin at the time of closure. Surface soils surrounding the basin could have been impacted during backfilling operations due to displacement of potentially contaminated surface water. Some time after 1973, but before 1987, an area approximately ten times the area of the original basin was regraded and vegetated with vetch (Pickett et al. 1987).

The history of investigation activities at the RdACB OU includes the installation of four groundwater monitoring wells in 1983 and 1984, installation of a fifth groundwater monitoring well in 1989 (Figure 2-1), nine boreholes drilled in 1989 (Figure 2-2), and a soil gas survey conducted in 1992 (Figure 2-3).

2.2.2 Physical Setting

The RdACB OU is located on the Aiken Plateau at a ground surface elevation of approximately 62.5 m (205 ft) above mean sea level (msl). Topographically, the basin is close to the escarpment found along an elevation contour of approximately 48.8 m (160 ft) that separates the Aiken Plateau from the Ellenton Plain. The Ellenton Plain is the highest of three step-like surfaces between the Savannah River and the Aiken Plateau (Pickett et al. 1987).

The ground surface slopes moderately from the basin at a rate of approximately 4 to 5 percent to the wetlands (Figure 1-2). These wetlands are approximately 243.8 m (800 ft) southwest of the RdACB OU. Fourmile Creek, a major tributary of the Savannah River, drains these wetlands between 1,676 and 1,829 m (5,500 and 6,000 ft) west of the RdACB OU. The unit is located in the Savannah River Floodplain Swamp Watershed. Figure 2-4 shows the location of the RdACB OU, in the Savannah River Floodplain Swamp Watershed, and its relation to the other watersheds at SRS.

The RdACB OU is situated within a cleared area adjacent to wooded lands in an area of moderate relief. The cleared area, approximately 569 m^2 (6,125 ft^2), is surrounded by pines and hardwoods, with a stand of bottomland hardwood approximately 200 m (656 ft) to the southwest. Five groundwater monitoring wells are located in the immediate vicinity of the RdACB OU. These wells are BRD-1, BRD-2, BRD-3, BRD-4D, and BRD-5D. Access to the RdACB OU is via a gravel road (Baxley Road) off of South Carolina Route 125 (Figure 1-1). Route 125 traverses through the SRS boundary and is open to the general public. Access to the unit is prevented by a 2.4 m (8 ft) locked chain-link fence that surrounds the basin. Orange Health Protection RFI/RI unit marker balls, which indicate a RCRA/CERCLA unit, are located at the corners of the RdACB OU.

Surface soils at the RdACB OU belong to the Udorthents soil series. Udorthents are soils that occur as spoil from excavated or disturbed areas of friable soil material. Udorthents soils generally are friable but can be firm in areas that have been compacted by heavy equipment. The Udorthents generally have a very low content of organic matter and are strongly to extremely acidic (Rodgers 1990). Figure 2-5 identifies the soil classifications at the unit and surrounding area.

The depth to groundwater beneath the RdACB OU is approximately 10.7 m (35 ft) bls at an elevation of approximately 50.6 m (166 ft) above msl. Groundwater elevations indicate that groundwater flow is to the southwest. Natural discharge of the Water Table Aquifer is toward the bottomland wetlands, which are about 243.8 m (800 ft) to the southwest (Figure 1-2). The groundwater from the Water Table Aquifer likely crops out in that area and then discharges to Fourmile Creek.

2.2.3 Demography and Land Use

SRS is located approximately 32 km (20 mi) south of Aiken, South Carolina, and approximately 40 km (25 mi) southeast of Augusta, Georgia. According to 1990 census data, the average population densities (people per square mile) for the surrounding South Carolina counties are 111 for Aiken County, 36 for Barnwell County, and 28 for Allendale County. For the surrounding Georgia counties, the densities are 228 for Columbia County, 524 for Richmond County, 25 for Burke County, and 21 for Screven County. The average population density in the counties surrounding SRS is 85 people per square mile. Based on 1990 U.S. Census Bureau data, the population within a 80.5 km (50 mi) radius of SRS is 620,100 (WSRC 1995c). The estimated population for the area in the year 2000 is projected to be 852,000. This estimate was calculated utilizing the 1970 to 1980 growth rate of each county within a 80.5 km (50 mi) radius, assuming the same growth rate for the period between the years 1990 and 2000. The calculation assumed that the population would remain constant for counties that experienced a negative population growth between 1970 and 1980. Additional details on demography can be found in the "Site Characteristics" chapter of the *Generic Safety Analysis Report for SRS* (WSRC 1995c).

Most of the urbanized development in the SRS area has occurred in and around the cities of Augusta, Georgia, and Aiken, South Carolina. Agriculture accounts for 24 percent of the total land use; forest, wetlands, water bodies, and unclassified land that is predominantly rural accounts for about 70 percent of the total land use. A projected 2 percent increase in the development of urban land surrounding SRS is expected by the year 2000. Within SRS, less than 5 percent of the total area is urbanized and/or developed. All of the facilities engaged in the production of special nuclear materials are located within a fraction of this area. Reservoirs and ponds comprise approximately 12.9 km^2 (5 mi^2) of SRS. The remainder of the more than 776 km^2 (300 mi^2) is comprised of natural vegetation and pine plantations. The *Savannah River Site Future Use Project Report* (DOE 1996) presents SRS stakeholder-preferred future use recommendations. The preferred future land use for the area where the RdACB OU is located is designated as residential (DOE 1996). Figure 2-6 illustrates proposed future land use for SRS.

2.2.4 Climate

The average regional annual temperature is 18.3°Celsius (C) (65°Fahrenheit [F]) at SRS. In general, the SRS region has a temperate climate with relatively short, mild winters and long, hot, and humid summers. Summer average low and high temperatures are approximately 21.1°C (70°F) and 33.3°C (92°F), respectively, while average winter low and high temperatures are approximately 2.2°C (36°F) and 15°C (59°F), respectively. The SRS region is subject to continental influences but is protected from relatively severe winters by the Appalachian Mountains to the north and northwest. Often influenced by warm, moist, maritime air masses throughout the year, less than one-third of the winter days have a minimum temperature below freezing.

Rainfall at the site tends to be evenly distributed throughout the year. The average annual precipitation at SRS is 122 centimeters (cm) (48 inches [in.]), and the greatest observed rainfall for a 24-hour (hr) period was approximately 50 cm (19.6 in.) in October 1990. The evaporation rate is approximately 76.2 cm (30 in.) per year. The most severe weather is limited to frequent thunderstorms and infrequent tornadoes and hurricanes. There are approximately 54 thunderstorm days per year. Most of these thunderstorm days occur during the summer.

In general, seasonal prevailing winds are as follows: winter, northwest to southeast; spring, west to east; summer, southwest to northeast; and autumn, toward the southwest and southeast. Additional details concerning the climatology and meteorology of SRS can be found in the "Site Characteristics" chapter of the *Generic Safety Analysis Report for SRS* (WSRC 1995c).

2.2.5 Ecological Setting

The RdACB OU is located in the Savannah River Floodplain Swamp Watershed (Figure 2-4). Seven major vegetation communities are reported from within the floodplain. These include the "Pine," "Nonforested," "Bottomland Hardwood," "Pine/Hardwood," "Upland Hardwood," "Swamp," and "Water" classes, providing a habitat for a wide range of terrestrial and aquatic animals (Workman and McLeod 1990). These community habitat types support about 54 species of mammals, 216 species of birds, 43 species of amphibians, and 58 species of reptiles throughout SRS (Wike et al. 1994).

In the immediate vicinity (within a 1,000 ft radius) of the RdACB OU, "Nonforested," "Pine," and "Pine/Hardwood" habitat types are mainly present. The dominant vegetative cover in the vicinity of the RdACB OU consists of loblolly pine (*Pinus taeda*), longleaf pine (*Pinus palustris*), slash pine (*Pinus elliottii*), various hardwoods and scrub/shrub species. Loblolly pine is widely planted at SRS from the uplands to bottomland terraces. Loblolly stands commonly contain sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), water oak (*Quercus nigra*) and persimmon seedlings (*Diospyros virginiana*), with southern red oak (*Quercus falcata*) and sand hickory (*Carya pallida*) occasionally present. The understory infrequently contains broomsedge (*Andropogon virginicus*), dog fennel (*Eupatorium capillifolium*) and Japanese honeysuckle (*Lonicera japonica*) (Workman and McLeod 1990).

Federally protected species occurring at SRS include the wood stork, red-cockaded woodpecker, bald eagle, peregrine falcon, and Kirkland's warbler. All are permanent residents at SRS, except the bald eagle, which migrates from July to September, and the peregrine falcon and Kirkland's warbler, which are rare visitors. No federally listed amphibians, reptiles, or mammals are known to occur on SRS. No threatened, endangered, or sensitive bird species are known to occur at the RdACB.

2.2.6 Geology

2.2.6.1 Regional Geology

Three distinct geologic and hydrogeologic systems occur in the subsurface beneath SRS: (1) Paleozoic metamorphic and igneous rocks; (2) Triassic mudstones, sandstones, and conglomerates; and (3) Late Cretaceous to Tertiary unconsolidated and semi-consolidated Coastal Plain sediments (Figure 2-7). The Coastal Plain sequence is essentially an undeformed wedge of sediments consisting of marine and fluvial clay, limestone, sand, and gravel. In South Carolina, the Coastal Plain sediments thicken southeastward from the Fall Line near Augusta, Georgia, to the coast where their thickness exceeds 1,097 m (3,600 ft). In the vicinity of SRS, these sediments are approximately 320 m (1,050 ft) thick and range in age from Late Cretaceous to Holocene.

The upper part of the Coastal Plain sequence at SRS consists of the Barnwell Group. The Barnwell Group includes (from oldest to youngest) the Clinchfield Formation, the Dry Branch Formation, the Tobacco Road Formation, and the Altamaha Formation. The group is about 21.3 m (70 ft) thick near the northwestern boundary of SRS and 51.8 m (170 ft) thick near the southeastern boundary (Aadland et al. 1995).

The uppermost aquifer beneath the RdACB OU consists of sediments representing the Barnwell Group (Figure 2-7). These sediments are described below. The nomenclature follows Fallaw and Price (1995); the source for these descriptions is Aadland et al. (1995) and references therein.

2.2.6.1.1 Clinchfield Formation

The basal late Eocene Clinchfield Formation consists of light-colored quartz sand and glauconitic, biomoldic limestone, calcareous sand, and clay. Sand beds of the formation constitute the Riggins Mill member of the Clinchfield Formation and are composed of medium to coarse, poorly to well-sorted, loose and slightly indurated, tan, gray, and green quartz. The sand is difficult to identify unless it occurs between the carbonate layers of the Griffins Landing member of the overlying Dry Branch Formation and the carbonate layers of the underlying Santee Formation. The Clinchfield Formation is about 7.6 m (25 ft) thick in the southeastern part of SRS and pinches out or becomes unrecognizable at the center of the site. Sand probably was deposited as the Barnwell Sea transgressed over the eroded Santee Formation.

The carbonate sequence of the Clinchfield Formation constitutes the Utley Limestone member of the Clinchfield Formation. It is composed of sandy, glauconitic limestone and calcareous sand, with an indurated, biomoldic facies developed in places. In lithologic cores, the sediments are tan and white and slightly to well indurated.

2.2.6.1.2 Dry Branch Formation

The Jacksonian (late Eocene) Dry Branch Formation is divided into the Griffins Landing member, the Twigs Clay member, and the Irwinton Sand member. The unit is about 18.3 m (60 ft) thick at SRS. The top of the Dry Branch Formation has been identified from geophysical logs, where a low gamma ray count in the relatively clean Dry Branch sand increases sharply in the more argillaceous sediments of the overlying Tobacco Road Formation. The Dry Branch Formation contains a tan, light gray, and brown discontinuous clay up to 3.6 m (12 ft) thick.

The Griffins Landing member is composed mostly of tan or green, slightly to well-indurated, quartzose, calcareous micrite and sparite, calcareous quartz sand, and slightly calcareous clay. Local oyster beds are common in the Griffins Landing member. The unit is widespread in the southeastern part of SRS, where it is about 15 m (50 ft) thick, but becomes sporadic in the center of SRS where it pinches out. Carbonate content is highly variable. In places, the unit lies unconformably on the Utley Limestone member, which contains much more indurated, moldic limestone. In other areas at SRS, the unit lies on the noncalcareous quartz sand of the Clinchfield Formation. Updip, the Clinchfield Formation is difficult to identify or is missing, and the Griffins Landing member may lie unconformably on the sand and clay facies of the Santee Formation. The Griffins Landing member appears to have formed in shallow marine to lagoonal environments.

The Twiggs Clay member is composed of tan, light gray, and brown clay. The Twiggs Clay member is as thick as 3.6 m (12 ft) but is not continuous over long distances.

The Irwinton Sand member is composed of tan, yellow and orange, moderately sorted, quartz sand, with interlaminated and locally abundant interbedded clay. Pebbly layers and clay clast-rich zones are common. Discontinuous clay beds are tan, light gray, and brown and can be several feet thick in places. These are the "tan clay" beds stated in various SRS reports. Irwinton sand beds have the characteristics of a shallow marine deposit, and the clay may have formed in a lagoonal or marsh environment. The thickness of the Irwinton Sand member varies from 12.2 to 21.3 m (40 to 70 ft).

2.2.6.1.3 Tobacco Road Formation

The late Jacksonian (Late Eocene) Tobacco Road Formation consists of moderately to poorly sorted, red, brown, tan, purple, and orange, fine to coarse, clayey quartz sand. Pebble layers are common, as are clay laminae and beds; burrows are abundant in parts of the formation. The top of the Tobacco Road Formation is identified where comparatively well-sorted sand is overlain by more poorly sorted sand, pebbly sand, and clay of the Altamaha Formation. Contact between the units is difficult to identify on geophysical logs because the upper surface of the unit is irregular due to fluvial incision that accompanied deposition of the overlying Altamaha Formation.

2.2.6.1.4 Altamaha Formation

Deposits of poorly sorted, silty, clayey sand, pebbly sand, and conglomerate of the Altamaha Formation (formerly "Upland Unit") cap many of the hills at higher elevations over much of SRS. Weathered feldspar is abundant in places. The color is variable, and facies changes are abrupt. These materials have previously been assigned to the Hawthorn Formation and may be Miocene in age. According to Siple (1967), a significant characteristic of the Hawthorn Formation that distinguishes it from underlying units is the presence of numerous clastic dikes. These features, according to Siple, do not occur in the Eocene (Jacksonian) sediments, at least to the degree that they do in the overlying Altamaha Formation. The environment of deposition for the Altamaha Formation appears to be fluvial, and the thickness changes abruptly, owing to channeling of the underlying Tobacco Road Formation during Altamaha deposition and subsequent erosion of the Altamaha Formation itself. Thicknesses up to 18.3 m (60 ft) have been documented.

The Altamaha Formation, Tobacco Road Formation, and Dry Branch Formation are similar in texture and composition, indicating that they might have a similar provenance (i.e., that they are part of the same transgressive/regressive depositional cycle, with the Altamaha Formation being the most continental lithofacies and the Dry Branch Formation being the most marine lithofacies). Thus, the Altamaha Formation represents a major regressive pulse that closed out deposition of the Barnwell Group depositional cycle. The Altamaha Formation may be correlative with the Chandler Bridge Formation downdip in South Carolina and Georgia. This hypothesis is significant because it implies that there was no major hiatus between the Altamaha Formation and the underlying Tobacco Road Formation and Dry Branch Formation. However, the existence of a hiatus between the units has been reported by numerous researchers of the South Carolina Coastal Plain.

2.2.6.1.5 Quaternary Deposits

Quaternary alluvium comprises the floodplains and constructional terraces of the Savannah River and its major tributaries. The deposits are poorly sorted sands, clays, and gravels, which vary in thickness from a fraction of an inch in the higher elevations of the subsequent streams to over 9 m (30 ft) thick in the Savannah River floodplain. Within the boundaries of SRS, the Quaternary terraces are generally thin and discontinuous.

2.2.6.2 Unit Geology

In 1989, a preliminary investigation was conducted at the RdACB OU. This preliminary investigation included drilling nine boreholes within and adjacent to the unit. Five of these boreholes were drilled to a depth of 3.0 m (10 ft) and four were drilled to a depth of 10.7 m (35 ft) (Figure 2-2). The lithologic logs from these boreholes and geologic data collected during groundwater monitoring well installation provide unit-specific lithologic data about the shallow geology beneath the RdACB OU. Appendix B contains the lithologic logs for the nine boreholes and groundwater monitoring well BRD-5D. Cross-sections were generated using the data obtained from the nine boreholes (Figures 2-8 and 2-9).

Based on the boreholes to 10.7 m (35 ft) deep and the lithologic log from monitoring well BRD-5D, which was installed to 18.9 m (62 ft) deep, the Tobacco Road and Dry Branch Formations of the Barnwell Group underlie the RdACB OU. Both of these formations are predominantly sandy, with the Tobacco Road Formation showing more orange color and the Dry Branch Formation showing more tan to yellow color. The lithologic logs from the nine boreholes installed at the RdACB OU indicate that most of the soil profile is predominantly sands and silty sands with minor amounts of clayey sand and cobbles. Cobbles are common near the surface and are present in an eroded area adjacent to the RdACB OU.

2.2.7 Unit Soils

The soils at the RdACB OU are predominantly sandy, varying primarily by their slope and degree of drainage. Soils series within and adjacent to the RdACB OU are Udorthents, Blanton sands, Wagram sands, and Pickney sands (Figure 2-5).

In the immediate RdACB OU area, the soils are classified as Udorthents, friable substratum. This classification is reserved for areas that have been graded, or otherwise disturbed, by human activities.

The Blanton sand is the predominant soil series present immediately beyond the disturbed area of the RdACB OU. These soils are generally excessively drained, low in organic matter and available water, and found on slopes of 0 to 6 percent. These soils are predominantly sand to a depth of 122 cm (48 in.). At this depth, the soil grades to a sandy loam (Rogers 1990).

Soils of the Wagram sand are adjacent to the Blanton sand series. These soils are very similar to Blanton sands with regards to the soil profile, composition, and other classification parameters. The primary difference is that the Wagram sand is found on slopes of 2 to 6 percent (Rogers 1990).

Along the perennial streams and floodplains in this area, the soils are predominantly classified as Pickney sand, frequently flooded. These soils are predominantly sandy with abundant organic matter near the surface, and less organic matter with increasing depth. This soil is typified by a high water table and is frequently flooded during the winter and spring (Rogers 1990).

2.2.8 Hydrogeology

2.2.8.1 Regional Hydrogeology

In the immediate area of the RdACB OU, hydrogeologic details are poorly defined compared to other areas of SRS. No Baseline Hydrogeologic Investigation Observation Well Clusters (P-well series) are in the immediate vicinity of the RdACB OU. The closest well cluster of this series (P-23) is approximately 3.2 km (2 mi) southeast of the RdACB OU. The following paragraphs describe the hydrogeology at the unit starting with the uppermost aquifer. This information has been summarized from *Hydrogeologic Framework of West-Central South Carolina* (Aadland et al. 1995).

The vadose zone contains sediments of the Barnwell Group. The thickness of the vadose zone is approximately 10.7 m (35 ft) beneath the RdACB OU. The unconfined aquifer, known as the Upper Three Runs Aquifer, belongs to the Floridan Aquifer System (Figure 2-7). The aquifer occurs between the water table and the Gordon Confining Unit. The aquifer is composed of Tertiary deposits of the Orangeburg Group and all of the overlying Barnwell Group. It consists mainly of unconsolidated, moderately sorted, subangular, lower coarse- to medium-grained, slightly gravelly, immature yellow and tan quartz sand and clayey sand of the Santee Formation; poorly to well-sorted sand and interbedded tan or gray clay of the Dry Branch Formation; and moderately to poorly sorted, fine- to coarse-grained sand, pebbly sand, and minor clay of the Tobacco Road Formation.

The Upper Three Runs Aquifer consists of the water-bearing sediment from the water table to the top of the Gordon Confining Unit. The aquifer is 18.3 m (60 ft) thick at the P-23 well cluster. The Upper Three Runs Aquifer generally demonstrates lower transmissivity values than the underlying Gordon Aquifer.

Hydrostratigraphic head generally decreases from the water table to the Gordon Aquifer, indicating downward migration of groundwater. However, vertical flow is impeded by the Gordon Confining Unit, where leakage is calculated to be approximately 5.3E-05 ft/day/ft (Aadland et al. 1995). In addition to impeded flow, the presence of clay minerals in the confining unit may retard migration of some contaminants, especially metals and metallic radionuclides.

The Gordon Confining Unit separates the Upper Three Runs Aquifer from the Gordon Aquifer across much of SRS. The Gordon Confining Unit consists of an interval of clayey sand and clay. Boundaries between the Upper Three Runs and Gordon Aquifers are defined by the vertical extent of the confining units. A confining unit is differentiated from an aquifer by a relative increase in silt and clay content that is consistent over a large area. The hydrogeologic changes do not always correspond with boundaries between stratigraphic units. Geologic formations therefore remain implicit in the hydrostratigraphy.

The Gordon Confining Unit is 2.1 m (7-ft) thick at the P-23 well cluster; it thickens to 26 m (85 ft) in the southeastern portion of SRS. It is composed of fine-grained, glauconitic, clayey sand and clay of the Warley Hill Formation, and clayey, micritic limestone of the Blue Bluff member of the Santee Formation. The Gordon Aquifer underlies the Gordon Confining Unit and comprises the lowermost element of the Floridan Aquifer System. Deeper hydrostratigraphic units include the Crouch Branch Confining Unit of the Meyers Branch Confining System; Crouch Branch Aquifer, McQueen Branch Confining Unit, and McQueen Branch Aquifer of the Dublin-Midville Aquifer System; and undifferentiated units of the Appleton Confining System.

2.2.8.2 Unit Hydrogeology

The unit hydrogeology is defined from data collected during the preliminary characterization borehole sampling and the five existing BRD series wells. Lithologic descriptions from the nine boreholes indicate that sands and silty sands underlie the RdACB OU. No continuous, low-permeability layers are present locally in the vadose zone. Therefore, there are no local barriers to prevent infiltration of precipitation to the Water Table Aquifer, based on the data provided by the nine boreholes.

The BRD series wells are all screened in the Upper Three Runs Aquifer. The top of the Upper Three Runs Aquifer, as recorded by the BRD well series, is approximately 11.3 m (37 ft) bls. Groundwater elevations beneath the RdACB OU range between 51.2 and 52.1 m (168 and 171 ft) above msl. As shown on Figure 2-10, groundwater flow is to the west-southwest at a gradient of approximately 0.006 m/m (0.006 ft/ft).

The ground surface elevation in the wetlands is approximately 48.8 m (160 ft) above msl, which is approximately 1.5 m (5 ft) below the water table elevation at the RdACB OU. Groundwater discharges along the seepage line are likely from the Water Table Aquifer (Upper Three Runs Aquifer). The drop in elevation results in an approximate 0.6 percent gradient, which is consistent with the expected range in this region.

The existing groundwater monitoring wells do not penetrate the deep aquifers in the vicinity of the RdACB OU. Therefore, the properties of these aquifers have not been tested. The approximate elevation of the potentiometric surface in the Gordon Aquifer beneath the RdACB OU is about 39.6 m (130 ft) above msl (Pickett et al. 1987). This lower elevation suggests possible downward flow from the Water Table Aquifer to the Gordon Aquifer. At the same time, the potentiometric surface of the Crouch Branch Aquifer is believed to be approximately 50.0 m (164 ft) above msl. This higher potentiometric surface suggests groundwater flow from the Crouch Branch Aquifer to the Gordon Aquifer (Bledsoe 1987). Potentiometric head relationships in the P-23 well cluster support this hypothesis. The P-23 well cluster, located approximately 3.2 km (2 mi) southeast of the RdACB OU, indicates a 0.9 m (3 ft) increase in hydraulic head from the Water Table Aquifer to the Gordon Aquifer (Figure 2-11) (Aadland et al. 1995). The P-26 well cluster also shows head reversal from the Gordon Aquifer to the Water Table Aquifer (Figure 2-12) (Aadland et al. 1995). The groundwater elevation of the deeper Crouch Branch Aquifer is 5 m (17 ft) higher than the groundwater elevation in the overlying

Gordon Aquifer at well cluster P-26, indicating potential upward flow across the Crouch Branch Confining Unit.

2.3 Existing/Previous Investigations

Previous investigations conducted at the RdACB OU include installation and sampling of groundwater monitoring wells, soil samples collected from nine boreholes, a soil gas survey, and a radiological survey. The results of these previous investigations are presented in the following sections.

2.3.1 Groundwater Monitoring

Based on review of the WSRC Environmental Protection Department's Well Inventory, and the unit reconnaissance presented in Appendix C, five groundwater monitoring wells are located in the vicinity of the RdACB OU (Figure 2-1). These wells are BRD-1, BRD-2, BRD-3, BRD-4D, and BRD-5D (WSRC 1996a). Wells BRD-1, BRD-2, BRD-3, and BRD-4D were installed in 1983 and 1984; well BRD-5D was installed in 1989. Well construction details are presented in Table 2-1. Monitoring well construction details for wells BRD-4D and BRD-5D are presented in Appendix B. Screened intervals range from 39.3 to 57.5 m (129.1 to 188.5 ft) above msl, and total depths range from 17.4 to 21.3 m (57 to 70 ft) deep. From 1984 to 1992, the groundwater elevations were measured quarterly in all five wells. Due to an observed drop in groundwater elevation, the upgradient well (BRD-3) went dry in 1987. However, groundwater was observed in this well again in 1992. After 1993, groundwater elevations were measured in the first, second, and third quarters of 1994; in the first quarters of 1995 and 1996; and in second quarter of 1997. Hydrographs for all five wells are presented in Figure 2-13. These hydrographs indicate a general decrease in the water table elevation from 1985 to 1989. The water table elevation increased from 1989 to 1991 and has remained relatively stable since 1991. Overall, the average groundwater elevations range from 49.9 to 51.7 m (163.7 to 169.5 ft) above msl. A statistical summary of the water level elevation data is presented in Table 2-2.

The water table surface map (Figure 2-10) was generated from first quarter 1996 groundwater elevations measured in all five BRD series wells. Groundwater flow is to the west-southwest. Based on this water table surface map, well BRD-3 is upgradient of the RdACB OU. Well BRD-2 is side-gradient, and wells BRD-1, BRD-4D, and BRD-5D are downgradient of the RdACB OU.

Based on groundwater velocities calculated in the area, the groundwater travel time from the RdACB OU to the wetlands seep line, which is approximately 243.8 m (800 ft) away, was estimated to range from 75 to 150 years (CH_2M Hill 1990).

2.3.2 Groundwater Sampling and Analysis

From 1988 to 1996, all five wells were sampled and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, dioxins/furans, pesticides, gross alpha, nonvolatile beta, and tritium. Groundwater is potentially contaminated through the leaching of contaminants from the deep soil. The discussion of the CSM in Section 3 presents this information in further detail.

Table 2-3 summarizes the groundwater analytical data collected and analyzed from 1988 to 1996 and presents all analytes detected in monitoring wells at the RdACB OU. Table 2-3 also provides the total number of samples collected, the number of times each analyte was detected, the maximum observed concentration, the Safe Drinking Water Act Maximum Contaminant Level (MCL), and the EPA Risk-Based Concentration (RBC). Both the MCL and RBC are used in the preliminary evaluation of groundwater quality. RBC values used in this evaluation are published by EPA Region III (EPA 1999).

Sixty analytes have been detected in samples collected from the monitoring wells. Of the 60 analytes detected in samples from the five BRD series wells, eight analytes exceeded MCLs and nine exceeded RBCs. Table 2-4 presents only the analytes that exceeded MCLs and/or RBCs. One indicator parameter (nitrate as nitrogen) was detected at concentrations that exceed the RBC value. Three VOCs (dichloromethane [methylene chloride], tetrachloroethylene [PCE], and trichloroethylene [TCE]) were detected at concentrations greater than their respective MCL and RBC values. Bis (2-ethylhexyl) phthalate was the only SVOC detected above its MCL and RBC values. Three pesticides (dieldrin, heptachlor, and heptachlor epoxide) were detected at concentrations greater than their respective RBC values. Radium was the only radionuclide detected above its MCL and risk-based activity (RBA) values. Two metals (lead and mercury) were detected at concentrations greater than their respective MCL values. Iron was detected at concentrations exceeding its RBC value. Detected concentrations of metals may be due to excess turbidity, and the high lead concentration may be due to the age of the pumps in the wells. The existing wells will be redeveloped with new pumps prior to re-sampling when the new wells are installed.

2.3.3 Soil Sampling

Surface soils and subsurface soils are potentially contaminated through deposition and bioturbation. Deep soils may be contaminated due to infiltration/percolation of rainwater through the waste mass and into the underling soil. The discussion of the CSM in Section 3 presents this information in further detail.

In 1989, nine boreholes (SB-1 through SB-9) were drilled and sampled with hollow-stem augers at the RdACB OU (Figure 2-2). Five boreholes were drilled to 3.0 m (10 ft) deep, and four were drilled to 10.6 m (35 ft) deep. Cross-sections generated from these boreholes are presented in Figures 2-8 and 2-9. Lithologic logs for each of these boreholes are presented in Appendix B. Continuous split-spoon samples were collected for lithologic description and laboratory analysis. Field screening for VOCs was performed on split-spoon samples with a photoionization detector. Field screening showed elevated levels of VOCs.

Soil samples consisted of fine to coarse sand and silty sand. Pebbles and/or cobbles were encountered in several boreholes in the 1.2 to 1.8 m (4 to 6 ft) depth interval. Minor clay and sandy clay lenses also were encountered. However, these clay lenses are discontinuous throughout the site.

Soil samples were collected from boreholes SB-6, SB-8, and SB-9 for laboratory analysis. Table 2-5 summarizes the soil sample intervals and parameters analyzed at these three borehole locations. Soil analytical results for boreholes SB-6, SB-8, and SB-9 are summarized in Appendix D. At each borehole, two samples were collected and analyzed for VOCs and metals. In addition, one sample was collected at each borehole and analyzed for base/neutral and acid extractable compounds, pesticides and polychlorinated biphenols (PCBs), radionuclide indicators, and total radium. No samples were collected for radiological analysis from the approximate basin bottom (57.9 m [190 ft] above msl).

No unit-specific background soil samples were collected during this investigation. Therefore, no comparisons can be made between the concentrations detected in soils at the RdACB OU and background concentrations. Other than anthropogenic contaminants (e.g., VOCs, SVOCs), it is not possible to determine the impact of contaminants on soil associated with the waste disposal activities at the RdACB OU.

Three VOCs (chlorobenzene, methylene chloride, and acetone) were detected in soil samples collected from boreholes SB-6, SB-8, and SB-9. Chlorobenzene was detected at a maximum concentration of 26 micrograms per kilogram (µg/kg) at a depth of 1.8 to 2.4 m (6 to 8 ft) in borehole SB-6. At this borehole location, chlorobenzene concentrations increased with depth to 2.4 m (8 ft), then decreased below this depth. Methylene chloride and acetone also were detected in Quality Assurance/Quality Control (QA/QC) blank samples associated with these samples. Methylene chloride and acetone are common laboratory contaminants; thus, the presence of these contaminants in soil samples is suspect. The concentrations detected in each soil sample, except SB-9-05, were less than ten times the concentration detected in the associated blanks. Therefore, the presence of methylene chloride and acetone is likely due to laboratory contamination and the results are eliminated from the data set. No other VOCs were detected in soil samples.

Seven metals were detected in soil samples collected from boreholes SB-6, SB-8, and SB-9. These metals are aluminum, arsenic, barium, chromium, lead, lithium, and mercury. The highest detected metal concentration was for aluminum, at 17,750 milligrams per kilogram (mg/kg). Aluminum is ubiquitous in SRS soils, therefore, it is likely that this concentration falls within the background soils range in the RdACB OU area. Arsenic was detected at a maximum concentration of 8.2 mg/kg. Barium and cadmium were detected in borehole SB-6 at maximum concentrations of 321.5 and 60.3 mg/kg, respectively. Lead was detected at a maximum concentration of 15.7 mg/kg in borehole SB-8. Mercury was detected in one sample collected from borehole SB-8 at a maximum concentration of 0.14 mg/kg. Lithium was detected in borehole SB-8 at a maximum concentration of 2.4 mg/kg.

Gross alpha activity was detected at borehole SB-6 from 0.6 to 1.2 m (2 to 4 ft) deep, and at borehole SB-9 from 1.8 to 2.4 m (6 to 8 ft) deep. Gross alpha activity was only analyzed in these two soil samples. The maximum gross alpha activity detected in these two soil samples was 16 picocuries per gram (pCi/g) in SB-6. The maximum nonvolatile beta activity was detected in SB-6 at 15 pCi/g. These maximum gross alpha and nonvolatile beta activities fall within the natural background ranges and are below the SRS radiological screening criteria of 20 pCi/g and 50 pCi/g, respectively. Total radium was detected at a maximum activity of 8 pCi/g in borehole SB-6.

2.3.4 Soil Gas Survey

Volatilization from surface, subsurface, and deep soils contaminated with VOCs can affect air quality at the unit. As a result, this volatilization can present potential risk to either human or ecological receptors. The CSM in Section 3 discusses this information in further detail.

In September 1992, a soil gas survey was performed at the RdACB OU. The objective of the soil gas survey was to determine the presence and lateral extent of VOCs in soil gas at the unit. A total of 36 soil gas sampling locations were selected. Eleven were located directly above the approximate boundaries of the RdACB OU (Figure 2-3). The soil gas samples were analyzed for light hydrocarbons (C_1-C_4); gasoline range normal paraffins (C_5-C_{10}); gasoline range aromatic hydrocarbons; chlorinated organics; and benzene, toluene, ethylbenzene, and xylene (BTEX). All analyses for the C_1-C_4 hydrocarbons were performed by an onsite laboratory. All VOC analyses were performed by Microseeps' laboratory in Pittsburgh, Pennsylvania. During the 1989 soil investigation, chlorobenzene was the only detected VOC other than common laboratory contaminants (acetone and methylene chloride). Chlorobenzene was included in the chlorinated organics analysis. Soil gas samples were analyzed on an instrument calibrated for chlorobenzene. However, none of the soil gas sample chromatograms indicated the presence of chlorobenzene. The results of these analyses are presented in Appendix E.

In general, VOC concentrations detected in this soil gas survey are very low. The most commonly observed VOCs at the RdACB OU were pentane and hexane. Pentane was detected in 24 of the 36 locations at a maximum concentration of 0.42 parts per million per volume (ppmv). Hexane was detected at six locations at a maximum concentration of 0.14 ppmv. The locations where pentane and hexane were detected are correlative with the location of the RdACB OU. Benzene, toluene, octane, and xylenes were detected at one location, and chloroform was detected at two locations.

2.3.5 Radiological Survey

In 1997, a radiological survey was performed at the RdACB OU. This survey included exposure rate measurements, direct alpha and beta/gamma contamination surveys, and collection and analysis of 20 surface soil samples. Exposure rate measurements were 10 microrem per hour (μrem/hr) at the RdACB OU. This exposure rate is equivalent to background in the area. Direct alpha and beta/gamma contamination surveys showed no detectable contamination of surface soil covering the RdACB OU. The maximum gross alpha activity detected in the soil samples was 90 pCi/g. The maximum nonvolatile beta activity detected in soil samples was 27 pCi/g. The results of the radiological survey are presented in Appendix F.

2.4 Unit Evaluation Conclusions

Based on quarterly groundwater monitoring data, soil and groundwater analytical data, and the results of the 1992 soil gas survey, potential environmental contamination exists at the RdACB OU. However, the nature and extent of environmental contamination at the RdACB OU are currently unknown for primary and secondary sources. It is also unknown if release mechanisms have impacted the groundwater media. Based upon the evaluation of the existing data, which have been determined to be insufficient, and the operational history of the RdACB OU, a unit characterization should be performed.

Fourteen years of groundwater monitoring and sampling data provides a baseline for groundwater quality at the RdACB OU. Additional groundwater quality data are needed; therefore, quarterly monitoring and sampling should continue at each of the five wells. Historical groundwater data collected from 1988 to 1996, and the soil analytical results collected from the nine boreholes, indicate potential soil contamination from VOCs, SVOCs, and metals. Insufficient data are available to determine if unit soils have been impacted by radionuclides. The results of the 1992 soil gas survey indicated low VOC concentrations. Pentane and hexane were detected in several soil gas samples. The locations where pentane and hexane were detected are correlative with the location of the RdACB OU.

Additional soil sampling should be conducted to establish unit-specific background concentrations at the RdACB OU. Additional soil sampling should be conducted within the RdACB OU and in adjacent areas. Additional soil sampling should be performed at locations adjacent to the basin based on surface water drainage pathways to assess the impact to soil downslope of the unit. The suite of analyses for soil samples should include VOCs, SVOCs, inorganics and metals, pesticides/PCBs, and radionuclide indicators (gross alpha and nonvolatile beta). Isotopic analysis of radionuclides will be performed if the indicator analyses exceed 20 pCi/g gross alpha or 50 pCi/g nonvolatile beta.

Lead was detected in monitoring well BRD-3, which is upgradient of the RdACB OU. A new background well should be installed and sampled at the RdACB OU to provide unit-specific background data. The suite of analyses for groundwater samples should include VOCs, SVOCs, metals, pesticides, and radionuclide indicators.

2.5 Operable Unit Strategy

The proposed operable unit strategy for the RdACB OU is based upon the assumption that the recommended final land use will be residential (DOE 1996). The strategy consists of the following steps:

- Develop the RFI/RI Work Plan to adequately characterize the nature of contaminants and the vertical and horizontal extent of contamination in all media
- Perform site characterization under the RFI/RI Work Plan to include surface and subsurface soil sampling within the waste unit boundaries; surface and subsurface soil sampling of the areas on the perimeter of the waste unit; soil sampling of the drainage swale adjacent to the waste unit; and groundwater characterization
- Evaluate all characterization data
- Develop an RFI/RI/BRA for the RdACB OU, including quantifying the nature and vertical/horizontal extent of contamination, determining contaminant migration, and quantifying human health and ecological risk
- Develop a Corrective Measures Study/Feasibility Study (CMS/FS) with remedial action objectives, including remedial alternatives screened against the nine CERCLA evaluation criteria
- Prepare a Proposed Plan and Final Record of Decision for the selected alternative
- Conduct a remedial action (if required)

At this time, the nature and quantity of the primary source are unknown. Also, there are no data concerning the impact to secondary sources or migration of contaminants to groundwater. As such, it is not possible to forecast remedial options until data of sufficient quality and quantity have been collected and evaluated. Evaluation of the characterization data will lead to a revised CSM, the development of protective remedial action objectives, and screening of remedial alternatives. Potential remedial options for soils must include the following: no action, institutional controls, excavation and removal, containment/stabilization, and/or natural soil cover/capping. Groundwater remedial options might include the following: no action, institutional controls, or mixing zone application. Because meaningful groundwater data have not been collected, an assessment to determine appropriate strategies, beyond those mentioned above, is limited (DOE 1996).

2.6 Potential Applicable or Relevant and Appropriate Requirements (ARARs) and "To-Be-Considered" (TBC) Criteria

A preliminary list of potential ARARs and TBC criteria for the RdACB OU is presented in Table 2-6. Development of ARARs and TBC criteria is an iterative process performed throughout the assessment and corrective action of the unit. This list of potential ARARs is expected to be modified and refined as more data are obtained. ARARs may be location-, chemical-, or action-specific.

Because groundwater monitoring data indicate possible impact to groundwater from the RdACB OU, the EPA and South Carolina Drinking Water Regulations and the South Carolina Water Standards are potential ARARs. The Atomic Energy Act is likely to be applicable, since radioactive materials are thought to be associated with disposal activities at the RdACB OU. Certain other requirements may be applicable, depending on specific remedial actions implemented at the unit. RCRA and South Carolina Hazardous Waste Management Regulations may be considered ARARs if removal of waste material from the unit is conducted. If groundwater extraction wells or monitoring wells are required for remedial action, then the South Carolina Well Standards would be considered an action-specific ARAR.

Certain potential ARARs can be identified as inappropriate based on existing information available about the RdACB OU. No critical habitats for endangered species have been identified in the immediate vicinity of the unit; therefore, the Endangered Species Act is not applicable.

There are no archeological or historic sites located at or near the RdACB OU; therefore, the National Archeological and Historical Preservation Act is not included as an ARAR.

2.7 Potential Corrective Measures Study/Feasibility Study (CMS/FS) Options

2.7.1 Standard Remedial Technologies

Based upon previous investigations, RdACB OU soils and groundwater may require remediation. Institutional controls, such as access controls, monitoring, and land use restrictions, are likely to be potential actions at the RdACB OU. Other remedial options for unit soils include "No Further Action," as required by the EPA, and excavation and disposal.

Historical groundwater monitoring data indicate that groundwater may also require remediation. Based on available data, the potential remediation techniques include use of alternate concentration limits, mixing zone concentration limits, and "No Further Action." Potential remedial alternatives for the RdACB OU are presented in Table 2-7.

2.7.2 Innovative Remedial Technologies

Available information indicates that innovative remedial technologies need not be considered for the RdACB OU. Standard remedial technologies and process options should provide appropriate protection to human health and the environment.

2.8 Potential Early and/or Interim Remedial Actions

An evaluation of data from the previous investigations of the RdACB OU indicates that there is no immediate human health or ecological risk associated with the RdACB OU. Additionally, historical groundwater analytical data do not indicate an immediate risk from groundwater contamination. Therefore, no early or interim remedial action will be necessary for the source material, soil, or groundwater. An interim remedial action, such as institutional controls, will be considered if an immediate threat is identified.

2.8.1 Early Action Strategy

The feasibility of an early action for the entire waste unit, or a portion, cannot be assessed at this time. Because of the lack of sufficient information about the primary source, location of the primary source, contamination of secondary sources, and the extent of contamination in groundwater (if any), it is not appropriate to propose an early action. This conclusion is consistent with the early action decision-making process presented in Plate 1.

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FIGURES

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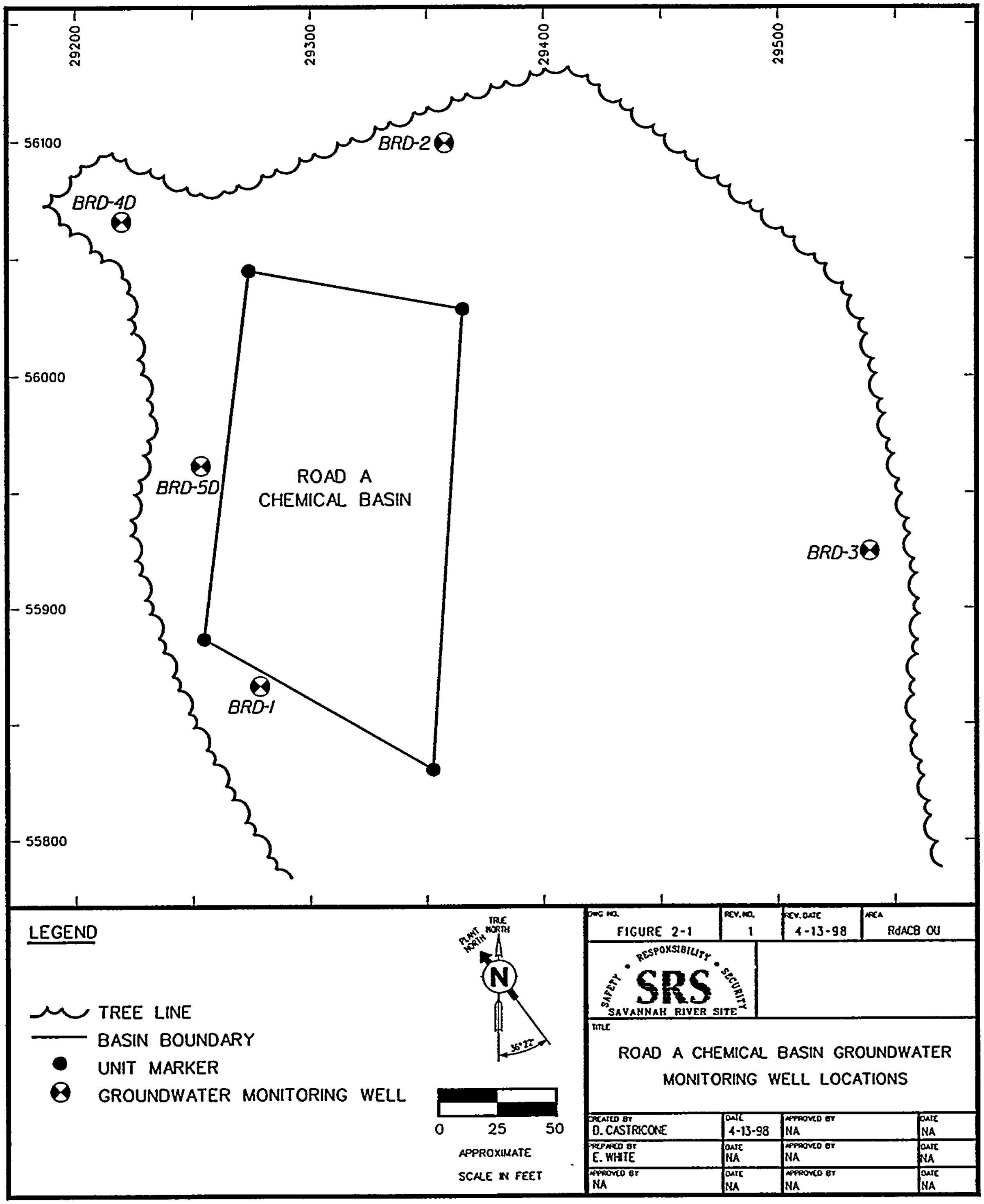

DWG NO.	REV. NO.	REV. DATE	AREA
FIGURE 2-1	1	4-13-98	RdACB OU

TITLE
ROAD A CHEMICAL BASIN GROUNDWATER MONITORING WELL LOCATIONS

	DATE		DATE
CREATED BY D. CASTRICONE	4-13-98	APPROVED BY NA	NA
PREPARED BY E. WHITE	NA	APPROVED BY NA	NA
APPROVED BY NA	NA	APPROVED BY NA	NA

Figure 2-1. Road A Chemical Basin Groundwater Monitoring Well Locations

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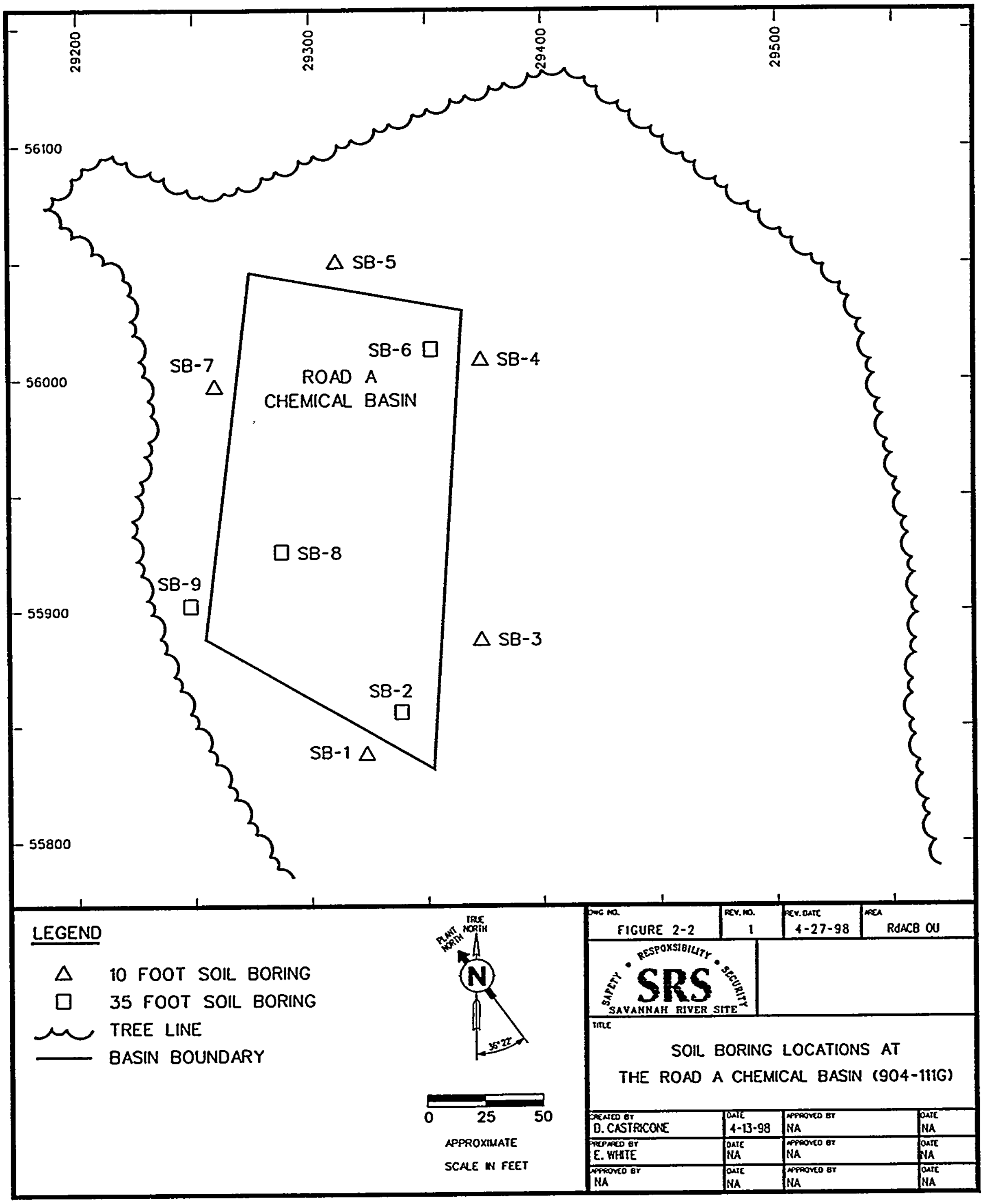

Figure 2-2. Borehole Locations at the Road A Chemical Basin (904-111G)

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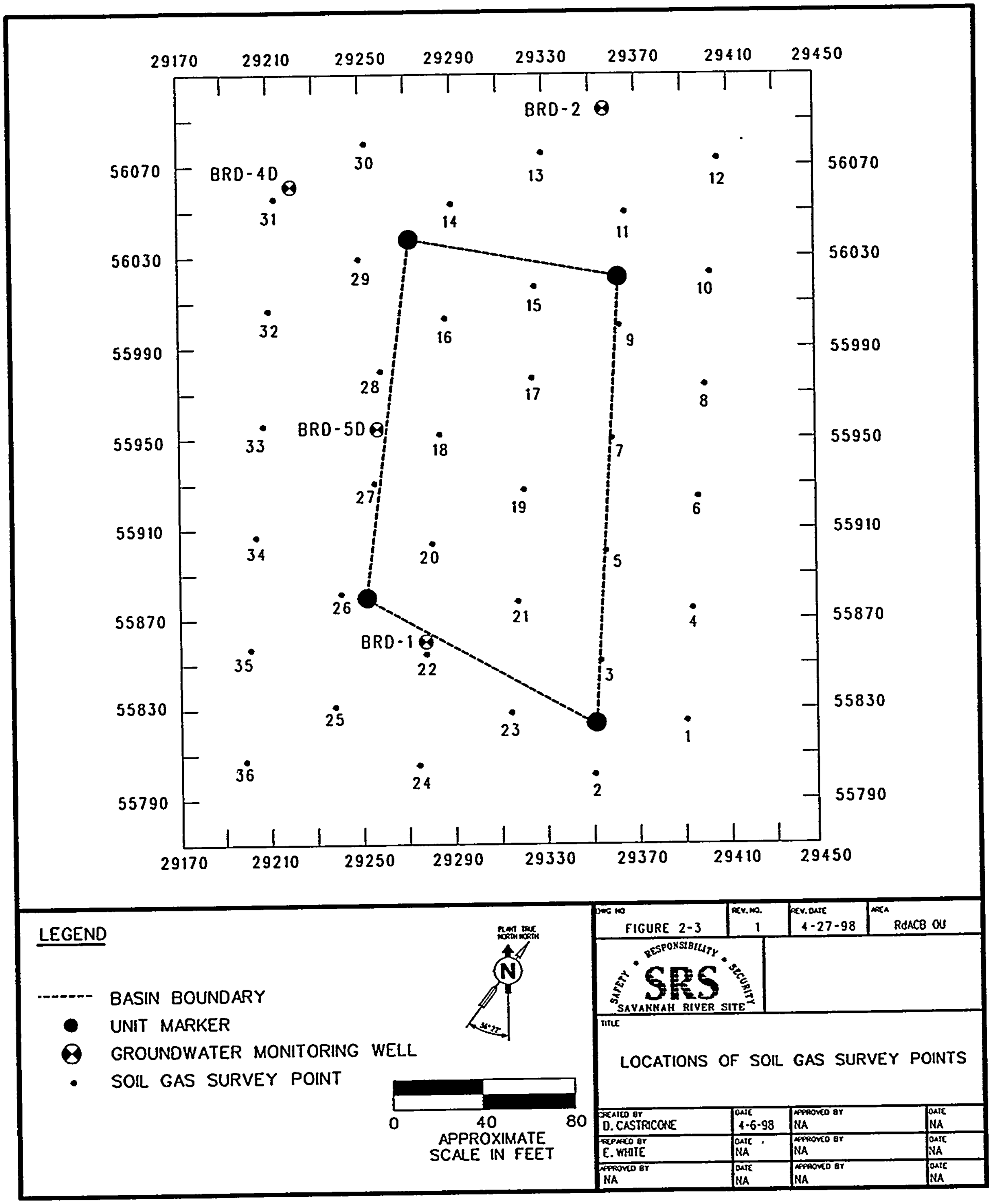

Figure 2-3. Locations of Soil Gas Survey Points

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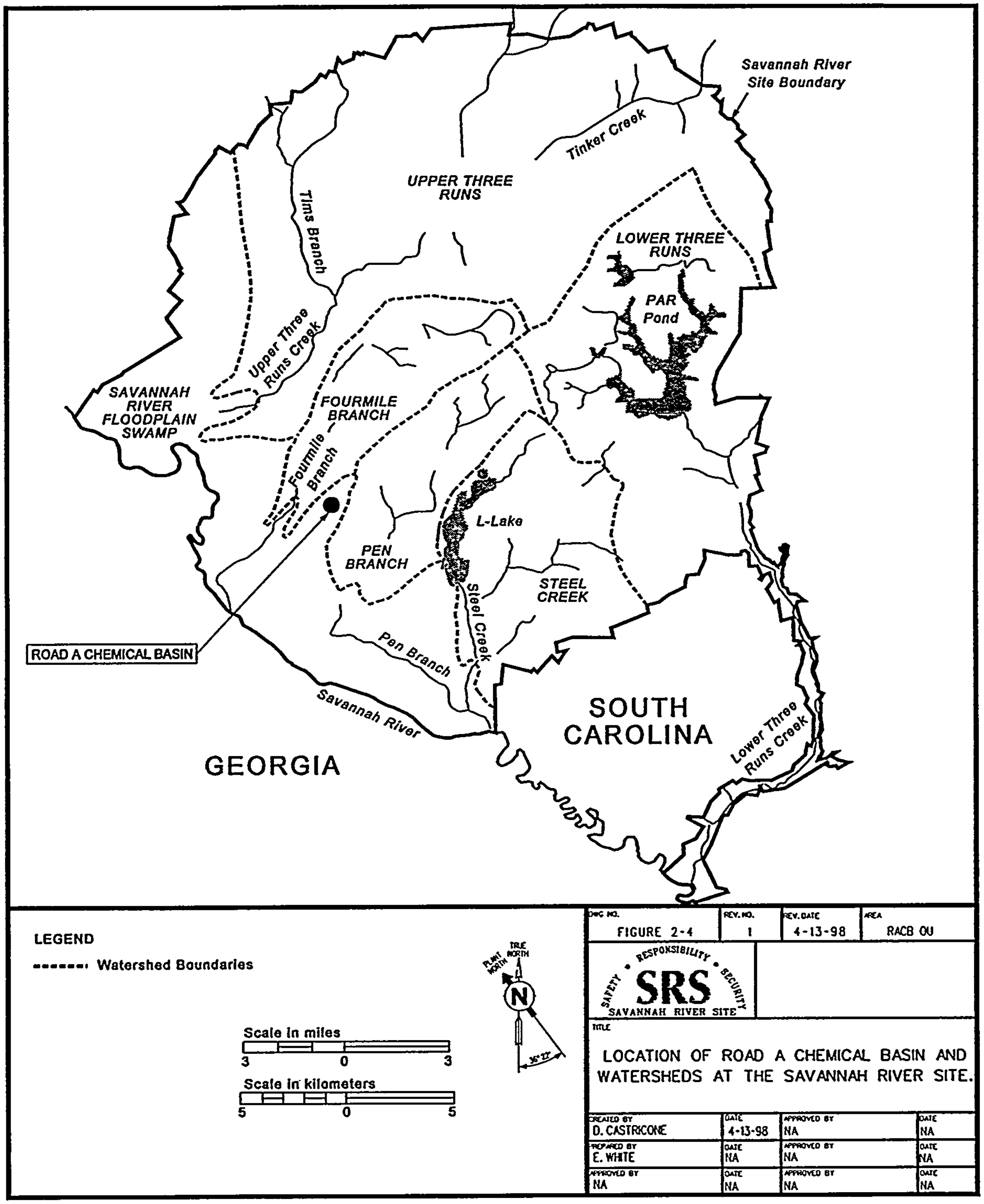

Figure 2-4. Location of the Road A Chemical Basin and Watersheds at the Savannah River Site

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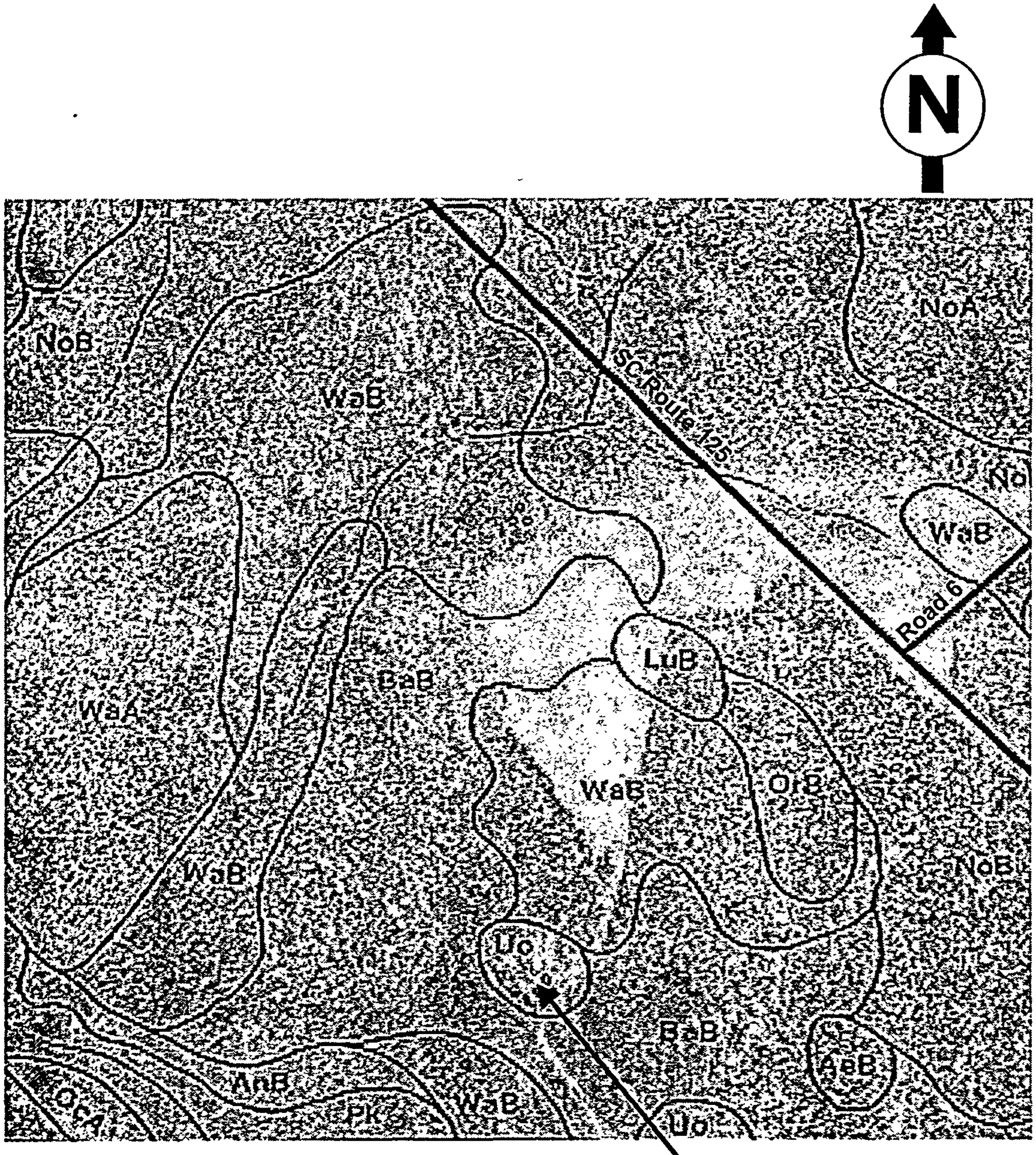

Uo: Udorthents, friable substratum
WaB: Wagram sand, 2 to 6 percent slopes
BaB: Blanton sand, 0 to 6 percent slopes
LuB: Lucy sand, 2 to 6 percent slopes
OrB: Orangeburg loamy sand, 2 to 6 percent slopes
AnB: Abany loamy sand, 0 to 6 percent slopes
OcA: Ocilla loamy sand, 0 to 2 percent slopes
NoA: Norfolk loamy sand, 0 to 2 percent slopes
Pk: Pickney sand, 0 to 2 percent slopes

ROAD A CHEMICAL BASIN

Figure 2-5. Soil Map of the RdACB OU and Vicinity

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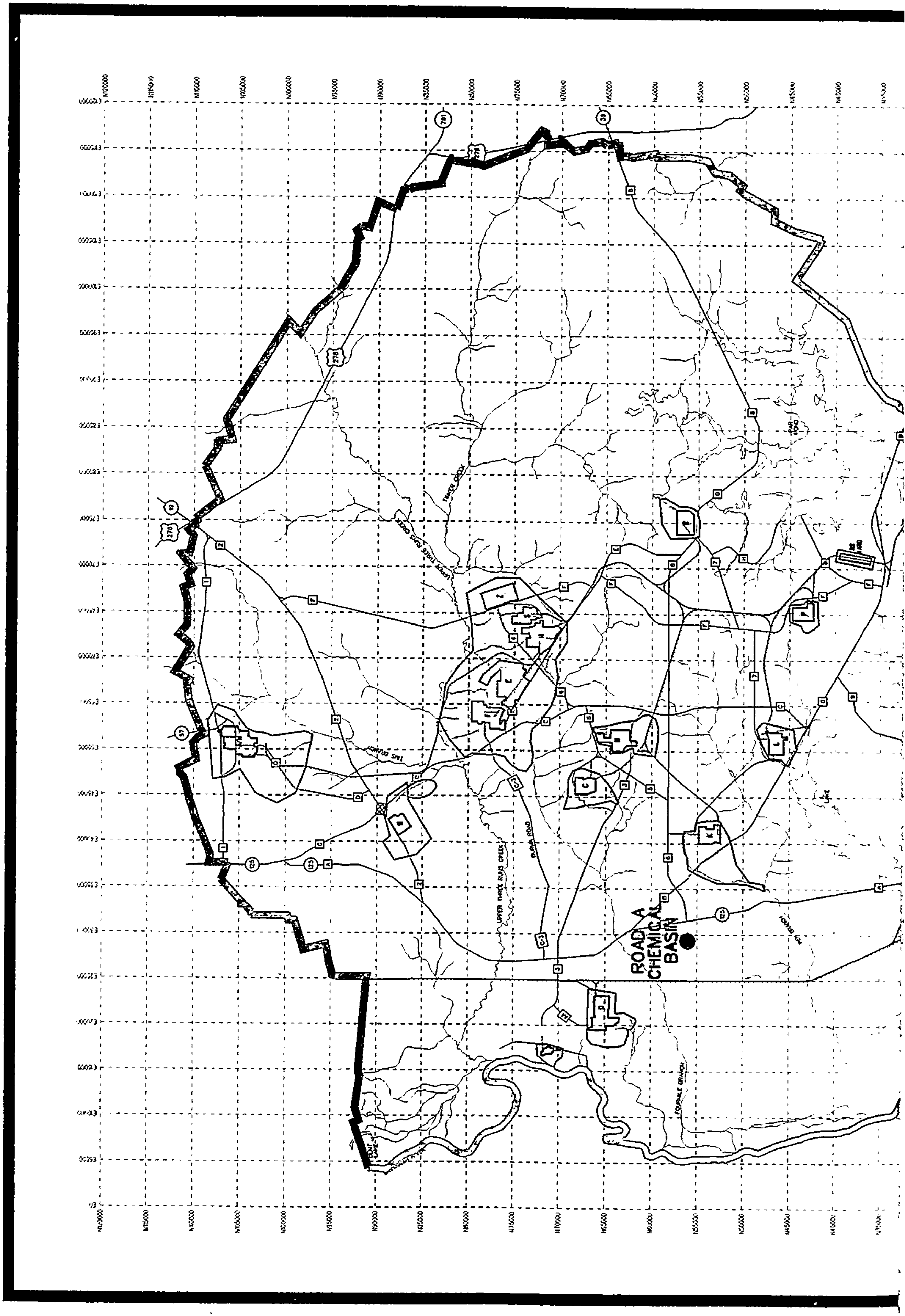
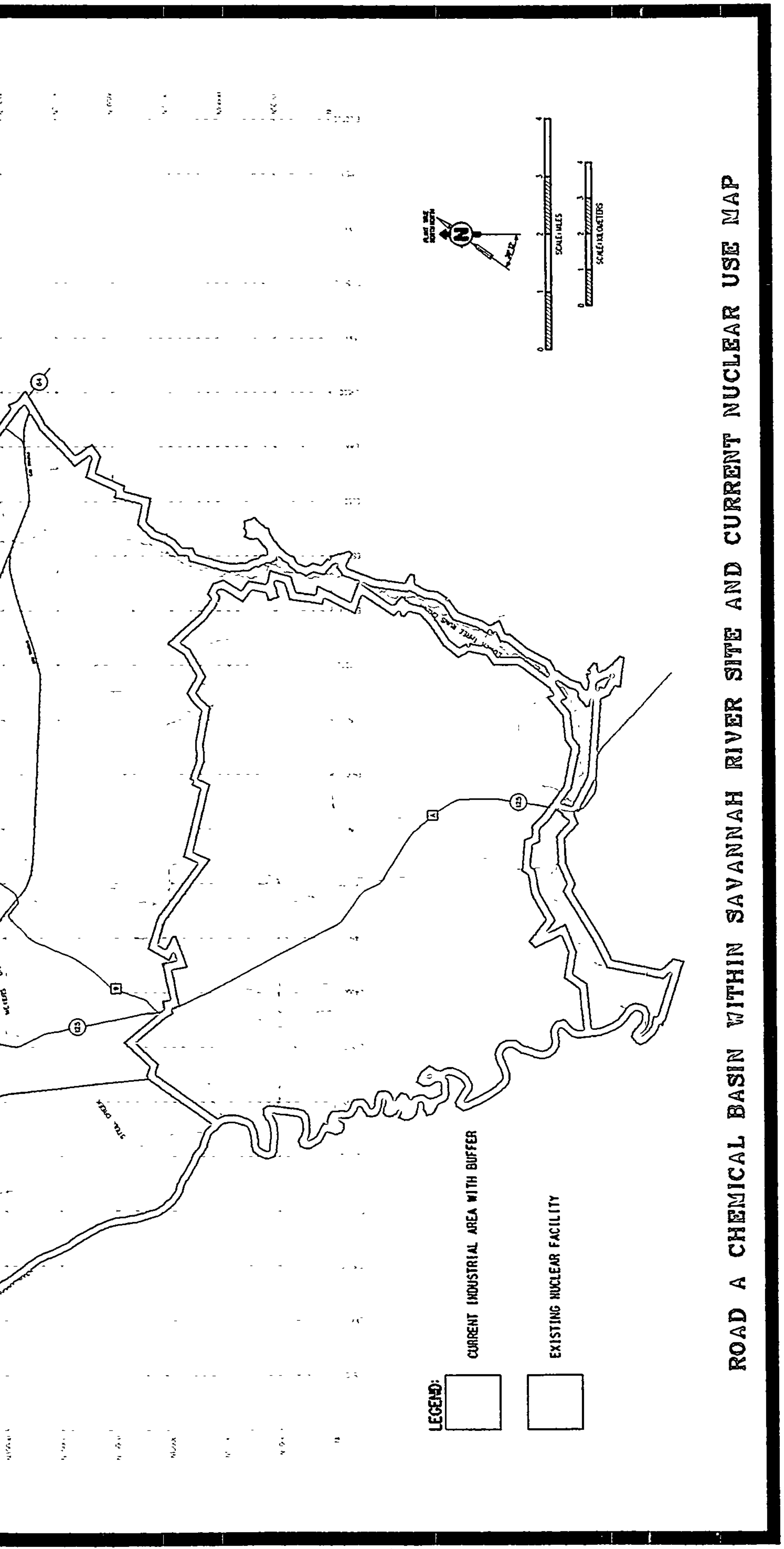


Figure 2-6. Proposed Future Land Use fo



ROAD A CHEMICAL BASIN WITHIN SAVANNAH RIVER SITE AND CURRENT NUCLEAR USE MAP

the Savannah River Site

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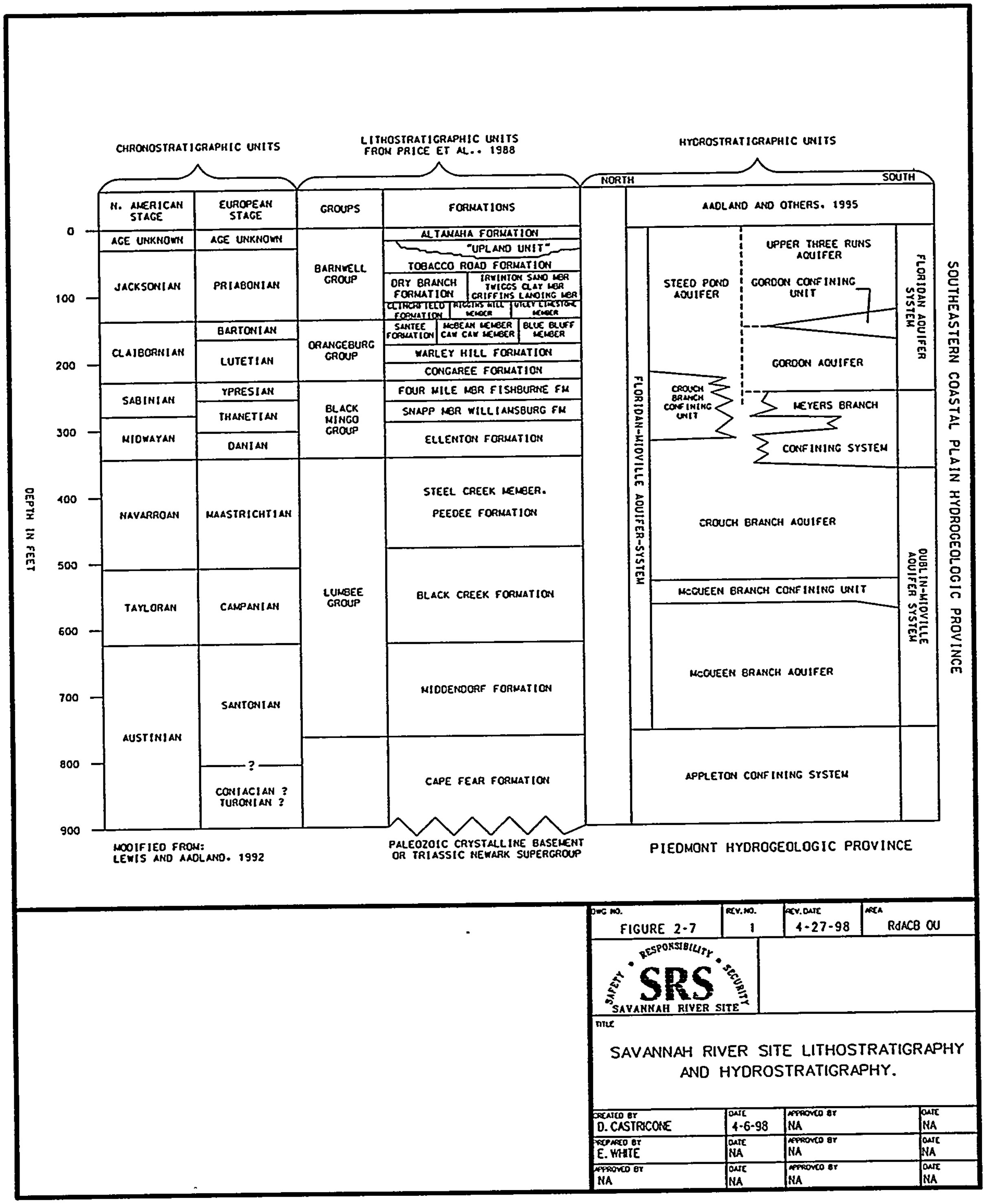

Figure 2-7. Savannah River Site Lithostratigraphy and Hydrostratigraphy

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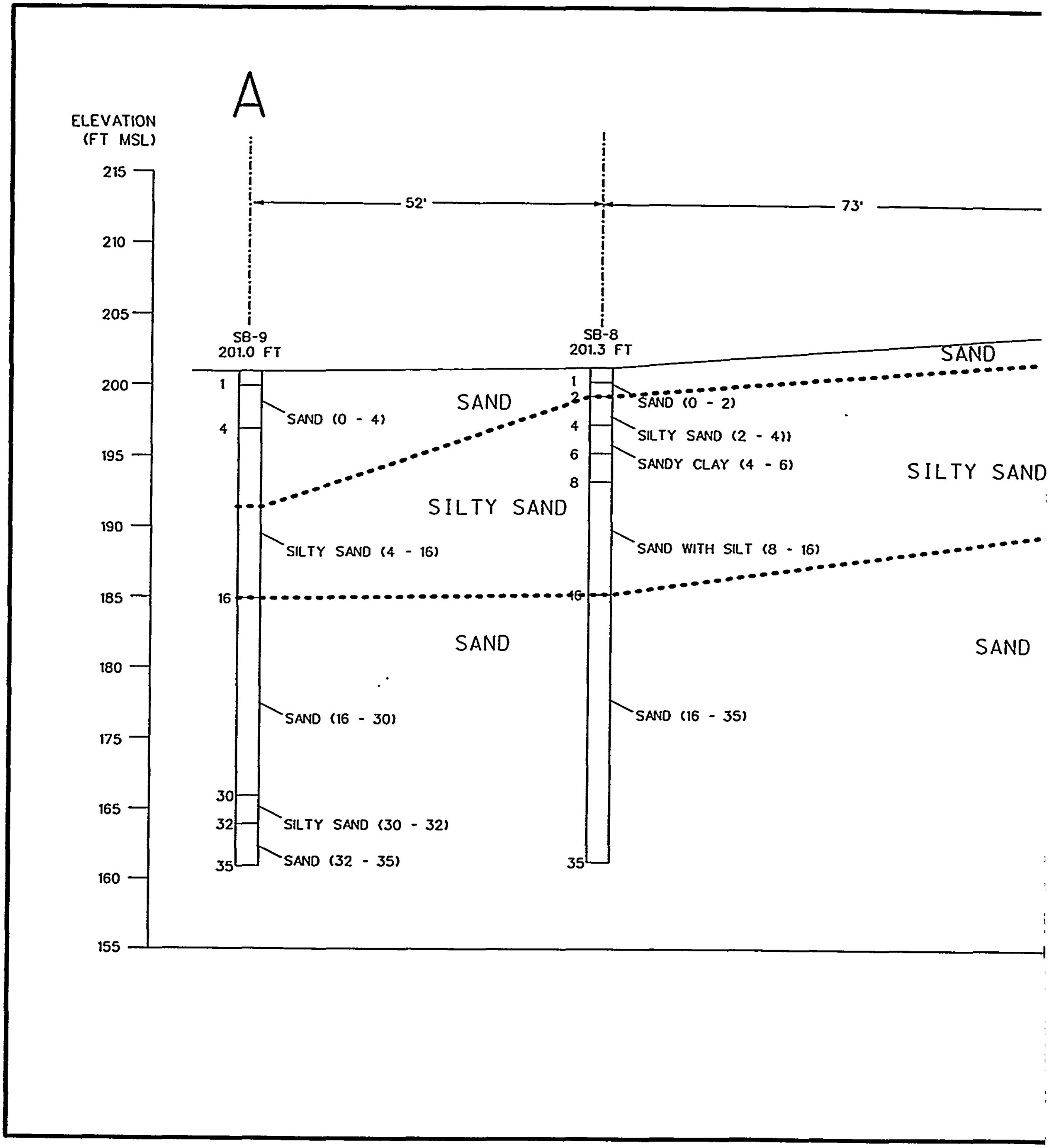
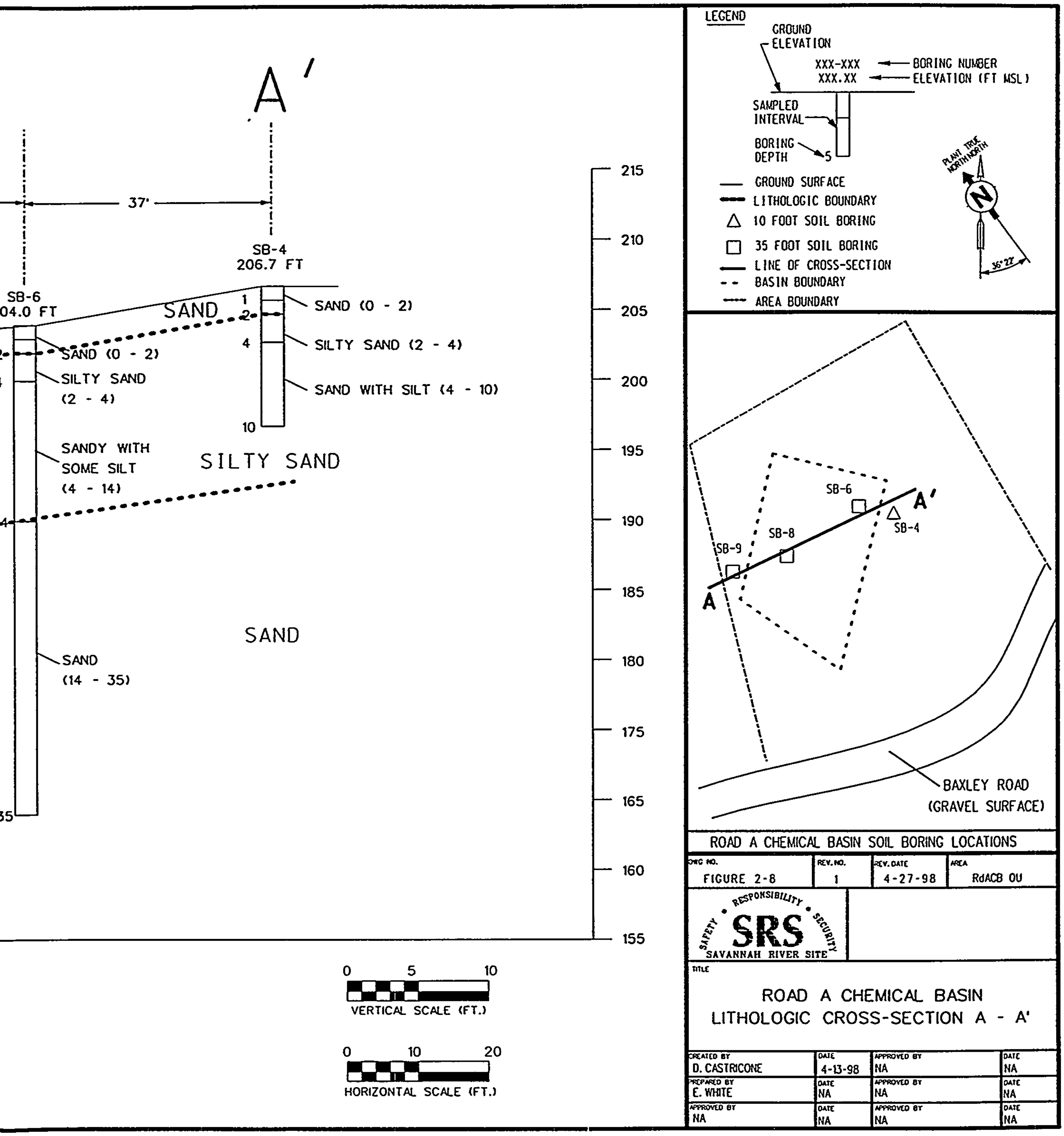


Figure 2-8. Road A Chemical Ba



n Lithologic Cross Section A-A'

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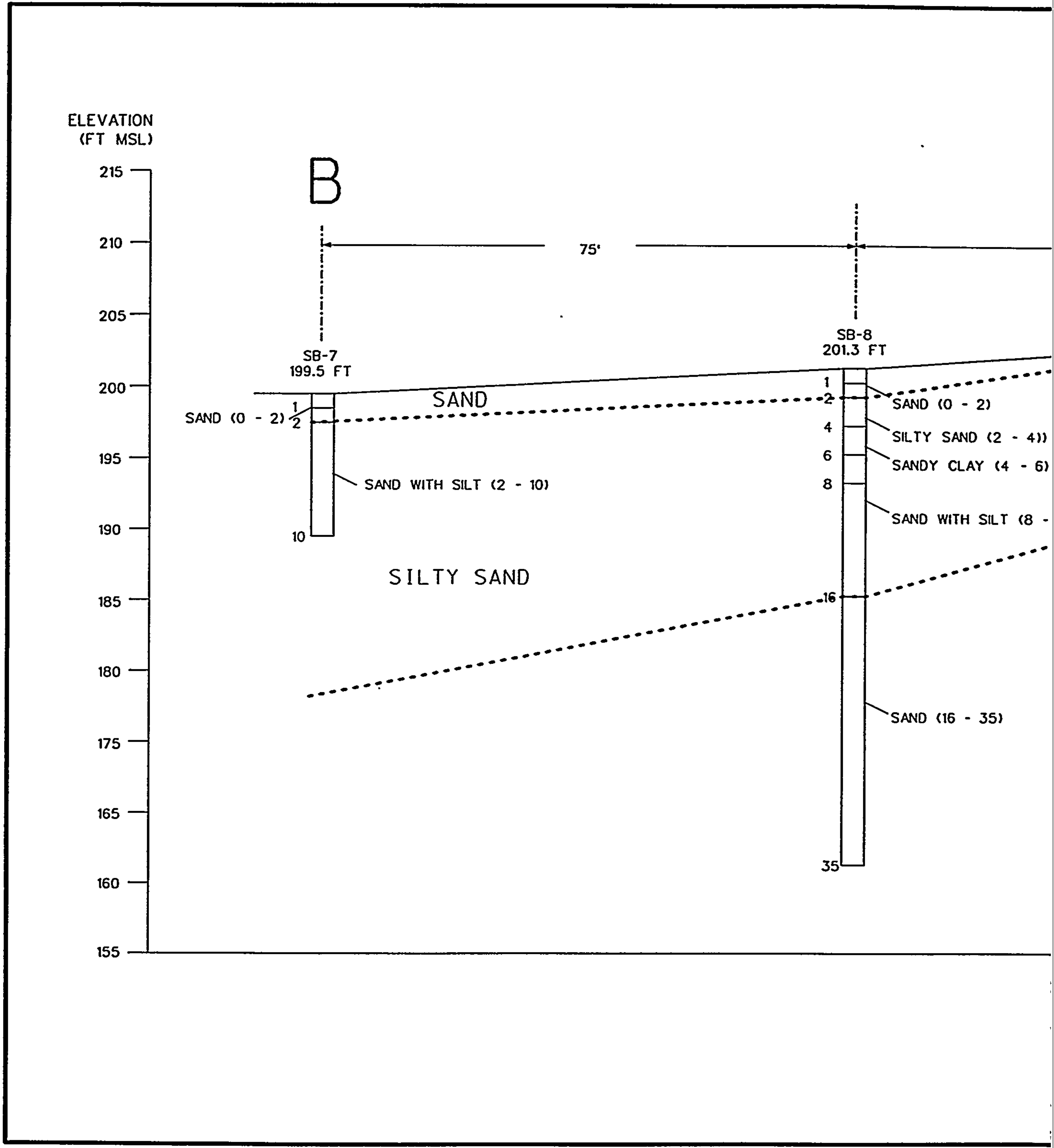
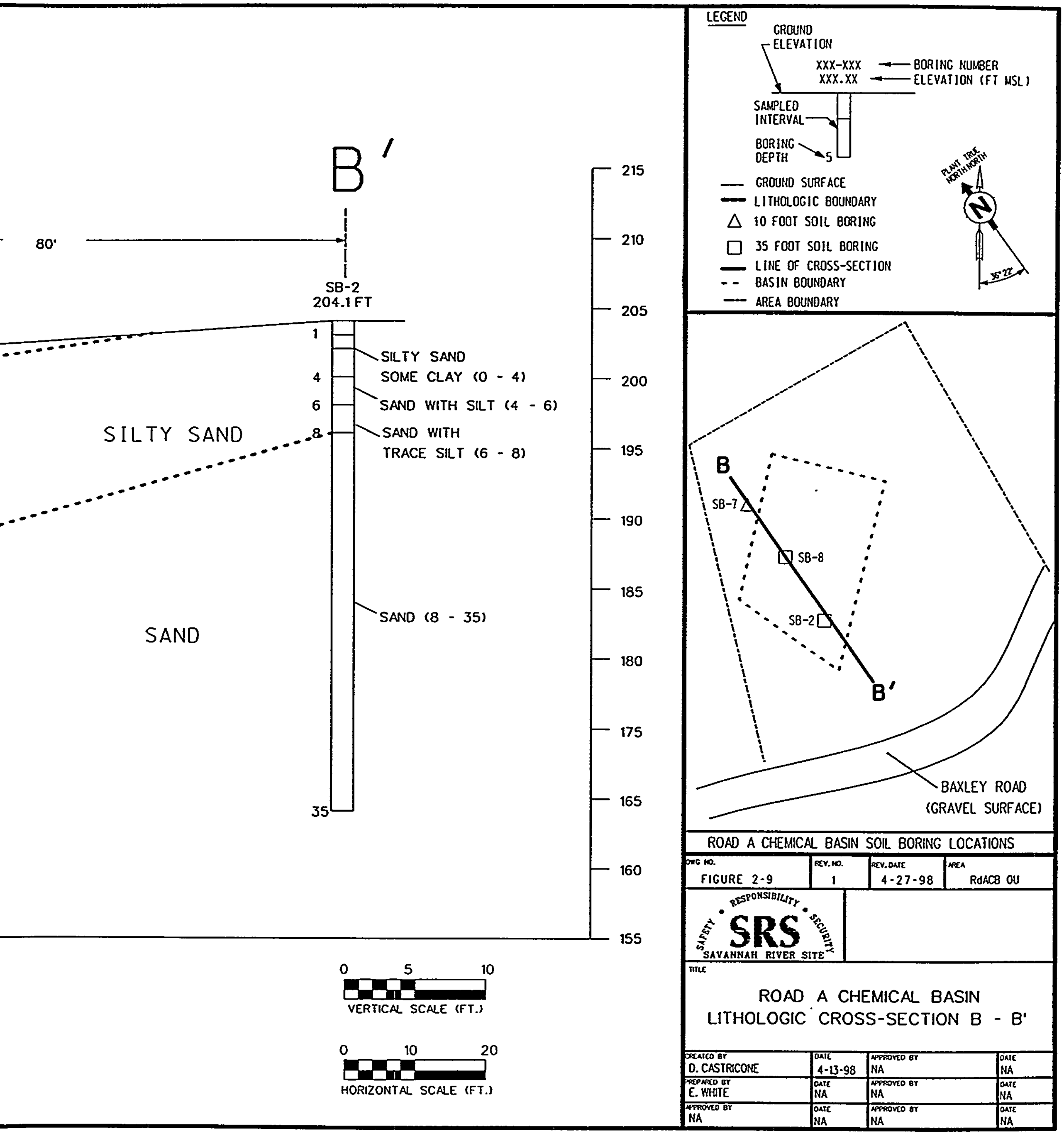


Figure 2-9. Road A Chemical B



n Lithologic Cross Section B-B'

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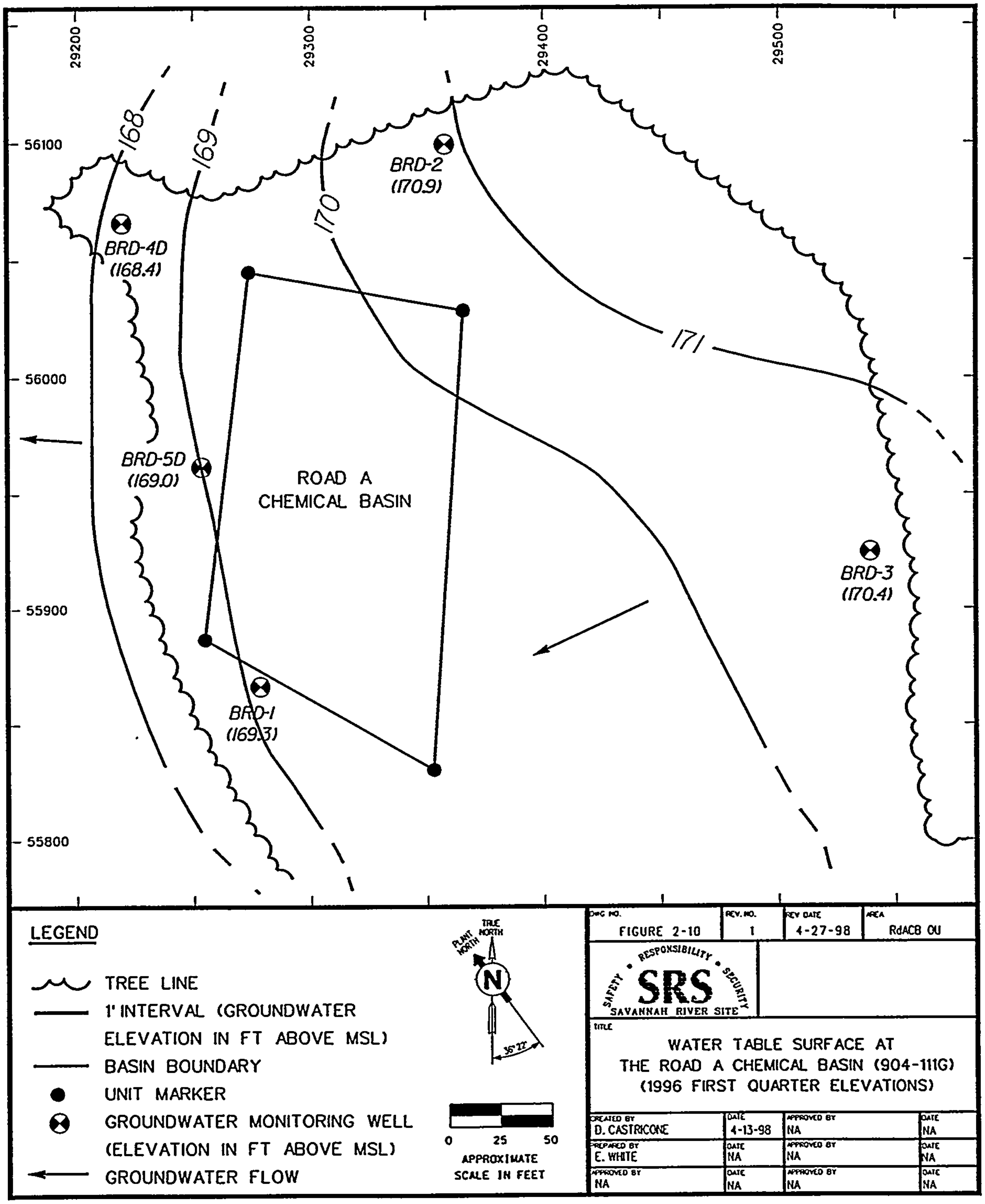

Figure 2-10. Water Table Surface at the Road A Chemical Basin (904-111G)

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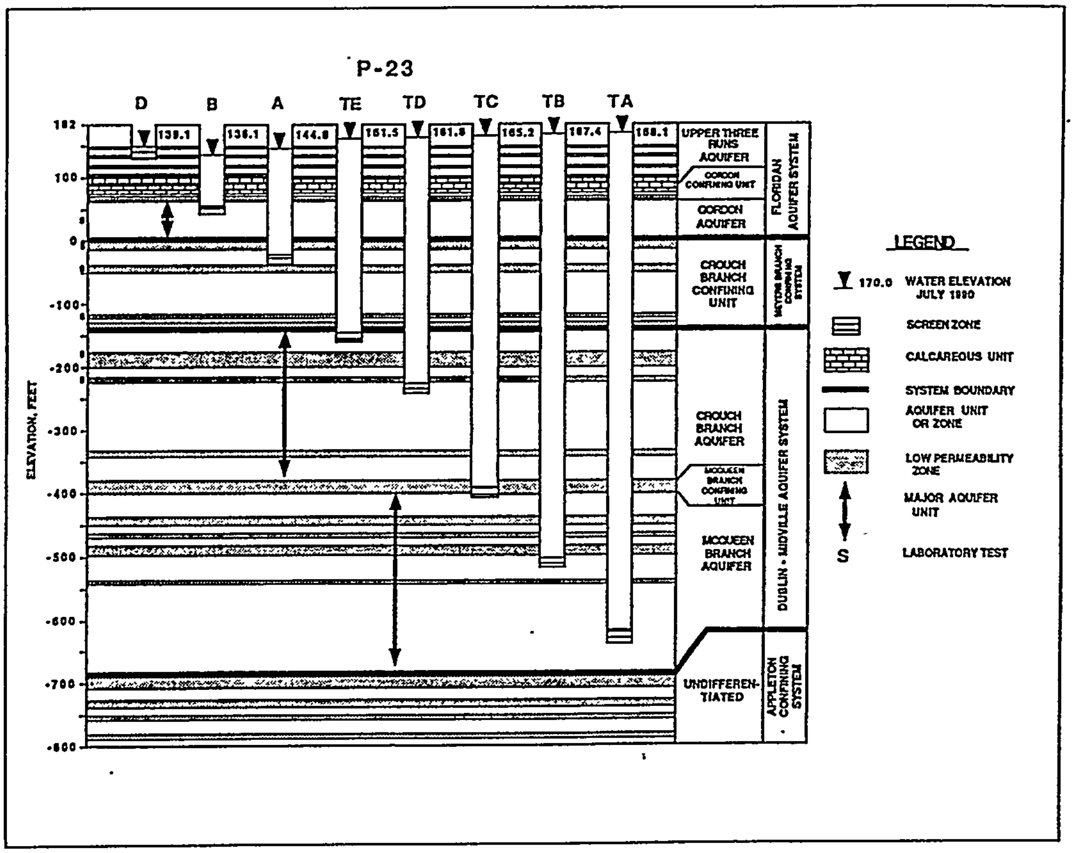

Figure 2-11. Hydraulic Head Relationships at the P-23 Well Cluster

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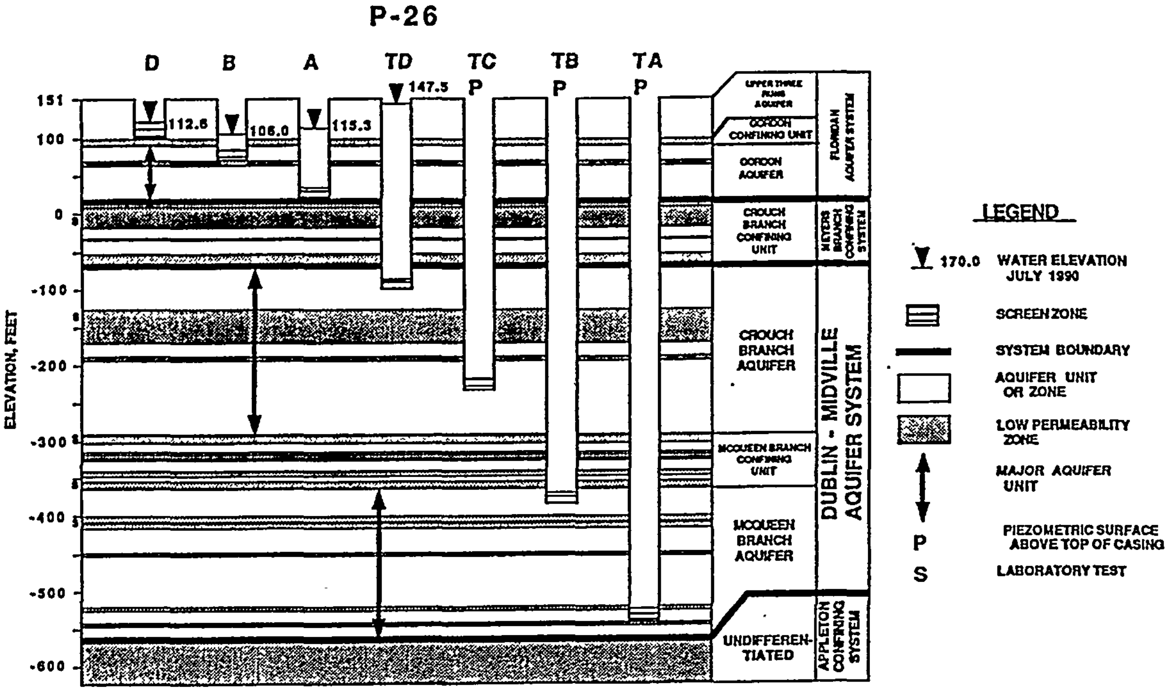

Figure 2-12. Hydraulic Head Relationships at the P-26 Well Cluster

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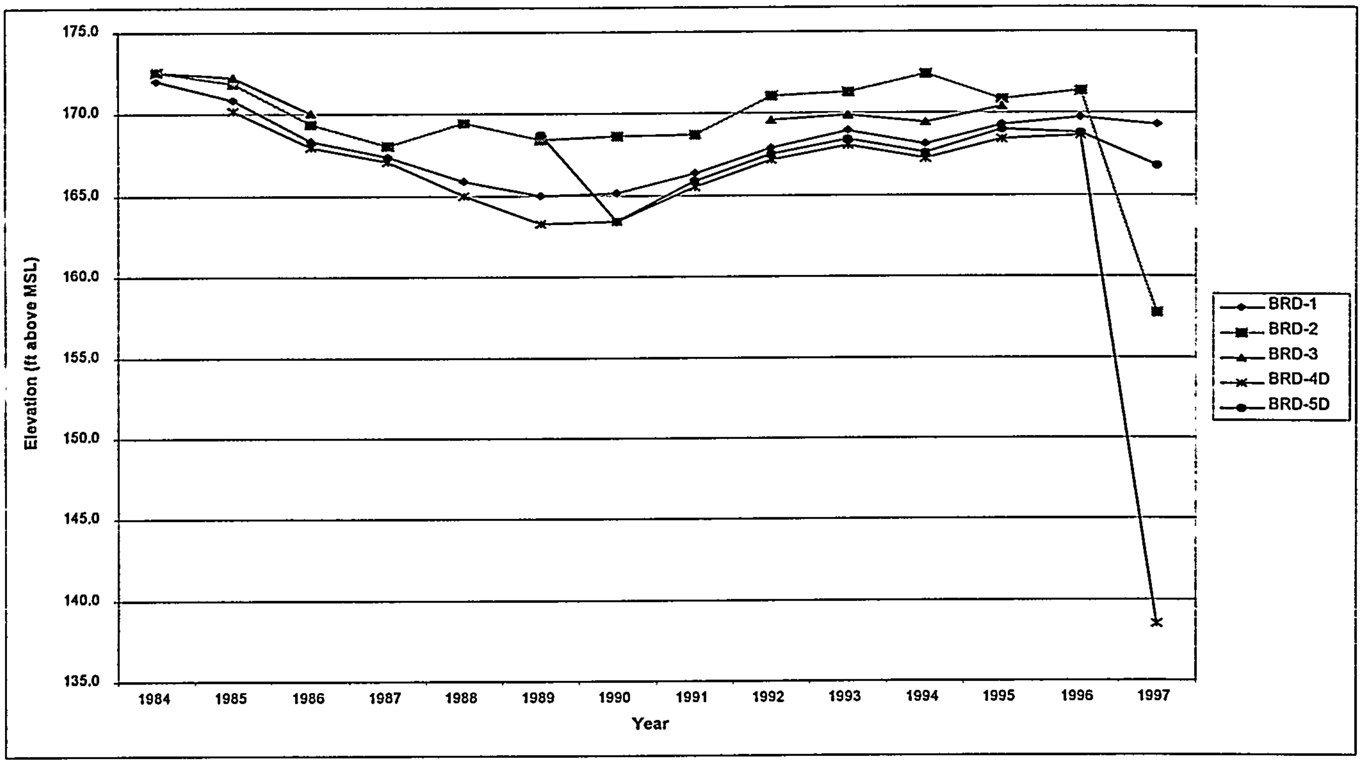

Figure 2-13. Hydrographs for Monitoring Wells at the Road A Chemical Basin (Based on Available Average Annual Water Levels)

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Plate 1.

Savannah River Site
Environmental Restoration RI/FS Early Action Strategy

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TABLES

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Table 2-1. Road A Chemical Basin Well Construction Summary

Well ID.	SRS Coordinate (Northing)	SRS Coordinate (Easting)	Total Depth (ft)	Screened Interval (ft)	Screened Interval (feet above msl)	Land Surface (feet above msl)	Measuring Point (feet above msl)	Casing Material	Casing Diameter (in)	Completion Date
BRD-1	55860.5	29277.7	57.0	25.0 - 55.0	148.9 - 178.9	204.0	205.8	SCH40 PVC	4.0	5/10/83
BRD-2	56093.3	29357.1	59.0	27.0 - 57.0	148.5 - 178.5	205.5	207.3	SCH40 PVC	4.0	5/13/83
BRD-3	55918.7	29538.9	62.0	30.0 - 60.0	158.5 - 188.5	218.5	220.4	SCH40 PVC	4.0	5/16/83
BRD-4D	56060.4	29219.2	70.0	37.0 - 67.0	129.1 - 159.1	195.4	197.9	SCH40 PVC	4.0	7/16/84
BRD-5D	55955.7	29252.6	62.0	34.3 - 54.3	148.4 - 168.4	202.5	205.2	SCH40 PVC	4.0	7/11/89

msl mean sea level

Table 2-2. Statistical Summary from Available 1984-1997 Groundwater Elevations Measured in Monitoring Wells at the RdACB

Well Number	Maximum Elevation ft-msl	Minimum Elevation ft-msl	Average Elevation ft-msl	Standard Deviation ft-msl
BRD-1	172.0	164.2	167.1	2.2
BRD-2	172.5	155.9	168.3	4.0
BRD-3	172.5	168.8	169.5	2.1
BRD-4D	170.2	164.0	163.7	8.3
BRD-5D	168.7	161.4	165.2	2.1

msl mean sea level

Table 2-3. Analytes Detected in Monitoring Wells at the RdACB from 1988 to 1996

ANALYTE NAME	No. of Samples	No. of Detections	Maximum Concentration Detected	Units	MCL	RBC[1]
INDICATOR PARAMETERS						
Fluoride	46	1	0.355	mg/L	NA	2.2
Nitrate as nitrogen	45	45	5.9	mg/L	10	5.8
Nitrate-nitrite as nitrogen	22	22	2.2	mg/L	10	5.8
Sulfate	47	16	2.25	mg/L	500	NA
Total dissolved solids	65	64	113	mg/L	NA	NA
Total organic carbon	47	6	2.0	mg/L	NA	NA
Total organic halogens	79	23	0.282	mg/L	NA	NA
Total phosphates (as P)	47	10	0.21	mg/L	NA	NA
METALS						
Aluminum, dissolved	14	6	0.045	mg/L	NA	37
Aluminum, total recoverable	45	34	1.08	mg/L	NA	37
Antimony, dissolved	17	2	0.004	mg/L	0.006	0.015
Barium, dissolved	52	48	0.016	mg/L	2	2.6
Barium, total recoverable	7	7	0.066	mg/L	2	2.6
Beryllium, dissolved	17	1	0.00047	mg/L	0.004	0.0073
Cadmium, dissolved	47	3	0.004	mg/L	0.005	0.018
Calcium, dissolved	51	51	3.626	mg/L	NA	NA
Calcium, total recoverable	8	8	1.83	mg/L	NA	NA
Chloride	62	61	9.0	mg/L	NA	NA
Chromium, dissolved	45	6	0.01	mg/L	0.10	0.11
Chromium, total recoverable	7	2	0.006	mg/L	0.10	0.11
Cobalt, dissolved	18	3	0.002	mg/L	NA	2.2
Copper, dissolved	21	15	0.916	mg/L	1.3	1.5
Iron, dissolved	52	46	0.170	mg/L	NA	1.1
Iron, total recoverable	42	38	1.51	mg/L	NA	1.1
Lead, dissolved	74	53	0.66	mg/L	0.015	NA
Lead, total recoverable	56	39	0.06	mg/L	0.015	NA
Lithium, dissolved	47	1	0.008	mg/L	NA	0.73
Magnesium, dissolved	52	52	0.598	mg/L	NA	NA
Magnesium, total recoverable	8	8	0.871	mg/L	NA	NA
Manganese, dissolved	68	68	0.057	mg/L	NA	0.73
Manganese, total recoverable	38	38	0.358	mg/L	NA	0.73
Mercury, dissolved	40	10	0.003	mg/L	0.002	0.011
Mercury, total recoverable	28	1	0.000304	mg/L	0.002	0.011
Nickel, dissolved	49	24	0.013	mg/L	0.100	0.73
Nickel, total recoverable	5	3	0.006	mg/L	0.100	0.73
Potassium, dissolved	46	16	1.13	mg/L	NA	NA

Table 2-3. Analytes Detected in Monitoring Wells at the RdACB from 1988 to 1996 (Continued)

ANALYTE NAME	No. of Samples	No. of Detections	Maximum Concentration Detected	Units	MCL	RBC[1]
METALS (continued)						
Potassium, total recoverable	6	2	0.784	mg/L	NA	NA
Sodium, dissolved	46	46	3.948	mg/L	NA	NA
Sodium, total recoverable	8	8	2.68	mg/L	NA	NA
Vanadium, dissolved	18	2	0.002	mg/L	0.002	0.260
Zinc, dissolved	22	21	0.181	mg/L	NA	11
PESTICIDES / PCBs						
Dieldrin	17	1	0.033	µg/L	NA	0.0042
Heptachlor	16	2	0.144	µg/L	0.4	0.015
Heptachlor epoxide	17	1	0.022	µg/L	0.2	0.0074
RADIONUCLIDES						
Gross alpha	77	30	9	pCi/L	NA	NA
Nonvolatile beta	65	27	9	pCi/L	NA	NA
Radium, total alpha-emitting	85	49	6	pCi/L	5	0.16
Radium-226	12	10	1	pCi/L	5	NA
Radium-228	11	8	3	pCi/L	5	NA
Tritium	74	51	0.004	pCi/L	20	NA
SEMIVOLATILE ORGANIC COMPOUNDS						
Bis(2-ethylhexyl) phthalate	17	1	24	µg/L	6	4.8
Phenol	24	2	9	µg/L	NA	22000
Phenols	46	3	85	µg/L	NA	22000
VOLATILE ORGANIC COMPOUNDS						
2,4-Dichlorophenoxyacetic acid	45	1	0.35	µg/L	NA	61
Acetone	19	3	37	µg/L	NA	61
Dichloromethane (Methylene chloride)	55	25	8	µg/L	5	4.1
Tetrachloroethylene	52	4	55	µg/L	5	1.1
Toluene	50	1	1	µg/L	1000	750
Trichloroethylene	51	3	6	µg/L	5	1.6
Trichlorofluoromethane	50	2	2	µg/L	NA	1300

NA – Not Applicable

[1] – RBC values from EPA Region III Risk-Based Concentrations Table, April 1999 update.

Table 2-4. Analytes Detected in Groundwater above the Maximum Contaminant Level (MCL) or the Risk-Based Concentration (RBC) at the RdACB

ANALYTE NAME	No. of Samples	No. of Detections	Maximum Concentration Detected	Units	MCL	RBC[1]
INDICATOR PARAMETERS						
Nitrate as N	45	45	5.9	mg/L	10	5.8
METALS						
Iron, total recoverable	42	38	1.51	mg/L	NA	1.1
Lead, dissolved	74	53	0.066	mg/L	0.015	NA
Lead, total recoverable	56	39	0.060	mg/L	0.015	NA
Mercury, dissolved[2]	40	10	0.003	mg/L	0.002	0.011
PESTICIDES / PCBs						
Dieldrin	17	1	0.033	µg/L	NA	0.0042
Heptachlor	16	2	0.144	µg/L	0.4	0.015
Heptachlor epoxide	17	1	0.022	µg/L	0.2	0.0074
RADIONUCLIDES						
Radium, total alpha-emitting[3]	85	49	6	pCi/L	5	0.16
SEMIVOLATILE ORGANIC COMPOUNDS						
Bis(2-ethylhexyl) phthalate	17	1	24	µg/L	6	4.8
VOLATILE ORGANIC COMPOUNDS						
Dichloromethane (Methylene chloride)	55	25	8	µg/L	5	4.1
Tetrachloroethylene	52	4	55	µg/L	5	1.1
Trichloroethylene	51	3	6	µg/L	5	1.6

NA – Not Applicable

[1] RBC set at 1.0E-6 cancer risk and 0.1 HQ for non-cancer hazard.

[2] Mercuric chloride RBC used.

[3] RBA for Ra-226 + daughter products used.

Table 2-5. Sampling Depths and Analyses for Soil Collected at the RdACB

Sample Interval	Analytical Parameter		
m (ft)	**Soil Boring-6**	**Soil Boring-8**	**Soil Boring-9**
0-0.6 (0-2)	• (1)		
0.6-1.2 (2-4)	• (1) (2) (3) (4)	• (1) (2) (4)	
1.2-1.8 (4-6)		• (1)	
1.8-2.4 (6-8)	• (1)	• (1)	• (2) (3) (4)
2.4-3.0 (8-10)		• (1)	
3.0-3.7 (10-12)	• (1)		
3.7-4.3 (12-14)			
4.3-4.9 (14-16)	• (1)	• (1)	
4.9-5.5 (16-18)			
5.5-6.1 (18-20)	• (1)		
6.1-6.7 (20-22)		• (1)	
6.7-7.3 (22-24)			
7.3-7.9 (24-26)	• (1)		• (1) (3)
7.9-8.5 (26-28)			
8.5-9.1 (28-30)			• (1) (3)
9.1-9.8 (30-32)	• (1) (3) (4)		
10.1-10.7 (33-35)			• (1) (3)
10.4-11.0 (34-36)	• (1) (3)		

(1) VOCs and Metals
(2) Radionuclides
(3) Pesticides and PBCs
(4) Base/Neutral and Acid Extractable Compounds
• Indicates Sample Collection Point

Table 2-6. Potential ARARs and TBC Criteria for the RdACB

Federal	Type	Applicability
Atomic Energy Act	Action/Chemical specific	Radioactive waste
Resource Conservation and Recovery Act	Action/Chemical specific	Treatment, storage and disposal of hazardous waste
Clean Air Act	Action/Chemical specific	Potential releases to air from units
Safe Drinking Water Act	Chemical specific	MCL and MCL Goals
Clean Water Act	Action/Chemical specific	Discharge Limitations
Toxic Substances Control Act	Action/Chemical specific	Potentially applicable if specific constituents determined to be present
Federal Insecticide, Fungicide, and Rodenticide Control Act	Chemical specific	Potentially applicable if pesticides determined to be present
DOE Orders	Action specific	Treatment, Storage and Disposal of hazardous and radioactive wastes

State	Type	Applicability
S.C. Pollution Control Act	Action specific	Potential releases to surface water, groundwater, air, or soil
S.C. Wastewater Regulations	Chemical specific	Discharge limitations
S.C. Drinking Water Regulations	Chemical specific	MCLs and MCL Goals
S.C. Hazardous Waste Management Regulations	Action specific	Treatment, Storage and Disposal of hazardous and radioactive wastes
S.C. Water Air Pollution Control Regulations	Action specific	Potential releases to air
S.C. Water Classification Standards	Chemical/location specific	Surface water and groundwater classification
S.C. Well Standards Regulations	Action specific	Well construction requirements

Table 2-7. Potential Effective Remedial Technologies for the RdACB

Response	Technology
Removal	Excavation
Treatment	Soil Flushing/Washing (Contaminated Soils)
	Air Stripping (Contaminated Water)
	Carbon Adsorption (Contaminated Water)
	Solidification: In-situ or Excavate and process (Contaminated Soils)
	Vitrification (Contaminated Soils)
Containment/Migration Control	Capping

3.0 DATA QUALITY OBJECTIVES

SAFER and ESC incorporate the DQO process developed by the EPA as guidance for data collection activities (EPA 1994). The DQOs are developed using an interactive and iterative approach to decision making based on seven steps outlined by EPA guidance.

DQOs are useful in identifying data gaps and in developing SAPs that describe the procedures for collecting sufficient data of known and defensible quality. These data are used to define the nature, magnitude, and extent of contamination and to define human-health and ecological risks. In turn, these findings will facilitate the derivation of sound decisions concerning remedial response activities. DQOs also assist in determining appropriate detection limits, analytical methods, and sampling and handling procedures/requirements.

The focus of the DQO development process is efficient planning for data collection. This process is participatory, encouraging input and consensus from all data users, thus facilitating the understanding and acceptance of project goals. The DQO process applies to the entire planning team, including management, regulators, and technical personnel. The DQO process is a series of planning steps based on the scientific methods (Sections 3.1.2 through 3.1.8 of this document) that are detailed in *Guidance for the Data Quality Objectives Process* (EPA 1994). This process provides a systematic, flexible approach to decision making. Although the steps are described sequentially, the DQO process is iterative. The results of the DQO process are a set of data specifications and an efficient, cost-effective SAP. This plan is designed to meet those specifications.

The major benefits of the DQO process are as follows:

- Promotes efficient, cost-effective, and timely data collection
- Provides a thorough, systematic approach to relate data collection specifications to the end needs of the data users
- Involves the decision makers and the assessment technical team in establishing a definitive plan with objective criteria
- Aids in communicating and understanding the levels of risk and the basis for decisions

- Encourages critical thinking about data gathering and interpretation

3.1 DQO Evaluation

3.1.1 Conceptual Site Model

EPA guidance for both RCRA RFI and CERCLA RI investigations stresses the need and utility of a conceptual representation of the unit under consideration. Such a representation provides an objective framework around which existing information can be organized and synthesized, data gaps can be identified, and sampling programs can be designed to address critical data needs identified in the DQO process. The CSM addresses EPA guidance for this conceptual representation. It presents the preliminary understanding of the unit and focuses on the identification of potential contaminant migration from the sources to various potential receptors.

The CSM for the RdACB OU is presented in Figure 3-1. It identifies the potential sources of contamination, release mechanisms, media of concern, exposure routes, and potential receptors. Each of these components is described in the following sections. The CSM is considered iterative and will be revised as more information is known about the unit from the planned characterization activities.

3.1.1.1 Primary Sources of Contamination

The primary sources of contamination are miscellaneous aqueous radioactive and chemical wastes disposed at the RdACB OU. The exact nature and quantities of materials disposed are not known, although an environmental information document for the RdACB OU identifies them as miscellaneous aqueous radioactive and chemical wastes (Pickett et al. 1987). Since the basin was backfilled in 1973, it is not likely that any primary source material remains in the basin.

3.1.1.2 Primary Release Mechanisms

Contaminants may have been released from the primary sources by three primary release mechanisms: (1) deposition of contaminants on the surface soil and soils adjacent to the basin during waste disposal and during closure and backfilling operations, (2) infiltration and percolation of waste constituents into underlying soil, and (3) infiltration of precipitation through the primary source material and leaching of contamination from the waste into underlying soils and groundwater. Deposition of contaminants includes water that may have drained directly into the basin during disposal activities. Infiltration includes ponded water in the basin prior to backfilling that may have subsequently infiltrated into the subsurface.

3.1.1.3 Secondary Sources of Contamination

Environmental media impacted by the release of contamination from the primary sources become secondary sources. Secondary sources of contamination at the RdACB OU include sludge, surface soil (0 to 0.3 m [0 to 1 ft]), subsurface soil (0.3 to 1.2 m [1 to 4 ft]), and deep soil (>1.2 m [>4 ft]) derived from the basin bottom, sidewalls, berm, and potentially from the drainage area at the basin outlet. Currently, sufficient data do not exist to perform a screening-level ecological risk assessment to determine if there is a complete ecological pathway at the RdACB. Therefore, a screening-level ecological risk assessment will not be performed as part of this Work Plan. However, as the characterization data are collected, they will be evaluated in the ecological risk assessment in the RI/BRA.

3.1.1.4 Secondary Release Mechanisms

The secondary sources may release contamination to other media through a variety of secondary release mechanisms, including the following:

- Release of volatile constituents from the soil (volatilization)
- Generation of contaminated fugitive dust by wind or other surface soil disturbance
- Biotic uptake
- Direct contact
- Leaching of contaminants from subsurface and deep soils to groundwater
- Transport of contaminants via stormwater runoff and erosion

The most significant secondary release mechanism affecting the RdACB OU is expected to be the leaching of contaminants into the deep soils because the primary source material (basin sludge) was not removed during closure. Near-surface mechanisms, such as volatilization, fugitive dust generation, biotic uptake, direct contact, and stormwater runoff and erosion, are not likely to be significant secondary release mechanisms because the unit was backfilled. The backfill is believed to have retarded or prohibited the release and dispersion of contaminants by surficial processes, such as stormwater runoff and water and wind erosion. In addition, because the basin bottom was below grade while the basin was in operation and waste material was not likely to have been deposited above grade, the dispersion of contaminants by surficial processes would be unlikely. Post-depositional erosion of the fill covering the basin has generally been limited by vegetation.

3.1.1.5 Exposure Pathways (Media)

Contact with contaminated environmental media creates pathways for both human and ecological receptors. The exposure pathways at the RdACB OU include air (vapor and particulates), biota, surface and subsurface soils, and groundwater.

3.1.1.6 Exposure Routes

The final element of the CSM linking the primary and secondary sources to potential receptors is the exposure route. Exposure routes for human and ecological receptors may include inhalation of volatile emissions and airborne dust, ingestion of contaminated media (soils, groundwater, surface water, and/or vegetation), dermal contact with contaminated media, and human showering (which takes into account inhalation of volatiles from the shower spray and dermal contact with the water). Showering and ingestion of produce pertain only to the scenario of a hypothetical on-unit resident. External radiation pathways include surface soil, subsurface soil, and groundwater.

3.1.1.7 Receptors

Contamination from the RdACB OU may reach either human or ecological receptors. Human receptors include known on-unit workers, hypothetical industrial workers, and hypothetical adult and child residents. The most likely human receptors are known on-unit workers who frequent the area while collecting samples from the groundwater monitoring wells and other phases of ongoing RFI/RIs. Because the RdACB OU is located within SRS's controlled boundaries, the general public is not considered to be a potential receptor; the large distances and access restrictions make all pathways to the general public incomplete. In terms of future industrial use, potential human receptors are most likely industrial workers. In the event that future land use is converted from industrial to residential, future human receptors could include on-unit residents.

Potential ecological receptors include terrestrial and aquatic organisms. Terrestrial ecological receptors, such as vegetation, invertebrates, birds, reptiles, and small and large mammals, likely inhabit the wooded and grassy areas near the basin. Aquatic ecological receptors, such as aquatic plants, aquatic reptiles, or amphibians, likely inhabit the bottomland hardwood swamp located several hundred feet downgradient of the basin. Terrestrial and aquatic receptors will be evaluated either qualitatively or quantitatively based on area ecological reconnaissance results.

3.1.2 State the Problem

The initial step in the DQO process is to define the problem so that the focus of the investigation will be clear and disciplined. To do this, existing data from previous investigations are summarized and evaluated (Section 2). From there, a CSM is developed (Section 3.1.1), and potential exposure pathways are identified.

The unit history indicates a potential for contamination at the RdACB OU. Secondary sources of contamination may also exist. The existing data are not adequate to identify the nature or extent of contaminants in soil and groundwater. Data needs begin with identifying the actual dimensions and location of the original basin. Currently, the unit-specific stratigraphy and hydrostratigraphy in the vicinity of the RdACB OU are not adequately defined and additional data are needed. These data will be necessary to support any future remedial actions.

Additional information must be collected to characterize surface, subsurface, and deep soils in the basin, adjacent to the basin, and downslope of the unit. In addition, groundwater quality at the unit must be characterized.

3.1.3 Identify the Decisions

The purpose of this DQO step is to identify the decisions that must be supported with the collected data to address the problem. This step helps define the objectives of the field investigation.

Unit process history and screening data indicate that the RdACB OU is a potential source of contamination. The following are decisions that need to be addressed under this Work Plan:

- Determine the dimensions and location of the original basin in order to accurately estimate the volume of the primary (if any) and secondary sources
- Collect data for lithologic characterization of soil beneath and adjacent to the basin
- Define the unit-specific stratigraphy and hydrostratigraphy
- Determine if principal threat source material (PTSM) or low level threat source material is present at the RdACB OU
- Determine the nature of contamination from the primary and secondary sources at the RdACB OU
- Determine the location(s), if any, of seeps and/or surface water between the OU and the Savannah River
- Determine whether any contaminant residual within basin soils will migrate to the groundwater in concentrations exceeding MCLs
- Determine the nature and concentrations of naturally occurring and anthropogenic analytes in the soil background
- Determine the nature and concentrations of naturally occurring and anthropogenic analytes in the groundwater background
- Determine whether surface, subsurface, and deep soils have been impacted by previous operations, within the unit boundaries, adjacent to the basin, and downslope of the unit
- Determine whether sediment and surface water have been impacted by previous operations in the bottomland hardwood swamp
- Determine whether groundwater has been impacted by operations at the RdACB OU; if so, determine the risk the impact poses and the appropriate response to that level of risk

Unit screening data will be compiled and evaluated as part of this investigation in accordance with EPA guidance (EPA 1994). In conjunction with existing data, the new data will be used to address the decisions listed above and to determine whether the contaminants at the RdACB OU exceed ARAR criteria (discussed in Section 2.6), ecological criteria, 1E-06 Risk-Based Concentrations/Risk-Based Activities (RBCs/RBAs), or background concentrations. Both human health and ecological risk assessments will be performed. The determination of the basin dimensions and unit-specific stratigraphy and hydrostratigraphy will support the design and implementation of remedial actions. Potential remedial alternatives are discussed in Section 2.7.

3.1.4 Identify the Inputs to the Decisions

The purpose of this step is to identify the information needed to support the decisions presented in Section 3.1.3 and to specify which inputs require new environmental measurements. Existing data that support the decisions are also addressed. Each of the following inputs requires new environmental measurements:

- Ground Penetrating Radar (GPR) survey data to identify the location and dimensions of the basin (to be confirmed by lithologic data)
- Soil descriptions from boreholes to define actual basin dimensions
- Site/area reconnaissance to identify the location(s) of seeps and surface water
- Geotechnical parameters to accurately develop a unit-specific vadose zone transport model to assess contaminant migration to groundwater
- Definitive analytical data for soil within, beneath, and adjacent to the basin to be used in contaminant fate and transport analyses and to supplement secondary source characterization
- Definitive analytical data for surface, subsurface, and deep soil adjacent to and downslope of the basin to determine the nature and extent of contamination in the soils
- Definitive analytical data for sediment and surface water from the bottomland hardwood swamp to determine impact from RdACB OU operations
- Definitive analytical data for soil hydraulically upgradient of the basin to establish unit-specific background
- Definitive analytical data for sediment and surface water from the bottomland hardwood swamp to establish unit-specific background

- Definitive analytical data for surface and subsurface soil and groundwater media to quantify human health and ecological risk in the BRA
- Constraints on the hydrostratigraphy and groundwater hydrology to identify the extent of a plume, if present, for input into contaminant fate and transport analyses and the BRA
- Screening-level VOC and radionuclide indicator data for input into the nature and extent of groundwater contamination and contaminant fate and transport analysis
- Definitive groundwater quality data from the Water Table Aquifer both side-gradient and downgradient of the basin to determine the nature of the plume, if present, for ecological and human health risk assessments and contaminant fate and transport analysis
- Definitive groundwater quality data from the Water Table and Gordon Aquifers to establish unit-specific background

3.1.5 Define the Boundaries of the Study

The purpose of this step is to identify the spatial limits of the affected media and to determine the discrete area affected by the decisions. This step also identifies the human health and ecological populations at risk and investigates the impact of present and future land use on these populations. Another goal of this step is to determine if the time of the sample collection will affect the quality of the characterization data.

The primary goal of this RFI/RI Work Plan is to determine the nature and extent of contamination resulting from RdACB OU operations. Characterization activities under this Work Plan will include soil sampling within the RdACB OU boundaries, as well as soil sampling adjacent to, and downslope, of the RdACB OU. Sediment and surface water samples will be collected from the bottomland hardwood swamp. In addition, unit groundwater quality and hydrogeology will be evaluated. This information will establish impacted surface, subsurface, deep, and adjacent soil and groundwater plume boundaries. These boundaries will determine the populations at risk and will affect the selection of the preferred remedial alternative. A preliminary evaluation of the potential populations at risk is provided in Section 3.1.1.7. Section 4, which discusses the unit assessment, provides specific details of the methodology to determine the nature and extent of contamination.

This methodology is designed to consider potential seasonal variations in groundwater flow direction, elevations, contaminant concentration, and other aquifer characteristics. Field observations indicate relative consistent groundwater flow direction. However, during field activities, groundwater monitoring will continue monthly. In general, sampling procedures will remain relatively unaffected by temporal variations.

3.1.6 Develop Decision Rules

The purpose of this step is to integrate output from the previous steps of the DQO process into a statement that defines the conditions that would cause the decision maker to choose among alternative actions. These actions encompass the entire RCRA/CERCLA process. The decisions will use the ESC concept, which requires frequent team review and possible modifications of field activities based on real-time data obtained during sampling. The decision rules are as follows:

- If media concentrations exceed unit-specific soil screening levels, then a contaminant fate and transport analysis will be performed to determine whether there is a potential impact to groundwater. If the media concentrations are less than soil screening levels, then the RdACB OU will not be considered a continuing source to groundwater.
- If media concentrations exceed risk criteria, then remedial goal objectives will be developed for the appropriate constituents. This item will be addressed in a BRA. If no concentrations exceed risk criteria, then it will be documented in the BRA that no further action will be required.
- If uncertainty exists for media concentrations that exceed risk criteria, then an uncertainty analysis will be conducted to clarify this issue. This item will be included in the BRA.
- Soils from 0.0 to 0.3 m (0 to 1 ft), 0.3 to 1.2 m (1 to 4 ft), 2.1 to 3.0 m (7 to 10 ft), and 3.0 to 4.0 m (10 to 13 ft) have required definitive analyses at an offsite certified laboratory for target compound list/target analyte list (TCL/TAL) and specific radionuclide analysis. Contingent soil samples from the basin will be sent to an offsite certified laboratory for definitive analysis if (1) field screening with a photoionization detector/flame ionization detector indicates greater than 1 ppm VOCs, or (2) onsite laboratory screening for radioactivity indicates greater

than 20 pCi/g gross alpha or 50 pCi/g nonvolatile beta-gamma. All of the offsite laboratory samples will be analyzed for TCL/TAL parameters, gross alpha, nonvolatile beta-gamma, and gamma spectroscopy. If gross alpha triggers are exceeded, the sample will receive additional alpha spectroscopy analyses. Similarly, if nonvolatile beta-gamma triggers are exceeded, gamma pulse height analysis (PHA) will be performed.

- At a given borehole, sampling will be terminated when two consecutive sample intervals screen "clean", tool refusal is met three times, perched water is encountered, or a maximum depth is obtained with the sample tool. "Clean" is defined as less than 1 ppm VOC (using field instrumentation), less than or equal to 20 pCi/g gross alpha, and/or less than or equal to 50 pCi/g nonvolatile beta-gamma.
- If a new borehole proposed in this Work Plan is located near a borehole performed during the 1989 soil investigation, and the results of the sampling and analysis for that particular location indicate potential contamination at depth, the new borehole will be sampled to the water table surface (approximately 10.7 m [35 ft] bgs), regardless of the screening results.
- For surface and subsurface soil samples collected below the surface water drainage culvert, if the screening gross alpha result for a sample exceeds the 20-pCi/g trigger, or if the screening nonvolatile beta-gamma result for a sample exceeds the 50-pCi/g trigger, a stepout surface soil sampling location will be located 3.5 m (10 ft) downslope of the initial location. Alpha spectroscopy and/or gamma PHA will be performed on all samples collected from this stepout location. Stepouts will continue to be collected until two clean stepout locations are encountered. Additionally, sediment and surface water samples will be collected in the bottomland hardwood swamp at the intersection of the drainage path and the swamp.
- If groundwater sampling from monitoring wells indicates VOC contamination, sampling will proceed downgradient, using direct push technology (DPT) sampling methods. The extent of contamination will be determined by obtaining screening-level VOC data. A sample will be considered contaminated if a VOC is detected above the MCL, or in the case an MCL is not available, above the RBC.

DPT sampling will continue downgradient until a sample does not indicate potential groundwater contamination that exceeds an MCL or RBC.

- If groundwater sampling from monitoring wells indicates contamination other than VOC contamination, additional monitoring wells will be installed further downgradient of the basin until the extent of groundwater contamination is defined.

3.1.7 Specify Tolerable Limits on Decision Errors

This section presents guidelines for the decision maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Due to inherent uncertainty introduced by heterogeneity and error in sampling, storing, transporting, and analyzing environmental media, it is important to specify the acceptable decision error rates. Potential errors resulting from field sampling modifications implemented under the ESC program will be minimized by using the decision rules outlined in Section 3.1.6. Establishing a sample protocol and using definitive analyses will also minimize potential errors introduced during field operations. During the field investigation, acceptable levels of uncertainty will be identified jointly between SRS and regulatory personnel using the procedures outlined in *Guidance for Data Usability in Risk Assessment – Parts A and B* (EPA 1992).

3.1.8 Optimize the Design for Obtaining Data

The final step in the DQO process is to develop a sampling plan that takes into account the problems, key issues, environmental variables, and process for identifying spatial and temporal boundaries of the contamination and populations at risk. The approaches will be used to optimize the design of the RFI/RI and SAFER and ESC. SAFER is being applied throughout the development of the CSM and DQOs. These tools are helpful in establishing site uncertainties and in determining data needs and are important factors in the development of a comprehensive SAP. ESC is applied by reviewing all existing data by performing a limited (Phase I) pre-characterization and by obtaining analytical data in a time frame that allows for timely decisions to streamline the investigation process. An integral part of the ESC process is a dynamic work plan that is viewed as a guide subject to modification, rather than an absolute, unchangeable document. As such, decisions will be made throughout the characterization to optimize field activities for obtaining data.

3.2 Summary of DQO Evaluation

This section discusses the unit characterization objectives as they address the CSM and meet the DQO process needs. The data needs developed under the DQO process are summarized in Table 3-1; the CSM is discussed in Section 3.1.1 and is presented as Figure 3-1.

The primary sources of contamination are miscellaneous aqueous radioactive and chemical wastes disposed at the RdACB OU. If unusual material, liquids, or visibly impacted soils are identified, samples of these materials will be obtained for characterization. A list of USCs has not been established based on validated analytical Phase I data. Limited additional sampling of the primary sources and the determination of the base of the basin are necessary to perform contaminant fate and transport analyses and to supplement primary source characterization.

Secondary source materials may have become contaminated by infiltration/percolation of the primary sources and/or deposition of contaminants on the surface soil during waste disposal activities. Leaching from the primary source material to deep soil may have contaminated the groundwater pathway. Geochemical data obtained from the Water Table Aquifer will be used to determine the nature of the primary and secondary sources' contribution to groundwater contamination, if any, and to refine the remedial design. If a plume does exist, its lateral and vertical extent will be delineated by collecting samples by DPT (if a VOC plume exists) to guide in the placement of new monitoring wells. Additional monitoring wells will be installed if a contaminant plume other than VOCs exists. Hydrostratigraphic and hydraulic properties of the affected aquifers will also be determined for site-specific contaminant fate and transport analyses.

Soils in and adjacent to the basin may have been contaminated by direct contact. To evaluate this pathway, surface and subsurface soil samples will be collected adjacent to the boundaries of the RdACB OU. Likewise, surface and subsurface soils downgradient of the RdACB OU may have been contaminated by surface water runoff. To evaluate this pathway, surface and subsurface soil samples will be collected. In addition, sediment and surface water samples will also be collected from the bottomland hardwood swamp to evaluate this pathway.

At present, human health and ecological risk assessments cannot be performed with existing data. Therefore, RCRA/CERCLA characterization objectives have not been satisfied. To resolve this issue, four areas of possible contamination require characterization: secondary source material; surface, subsurface, and deep soils at the RdACB OU; soils adjacent to the basin; and groundwater in the Water Table and Gordon Aquifers. Characterization of these areas will establish whether secondary sources exist and whether pathways to potential receptors are complete.

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FIGURES

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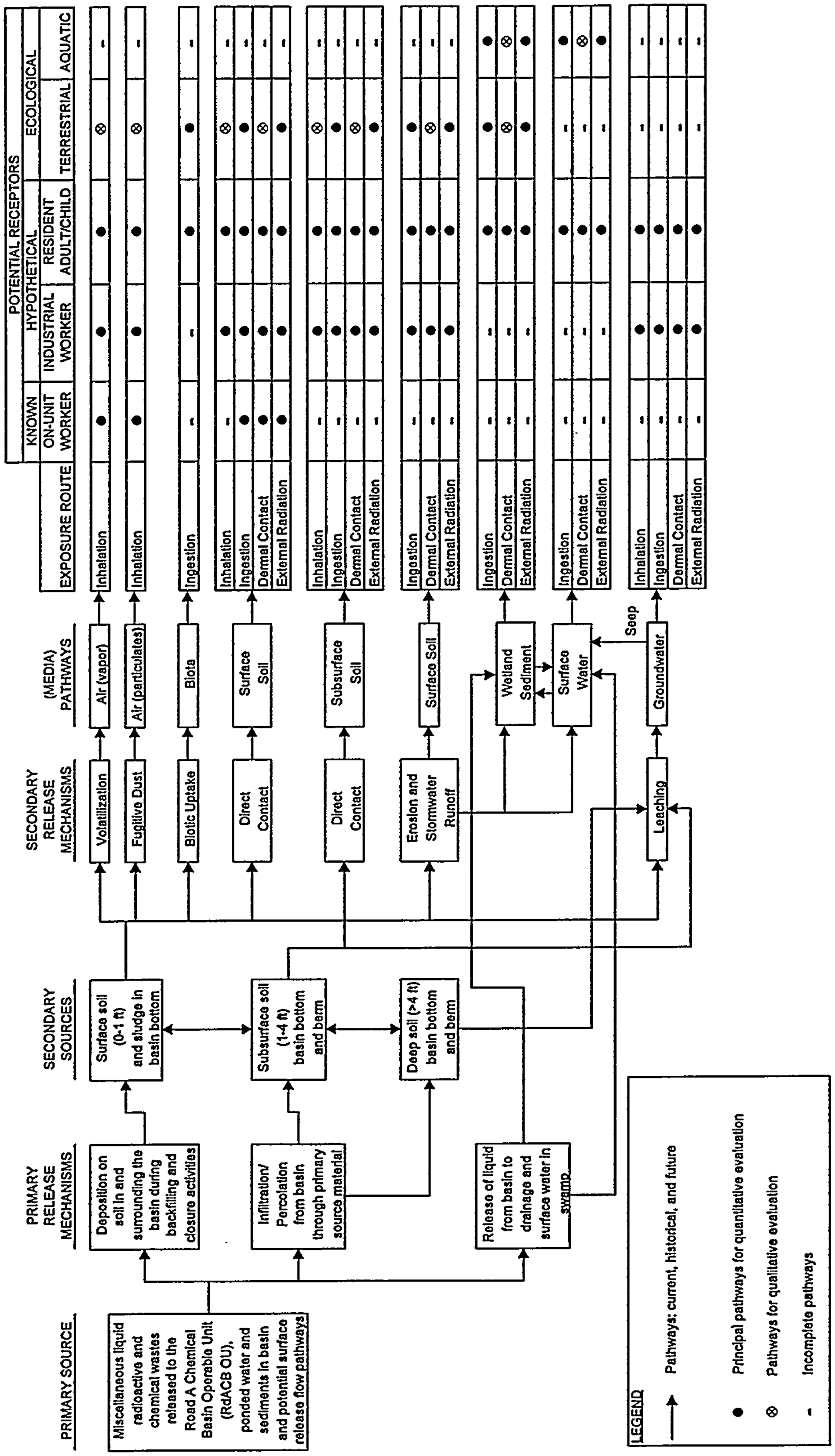

(MEDIA) PATHWAYS	EXPOSURE ROUTE	POTENTIAL RECEPTORS KNOWN ON-UNIT WORKER	HYPOTHETICAL INDUSTRIAL WORKER	RESIDENT ADULT/CHILD	ECOLOGICAL TERRESTRIAL	AQUATIC
Air (vapor)	Inhalation	●	●	●	⊗	-
Air (particulates)	Inhalation	●	●	●	⊗	-
Biota	Ingestion	-	-	●	●	-
Surface Soil	Inhalation	-	●	●	⊗	-
	Ingestion	●	●	●	●	-
	Dermal Contact	●	●	●	⊗	-
	External Radiation	●	●	●	●	-
Subsurface Soil	Inhalation	-	●	●	⊗	-
	Ingestion	-	●	●	●	-
	Dermal Contact	-	●	●	⊗	-
	External Radiation	-	●	●	●	-
Surface Soil	Ingestion	-	●	●	●	-
	Dermal Contact	-	●	●	⊗	-
	External Radiation	-	●	●	●	-
Wetland Sediment	Ingestion	-	-	●	●	●
	Dermal Contact	-	-	●	⊗	⊗
	External Radiation	-	-	●	●	●
Surface Water	Ingestion	-	-	●	-	●
	Dermal Contact	-	-	●	-	⊗
	External Radiation	-	-	●	-	●
Groundwater	Inhalation	-	●	●	-	-
	Ingestion	-	●	●	-	-
	Dermal Contact	-	●	●	-	-
	External Radiation	-	●	●	-	-

Figure 3-1. Conceptual Site Model for the Road A Chemical Basin

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TABLES

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Table 3-1. Data Quality Objectives Worksheet

Primary Sources	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives	Bias for Action
Miscellaneous Aqueous Radioactive and Chemical Wastes Disposed at the RdACB OU (approximate depth determined from GPR survey).	The primary source (aqueous waste) is no longer present. Basin soil is covered with fill and graded. Soil is present in a heterogeneous mixture to the base of the basin. Soil previously in contact with aqueous waste may be contaminated. Since the basin was backfilled and no wastes have been disposed at the basin since 1973, it is not expected to encounter primary source material, principal threat source material (PTSM), or low level threat source material (LLTSM).	Contaminants from soil and aqueous waste leaching into the groundwater.	Depth of the original basin. Additional characterization of basin wastes to support leachability and mass limit calculations and to supplement primary source characterization. Additional data to confirm whether PTSM or low level threat source material is present.	GPR and electromagnetic (EM) surveys to determine the boundary and depth of the basin. Installation of wells to provide lithological and geophysical information. Perform additional borings in the vicinity of the basin.	Collect samples of primary source (if any) and analyze for the following: TAL/TCL and full radiological analysis for all required samples. Contingent samples will undergo radiological and VOC screening. Indicators of 20/50 pCi/g alpha/beta and 1 ppm VOC to trigger TAL/TCL and full radiological analysis.	Alternatives include no action, institutional controls, natural soil cover, soil mixing, in-situ grouting, cover/capping, and excavation and removal of contaminated media.	No

Table 3-1. Data Quality Objectives Worksheet (continued)

Secondary Sources	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives	Bias for Action
Surface Soil (0-1 ft) within and adjacent to the basin.	Basin and perimeter soil is not contaminated because basin was backfilled and covered with clean soil. Surface water runoff is unlikely because primary source was contained in the basin. Radiological surveys of the waste unit have not detected any contamination at the surface. Deviation: potential for surface soil contamination due to spills or direct contact with primary source material during operations and contact with potentially contaminated surface water during backfilling and closure of the RdACB OU.	Potential exposure routes for 0-1 ft are inhalation, ingestion, dermal contact, and external radiation.	Determine USCs and horizontal extent of contamination within and adjacent to the basin. Generate definitive level data for risk assessment.	Collection of 0-1 ft samples distributed in and adjacent to the basin.	Required samples will undergo full TAL/TCL and radionuclide analysis. Contingent samples failing to screen below 20/50 pCi/g alpha/beta and 1 ppm VOC will undergo full TAL/TCL and radiological analysis.	Alternatives include no action, institutional controls, natural soil cover, soil mixing, in-situ grouting, cover/capping, and excavation and removal of contaminated media.	No

Table 3-1. Data Quality Objectives Worksheet (continued)

Secondary Sources	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives	Bias for Action
Subsurface soil (1-4 ft) within and adjacent to the basin.	Basin and perimeter subsurface soil is not contaminated because the basin was backfilled and covered with clean soil. The basin bottom was deeper than 4 ft; therefore, the backfill should be clean. Historical soil sampling did not detect radiological indicators above background levels in subsurface soils. Deviation: potential for subsurface soil contamination due to spills or direct contact with primary source material during operations.	Potential exposure routes are inhalation, ingestion, dermal contact, and external radiation.	Determine USCs and horizontal extent of contamination within and adjacent to the basin. Assess impact on soils adjacent to the basin, and supplement risk assessment data.	Initial borings located within and no more than 10 ft from basin edges. 1-4 ft around perimeter of the original basin.	Required samples will undergo full TAL/TCL and radionuclide analysis. Contingent samples failing to screen below 20/50 pCi/g alpha/beta and 1 ppm VOC will undergo full TAL/TCL and radiological analysis.	Alternatives include no action, institutional controls, natural soil cover, soil mixing, in-situ grouting, cover/capping, and excavation and removal of contaminated media.	No

Table 3-1. Data Quality Objectives Worksheet (continued)

Secondary Sources	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives	Bias for Action
Deep soil (>4 ft) does not include primary source material, which may exist within the basin.	Undisturbed soil in the natural geologic profile below and adjacent to the basin. Potential leaching of contaminants to the groundwater. Soil at the basin bottom contains residual contamination from the primary source. Potential for lateral migration from the bottom of the basin to perimeter soils.	Potential infiltration or percolation of contamination to groundwater resulting in exposure to industrial worker and future residents through ingestion, inhalation, external radiation, and dermal contact.	Soil samples required to: (1) Characterize contamination in the interval between the base of the basin and the water table; (2) Characterize contamination outside the basin, if present, of soils >4 ft, if necessary based on screening results; (3) Determine unit-specific lithologic and hydrostratigraphic characteristics for evaluation of contaminant fate and transport.	GPR survey within the basin to identify bottom of the basin. Soil boring samples outside of the basin. Sampling to terminate when two consecutive samples screen “clean” or when water table is encountered. Deepest interval will receive definitive analysis. Geotechnical samples from the interval beneath the basin.	Required samples will undergo full TAL/TCL and radionuclide analysis. Contingent samples failing to screen below 20/50 pCi/g alpha/beta and 1 ppm VOC will undergo full TAL/TCL and radiological analysis. Geotechnical parameters from Shelby tubes: pH, Hydrometer, horizontal/vertical conductivity, total organic compound (TOC), cation exchange capacity (CEC), porosity, Atterberg Limits, grain size distribution, bulk density, moisture content.	Alternatives include no action, institutional controls, natural soil cover, soil mixing, in-situ grouting, cover/capping, and excavation and removal of contaminated media.	No
Background Soil	Unimpacted by RdACB OU operations.	Not Applicable	Determine 2X average background soil concentrations.	Collect and analyze soil samples from locations in background areas.	TAL/TCL and full radionuclide analysis.	Not Applicable	Not Applicable

Table 3-1. Data Quality Objectives Worksheet (continued)

Pathway (Media)	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives	Bias for Action
Downslope Surface soil (0-1 ft) and bottomland hardwood swamp sediment (0-1 ft) contaminated by surface water runoff.	Surface soils downgradient of the basin probably have not been impacted by surface water runoff because the basin was backfilled and covered. Historical soil sampling did not detect radiological indicators above background levels. Radiological surveys have not detected activities at the surface. Deviation: surface water runoff carried contaminants from spill areas into drainage swales downgradient of the waste unit.	Potential exposure routes for 0-1 ft are ingestion, inhalation, dermal contact, and external radiation.	Soil sample to determine potential impact to known hypothetical and ecological receptors.	Collect 0-1 ft sample below drainage culvert downslope of the basin. Contingent stepout sampling will continue to be collected until two clean stepout locations are encountered. Additionally, surface water and sediment samples will be collected in the bottomland hardwood swamp at the intersection of the drainage path and the swamp.	Samples will be collected as contingent samples. Contingent samples failing to screen below 20/50 pCi/g alpha/beta and 1 ppm VOC will undergo full TAL/TCL and radiological analysis.	Alternatives include no action, institutional controls, excavation, disposal, and excavation/ consolidation.	No

Table 3-1. Data Quality Objectives Worksheet (continued)

Pathway (Media)	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives	Bias for Action
Downslope Subsurface soil (1-4 ft) and bottomland hardwood swamp sediment (0-4 ft) contaminated by surface water runoff.	Surface soils downgradient of the basin probably have not been impacted by surface water runoff because the basin was backfilled and covered. Historical soil sampling did not detect radiological indicators above background levels. Radiological surveys have not detected activities at the surface. Deviation: surface water runoff carried contaminants from spill areas into drainage swales downgradient of the waste unit.	Potential exposure routes for 1-4 ft are ingestion, inhalation, dermal contact, and external radiation.	Soil sample to determine potential impact to known hypothetical and ecological receptors.	Collect 1-4 ft sample below drainage culvert downslope of the basin. Contingent stepout sampling will continue to be collected until two clean stepout locations are encountered. Additionally, surface water and samples will be collected in the bottomland hardwood swamp at the intersection of the drainage path and the swamp.	Samples will be collected as contingent samples. Contingent samples failing to screen below 20/50 pCi/g alpha/beta and 1 ppm VOC will undergo full TAL/TCL and radiological analysis.	Alternatives include no action, institutional controls, excavation, disposal, and excavation/ consolidation.	No

Table 3-1. Data Quality Objectives Worksheet (continued)

Pathway (Media)	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives	Bias for Action
Groundwater	Possible contamination from leaching of primary source.	Ingestion or dermal contact with groundwater, showering (includes inhalation and dermal), or inhalation of groundwater vapor.	Establish unit-specific background conditions. Nature and extent of contamination in groundwater. Also definition of aquifer hydraulic properties and hydrostratigraphy.	Install two background monitoring wells in the Water Table and Gordon Aquifers. Use DPT if existing and new wells cannot sufficiently determine the extent of contamination and geometry of the groundwater plume. Obtain geotechnical samples from uppermost confining unit. Install three new monitoring wells upgradient, sidegradient, and downgradient of the RdACB OU in the Gordon Aquifer to determine groundwater flow and hydraulic head, in addition to obtaining groundwater samples for analysis Install two new water table monitoring wells to monitor downgradient of the basin.	TAL/TCL suites and full radiological speciation required. Lithologic data and description of soils during monitoring well installation. Geotechnical parameters from Shelby tubes: pH, hydrometer, horizontal/vertical conductivity, TOC, CEC, porosity, Atterberg limits, grain size distribution, bulk density, and moisture content. Hydraulic head measurements. Hydraulic conductivity values calculated from field permeability tests.	Alternatives include institutional controls and collection and treatment.	No

Table 3-1. Data Quality Objectives Worksheet (continued)

Pathway (Media)	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering / Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives	Bias for Action
Groundwater (continued)				Obtain two rounds of groundwater data at least 30 days apart from existing and new monitoring wells. Conduct field permeability tests on all new monitoring wells. Perform geophysical logging of pilot holes for the upgradient and downgradient monitoring wells installed in the Gordon Aquifer.	Geophysics to include resistivity, natural gamma, caliper, and spontaneous potential (SP).		

4.0 UNIT ASSESSMENT

The unit assessment for the RdACB OU is designed to supplement and expand the pre-existing data set developed from historical data, soil gas surveys, soil boreholes, and groundwater monitoring. These data have been used to streamline characterization efforts, eliminate unnecessary sampling, and provide sufficient data required to help make decisions at various points in the environmental assessment process. The combined data will be used to support contaminant fate and transport analyses, determine the nature and extent of contamination, evaluate remedial action objectives, and support human health and ecological risk assessments to satisfy RCRA and CERCLA requirements for the RdACB OU.

This section discusses the unit objectives as they address the CSM and meet the DQO process needs. Based on the DQOs developed in Section 3, the following data needs have been identified:

- Define the location and lateral and vertical extent of the original basin
- Characterize the lithology beneath and adjacent to the basin
- Identify the geotechnical properties of the upper confining unit
- Characterize the nature and extent of contamination in surface, subsurface, and deep soils beneath and adjacent to the basin
- Identify surface water and seep locations between the OU and the Savannah River, if any
- Characterize deep soil in the interval between the bottom of the basin and the water table
- Determine the 2X average background soil screening concentrations
- Determine the nature and extent of groundwater contamination in the Water Table Aquifer
- Determine the nature and extent of groundwater contamination and groundwater flow direction in the Gordon Aquifer
- Characterize the nature and extent of the surface runoff pathway from the basin to the bottomland hardwood swamp and within the swamp.

All soil and groundwater samples will be analyzed by EPA-certified laboratories using SW-846 methods. Physical and hydrological parameters will be determined using American Society for Testing and Materials (ASTM) or other standard methods. Water samples collected by DPT will be screened for VOCs by an onsite laboratory with a 24-hour turnaround schedule to allow the project team to adjust the sampling strategy, as necessary, based on analytical data.

4.1 Objectives

The field investigation will be conducted in compliance with WSRC Manual 3Q5 (WSRC 1997) and Manual 3Q1-7 (WSRC 1995b). The characterization activities are summarized in Table 4-1. Proposed soil sample locations are presented in Figures 4-1 and 4-2. Figure 4-3 shows the locations of the proposed piezometer and groundwater monitoring wells. GPR and EM survey transect locations are presented in Figure 4-4. All sample locations from previous investigations are presented in Section 2.

In general, samples collected during this investigation will be analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TAL inorganics. Samples also will be analyzed for radioisotopes. The constituents, analytical methods, and detection limits for each parameter are presented in Tables 4-2 and 4-3. Upon review, the analyte list from previous investigations was inadequate (see Section 2) and results were considered inconclusive. Therefore, for this investigation, samples will be analyzed for full analyte suites as discussed in the following sections.

In accordance with QA/QC requirements, during the unit assessment, field QC samples consisting of duplicates, splits, rinsate blanks, field blanks, and trip blanks will be collected for samples requiring definitive analytical data. Duplicates and splits will be analyzed for the same analytical parameters as the associated sample. Duplicates will be collected at a rate of one per 20 definitive samples per matrix (soil or water). Splits will also be collected at a rate of one per 20 definitive samples per matrix. Duplicates are independent samples collected from the same source and analyzed independently by the same laboratory. Duplicates are useful in evaluating the precision of the sampling process. A split is also an independent sample collected from the same source and analyzed independently by two different laboratories. Split samples are used to evaluate interlaboratory precision. Rinsate blanks, field blanks, and trip blanks will be analyzed for only TCL VOCs and TAL inorganics. If contamination from either of these two suites is detected in the rinsate blanks, field blanks, or trip blanks, then contamination of the associated samples for all analyte suites will be suspected.

Field blanks will be collected at the rate of one per 20 definitive samples per matrix, except where the sample is not exposed to potential external contamination from handling during the sample event. Thus, field blanks are not required when the sample is pumped directly from its natural condition into the sample bottle.

Rinsate blanks will also be collected at a rate of one per 20 definitive samples per matrix, except where the sample is collected with a dedicated sampling tool. Dedicated sampling tools effectively eliminate the risk of cross-contamination. Trip blanks will be analyzed for TCL VOCs only. They will be collected and shipped at the rate of one per cooler containing a VOC sample.

4.2 Primary Source Characterization

The primary sources (miscellaneous aqueous radioactive and chemical wastes disposed at the RdACB OU) may have been released by deposition or infiltration/percolation to deep soil. The primary sources were not characterized during the previous investigations. Since the basin was backfilled in 1973 and no wastes have been disposed at the RdACB OU since that time, it is unlikely that primary source material will be encountered. However, if unusual materials are encountered, additional samples will be collected. Sampling of the primary sources is contingent upon identifying material during the soil sampling and is described in Section 4.3.

4.3 Secondary Source Characterization

To characterize secondary sources identified in the CSM, surface, subsurface, and deep soils at the basin will be sampled. There are three secondary sources identified in the CSM: surface soil (0 to 0.3 m [0 to 1 ft] bls), subsurface soil (0.3 to 1.2 m [1 to 4 ft] bls), and deep soil (>1.2 m [> 4 ft] bls). Table 4-2 lists the analytical parameters for groundwater and soil samples, and Table 4-3 summarizes secondary source sampling, locations, and suites of analytes.

4.3.1 Soil Sampling at the RdACB OU

To determine the nature and extent of contamination beneath the RdACB OU, soil samples will be collected at six borehole locations (RAC-01 through RAC-06) within the basin footprint. In addition, the lithology of the soil samples collected from each borehole will be described and used to define the original depth of the basin. The proposed borehole locations are shown in Figure 4-1. Prior to soil sampling, GPR and EM surveys will be conducted to better define the lateral and vertical extent of the basin. The proposed borehole locations may be changed based on the results of the GPR and EM surveys. The GPR survey is described in greater detail in Section 4.5.1. To determine if contaminants from the RdACB OU have laterally migrated from the basin or overflowed from the basin to the perimeter surface soil/vadose zone soils, ten borehole locations (RAC-07 through RAC-16) around the perimeter of the basin footprint will be sampled (Figure 4-1). The perimeter boreholes will characterize potential surface releases from the displacement of standing water or waste observed during backfill operations. Boreholes RAC-07, RAC-11, and RAC-12 are located topographically downgradient of the basin.

If the perimeter samples fail to screen "clean," one stepout borehole will be sampled proximate to the suspect location. The stepout boring will be located 3 m (10 ft) from the suspect borehole and perpendicular to the basin boundary. Stepout sampling will begin at the elevation where contamination was first detected.

Samples will be collected beneath the RdACB OU and at the perimeter of the basin with a split-spoon sampler using DPT at the following intervals (Figure 4-5):

- 0 to 0.3 m (0 to 1 ft) bls
- 0.3 to 1.2 m (1 to 4 ft) bls
- 1.2 to 2.1 m (4 to 7 ft) bls (contingent based on 0.3 to 1.2 m [1 to 4 ft] screening results)
- 2.1 to 3.0 m (7 to 10 ft) bls
- 3.0 to 3.9 m (10 to 13 ft) bls

The locations and intervals of these borings may be adjusted based on the results of the GPR and EM survey. Each sample will be screened for both radioactivity and VOCs. Soil samples collected deeper than 3.9 m (13 ft) bls (depending upon the elevation of the basin bottom) will be screened for radioactivity and VOCs. A sample will be considered "clean" if radioactivity is below 20 pCi/g for gross alpha, or below 50 pCi/g for nonvolatile beta-gamma, and if VOCs are less than 1 ppm above background. If the deepest required soil sample interval (estimated at approximately 3.9 m [13 ft] bls) does not screen "clean," then samples will be collected continuously at 0.9 m (3 ft) intervals until screening for radioactivity and VOCs indicates that two consecutive soil samples screen clean. If soil sampling is terminated because two consecutive samples screen "clean" for radioactivity and VOCs, the last sample interval will be sent to the offsite laboratory for detailed analyses. The results of the offsite analyses will be used to confirm the accuracy of the screening results and to define the vertical extent of contamination.

All samples will be sent to an offsite laboratory for analysis and will be analyzed for the following:

- TCL VOCs
- TCL SVOCs
- TCL pesticides/PCBs
- TAL inorganics
- Full radiological analysis

4.3.2 Background Soil, Sediment, and Surface Water Characterization

Site-specific background samples will be collected and analyzed to quantify concentrations of naturally occurring or non-unit related constituents. These data will be used to establish the 2X average background screening values, which in turn will be used to screen against the unit-specific sample results to determine the magnitude of contamination associated with waste unit operations. Background surface, subsurface, and deep soil samples will be collected from six locations (RAC-19 through RAC-24) indicated in Figure 4-2. The background locations will be hydraulically upgradient of the RdACB OU in an area expected to be un-impacted by former RdACB OU operations.

Background soil sampling will occur after the soil samples beneath the basin have been collected. The borehole depths and sampling intervals at the background locations will be consistent with the borehole depths and sampling intervals of the basin and perimeter borings.

Soil samples will be collected with a split-spoon sampler using DPT, and all samples will be sent to an offsite laboratory for analysis and will be analyzed for the same suites of analyses as for the basin (Section 4.3.1).

Site-specific background sediment and surface water samples will be collected and analyzed to quantify concentrations of naturally occurring or non-unit related constituents. These data will be used to establish 2X average background screening values.

Background sediment and surface water samples will be collected from three locations (RAC-25 through RAC-27) in the bottomland hardwood swamp south of the RdACB OU. Background sediment and surface water samples will be collected with a stainless steel scoop, and all samples will be sent to an offsite laboratory for analysis. Background sediment and surface water samples will be analyzed for the same suites of analyses as unit-specific samples.

4.4 Exposure Media Characterization

To evaluate exposure media pathways identified in the CSM, surface soils downslope of the basin and groundwater will be characterized to support risk assessment and contaminant fate and transport analyses. Air and biota were also identified as exposure media in the CSM. However, these media will not be evaluated because they are not considered significant pathways for exposure. Table 4-3 provides a summary of exposure source sampling, locations, and suites of analytes.

4.4.1 Downslope Soil, Sediment, and Surface Water

Two site-specific boreholes (RAC-17 and RAC-18) will be sampled to determine if contaminants from the unit were discharged through an overflow culvert downslope in the drainage ditch. The boreholes will be located immediately below the surface water drainage culvert, downslope of the RdACB OU (Figure 4-1). The boreholes will be advanced with a hand auger from 0 to 0.3 m (0 to 1 ft) and 0.3 to 1.2 m (1 to 4 ft) bls. Contingent stepout sampling (RAC-28 through RAC-34) will continue to be collected until two clean stepout locations are encountered. Additionally, surface water and sediment samples will be collected from four locations (RAC-35 through RAC-38) in the bottomland hardwood swamp at the intersection of the drainage path and the swamp. These samples will be analyzed for the following constituents:

- TCL VOCs
- TCL SVOCs
- TCL pesticides/PCBs
- TAL inorganics
- Full radiological analysis

If any soil samples fail to screen "clean," two additional boreholes will be drilled downslope of the previous borings. This process will continue until two consecutive samples are screened "clean."

4.4.2 Groundwater

Three Water Table Aquifer monitoring wells (BRD-6D, BRD-7D, and BRD-8D) and three Gordon Aquifer monitoring wells (BRD-2C, BRD-6C, and BRD-7C) are proposed for installation for this investigation. The three monitoring wells installed in the Gordon Aquifer (below the Gordon Confining Unit) will be used to determine the vertical hydraulic gradient between the Water Table Aquifer and the Gordon Aquifer, as well as groundwater flow direction and groundwater quality in the Gordon Aquifer. The monitoring well locations were determined based upon characteristics and direction of local groundwater flow (Figure 4-3). Tables 4-2 and 4-4 summarize groundwater samples and constituents to be analyzed. Wells BRD-6D and BRD-6C will serve as unit background wells. Wells BRD-7D, BRD-7C, and BRD-8D will be located downgradient of the basin. Well BRD-2C will be located within 3 m (10 ft) of existing monitoring well BRD-2, located side-gradient of the basin. Lithologic and geotechnical data will be collected during the installation of these wells as described in Sections 4.5.2 and 4.5.3, respectively. The data needs to be addressed by the groundwater investigation are as follows:

- Determining USCs and ARAR COCs
- Generating definitive data for risk assessment
- Defining the nature and extent of contamination in the Water Table and Gordon Aquifers (if present)

The existing and proposed wells will be sampled 30 days apart following groundwater sampling procedures presented in WSRC Manual 3Q5 (WSRC 1997). The 30-day period between the two sampling events will allow for adequate aquifer recovery and timely collection and analysis of the groundwater quality data. The five existing wells will be redeveloped and new dedicated pumps will be installed prior to sampling. Samples will be analyzed for the constituents listed in Table 4-2. These data will indicate whether contaminants have migrated from the basin through the vadose zone and into the groundwater, and will be used in contaminant fate and transport modeling and risk analyses. In addition, field parameters, such as temperature, pH, specific conductance, and turbidity, will be recorded at each monitoring well. These parameters are used to indicate when formation water is being pumped from the well. Once the parameters stabilize, the groundwater sample is collected. In addition, these parameters provide an indication of water quality and may be useful in evaluating data anomalies.

If the existing and newly installed wells cannot sufficiently determine the extent of contamination and geometry of the groundwater plume (if present), groundwater samples will be collected downgradient of the basin with DPT. After an evaluation of the DPT groundwater data, additional groundwater monitoring wells will be installed in areas required to define the horizontal and vertical extent of groundwater contamination. Prior to performing DPT and monitoring well installation activities, an addendum to this Work Plan will be submitted to the appropriate regulatory agencies for approval.

4.5 Physical Characteristics

Physical/analytical parameters of the RdACB OU will be obtained to evaluate the CSM and to explain the lithologic, hydrogeologic, and geotechnical characteristics of the basin to perform contaminant fate and transport analysis.

4.5.1 Geophysical Survey

4.5.1.1 Ground Penetrating Radar

Prior to soil sampling, a GPR survey will be conducted to better define the lateral and vertical extent of the basin. The GPR survey results will be used to help determine the depth to the bottom of the original basin. This information will be used to determine the proper soil sample locations and interval depths required to characterize the basin soils. Four GPR transects will be run parallel to the long axis of the basin, and seven GPR transects will be run transverse to the long axis of the basin. The proposed transect locations are shown in Figure 4-4.

The depth of penetration of GPR is dependent on the lithology and amount of moisture in the soils. Best penetration is achieved in dry sandy areas (up to 25 m [80 ft]) (EPA 1993). Depth of penetration is typically 1 to 15 m (3 to 50 ft) and is further reduced in moist and/or clayey soils.

4.5.1.2 Electromagnetic Survey

In addition to a GPR survey, an EM survey also will be conducted. The EM survey can be used to help locate buried bulk wastes with and without metal (to depths up to 6 m [20 ft]) (EPA 1993) that may potentially be buried beneath the basin. The EM survey, however, is susceptible to interference due to the presence of metal on the surface (in this case, the chain-link fence that surrounds the perimeter of the site). Because of this limitation, transects will be located only in the interior portions of the basin footprint. The transect locations will be identical to those of the GPR survey, excluding the outermost transects. The proposed transect locations are shown in Figure 4-4.

4.5.2 Lithologic Characterization

All lithologic samples will be described during the soil sampling and monitoring well installation activities following the procedures in WSRC Manual 3Q5 (WSRC 1997).

Continuous core logging will be conducted during installation of the background monitoring well and at one of the downgradient monitoring wells. Soil samples will be described and classified in accordance with Manual 3Q5. At each pilot borehole, the following geophysical logs will be run:

- Caliper
- Natural gamma
- Resistivity
- Spontaneous potential

4.5.3 Geotechnical Characterization

The geotechnical data will be used to determine the integrity of the Gordon Confining Unit in preventing vertical migration of potentially contaminated groundwater. Undisturbed soil samples will be collected from the first confining layer (Gordon Confining Unit) encountered for geotechnical characterization of the RdACB OU. The undisturbed soil samples will be collected from each of the pilot boreholes drilled for each monitoring well installed in the Gordon Aquifer. One sample will be collected using Shelby tubes at each location.

The samples will be analyzed for the following geotechnical properties:

- pH
- Horizontal and vertical hydraulic conductivity
- TOC
- CEC
- Total soil porosity
- Atterberg limits
- Grain size distribution
- Bulk density
- Moisture content

4.5.4 Field Permeability Testing

Field hydraulic permeability tests (slug tests) will be performed on all monitoring wells to further define the hydraulic conductivity of the Water Table Aquifer. Rising head tests will be performed on each well, and the data will be analyzed using the Bouwer and Rice Method (Bouwer and Rice 1976).

4.5.4.1 Summary of Test Method

This test method describes the field procedures involved in conducting an instantaneous head (slug) test. The slug test method involves causing a sudden change in head in a test well and measuring the water level response within that well. Head change may be induced by removing a known quantity or "slug" of water from the well, rapidly removing a mechanical "slug" from below the water level, or decreasing the air pressure in the well casing. The water level response in the well is a function of the mass of water in the well and the transmissivity and coefficient of storage of the aquifer.

The slug test provides an advantage over pumping tests in that it does not require the disposal of large quantities of water that may be produced. This advantage is of special importance when testing a potentially contaminated aquifer. However, slug tests reflect conditions near the well and are influenced by near-well conditions, such as gravel pack, poor well development, and skin effects.

4.5.4.2 Test Procedure

A pressure transducer linked to a data logger will be used to measure head change with time. Prior to each test, the water level in the test well will be measured for a period of about the duration of the test to determine the pre-test water level fluctuations and to determine a reference static water level.

At each test well location, the test will be performed first either by injecting a slug of water or by emplacing a mechanical slug below the water level. After the water level has recovered to static, a rising head test will be conducted by removing either a slug of water or the mechanical slug. There is no fixed requirement for the magnitude of the change in water level. Similar results can be achieved with a wide range of induced head change. Generally a head change of 0.3 to 0.9 m (1 to 3 ft) is adequate.

4.5.4.3 Presentation and Interpretation of Results

The water level tables of data collected during each test and the data plots used in analysis of the data will be presented in an EXCEL spreadsheet. The data plots and the straight-line matches and corresponding parameters at match points will be shown graphically in EXCEL.

The test reports will include the following:

- Date, time, and well identification
- Method of slug injection or withdrawal, as well as whether the test is a falling head or rising head test
- Inside diameter of the well screen and well casing above the screen
- Volume of slug (although this information is not necessary to do a Bouwer and Rice analysis)

- Depth of well, and length and depth of screen
- Pre-testing water-level trend

Water levels measured during the test will include information on date, clock time, and time since the test started, along with the data logger and pressure transducer used.

4.6 Investigation-Derived Waste Identification, Generation, and Management

Sampling activities associated with the RdACB OU may generate both aqueous and non-aqueous investigation-derived waste (IDW). These materials will be managed in accordance with the IDW Management Plan (WSRC 1994b). Aqueous IDW may consist of decontamination rinsates and purge water from monitoring wells, and drilling fluids. Non-aqueous IDW may consist of material from drilling mud, personal protective equipment, and excess soil from drilling within the unit. It is anticipated that decontamination rinsates and purge water from monitoring wells will generate three 55-gallon drums of aqueous IDW per monitoring well. All DPT boreholes will generate no more than one 55-gallon drum of combined excess soil. Each pilot borehole drilled during monitoring well installation will generate almost three 55-gallon drums of excess soil and two 55-gallon drums of drilling fluids. Personal protective equipment will be decontaminated and reused, where possible. Additional IDW-specific information will be documented in an IDW Management Strategy, which will be maintained in the project file.

FIGURES

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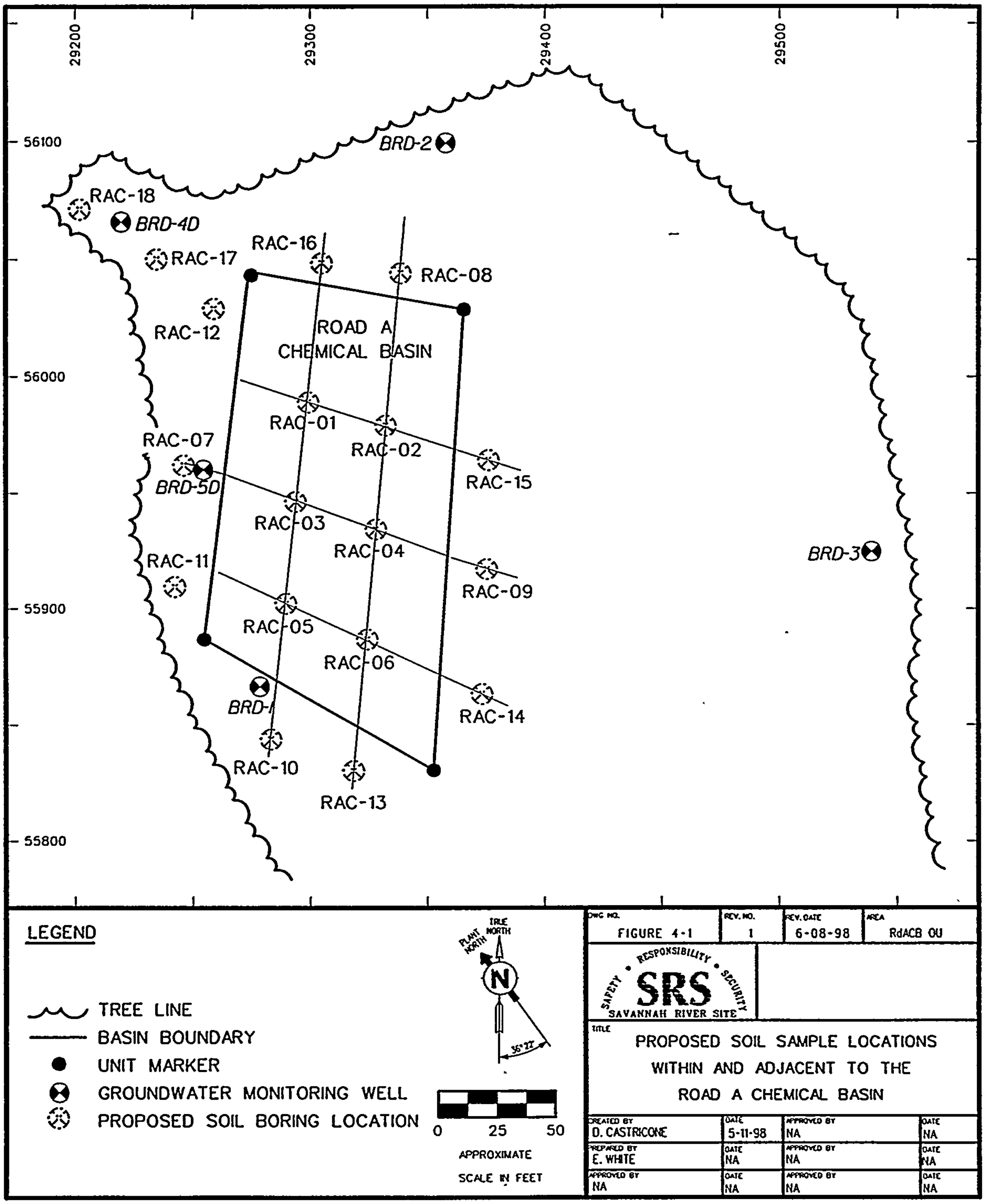

Figure 4-1. Proposed Soil Sample Locations Within and Adjacent to the Road A Chemical Basin

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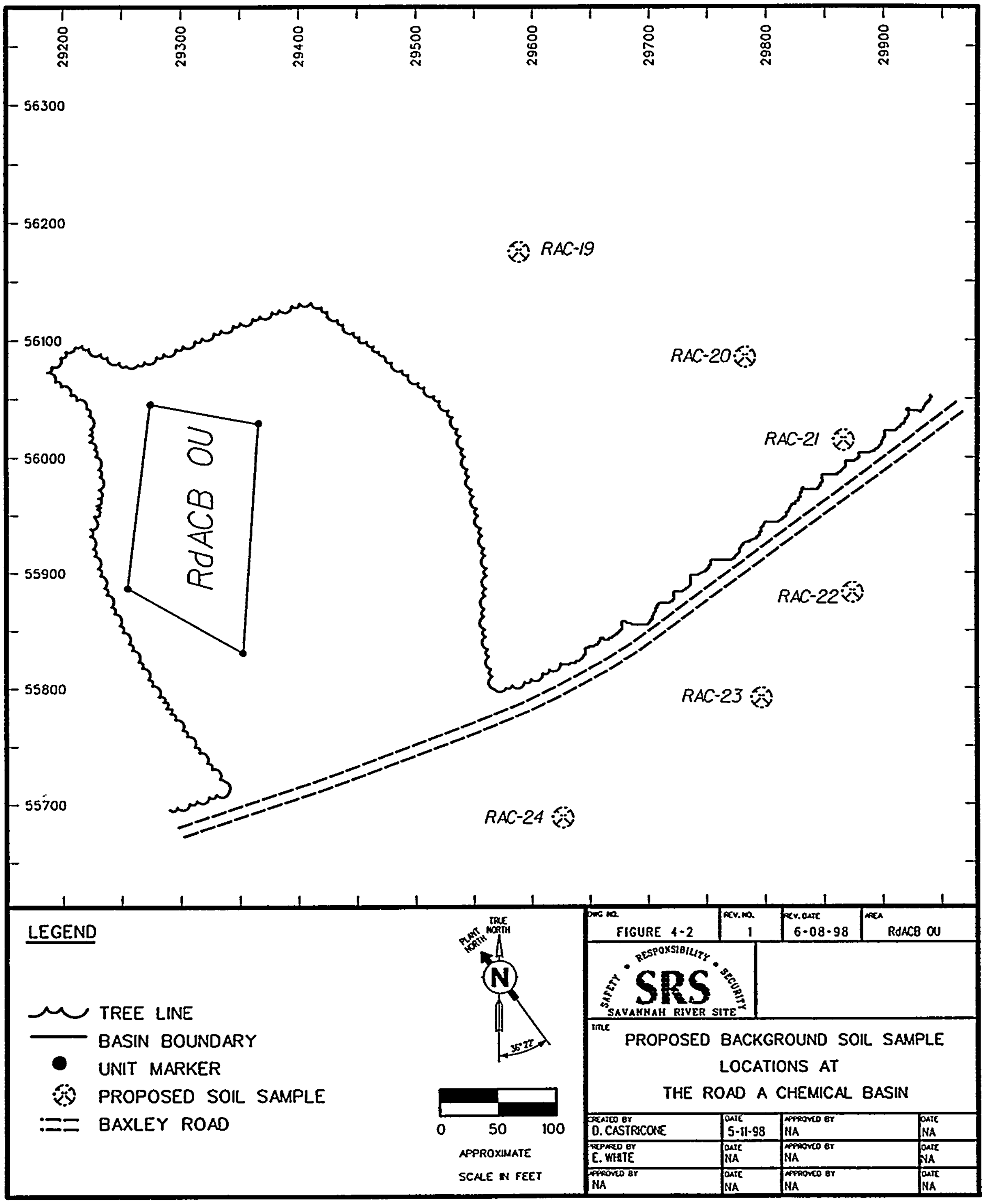

Figure 4-2. Proposed Background Soil Sample Locations at the Road A Chemical Basin

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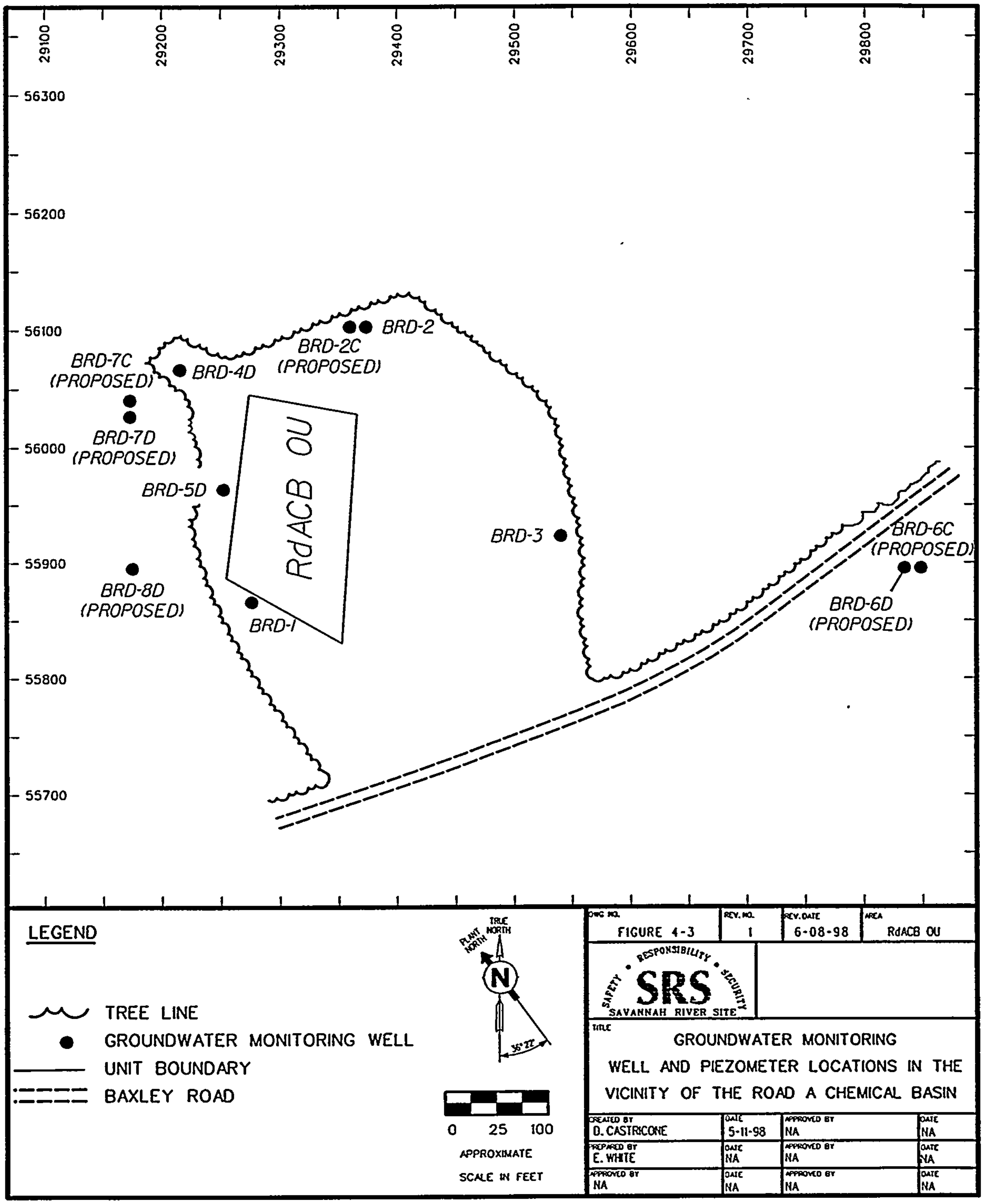

Figure 4-3. Groundwater Monitoring Well and Piezometer Locations in the Vicinity of the Road A Chemical Basin

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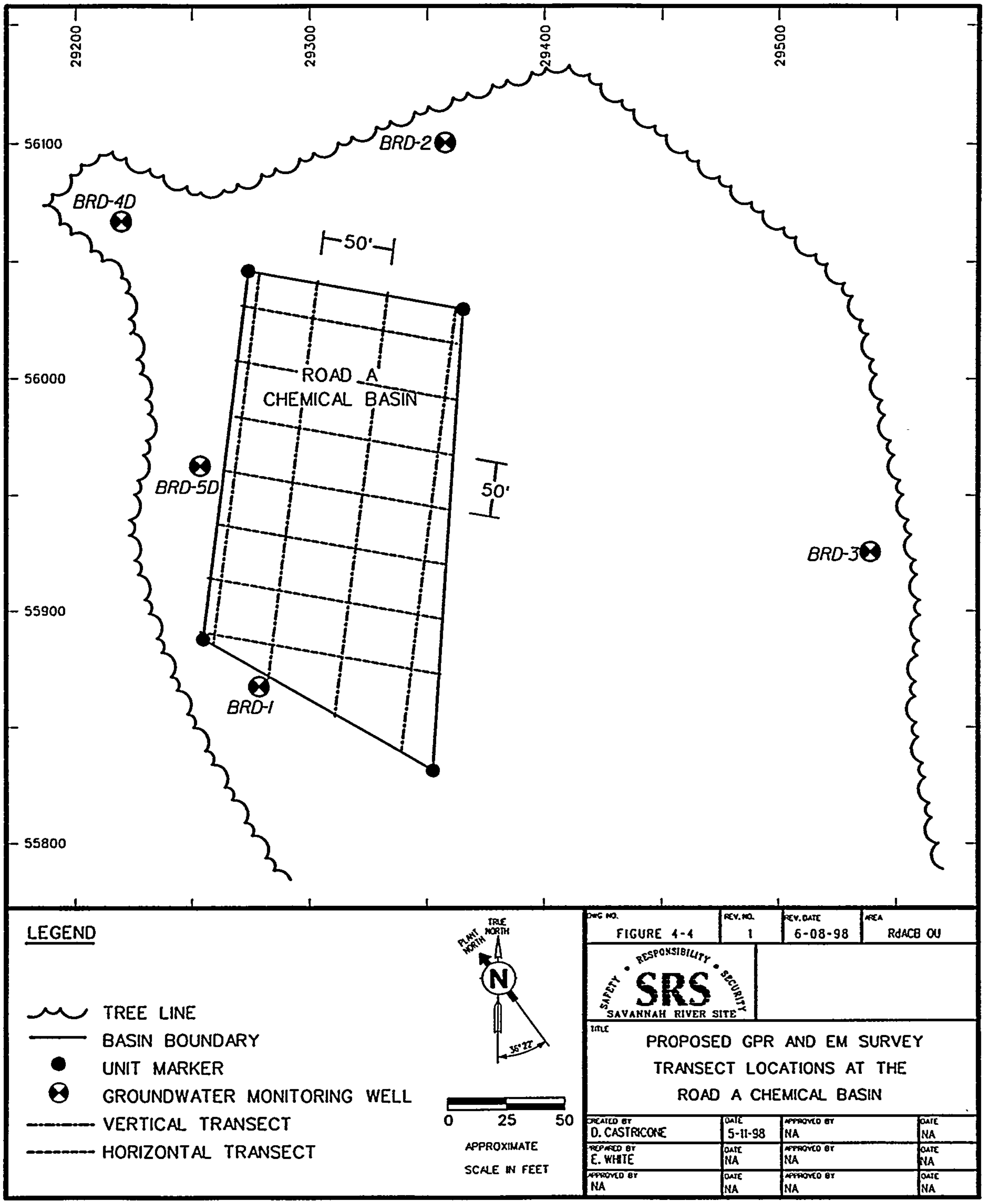

Figure 4-4. Proposed GPR and EM Survey Transect Locations at the Road A Chemical Basin

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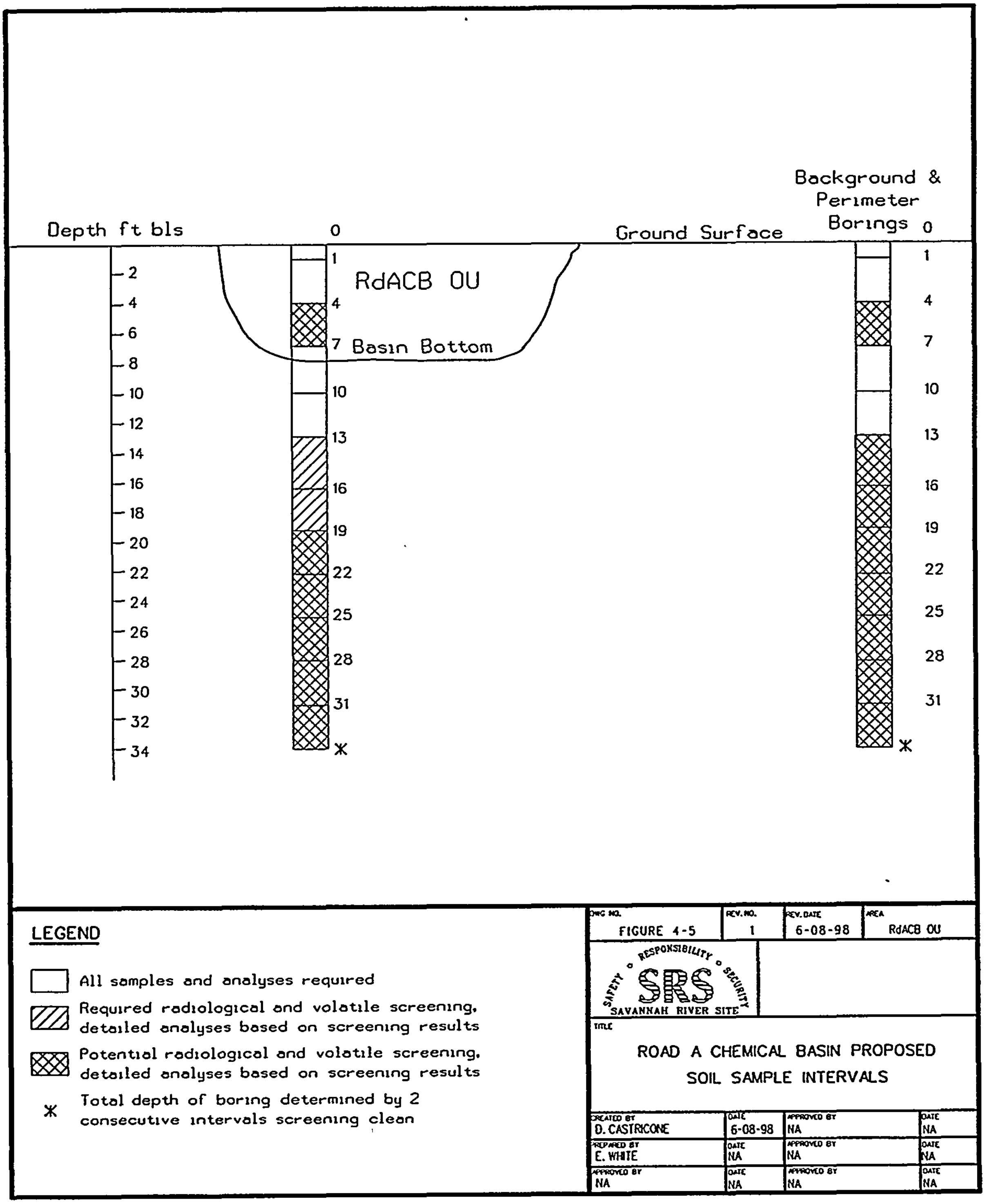

Figure 4-5. Road A Chemical Basin Proposed Soil Sample Intervals

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TABLES

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Table 4-1. Summary of Characterization Activities at the RdACB OU

Unit Component	Data Needs	Characterization Activity	Parameters
RdACB Lithology/Hydrogeology	Determine unit-specific lithologic and hydrogeologic characteristics. Generate unit-specific geotechnical data for contaminant fate and transport analysis and FS.	Install three Water Table Aquifer monitoring wells Install three monitoring wells in the Gordon Aquifer. Geophysically log two wells installed in the Gordon Aquifer Perform slug tests on new wells. Collect water level data in existing and proposed monitoring wells Collect geotechnical data from the three new monitoring wells installed in the Gordon Aquifer	Resistivity, gamma, caliper, SP Slug tests to calculate hydraulic conductivity Hydraulic head to determine head reversal Shelby tubes: pH, Hydrometer, horizontal/vertical conductivity, TOC, CEC, porosity, Atterberg Limits, grain size distribution, bulk density, moisture content.
Background Soil Quality	Determine 2X average background soil concentrations.	Collect soil samples with a split-spoon sampler using DPT at the same sample intervals for the boreholes located in the basin.	TAL/TCL and full radiological analysis for all samples.
Background Sediment and Surface Water Quality	Determine 2X average background sediment and surface water concentrations	Collect sediment samples from the 0.0-1.0 ft interval with a stainless steel scoop. Surface water samples will also be collected with a stainless steel scoop.	TAL/TCL and full radiological analysis for all samples.
Basin Surface Soils (0.0-1.0 ft)	Determine USCs and vertical/horizontal extent of contamination within basin and generate definitive level data for risk assessment.	Collect and analyze soil samples from 0.0-1.0 ft interval from six grid sample locations.	VOC and gross alpha and nonvolatile beta field screening to be performed on all samples. TAL/TCL and full radiological analysis for all samples.
Basin Subsurface Soils (1.0-4.0 ft)	Determine USCs and vertical/horizontal extent of contamination within basin and generate definitive level data for risk assessment.	Collect and analyze soil samples from 1.0-4.0 ft interval from six grid sample locations.	VOC and gross alpha and nonvolatile beta field screening to be performed on all samples. TAL/TCL and full radiological analysis for all samples.
Basin Deep Soils (>4.0 ft)	Determine USCs and vertical/horizontal extent of contamination within basin and generate definitive level data for contaminant fate and transport analysis. Continue deep soil borings to determine vertical extent of contamination.	Collect and analyze soil samples from basin soils>4.0 ft interval from six grid sample locations. Sample 4.0-7.0 ft interval contingent as VOC and radiological screening indicates.	VOC and gross alpha and nonvolatile beta field screening to be performed on all samples. TAL/TCL and full radiological analysis for all required sample locations (non-contingent).

Table 4-1. Summary of Characterization Activities at the RdACB OU (continued)

Unit Component	Data Needs	Characterization Activity	Parameters
Basin Deep Soils (>4.0 ft) (continued)		Sampling of 7.0-10.0 and 10.0-13.0 ft intervals is required for the full TAL/TCL and speciated radiological suites. Contingency sampling based on VOC and radiological screening for soil samples>13.0 ft.	
Basin Perimeter Soils	Determine if contaminants from RdACB OU have laterally migrated from basin bottoms or overflowed from basin to perimeter surface/vadose zone soils.	Collect and analyze soil samples from 0.0-1.0, 1.0-4.0, 7.0-10.0, 10.0-13.0 ft intervals. All other samples and analyses contingent as VOC and radiological screening indicates. Step-out 10 ft if lateral contamination of media is detected. Step-out sampling begins at elevation where contamination was detected.	VOC and gross alpha and nonvolatile beta-gamma field screening to be performed on all samples. TAL/TCL and full radiological analysis for all required sample locations. All other analyses contingent as VOC and radiological screening indicates.
Downslope Surface and Subsurface Soil	Determine if contaminants from RdACB OU were carried downgradient in drainage ditch by erosion or sheet flow.	Sample locations 0.0-1.0 ft and 1.0-4.0 ft at the outlet pipe discharge point.	VOC and gross alpha and nonvolatile beta-gamma field screening to be performed on all samples. TAL/TCL and full radiological analysis for all required sample locations. All other analyses contingent as VOC and radiological screening indicates.
Swamp Sediment and Surface Water	Determine if contaminants were carried downgradient to the swamp.	Collect sediment sample from the 0.0-1.0 ft interval with a stainless steel scoop. Surface water samples will also be collected with a stainless steel scoop.	TAL/TCL and full radiological analysis for all samples.
Groundwater	Determine USCs and ARAR COCs. Generate definitive level data from risk assessment.	Collect groundwater samples from existing and new monitoring wells for two episodes 30 days apart.	TAL/TCL suites and full radiological speciation required.
Groundwater Phase II (if required)	Determine extent of contamination and plume geometry.	Collect groundwater samples downgradient of the basin with geoprobe or CPT if possible. Otherwise install monitoring wells.	To be determined after evaluation of groundwater data.

Table 4-2. Analytical Parameters for Groundwater and Soil Samples

TARGET COMPOUND LIST (TCL)

	Quantitation Limits[a]		
Compound	Groundwater (μg/L)	Soil[b] (μg/kg)	Analytical Method[c,e]
Volatile Organic Compounds:			
Chloromethane	10	10	8240/8260B/5035
Bromomethane	10	10	8240/8260B/5035
Vinyl Chloride	10	10	8240/8260B/5035
Chloroethane	10	10	8240/8260B/5035
Methylene Chloride	5	5	8240/8260B/5035
Acetone	10	10	8240/8260B/5035
Carbon Disulfide	5	5	8240/8260B/5035
1,1-Dichloroethylene	5	5	8240/8260B/5035
1,1-Dichloroethane	5	5	8240/8260B/5035
1,2-Dichloroethylene (total)	5	5	8240/8260B/5035
Chloroform	5	5	8240/8260B/5035
1,2-Dichloroethane	5	5	8240/8260B/5035
2-Butanone	10	10	8240/8260B/5035
1,1,1-Trichloroethane	5	5	8240/8260B/5035
Carbon Tetrachloride	5	5	8240/8260B/5035
Vinyl Acetate	10	10	8240/8260B/5035
Bromodichloromethane	5	5	8240/8260B/5035
1,1,2,2-Tetrachloroethane	5	5	8240/8260B/5035
1,2-Dichloropropane	5	5	8240/8260B/5035
trans-1,3-Dichloropropene	5	5	8240/8260B/5035
Trichloroethylene	5	5	8240/8260B/5035
Dibromochloromethane	5	5	8240/8260B/5035
1,1,2-Trichloroethane	5	5	8240/8260B/5035
Benzene	5	5	8240/8260B/5035
cis-1,3-Dichloropropene	5	5	8240/8260B/5035
Bromoform	5	5	8240/8260B/5035
4-Methyl-2-Pentanone	10	10	8240/8260B/5035
2-Hexanone	10	10	8240/8260B/5035
Tetrachloroethylene	5	5	8240/8260B/5035
Toluene	5	5	8240/8260B/5035
Chlorobenzene	5	5	8240/8260B/5035
Ethylbenzene	5	5	8240/8260B/5035
Styrene	51	5	8240/8260B/5035
Xylene (total)	51	5	8240/8260B/5035

Table 4-2. Analytical Parameters for Groundwater and Soil Samples (continued)

TARGET COMPOUND LIST (TCL)

Compound	Quantitation Limits[a] Groundwater (µg/L)	Soil[b] (µg/kg)	Analytical Method[c,e]
Semi-Volatile Organic Compounds:			
Phenol	10	330	8270G
Benzidine	10	330	8270G
bis(2-chloroethyl)ether	10	330	8270G
2-Chlorophenol	10	330	8270G
1,3-Dichlorobenzene	10	330	8270G
1,4-Dichlorobenzene	10	330	8270G
Benzyl alcohol	10	330	8270G
1,2-Dichlorobenzene	10	330	8270G
2-Methylphenol	10	330	8270G
bis(2-chloroisopropyl)ether	10	330	8270G
4-Methylphenol	10	330	8270G
N-Nitroso-di-n-propylamine	10	330	8270G
Hexachloroethane	10	330	8270G
Nitrobenzene	10	330	8270G
Isophorone	10	330	8270G
2-Nitrophenol	10	330	8270G
2,4-Dimethylphenol	10	330	8270G
Benzoic acid	50	1,600	8270G
bis(2-chloroethoxy) methane	10	330	8270G
2,4-Dichlorophenol	10	330	8270G
1,2,4-Trichlorobenzene	10	330	8270G
Naphthalene	10	330	8270G
4-Chloroaniline	10	330	8270G
Hexachlorobutadiene	10	330	8270G
4-Chloro-3-methylphenol	10	330	8270G
2-Methylnaphthalene	10	330	8270G
Hexachlorocyclopentadiene	10	330	8270G
2,4,6-Trichlorophenol	10	330	8270G
2,4,5-Trichlorophenol	50	1,600	8270G
2-Chloronaphthalene	10	330	8270G
2-Nitroaniline	50	330	8270G
Dimethylphthalate	10	330	8270G
Acenaphthylene	10	330	8270G
2,6-Dinitrotoluene	10	330	8270G
3-Nitroaniline	10	330	8270G
Acenaphthene	50	1,600	8270G

Table 4-2. Analytical Parameters for Groundwater and Soil Samples (continued)

TARGET COMPOUND LIST (TCL)

	Quantitation Limits[a]		
Compound	Groundwater (µg/L)	Soil[b] (µg/kg)	Analytical Method[c,e]
Semi-Volatile Organic Compounds (continued):			
2,4-Dinitrophenol	50	1,600	8270G
4-Nitrophenol	50	1,600	8270G
Dibenzofuran	10	330	8270G
2,4-Dinitrotoluene	10	330	8270G
Diethylphthalate	10	330	8270G
4-Chlorophenyl-phenylether	10	330	8270G
Fluorene	10	330	8270G
4-Nitroaniline	50	1,600	8270G
4,6-Dinitro-2-methylphenol	50	1,600	8270G
N-Nitrosodiphenylamine[d]	10	330	8270G
4-Bromophynyl-phenylether	10	330	8270G
Hexachlorobenzene	10	330	8270G
Pentachlorophenol	50	1,600	8270G
Phenanthrene	10	330	8270G
Anthracene	10	330	8270G
Di-n-butylphthalate	10	330	8270G
Fluoranthene	10	330	8270G
Pyrene	10	330	8270G
Butylbenzylphthalate	10	330	8270G
3,3'-Dichlorobenzidine	20	660	8270G
Benzo(a)anthracene	10	330	8270G
Chrysene	10	330	8270G
bis(2-ethylhexyl)phthalate	10	330	8270G
Di-n-octylphthalate	10	330	8270G
Benzo(b)fluoranthene	10	330	8270G
Benzo(k)fluoranthene	10	330	8270G
Benzo(a)pyrene	10	330	8270G
Indeno(1,2,3-cd)pyrene	10	330	8270G
Dibenz(a,h)anthracene	10	3,301	8270G
Benzo(g,h,i)perylene	10	3,301	8270G

Table 4-2. Analytical Parameters for Groundwater and Soil Samples (continued)

TARGET COMPOUND LIST (TCL)

	Quantitation Limits[a]		
Compound	**Groundwater (µg/L)**	**Soil[b] (µg/kg)**	**Analytical Method[c,e]**
Polynuclear Aromatic Hydrocarbons:			
Acenaphthene	18.0	1.2	8310
Acenaphthylene	23.0	1.54	8310
Anthracene	6.6	0.44	8310
Benzo(a)anthracene	0.13	0.009	8310
Benzo(a)pyrene	0.23	0.015	8310
Benzo(b)fluoranthene	0.18	0.012	8310
Benzo(g,h,i)perylene	0.76	0.05	8310
Benzo(k)fluoranthene	0.17	0.011	8310
Chrysene	1.5	0.1	8310
Dibenzo(a,h)anthracene	0.3	0.02	8310
Fluoranthrene	2.1	0.14	8310
Fluorene	2.1	0.14	8310
Indeno(1,2,3-c,d)pyrene	0.43	0.03	8310
Naphthalene	18.0	1.2	8310
Phenanthrene	6.4	0.42	8310
Pesticides/PCBs:			
alpha-BHC	0.05	8	8080
beta-BHC	0.05	8	8080
delta-BHC	0.05	8	8080
gamma-BHC (Lindane)	0.05	8	8080
Heptachlor	0.05	8	8080
Aldrin	0.05	8	8080
Heptachlor epoxide	0.05	8	8080
Endosulfan I	0.05	8	8080
Dieldrin	0.1	16	8080
4,4'-DDE	0.1	16	8080
Endrin	0.1	16	8080
Endosulfan II	0.1	16	8080
4,4'-DDD	0.1	16	8080
Endosulfan sulfate	0.1	16	8080
4,4'-DDT	0.1	16	8080
Methoxychlor	0.5	80	8080
Endrin ketone	0.1	16	8080
alpha-chlordane	0.5	80	8080
gamma-chlordane	0.5	80	8080
Toxaphene	1	160	8080
Aroclor-1016	0.5	80	8080
Aroclor-1221	0.5	80	8080
Aroclor-1232	0.5	80	8080
Aroclor-1242	0.5	80	8080
Aroclor-1248	0.5	80	8080
Aroclor-1254	1	1,601	8080
Aroclor-1260	1	1,601	8080

Table 4-2. Analytical Parameters for Groundwater and Soil Samples (continued)

TARGET COMPOUND LIST (TCL)

Compound	Quantitation Limits[a] Groundwater (µg/L)	Quantitation Limits[a] Soil[b] (µg/kg)	Analytical Method[c,e]
Metals:			
Aluminum	200	200	6010B
Antimony	60	60	7041
Arsenic	10	10	7060
Barium	200	200	6010B
Beryllium	5	5	6010B
Cadmium	5	5	7131
Calcium	5,000	5,000	6010B
Chromium	10	10	6010B
Cobalt	50	50	6010B
Copper	25	25	6010B
Iron	100	100	6010B
Lead	5	5	7421
Magnesium	5,000	5,000	6010B
Manganese	15	15	6010B
Mercury	0.2	0.2	7470
Nickel	40	40	6010B
Potassium	5,000	5,000	6010B
Selenium	5	5	7740
Silver	10	10	6010B
Sodium	5,000	5,000	6010B
Thallium	10	10	7841
Vanadium	50	50	6010B
Zinc	20	20	6010B
Common Anions:			
Nitrate	100	100	9056
Conventionals:			
Cyanide	25	500	9010
Total Petroleum Hydrocarbons:	10 mg/L	50 mg/kg	418.1
RCRA Herbicides:			
2,4-Dichlorophenoxyacetic Acid	1	20	8150
2,4,5-TP (Silvex)	0.5	10	8150

Table 4-2. Analytical Parameters for Groundwater and Soil Samples (continued)

RADIONUCLIDES

	Quantitation Limits[a]		
Compound	Groundwater (pCi/L)	Soil[b] (pCi/g)	Analytical Method[c,e]
Gross Alpha	1.5	4	GFPC
Nonvolatile Beta	2	10	GFPC
Tritium	700	10	LS
Americium-241	1	0.6	AS
Curium-242	1	0.6	AS
Curium-243	1	0.6	AS
Curium-244	1	0.6	AS
Curium-246	1	0.6	AS
Neptunium-237	I	o.6	AS
Uranium-234	1	0.6	AS
Uranium-235	1	0.6	AS
Uranium-238	1	0.6	AS
Thorium-228	1	0.1	AS
Thorium-230	1	0.6	AS
Thorium-232	1	0.1	AS
Plutonium-238	1	0.6	AS
Plutonium-239	1	0.6	AS
Plutonium-240	1	0.6	AS
Radium-226	1	0.6	GS/LC
Radium-228	1	0.8	GFPC/GS
Iodine-129	2	2	LEGS
Carbon-14	200	2	LS
Technecium-99	300	1	LS
Strontium-90	2	1	GFPC
Sodium-22	10	0.1	Gamma SPEC
Potassium-40	50	0.5	Gamma SPEC
Manganese-54	10	0.6	Gamma SPEC
Cobalt-57	10	0.1	Gamma SPEC
Cobalt-58	10	0.1	Gamma SPEC
Cobalt-60	10	0.1	Gamma SPEC
Zinc-65	15	0.1	Gamma SPEC
Yttrium-88	30	0.3	Gamma SPEC
Zirconium-95	10	0.2	Gamma SPEC
Ruthenium-106	60	0.5	Gamma SPEC
Tin-113	50	0.1	Gamma SPEC
Antimony-124	10	0.1	Gamma SPEC

Table 4-2. Analytical Parameters for Groundwater and Soil Samples (continued)

RADIONUCLIDES

	Quantitation Limits[a]		
Compound	Groundwater (pCi/L)	Soil[b] (pCi/g)	Analytical Method[c,e]
Antimony-125	20	0.2	Gamma SPEC
Cesium-134	10	0.1	Gamma SPEC
Cesium-137	10	0.1	Gamma SPEC
Barium-133	10	0.1	Gamma SPEC
Cerium-144	40	0.4	Gamma SPEC
Promethium-144	10	0.1	Gamma SPEC
Promethium-146	10	0.1	Gamma SPEC
Europium-152	40	0.6	Gamma SPEC
Europium-154	10	0.3	Gamma SPEC
Europium-155	20	0.1	Gamma SPEC
Lead-212	15	0.5	Gamma SPEC
Thorium-234	175	5	Gamma SPEC
Actinium-228	30	0.2	Gamma SPEC
Neptunium-239	20	0.4	Gamma SPEC
Nickel-59	10,001	21	X-Ray SPEC

[a] Specific quantification limits are highly matrix-dependent. The quantification limits listed herein are provided for guidance and may not always be achievable.

[b] Quantitation limits listed for soil are based on wet weight. The quantification limits calculated by the laboratory for soil, calculated on a dry-weight basis, will be higher.

[c] Analytical methods may vary between laboratories for the same analysis.

AS = Alpha Spectroscopy
Gamma SPEC = Previously Gamma PHA
GFPC = Gas Flow Proportional Counting
GS = Gamma Spectroscopy
LC = Lucas Cell
LEGS = Low Energy Gamma Spectroscopy
LS = Liquid Scintillation
ppt = parts per trillion

[d] Cannot be separated from Diphenylamine.

[e] Method 5035 is for soil analysis only.

Table 4-3. Summary of Proposed Sampling at the Road A Chemical Basin

Sample Point	Sample Number	Sampling Equipment	Sample Type	Sample Location	Sampling Interval (Depth in Feet)		*Constituents for Analysis	**Required (R) Contingent (C)
					Top	Bottom		
RAC-1	01	DPT	Soil	In Basin	0	1	A,B,C,D	R
RAC-1	02	DPT	Soil	In Basin	1	4	A,B,C,D	R
RAC-1	03	DPT	Soil	In Basin	4	7	A,B,C,D	C
RAC-1	04	DPT	Soil	In Basin	7	10	A,B,C,D	R
RAC-1	05	DPT	Soil	In Basin	10	13	A,B,C,D	R
RAC-1	06	DPT	Soil	In Basin	13	16	A,B,C,D	C
RAC-1	07	DPT	Soil	In Basin	16	19	A,B,C,D	C
RAC-1	08	DPT	Soil	In Basin	19	22	A,B,C,D	C
RAC-2	01	DPT	Soil	In Basin	0	1	A,B,C,D	R
RAC-2	02	DPT	Soil	In Basin	1	4	A,B,C,D	R
RAC-2	03	DPT	Soil	In Basin	4	7	A,B,C,D	C
RAC-2	04	DPT	Soil	In Basin	7	10	A,B,C,D	R
RAC-2	05	DPT	Soil	In Basin	10	13	A,B,C,D	R
RAC-2	06	DPT	Soil	In Basin	13	16	A,B,C,D	C
RAC-2	07	DPT	Soil	In Basin	16	19	A,B,C,D	C
RAC-2	08	DPT	Soil	In Basin	19	22	A,B,C,D	C
RAC-3	01	DPT	Soil	In Basin	0	1	A,B,C,D	R
RAC-3	02	DPT	Soil	In Basin	1	4	A,B,C,D	R
RAC-3	03	DPT	Soil	In Basin	4	7	A,B,C,D	C
RAC-3	04	DPT	Soil	In Basin	7	10	A,B,C,D	R
RAC-3	05	DPT	Soil	In Basin	10	13	A,B,C,D	R
RAC-3	06	DPT	Soil	In Basin	13	16	A,B,C,D	C
RAC-3	07	DPT	Soil	In Basin	16	19	A,B,C,D	C
RAC-3	08	DPT	Soil	In Basin	19	22	A,B,C,D	C
RAC-4	01	DPT	Soil	In Basin	0	1	A,B,C,D	R
RAC-4	02	DPT	Soil	In Basin	1	4	A,B,C,D	R
RAC-4	03	DPT	Soil	In Basin	4	7	A,B,C,D	C
RAC-4	04	DPT	Soil	In Basin	7	10	A,B,C,D	R

Table 4-3. Summary of Proposed Sampling at the Road A Chemical Basin (continued)

Sample Point	Sample Number	Sampling Equipment	Sample Type	Sample Location	Sampling Interval (Depth in Feet)		*Constituents for Analysis	**Required (R) Contingent (C)
					Top	Bottom		
RAC-4	05	DPT	Soil	In Basin	10	13	A,B,C,D	R
RAC-4	06	DPT	Soil	In Basin	13	16	A,B,C,D	C
RAC-4	07	DPT	Soil	In Basin	16	19	A,B,C,D	C
RAC-4	08	DPT	Soil	In Basin	19	22	A,B,C,D	C
RAC-5	01	DPT	Soil	In Basin	0	1	A,B,C,D	R
RAC-5	02	DPT	Soil	In Basin	1	4	A,B,C,D	R
RAC-5	03	DPT	Soil	In Basin	4	7	A,B,C,D	C
RAC-5	04	DPT	Soil	In Basin	7	10	A,B,C,D	R
RAC-5	05	DPT	Soil	In Basin	10	13	A,B,C,D	R
RAC-5	06	DPT	Soil	In Basin	13	16	A,B,C,D	C
RAC-5	07	DPT	Soil	In Basin	16	19	A,B,C,D	C
RAC-5	08	DPT	Soil	In Basin	19	22	A,B,C,D	C
RAC-6	01	DPT	Soil	In Basin	0	1	A,B,C,D	R
RAC-6	02	DPT	Soil	In Basin	1	4	A,B,C,D	R
RAC-6	03	DPT	Soil	In Basin	4	7	A,B,C,D	C
RAC-6	04	DPT	Soil	In Basin	7	10	A,B,C,D	R
RAC-6	05	DPT	Soil	In Basin	10	13	A,B,C,D	R
RAC-6	06	DPT	Soil	In Basin	13	16	A,B,C,D	C
RAC-6	07	DPT	Soil	In Basin	16	19	A,B,C,D	C
RAC-6	08	DPT	Soil	In Basin	19	22	A,B,C,D	C
RAC-7	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-7	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-7	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-7	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-7	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-7	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-7	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-7	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C

Table 4-3. Summary of Proposed Sampling at the Road A Chemical Basin (continued)

Sample Point	Sample Number	Sampling Equipment	Sample Type	Sample Location	Sampling Interval (Depth in Feet)		*Constituents for Analysis	**Required (R) Contingent (C)
					Top	Bottom		
RAC-8	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-8	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-8	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-8	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-8	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-8	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-8	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-8	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C
RAC-9	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-9	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-9	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-9	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-9	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-9	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-9	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-9	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C
RAC-10	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-10	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-10	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-10	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-10	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-10	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-10	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-10	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C
RAC-11	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-11	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-11	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-11	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R

Table 4-3. Summary of Proposed Sampling at the Road A Chemical Basin (continued)

Sample Point	Sample Number	Sampling Equipment	Sample Type	Sample Location	Sampling Interval (Depth in Feet)		*Constituents for Analysis	**Required (R) Contingent (C)
					Top	Bottom		
RAC-11	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-11	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-11	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-11	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C
RAC-12	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-12	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-12	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-12	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-12	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-12	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-12	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-12	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C
RAC-13	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-13	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-13	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-13	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-13	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-13	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-13	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-13	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C
RAC-14	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-14	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-14	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-14	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-14	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-14	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-14	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-14	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C

Table 4-3. Summary of Proposed Sampling at the Road A Chemical Basin (continued)

Sample Point	Sample Number	Sampling Equipment	Sample Type	Sample Location	Sampling Interval (Depth in Feet)		*Constituents for Analysis	**Required (R) Contingent (C)
					Top	Bottom		
RAC-15	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-15	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-15	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-15	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-15	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-15	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-15	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-15	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C
RAC-16	01	DPT	Soil	Perimeter of Basin	0	1	A,B,C,D	R
RAC-16	02	DPT	Soil	Perimeter of Basin	1	4	A,B,C,D	R
RAC-16	03	DPT	Soil	Perimeter of Basin	4	7	A,B,C,D	C
RAC-16	04	DPT	Soil	Perimeter of Basin	7	10	A,B,C,D	R
RAC-16	05	DPT	Soil	Perimeter of Basin	10	13	A,B,C,D	R
RAC-16	06	DPT	Soil	Perimeter of Basin	13	16	A,B,C,D	C
RAC-16	07	DPT	Soil	Perimeter of Basin	16	19	A,B,C,D	C
RAC-16	08	DPT	Soil	Perimeter of Basin	19	22	A,B,C,D	C
RAC-17	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	R
RAC-17	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	R
RAC-18	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	R
RAC-18	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	R
RAC-19	01	DPT	Soil	Background	0	1	A,B,C,D	R
RAC-19	02	DPT	Soil	Background	1	4	A,B,C,D	R
RAC-19	03	DPT	Soil	Background	4	7	A,B,C,D	C
RAC-19	04	DPT	Soil	Background	7	10	A,B,C,D	R
RAC-19	05	DPT	Soil	Background	10	13	A,B,C,D	R
RAC-19	06	DPT	Soil	Background	13	16	A,B,C,D	C

Table 4-3. Summary of Proposed Sampling at the Road A Chemical Basin (continued)

Sample Point	Sample Number	Sampling Equipment	Sample Type	Sample Location	Sampling Interval (Depth in Feet)		*Constituents for Analysis	**Required (R) Contingent (C)
					Top	Bottom		
RAC-19	07	DPT	Soil	Background	16	19	A,B,C,D	C
RAC-19	08	DPT	Soil	Background	19	22	A,B,C,D	C
RAC-20	01	DPT	Soil	Background	0	1	A,B,C,D	R
RAC-20	02	DPT	Soil	Background	1	4	A,B,C,D	R
RAC-20	03	DPT	Soil	Background	4	7	A,B,C,D	C
RAC-20	04	DPT	Soil	Background	7	10	A,B,C,D	R
RAC-20	05	DPT	Soil	Background	10	13	A,B,C,D	R
RAC-20	06	DPT	Soil	Background	13	16	A,B,C,D	C
RAC-20	07	DPT	Soil	Background	16	19	A,B,C,D	C
RAC-20	08	DPT	Soil	Background	19	22	A,B,C,D	C
RAC-21	01	DPT	Soil	Background	0	1	A,B,C,D	R
RAC-21	02	DPT	Soil	Background	1	4	A,B,C,D	R
RAC-21	03	DPT	Soil	Background	4	7	A,B,C,D	C
RAC-21	04	DPT	Soil	Background	7	10	A,B,C,D	R
RAC-21	05	DPT	Soil	Background	10	13	A,B,C,D	R
RAC-21	06	DPT	Soil	Background	13	16	A,B,C,D	C
RAC-21	07	DPT	Soil	Background	16	19	A,B,C,D	C
RAC-21	08	DPT	Soil	Background	19	22	A,B,C,D	C
RAC-22	01	DPT	Soil	Background	0	1	A,B,C,D	R
RAC-22	02	DPT	Soil	Background	1	4	A,B,C,D	R
RAC-22	03	DPT	Soil	Background	4	7	A,B,C,D	C
RAC-22	04	DPT	Soil	Background	7	10	A,B,C,D	R
RAC-22	05	DPT	Soil	Background	10	13	A,B,C,D	R
RAC-22	06	DPT	Soil	Background	13	16	A,B,C,D	C
RAC-22	07	DPT	Soil	Background	16	19	A,B,C,D	C
RAC-22	08	DPT	Soil	Background	19	22	A,B,C,D	C
RAC-23	01	DPT	Soil	Background	0	1	A,B,C,D	R
RAC-23	02	DPT	Soil	Background	1	4	A,B,C,D	R
RAC-23	03	DPT	Soil	Background	4	7	A,B,C,D	C

Table 4-3. Summary of Proposed Sampling at the Road A Chemical Basin (continued)

Sample Point	Sample Number	Sampling Equipment	Sample Type	Sample Location	Sampling Interval (Depth in Feet)		*Constituents for Analysis	**Required (R) Contingent (C)
					Top	Bottom		
RAC-23	04	DPT	Soil	Background	7	10	A,B,C,D	R
RAC-23	05	DPT	Soil	Background	10	13	A,B,C,D	R
RAC-23	06	DPT	Soil	Background	13	16	A,B,C,D	C
RAC-23	07	DPT	Soil	Background	16	19	A,B,C,D	C
RAC-23	08	DPT	Soil	Background	19	22	A,B,C,D	C
RAC-24	01	DPT	Soil	Background	0	1	A,B,C,D	R
RAC-24	02	DPT	Soil	Background	1	4	A,B,C,D	R
RAC-24	03	DPT	Soil	Background	4	7	A,B,C,D	C
RAC-24	04	DPT	Soil	Background	7	10	A,B,C,D	R
RAC-24	05	DPT	Soil	Background	10	13	A,B,C,D	R
RAC-24	06	DPT	Soil	Background	13	16	A,B,C,D	C
RAC-24	07	DPT	Soil	Background	16	19	A,B,C,D	C
RAC-24	08	DPT	Soil	Background	19	22	A,B,C,D	C
RAC-25	01	Scoop	Sediment	Background	0	1	A,B,C,D	R
RAC-25	02	Scoop	Surface Water	Background	0	1	A,B,C,D	R
RAC-26	01	Scoop	Sediment	Background	0	1	A,B,C,D	R
RAC-26	02	Scoop	Surface Water	Background	0	1	A,B,C,D	R
RAC-27	01	Scoop	Sediment	Background	0	1	A,B,C,D	R
RAC-27	02	Scoop	Surface Water	Background	0	1	A,B,C,D	R
RAC-28	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	C
RAC-28	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	C
RAC-29	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	C
RAC-29	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	C
RAC-30	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	C
RAC-30	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	C
RAC-31	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	C
RAC-31	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	C

Table 4-3. Summary of Proposed Sampling at the Road A Chemical Basin (continued)

Sample Point	Sample Number	Sampling Equipment	Sample Type	Sample Location	Sampling Interval (Depth in Feet)		*Constituents for Analysis	**Required (R) Contingent (C)
					Top	Bottom		
RAC-32	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	C
RAC-32	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	C
RAC-33	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	C
RAC-33	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	C
RAC-34	01	Hand Auger	Soil	Downslope	0	1	A,B,C,D	C
RAC-34	02	Hand Auger	Soil	Downslope	1	4	A,B,C,D	C
RAC-35	01	Scoop	Sediment	Swamp	0	1	A,B,C,D	R
RAC-35	02	Scoop	Surface Water	Swamp	0	1	A,B,C,D	R
RAC-36	01	Scoop	Sediment	Swamp	0	1	A,B,C,D	R
RAC-36	02	Scoop	Surface Water	Swamp	0	1	A,B,C,D	R
RAC-37	01	Scoop	Sediment	Swamp	0	1	A,B,C,D	R
RAC-37	02	Scoop	Surface Water	Swamp	0	1	A,B,C,D	R
RAC-38	01	Scoop	Sediment	Swamp	0	1	A,B,C,D	R
RAC-38	02	Scoop	Surface Water	Swamp	0	1	A,B,C,D	R

Notes:

DPT - Direct Push Technology

Sampling to greater depths may be required.

If required, location will be identified by geophysical surveys.

All samples, except background samples, should be screened for gross alpha, nonvolatile beta-gamma, and VOCs.

* Constituents for Analysis:

A. TCL organics (VOCs, SVOCs, and pesticides/PCBs)

B. TAL inorganics and metals

C. Pesticides/PCBs

D. Radionuclides (see Section 3.2.1)

** Contingent samples should be analyzed if the field screening results exceed 20 pCi/g gross alpha, 50 pCi/g nonvolatile beta-gamma, or 1 ppm VOC, or if the sample is the deepest of two consecutive clean samples.

Table 4-4. Summary of Groundwater Samples and Constituents to be Analyzed at the RdACB OU

Monitoring Well	Well Status	Sampling Instrument	Sample Location	Sampling Interval	Constituent for Analysis[b]
BRD-1	Existing	Pump	Side-gradient to RdACB OU	Water Table	1,2,3
BRD-2	Existing	Pump	Side-gradient to RdACB OU	Water Table	1,2,3
BRD-2C	Proposed	Pump	Side-gradient to RdACB OU	Gordon Aquifer	1,2,3
BRD-3	Existing	Pump	Upgradient to RdACB OU	Water Table	1,2,3
BRD-4D	Existing	Pump	Downgradient to RdACB OU	Water Table	1,2,3
BRD-5D	Existing	Pump	Downgradient to RdACB OU	Water Table	1,2,3
BRD-6D	Proposed	Pump	Upgradient to RdACB OU	Water Table	1,2,3
BRD-6C	Proposed	Pump	Upgradient to RdACB OU	Gordon Aquifer	1,2,3
BRD-7D	Proposed	Pump	Downgradient to RdACB OU	Water Table	1,2,3
BRD-7C	Proposed	Pump	Downgradient to RdACB OU	Gordon Aquifer	1,2,3
BRD-8D	Proposed	Pump	Downgradient to RdACB OU	Water Table	1,2,3
BRD-XC[a]		Pump		Gordon Aquifer	1,2,3
BRD-XD[a]		Pump		Water Table	1,2,3

[a] **Contingency:** Number and location of wells determined by nature and extent of contaminant plume, if present

[b] Analyte Codes:

1 Unit-specific groundwater analyte suite (Table 4-2)
2 Field measurements: pH, specific conductivity, and turbidity
3 Two rounds of sampling at least 30 days apart. QA/QC samples collected in accordance with WSRC Groundwater Monitoring Program Protocols

5.0 SCHEDULE

This section includes the proposed implementation schedule of field activities and document submittals for the RdACB OU (Figure 5-1). The field start for characterization is scheduled to begin on June 30, 1999. The Revision 0 RFI/RI/BRA Report will be submitted on November 10, 2000. The Revision 0 Corrective Measures Study/Feasibility Study/Statement of Basis/Proposed Plan/draft Record of Decision will be submitted on July 6, 2001. Submittal of the signed Record of Decision is forecasted for June 29, 2002. This schedule will be submitted for approval by EPA and SCDHEC upon approval of this RFI/RI Work Plan.

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FIGURES

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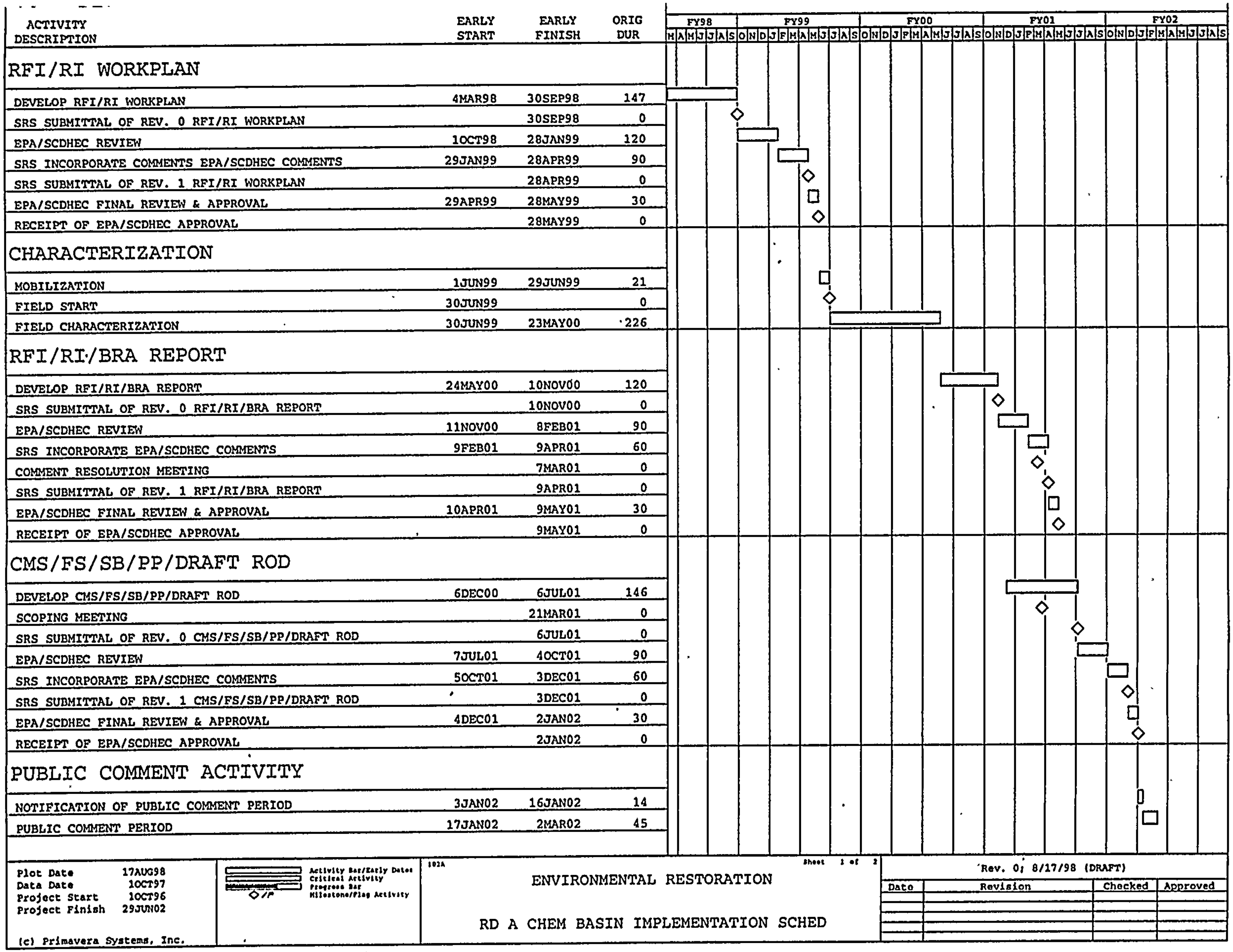

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	ORIG DUR
RFI/RI WORKPLAN			
DEVELOP RFI/RI WORKPLAN	4MAR98	30SEP98	147
SRS SUBMITTAL OF REV. 0 RFI/RI WORKPLAN		30SEP98	0
EPA/SCDHEC REVIEW	1OCT98	28JAN99	120
SRS INCORPORATE COMMENTS EPA/SCDHEC COMMENTS	29JAN99	28APR99	90
SRS SUBMITTAL OF REV. 1 RFI/RI WORKPLAN		28APR99	0
EPA/SCDHEC FINAL REVIEW & APPROVAL	29APR99	28MAY99	30
RECEIPT OF EPA/SCDHEC APPROVAL		28MAY99	0
CHARACTERIZATION			
MOBILIZATION	1JUN99	29JUN99	21
FIELD START	30JUN99		0
FIELD CHARACTERIZATION	30JUN99	23MAY00	226
RFI/RI/BRA REPORT			
DEVELOP RFI/RI/BRA REPORT	24MAY00	10NOV00	120
SRS SUBMITTAL OF REV. 0 RFI/RI/BRA REPORT		10NOV00	0
EPA/SCDHEC REVIEW	11NOV00	8FEB01	90
SRS INCORPORATE EPA/SCDHEC COMMENTS	9FEB01	9APR01	60
COMMENT RESOLUTION MEETING		7MAR01	0
SRS SUBMITTAL OF REV. 1 RFI/RI/BRA REPORT		9APR01	0
EPA/SCDHEC FINAL REVIEW & APPROVAL	10APR01	9MAY01	30
RECEIPT OF EPA/SCDHEC APPROVAL		9MAY01	0
CMS/FS/SB/PP/DRAFT ROD			
DEVELOP CMS/FS/SB/PP/DRAFT ROD	6DEC00	6JUL01	146
SCOPING MEETING		21MAR01	0
SRS SUBMITTAL OF REV. 0 CMS/FS/SB/PP/DRAFT ROD		6JUL01	0
EPA/SCDHEC REVIEW	7JUL01	4OCT01	90
SRS INCORPORATE EPA/SCDHEC COMMENTS	5OCT01	3DEC01	60
SRS SUBMITTAL OF REV. 1 CMS/FS/SB/PP/DRAFT ROD		3DEC01	0
EPA/SCDHEC FINAL REVIEW & APPROVAL	4DEC01	2JAN02	30
RECEIPT OF EPA/SCDHEC APPROVAL		2JAN02	0
PUBLIC COMMENT ACTIVITY			
NOTIFICATION OF PUBLIC COMMENT PERIOD	3JAN02	16JAN02	14
PUBLIC COMMENT PERIOD	17JAN02	2MAR02	45

Plot Date	17AUG98
Data Date	1OCT97
Project Start	1OCT96
Project Finish	29JUN02

(c) Primavera Systems, Inc.

▭	Activity Bar/Early Dates
▭	Critical Activity
▭	Progress Bar
◇/▸	Milestone/Flag Activity

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Sheet 1 of 2

ENVIRONMENTAL RESTORATION

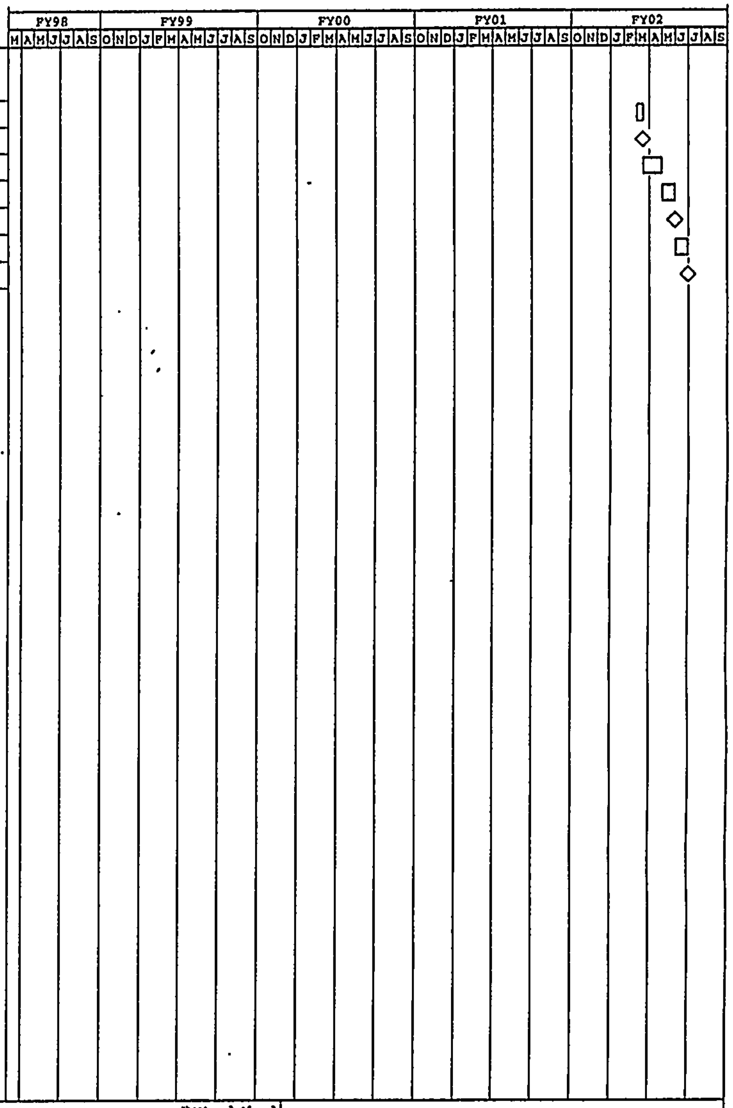
RD A CHEM BASIN IMPLEMENTATION SCHED

Rev. 0; 8/17/98 (DRAFT)

Date	Revision	Checked	Approved

Figure 5-1. Road A Chemical Basin Implementation Schedule

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	ORIG DUR
RECORD OF DECISION			
RESPONSIVENESS SUMMARY & APPROVALS	3MAR02	16MAR02	14
SRS SUBMITTAL OF REV. 0 ROD		16MAR02	0
EPA/SCDHEC REVIEW	17MAR02	30APR02	45
SRS INCORPORATE EPA/SCDHEC COMMENTS	1MAY02	30MAY02	30
SRS SUBMITTAL OF REV. 1 ROD		30MAY02	0
EPA/SCDHEC FINAL REVIEW & APPROVAL	31MAY02	29JUN02	30
SUBMIT SIGNED ROD TO EPA/SCDHEC		29JUN02	0



Plot Date 17AUG98
Data Date 1OCT97
Project Start 1OCT96
Project Finish 29JUN02

(c) Primavera Systems, Inc.

▭	Activity Bar/Early Dates
▭	Critical Activity
▭	Progress Bar
◇/F	Milestone/Flag Activity

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Sheet 2 of 2

ENVIRONMENTAL RESTORATION

RD A CHEM BASIN IMPLEMENTATION SCHED

Rev. 0; 8/17/98 (DRAFT)

Date	Revision	Checked	Approved

Figure 5-1. Road A Chemical Basin Implementation Schedule (continued)

6.0 SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN

A Site-Specific Health and Safety Plan will be prepared in accordance with Title 29 Code of Federal Regulations Part 1910.120 and approved prior to starting the field investigation. This plan will meet Occupational Safety and Health Administration requirements. The plan will also fulfill the requirements of *SRS RFI/RI Work Plan SHERP, QA/QC and Data Management Requirements, Revision 1 (U)* (WSRC 1996c). All personnel involved in the performance of work shall be familiar with the provisions of the Site-Specific Health and Safety Plan.

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7.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN

Precision, accuracy, completeness, representativeness, comparability, and documentation of the characterization are specified in the following site-level QA procedures:

- WSRC Manual 1Q, *Quality Assurance Manual (U)* (WSRC 1994a)
- WSRC Manual 3Q5, *Hydrogeologic Data Collection (U)* (WSRC 1997)
- ESH-EMS-950076, *Environmental Monitoring Section, Environmental Geochemistry Group Program Overview* (WSRC 1995a)
- WSRC-RP-96-234, *SRS RFI/RI Work Plan SHERP, QA/QC and Data Management Requirements, Revision 1 (U)* (WSRC 1996c)

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8.0 DATA MANAGEMENT PLAN

Data management will be performed in accordance with the *Environmental Monitoring Section, Environmental Geochemistry Group Program Overview* (WSRC 1995a). Data management will also fulfill the requirements of *SRS RFI/RI Work Plan SHERP, QA/QC and Data Management Requirements, Revision 1 (U)* (WSRC 1996c).

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Appendix A

Photographs

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View looking north approximately 4.6 m (15 ft) from the RdACB OU boundary

Figure A-1. Road A Chemical Basin Prior to Closure and Backfilling

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View looking north approximately 3 m (10 ft) from the RdACB OU boundary

Figure A-2. Road A Chemical Basin Prior to Closure and Backfilling

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View looking north approximately 61 m (200 ft) from the RdACB OU boundary

Figure A-3. Road A Chemical Basin Prior to Closure and Backfilling

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Appendix B

Soil Boring Log

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PROJECT NUMBER	BORING NUMBER	SHEET 1 OF 1
SAT 22540.16.RA	BRD SB-1	

(RACB)

SOIL BORING LOG

PROJECT SRP RHET RFI LOCATION Baxley Rd. (RACB)

ELEVATION DRILLING CONTRACTOR MTC

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVEL AND DATE NA START 3-20-89 FINISH 3-20-89 LOGGER M. Reilly

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
1 2	0-2	SS-1	16"	20-23-17-14 (40)	SAND, light brown, fine-medium, quartz pebbles, cobbles upto 2" diameter	SW	HNu Background 0.6ppm Headspace 0.6ppm
3 4	2-4	SS-2	4"	20-17-17- (34)	SAND, orange, fine-medium, cobbles, wet	SW	Headspace 0.6ppm
5 6	4-6	SS-3	14"	8-19-29-32 (48)	SILTY SAND, SILTY CLAY, orange red mottled, dry, slightly plastic dense	SM	Headspace 4.5ppm
7 8	6-8	SS-4	22"	17-29-37-42 (66)	SILTY SAND, mottled, dense plastic	SM	Headspace 0.6ppm
9 10	8-10	SS-5	20"	11-36-40-42 (76)	SAND WITH SILT, dark orange, non-plastic, streaks of yellow silty sand	SW-SM	Headspace 0.6ppm

PROJECT NUMBER SAT22540.16.RA

BORING NUMBER BRD-SB-2 SHEET 1 OF 2

(RACB)

SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Barkley Rd. (RACB)

ELEVATION ______ DRILLING CONTRACTOR MTC

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVEL AND DATE ______ START 4-3-89 FINISH 4-3-89 LOGGER M. Clasen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0	0-2	SS-1	16"	4-7-9 (16)	SILTY SAND, brown, fine to medium quartz, some silt/clay moist	SM	HNu Background 0.2 Headspace 0.4 ppm
	2-4	SS-2	20"	6-10-28-30 (38)	SILTY SAND, brown/red, fine to medium subangular quartz some silt/clay	SM	Headspace 0.4 ppm
5	4-6	SS-3	22"	7-21-25-40 (46)	SAND WITH SILT, red fine to medium, subangular quartz moist, well graded	SW-SM	Headspace 0.4 ppm
	6-8	SS-4	16"	9-18-24-24 (42)	SAND, red, fine to medium quartz, poorly graded, trace silt, moist	SP	Headspace 0.4 ppm
	8-10	SS-5	22"	13-24-26-30 (50)	SAND, red, fine, subangular quartz poorly graded, moist	SP	Headspace. 6.4 ppm
10	10-12	SS-6	21"	10-12-20-31 (32)	SAND, red, fine, subangular quartz, poorly graded, moist	SP	Headspace 1.6 ppm
	12-14	SS-7	20"	10-22-27-32	SAND, red, fine subangular quartz, poorly graded, quartz	SP	Headspace 3.2 ppm
15	14-16	SS-8	19"	12-20-27-32 (47)	SAND, red, fine subangular quartz, trace black minerals, poorly graded, moist	SP	Headspace 5.4 ppm
	16-18	SS-9	22"	9-15-18-25 (33)	SAND, red, orange, fine subangular quartz, white clay mottling, poorly graded, moist	SP	Headspace 6.0
	18-20	SS-10	13"	7-15-21-27 (36)	SAND, orange, fine subangular quartz, poorly graded, moist	SP	Headspace 3.4
20	20-22	SS-11	20"	6-12-15-22 (27)	SAND, orange, fine subangular quartz, poorly graded, moist	SP	Headspace 0.4
	22-24	SS-12	22"	12-18-23-30 (41)	SAND, orange, fine subangular quartz	SP	Headspace 1.2
25	24-26	SS-13	20"	8-12-15-20 (27)	SAND, orange, tan, pink, red, mottled, subangular quartz, poorly graded, moist	SP	Headspace 2.2
	26-28	SS-14	22"	8-12-15-24 (27)	SAND, white, pink, fine quartz, poorly graded, moist	SP	Headspace 1.2
30	28-30	SS-15	19"	16-13-20-14 (33)	SAND, white, tan, pink, fine subangular quartz, poorly graded dry	SP	Headspace 3.6

CH2MHILL

PROJECT NUMBER SAT 22540.16.RA	BORING NUMBER BRD-SB-2 SHEET 2 OF 2

(RACB)

SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Baxley Rd. (RACB)
ELEVATION DRILLING CONTRACTOR MTC
DRILLING METHOD AND EQUIPMENT Hollow Stem Auger
WATER LEVEL AND DATE START 4-3-89 FINISH 4-3-87 LOGGER M. Chasey

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30	30-32	SS-16	20"	9-18-22-16 (40)	SAND, tan, fine subangular quartz, poorly graded, dry/moist	SP	HNu Background 0.2 Headspace 6.4 ppm
35	33-35	SS-17	22"	16-18-23-20 (41)	SAND, tan with red, white mottling, fine subangular quartz, poorly graded, moist	SP	Headspace 0.4 ppm

CH2MHILL

PROJECT NUMBER	BORING NUMBER
SAT 22540.16.2A	BRD - SB-3 (RACB) SHEET 1 OF 1

SOIL BORING LOG

PROJECT SRP RHET RFI LOCATION Baxley Rd. (RACB)
ELEVATION DRILLING CONTRACTOR MTC
DRILLING METHOD AND EQUIPMENT Hollow Stem Auger
WATER LEVEL AND DATE NA START 3-20-89 FINISH 3-20-89 LOGGER H. Reilly

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
1 2	0-2	SS-1	17"	9-10-17-22 (27)	SAND WITH SILT, yellow, fine to coarse quartz, pebbles, moist dense, non-plastic, bottom 7" silty.	SW-SM	HNu Background 0.4ppm Headspace. 0.4ppm
3 4	2-4	SS-2	24"	9-15-20-26 (35)	SAND WITH SILT, brown, fine to coarse, moist	SW-SM	Headspace 1.5ppm
5 6	4-6	SS-3	14"	5-9-18-29 (27)	SAND WITH SILT, dark orange red non-plastic, fine to coarse quartz well graded, white clay layers	SW-SM	Headspace 0.4ppm
7 8	6-8	SS-4	19"	7-19-27-33 (46)	" "	SW-SM	Headspace 0.4ppm
9 10	8-10	SS-5	16"	9-27-33-42 (60)	SAND WITH SILT, mottled, fine to coarse, clay lenses	SW-SM	Headspace 0.4ppm

CH2MHILL

PROJECT NUMBER SAT 22540.16.RA	BORING NUMBER BRD SB-4	SHEET 1	OF 1

(RACB)
SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Baxley Rd. (RACB)
ELEVATION DRILLING CONTRACTOR MTC
DRILLING METHOD AND EQUIPMENT Hollow Stem Auger
WATER LEVEL AND DATE NA START 3-21-89 FINISH 3-21-89 LOGGER M. Reilly

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
1 2	0-2	SS-1	24"	8-15-17-22 (32)	SAND, brown, fine-medium bottom 16" SAND WITH SILT	SW-SM	HNu Background 0.2ppm Headspace 1.5ppm
3 4	2-4	SS-2	20"	13-15-20-26 (35)	SILTY SAND, mottled orange-red white, fine to coarse quartz, well graded, dry, silty matrix	SM	Headspace 0.5ppm
5 6	4-6	SS-3	18"	7-22-24-34 (46)	SAND WITH SILT, mottled fine-coarse, quartz, clay lenses, dry, well graded	SW-SM	Headspace 1.0ppm
7 8	6-8	SS-4	14"	9-13-18-21 (31)	SAND WITH SILT, orange, fine-coarse quartz, clay lenses, 5% silt	SW-SM	—
9 10	8-10	SS-5	22"	9-13-14-19 (27)	〃 〃	SW-SM	Headspace 0.2ppm

PROJECT NUMBER SAT 22540.16.RA

BORING NUMBER BRD SB-5 (RACB) SHEET 1 OF 1

SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Baxley Rd. (RACB)

ELEVATION

DRILLING CONTRACTOR MTC

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVEL AND DATE NA START 3-21-89 FINISH 3-21-89 LOGGER M. Reilly

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
1 2	0-2	SS-1	12"	7-7-20-50 (27)	SAND, brown, fine quartz, pebbles, organic debris 0-2", dry	SW	HNu Background 0.2ppm Headspace 1.0ppm
3 4	2-4	SS-2	16"	3-7-12-18 (19)	0-8" SAND WITH SILT, orange bottom 8" SILTY CLAY, mottled orange, plastic	SM-CL	Headspace 0.2ppm
5 6	4-6	SS-3	20"	5-9-14-24 (23)	SAND WITH SILT, mottled orange, fine-medium quartz, dense, non-plastic	SW-SM	Headspace 0.2ppm
7 8	6-8	SS-4	20"	7-13-21-40 (34)	SAND WITH SILT, dark brown, fine-medium quartz, dry	SW-SM	Headspace 1.5ppm
9 10	8-10	SS-5	22"	10-20-25-50 (45)	SAND WITH SILT, dark orange brown, fine-medium quartz, dry, non-plastic	SW-SM	Headspace 2.5ppm

CH2M HILL

PROJECT NUMBER SAT 22540.16.RA	BORING NUMBER BRD-SB-6 SHEET 1 OF 2

(RACB)

SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Baxley Rd. (RACB)

ELEVATION ______ DRILLING CONTRACTOR MTC

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVEL AND DATE ______ START 3-28-89 FINISH 3-30-89 LOGGER M. Clasen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
1 2	0-2	SS-1	15"	21-17-20-38 (37)	SAND, brown, fine-medium grained quartz, some cobbles trace silt; some fill, 20% gravel	SW	HNu Background 0.2ppm Headspace - 0.2ppm
3 4	2-4	SS-2	16"	15-16-15-14 (31)	SAND, brown, fine-medium grained quartz, trace coarse 3-4' - silty sand	SW SM	Headspace 0.2 ppm
5 6	4-6	SS-3	18"	11-11-14-21 (25)	SAND, brown, fine-medium grained quartz, some gravel, pebbles, some silt	SW	Headspace 0.2 ppm
7 8	6-8	SS-4	12"	4-4-5-15 (9)	SAND, red, fine-medium quartz, trace silt, trace white clay mottling	SP	Headspace 0.2
9 10	8-10	SS-5	4"	5-5-5-10 (10)	Poor Recovery	SP	Headspace 0
11 12	10-12	SS-6	16"	5-4-4-10 (8)	SAND, red, fine-medium quartz trace silt	SP	Headspace 0
13 14	12-14	SS-7	12"	4-6-8-11 (14)	SAND, red, fine-medium quartz trace silt	SP	Headspace 0.1
15 16	14-16	SS-8	16"	4-7-10-9 (17)	SAND, red, fine grained qtz, some yellow mottling	SP	Headspace 0
17 18	16-18	SS-9	0	4-7-10-20 (17)	NO RECOVERY	—	Headspace 0
19 20	18-20	SS-10	18"	7-13-13-16 (26)	SAND, orange to red, fine, subangular quartz, trace dark minerals, dry	SP	HNu background = 0.5ppm Headspace - 0.5ppm.
21 22	20-22	SS-11	18"	11-12-9-12 (21)	SAND, pink to white, fine subangular quartz, dry	SP	Headspace 0.5ppm
23 24	22-24	SS-12	18"	24-34-36-36 (70)	SAND, light brown to orange, fine subangular quartz, trace silt, dry	SP	Headspace 2.0ppm
25 26	24-26	SS-13	16"	14-18-23-25 (41)	SAND, light brown, fine subangular quartz, poorly graded, dry	SP	Headspace 2.5ppm
27 28	26-28	SS 14	18"	12-17-20-21 (37)	SAND, white, with orange mottling, fine subangular quartz, poorly graded, dry	SP	Headspace 1.0ppm
29	28-30	SS-15	18"	6-12-10-14	SAND white with orange mottling, fine subangular qtz-	SP	Headspace 1.0ppm

PROJECT NUMBER	BORING NUMBER	
SAT 22540.16.RR	BRD-SB-6	SHEET 2 OF 2

(RACB)

SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Baxley Rd. (RACB)

ELEVATION DRILLING CONTRACTOR MJC

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVEL AND DATE START 3-28-89 FINISH 3-30-89 LOGGER M. Clasen

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30	30-32	SS-16	19"	10-14-16-19 (30)	SAND, light orange, fine subangular quartz, poorly graded dry	SP	Background - 0.5 Headspace 1.5 ppm
	32-34	SS-17	23"	9-11-14-19 (25)	SAND, light orange, fine to med quartz, trace silt, trace coarse sand dry	SW	Headspace 0.5 ppm
35	34-36	SS-18	20"	12-12-12-12 (24)	SAND, tan to light orange, fine subangular quartz, trace silt dry	SP	Headspace 0.5 ppm

CH2MHILL

PROJECT NUMBER	BORING NUMBER
SRT 22540.16.RA	BRD SB-7 SHEET 1 OF 1

(RACB)
SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Baxley Rd. (RACB)
ELEVATION DRILLING CONTRACTOR MTC
DRILLING METHOD AND EQUIPMENT Hollow Stem Auger
WATER LEVEL AND DATE N A START 3-22-89 FINISH 3-22-89 LOGGER M. Reilly

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
1 2	0-2	SS-1	12"	3-3-3-4 (6)	SAND, brown, fine-medium, organic rich top 4" 4-6" wet gray sand dry-moist below, fill	SW	HNu Background 0.2ppm Headspace 1.0ppm
3 4	2-4	SS-2	12"	2-10-20-20 (30)	SAND WITH SILT, brown, fine-medium, quartz pebbles, cobbles fill	SW-SM	Headspace 0.9ppm
5 6	4-6	SS-3	12"	5-12-18-25 (30)	SAND WITH SILT, 10-20% quartz cobbles, bottom 8" silty clay	SW-SM	Headspace 0.2ppm
7 8	6-8	SS-4	9"	12-24-36-52 (60)	SAND WITH SILT, looks like fill, well graded, silty	SW SM	Headspace 0.6ppm
9 10	8-10	SS-5	14"	7-27-47-50 (74)	SAND WITH SILT, not fill, dark orange, top 2" quartz pebbles	SW-SM	Headspace 2.0ppm

PROJECT NUMBER SAT22540.16.RA

BORING NUMBER BRD-SB-8 (RACB) SHEET 1 OF 2

SOIL BORING LOG

PROJECT SRP RHET RFI LOCATION Baxley Rd. (RACB)

ELEVATION ______ DRILLING CONTRACTOR MTC

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVEL AND DATE ______ START 4-3-89 FINISH 4-3-89 LOGGER M. Olsen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0	0-2	SS-1	18"	8-9-11-11 (20)	SAND, brown, gray fine quartz, some silt, 10% gravel up to 2" diameter, dry	SW	HNu Background 0.2ppm Headspace 0.2ppm
	2-4	SS-2	15"	8-41-62-86 (91)	SILTY SAND, gray wet "sludge" 50% gray silt, 50% gravel wet	SM	Headspace 0.4ppm
5	4-6	SS-3	16"	36-32-14-16 (46)	SANDY CLAY, brown, orange plastic soft, clay, 15% sand trace gravel, moist	CL	Headspace 0.2ppm
	6-8	SS-4	20"	12-20-34-50 (54)	6-7 SILT, orange clayey, stiff 7-8 SILTY SAND, red fine quartz 20% silt, trace pebbles	ML	Headspace 0.5ppm
10	8-10	SS-5	12"	20-32-49-74 (81)	SAND WITH SILT, red, fine, subangular quartz, well graded, moist	SW-SM	Headspace 5.0ppm
	10-12	SS-6	23"	24-32-35-39 (67)	SAND WITH SILT, red, fine, subangular quartz, trace black minerals, moist poorly graded	SP-SM	Headspace 4.0ppm
	12-14	SS-7	22"	11-32-52-56 (84)	SAND WITH SILT, red fine, subangular quartz, poorly graded	SP-SM	Headspace 9.0ppm
15	14-16	SS-8	14"	8-24-35-46 (59)	SAND WITH SILT, red, fine subangular quartz, poorly graded moist	SP-SM	Headspace 7.2ppm
	16-18	SS-9	15"	8-15-19-23 (34)	SAND, red/orange, fine-medium quartz, poorly graded trace silt moist	SP	Headspace 3.8ppm
20	18-20	SS-10	18"	8-16-18-25 (34)	SAND, orange, fine, subangular quartz, poorly graded, trace black minerals	SP	Headspace 4.5
	20-22	SS-11	19"	11-15-23-26 (38)	SAND, orange fine subangular quartz, poorly graded, trace black minerals, moist	SP	Headspace 6.6
	22-24	SS-12	23"	11-21-21-28 (42)	SAND, pink to red, fine subangular quartz, poorly graded, moist	SP	Headspace 10.2
25	24-26	SS-13	22"	8-20-23-28 (43)	SAND, white, orange, red, pink fine, subangular quartz, poorly graded moist	SP	Headspace 20.5
	26-28	SS-14	22"	10-18-26-30 (44)	SAND, white with orange and pink mottling, fine, subangular quartz, poorly graded, moist	SP	Headspace 0.8
30	28-30	SS-15	22"	8-13-23-35 (36)	SAND, white with orange/red mottling, fine subangular quartz	SP	Headspace 0.8

CH2MHILL

PROJECT NUMBER	BORING NUMBER
SAT22540.16.RA	BRD - SB-8 SHEET 2 OF 2

(RACB)

SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Baxley Rd. (RACB)
ELEVATION DRILLING CONTRACTOR MTC
DRILLING METHOD AND EQUIPMENT Hollow Stem Auger
WATER LEVEL AND DATE START 4-3-89 FINISH 4-3-89 LOGGER M. Clasen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30	30-32	SS-16	16"	15-22-24-30 (46)	SAND, tan, fine, subrounded quartz, poorly graded, dry	SP	HNu Background 0.2ppm Headspace 1.2ppm
35	33-35	SS-17	22'	7-12-15-25 (27)	SAND, tan, with orange/red/pink mottling, fine subangular quartz, poorly graded, dry	SP	Headspace 1.8 pp

PROJECT NUMBER	BORING NUMBER
SAT 22540.16.RA	BRD-SB-9 SHEET 1 OF 2

(RACB)

SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Baxley Rd. (RACB)

ELEVATION DRILLING CONTRACTOR MTC

DRILLING METHOD AND EQUIPMENT Hollow Stem Auger

WATER LEVEL AND DATE START 3-22-89 FINISH 3-31-89 LOGGER M. Clasen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
0	0-2	SS-1	24"	9-10-9-11 (19)	SAND, brown, fine-medium quartz some organics, 5% pebbles and cobbles	SW	HNu background 0.2ppm Headspace 0.4ppm
	2-4	SS-2	4"	7-5-5-6 (10)	SAND, fine-medium quartz, wet grey sandy sludge	SM	Headspace 0.4ppm
5	4-6	SS-3	10"	2-2-16-17 (18)	SILTY SAND, dark orange red, mustard brown, fine quartz, trace coarse sand, trace cobbles-5"	SM	Headspace 4.0 ppm
	6-8	SS-4	8"	5-17-26-30 (43)	SILTY SAND, dark orange red, fine-medium quartz, well graded dry	SM	Headspace 20 ppm
	8-10	SS-5	15"	9-23-25-31 (48)	SILTY SAND, dark orange red, fine-medium quartz, dense, dry	SM	Headspace 1.0ppm
10	10-12	SS-6	10"	5-9-21-25 (30)	SILTY SAND, dark orange red, fine medium quartz, dense, dry	SM	Headspace 14 ppm
	12-14	SS-7	3"	10-25-40-42 (65)	SAND WITH SILT, dark orange red, yellow clay mottling, dense, dry	SP	Headspace 0.4ppm
15	14-16	SS-8	18"	2-12-16-25 (28)	SAND WITH SILT, dark orange red, fine quartz, dense	SP	Headspace 1.0 ppm
	16-18	SS-9	14"	4-5-12-20 (17)	SAND, light orange, fine-medium grained quartz, <5% silt dry, dense	SP	Headspace 4.0ppm
	18-20	SS-10	24"	9-20-25-27 (45)	SAND, orange, fine quartz, some clay mottling, trace coarse sand, dense, dry	SP	Headspace 1.0 ppm
20	20-22	SS-11	15"	5-6-17-24 (23)	SAND, orange, fine quartz, some silt, some clay, dry	SW	Headspace 2.0 ppm
	22-24	SS-12	17"	12-16-26-30 (42)	SAND, orange, fine-coarse quartz some silt, some clay	SW	Headspace 1.0ppm
25	24-26	SS-13	6"	11-24-56-100 (80)	SAND, orange, fine-coarse quartz, some silt, clay	SW	Headspace 2.0 ppm
	26-28	SS-14	4"	15-100/5 (70)	SAND, dark orange red, fine-medium quartz, dry	SW	Headspace 2.0 ppm
30	28-30	SS-15	15"	10-18-22-26 (40)	SAND, red, fine subangular quartz, trace silt, trace black minerals, moist	SP	Background 0.5ppm Headspace 0.5ppm

PROJECT NUMBER	BORING NUMBER
SAT 22540.16.RA	BRD-SB-9 SHEET 2 OF 2

(RACB)

SOIL BORING LOG

PROJECT SRP RMET RFI LOCATION Boxley Rd. (RACB)
ELEVATION DRILLING CONTRACTOR MTC
DRILLING METHOD AND EQUIPMENT Hollow Stem Auger
WATER LEVEL AND DATE START 3-22-89 FINISH 3-31-89 LOGGER M. Clasen

DEPTH BELOW SURFACE (FT)	SAMPLE			STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	RECOVERY (FT)	6"-6"-6" (N)	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30	30-32	SS-15	23"	12-18-26-34 (44)	SILTY SAND, orange fine quartz, some silt, 10% white soft clay lenses, moist	SM	HNu background 0.5 Headspace 0.6 ppm
35	33-35	SS-16	22"	9-18-22-29 (40)	SAND, red, fine subangular quartz, trace silt, trace black minerals, moist	SP	Headspace 0.6 ppm

OEX 30-3

FIELD GEOLOGIC LOG

PROJECT: BAYLEY ROAD CHEMICAL BASIN-RFI	DATE: Day / 07-11-89	SHEET: 1 of 3
REFERENCE DATUM: GROUND SURFACE	DRILLING CONTRACTOR: HTC	
WELL NO.: BRD-5D	SRP COORDINATES:	DRILLER: Dave Cunningham
LOGGED BY: TBHughes	COMPANY: Westinghouse	DRILLING METHOD: MUD ROTARY

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
1	0–5		GRAB SAMPLES	SAND material yellowish brown (10 YR 5/4) moderately sorted and medium to fine grained subangular to subrounded trace manganese	
2	5–10			AS ABOVE	
3	10–15			CLAYEY SAND clay ([illegible]), light brown (5 YR [illegible]), poorly sorted, fine to coarse grained, subangular to angular trace gravel	
4	15–20			AS ABOVE	

OCR 30-8

FIELD GEOLOGIC LOG

PROJECT BAILEY ROAD CHEMICAL BASIN	DATE TUESDAY 07-11-95	SHEET 2 of 3
REFERENCE DATUM GROUND SURFACE	DRILLING CONTRACTOR HTC	
WELL NO. BRD-5D	SRP COORDINATES	DRILLER DAVE CUNNINGHAM
LOGGED BY TBHUGHES	COMPANY WESTINGHOUSE	DRILLING METHOD MUD ROTARY

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
5	20			Sandy clay sand (30%), light brown (10YR 5/4) moderately sorted fine to medium grained subangular to subrounded slightly plastic	
	21				
	22				
	23				
	24				
6	25		GRAB SAMPLES	As above	
	26				
	27				
	28				
	29				
7	30			As above	
	31				
	32				
	33				
	34				
8	35			As above, trace angular gravel	
	36				
	37				
	38				
	39				
	40				

06X30-3

FIELD GEOLOGIC LOG

PROJECT Barley Road Chemical Basin		DATE Tuesday 07-11-99	SHEET 3 of 3
	REFERENCE DATUM Ground Surface	DRILLING CONTRACTOR MTC	
WELL NO. BED-5D	SRP COORDINATES	DRILLER Dave Cunningham	
LOGGED BY TBHughes	COMPANY Westinghouse	DRILLING METHOD Mud Rotary	

RUN NUMBER	DEPTH, FEET	LITHOLOGY	PERCENT RECOVERY	SAMPLE DESCRIPTION	DRILLING COMMENTS
9	40			Sandy clay, sand ([illegible]%), light brown	
				(5YR 5/[illegible]) to light olive gray (5Y 6/2)	
	41			moderately sorted medium to coarse	
				grained subrounded	
	42				
	43				
	44				
10	45			As Above	
	46				
	47				
	48				
	49				
11	50		GRAB SAMPLES	As Above	
	51				
	52				
	53				
	54				
12	55				
	56				
	57				
	58				
	59				
	60			TD Borehole – 62.0'	

ENVIRODYNE
ENGINEERS INC.

WELL CONSTRUCTION DETAILS

Job No. ____

Boring No. 904-111G #4

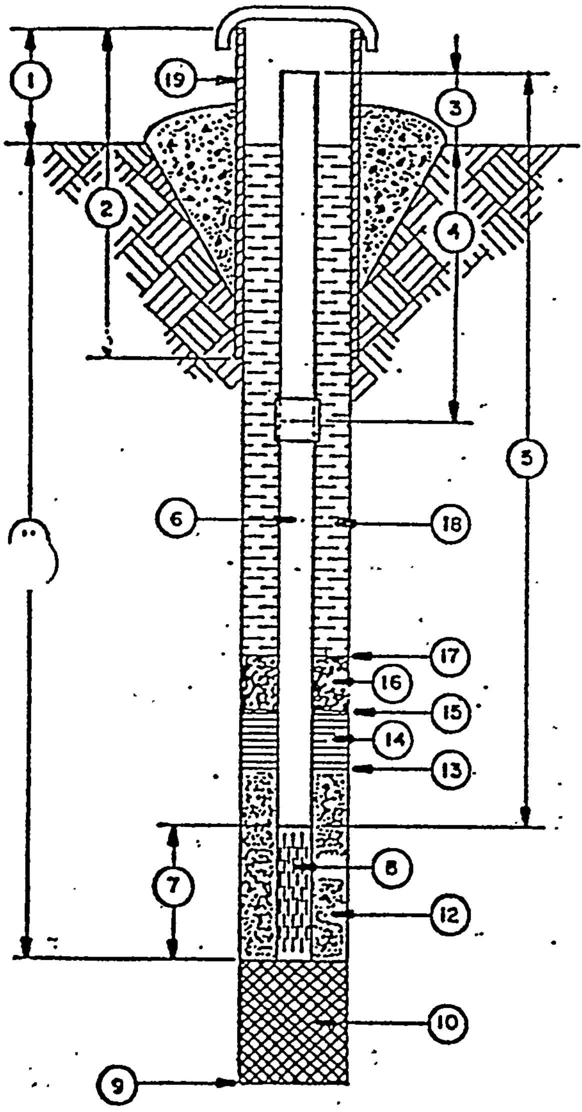
ate of Installation 7/16/94

Time Started 8:00

Time Completed 2:00

nd Surface Elev. 220'

ll depth measurements of well detail are from ground surface unless otherwise indicated.



① Height of Protective Casing Above Ground n/a

② Total Length of Protective Casing N/A

③ Height of Standpipe Above Ground 2'

④ Depth to First Coupling 17'

Coupling Interval 20'/20'/10'/20'

⑤ Total Length of Blank Pipe 37'

⑥ Type of Blank Pipe PVC 4"

⑦ Length of Screen 30'

⑧ Type of Screen PVC 4" .018

⑨ Total Depth of Boring 70' Hole Diam. 10"

⑩ Type of Material Native sd + cly

⑪ Depth to Bottom of Screen 67'

⑫ Type of Screen Filter Pea Gravel

Quantity Used 16 bags

⑬ Depth to Top of Filter 32'

⑭ Type of Seal Sand

Quantity Used 3 bags

⑮ Depth to Top of Seal 28'

⑯ Type of Seal Weight N/a

Quantity Used n/a

⑰ Depth to Top of Seal Weight N/a

⑱ Type of Grout Cement

Grout Mixture Cement/water

⑲ Type of Protective Casing n/a

Concrete Collar Mixture Cement/sand/water

marks:

OSR 30-5
(Rev 1-88)

SRP MONITORING WELL CONSTRUCTION DETAILS

DRILLING SUBCONTRACTOR MTG

WELL NUMBER BCD - 5D

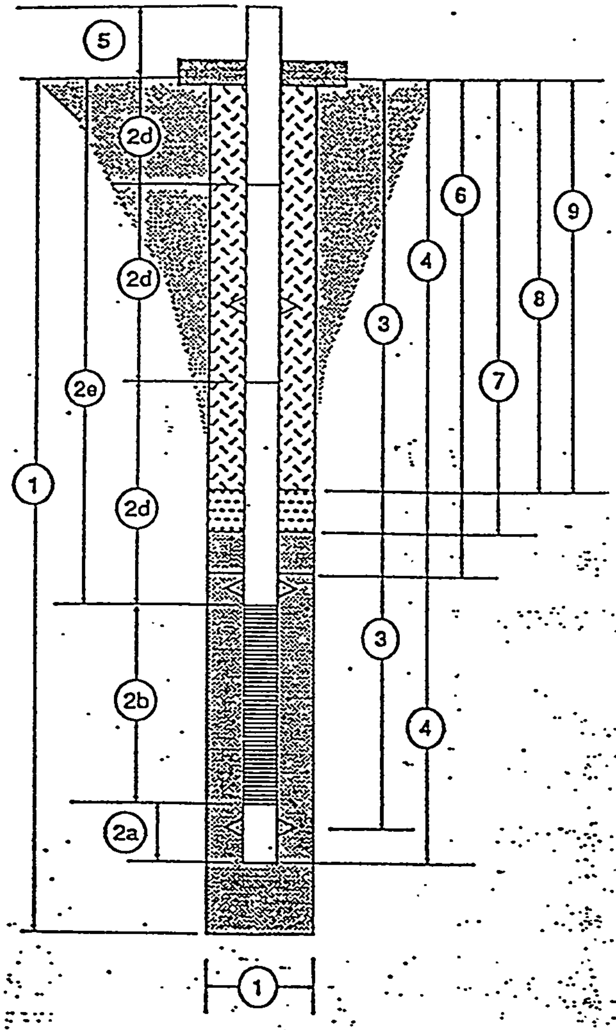
DRILLER DAVE CUNNINGHAM

SRP COORDINATES

DATE OF INSTALLATION 7-11-99

SANITARY SEAL ELEVATION

TECH. O.S./CO. NAME TERRY B. HUGHES
WESTINGHOUSE



1) Total drilled depth/hole diameter 62.0 / 9 7/8"

2) Casing/Screen Tally (Measured to Nearest 0.01 Foot)

(a) Sump & Plug 5.34'

(b) Screen Length 20.05'

(c) Screen Type/Slot Size PVC SCH-40 / 0.010"

(d) Casing Joint Lengths (Measured in up-hole Sequence From Top of Screen) (1) 10.02';
(2) 10.01'; (3) 10.03' (4) 4.25'

(e) Total Length of Casing 34.31

(f) Type of Casing PVC SCH-40

3) Depths to Centralizers 20.0', 32.2', 54.5'

4) Total Depth of Installed Well 59.7'

5) Casing Stick Up (Standard 2.5' A.G.S.) 7.5'

6) Depth to Top of Filter Pack 26.9

Quantity (Bags) 14 Size .45-.55 mm

Brand/Trade Name Foster Dixiana FX-50

7) Depth to Top of Fine Sand Seal 20.9

Quantity (Sacks) 1

8) Depth to Top of Bentonite Seal 17.0'

Quantity (Buckets) 2

9) Thickness of Grout 17.0'

Total Grout Quantity (Bags) 6

NOTE: ALL MEASUREMENTS ARE FROM GROUND SURFACE AT START OF BORING – MEASUREMENTS TO NEAREST 0.1 FOOT.

Appendix C

Field Data Sheet

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UNIT RECONNAISSANCE
FIELD DATA SHEET
SAVANNAH RIVER SITE, AIKEN SOUTH CAROLINA

RFI/RI Unit Name: Road A Chemical Basin 904-111G

Completed By: R. D. Gamble

RFI/RI Unit Location: Road A Chemical Basin

SRS Representative Name: Stephani Fuller

I. ENVIRONMENTAL SETTING

Unit Arrival Time: 1320
Health and Safety Recommendation Initiated: No

1. Meteorological Conditions

    a. Temperature: ~ 50 °F Sky Cover: Sunny

    b. Precipitation: N/A

    c. Wind Conditions: Negligible

2. Topographical/Biological Description

    a. Description of corresponding natural features (hills, valleys, depressions, etc.): The topography at the unit is moderately sloping towards the southwest. The area immediately adjacent to the unit on the southwest side is relatively steep, indicative of a berm. Two depressions (drainage swales) filled with rip-rap are present along the southwest side of the unit. One at the approximately the mid-point of the southwest side and one at the west corner of the unit.

    b. Description of surface water bodies (stream, river, lake, leachate): No surface water bodies are located in the immediate vicinity of the unit

    c. Description of corresponding vegetation (weeds, grass, underbrush, small/mature trees): The unit is covered primarily with grass. Patches of heavy underbrush and thicket which has recently been cut are present in the center portion of the unit. Two mature pine trees (~ 1.0 ft. in diameter at their base) are growing within the unit boundaries as well as two smaller pine trees > 2 inches in diameter.

d. Description of animal presence/habitat (tracks, nests, dens, etc.): No nests or dens were observed on the unit or in the immediate vicinity. Deer tracks were found in an eroded area approximately 20.0 ft. east of the unit.

3. Man-Made Features

a. Description of corresponding features (buildings, roads, powerlines, wells): An 8.0 ft. high chain-link fence surrounds the entire unit. Five groundwater monitoring wells are located in the immediate area, three are located outside the fenced area, two are located within the fenced area. The gravel access road is located approximately 125 feet from the nearest unit boundary marker. An unimproved road is located approximately 50 feet northeast of the unit.

II. SOURCE CHARACTERIZATION

1. Unit Area Characteristics

a. Description of management activities (landfill, surface impoundment, etc.): Historical photographs indicate the unit was a surface impoundment

b. Estimation of waste management area size: The aerial dimensions of the unit are approximately 90 ft x 200 ft x 110 ft x 160 ft.

c. Construction of waste management area (earthen, liners, cement, above grade, etc.): The unit was a earthen basin during its operational period. The unit was filled with native soil and graded in 1973

d. Is the unit in current use/operation: No

2. Waste Characteristics

a. Description of any visible waste: None visible, basin backfilled with native soils in 1973

b. Quantity of waste (number of drums, pile size, etc.): information is not available

III. WASTE RELEASE POTENTIAL

1. To Soil/Groundwater/Surface Water

   a. Description of waste run-off/leachate (soil discoloration, dead vegetation or no growth, erosion, etc.): The unit is currently filled with native soil and graded and vegetated to prevent erosion. Surface runoff from the unit is channeled to two drainage swales on the down-slope side of the unit. A culvert in each drainage swale directs surface runoff to the southwest. No leachate, dead or stressed vegetation was observed.

   b. Estimate of impacted area (size of area, distance from the source, etc.) No impact to soil or surface water observed

IV. FINAL CHARACTERIZATION

1. Additional comments: The unit perimeter is protected by an 8.0 ft high chain-link fence. The access gate is too small to allow drill rig access on the unit itself. Large rounded pebbles and cobbles are present at the surface east of the unit. If these materials are predominant in the surface and near-surface soil at the unit, this may prevent hand auger sampling methods during the characterization phase.

2. Follow-up questions: Request additional information on groundwater monitoring data and construction details of wells at the unit.

3. Health/Safety concerns: Wildlife in forested area

4. Site Departure Time: 1430

V. PHOTOGRAPHS

1. Photographs taken: No

2. Quantity of Photographs Taken: N/A

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Appendix D

Soil Boring Analyses

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Soil Borings Analyses
Road A Chemical Basin

Soil Boring Number	BRD-SB-6-1	BRD-SB-6-2	BRD-SB-6-2	BRD-SB-6-3	BRD-SB-6-4	BRD-SB-6-4	BRD-SB-6-5	BRD-SB-6-6	BRD-SB-6-7	BRD-SB-6-8
Depth	0' - 2'	2' - 4'	2' - 4'	6' - 8'	10' - 12'	10' - 12'	14' - 16'	18' - 20'	24' - 26'	30' - 32'
Sample Date	3/28/98	3/28/89	3/29/89	3/28/89	3/28/89	3/28/89	3/28/89	3/29/89	3/30/89	3/30/89
Volatile Compounds (ug/kg)										
Acetone	67	82	49	49	92	----	27	45	32	57
Chlorobenzene	9	20	----	26	7	5	2	----	----	4
Methylene Chloride	15	10	9	12	16	----	7	8	10	15
Radioactive Compounds (pCi/g)										
Gross Alpha		16	13							
Nonvolatile Beta		14	15							
Total Radium		8	7.1							
Metals (ug/g)										
Aluminum	7938	2645		5491	5304		5519	2720	3215	1773
Arsenic	1.94	----		1.13	1.02		----	1.49	----	----
Barium	13.81	9.768		6.907	6.117		321.5	24.27	100.9	8.683
Chromium	12.14	60.3		23.54	22.14		16.52	16.27	10.16	5.204
Lead	5.71	1.49		9.73	5.63		1.81	7.27	2.84	2.65
Lithium	----	----		----	----		----	----	----	----
Mercury	----	----		----	----		----	----	----	----

Soil Borings Analyses
Road A Chemical Basin

Soil Boring Number Depth Sample Date	BRD-SB-6-9 34' - 36' 3/30/89	BRD-SB-8-1 2' - 4' 4/3/89	BRD-SB-8-2 4' - 6' 4/3/89	BRD-SB-8-3 6' - 8' 4/3/89	BRD-SB-8-4 8' - 10' 4/3/89	BRD-SB-8-5 14' - 16' 4/3/89	BRD-SB-8-6 20' - 22' 4/3/89	BRD-SB-9-1 6' - 8' 3/30/89	BRD-SB-9-4 24' - 26' 3/31/89	BRD-SB-9-5 28' - 30' 3/31/89	BRD-SB-9-6 33' - 35' 3/31/89
Volatile Compounds (ug/kg)											
Acetone	47	26	75	41	63	34	58		----	240	----
Chlorobenzene	----	----	7	----	----	----	8		6	----	----
Methylene Chloride	15	6	9	8	6	7	8		11	11	----

Radioactive Compounds (pCi/g)											
Gross Alpha								9			
Nonvolatile Beta		6						----			
Total Radium		3.3						4.1			
Metals (ug/g)											
Aluminum	721.5	9431	17750	17040	3934	5133	2903		2401	2439	2237
Arsenic	----	0.6	3.59	8.23	0.85	2.87	----		0.44	0.98	----
Barium	30.69	17.56	16.58	11.64	23.68	4.736	101.6		3.552	----	13.22
Chromium	5.286	11.15	44.02	46.25	14.21	29.07			11.65	11.4	12.14
Lead	1.01	5.62	11.1	15.7	7.39	2.74			8.45	3.41	5.08
Lithium	----	2.398	0.9385	----	----	----			----	----	----
Mercury	----	0.14	----	----	----	----			----	----	----

'---- Below detection limit
Blank denotes no data

Appendix E

Soil Gas Investigations at the Road A Chemical Basin

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Draft Report

SOIL GAS INVESTIGATIONS
at the
ROAD A CHEMICAL BASIN
(904-111G)

SAVANNAH RIVER SITE

March, 1993

Robert J. Pirkle
David J. Masdea

Task 24
Subcontract #AA-00655N

MICROSEEPS

University of Pittsburgh Applied Research Center
220 William Pitt Way
Pittsburgh, PA 15238
(412) 826-5245

EXECUTIVE SUMMARY

A soil gas survey was performed at the Road A Chemical Basin (904-111G) during September, 1992. The survey monitored the presence and distribution of the C_1-C_4 hydrocarbons; the C_5-C_{10} normal paraffins; the aromatic hydrocarbons, BTEX BTXE; and selected chlorinated hydrocarbons at a total of 36 sample locations.

Levels of volatile organics observed are very low. Only occasional, isolated observations of benzene, toluene, the xylenes, and chloroform were made. Levels of methane are anomalous at several sites which may be suggestive of active biological processes.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES
(continued)

LIST OF TABLES

I. INTRODUCTION

A soil gas survey was designed and executed at the Road A Chemical Basin (904-111G) at the Savannah River Site in September, 1992. The objective of the soil gas survey was to determine the presence and extent, or absence of contamination in near surface soil gases at the site. A total of 36 sample locations were established, as shown on Figure 1 , and sampled for soil gases in order to accomplish these objectives. Species monitored were the light hydrocarbons, (C_1-C_4); gasoline range normal paraffins (C_5-C_{10}); gasoline range aromatic hydrocarbons, (BTXE); and selected chlorinated organics. All analyses for the C_1-C_4 hydrocarbons were carried out in an on-site laboratory staffed and equipped by Microseeps. All VOC analyses were carried out in Microseeps' laboratory in Pittsburgh, PA. The results of these analyses are shown on Tables 1, 2 and 3, and selected data are mapped as shown on Figures 10 - 27.

II. BACKGROUND

The 904-111G Road A Chemical Basin received uranium contaminated process liquids, primarily caustics from the 300-M Area from an unknown time until 1974. These wastes were routinely disposed of in a borrow pond and holding pond. The site was closed in 1974. There are no other records of hazardous wastes or hazardous constituents disposed at this site. Other data relative to this site are is documented on page ~~A-12~~ C-61 of Volume I: Waste Management Unit Worksheets, October, 1990; WSRC-RP-90-1046 (which is attached in Appendix II).

III. QUALITY ASSURANCE

Microseeps quality assurance procedures have been documented in its Quality Assurance Manual and have been audited and approved by the Department of Energy for implementation at the Savannah River Site. A copy of this manual in its entirety was submitted at the time of the audit and is on file. Documentation of applicable sampling and analytical methods and associated quality assurance procedures are on file in our laboratory at all times and are included in this report in Appendix I.

A. Sampling Methods

Methods and quality assurance procedures used to obtain soil gas samples are documented in Sampling Method SM1 in Appendix I. Samples were generally obtained from depths of 36" to 48". Actual sample depths for this survey are recorded in the Soil Gas Sample Collection Log in Appendix II. Samples for the light hydrocarbon analyses were taken in previously evacuated 125 ml bottles. Samples for volatile organic compound (VOC) analyses were taken in previously evacuated 22 ml bottles. A duplicate sample and a blank was collected for every ten samples. The duplicate samples were taken from a separate location which was approximately 1 ft. from the original site. Logs which document the details of sample collection are included in Appendix II.

B. Analytical Methods

Methods and quality assurance procedures for the analysis of light hydrocarbon soil gas samples are documented in Analytical Method AM1 and for VOC soil gas samples in Analytical Method AM4 in Appendix I. Methods AM1 and AM4 are modifications of EPA Headspace Method 3810 and Gas Chromatography Method 8000. Representative chromatograms of a sample and a blank from this data set are shown on Figures 2 - 5.

C. Accuracy

Calibration of the C_1-C_4 hydrocarbon gas chromatograph was accomplished using a certified commercial standard (Matheson Gas Products Inc.) which is of the order 10 ppm for methane and 1 ppm for the other light hydrocarbons and is called Standard "M"; and a second commercial standard (Scotty Specialty Gases, Can Mix 224, ICN #35) which contains only the C_1-C_4 straight chain hydrocarbons and is of the order 1000 ppmv for each hydrocarbon. Chromatograms of Standards "M" and "224" are shown on Figure 6.

Calibration of the gas chromatograph used to analyze volatile organics was accomplished using standards prepared as a blend of pure compounds according to the methods documented in Standard Preparation Method SP3 which is included in Appendix I. These standards were prepared in methanol (Aldrich, HPLC grade. ICN #30), at six concentration levels as shown on Table 4. Initially two standards from each of levels 1 through 6 were run to set up the calibration table. Thereafter, one standard was run for every 10 samples. A chromatogram of Standard K4, Level 3 for the FID is shown on Figure 7 and Level 5 for the ECD on Figure 8.

Calibration of the gas chromatograph for vinyl chloride was achieved using a commercial standard gas (Scotty Specialty Gases, Can Mix 74, ICN # 9) @ 1000 ppmv.

D. Reliability of Vinyl Chloride and Methylene Chloride Data

The reliability of results presented in this report for vinyl chloride and methylene chloride is adversely affected by compounds which elute closely in time to their retention times. Namely, in the case of vinyl chloride, the presence of two frequently occurring compounds which elute 0.07 minutes before and 0.15 minutes after the vinyl chloride elution time. The earlier peak is probably n-butane and the later peak is presently unknown. In the case of methylene chloride, an impurity thought to be derived from the septum (identity unknown), elutes 0.07 minutes before the methylene chloride elution time. While we can normally distinguish between such retention times, these separations are of the same order as the peak widths.

E. Precision

The analytical precision was calculated using the repetitive analysis of standards as shown in Tables 5 - 7. In order to derive a meaningful estimate of precision, the calculation was made over all standards in a data directory rather than a single survey. A data directory includes data from the analyses of all samples, standards and blanks for a period of 3 to 6 weeks. The 904-111G Basin data reside in data directory #23. Standards, which were run with the samples and blanks from the Road A Chemical Basin survey, are designated on Tables 5 and 6 as area "904-111G".

For the VOC standards in general, percent standard deviations are less than 10%. At the 10 ppbv level, percent standard deviations for the chlorinated hydrocarbon standard analyses increase as background concentrations become a significant part of the overall signal.

For the light hydrocarbons, the precision is better than 4% for all hydrocarbons for analyses of standard "M" and "224" as shown on Table 7.

F. Minimum Detection Levels

Minimum detection levels reported in this survey for the light hydrocarbons, C_1-C_4, are 5 ppbv. In practice a 5 ppbv standard (Microseeps Standard M diluted 200:1) is reliably determined with signal to noise ratio (S/N) >2. A chromatogram of the diluted standard is shown on Figure 9.

For the VOC standard, where peaks are well separated and the baseline is stable, signals of the order 8 uv may be detected with a S/N $\geq$4. In a complex mixture of VOC's with many compounds, and overlapping peaks, we have determined that signals of the order 20 uv are the smallest that can be reliably and routinely determined. This corresponds to a concentration of about 70 ppbv for the gasoline range compounds; 5 ppbv for the tri- and tetrahalocarbons; and 100 ppb for trans 1,2-dichloroethylene. We have visually checked the integration of each peak for these compounds down to these concentration levels. We have not reported concentration levels for smaller signals, though in some individual cases they may be valid.

Under ideal conditions where an 8 uv signal can be reliably integrated, minimum detection levels may be considerably lower. Experience has shown that with our system, an 8 uv signal corresponds to approximately 40 area counts. We have used our calibration factors to calculate the amount of each compound corresponding to 40 area counts as shown on Table 8. In practice, we have set the "area reject" of our system to 40 area counts, which programs the system to reject lesser areas. This minimizes the integration of noise related events.

G. Blanks

System blanks are collected after normal purging of the probe sampler at each 10th sample location. Ambient air is drawn through the probe then displaced into evacuated vials. The vials are then given the same consideration as samples and analyzed identically. The purpose of the system blanks is to determine if and when sample-to-sample contamination occurs, and also to help establish background levels throughout the sampling and analytical process.

Results of the analyses of all blank samples run as a part of data directory D23 are shown on Tables 9 and 10. The symbol "ND" means "not detected" and suggests an area of less than 40 area counts as discussed above. For calculation of means and standard deviations, the amounts indicated on Table 8 for 40 area counts were used when "ND" is indicated. Results of analyses of blanks for the 904-111G basin data set are included on Tables 1, 2, and 3, and representative chromatograms are shown on Figures 4 and 5. Amounts measured in the blanks have not been subtracted from the reported sample concentrations in this report.

H. Data On Magnetic Disk

All analytical data, including samples, duplicates, standards, and blanks are provided (one copy) on magnetic disk. All data are in units of ppmv or ppbv as reported on Tables 1, 2, and 3.

All data are in Lotus 123 (Release 2, 1985) spreadsheet format using DOS (Version 5.0). All analytical data are accumulated and processed via Microseeps gas chromatographic data system.

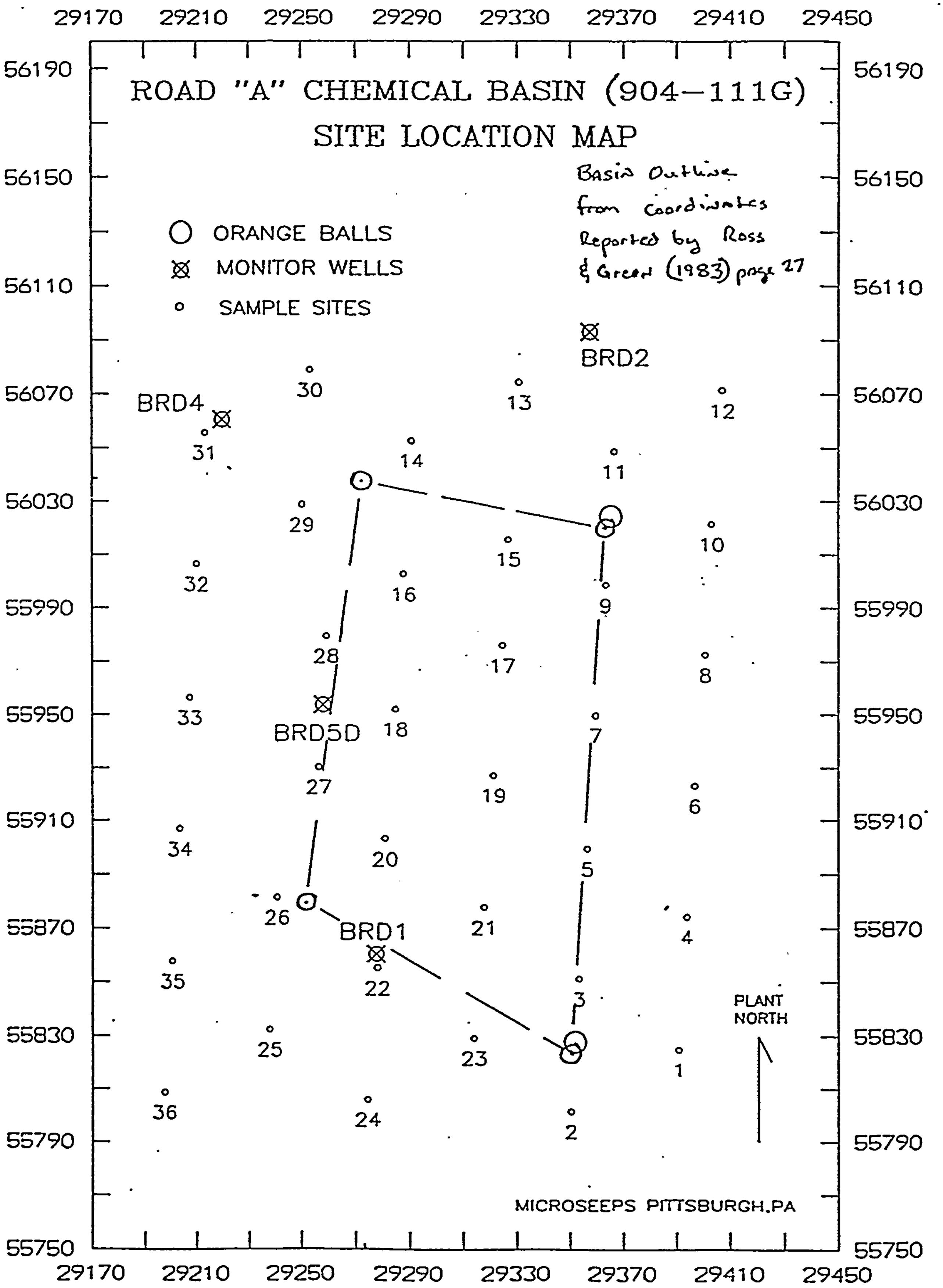
V. RESULTS

The results of the soil gas survey described above are recorded in Tables 1, 2 and 3 and selected data are mapped on Figures 10 - 27. In general, levels of volatile organics detected in this survey are very low. The most commonly observed VOC's at this site were pentane and hexane as shown on Table 1 and Figures 18 - 21, however their concentrations appear to be only slightly higher than levels observed in the SRS Background Study (in progress). At site 29, low, but anomalous levels of toluene, o-xylene, and m&p-xylene were observed, as shown on Table 1. As shown on Figures 12 - 17, this is an isolated occurrence. At site 30, a low level of chloroform was observed and a similar amount was also observed in the duplicate site 30A one foot away as shown on Table 2. This level of chloroform was occasionally observed in widely scattered samples in the SRS Background Study. While to our knowledge, chloroform is not naturally occurring, it is observed with regularity in the SRS area. Possibly, since gas chromatography does not physically identify the compound causing the detector response, one might attribute this observation to a naturally occurring compound with the same retention time in our column. Similar speculation can be made with regard to widespread occurrences of o-xylene and its apparent association with the occurrence of pinenes which are natural products in pine resins which are common at SRS. In the case of chloroform, however, the observation is made with the electron capture detector which is reasonably specific for halogenated compounds. It is more difficult to imagine a compound with a response on the electron capture detector which has the identical retention time as chloroform.

Methane concentrations, as shown on Table 3 and Figures 26 and 27, at several sites are anomalously high and are suggestive of biological activity.

V. CONCLUSIONS

Levels of volatile organics observed in the soil gas survey at the Road A Chemical Basin are very low. Only occasional, isolated observations of benzene, toluene, the xylenes, and chloroform were made. Levels of methane are anomalous at several sites which may be suggestive of active biological processes.



BRD3

Figure 1. The Road A Chemical Basin (904-111G) Sample Location Map

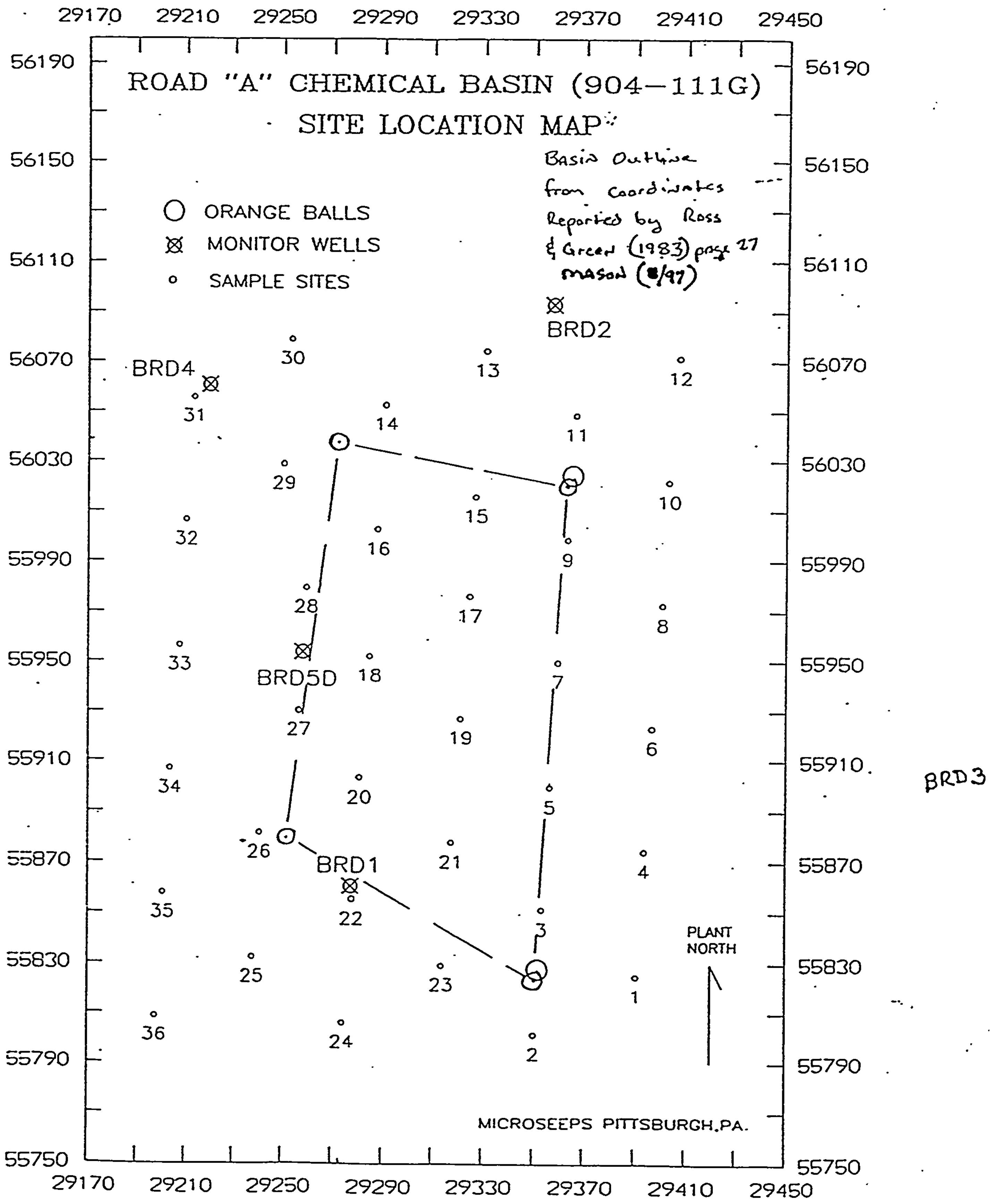


Figure 1. The Road A Chemical Basin (904-111G) Sample Location Map

```
le=C:\CP\D23\W23A1.89R Sample name=904-111G-29  Date printed= 03-01-1993 Time= 18:33:10
 3.85 to  30.00 min.  Low Y =      0.39813 mv    High Y =      0.93148 mv     Span =      0.53335 mv
```

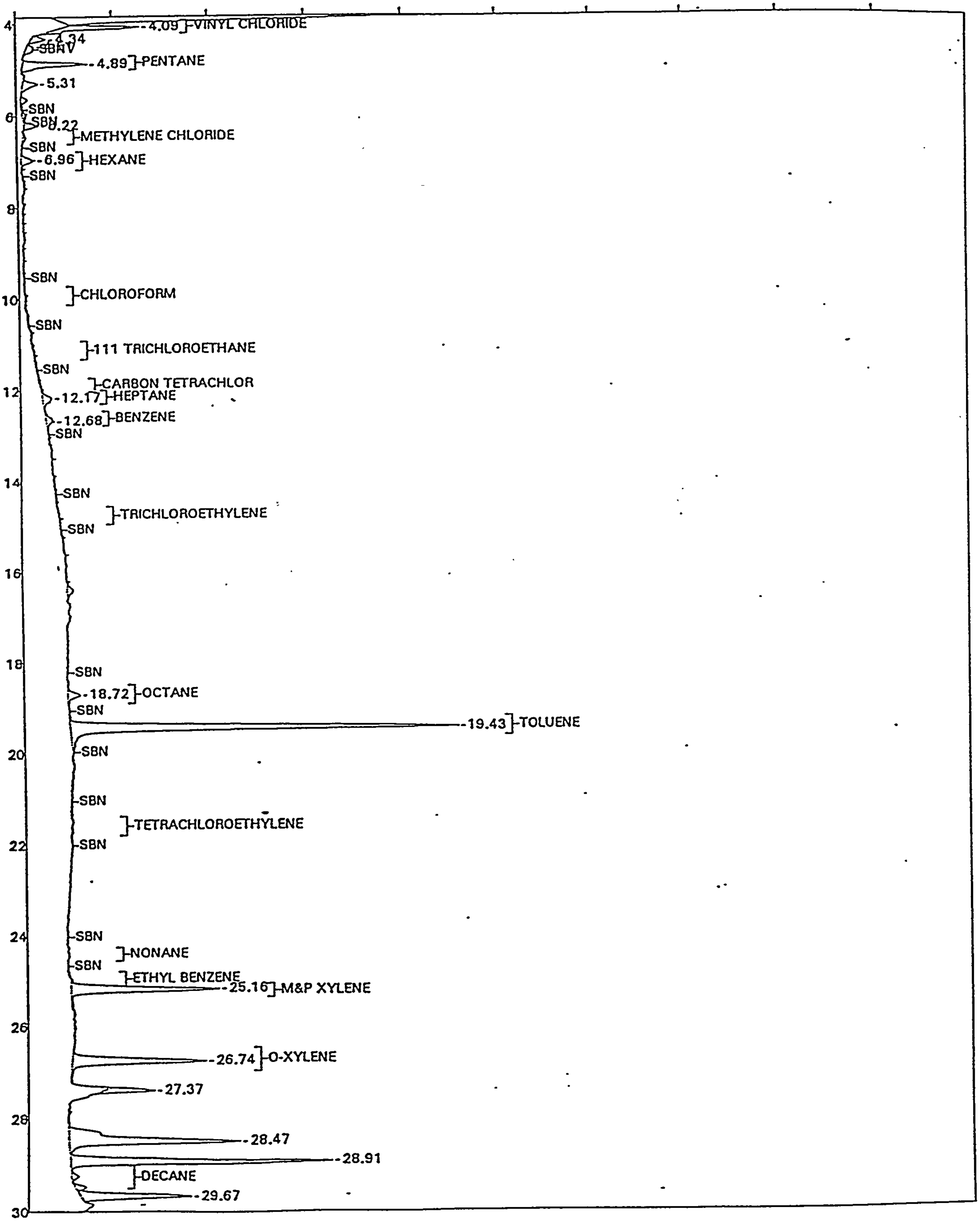


Figure 2. Gas Chromatogram of Soil Gases at Site·29 from

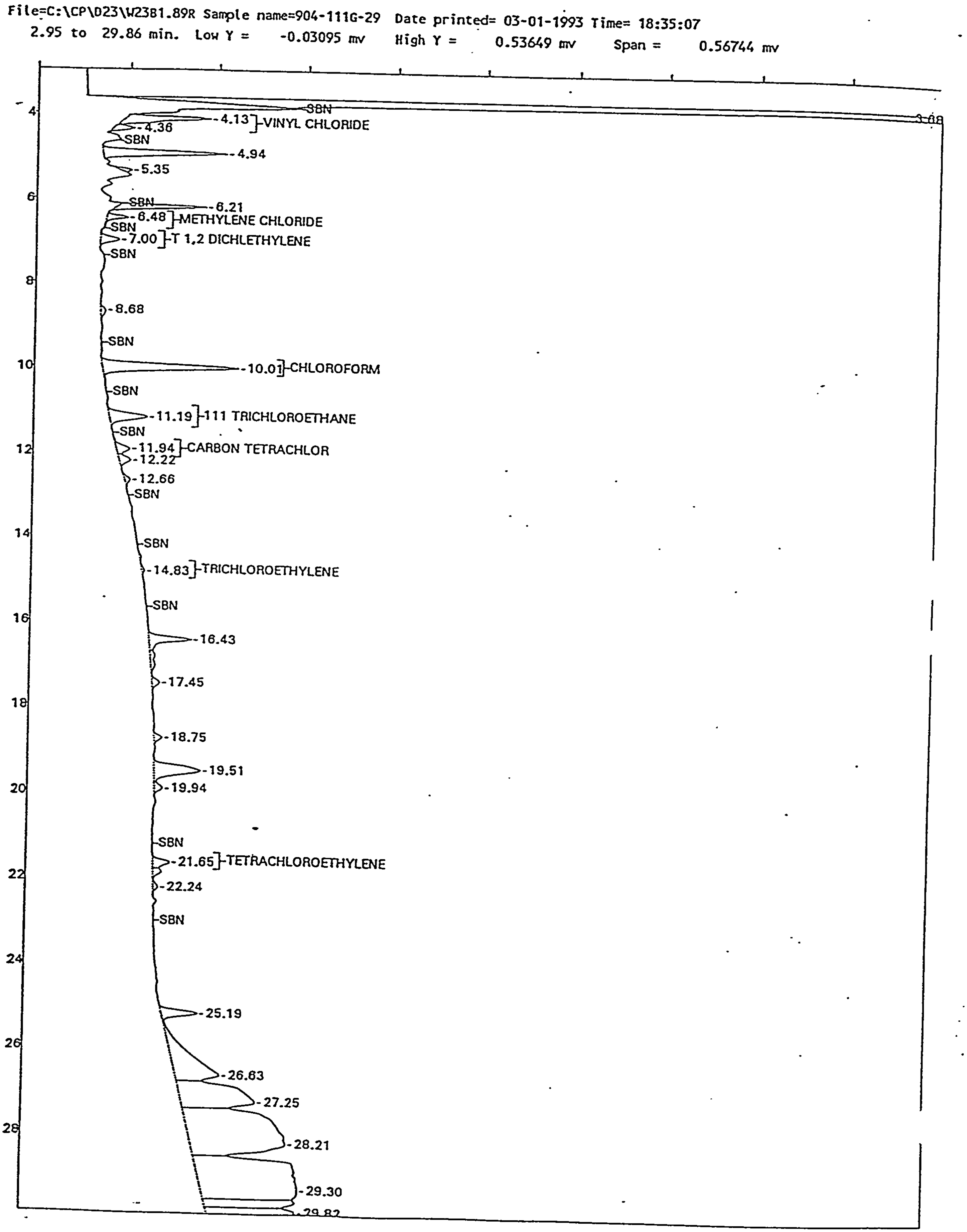


Figure 3. Gas Chromatogram of Soil Gases at Site 29 from the Electron Capture Detector

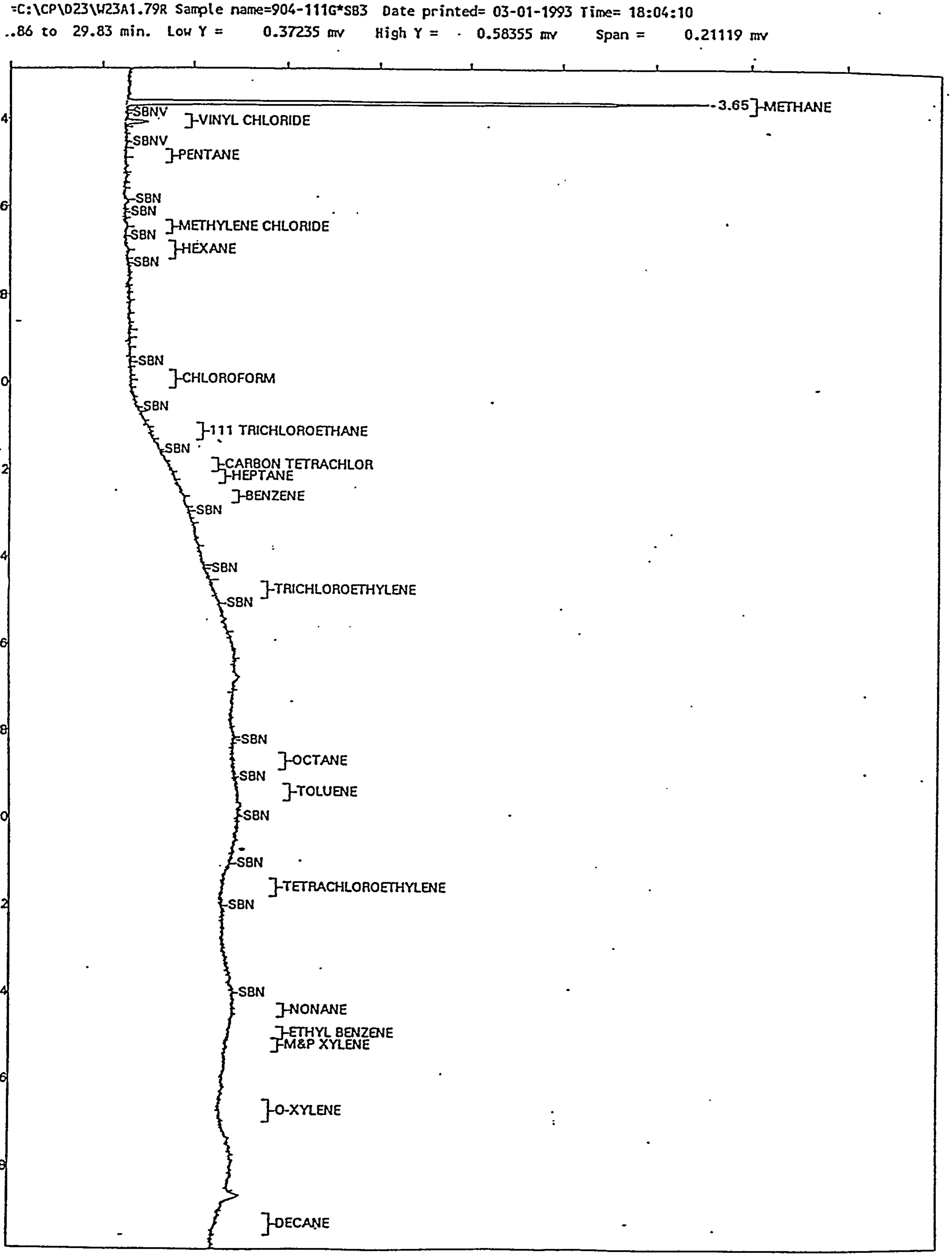


Figure 4. Gas Chromatogram of System Blank # 3 from the FID

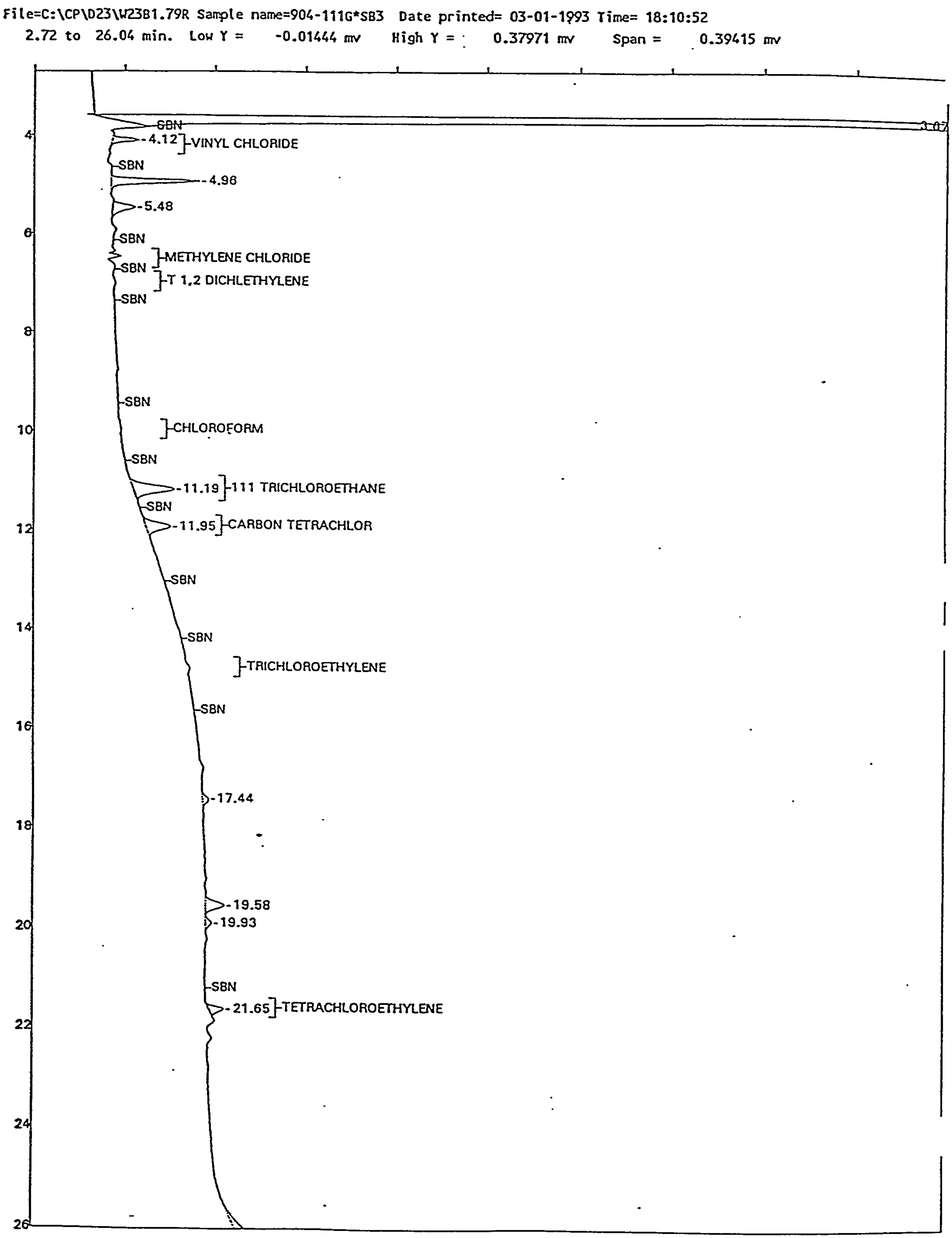
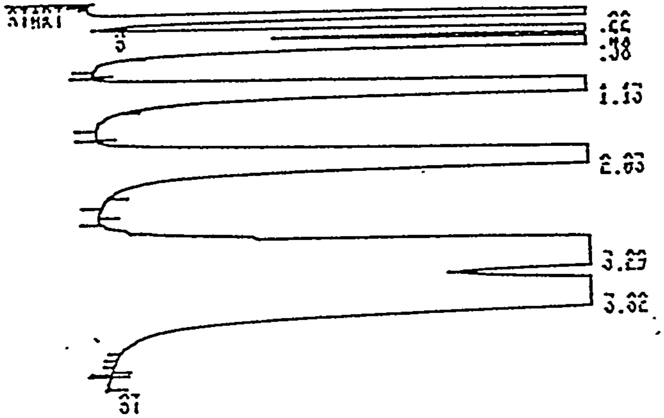


Figure 5. Gas Chromatogram of System Blank # 3 from the ECD Detector

STD M 10/21



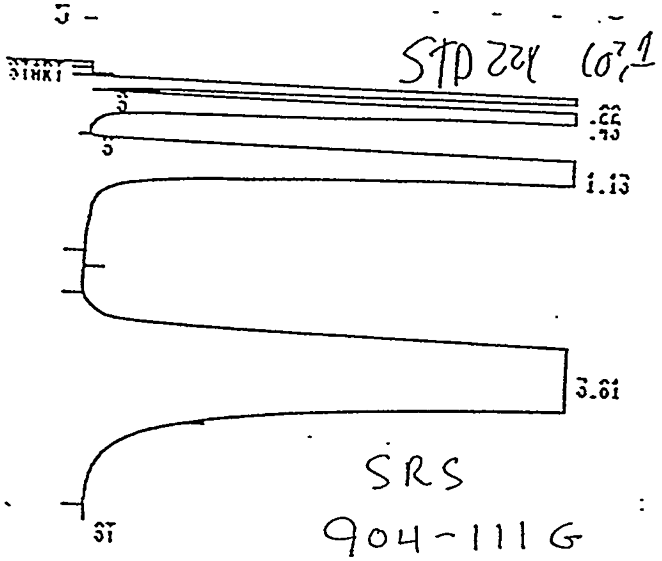
```
RUN #  191                 OCT 20/92  10-19-02
WORKFILE ID- B
WORKFILE NAME-

ESTD
  RT           AREA TYPE  CAL #        AMOUNT
  0.22      2587200  SHB    1          10.101
  0.43       523210  BV     2           1.007
  0.38       659700  VB     3           1.009
  1.13       693950  PB     4R          1.005
  2.03       563540  BB     5           1.000
  3.29       774430  BV     6           1.011
  3.82       694190  VV     7           1.044

 TOTAL AREA-    6496300
 MUL FACTOR- 1.0000E+00
```

904116-1

Figure 6a. Gas Chromatogram of C_1–C_4 Standard M



STD 224 (0,1

SRS
904-111G

```
RUN #  216                     OCT/20/92  13·36·31.
WORKFILE ID· D
WORKFILE NAME·

ESTD
  RT
 0.22        AREA  TYPE  CAL #        AMOUNT
 0.43      3196400  SBB    1        1011.600
 1.13      6036000  SPB    2        1030.400
 3.81      8619900   BB   3R        1013.000
           9432200   PB    4        1032.300

TOTAL AREA- 2.7303E+07
MUL FACTOR- 1.0000E+00


CALIB  2
RECALIBRATION
ESTD                         CALIB RUNS  2
REF·% RTW-   3.00           % RTW-   3.00

CAL #      RT          AMT            AMT/AREA
  1       0.22     1.0000E+03      3.1466E-04
  2       0.43     1.0400E+03      1.7314E-04
  3R      1.13     1.0030E+03      1.1763E-04
  4       3.81     1.0100E+03      1.0709E-04
```

Figure 6_b. Gas Chromatogram of C_1–C_4 Standard 224.

```
ile=C:\CP\D23\W23A2.01R Sample name=STD K4 R3  Date printed= 03-01-1993 Time= 18:14:28
  3.85 to  29.88 min.  Low Y =     0.21061 mv    High Y =    7.48547 mv     Span =     7.27486 mv
```

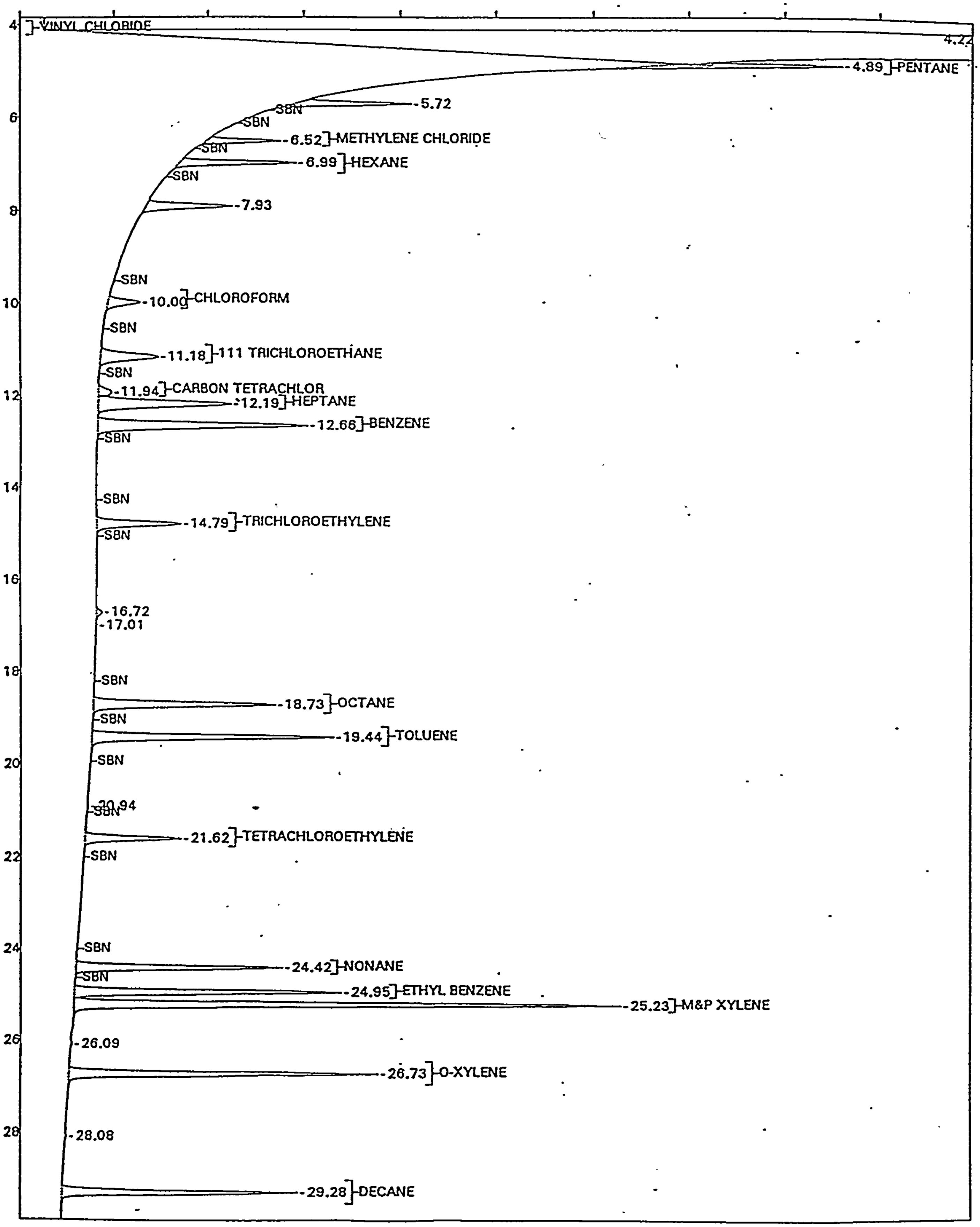


Figure 7. Gas Chromatogram (FID) of VOC

```
File=C:\CP\D23\W2381.80R Sample name=STD K4 R5  Date printed= 03-01-1993 Time= 18:12:38
  3.85 to  30.00 min.  Low Y =    -0.03660 mv   High Y =    13.97089 mv    Span =    14.00749 mv
```

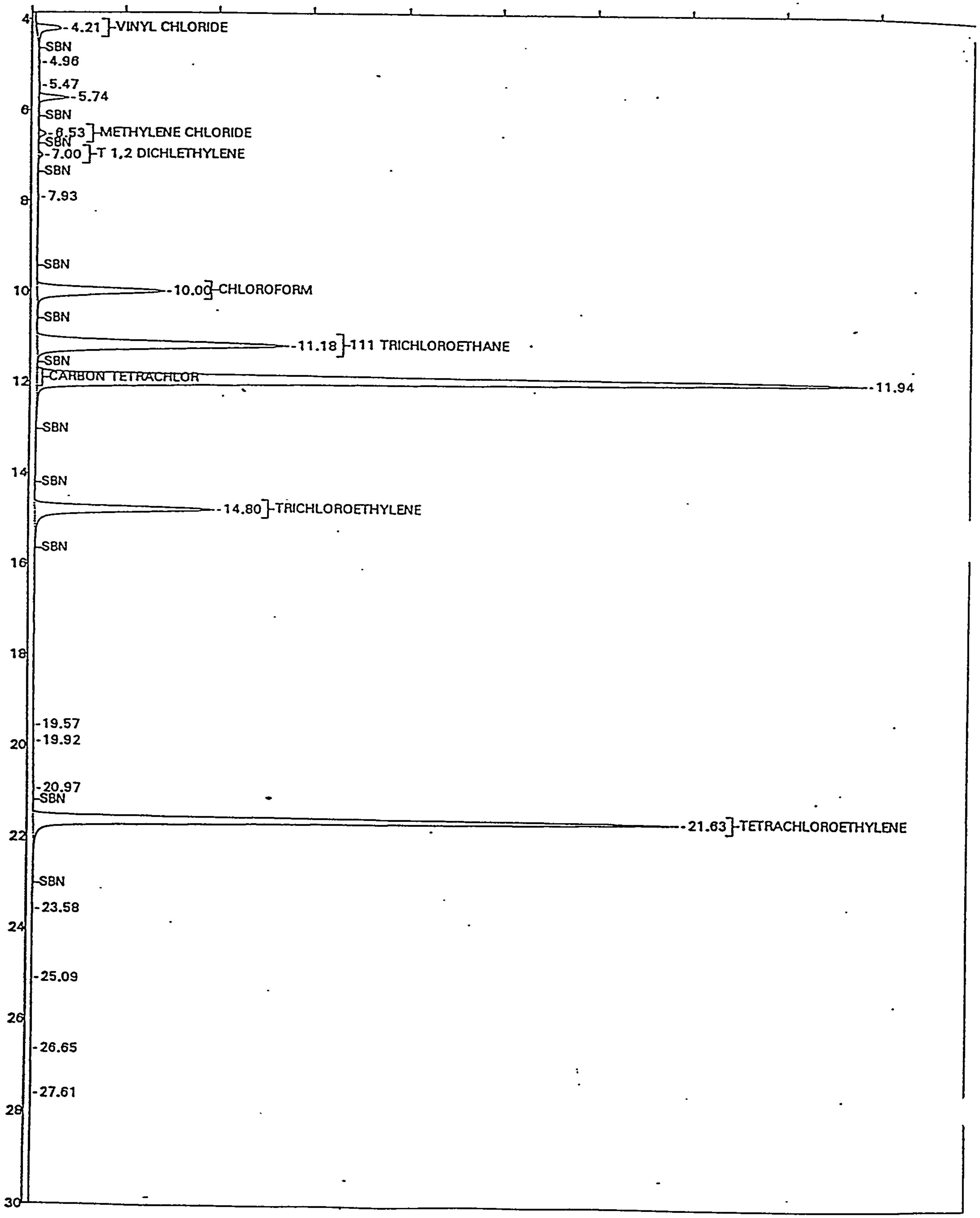


Figure 8. Gas Chromatogram (ECD) of VOC Standard "K4", Level 5

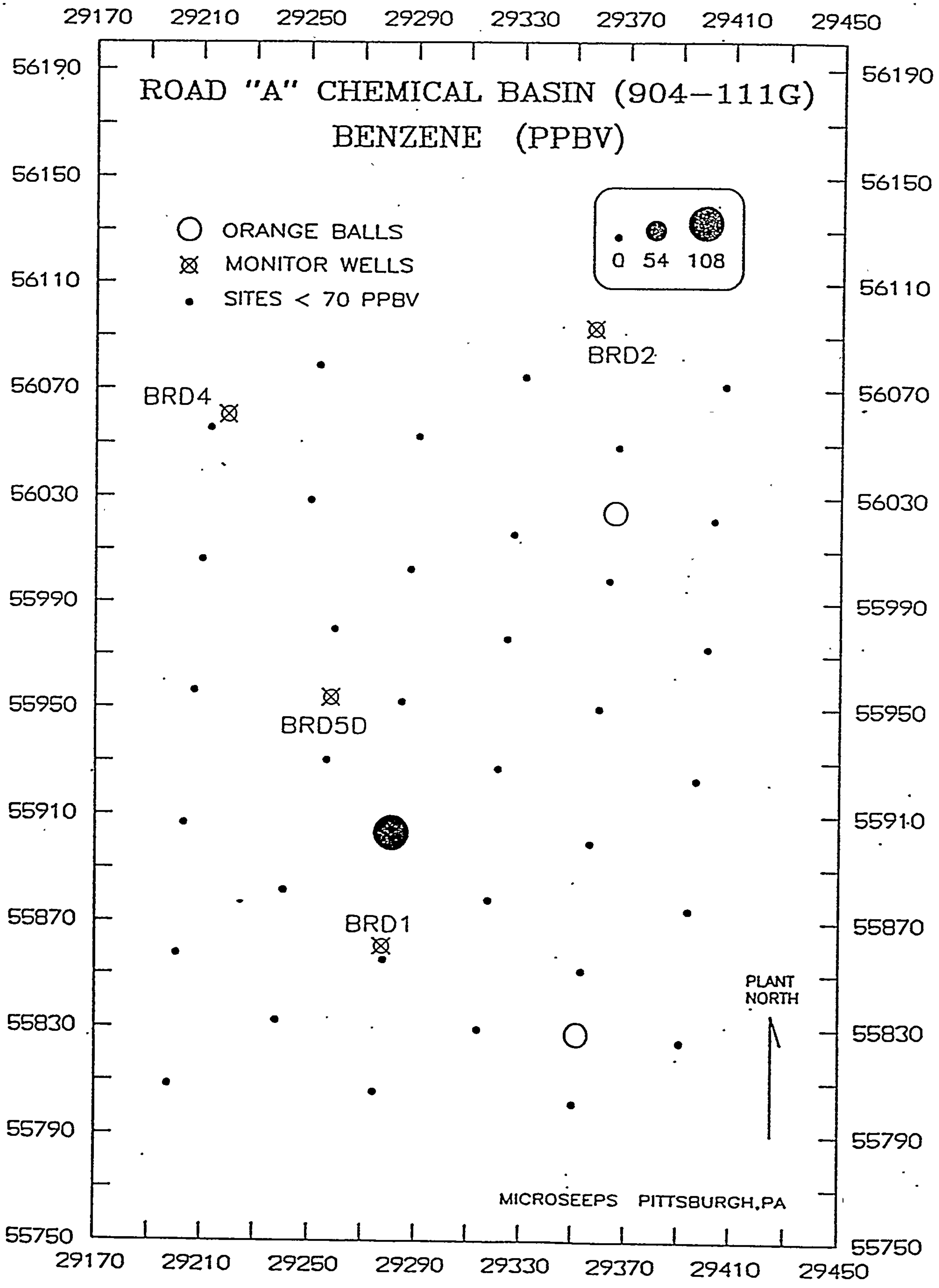


Figure 10 Benzene Symbol Map

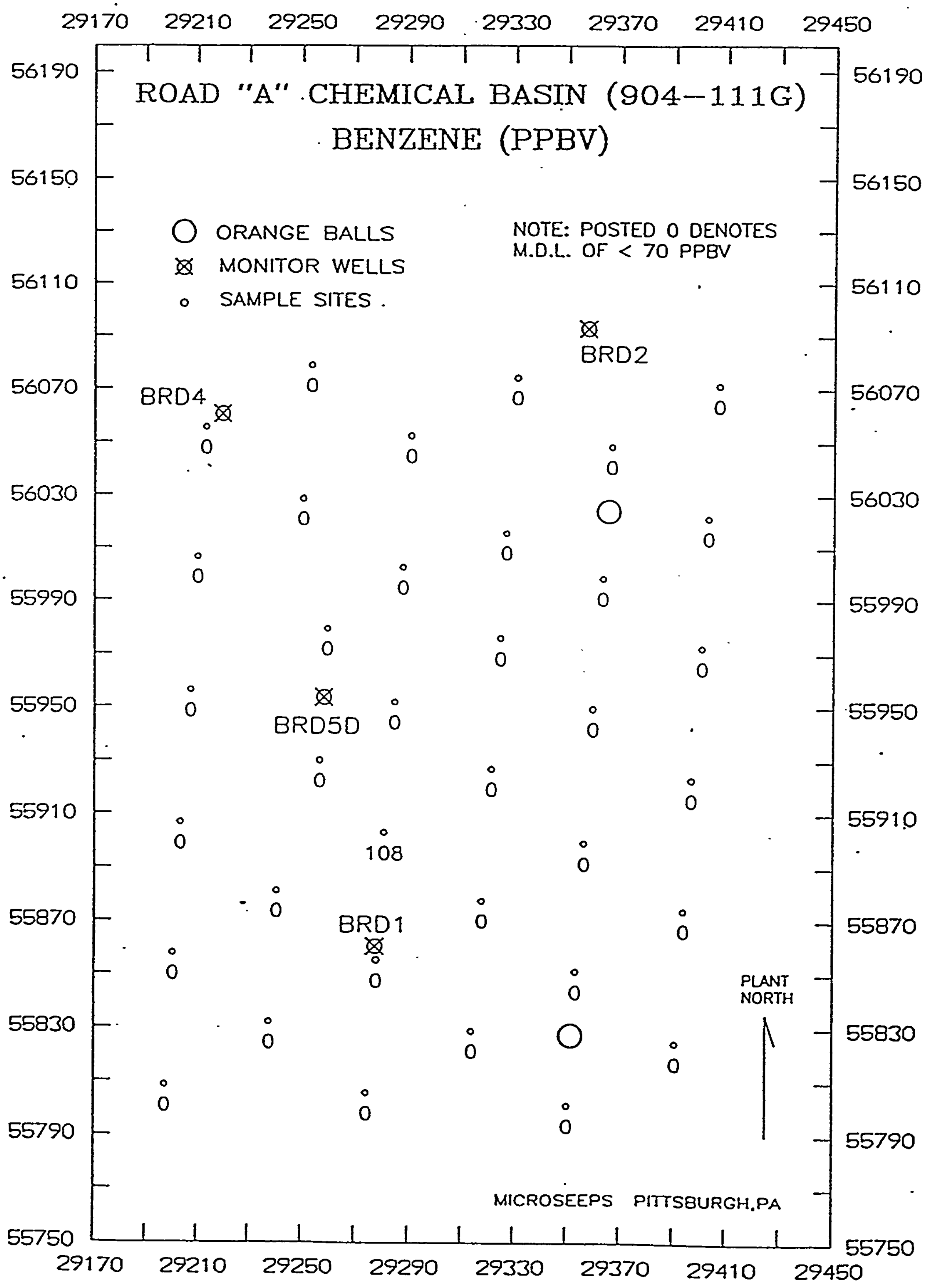


Figure 11. Benzene (ppbv) Map

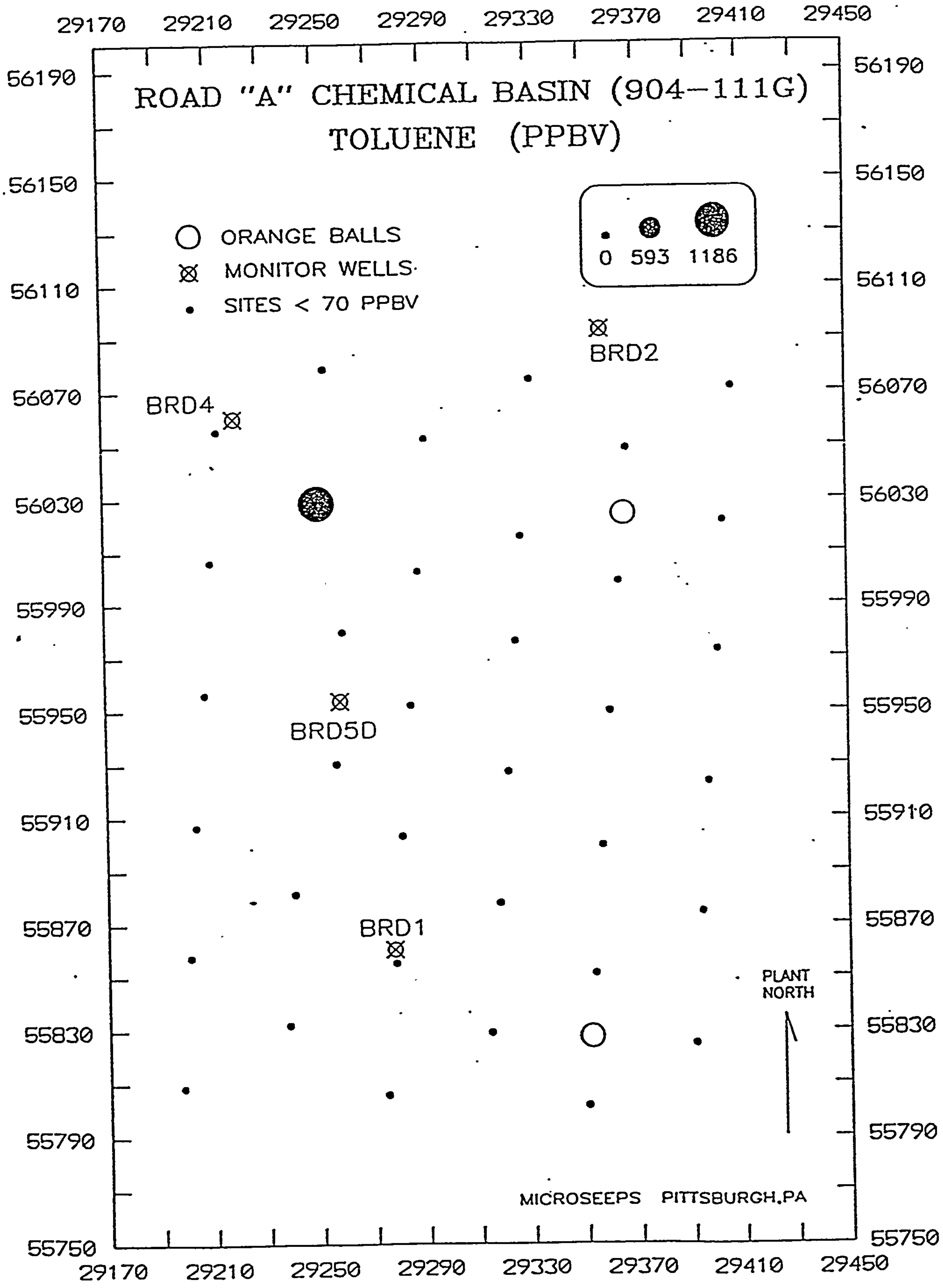


Figure 12. Toluene Symbol Map

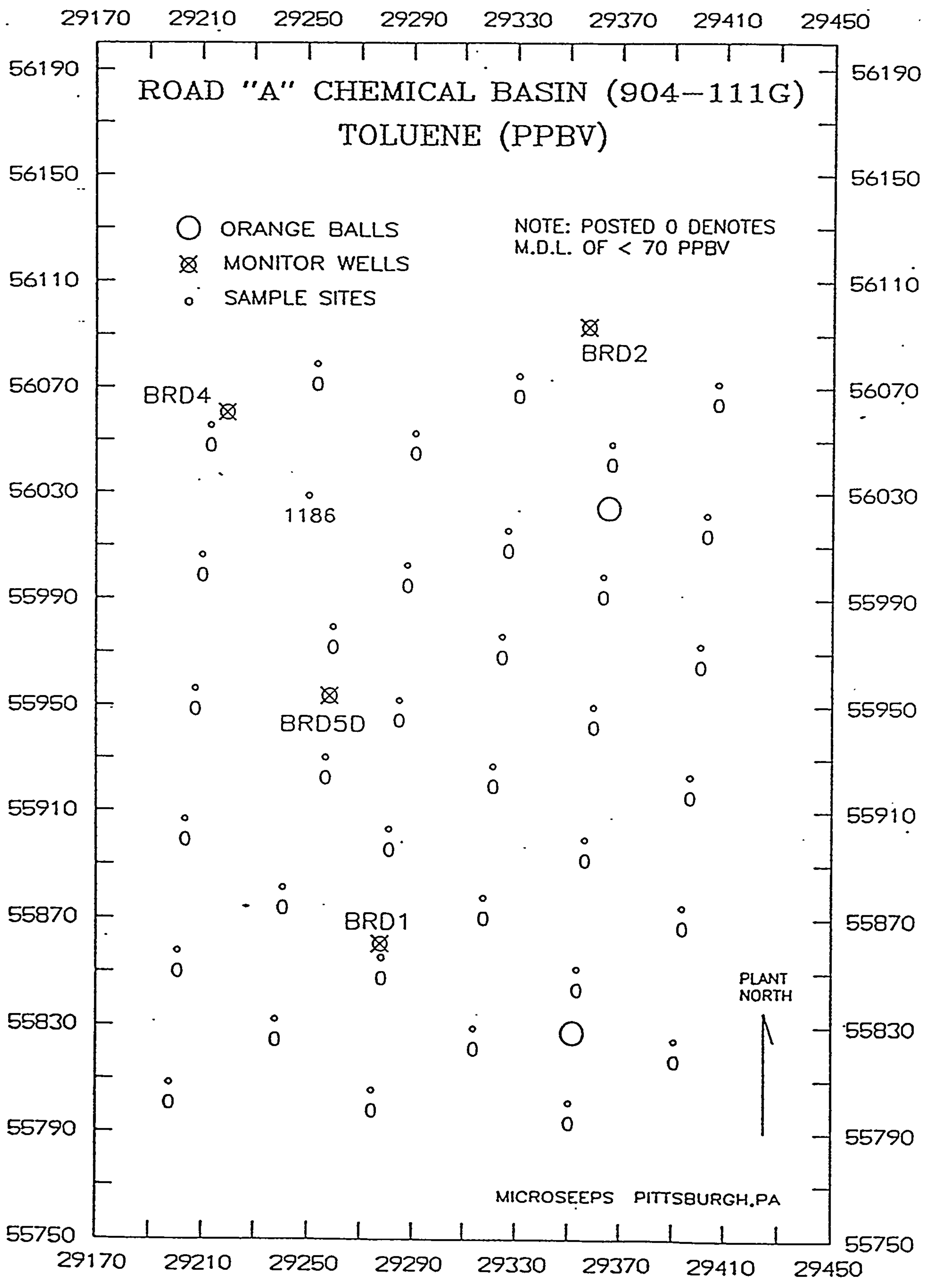


Figure 13. Toluene (ppbv) Map

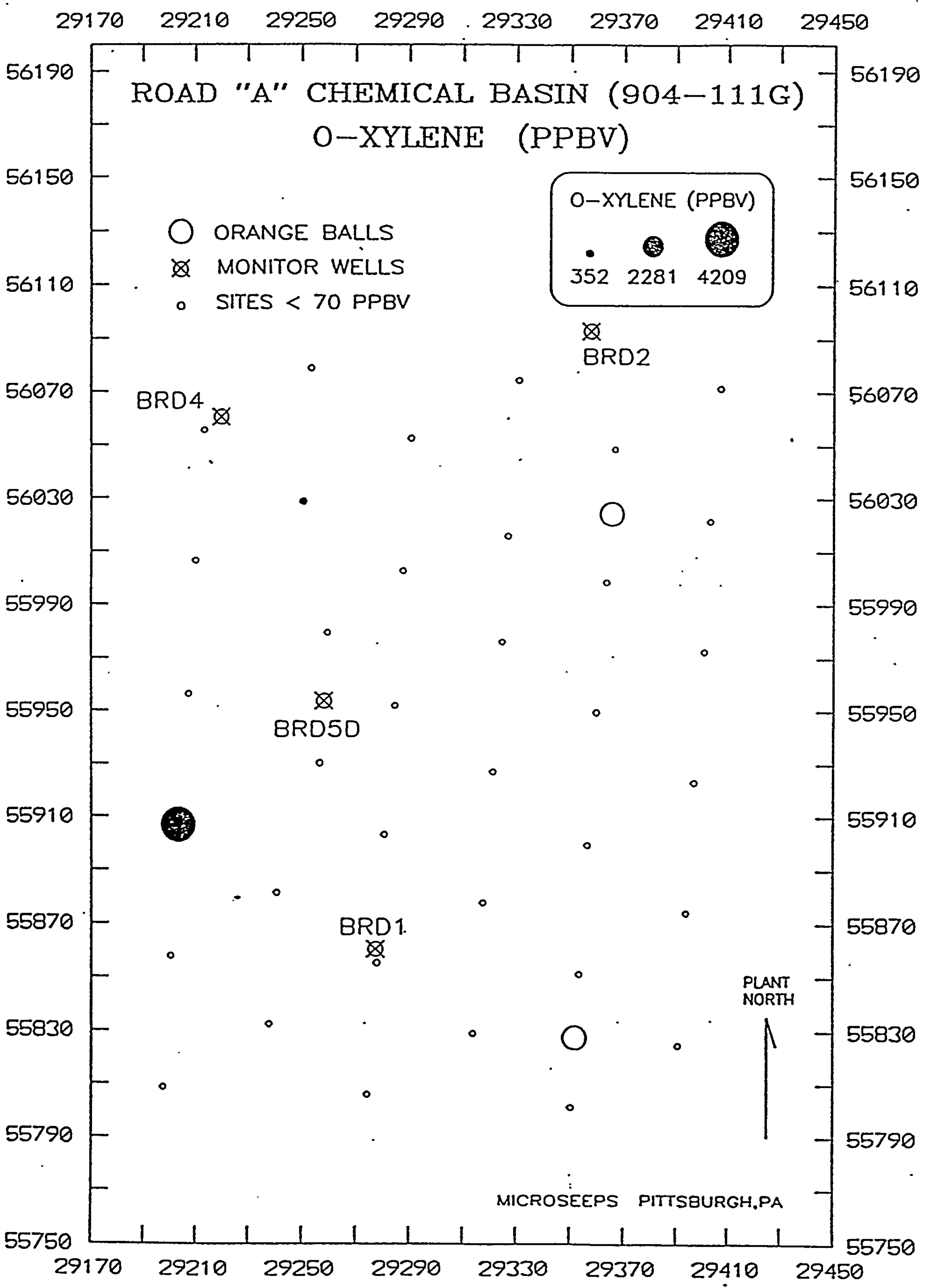


Figure 14. o-Xylene Symbol Map

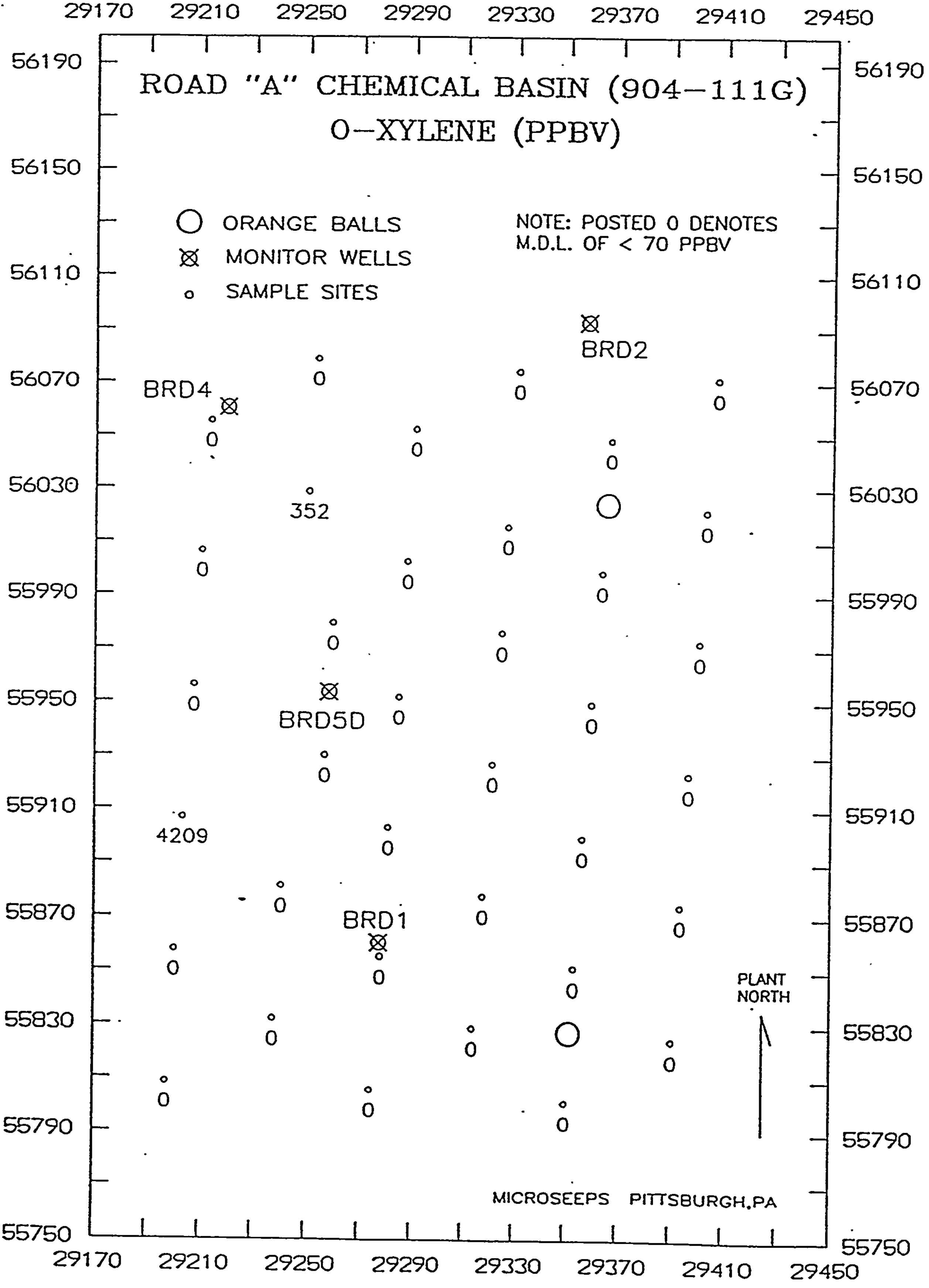


Figure 15. o-Xylene (ppbv) Map

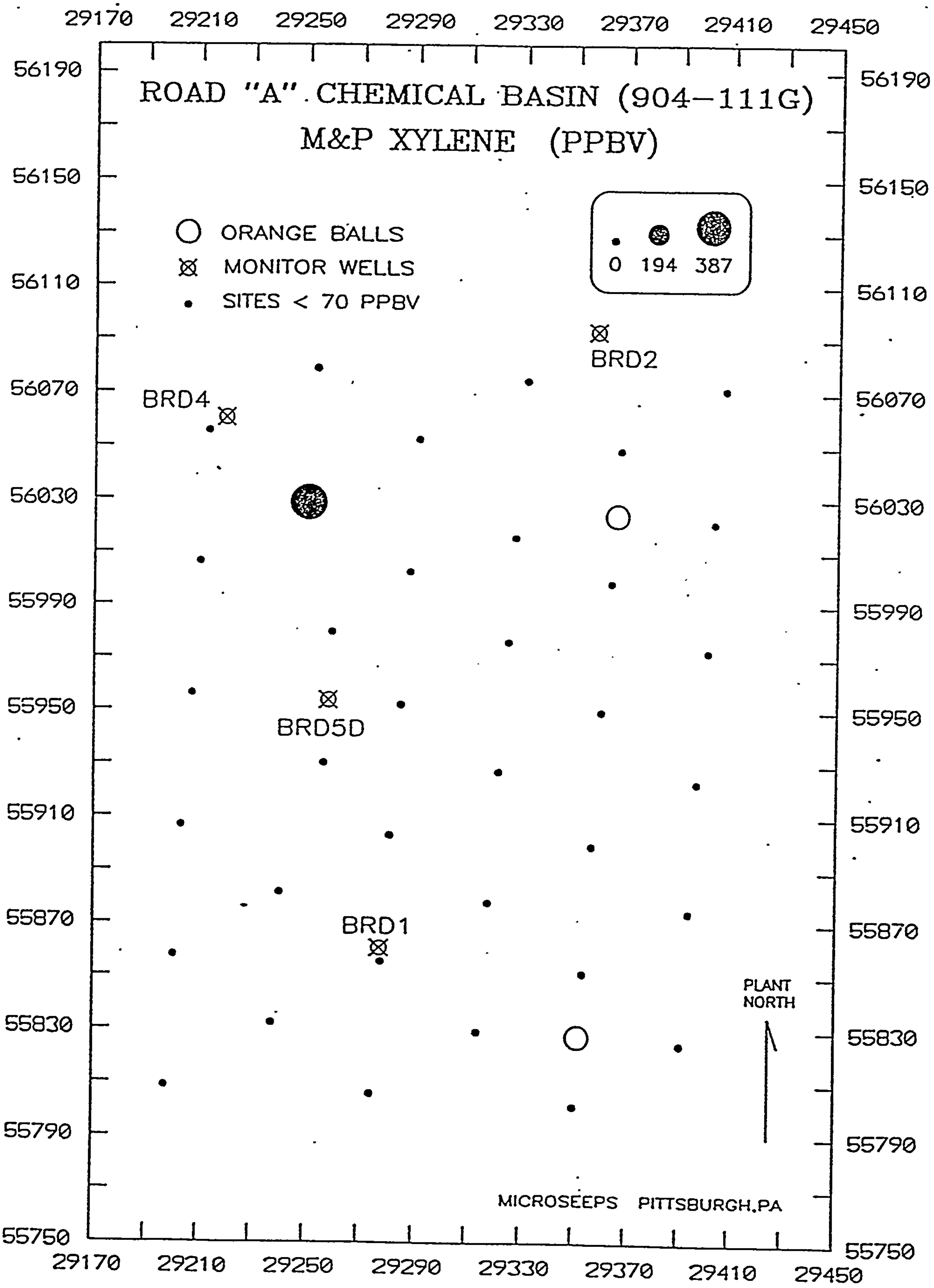


Figure 16. m&p-Xylene Symbol Map

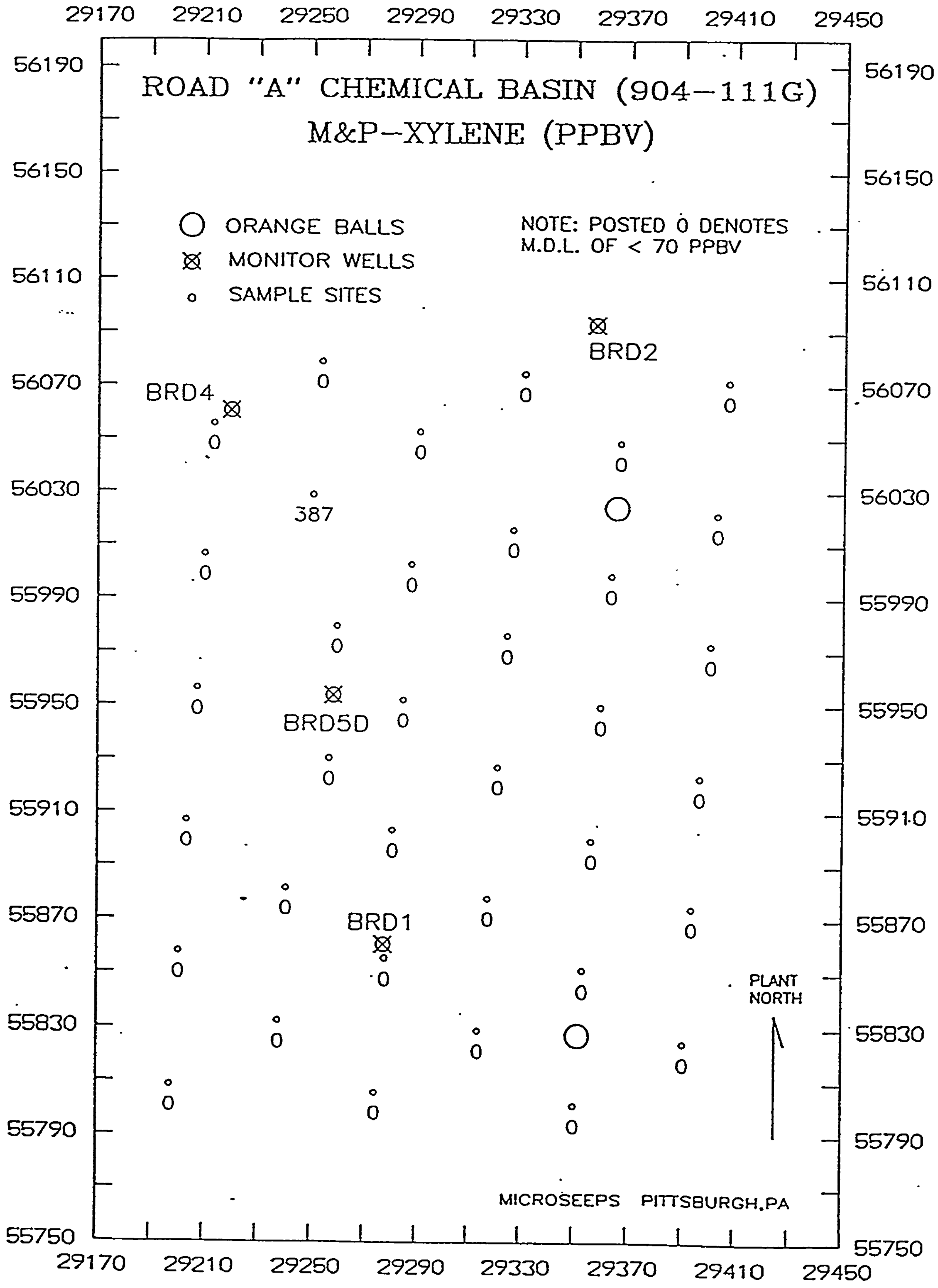


Figure 17. m&p-Xylene (ppbv) Map

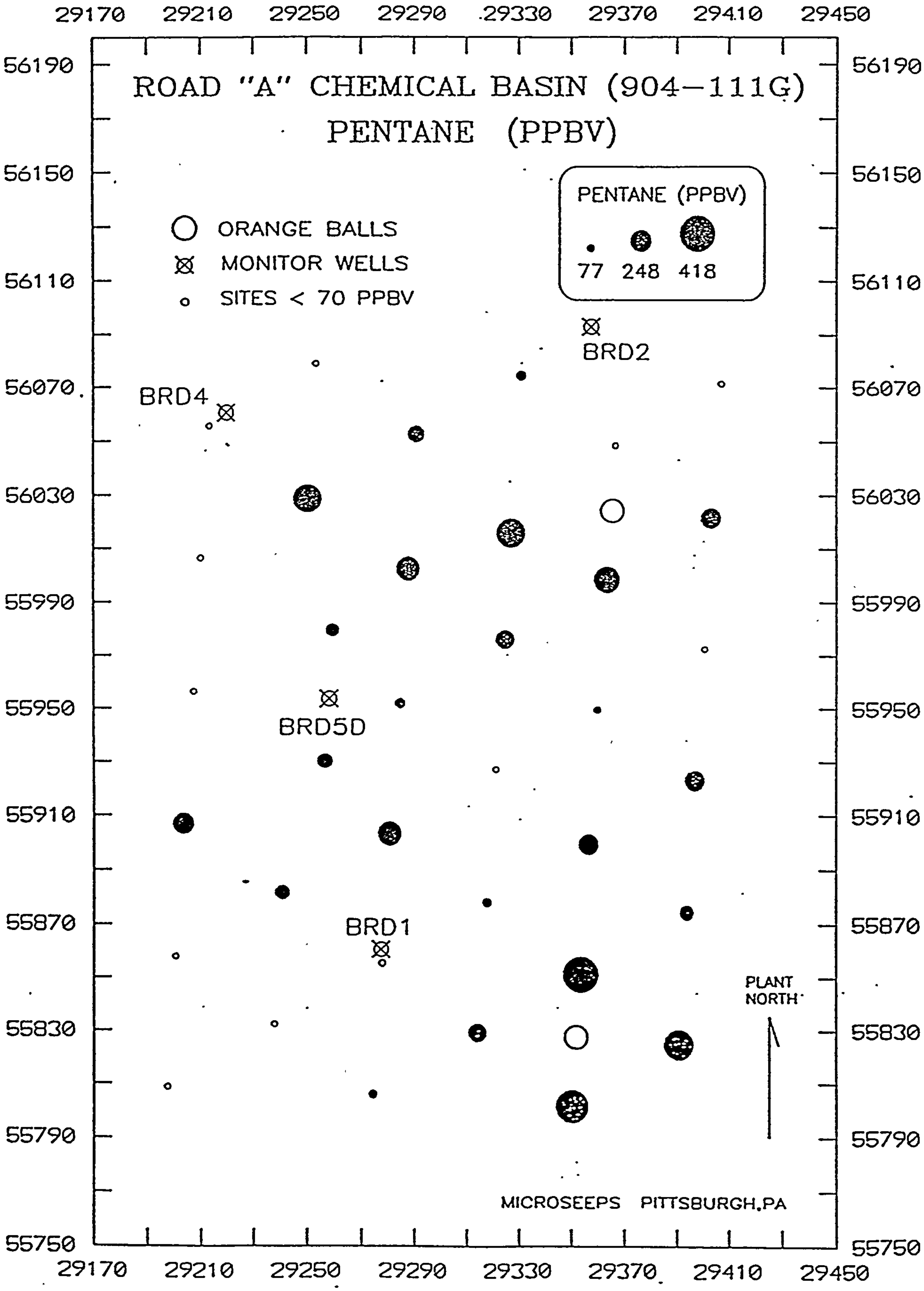


Figure 18. Pentane Symbol Map

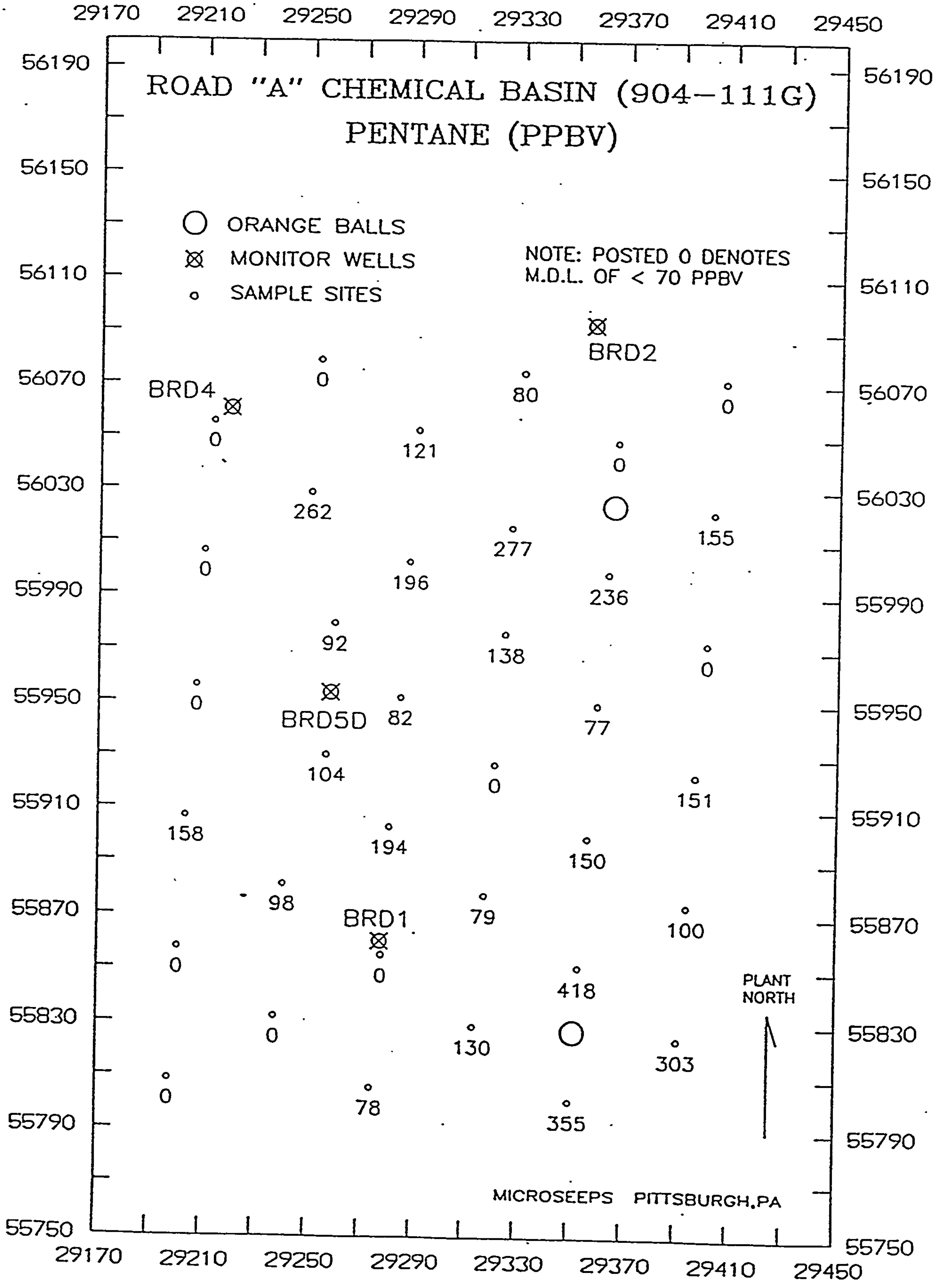


Figure 19. Pentane (ppbv) Map

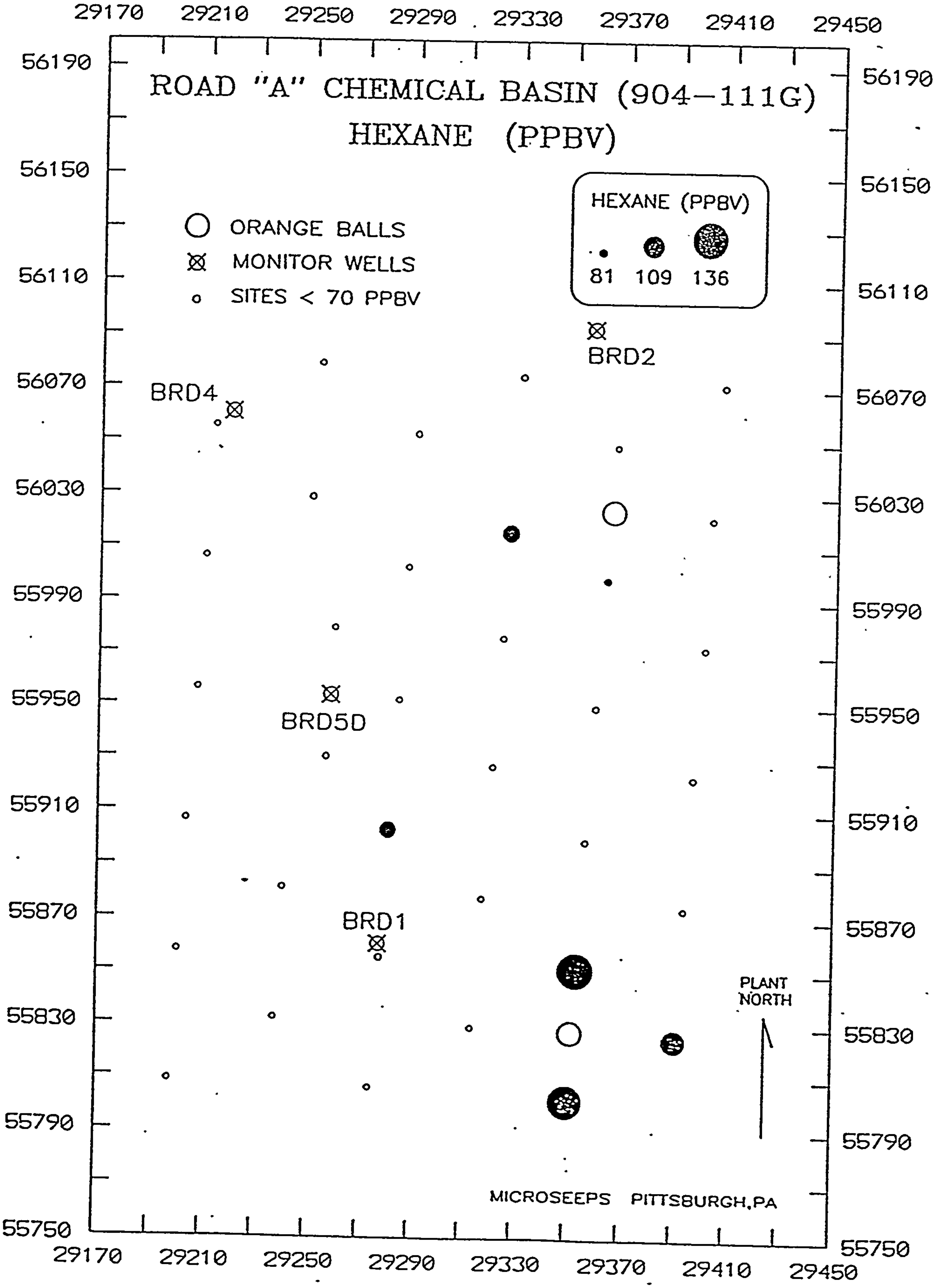


Figure 20 Hexane

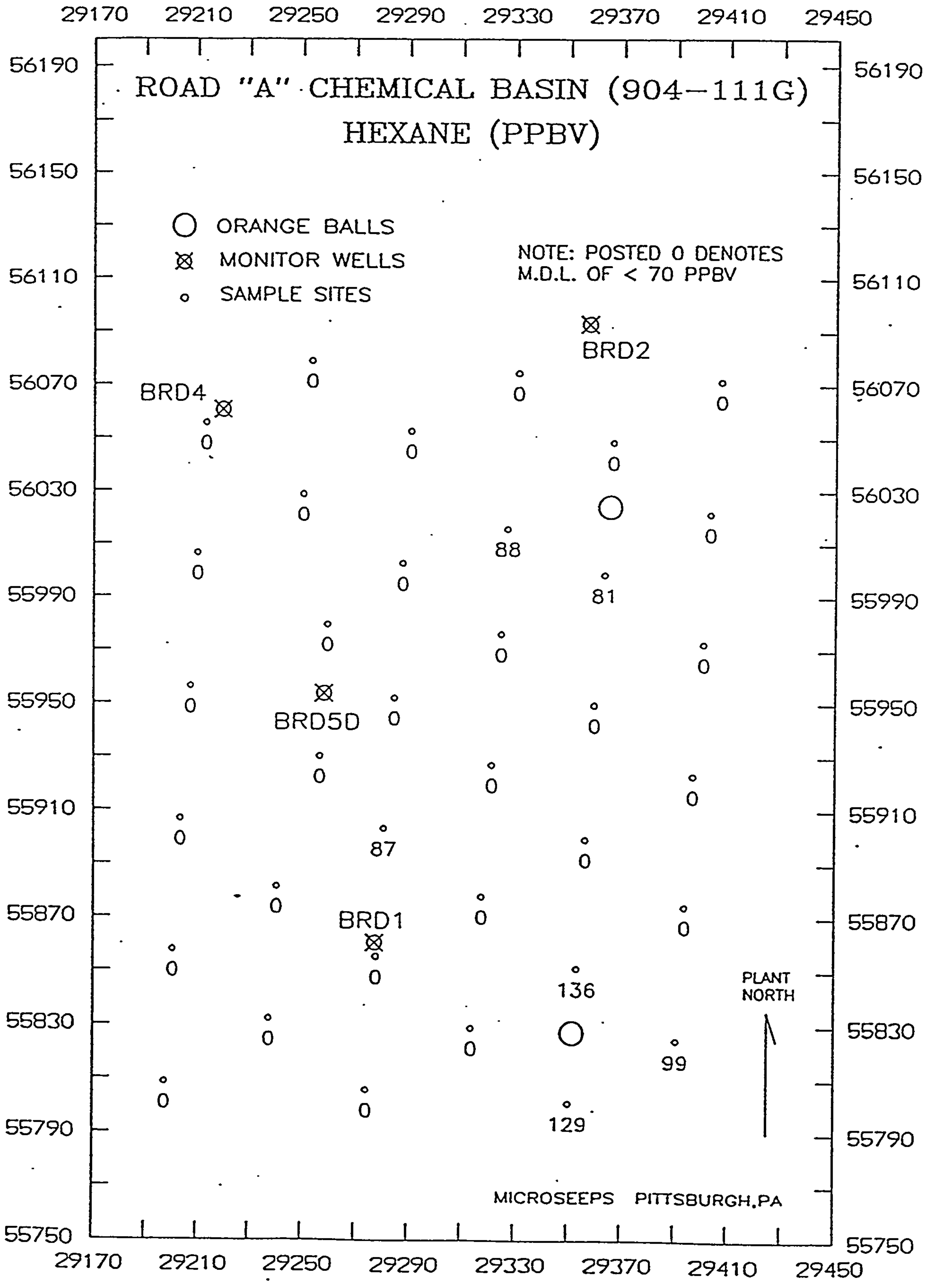
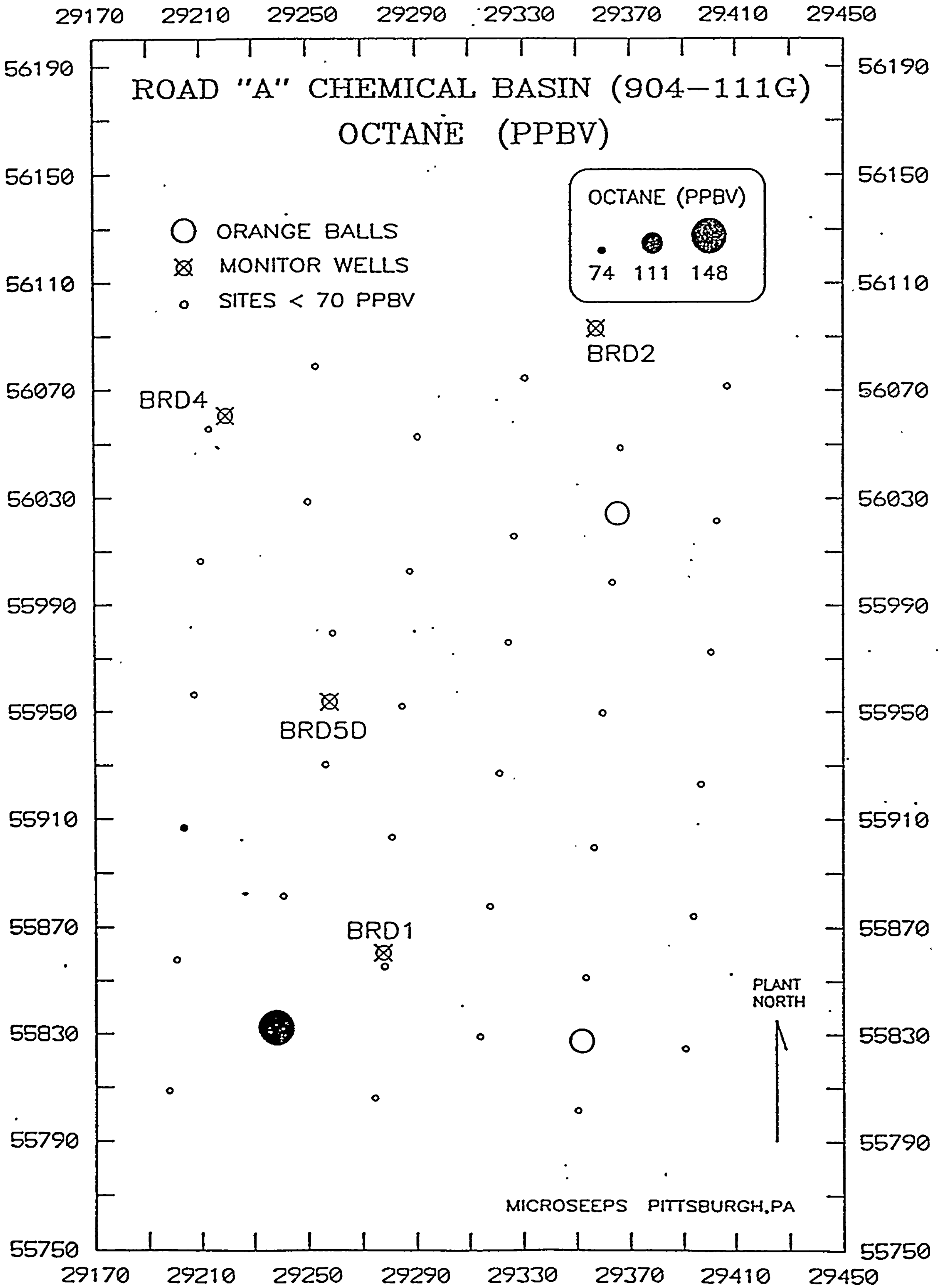


Figure 21. Hexane (ppbv) Map


ROAD "A" CHEMICAL BASIN (904-111G)
OCTANE (PPBV)
ORANGE BALLS
MONITOR WELLS
SITES < 70 PPBV
OCTANE (PPBV)
74
111
148
BRD2
BRD4
BRD5D
BRD1
PLANT NORTH
MICROSEEPS PITTSBURGH,PA
29170
29210
29250
29290
29330
29370
29410
29450
56190
56150
56110
56070
56030
55990
55950
55910
55870
55830
55790
55750

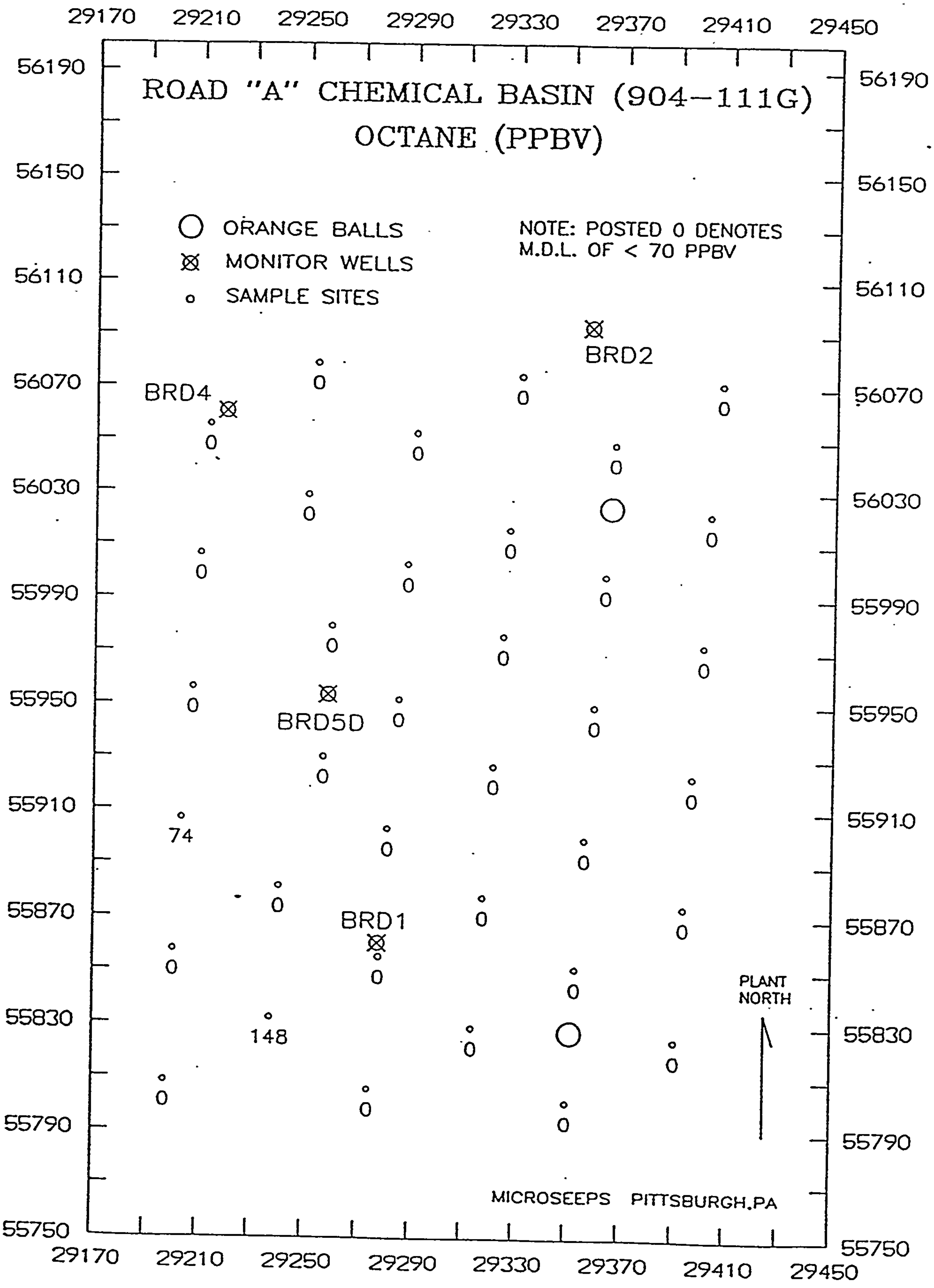


Figure 23. Octane (ppbv) Map

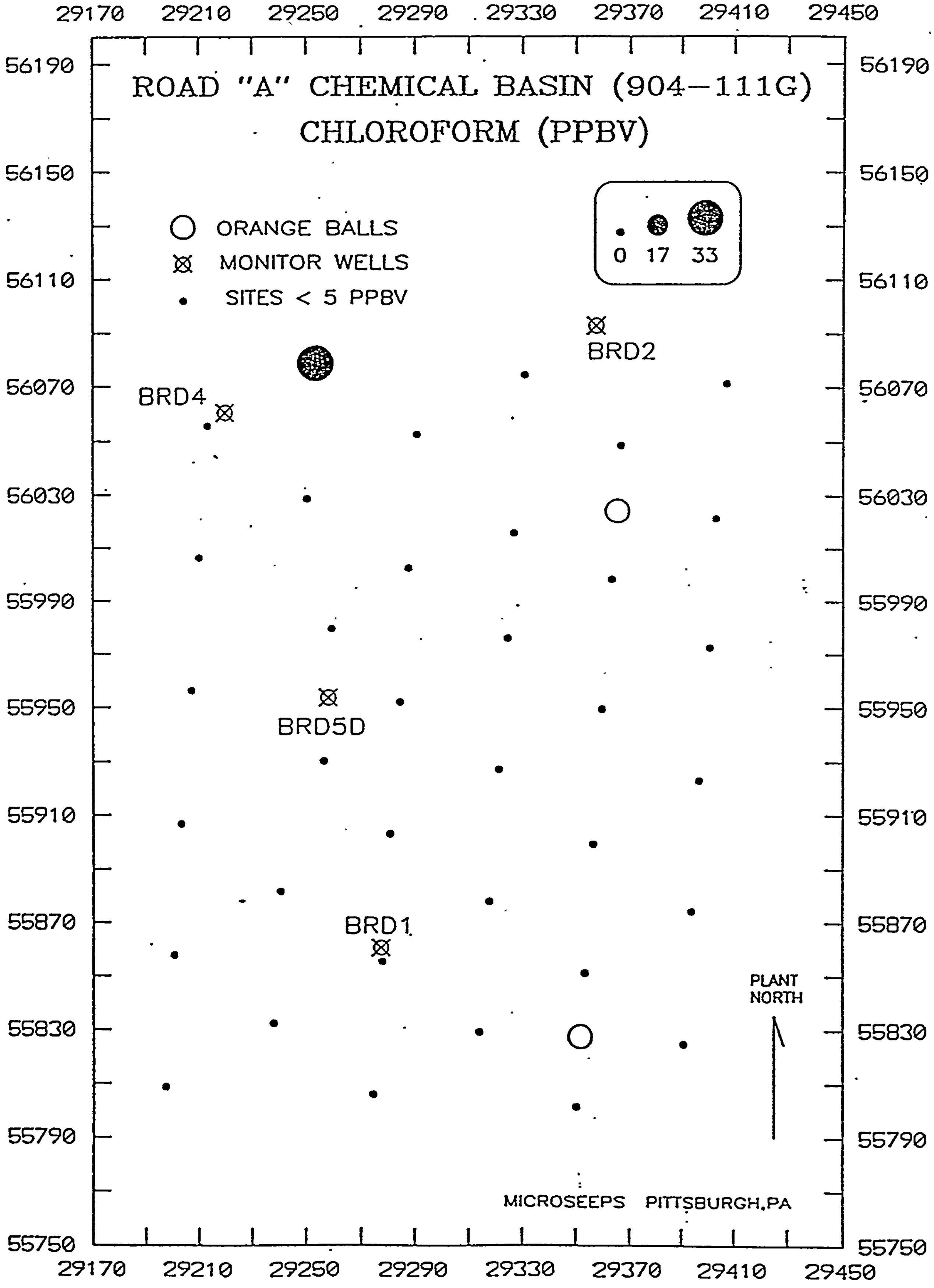


Figure 24. Chloroform Symbol Map

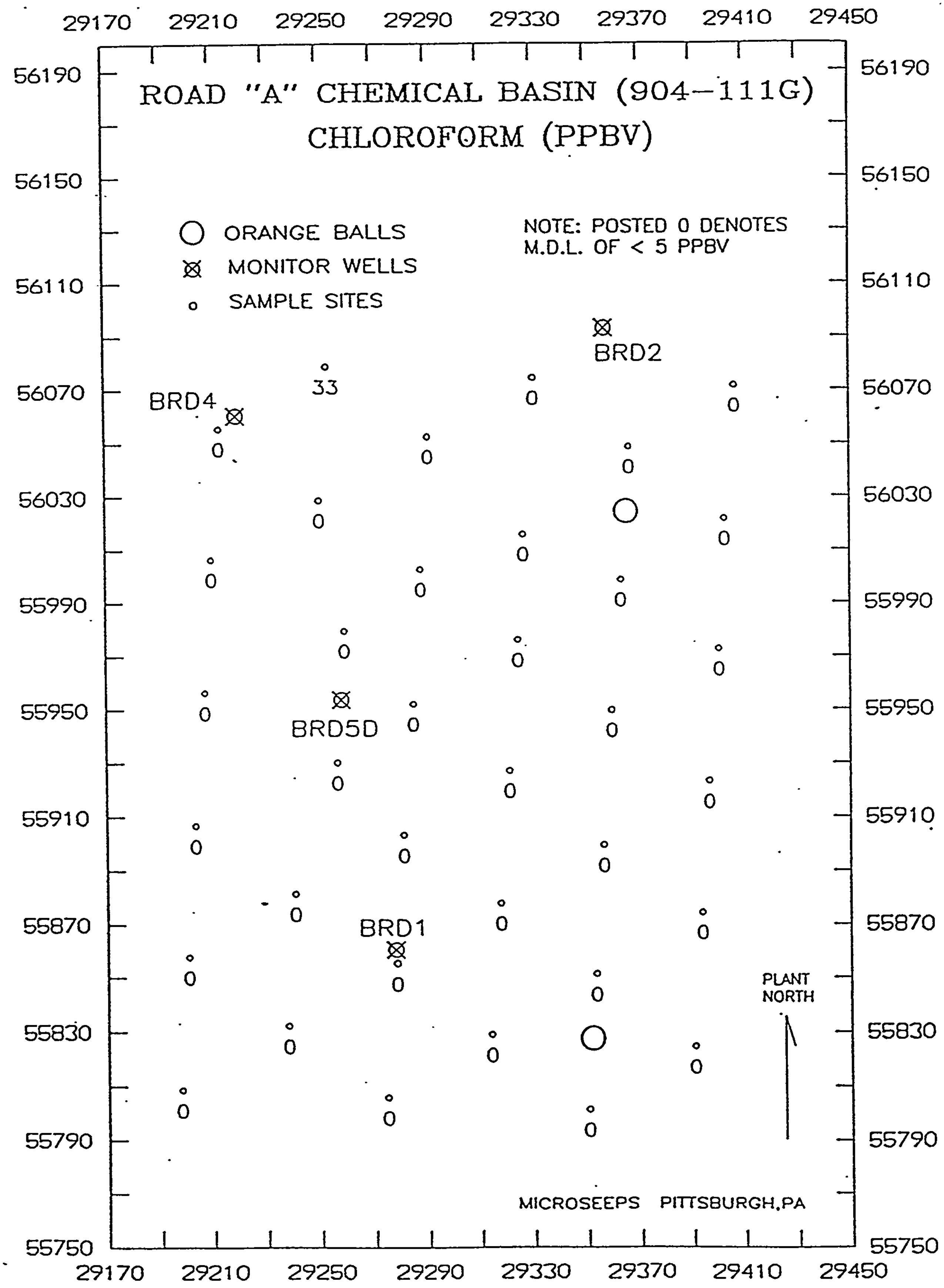


Figure 25. Chloroform (ppbv) Map

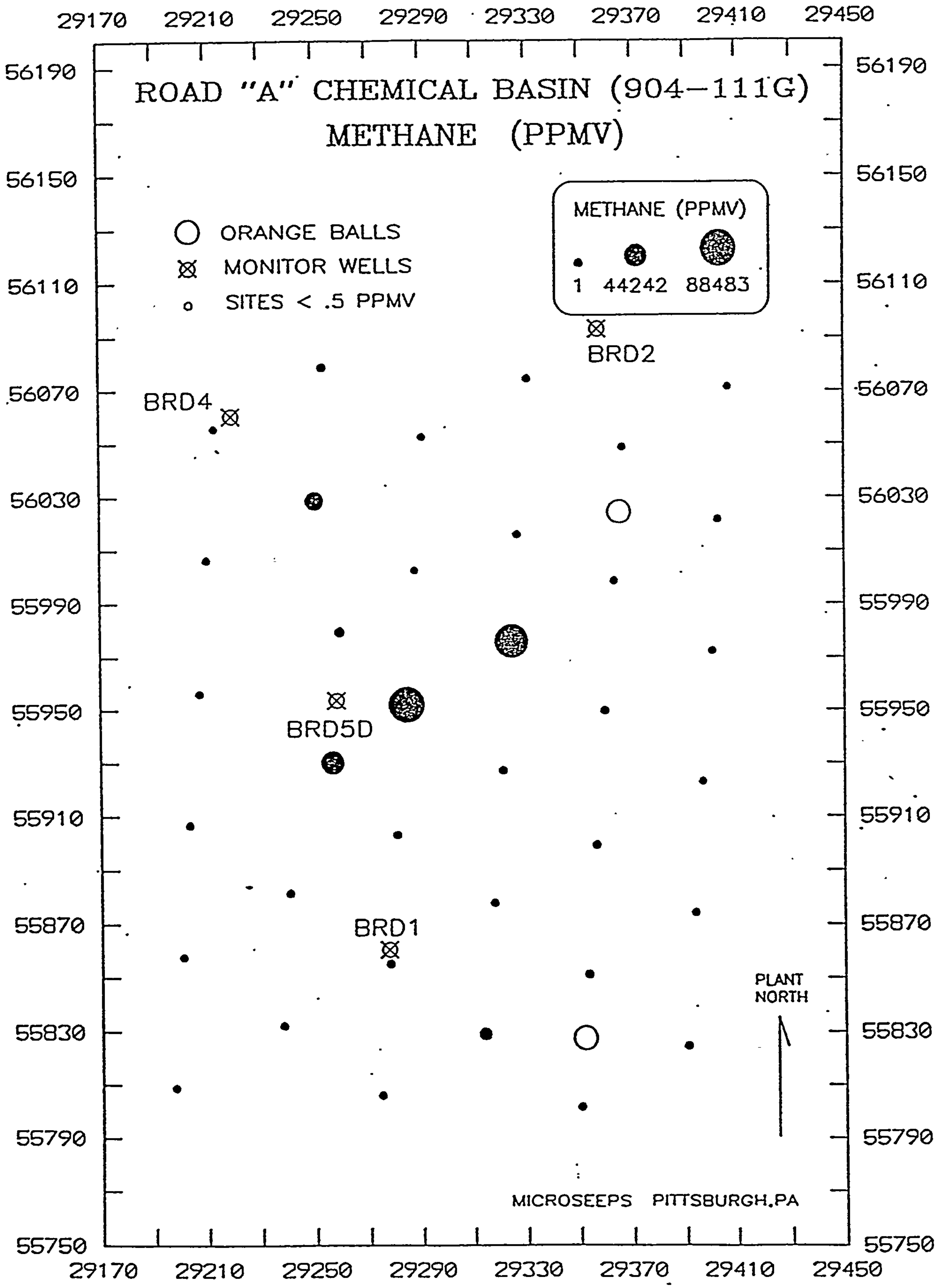


Figure 26. Methane Symbol Map

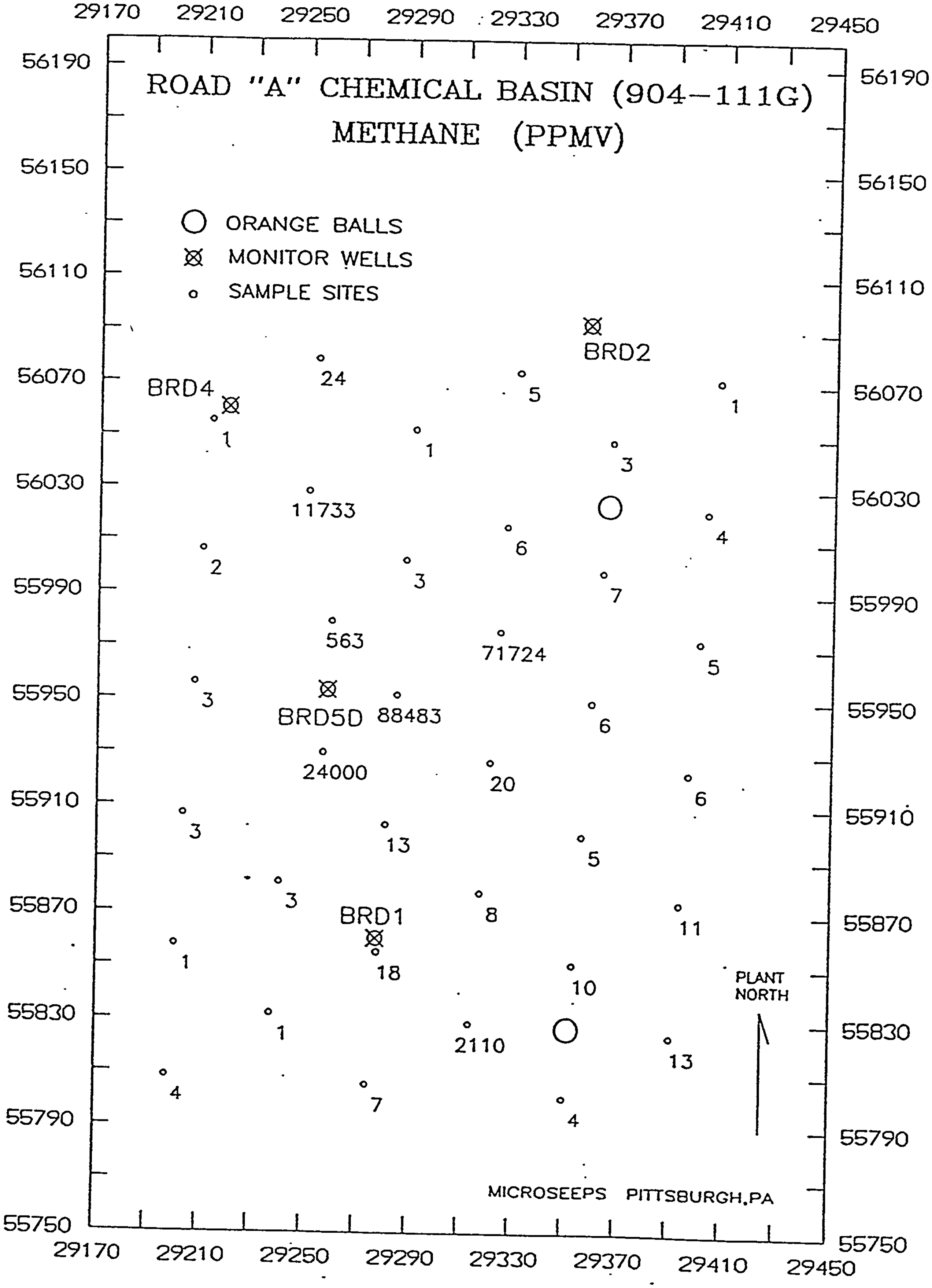


Figure 27. Methane (ppmv) Map

MICROSEEPS

----- SAVANNAH RIVER SITE -----
----- ROAD A CHEMICAL BASIN (904-111G) -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	PENTANE	HEXANE	HEPTANE	BENZENE	OCTANE	TOLUENE	NONANE	ETHYL BENZENE	M&P-XYLENE	O-XYLENE	DECANE
904-111G-1	0.30	0.10	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-2	0.36	0.13	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-3	0.42	0.14	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-4	0.10	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-5	0.15	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-6	0.15	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-7	0.08	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-8	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-9	0.24	0.08	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-10	0.16	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-10A	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-11	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-12	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-13	0.08	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-14	0.12	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-15	0.28	0.09	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-16	0.20	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-17	0.14	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-18	0.03	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-19	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-20	0.19	0.09	<.07	0.11	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-20A	0.19	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-21	0.08	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-22	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-23	0.13	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-24	0.08	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-25	<.07	<.07	<.07	<.07	0.15	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-26	0.10	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-27	0.10	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-28	0.09	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-29	0.26	<.07	<.07	<.07	<.07	1.19	<.07	<.07	0.39	0.35	<.07
904-111G-30	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-30A	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-31	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-32	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-33	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-34	0.16	<.07	<.07	<.07	0.07	<.07	<.07	<.07	<.07	4.21	<.07
904-111G-35	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G-36	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G*SB1	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G*SB2	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G*SB3	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
904-111G*SB4	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07

Table 1. Hydrocarbon Soil Gas Concentrations and System Blanks at the Road A Chemical Basin (904-111G)

14-Dec-92

MICROSEEPS

----- SAVANNAH RIVER SITE -----
----- ROAD A CHEMICAL BASIN (904-111G) -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	VINYL CHLORIDE	METHYLENE CHLORIDE	TRANS 1,2 DICHLORO ETHYLENE	CHLORO FORM	111 TRI CHLORO ETHANE	CARBON TETRA CHLORIDE	TRI CHLORO ETHYLENE	TETRA CHLORO ETHYLENE	FILE #
904-111G-1	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 155
904-111G-2	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 156
904-111G-3	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 157
904-111G-4	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 158
904-111G-5	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 159
904-111G-6	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 160
904-111G-7	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 161
904-111G-8	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 162
904-111G-9	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 163
904-111G-10	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 164
904-111G-10A	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 165
904-111G-11	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 168
904-111G-12	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 169
904-111G-13	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 170
904-111G-14	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 171
904-111G-15	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 172
904-111G-16	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 173
904-111G-17	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 174
904-111G-18	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 175
904-111G-19	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 176
904-111G-20	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 177
904-111G-20A	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 178
904-111G-21	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 181
904-111G-22	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 182
904-111G-23	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 183
904-111G-24	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 184
904-111G-25	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 185
904-111G-26	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 186
904-111G-27	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 187
904-111G-28	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 188
904-111G-29	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 189
904-111G-30	<3	<2	<.10	0.033	<.005	<.005	<.005	<.005	W23 190
904-111G-30A	<3	<2	<.10	0.035	<.005	<.005	<.005	<.005	W23 191
904-111G-31	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 194
904-111G-32	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 195
904-111G-33	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 196
904-111G-34	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 197
904-111G-35	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 198
904-111G-36	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 199
904-111G*SB1	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 153
904-111G*SB2	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 166
904-111G*SB3	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 179
904-111G*SB4	<3	<2	<.10	<.005	<.005	<.005	<.005	<.005	W23 192

Table 2. Chlorinated Hydrocarbon Soil Gas Concentrations and System Blanks at the Road A Chemical Basin (904-111G)

14-Dec-92

MICROSEEPS

----- SAVANNAH RIVER SITE -----
----- ROAD A CHEMICAL BASIN (904-111G) -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	METHANE (PPMV)	ETHANE (PPBV)	PROPANE (PPBV)	I-BUTANE (PPBV)	N-BUTANE (PPBV)	ETHYLENE (PPBV)	PROPYLENE (PPBV)
904-111G-1	13.132	1363	561	197	207	802	878
904-111G-2	4.443	393	171	71	72	251	577
904-111G-3	9.589	487	180	127	<5	325	346
904-111G-4	11.332	734	263	194	122	504	585
904-111G-5	5.080	303	143	109	<5	217	248
904-111G-6	5.579	309	120	34	<5	165	196
904-111G-7	5.531	356	92	20	<5	199	192
904-111G-8	4.615	111	39	49	<5	52	61
904-111G-9	6.780	116	48	<5	<5	77	81
904-111G-10	3.737	183	79	17	<5	154	155
904-111G-10A	3.821	136	52	40	<5	113	106
904-111G-11	3.167	166	62	29	<5	122	118
904-111G-12	1.422	37	14	6	<5	29	25
904-111G-13	4.596	237	88	124	<5	188	209
904-111G-14	1.319	134	61	23	<5	91	113
904-111G-15	5.744	390	147	91	<5	279	287
904-111G-16	3.383	312	122	26	24	204	199
904-111G-17	71724.000	ND	395	262	143	480	580
904-111G-18	88483.000	ND	1097	216	1664	<5	221
904-111G-19	20.353	129	73	<5	87	88	90
904-111G-20	12.687	400	156	379	<5	341	352
904-111G-20A	50.438	688	191	147	<5	386	378
904-111G-21	7.803	102	42	22	<5	82	85
904-111G-22	17.942	65	26	<5	<5	63	61
904-111G-23	2109.900	162	109	113	<5	198	198
904-111G-24	6.642	291	221	<5	445	226	188
904-111G-25	0.723	36	47	<5	103	15	<5
904-111G-26	2.940	181	75	<5	19	135	137
904-111G-27	24000.000	ND	169	25	<5	156	198
904-111G-28	563.010	98	52	<5	<5	107	101
904-111G-29	11733.333	ND	238	<5	<5	145	201
904-111G-30	24.017	22	12	<5	<5	17	21
904-111G-30A	2.585	19	7	<5	<5	16	16
904-111G-31	1.230	10	5	<5	<5	11	13
904-111G-32	2.395	15	9	<5	<5	5	<5
904-111G-33	3.345	51	19	<5	<5	40	46
904-111G-34	3.460	262	118	102	<5	190	215
904-111G-35	0.660	53	21	<5	<5	38	40
904-111G-36	4.294	86	21	39	<5	81	57
904-111G*SB1	1.772	<5	<5	<5	<5	5	<5
904-111G*SB2	1.791	6	<5	<5	<5	<5	<5
904-111G*SB3	3.439	5	<5	<5	<5	<5	<5
904-111G*SB4	1.900	<5	<5	<5	<5	<5	<5

Table 3.- Light Hydrocarbon Soil Gas Concentrations and System Blanks at the Road A Chemical Basin (904-111G)

— VOC STANDARD CONCENTRATIONS (ppmv) —

COMPOUND	RANGE 1	RANGE 2	RANGE 3	RANGE 4	RANGE 5	RANGE 6
PENTANE	942.19	91.52	9.13	0.91	0.091	0.0091
11 DICHLOROETHYLENE	1358.80	131.99	13.16	1.32	0.132	0.0132
METHYLENE CHLORIDE	1694.16	164.57	16.41	1.64	0.164	0.0164
TRANS 1,2 DICHLOROETHYLENE	1408.09	136.78	13.64	1.36	0.136	0.0136
11 DICHLOROETHANE	1291.56	125.46	12.51	1.25	0.125	0.012[illegible]
CHLOROFORM	1356.81	131.80	13.14	1.31	0.131	0.013[illegible]
111 TRICHLOROETHANE	1089.10	105.79	10.55	1.05	0.105	0.0105
CARBON TETRACHLORIDE	1125.32	109.31	10.90	1.09	0.109	0.0109
HEPTANE	741.22	72.00	7.18	0.72	0.072	0.0072
BENZENE	1214.92	118.02	11.77	1.18	0.118	0.0118
TRICHLOROETHYLENE	1208.33	117.38	11.70	1.17	0.117	0.0117
OCTANE	668.30	64.92	6.47	0.65	0.065	0.0065
TOLUENE	1021.92	99.27	9.90	0.99	0.099	0.0099
TETRACHLOROETHYLENE	1062.81	103.24	10.29	1.03	0.103	0.0103
NONANE	607.90	59.05	5.89	0.59	0.059	0.0059
ETHYL BENZENE	886.78	86.14	8.59	0.86	0.086	0.0086
M-XYLENE	883.71	85.84	8.56	0.86	0.086	0.0086
P-XYLENE	880.64	85.54	8.53	0.85	0.085	0.0085
O-XYLENE	888.83	86.34	8.61	0.86	0.086	0.0086
DECANE	557.12	54.12	5.40	0.54	0.054	0.0054

Table 4. VOC Prepared Standard Concentrations

----- OCTOBER, 1992 (D23) STANDARDS -----
----- GAS CONCENTRATIONS IN (PPMV) -----

STANDARD NAME	AREA	GC CYCLE	PENTANE	HEXANE	HEPTANE	BENZENE	OCTANE	TOLUENE	NONANE	ETHYL BENZENE	M&P-XYLENE	O-XYLENE	DECANE
STD K4 R5	ALL	W23 5	NA	NA	0.07	0.12	0.07	0.10	0.06	0.08	0.17	0.10	0.07
STD K4 R5	ALL	W23 6	NA	NA	0.07	0.12	0.07	0.10	0.06	0.09	0.17	0.09	0.05
STD K4 R5	289-F	W23 85	NA	NA	0.07	0.11	0.07	0.10	0.05	0.07	0.16	0.10	0.05
STD K4 R5	904-111G	W23 180	NA	NA	0.07	0.12	0.08	0.12	0.06	0.09	0.17	0.08	0.06
MEAN	....				0.07	0.12	0.07	0.10	0.06	0.08	0.17	0.09	0.06
STD DEV	....				0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.00
% STD DEV	....				3.07	3.34	5.78	7.74	5.17	7.60	4.49	9.59	8.36
STD K4 R4	ALL	W23 7	NA	NA	0.72	1.19	0.66	1.01	0.60	0.88	1.76	0.88	0.57
STD K4 R4	ALL	W23 8	NA	NA	0.72	1.18	0.65	0.99	0.59	0.86	1.71	0.86	0.54
STD K4 R4	489-D	W23 22	NA	NA	0.73	1.20	0.65	1.01	0.60	0.88	1.75	0.88	0.55
STD K4 R4	489-D	W23 48	NA	NA	0.72	1.21	0.65	1.00	0.58	0.86	1.69	0.87	0.51
STD K4 R4	289-F	W23 72	NA	NA	0.71	1.18	0.63	0.99	0.58	0.85	1.70	0.86	0.53
STD K4 R4	289-F	W23 98	NA	NA	0.72	1.20	0.64	1.00	0.59	0.86	1.71	0.88	0.54
STD K4 R4	189-K	W23 114	NA	NA	0.72	1.18	0.64	1.00	0.57	0.85	1.66	0.86	0.51
STD K4 R4	189-K	W23 141	NA	NA	0.69	1.17	0.61	0.95	0.55	0.81	1.58	0.82	0.47
STD K4 R4	904-111G	W23 167	NA	NA	0.70	1.18	0.64	0.99	0.58	0.86	1.70	0.86	0.53
STD K4 R4	904-111G	W23 193	NA	NA	0.70	1.15	0.62	0.95	0.56	0.82	1.62	0.82	0.50
STD K4 R4	ALL	W23 213	NA	NA	0.72	1.18	0.65	1.00	0.59	0.88	1.74	0.87	0.56
MEAN	....				0.71	1.18	0.64	0.99	0.58	0.85	1.69	0.86	0.53
STD DEV	....				0.01	0.02	0.01	0.02	0.02	0.02	0.05	0.02	0.03
% STD DEV	....				1.42	1.28	2.11	1.92	2.81	2.61	3.05	2.38	5.32
STD K4 R3	ALL	W23 9	9.13	NA	7.22	11.85	6.51	9.99	5.94	8.65	17.24	8.69	5.44
STD K4 R3	ALL	W23 10	9.13	NA	7.18	11.77	6.47	9.90	5.89	8.59	17.09	8.61	5.40
STD K4 R3	489-D	W23 35	9.06	NA	6.99	11.44	6.22	9.53	5.55	8.16	16.05	8.19	4.87
STD K4 R3	189-K	W23 128	8.90	NA	6.94	11.40	6.12	9.37	5.33	7.94	15.45	7.92	4.51
STD K4 R3	ALL	W23 201	8.96	NA	7.02	11.50	6.34	9.71	5.81	8.45	16.86	8.47	5.37
MEAN	....		9.03	NA	7.07	11.59	6.33	9.70	5.71	8.36	16.54	8.38	5.12
STD DEV	....		0.09	NA	0.11	0.18	0.15	0.23	0.23	0.27	0.68	0.28	0.37
% STD DEV	....		1.03	NA	1.55	1.57	2.33	2.36	4.02	3.25	4.12	3.37	7.18
STD K4 R2	ALL	W23 11	91.06	NA	71.93	117.70	65.04	99.41	59.66	86.64	173.21	87.01	55.73
STD K4 R2	ALL	W23 12	91.52	NA	72.00	118.02	64.92	99.27	59.05	86.14	171.38	86.34	54.12
STD K4 R2	ALL	W23 110	91.07	NA	71.29	117.05	63.55	97.17	56.60	83.36	164.03	83.47	49.73
STD K4 R1	ALL	W23 13	946.30	NA	743.70	1217.73	669.02	1024.23	606.03	885.75	1765.12	885.91	552.45
STD K4 R1	ALL	W23 14	942.19	NA	741.22	1214.92	668.30	1021.92	607.90	886.78	1764.35	888.34	557.12
STD 220	ALL	W23 16	NA	104.07	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W23 17	NA	103.20	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W23 220	NA	99.70	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 224	ALL	W23 18	NA	1100.05	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 224	ALL	W23 19	NA	1081.98	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 224	ALL	W23 221	NA	1052.90	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 5. Hydrocarbon Analyses of VOC Standard "K4" in Data Directory 23

----- OCTOBER, 1992 (D23) STANDARDS -----
----- GAS CONCENTRATIONS IN (PPMV) -----

STANDARD NAME	AREA	GC CYCLE	VINYL CHLORIDE	METHYLENE CHLORIDE	TRANS 1,2 DICHLORO ETHYLENE	CHLORO FORM	111 TRI CHLORO ETHANE	CARBON TETRA CHLORIDE	TRI CHLORO ETHYLENE	TETRA CHLORO ETHYLENE
STD K4 R6	ALL	W23 3	NA	NA	NA	0.013	0.011	0.011	0.012	0.010
STD K4 R6	ALL	W23 4	NA	NA	NA	0.013	0.011	0.011	0.012	0.010
STD K4 R6	080-24G	W23 60	NA	NA	NA	0.016	0.014	0.012	0.013	0.011
STD K4 R6	904-111G	W23 154	NA	NA	NA	0.013	0.009	0.011	0.012	0.011
MEAN	....					0.014	0.011	0.011	0.012	0.011
STD DEV	....					0.001	0.002	0.000	0.000	0.000
% STD DEV	....					9.448	15.870	3.849	3.535	4.762
STD K4 R5	ALL	W23 5	NA	NA	0.14	0.133	0.105	0.110	0.120	0.106
STD K4 R5	ALL	W23 6	NA	NA	0.14	0.131	0.105	0.109	0.117	0.103
STD K4 R5	289-F	W23 85	NA	NA	0.14	0.131	0.105	0.109	0.117	0.103
STD K4 R5	904-111G	W23 180	NA	NA	0.13	0.130	0.106	0.111	0.117	0.103
MEAN	....				0.14	0.131	0.105	0.110	0.118	0.104
STD DEV	....				0.00	0.001	0.000	0.001	0.001	0.001
% STD DEV	....				1.04	0.830	0.411	0.755	1.103	1.252
STD K4 R4	ALL	W23 7	NA	1.69	1.36	1.328	1.054	1.094	1.191	1.053
STD K4 R4	ALL	W23 8	NA	1.64	1.36	1.310	1.050	1.090	1.170	1.030
STD K4 R4	489-D	W23 22	NA	1.67	1.54	1.559	1.186	1.190	1.304	1.121
STD K4 R4	489-D	W23 48	NA	1.68	1.56	1.554	1.202	1.206	1.293	1.099
STD K4 R4	289-F	W23 72	NA	1.64	1.36	1.295	1.039	1.079	1.158	1.019
STD K4 R4	289-F	W23 98	NA	1.77	1.36	1.302	1.050	1.095	1.162	1.025
STD K4 R4	189-K	W23 114	NA	1.67	1.35	1.304	1.045	1.085	1.146	1.000
STD K4 R4	189-K	W23 141	NA	1.69	1.33	1.297	1.045	1.082	1.128	0.971
STD K4 R4	904-111G	W23 167	NA	1.70	1.34	1.293	1.041	1.087	1.149	1.018
STD K4 R4	904-111G	W23 193	NA	1.62	1.32	1.268	1.026	1.075	1.118	0.984
STD K4 R4	ALL	W23 213	NA	1.63	1.35	1.315	1.148	1.099	1.164	1.043
MEAN	....			1.67	1.38	1.348	1.081	1.107	1.180	1.033
STD DEV	....			0.04	0.08	0.099	0.062	0.043	0.059	0.043
% STD DEV	....			2.30	5.64	7.379	5.704	3.914	4.986	4.172
STD K4 R3	ALL	W23 9	NA	16.49	13.81	13.146	10.613	11.016	11.806	10.432
STD K4 R3	ALL	W23 10	NA	16.41	13.64	13.100	10.550	10.900	11.700	10.290
STD K4 R3	489-D	W23 35	NA	16.08	14.56	14.183	11.144	10.604	12.034	9.783
STD K4 R3	189-K	W23 128	NA	15.94	13.71	13.343	10.821	10.377	11.670	9.467
STD K4 R3	ALL	W23 201	NA	15.93	13.69	13.196	10.738	10.903	11.894	10.119
MEAN	....			16.17	13.88	13.394	10.773	10.760	11.821	10.018
STD DEV	....			0.24	0.34	0.403	0.208	0.235	0.133	0.351
% STD DEV	....			1.46	2.47	3.009	1.932	2.186	1.125	3.499
STD K4 R2	ALL	W23 11	NA	163.78	136.68	131.060	105.291	107.879	117.666	104.111
STD K4 R2	ALL	W23 12	NA	164.57	136.78	131.800	105.790	109.310	117.380	103.200
STD K4 R2	ALL	W23 110	NA	164.56	136.78	131.723	106.042	106.481	115.161	100.004
STD K4 R1	ALL	W23 13	NA	1701.07	2615.52	1361.363	1092.136	1117.806	1214.405	1068.049
STD K4 R1	ALL	W23 14	NA	1694.16	2625.02	1356.810	1089.100	1125.320	1208.530	1063.000
STD VC-99.6	ALL	W23 308	2409.7	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	ALL	W23 309	2428.7	NA	NA	NA	NA	NA	NA	NA

Table 6. Chlorinated Hydrocarbon Analyses of VOC Standard "K4" in Data Directory 23

---- SAVANNAH RIVER SITE ----
---- LIGHT HYDROCARBON STANDARD ANALYSIS ----
---- 904-111G ROAD A CHEMICAL BASIN ----

STANDARD TYPE	RUN#	DATE ANALYZED	METHANE PPBV	ETHANE PPBV	PROPANE PPBV	I-BUTANE PPBV	N-BUTANE PPBV	ETHYLENE PPBV	PROPYLENE PPBV
STD M	191	10-20-92	10101	1007	1005	1011	1044	1009	1000
STD M	202	10-20-92	10123	1010	1005	1020	1056	1010	988
STD M	229	10-21-92	10274	1030	1029	1048	1105	1028	1025
STD M	230	10-21-92	10231	1024	1024	1042	1100	1022	1022
STD M	244	10-21-92	10599	1003	1003	1007	1018	1003	998
		MEAN	10266	1015	1013	1026	1065	1014	1007
		STD DEV	179	10	11	16	33	9	14
		% STD DEV	1.74	1.02	1.09	1.61	3.13	0.90	1.43
STD 224	216	10-20-92	1011600	1050400	1013000		1052300		
STD 224	227	10-20-92	1007300	1042400	1005700		1031100		
STD 224	232	10-21-92	980860	1029800	1014600		1014600		
STD 224	233	10-21-92	1004600	1047000	1012500		1080200		
		MEAN	1001090	1042400	1011450		1044550		
		STD DEV	11944	7809	3409		24540		
		% STD DEV	1.19	0.75	0.34		2.35		

Table 7. Light Hydrocarbon Analyses of Standards "M" and "224"

---- SAVANNAH RIVER SITE ----
---- MINIMUM DETECTION LEVELS for 904-111G ROAD A CHEMICAL BASIN ---
---- AREA REJECT = 40, CONCENTRATIONS IN PPMV ----

COMPOUND NAME	IDEAL M.D.L.	ACTUAL M.D.L.
VINYL CHLORIDE	0.10	3.0
PENTANE	0.040	0.070
HEXANE	0.033	0.070
METHYLENE CHLORIDE	0.03	2.0
TRANS 1,2 DICHLOROETHYLEN	0.011	0.1
CHLOROFORM	0.00019	0.005
111 TRICHLOROETHANE	0.00007	0.005
CARBON TETRACHLORIDE	0.00004	0.005
HEPTANE	0.026	0.070
BENZENE	0.032	0.070
TRICHLOROETHYLENE	0.00015	0.005
OCTANE	0.023	0.070
TOLUENE	0.028	0.070
TETRACHLOROETHYLENE	0.00005	0.005
NONANE	0.021	0.070
ETHYL BENZENE	0.024	0.070
M&P-XYLENE	0.025	0.070
O-XYLENE	0.024	0.070
DECANE	0.020	0.070

Table 8. Minimum Detection Levels

----- SAVANNAH RIVER SITE -----
----- SOIL GAS SYSTEM BLANKS -- DATA DIRECTORIES D21 THRU D25 -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	PENTANE	HEXANE	HEPTANE	BENZENE	OCTANE	TOLUENE	NONANE	ETHYL BENZENE	M&P-XYLENE	O-XYLENE	DECANE	FILE CYCLE
631-4G-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 41
631-4G-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 54
731-5A-SB1	0.096	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 85
731-5A-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 98
731-5A-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 111
731-5A-SB4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 124
731-5A-SB5	ND	0.197	ND	ND	ND	ND	ND	0.033	0.111	0.070	ND	W21 137
484-10D-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 149
731-5A-SB6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 192
731-5A-SB7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 200
731-5A-SB8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 217
731-5A-SB9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 230
731-5A-SB10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 243
731-5A-SB11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 256
731-5A-SB12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W21 269
731-5A-SB13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 18
731-5A-SB14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 27
731-5A-SB15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 40
31-5A-SB16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 53
1-5A-SB17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 66
731-5A-SB18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 79
731-5A-SB19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 92
731-5A-SB20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.017	W22 100
731-5A-SB21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 107
731-5A-SB22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 120
731-5A-SB23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 133
731-5A-SB24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 146
731-5A-SB25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 159
731-5A-SB26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 172
731-5A-SB27	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 243
080-24G-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 193
080-24G-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 206
080-24G-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 219
080-24G-SB4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 232
080-24G-SB5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 236
643-11G-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 246
643-11G-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 258
643-11G-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 271
484-100-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 367
484-100-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 380
484-100-SB4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W22 394
489-D-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 21
489-D-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 34
489-D-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 47
289-F-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 71
89-F-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 84
-F-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 97
89-K-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 115
189-K-SB2	ND	ND	ND	ND	ND	ND	ND	ND	0.043	ND	ND	W23 127
189-K-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 140
904-111G-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 153
904-111G-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 166

Table 9 System Blanks

----- SAVANNAH RIVER SITE -----
----- SOIL GAS SYSTEM BLANKS -- DATA DIRECTORIES D21 THRU D25 -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	PENTANE	HEXANE	HEPTANE	BENZENE	OCTANE	TOLUENE	NONANE	ETHYL BENZENE	M&P-XYLENE	O-XYLENE	DECANE	FILE CYCLE
904-111G-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 179
904-111G-SB4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W23 192
289-H-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 85
289-H-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 97
289-H-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 110
231-4F-SB13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 176
231-4F-SB14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 188
231-4F-SB15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 201
231-4F-SB16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 214
231-4F-SB17	ND	ND	ND	0.053	ND	ND	ND	ND	ND	ND	ND	W24 236
231-4F-SB18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 261
231-4F-SB19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 278
231-4F-SB20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 287
HPSL-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 300
131-1L-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 302
131-1L-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 315
131-1L-SB4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 328
131-1L-SB5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 351
131-1L-SB6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 364
MAPL-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 368
MAPL-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 382
MAPL-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 395
UTRC-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 413
UTRC-SB4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 426
UTRC-SB5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 439
UTRC-SB6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 452
UTRC-SB7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W24 465
189-P-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 35
189-P-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 48
189-P-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 61
189-C-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 106
189-C-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 119
189-C-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 132
788-3A-SB1	ND	ND	ND	ND	ND	0.084	ND	ND	ND	ND	ND	W25 157
788-3A-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 173
788-3A-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 187
MSB-76-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 201
MSB-76-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 220
OHS-SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 227
OHS-SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 240
131-4L-SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 290
131-4L-SB4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 297
484-10D-SB5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	W25 308
AVERAGE	0.041	0.035	0.026	0.032	0.023	0.029	0.021	0.024	0.026	0.024	0.020	
STD DEV	0.006	0.017	0.000	0.002	0.000	0.006	0.000	0.001	0.009	0.005	0.000	
AVG+2STD DEV	0.052	0.068	0.026	0.037	0.023	0.040	0.021	0.026	0.044	0.034	0.021	

Table 9. System Blanks (FID) for Data Directories "D21 - D25"

----- SAVANNAH RIVER SITE -----
----- SOIL GAS SYSTEM BLANKS -- DATA DIRECTORIES D21 THRU D25 -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	VINYL CHLORIDE	METHYLENE CHLORIDE	TRANS 1,2 DICHLORO ETHYLENE	CHLORO FORM	111 TRI CHLORO ETHANE	CARBON TETRA CHLORIDE	TRI CHLORO ETHYLENE	TETRA CHLORO ETHYLENE	FILE CYCLE
631-4G-SB1	ND	ND	ND	ND	ND	ND	ND	ND	W21 41
631-4G-SB2	ND	ND	ND	ND	ND	ND	ND	ND	W21 54
731-5A-SB1	ND	ND	0.012	ND	ND	ND	ND	ND	W21 85
731-5A-SB2	ND	ND	ND	ND	ND	ND	0.00100	0.01400	W21 98
731-5A-SB3	ND	ND	ND	ND	ND	ND	ND	0.01000	W21 111
731-5A-SB4	ND	ND	ND	ND	ND	ND	0.00100	0.01700	W21 124
731-5A-SB5	1.2	.0.45	0.088	0.00100	ND	0.00100	0.24700	0.00500	W21 137
484-100-SB1	0.7	ND	ND	ND	ND	ND	0.01000	0.00500	W21 149
731-5A-SB6	ND	ND	ND	ND	ND	ND	ND	ND	W21 192
731-5A-SB7	0.3	ND	ND	ND	ND	ND	ND	ND	W21 200
731-5A-SB8	0.2	ND	ND	ND	ND	ND	ND	ND	W21 217
731-5A-SB9	0.2	ND	ND	ND	ND	ND	ND	0.00400	W21 230
731-5A-SB10	0.2	ND	ND	ND	ND	ND	ND	0.00100	W21 243
731-5A-SB11	0.2	ND	ND	ND	ND	ND	0.00100	0.00900	W21 256
731-5A-SB12	0.1	ND	ND	ND	ND	ND	0.00200	0.01200	W21 269
731-5A-SB13	0.2	ND	ND	ND	0.00100	ND	ND	ND	W22 18
731-5A-SB14	0.3	ND	ND	ND	ND	ND	ND	0.00100	W22 27
731-5A-SB15	0.2	ND	0.005	ND	ND	ND	ND	ND	W22 40
731-5A-SB16	ND	ND	0.006	ND	ND	ND	ND	ND	W22 53
-5A-SB17	ND	ND	0.007	ND	ND	ND	ND	ND	W22 66
731-5A-SB18	0.4	ND	ND	ND	ND	ND	ND	ND	W22 79
731-5A-SB19	0.2	ND	0.007	ND	ND	ND	ND	ND	W22 92
731-5A-SB20	0.3	ND	0.011	ND	0.00100	ND	ND	ND	W22 100
731-5A-SB21	0.4	ND	ND	ND	ND	ND	0.00300	0.00100	W22 107
731-5A-SB22	ND	ND	ND	ND	ND	ND	0.10100	0.00100	W22 120
731-5A-SB23	ND	ND	ND	ND	ND	ND	0.01400	ND	W22 133
731-5A-SB24	0.2	ND	ND	ND	ND	ND	0.01400	0.00100	W22 146
731-5A-SB25	ND	ND	ND	0.00100	ND	0.00100	0.20200	0.00200	W22 159
731-5A-SB26	0.1	ND	0.009	ND	ND	ND	0.00800	ND	W22 172
731-5A-SB27	ND	ND	ND	ND	ND	ND	ND	ND	W22 243
080-24G-SB1	ND	ND	ND	ND	ND	ND	ND	ND	W22 193
080-24G-SB2	0.2	ND	ND	ND	ND	ND	ND	ND	W22 206
080-24G-SB3	ND	ND	ND	ND	ND	ND	ND	ND	W22 219
080-24G-SB4	ND	ND	ND	ND	ND	ND	ND	ND	W22 232
080-24G-SB5	ND	ND	ND	ND	ND	ND	ND	ND	W22 236
643-11G-SB1	ND	ND	ND	ND	ND	ND	ND	ND	W22 246
643-11G-SB2	ND	ND	ND	ND	ND	ND	ND	ND	W22 258
643-11G-SB3	0.1	ND	ND	ND	ND	ND	ND	ND	W22 271
484-100-SB2	ND	ND	ND	ND	ND	ND	ND	ND	W22 367
484-100-SB3	ND	ND	ND	ND	ND	ND	ND	ND	W22 380
484-100-SB4	ND	ND	ND	ND	0.00700	ND	ND	0.00400	W22 394
489-D-SB1	ND	ND	ND	ND	ND	ND	0.00100	0.00100	W23 21
489-D-SB2	ND	ND	ND	ND	ND	ND	ND	ND	W23 34
489-D-SB3	ND	ND	ND	ND	ND	ND	ND	ND	W23 47
289-F-SB1	ND	ND	ND	ND	ND	ND	ND	ND	W23 71
289-F-SB2	ND	ND	ND	ND	ND	ND	ND	ND	W23 84
9-F-SB3	ND	ND	ND	ND	ND	ND	ND	ND	W23 97
9-K-SB1	ND	ND	ND	ND	ND	ND	ND	ND	W23 115
189-K-SB2	ND	ND	ND	ND	ND	ND	ND	ND	W23 127
189-K-SB3	ND	ND	ND	ND	ND	ND	ND	ND	W23 140
904-111G-SB1	ND	ND	ND	ND	ND	ND	ND	ND	W23 153
904-111G-SB2	ND	ND	ND	ND	ND	ND	ND	ND	W23 166

Table 10. System Blanks (ECD) for Data Directories "D21 - D25"

----- SAVANNAH RIVER SITE -----

----- SOIL GAS SYSTEM BLANKS -- DATA DIRECTORIES D21 THRU D25 -----

----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	VINYL CHLORIDE	METHYLENE CHLORIDE	TRANS 1,2 DICHLORO ETHYLENE	CHLORO FORM	111 TRI CHLORO ETHANE	CARBON TETRA CHLORIDE	TRI CHLORO ETHYLENE	TETRA CHLORO ETHYLENE	FILE CYCLE
904-111G-SB3	ND	ND	ND	ND	ND	ND	ND	ND	W23 179
904-111G-SB4	ND	ND	ND	ND	ND	ND	ND	ND	W23 192
289-H-SB1	ND	ND	ND	ND	ND	ND	ND	ND	W24 85
289-H-SB2	0.2	ND	ND	ND	0.00100	ND	ND	ND	W24 97
289-H-SB3	0.1	ND	ND	ND	ND	ND	ND	ND	W24 110
231-4F-SB13	ND	ND	0.011	ND	0.00100	ND	ND	0.00500	W24 176
231-4F-SB14	0.2	ND	0.012	ND	ND	ND	ND	0.00100	W24 188
231-4F-SB15	0.2	ND	0.013	0.00400	ND	ND	ND	ND	W24 201
231-4F-SB16	0.1	ND	0.016	ND	0.00100	ND	ND	0.00100	W24 214
231-4F-SB17	0.1	ND	0.015	ND	ND	ND	ND	0.00100	W24 236
231-4F-SB18	0.1	ND	0.010	ND	0.00100	ND	ND	0.00100	W24 261
231-4F-SB19	0.3	ND	0.015	ND	0.00100	ND	ND	ND	W24 278
231-4F-SB20	0.2	ND	0.014	ND	ND	ND	ND	ND	W24 287
HPSL-SB1	0.2	ND	0.014	ND	0.00200	ND	ND	0.00100	W24 300
131-1L-SB2	0.2	ND	0.008	ND	0.00100	ND	ND	ND	W24 302
131-1L-SB3	ND	ND	ND	ND	ND	ND	ND	ND	W24 315
131-1L-SB4	0.1	ND	0.010	ND	ND	ND	ND	ND	W24 328
131-1L-SB5	0.2	ND	0.012	ND	ND	ND	ND	ND	W24 351
131-1L-SB6	0.3	ND	0.025	ND	0.00100	ND	ND	ND	W24 364
HAPL-SB1	0.2	ND	0.011	ND	0.00100	ND	ND	ND	W24 368
HAPL-SB2	0.4	ND	0.016	ND	0.00100	ND	ND	ND	W24 382
HAPL-SB3	0.2	ND	0.012	ND	0.00100	ND	ND	0.25500	W24 395
UTRC-SB3	ND	ND	0.009	ND	ND	ND	ND	ND	W24 413
UTRC-SB4	0.1	ND	0.009	ND	ND	ND	ND	ND	W24 426
UTRC-SB5	0.1	ND	0.008	ND	ND	ND	ND	ND	W24 439
UTRC-SB6	0.2	ND	0.015	ND	ND	ND	ND	ND	W24 452
UTRC-SB7	0.3	0.36	0.030	ND	ND	ND	ND	ND	W24 465
189-P-SB1	0.0	ND	0.009	ND	0.00100	ND	ND	ND	W25 35
189-P-SB2	0.0	ND	0.010	ND	0.00100	ND	ND	ND	W25 48
189-P-SB3	0.0	ND	0.011	ND	0.00100	ND	ND	ND	W25 61
189-C-SB1	0.0	ND	0.015	ND	0.00300	ND	ND	ND	W25 106
189-C-SB2	0.0	ND	0.009	ND	ND	ND	ND	ND	W25 119
189-C-SB3	0.0	ND	0.009	ND	ND	ND	ND	ND	W25 132
788-3A-SB1	0.0	ND	0.016	ND	0.00100	ND	ND	ND	W25 157
788-3A-SB2	0.0	ND	0.009	ND	ND	ND	ND	ND	W25 173
788-3A-SB3	0.0	ND	0.007	ND	ND	ND	ND	ND	W25 187
MSB-76-SB1	0.0	ND	0.012	ND	ND	ND	ND	ND	W25 201
MSB-76-SB2	0.0	ND	0.018	ND	0.00100	ND	ND	ND	W25 220
OHS-SB1	0.0	ND	0.018	ND	0.00100	ND	ND	ND	W25 227
OHS-SB2	0.0	ND	0.027	ND	0.00300	ND	ND	ND	W25 240
131-4L-SB3	ND	ND	ND	ND	0.00100	ND	ND	ND	W25 290
131-4L-SB4	0.0	ND	ND	ND	0.00100	ND	ND	ND	W25 297
484-100-SB5	ND	ND	ND	ND	0.00100	ND	ND	ND	W25 308
AVERAGE	0.1	0.04	0.012	0.00025	0.00112	0.00006	0.00650	0.00375	
STD DEV	0.2	0.05	0.009	0.00040	0.00068	0.00014	0.03381	0.02608	
AVG+2STD DEV	0.5	0.15	0.030	0.00106	0.00247	0.00034	0.07411	0.05591	

Table 10. System Blanks (ECD) for Data Directories "D21 - D25"

APPENDIX I

SAMPLING METHODS

SAMPLING METHOD SM1

SOIL GAS PROBE SAMPLING

1.0 Scope and Application

1.1 Soil gas probe samples are collected with Microseeps unique, portable soil gas sampling probe which permits access to any area. In addition, the probe allows unlimited purging between sample sites and incorporates the capability to discard the volume of air in the sample probe before the soil gas sample at each site is taken.

2.0 Apparatus

2.1 Soil Gas Probe: The soil gas probe consists of a 1/2 inch diameter steel tube equipped with a rubber packer and a 1/8" o.d. ss sample tube inserted concentrically to the bottom of the 1/2" diameter tube to minimize dead space in the sample volume. The 1/8" o.d. sample tube is connected through a three way valve to a 250 cc gas tight syringe mounted as an integral part of the sample probe. The third port of the three-way valve is terminated with a syringe needle and serves two functions: first a small amount of gas equal to or larger than the dead space volume of the 1/8" o.d. sample tube is discarded through this port before each soil gas sample is taken; second, the syringe needle serves to facilitate transfer of the soil gas sample through a rubber septum into a previously evacuated sample vial, minimizing the possibility of contamination of any sample.

2.2 Slide Hammer Plunger Bar: The slide hammer plunger bar contains a 5.5 ft. x .5 in rod with a 9/16 inch ball. Fitted over one end of the rod is a weighted slide hammer. (Heath Consultants cat# 478).

2.3 Sample vials: The sample vials used are determined by the analytical method that is required for analysis. All vials should be free of interferences and meet the specifications described in the analytical method to be used.

3.0 Procedure

3.1 Prior to any sampling, the soil gas sampling probe should be purged clean of interferences, the syringe needle should be removed, and the three way valve should be in the stop flow position.

3.2 A 9/16 inch diameter hole is created to the desired depth using the slide hammer plunger bar.

3.3 The plunger bar is removed and the sample probe is inserted into the hole. A seal should be obtained to prevent ambient air from entering the hole when the soil gas sample is removed.

3.4 The three way valve is turned to the probe/syringe position.

3.5 A 10 cc volume of gas is drawn into the syringe.

3.6 The three way valve is turned to the syringe/needle position (needle removed as described in section 3.1) and the 10 cc sample is discarded.

3.7 The three way valve is turned to the probe/syringe position and the appropriate amount of soil gas is drawn into the syringe.

3.8 The three way valve is turned to the stop flow position

3.9 The needle is attached to the probe needle fitting.

3.10 An evacuated sample vial is attached by inserting the sample vial septum onto the needle.

3.11 The three way valve is turned to the syringe/needle position. The volume of the evacuated vial will be drawn into the sample vial. Additional volume (positive pressure) can then be added by depressing the plunger and displacing the remaining volume in the syringe.

3.12 The sample vial should be quickly removed once desired volume is displaced.

3.13 A volume of approximately 50 cc of ambient air should be drawn back through the needle.

3.14 Remove the needle.

3.15 Remove the sample probe from the hole.

3.16 Purge the sample probe clean of interferences by filling and exhausting the syringe five times before taking the next sample.

4.0 Sample Documentation

4.1 All samples should be labeled immediately after collection with the following information:

1. Site number
2. Daily sequence number
3. Date and time
4. Samplers initials
5. Project

4.2 All samples taken in the field by Microseeps, Ltd. should be entered onto a Field Log Sheet. For each sample, the following entries will be made:

1. Site number
2. Daily sequence number
3. Date and time
4. Samplers initials
5. Project
6. Location
7. Sample description
8. Miscellaneous comments

4.3 When appropriate, samples will be security sealed and chain of custody records will be maintained.

5.0 Safety Precautions

5.1 Do not use a mechanical device to depress the sampling syringe plunger.

5.2 Do not attempt to collect soil gas probe samples without prior knowledge of the location of underground utilities and other possible environmental hazards.

5.3 Always cap or remove the soil gas probe syringe needle when transporting or handling the soil gas probe.

6.0 Preventive Maintenance

6.0 The soil gas sample probe should be cleaned when necessary or at the end of each day with soap and organic free water. It is especially important to keep the gas sampling syringe clean from fine soil particles as the particles will quickly deteriorate the teflon/glass plunger seal.

6.1 The glass wool filter plug (located in the probe tip) should be changed often and the probe tip should be kept clear of soil.

APPENDIX I

ANALYTICAL METHODS

ANALYTICAL METHOD AM1

ANALYSIS OF C_1-C_4 HYDROCARBONS, HYDROGEN, HELIUM, IN SOIL GAS

1.0 Scope and Application

1.1 Method AM1 is used to determine the concentration of C_1-C_4 hydrocarbons, helium and hydrogen in soil gas samples. Specifically, Method AM1 may be used to detect the following substances:

methane
ethane
ethylene
propane
propylene
i-butane
n-butane
helium
hydrogen

1.2 This method is recommended for use by, or under the supervision of, analysts experienced in the operation of gas chromatographs and in the interpretation of chromatograms.

2.0 Summary of Method

2.1 Analysis of the above constituents of free soil gas is accomplished with a custom chromatograph, built by Microseeps. The custom, dual detector gas chromatograph provides a sequential output from two detectors. First, the C_1-C_4 hydrocarbons are detected with a flame ionization detector (FID), next helium and hydrogen are detected with a thermal conductivity detector (TCD). The sample (and standard calibration gas) is flowed through the gas chromatograph and introduced into the columns by the mechanical injection of two sample loops.

3.0 Interferences

3.1 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. A non-restricted flow of pure nitrogen from a 10 psig source should be purged for 30 seconds through the sample loops prior to all analyses.

3.2 The analyst should demonstrate the absence of contamination by carryover by analysis of the contents of the sample loops when purged with nitrogen. This demonstration should be performed prior to the analysis of a sample set and when carryover contamination is suspected (after high samples). In the event that 'ghost peaks' (peaks similar to previous sample) appear when a pure nitrogen sample is analyzed, measures should be taken to eliminate the carryover contamination.

3.3 Extra peaks in a chromatogram can be actual peaks from a previous run. Contamination from late eluting peaks can occur when injection to injection time is too short. The dual gas chromatograph is set up in the backflush pre-column valve arrangement to minimize this interference.

3.4 The analyst should be certain that all peaks have eluted from the previous analysis prior to analyzing any sample or standard. If samples or standard chromatograms contain suspected 'extra peaks' the sample should again be analyzed after a clean baseline is established.

4.0 Apparatus and Materials

4.1 Sample vials: 125 ml glass vials (Wheaton #223748 or equivalent). Vials should be free of hydrocarbons, helium, and hydrogen prior to use. This can be accomplished by heating to 100 degrees C followed by purging with pure nitrogen.

4.2 Septums: Butyl rubber septums (Wheaton #224154 or equivalent) may be used provided vials are capped within two weeks prior to use. Other septums may be used, provided they are gas tight and do not produce interferences.

4.3 Gas Chromatograph: The chromatograph is equipped with two sets of the following: column oven, pre-column, analytical column, detector, injection port, sample valve and sample loop. The column and detector for determination of C_1-C_4 hydrocarbons are a granular 3 ft. x 3/16 in. alumina analytical column and a flame ionization detector. The alumina column is protected against contamination by heavy organics by a 3 in. x 3/16 in. pre-column which is back-flushed after butanes have entered the analytical column. This arrangement allows rapid turn-around for consecutive analyses and a clean baseline for accurate, reproducible results. The flame ionization detector is of a special design which allows considerably more sensitivity than commercially available models. In a laboratory setting, noise levels are commonly at the 500 ppt level. Although, these sensitivities are rarely realized in the field, 1 to 2 ppb is achievable and 5 ppb is routine. Hydrogen and helium, are simultaneously determined using a 3 ft. x 3/16 in. molecular sieve 5A (80/100 mesh) pre-column and 10 ft. x 3/16 in. analytical column connected to a thermal conductivity detector. Injection times and the signal output are sequenced so that the output of the two detectors is displayed in a single continuous chromatogram.

4.4 Data Collection: The output of the chromatograph is directed to a chart recorder and a Hewlett Packard (HP-3392A) Networking Integrator which passes the processed data to a microcomputer for data storage and/or further processing.

5.0 Sample Preparation and Analysis

5.1 Sample vial preparation: All sample vials should meet specifications as noted in sections 4.1 and 4.2 above. Vials should be tightly capped and evacuated to a pressure of less than 100 millitorr. The vial septum should be punctured with needles of 22 gauge or smaller.

5.2 The evacuated sample vials should be filled with sample gas to a pressure of 9 psig. A positive pressure capable of delivering at least 25 cc of sample must be available per each injection.

5.3 The pressurized sample vial is connected to the sample loops through a needle fitting and flow control valve. The flow is monitored by a flow meter connected to the out port on the gas chromatograph.

5.4 After the appropriate volume of sample (minimum 25 cc) has been flushed through the sample loops of the gas chromatograph, the injection valves may be activated. This is accomplished by switching on the cycle timer.

6.0 Calibration

6.1 The standard calibration gas should be introduced in the same manner as described in section 5.4 above. Measured peak areas are converted to concentrations in parts per million by volume using certified commercial gas standards traceable to NBS standards. (Matheson Gas Products Inc., or Scott Specialty Gases). The sample concentrations are calculated from calibration points near the concentration level of the sample.

6.2 At the beginning of a project or sample set, standards of appropriate calibration ranges will be run at least three times or until the results agree with a percent standard deviation no greater than 10%.

6.3 The instrument response (for any one subsequent standard in section 6.5 above) must not vary by more than 20%; or any two consecutive standards must not vary by more than 15% from the mean of the three previous standards.

7.0 Quality Control

7.1 If the parameters set forth in section 6.3 are not met, the analytical program will be terminated until the cause is determined and a solution is effected. The cause and the solution will be recorded in the Laboratory Notebook and signed by the operater, before the analytical program is resumed.

7.2 Before and during sample analysis, instrument blanks (sample loops filled with flush nitrogen) should be analyzed to assure the absence of interferences as described in section 3.0 above.

7.3 Standards analyzed during the course of analyzing samples are averaged into the calibration table as well as being used for peak identification. All chromatograms should be examined by an experienced analyst.

7.4 Throughout analysis the soil gas samples are injected mechanically to achieve a uniform sample size from a flow directly from the soil gas sample vial which has been pressured at the time of sampling. This pressuring preserves sample integrity since any leakage is out of the vial and does not result in contamination or sample ution.

7.5 Calibration records are generated and stored. All such records will be maintained in the laboratory during the course of the project.

8.0 Instrument Conditions

8.1 Gas Chromatograph:
Injection Temp. ambient
Flame Ionization Detector Temp. ambient
Thermal Conductivity Detector Temp. 45 deg. C.
C1-C4 Oven Temp. 100 deg. C. isothermal
Helium/Hydrogen Oven Temp. 45 deg. C. isothermal
Initial T.C.D. Signal Range 10
Initial F.I.D. Signal Range 10E9
Carrier Gas Regulator Pressures:
    T.C.D. 40 psig.
    F.I.D. 17 psig.
Hydrogen Pressure 22 psig.
Flame Air Pressure 30 psig. (1.0 scfh)

ANALYTICAL METHOD AM4

ANALYSIS OF VOLATILE ORGANIC COMPOUNDS IN SOIL GAS

1.0 Scope and Application

1.1 Method AM4 is used to determine the concentration of volatile organic compounds in soil gas samples. Specifically, Method AM4 may be used to detect the volatile organics including but not limited to the following compounds:

pentane
hexane
heptane
octane
nonane
methane
vinyl chloride
1,1-dichloroethylene
methylene chloride
1,1-dichloroethane
1,2-dichloroethane
trans 1,2-dichloroethylene
chloroform
1,1,1-trichloroethane
carbon tetrachloride
trichloroethylene
tetrachloroethylene
1,1,2,2-tetrachloroethane
1,3-dichlorobenzene
benzene
toluene
m & p-xylene
o-xylene
ethyl benzene
chloromethane
bromomethane
chloroethane
fluorotrichloromethane
1,2-dichloropropane
bromodichloromethane
cis 1,3-dichloropropylene
trans 1,3-dichloropropylene
1,1,2-trichloroethane
chlorodibromomethane
chlorobenzene
bromoform
1,2-dichlorobenzene
1,4-dichlorobenzene

1.2 This method is recommended for use by, or under the supervision of, analysts experienced in the operation of a gas chromatograph and in the interpretation of a chromatogram.

2.0 Summary of Method

The volatile organic compounds are analyzed using a Hewlett Packard Model 5890A Gas Chromatograph in conjunction with a Hewlett Packard Model 19395A Automated Headspace Sampler and an H.P. 3396A Networking Integrator. A Supelco, 60M x 0.75mm i.d. Vocol, wide bore capillary column is used in conjunction with an output splitter connected to an electron capture detector and a flame ionization detector. The integrator is interfaced to an IBM microcomputer for data storage and processing. Data transfer and analyses are facilitated using a chromatography data system (Chrom Perfect, Justice Innovations).

3.0 Interferences

3.1 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. While in the standby mode, the HP 19395A provides continuous flushing of the sample loop and sample valve between sample analyses. This flush flow should be maintained and the sample valve and loop should be kept heated.

3.2 The analyst should demonstrate the absence of carryover contamination by analysis of the contents of the sample loop when purged with pure nitrogen. This demonstration should be performed prior to the analysis of a sample set and when carryover contamination is suspected (after high samples). In the event that 'ghost peaks' (peaks similar to previous sample) appear when a pure nitrogen sample is analyzed measures should be taken to eliminate the carryover contamination.

3.3 Extra peaks in a chromatogram can be actual peaks from a previous run. Contamination from compounds eluting late in the chromatogram can occur when injection to injection time is too short. The HP 5890A is equipped with a temperature programmable oven which can be utilized to minimize this interference.

3.4 The analyst should be certain that all peaks have eluted from the previous analysis prior to analyzing any sample or standard. This can be accomplished by elevating the oven temperature after an analysis until such time that a clean stable baseline is obtained. If samples or standard chromatograms contain suspected 'extra peaks' the sample should be reanalyzed after a clean baseline is established.

4.0 Materials and Equipment

4.1 Sample vials: 22 ml glass vials (Hewlett Packard #9301-0716 or equivalent). Vials should be free of chlorinated hydrocarbons prior to use. This can be accomplished by washing and rinsing with hydrocarbon free water then heating to 100 degrees C for 1 hour followed by purging with pure nitrogen.

4.2 Septums: Teflon lined septums (Wheaton #224168 or equivalent) may be used provided vials are capped within two weeks prior to use. Other septums may be used provided they are gas tight and do not produce interferences.

4.3 Gas Chromatograph: The Hewlett Packard 5890A Gas Chromatograph is equipped with a Supelco, 60M x 0.75mm i.d. Vocol, wide bore capillary column connected to an electron capture detector and flame ionization detector.

4.4 Headspace Sampler: A Hewlett Packard Model 19395A Automated Headspace Sampler is used which contains a heated bath with 24 slots for headspace vials, a heated sample valve, a heated sample loop and a heated transfer line to facilitate transfer of the sample onto the column in the gas chromatograph.

4.5 Data Collection: The output of the chromatograph is directed to a chart recorder and a Hewlett Packard (HP-3396A) Networking Integrator which passes the processed data to a microcomputer for data storage and/or further processing.

5.0 Sample Preparation and Analysis

5.1 Sample vial preparation: All sample vials should meet specifications as noted in sections 4.1 and 4.2 above. Vials should be tightly capped and evacuated to a pressure of less than 100 millitorr. The vial septum should be punctured only with needles of 22 gauge or smaller.

5.2 The evacuated sample vials should be filled with sample or standard gas to a positive gauge pressure. Sample vials should be used (filled with sample) within two weeks of preparation.

5.3 The 22 cc sample vials are placed directly into the heated headspace sampling unit for a minimum of 90 minutes prior to injection.

5.4 The headspace sampling unit is programmed to mechanically puncture the septum, transfer the sample to the heated sample loop, and mechanically inject the sample into the column flow stream via the heated transfer line.

6.0 Standards and Calibrations

6.1 Gas standards or liquid standards may by used to achieve calibrations. In some situations it may be necessary to use both types of standards. Certified commercial gas standards are most desirable, but may not always be available for all the compounds or for the concentration levels of the compounds of interest.

6.2 Commercial gas standards are introduced by filling a 22ml headspace vial with standard gas. The gas standards are placed in the vials and analyzed in the same manner as samples (as described in section 5.0). The concentrations are those certified by the manufacturer.

6.3 Liquid standard solutions are injected directly into a capped vial and allowed to vaporize. These standards are produced from high purity compounds as described in Standard Preparation Method SP1. The liquid standard solutions are placed in vials that meet specifications described in sections 4.1 and 4.2. The vials used must be capped and be at atmospheric pressure when the liquid standard is injected. The vial is then analyzed in the same manner as a sample as described in section 5.3.

6.4 At the beginning of a project or sample set, standards of appropriate calibration ranges will be run at least three times or until the results agree with a percent standard deviation no greater than 10%.

6.5 Thereafter, at least one standard will be run for every 10 samples.

6.6 The instrument response (for any one subsequent standard in section 6.5 above) must not vary by more than 20%; or any two consecutive standards must not vary by more than 15% from the mean of the three previous standards.

7.0 Quality Control

7.1 If the parameters set forth in section 6.6 are not met the analytical program will be terminated until the cause is determined and a solution is effected. The cause and the solution will be recorded in the Laboratory Notebook and signed by the operator, before the analytical program is resumed.

7.2 Before and during sample analysis, instrument blanks (sample loops filled with flush nitrogen) should be analyzed to assure the absence of interferences as described in section 3.0 above.

7.3 Prior to the analysis of a sample set, multiple standards, at different concentration levels, should be analyzed to establish an initial calibration table. During sample analysis, standards should be run at a rate of 1 for each 10 samples.

7.4 Standards analyzed during the course of analyzing samples are compared to the calibration table as well as being used for peak identification. All chromatograms should be examined by an experienced analyst.

7.5 The soil gas sample vial is pressurized at the time of sampling. This pressure preserves sample integrity since any leakage is out of the vial and does not result in contamination or sample dilution.

7.6 The headspace sampling unit contains a heated bath as well as a heated sampling loop and transfer line. The latter two zones are continually flushed with nitrogen between sample analyses to minimize the chance of instrumental carry over. This nitrogen in the sample loop is injected periodically to check for instrument contamination.

7.7 Once the headspace vials are punctured in the headspace unit, the sample loop is allowed to equilibrate to atmospheric pressure just prior to injection (see section 8.2, vent time). This insures that an accurate, equal volume will be injected each time. Each vial is analyzed one time only.

7.8 Calibration records are generated and stored in the computer. All such records will be maintained in the laboratory during the course of the project.

8.0 Instrument Conditions

8.1 Gas Chromatograph:
- Injection Temp. 220 deg. C.
- Flame Ionization Detector Temp. 220 deg. C.
- Electron Capture Detector Temp. 375 deg. C.
- Oven Temp. Program:
  - Initial temp. 30 deg. C.
  - Hold 10 min.
  - Rate 4 deg. min. to 110 deg. C.
  - Hold .01 min.
  - Rate 20 deg. min. to 200 deg. C.
  - Hold 15 min.
- Equilibration Time 1 min.
- Initial E.C.D. Signal Range 5
- Initial F.I.D. Signal Range 4
- Carrier Flow Rates: (output of column split)
  - Packed Injection Port 2 cc/min.
  - Head Space Sampler 10 cc/min.
  - Make up gas to E.C.D. 76 cc/min.
  - Make up gas to F.I.D. 34 cc/min.
  - Total column 12 cc/min.
- Hydrogen Pressure 22 psig.
- Flame Air Pressure 30 psig.

8.2 Headspace Sampler:
- Bath Temp. 75 deg. C.
- Valve/Loop Temp. 140 deg. C.
- Headspace Method 1
- Equilibration time 0 min.
- Sampling interval 90 min (remote)
- Valve Timing:
  - Probe down 1 sec.
  - Vent/fill loop 3 sec.
  - Vent/fill loop off 13 sec.
  - Inject to G.C. 15 sec.
  - Inject return 1:15 sec.
  - Probe up 1:17 sec.
- Aux pressure (flush) .5 bar
- Valve Air pressure 3.5 bar
- Carrier Flow 10 cc/min.

STANDARD PREPARATION METHOD SP3

GAS STANDARD PREPARATION FOR VOC'S

1.0 Scope and Application

1.1 Gas standards may be prepared from pure liquid compounds when commercial gas standards are not available. Known weights of pure compounds are placed in a 22ml vial under known conditions. The ideal gas law is used to calculate gas volumes for each compound. Concentrations may be calculated in parts per million volume (ppmv) or micrograms per liter air (ug/l air).

2.0 Summary

2.1 Equal volumes of pure liquid compounds are combined. A uL amount of the pure blend is injected into a 22ml headspace vial (at atmos. pressure) to produce a known concentration gas (level 1 standard). The pure compound blend is diluted in solvent so that when ul amounts of the diluted blend are injected into a 22ml Headspace vial (at atmos. pressure) a known concentration of gas (level 2) is produced. The pure blend is again diluted in solvent to produce other gas standards (level 3 and 4). Level 5 and level 6 gas standard may be produced by further diluting level 2 and level 3 blends 1000:1. For each level number increase, the weight amount of compound (ug/ul blend) decreases by a factor of 10.

3.0 Apparatus and Materials

3.1 Solvent: The solvent normally used is high purity (99+%) chromatographic grade methyl alcohol. It must be determined if the solvent will interfere with or mask compounds of interest.

3.2 Pure compounds of interest: All compounds used must meet required specifications and be approved on the Supplies and Materials List.

3.3 Storage of Prepared Standards: Vials (Alltech #72716 or equivalent), Caps (Alltech #95246,mininert valves), septa (Alltech #9548).

3.4 1 ml disposable pipettes: Corning #7078-1CN or equivalent.

3.5 22 ml Headspace Vial: Hewlett Packard #9301-0716.

3.6 10 ul liquid syringe: Hamilton #701 or equivalent.

3.7 Pipette Dispenser, Micro-Pipex: Fisher Scientific.

4.0 Procedure

4.1 Add 1ml of each compound to a pre-cleaned 22ml vial using a new disposable 1ml pipette for each compound. The total volume of the pure blend should be greater than 9 ml. If less than 9 compounds are used then 2ml of each compound should be combined.

4.2 Using a disposable 1.0 ml glass pipette, fill at least two 4.5 ml vials with the pure blend. Immediately cap the vials with mininert valve caps. Label the vials "Pure Blend Standard [I.D.] Level 1" along with the date and the preparer's initials.

4.3 Using a disposable 1.0 ml glass pipete, fill each of three new pre-labeled 4.5ml vials with the following ml amounts of solvent; 3.960 (level 2), 4.355 (level 3), and 4.395 (level 4). The labels should reflect the appropriate standard I.D. and level. Cap all vials with mininert valve caps.

4.4 Using a clean 10ul syringe add 4.4 ul of pure blend to the vial containing 4.395 ml of solvent and labeled level 4.

4.5 Using the same 10 ul syringe as in step 4.4 add 44 ul of pure blend to the vial containing 4.355 and labeled level 3.

4.6 Using a clean 1 ml pipette add .44 ml of pure blend to the vial containing 3.960 ml of solvent and labeled level 2.

4.7 To produce level 5 and level 6 dilute blends add 4.395 ml of solvent to two clean prelabeled 4.5 ml vials. For level 5 add 4.4 ul of level 2 blend and for level 6 add 4.4 ul of level 3 blend.

4.8 Gas standards are produced by injecting ul amounts of blend (levels 1-6) into 22ml headspace vials containing clean air and capped with TFE lined septums. Refer to the appropriate Standard Calculations Table for actual amounts to inject into the headspace vials and resulting concentrations of each compound.

4.9 The standard calculations table is produced in spreadsheet format and contains at least the following information; solvent used, compound density and molecular weight, ul compound/1ul blend, compound weight/volume of blend, gas volume of compound, weight of compound per liter of air, and the parts per million of compound by volume for each concentration level of standard.

5.0 Calculations

5.1 The following formulas are used to calculate the gas concentration (vol/vol) originating from liquid (weight).

CONCENTRATION in PPMV = (COMPOUND VOL/TOTAL VOL)*1000000

P = 1 ATM
V = 1 MOLE (IDEAL GAS) 22.4 LITER
T = TEMP. 273K
R = IDEAL GAS CONSTANT (.082)   R = PV/NT R =(1*22.4)/(1*273)
N = COMPOUND WEIGHT/MOL. WEIGHT
W = WEIGHT OF COMPOUND USED (IN ug)
M = MOL. WEIGHT OF THE COMPOUND
D = DENSITY (GRAMS/mL)
L = LIQUID VOL. USED (IN uL)
t = TEMP. 25C + 273K = 298K
v = UNKNOWN VOLUME

Pv = NRt
v = N (Rt/P)
v = W/M (Rt/P)
v = W/M ((.082*298)/1)
v = (W/M)*24.4

D = W/L*1000
W = DL*1000

5.2 To calculate the standard gas concentrations in ug/l air the above ideal gas law formula must be used to calculate the volume of gas of the compound when added to the headspace vial. This volume is then added to the volume of the headspace vial to determine the total volume. The following formula can then be used:

CONCENTRATION (ug/l air) =
(1 Liter air/total vol)(compound weight/total volume).

6.0 Safety Precautions

6.1 General laboratory safety precautions should be followed when preparing standards. The safety precautions should include, but not be limited to, the following safeguards; Eye and face protection, proper clothing (gloves, shoes, etc.), proper ventilation, spill protection, and an emergency response plan.

6.2 All safety precautions as stated on the material data sheets should be followed when handling hazardous materials.

APPENDIX II

SOIL GAS SAMPLE COLLECTION LOGS

MICROSEEPS LTD.

CLIENT: SRS / Kelly Ward
LOCATION: Road A Chemical Basin
PROJECT(#): 904-111G
PAGE: _____ OF: _____

*********** SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): Kgb / Cds

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	S	W	SAMPLE SIZE	COMMENTS
904-111G-SB-1	9-17	1155	1	-0-	✓			22	
904-111G-SB-1		1156	2	-0-	↓			125	
" " 111G-1		1157	3	3'				22	
" " 111G-1		1158	4	↓				↓	
-2		1203	5						
-2		1204	6						
-3		1210	7						
-3		1211	8						
-4		1218	9						
-4		1219	10						
-5		1224	11						
-5		1225	12						
-6		1241	13						
-6		1242	14						
-7		1250	15						
-7		1251	16						
-8		1300	17						
-8		1301	18						
-9		1310	19						
-9		1311	20						
-10		1315	21						
-10		1316	22						
-10A		1320	23						
-10A		1321	24	↓					
904-111G-SB-2		1325	25	-0-					
904-111G-SB-2		1326	26	-0-					
-11		1332	27	3'					
-11		1333	28	↓					
-12		1340	28						
-12		1341	30						
-13		1345	31						
-13		1346	32						
14		1350	33						
14		1351	34						
15		1355	35						
15		1356	36						
16		1930	37						
16		1431	38						
17		1435	39						
18		1436	40						
18		1440	41						
18		1441	42						
19		1445	43	↓	↓			↓	

APPENDIX II

WASTE MANAGEMENT UNIT WORKSHEETS

MICROSEEPS LTD.

CLIENT: SRS | Kelly Ward
LOCATION: Road A Chem Basin
PROJECT(#): 904-111G
PAGE: ____ OF: ____

*********** SAMPLE COLLECTION LOG **********

SAMPLER NAME(S): Kaq/cds

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	SAMPLE TYPE S	SAMPLE TYPE V	SAMPLE SIZE	COMMENTS
904-111G-19	9-17	1446	44	3'	✓			125	
-20		1455	45	⌇	⌇			22	
-20		1456	46	⌇	⌇			⌇	
20A		1500	47	⌇	⌇			⌇	
20A		1601	48	↓	⌇			⌇	
904-111G-SB-3		1505	49	-0-	⌇			⌇	
904-111G-SB-3		1506	50	-0-	⌇			⌇	
21		1507	51	3'	⌇			⌇	
21		1508	52	⌇	⌇			⌇	
22		1513	53	⌇	⌇			⌇	
22		1514	54	⌇	⌇			⌇	
23		1518	55	⌇	⌇			⌇	
23		1519	56	⌇	⌇			⌇	
24		1525	57	⌇	⌇			⌇	
24		1526	58	⌇	⌇			⌇	
25		1530	59	⌇	⌇			⌇	
25		1531	60	⌇	⌇			⌇	
26		1535	61	⌇	⌇			⌇	
26		1536	62	⌇	⌇			⌇	
27		1540	63	⌇	⌇			⌇	
27		1541	64	⌇	⌇			⌇	
28		1645	65	⌇	⌇			⌇	
28		1546	66	⌇	⌇			⌇	
29		1550	67	⌇	⌇			⌇	
29		1551	68	⌇	⌇			⌇	
30		1555	69	⌇	⌇			⌇	
30		1556	70	⌇	⌇			⌇	
30A		1600	71	⌇	⌇			⌇	
30A		1601	72	↓	⌇			⌇	
904-111G-SB-4		1605	73	-0-	⌇			⌇	
904-111G-SB-4		1606	74	-0-	⌇			⌇	
31		1608	75	3'	⌇			⌇	
31		1609	76	⌇	⌇			⌇	
32		1625	77	⌇	⌇			⌇	
32		1626	78	⌇	⌇			⌇	
33		1639	79	⌇	⌇			⌇	
33		1640	80	⌇	⌇			⌇	
34		1645	81	⌇	⌇			⌇	
34		1646	82	⌇	⌇			⌇	
35		1655	83	⌇	⌇			⌇	
35		1656	84	⌇	⌇			⌇	
36		1700	85	⌇	⌇			⌇	
36		1701	86	↓	↓			↓	

MICROSEEPS

University of Pittsburgh Applied Research Center
220 William Pitt Way, Pittsburgh, PA 15238
(412) 826-5245
FAX (412) 826-3433

February 4, 1999

Mr. Tom McAdams
Westinghouse Savannah River Company
Building 730-2B #3137
Aiken, SC 29808

Dear Tom:

We have examined the raw data for the soil vapor samples collected at the Road A Chemical Basin in 1992 and have found no evidence of the presence of chlorobenzene.

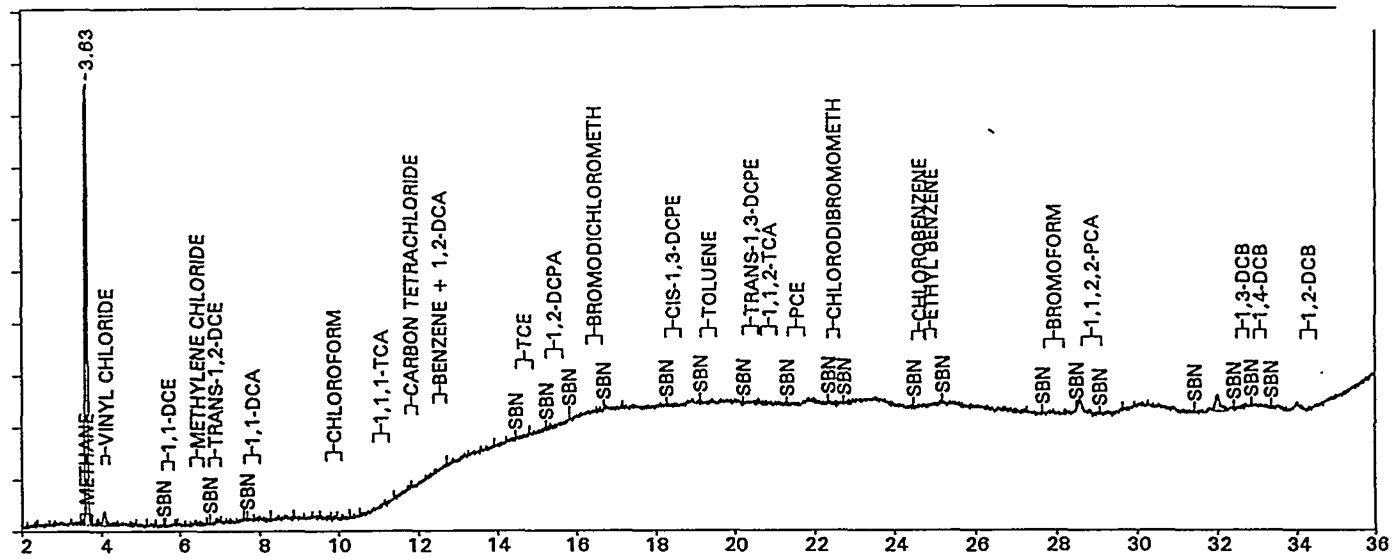
Even though the SRS request did not include chlorobenzene as a compound of interest, the samples were analyzed on an instrument that was calibrated for that compound. When samples are analyzed the detector responses are digitized and recorded as "raw" data files. The chromatography software processes the raw data using a calibration file with retention times and detector response factors for known amounts of compounds in the calibration mix. We were able to reload the raw data files for the Road A samples and reprocess them with a calibration file which included chlorobenzene. None of the sample chromatograms showed a peak at the known retention time. I have enclosed copies of the reports showing the chromatograms processed with the calibration file that includes chlorobenzene and a copy of a continuing calibration verification showing a chlorobenzene peak. Even though the calibration verification was analyzed two days after the last Road A sample, you can see on the reports that the initial calibration was performed prior to beginning the Road A analyses.

If you have any further questions, please contact me at the above telephone number.

Sincerely,

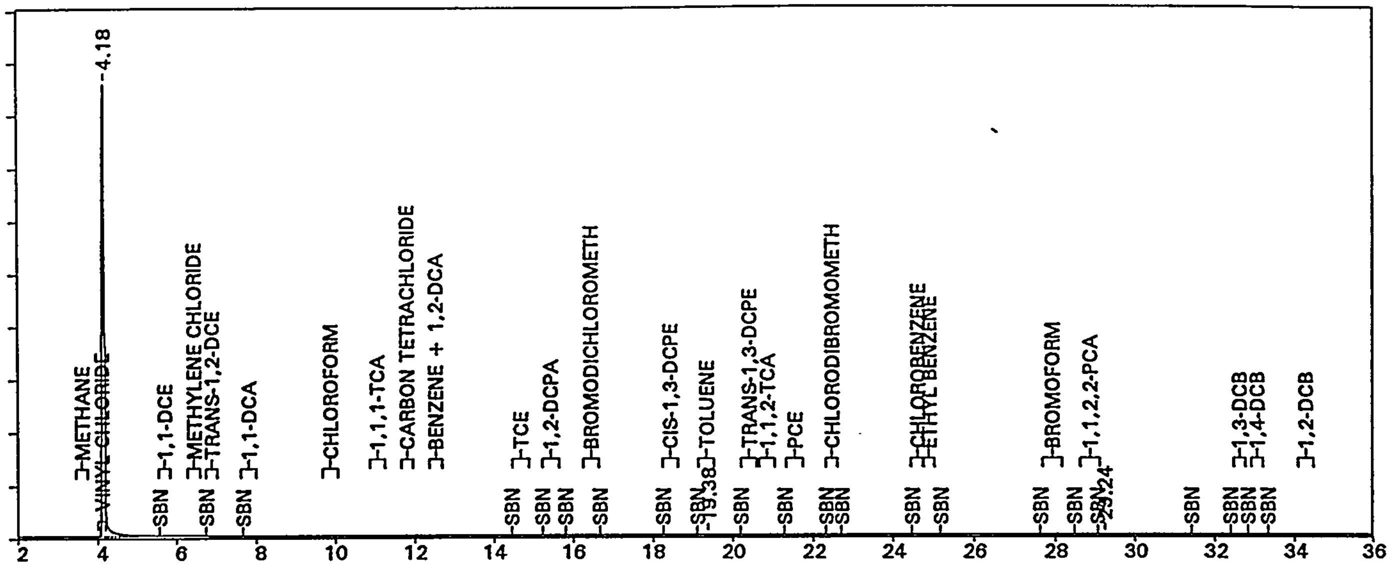
Allan Sprayberry

```
File=C:\CP\D23\W23A1.53R Date printed=01-27-1999 Time= 15:12:15
Sample Name=904-111G*SB1
2.0 to 36.0 min. Low Y=0.388 High Y=0.503 mv Span=0.115
```



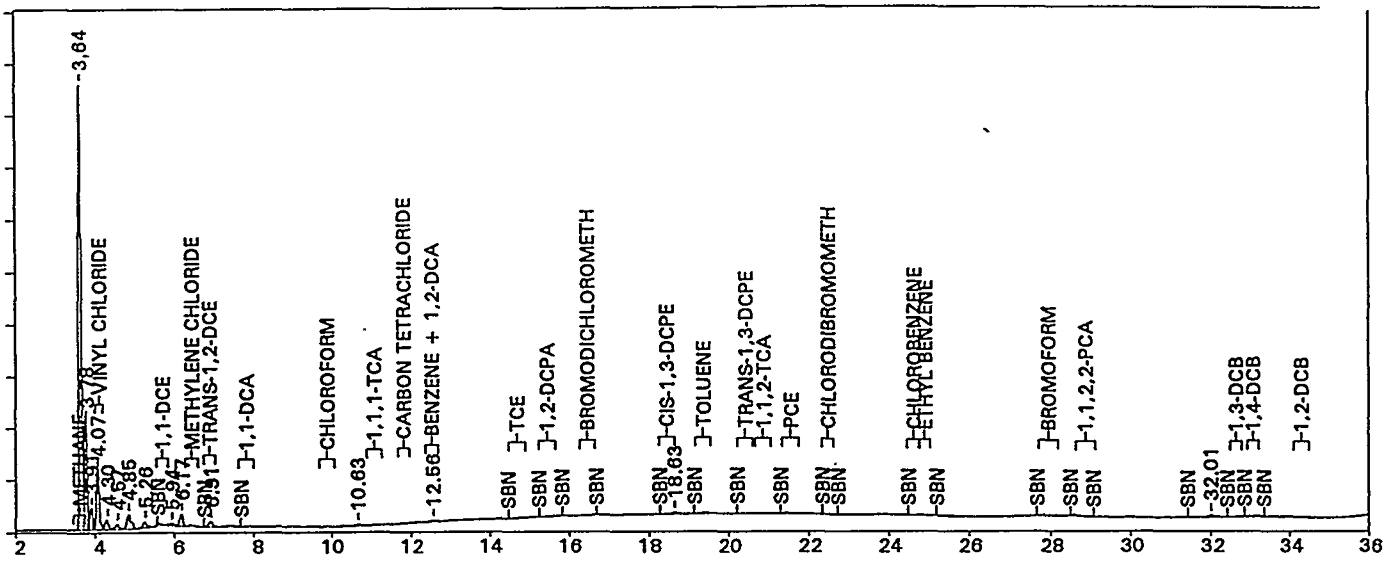
```
************************ MICROSEEPS LABORATORY ************************
*                                                                     *
* SAMPLE NAME......... 904-111G*SB1                    OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.53R                            *
* DATE ANALYZED....... SEP 22, 1992  14:43:40                         *
* REPORT DATE.... 01-27-1999                                          *
* METHOD FILE.... C:\CP\D23\W23A624.MET                               *
* CAL FILE....... C:\CP\D23\W23A624.CAL                               *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08             *
* RUN TIME....... 53.245               THRESHOLD..... -4              *
* AREA REJECT.... 40                   COM PORT......  1              *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1               *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333        *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58          *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32          *
* HP REF FILE.... Q5384E9Eb#153        FMT FILE.. C:\CP\D23\GAS.FMT   *
***********************************************************************
Out of Ret Time                 Amount   % Delta    Peak            Amount/    Peak    Peak      ug/l
Bound   (min)      Peak Name     PPMV    Ret Time   Area   AREA %    Area       #     Height     AIR
       3.629  METHANE            0.740    0.52%     420    100.00   0.0017627   1      97       0.000
Total amt. ID. = .7403163             Total area (all peaks) = 419.9782
```

```
File=C:\CP\D23\W23A1.54R Date printed=01-27-1999 Time= 15:13:35
Sample Name=STD K4 R6
2.0 to 36.0 min. Low Y=-7.779 High Y=1694.008 mv Span=1701.786
```



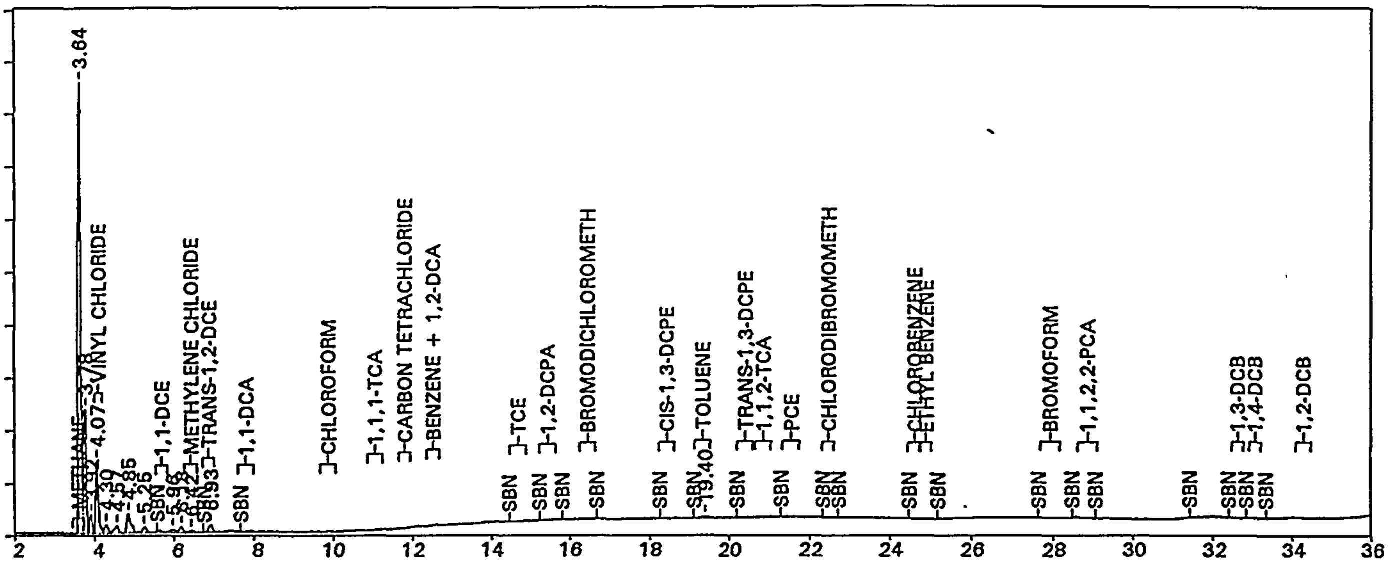
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... STD K4 R6                         OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.54R                              *
* DATE ANALYZED....... SEP 22, 1992  15:50:50                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08             *
* RUN TIME....... 53.245                 THRESHOLD..... -4              *
* AREA REJECT.... 40                     COM PORT......  1              *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1               *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333        *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5385E5Bb#154          FMT FILE.. C:\CP\D23\GAS.FMT   *
*************************************************************************
Out of Ret Time                     Amount   % Delta   Peak            Amount/   Peak  Peak      ug/l
Bound  (min)       Peak Name        PPMV     Ret Time  Area    AREA %  Area      #     Height    AIR
        4.180  VINYL CHLORIDE     44146.730    1.71%  6939147  100.00  0.0063620   2 1448522    0.000
       19.379  TOLUENE                0.077    0.20%      104    0.00  0.0007390   3      10    0.000
Total amt. ID. = 44146.81                 Total area (all peaks) = 6939318
```

```
File=C:\CP\D23\W23A1.55R Date printed=01-27-1999 Time= 15:14:58
Sample Name=904-111G-1
2.0 to 36.0 min. Low Y=0.382 High Y=1.622 mv Span=1.24
```



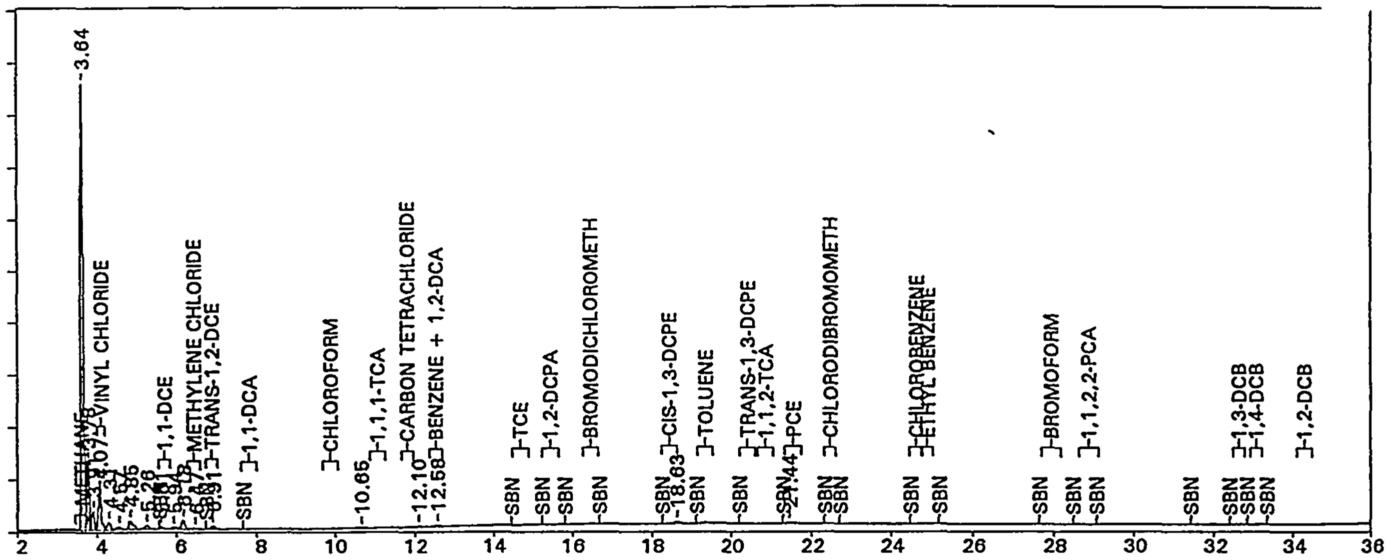
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-1                          OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.55R                              *
* DATE ANALYZED....... SEP 22, 1992  16:58:19                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08             *
* RUN TIME....... 53.245                 THRESHOLD..... -4              *
* AREA REJECT.... 40                     COM PORT......  1              *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1               *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333        *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5386E2Cb#155          FMT FILE.. C:\CP\D23\GAS.FMT   *
*************************************************************************
Out of Ret Time                      Amount  % Delta   Peak           Amount/   Peak  Peak      ug/l
Bound  (min)      Peak Name          PPMV    Ret Time  Area   AREA %   Area      #    Height    AIR
       3.642  METHANE                 7.987   0.90%    4820   60.53  0.0016569   1    1059     0.000
       4.068  VINYL CHLORIDE          4.537  -1.01%     712    8.94  0.0063709   4     140     0.000
       6.911  TRANS-1,2-DCE           1.766   0.44%      97    1.22  0.0181932  12      13     0.000
      12.563  BENZENE + 1,2-DCA       0.049   0.31%      40    0.51  0.0012136  17       4     0.000
      18.634  CIS-1,3-DCPE            0.077   1.05%      43    0.54  0.0018091  18       4     0.000
Total amt. ID. = 14.41567          Total area (all peaks) = 7963.615
```

File=C:\CP\D23\W23A1.56R Date printed=01-27-1999 Time= 15:16:23
Sample Name=904-111G-2
2.0 to 36.0 min. Low Y=0.381 High Y=1.461 mv Span=1.08



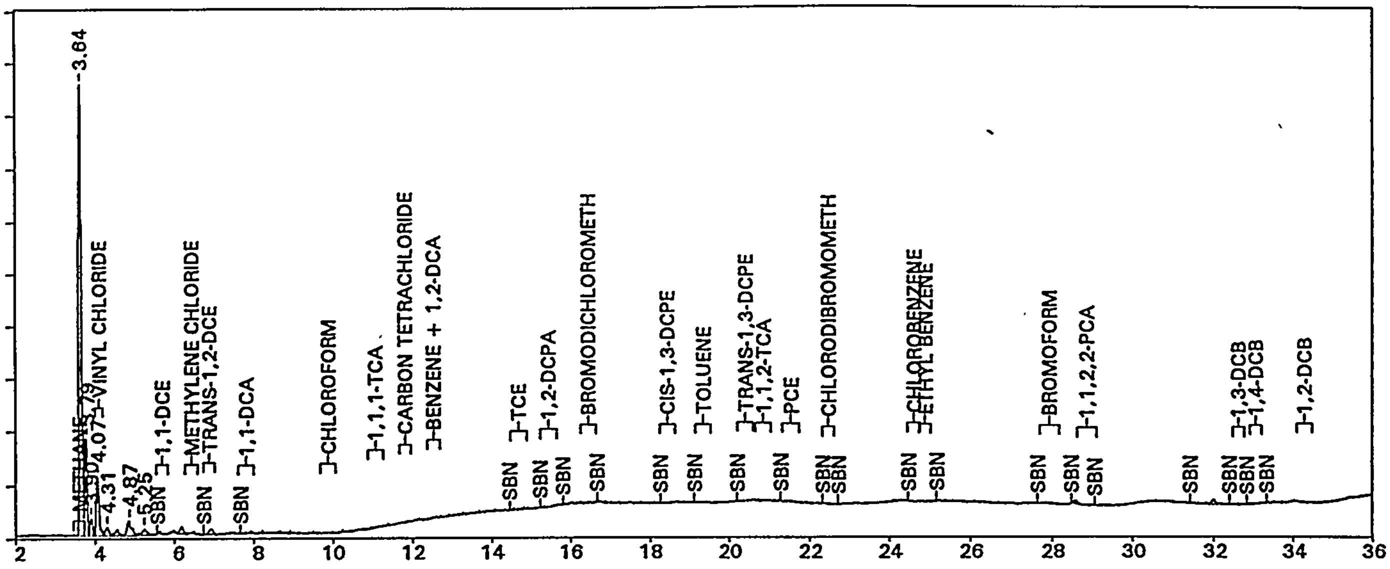
```
************************* MICROSEEPS LABORATORY **************************
*                                                                        *
* SAMPLE NAME......... 904-111G-2                         OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.56R                                *
* DATE ANALYZED....... SEP 22, 1992  18:05:40                             *
* REPORT DATE.... 01-27-1999                                              *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                   *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                   *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08               *
* RUN TIME....... 53.245                 THRESHOLD..... -4                *
* AREA REJECT.... 40                     COM PORT......  1                *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1                 *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58              *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32              *
* HP REF FILE.... Q5387DF5b#156          FMT FILE.. C:\CP\D23\GAS.FMT     *
**************************************************************************
Out of Ret Time                        Amount   % Delta    Peak            Amount/   Peak   Peak      ug/l
Bound  (min)        Peak Name          PPMV    Ret Time    Area   AREA %    Area       #    Height     AIR
         3.644 METHANE                 6.944    0.93%      4118    57.20  0.0016860   1     921      0.000
         4.074 VINYL CHLORIDE          4.762   -0.88%       748    10.38  0.0063705   4     149      0.000
         6.424 METHYLENE CHLORIDE      0.311   -0.02%        51     0.71  0.0060595  12       5      0.000
         6.929 TRANS-1,2-DCE           2.218    0.72%       123     1.70  0.0181022  13      16      0.000
        19.400 TOLUENE                 0.032    0.31%        43     0.59  0.0007390  16       4      0.000
Total amt. ID. = 14.26668                   Total area (all peaks) = 7199.902
```

```
File=C:\CP\D23\W23A1.57R Date printed=01-27-1999 Time= 15:17:49
Sample Name=904-111G-3
2.0 to 36.0 min. Low Y=0.379 High Y=3.013 mv Span=2.634
```



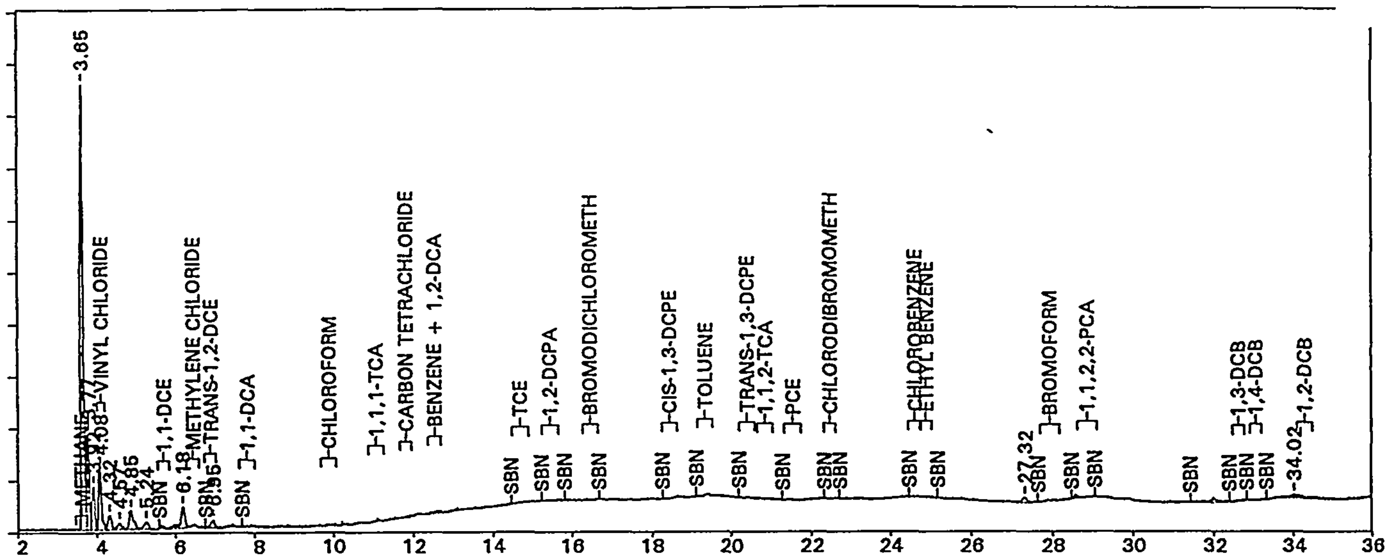
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-3                        OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.57R                              *
* DATE ANALYZED....... SEP 22, 1992  19:12:42                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5388DACb#157        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                      Amount   % Delta    Peak             Amount/   Peak   Peak     ug/l
Bound  (min)       Peak Name          PPMV    Ret Time   Area   AREA %    Area       #    Height    AIR
        3.641  METHANE               16.905    0.86%    10114   67.61  0.0016715    1    2243     0.000
        4.070  VINYL CHLORIDE         6.276   -0.97%      985    6.59  0.0063684    4     182     0.000
        5.606  1,1-DCE                0.009   -1.56%       43    0.29  0.0002046    9       8     0.000
        6.473  METHYLENE CHLORIDE     0.458    0.74%       76    0.51  0.0060595   12       7     0.000
        6.906  TRANS-1,2-DCE          2.326    0.37%      130    0.87  0.0179167   13      17     0.000
       12.578  BENZENE + 1,2-DCA      0.095    0.43%       78    0.52  0.0012136   20       8     0.000
       18.631  CIS-1,3-DCPE           0.173    1.03%       96    0.64  0.0018091   21      10     0.000
       21.436  PCE                    0.146   -0.44%       74    0.50  0.0019709   23       5     0.000
Total amt. ID. = 26.38858               Total area (all peaks) = 14959.12
```

```
File=C:\CP\D23\W23A1.58R Date printed=01-27-1999 Time= 15:19:14
Sample Name=904-111G-4
2.0 to 36.0 min. Low Y=0.392 High Y=0.83 mv Span=0.438
```



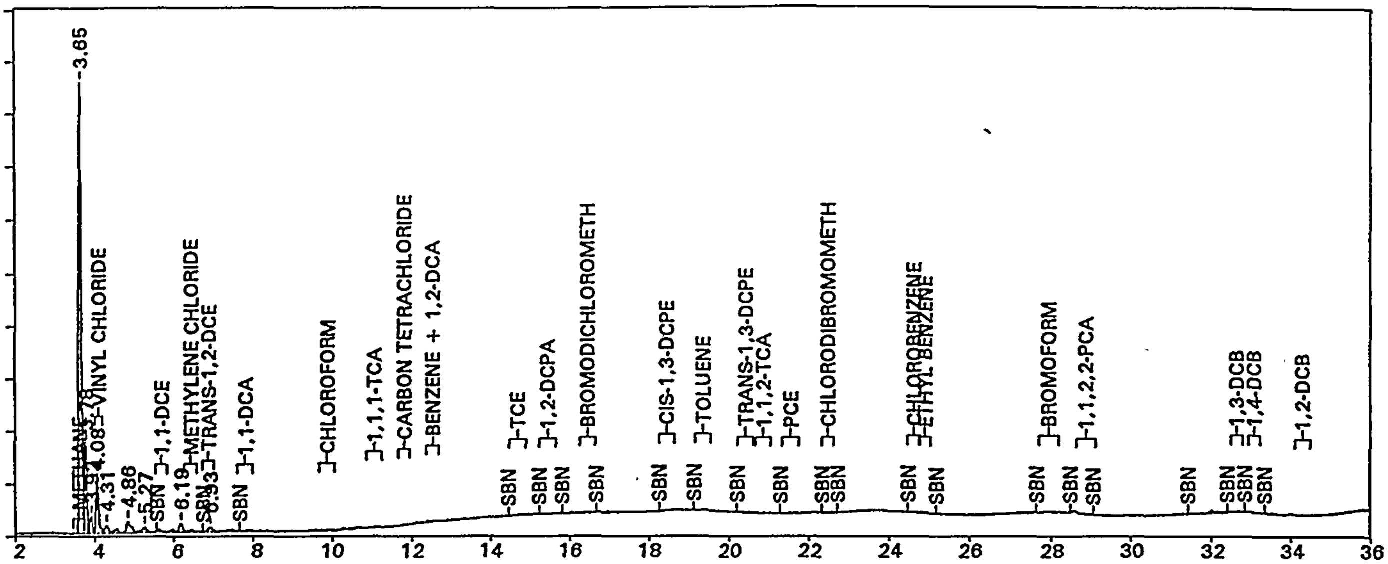
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-4                       OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.58R                              *
* DATE ANALYZED....... SEP 22, 1992  20:19:46                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5389D63b#158        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                    Amount  % Delta   Peak             Amount/   Peak   Peak      ug/l
Bound  (min)       Peak Name        PPMV   Ret Time  Area   AREA %     Area      #    Height     AIR
        3.645  METHANE              2.812   0.97%    1697   66.06  0.0016572    1     372      0.000
        4.071  VINYL CHLORIDE       1.576  -0.96%     247    9.60  0.0063877    4      48      0.000
Total amt. ID. = 4.388273              Total area (all peaks) = 2568.965
```

```
File=C:\CP\D23\W23A1.59R Date printed=01-27-1999 Time= 15:20:37
Sample Name=904-111G-5
2.0 to 36.0 min. Low Y=0.395 High Y=0.856 mv Span=0.461
```



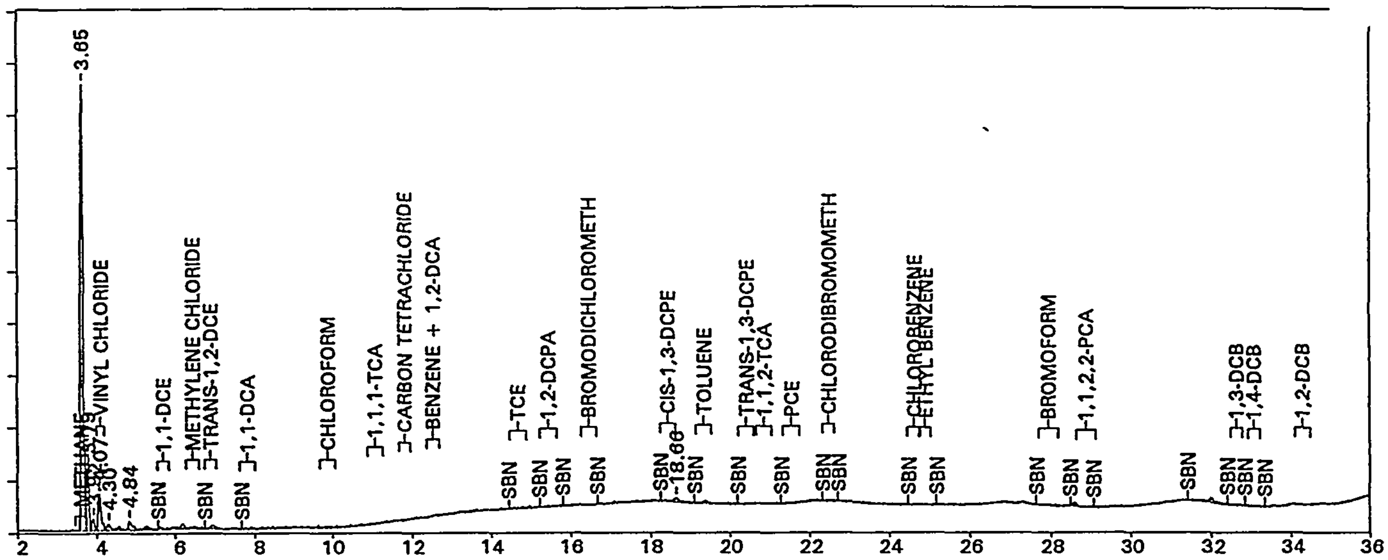
```
************************* MICROSEEPS LABORATORY *************************
*                                                                        *
* SAMPLE NAME......... 904-111G-5                         OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.59R                               *
* DATE ANALYZED....... SEP 22, 1992  21:27:00                            *
* REPORT DATE.... 01-27-1999                                             *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                  *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                  *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08                *
* RUN TIME....... 53.245               THRESHOLD..... -4                 *
* AREA REJECT.... 40                   COM PORT......  1                 *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                  *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333           *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58             *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32             *
* HP REF FILE.... Q538AD25b#159        FMT FILE.. C:\CP\D23\GAS.FMT      *
**************************************************************************
Out of Ret Time                     Amount  % Delta   Peak           Amount/   Peak   Peak     ug/l
Bound   (min)      Peak Name         PPMV   Ret Time  Area   AREA %   Area       #   Height    AIR
        3.647  METHANE              2.965    1.02%    1788   54.69  0.0016584   1     393     0.000
        4.078  VINYL CHLORIDE       1.793   -0.77%     281    8.59  0.0063846   4      54     0.000
        6.950  TRANS-1,2-DCE        0.956    1.02%      53    1.61  0.0181932  11       7     0.000
Total amt. ID. = 5.713928             Total area (all peaks) = 3269.078
```

```
File=C:\CP\D23\W23A1.60R Date printed=01-27-1999 Time= 15:22:01
Sample Name=904-111G-6
2.0 to 36.0 min. Low Y=0.394 High Y=1.06 mv Span=0.665
```



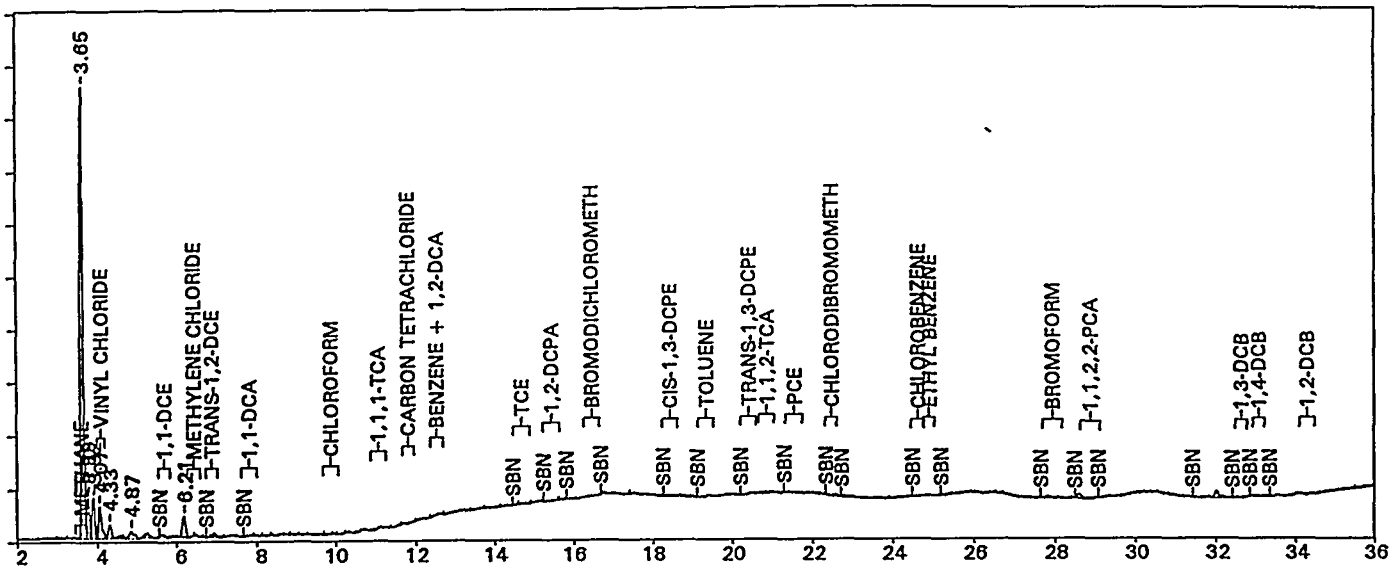
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-6                        OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.60R                              *
* DATE ANALYZED....... SEP 22, 1992  22:34:09                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                THRESHOLD..... -4               *
* AREA REJECT.... 40                    COM PORT......  1               *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q538BCE2b#160         FMT FILE.. C:\CP\D23\GAS.FMT    *
*************************************************************************
Out of Ret Time                   Amount   % Delta   Peak            Amount/   Peak   Peak      ug/l
Bound   (min)       Peak Name      PPMV   Ret Time   Area   AREA %    Area      #    Height     AIR
        3.649  METHANE            4.274    1.09%     2581   66.64  0.0016562   1     566      0.000
        4.076  VINYL CHLORIDE     2.053   -0.84%      322    8.31  0.0063817   4      63      0.000
        6.933  TRANS-1,2-DCE      0.813    0.77%       45    1.15  0.0181932  13       5      0.000
Total amt. ID. = 7.140236             Total area (all peaks) = 3873.055
```

```
File=C:\CP\D23\W23A1.61R Date printed=01-27-1999 Time= 15:23:24
Sample Name=904-111G-7
2.0 to 36.0 min. Low Y=0.396 High Y=0.906 mv Span=0.509
```



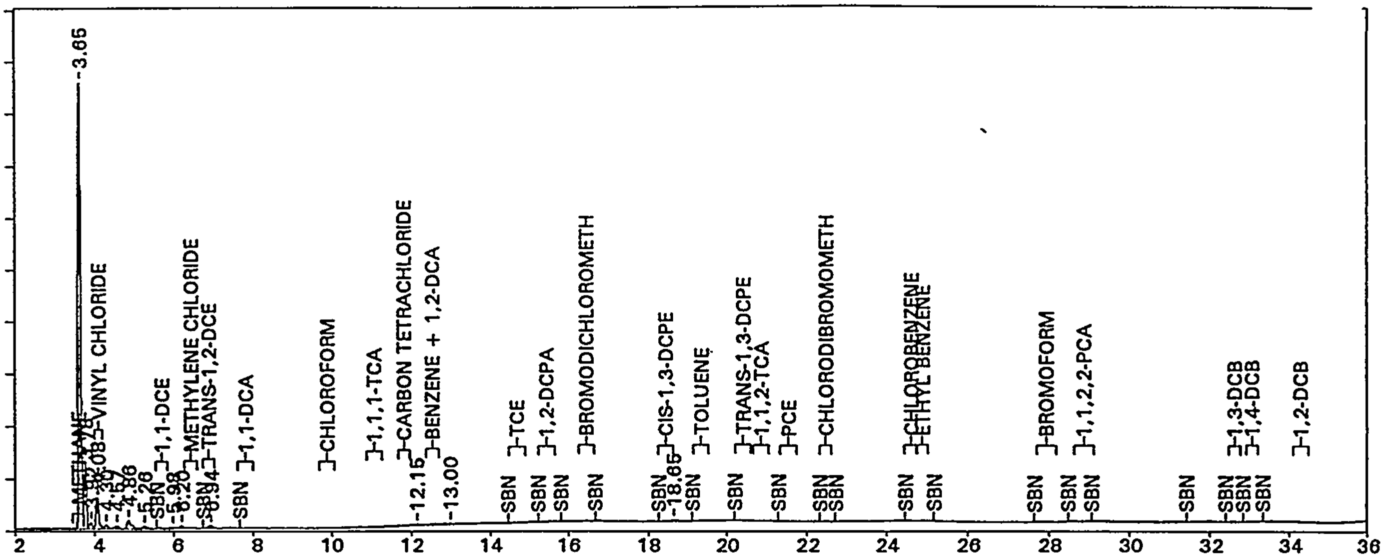
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-7                    OPERATOR...ADS     *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.61R                              *
* DATE ANALYZED....... SEP 22, 1992  23:40:54                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58           *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32           *
* HP REF FILE.... Q538CC88b#161        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                 Amount   % Delta   Peak           Amount/   Peak   Peak      ug/l
Bound  (min)     Peak Name      PPMV     Ret Time  Area   AREA %   Area      #    Height    AIR
        3.645  METHANE          3.272     0.98%    1941   74.01  0.0016858   1     433      0.000
        4.072  VINYL CHLORIDE   1.262    -0.92%     197    7.52  0.0063941   4      35      0.000
Total amt. ID. = 4.534022           Total area (all peaks) = 2622.756
```

```
File=C:\CP\D23\W23A1.62R Date printed=01-27-1999 Time= 15:24:46
Sample Name=904-111G-8
2.0 to 36.0 min. Low Y=0.398 High Y=0.728 mv Span=0.33
```



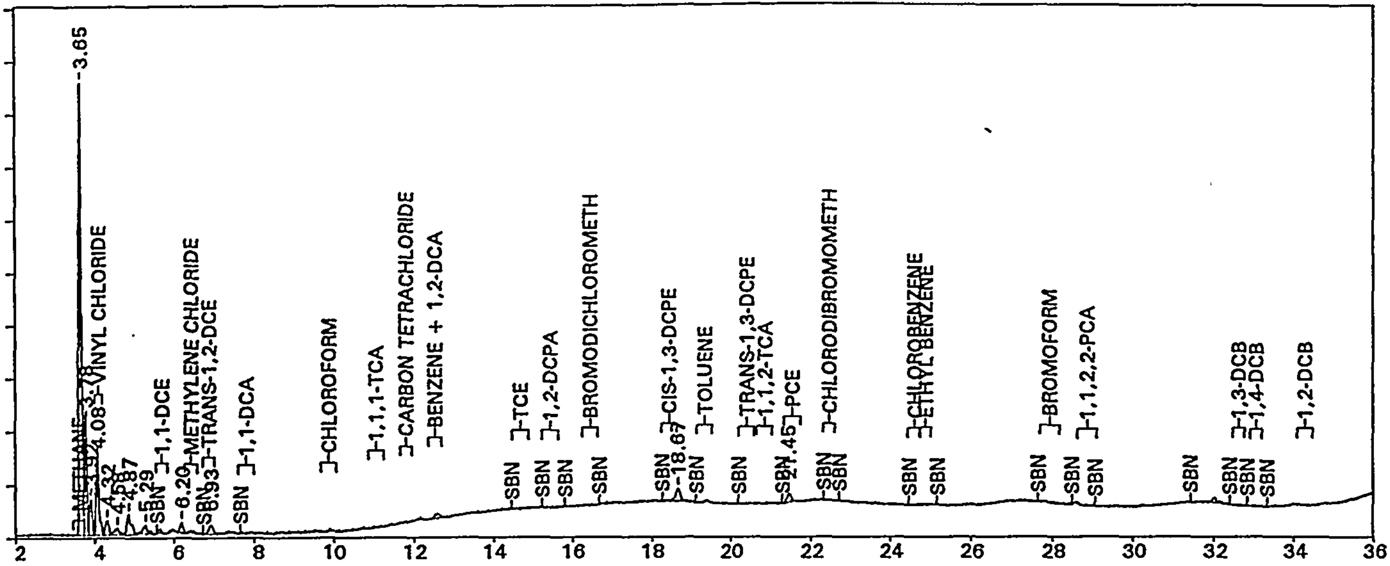
```
************************* MICROSEEPS LABORATORY *************************
*                                                                        *
* SAMPLE NAME......... 904-111G-8                          OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.62R                               *
* DATE ANALYZED....... SEP 23, 1992  00:47:52                            *
* REPORT DATE.... 01-27-1999                                             *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                  *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                  *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08               *
* RUN TIME....... 53.245                THRESHOLD..... -4                *
* AREA REJECT.... 40                    COM PORT......  1                *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                 *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58             *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32             *
* HP REF FILE.... Q538DC3Ab#162         FMT FILE.. C:\CP\D23\GAS.FMT     *
**************************************************************************
Out of Ret Time                    Amount   % Delta    Peak              Amount/     Peak   Peak      ug/l
Bound   (min)      Peak Name        PPMV    Ret Time   Area     AREA %    Area        #     Height     AIR
        3.648  METHANE              2.129    1.04%     1257     70.81   0.0016931    1      282      0.000
        4.075  VINYL CHLORIDE       0.734   -0.86%      114      6.44   0.0064175    4       20      0.000
Total amt. ID. = 2.862413             Total area (all peaks) = 1775.765
```

```
File=C:\CP\D23\W23A1.63R Date printed=01-27-1999 Time= 15:26:09
Sample Name=904-111G-9
2.0 to 36.0 min. Low Y=0.392 High Y=2.089 mv Span=1.697
```



```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-9                       OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.63R                              *
* DATE ANALYZED....... SEP 23, 1992  01:54:53                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                THRESHOLD..... -4               *
* AREA REJECT.... 40                    COM PORT......  1               *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q538EBEFb#163         FMT FILE.. C:\CP\D23\GAS.FMT    *
*************************************************************************
Out of Ret Time                     Amount  % Delta    Peak            Amount/    Peak   Peak     ug/l
Bound  (min)      Peak Name         PPMV    Ret Time   Area   AREA %   Area       #      Height   AIR
        3.648  METHANE              10.926   1.04%     6423   74.76   0.0017011   1      1449     0.000
        4.079  VINYL CHLORIDE        3.313  -0.75%      520    6.05   0.0063742   4       102     0.000
        6.943  TRANS-1,2-DCE         1.432   0.91%       79    0.92   0.0181932  12         9     0.000
Total amt. ID. = 15.67158                  Total area (all peaks) = 8591.569
```

File=C:\CP\D23\W23A1.64R Date printed=01-27-1999 Time= 15:27:34
Sample Name=904-111G-10
2.0 to 36.0 min. Low Y=0.399 High Y=0.834 mv Span=0.435

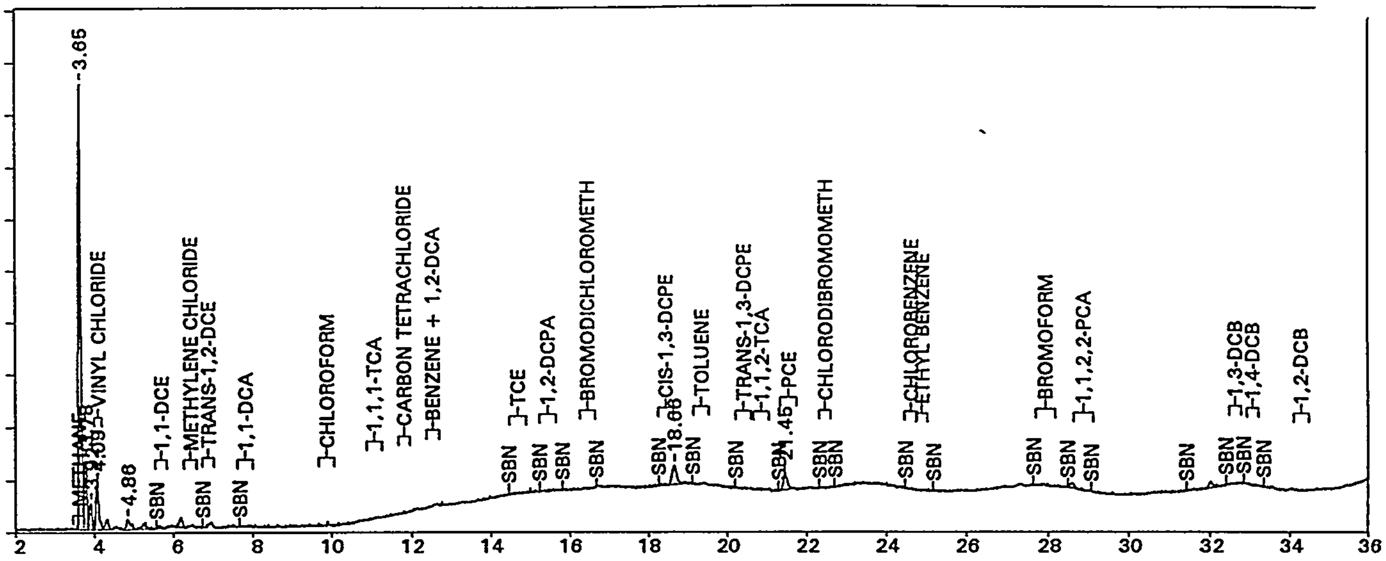


```
************************* MICROSEEPS LABORATORY *************************
*                                                                         *
* SAMPLE NAME......... 904-111G-10                       OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.64R                                *
* DATE ANALYZED....... SEP 23, 1992  03:01:38                             *
* REPORT DATE.... 01-27-1999                                              *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                   *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                   *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08               *
* RUN TIME....... 53.245                 THRESHOLD..... -4                *
* AREA REJECT.... 40                     COM PORT......  1                *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1                 *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58              *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32              *
* HP REF FILE.... Q538FB94b#164          FMT FILE.. C:\CP\D23\GAS.FMT     *
***************************************************************************
```

Out of Bound	Ret Time (min)	Peak Name	Amount PPMV	% Delta Ret Time	Peak Area	AREA %	Amount/ Area	Peak #	Peak Height	ug/l AIR
	3.652	METHANE	2.803	1.17%	1703	54.24	0.0016462	1	371	0.000
	4.081	VINYL CHLORIDE	2.078	-0.71%	326	10.37	0.0063815	4	59	0.000
	6.934	TRANS-1,2-DCE	1.114	0.78%	61	1.95	0.0181932	11	8	0.000
	21.446	PCE	0.107	-0.39%	54	1.73	0.0019709	14	8	0.000

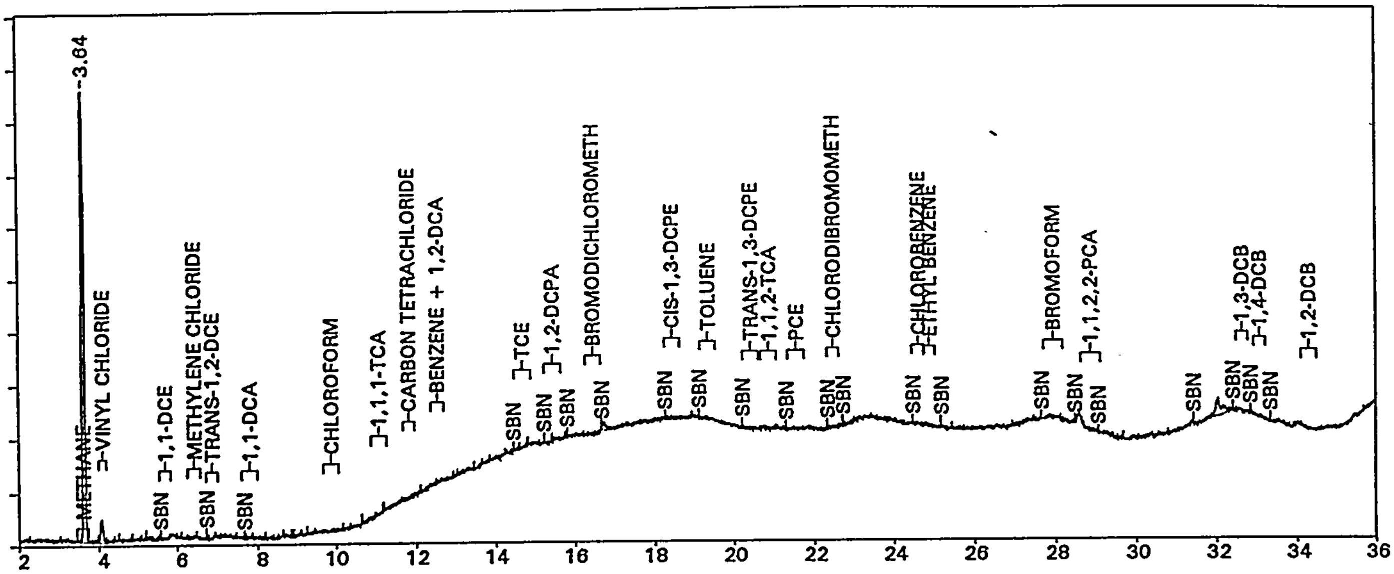
Total amt. ID. = 6.101829   Total area (all peaks) = 3139.906

File=C:\CP\D23\W23A1.65R Date printed=01-27-1999 Time= 15:28:58
Sample Name=904-111G-10A
2.0 to 36.0 min. Low Y=0.401 High Y=0.713 mv Span=0.312



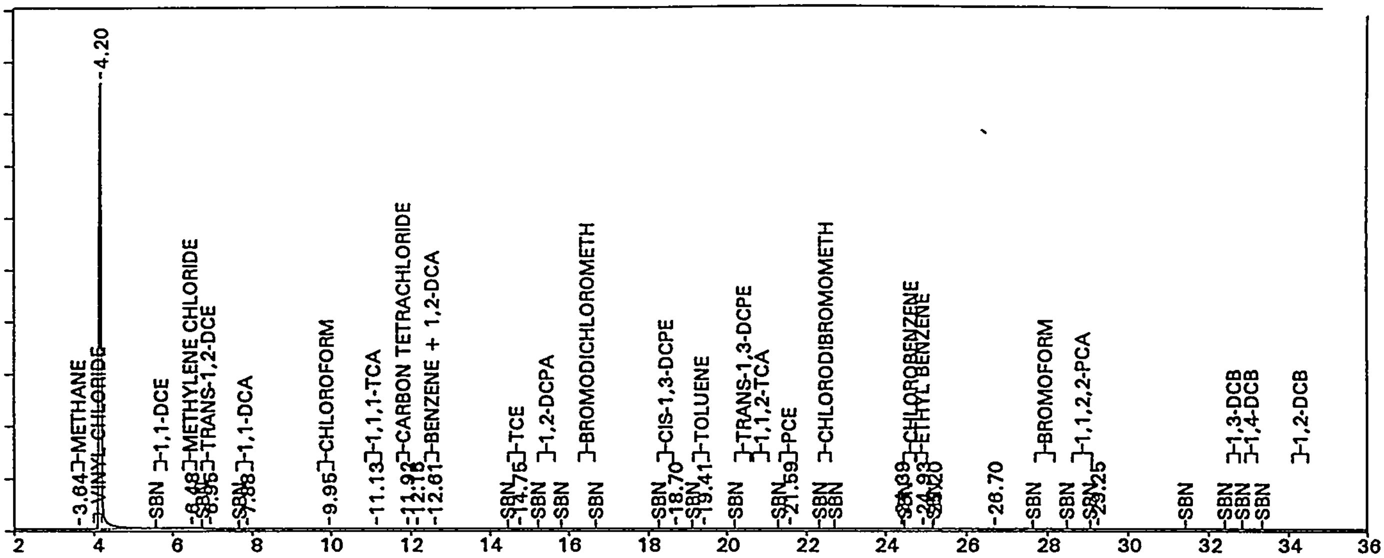
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-10A                    OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.65R                              *
* DATE ANALYZED....... SEP 23, 1992  04:09:08                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                THRESHOLD..... -4               *
* AREA REJECT.... 40                    COM PORT......  1               *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5390B65b#165         FMT FILE.. C:\CP\D23\GAS.FMT    *
*************************************************************************
Out of Ret Time                    Amount   % Delta   Peak           Amount/    Peak   Peak      ug/l
Bound  (min)        Peak Name      PPMV     Ret Time  Area   AREA %   Area       #     Height    AIR
        3.653  METHANE             2.013     1.19%    1198   66.03   0.0016811   1     266      0.000
        4.088  VINYL CHLORIDE      0.936    -0.54%     146    8.06   0.0064054   4      27      0.000
       21.446  PCE                 0.130    -0.39%      66    3.63   0.0019709  11       9      0.000
Total amt. ID. = 3.079249             Total area (all peaks) = 1813.993
```

```
File=C:\CP\D23\W23A1.66R Date printed=01-27-1999 Time= 15:30:21
Sample Name=904-111G*SB2
2.0 to 36.0 min. Low Y=0.402 High Y=0.521 mv Span=0.119
```



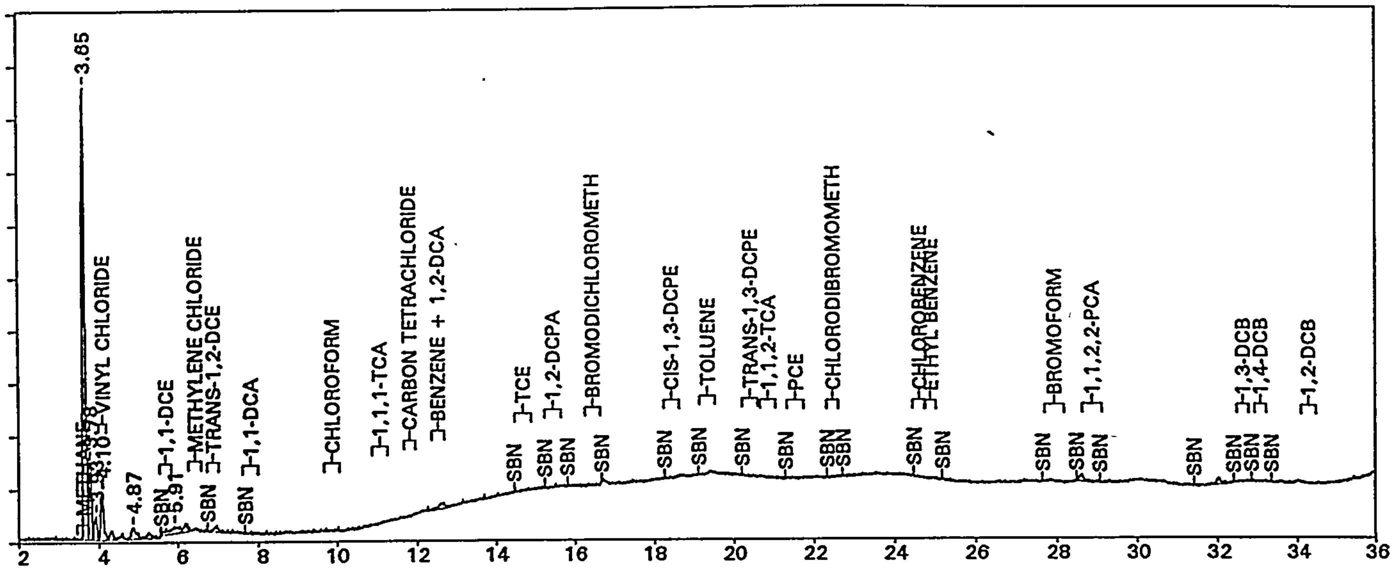
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G*SB2                    OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.66R                              *
* DATE ANALYZED....... SEP 23, 1992  05:15:59                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5391B11b#166        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                  Amount   % Delta    Peak              Amount/    Peak    Peak      ug/l
Bound  (min)       Peak Name     PPMV    Ret Time    Area    AREA %     Area       #     Height     AIR
       3.637  METHANE            0.771    0.76%      442    100.00   0.0017433    1      101      0.000
Total amt. ID. = .7712644              Total area (all peaks) = 442.4043
```

```
File=C:\CP\D23\W23A1.67R Date printed=01-27-1999 Time= 15:31:44
Sample Name=STD K4 R4
2.0 to 36.0 min. Low Y=-7.727 High Y=1686.362 mv Span=1694.089
```



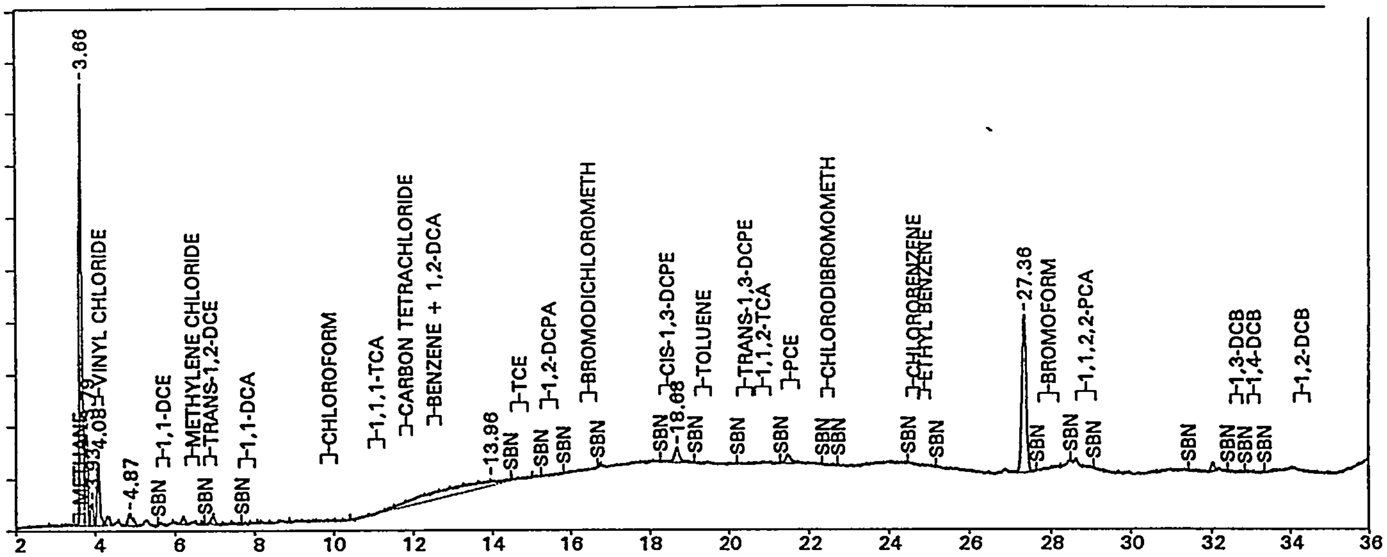
```
************************* MICROSEEPS LABORATORY *************************
*                                                                        *
* SAMPLE NAME......... STD K4 R4                        OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.67R                               *
* DATE ANALYZED....... SEP 23, 1992  06:22:48                            *
* REPORT DATE.... 01-27-1999                                             *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                  *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                  *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08                *
* RUN TIME....... 53.245               THRESHOLD..... -4                 *
* AREA REJECT.... 40                   COM PORT......  1                 *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                  *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333           *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5392ABAb#167        FMT FILE.. C:\CP\D23\GAS.FMT      *
**************************************************************************
Out of Ret Time                     Amount   % Delta    Peak              Amount/   Peak    Peak      ug/l
Bound   (min)     Peak Name          PPMV   Ret Time    Area    AREA %     Area       #    Height     AIR
        3.639  METHANE              0.359    0.80%       200     0.00  0.0017986    1       47     0.000
        4.199  VINYL CHLORIDE    44247.688    2.16%   6955016    99.82  0.0063620    2  1443147     0.000
        6.477  METHYLENE CHLORIDE   1.483    0.80%       245     0.00  0.0060595    3       47     0.000
        6.949  TRANS-1,2-DCE        7.502    1.01%       432     0.01  0.0173664    4       81     0.000
        7.881  1,1-DCA              1.160    1.01%       423     0.01  0.0027437    5       63     0.000
        9.951  CHLOROFORM           0.958    1.01%       174     0.00  0.0054980    6       24     0.000
       11.133  1,1,1-TCA            1.075    1.01%       451     0.01  0.0023861    7       44     0.000
       11.924  CARBON TETRACHLORID  2.034    0.97%        81     0.00  0.0249870    8       10     0.000
       12.612  BENZENE + 1,2-DCA    1.659    0.69%      1367     0.02  0.0012136   10      159     0.000
       14.753  TCE                  1.224    0.53%       511     0.01  0.0023937   11       63     0.000
       19.409  TOLUENE              0.987    0.35%      1336     0.02  0.0007390   14      185     0.000
       21.588  PCE                  0.926    0.27%       470     0.01  0.0019709   15       72     0.000
       24.928  ETHYL BENZENE        0.866    0.19%      1152     0.02  0.0007523   17      191     0.000
Total amt. ID. = 44267.92                  Total area (all peaks) = 6967245
```

```
File=C:\CP\D23\W23A1.68R Date printed=01-27-1999 Time= 15:33:10
Sample Name=904-111G-11
2.0 to 36.0 min. Low Y=0.394 High Y=0.672 mv Span=0.277
```



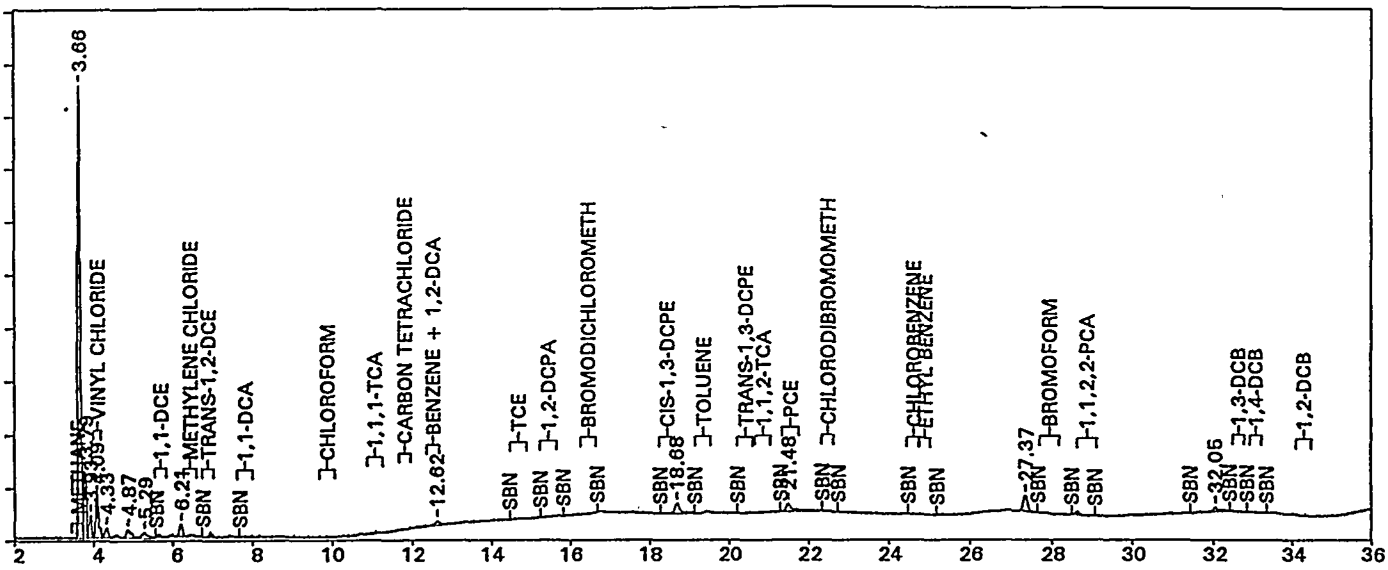
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-11                        OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.68R                              *
* DATE ANALYZED....... SEP 23, 1992  07:29:39                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5393A65b#168        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                   Amount  % Delta   Peak              Amount/   Peak   Peak      ug/l
Bound  (min)        Peak Name     PPMV    Ret Time  Area    AREA %    Area      #      Height    AIR
-------------------------------------------------------------------------------------------------------
       3.655 METHANE              1.784   1.25%     1066    68.19     0.0016738  1     236       0.000
       4.098 VINYL CHLORIDE       0.845   -0.28%    132     8.43      0.0064101  4     25        0.000
Total amt. ID. = 2.629219          Total area (all peaks) = 1563.094
```

File=C:\CP\D23\W23A1.69R Date printed=01-27-1999 Time= 15:34:32
Sample Name=904-111G-12
2.0 to 36.0 min. Low Y=0.398 High Y=0.627 mv Span=0.228



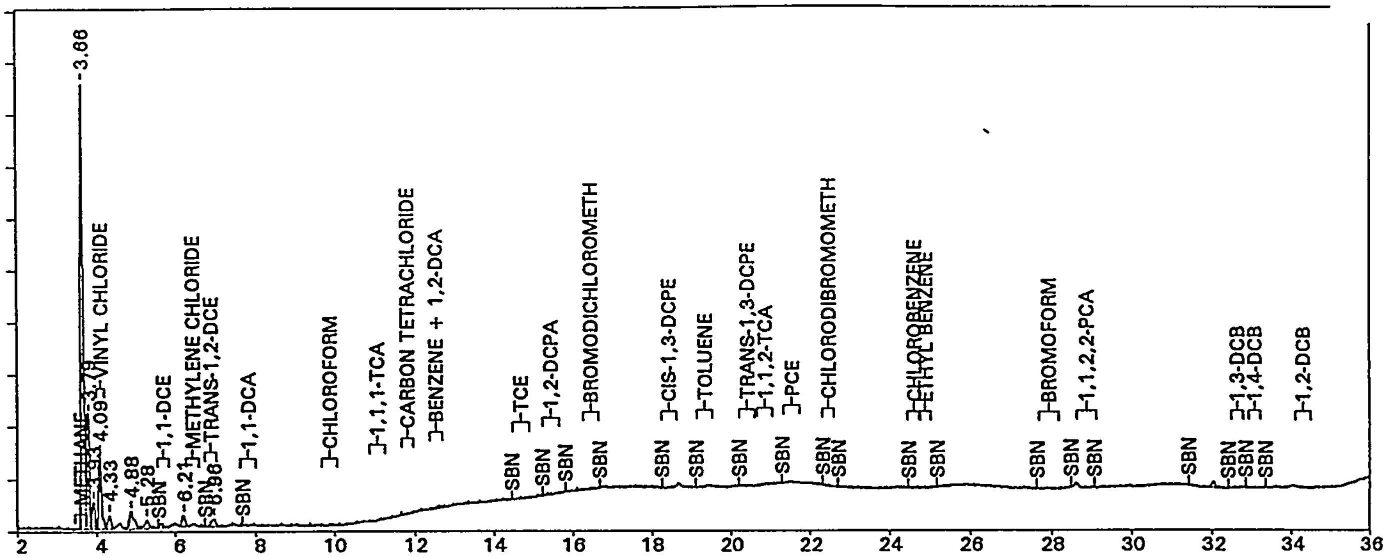
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-12                      OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.69R                              *
* DATE ANALYZED....... SEP 23, 1992  08:38:29                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                THRESHOLD..... -4               *
* AREA REJECT.... 40                    COM PORT......  1               *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5394A87b#169         FMT FILE.. C:\CP\D23\GAS.FMT    *
*************************************************************************
Out of Ret Time                    Amount  % Delta   Peak          Amount/   Peak   Peak    ug/l
Bound  (min)     Peak Name         PPMV    Ret Time  Area  AREA %  Area      #      Height  AIR
       3.659  METHANE              1.463   1.35%     885   38.76   0.0016534  1     193     0.000
       4.080  VINYL CHLORIDE       0.898   -0.72%    140    6.14   0.0064072  4      27     0.000
Total amt. ID. = 2.361759              Total area (all peaks) = 2283.139
```

```
File=C:\CP\D23\W23A1.70R Date printed=01-27-1999 Time= 15:35:55
Sample Name=904-111G-13
2.0 to 36.0 min. Low Y=0.396 High Y=0.907 mv Span=0.51
```



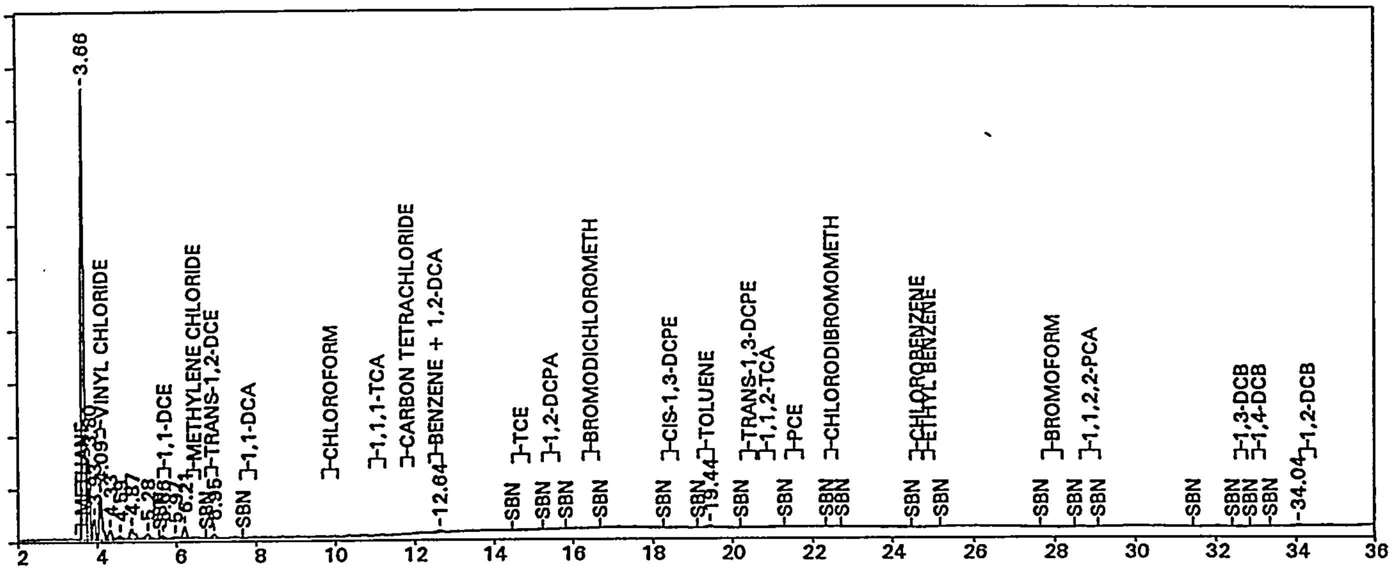
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-13                     OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.70R                              *
* DATE ANALYZED....... SEP 23, 1992  09:46:21                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5395A6Eb#170        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                  Amount   % Delta   Peak          Amount/   Peak   Peak     ug/l
Bound   (min)      Peak Name      PPMV   Ret Time   Area  AREA %    Area      #   Height    AIR
         3.661  METHANE           3.281    1.40%    1966   60.16  0.0016690   1     434    0.000
         4.090  VINYL CHLORIDE    1.408   -0.48%     220    6.74  0.0063908   4      38    0.000
        12.622  BENZENE + 1,2-DCA 0.086    0.77%      71    2.18  0.0012136  11       5    0.000
        21.485  PCE               0.201   -0.21%     102    3.13  0.0019709  13       8    0.000
Total amt. ID. = 4.975706         Total area (all peaks) = 3267.244
```

```
File=C:\CP\D23\W23A1.71R Date printed=01-27-1999 Time= 15:37:20
Sample Name=904-111G-14
2.0 to 36.0 min. Low Y=0.393 High Y=0.748 mv Span=0.354
```



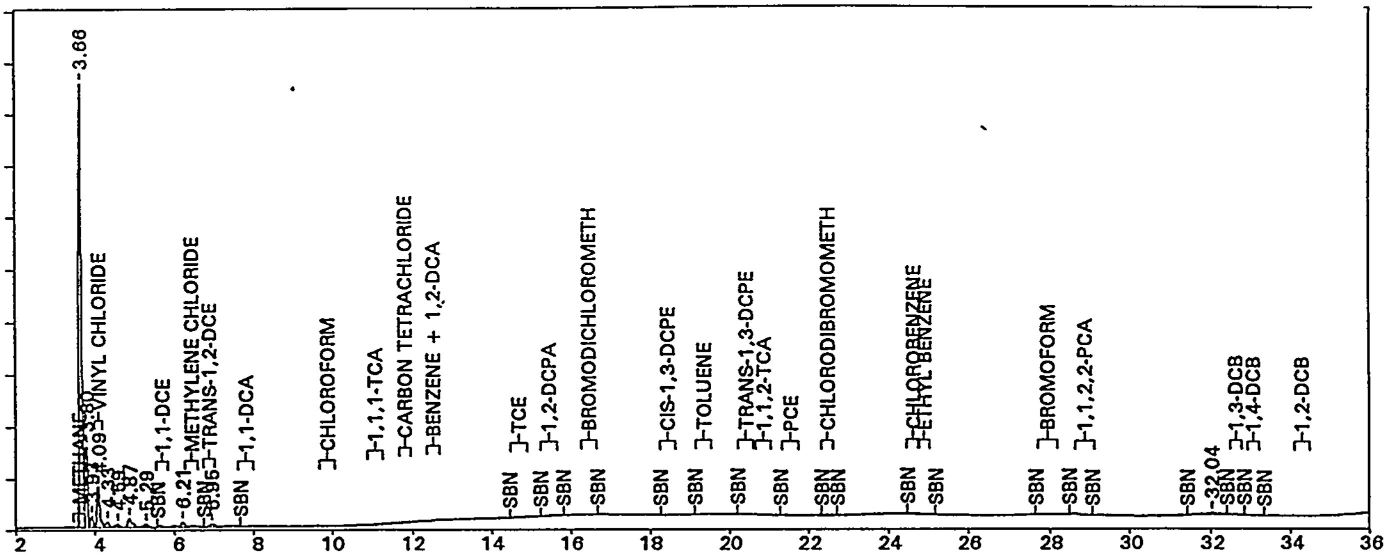
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-14                      OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.71R                              *
* DATE ANALYZED....... SEP 23, 1992  10:54:09                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5396A52b#171        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                        Amount  % Delta   Peak            Amount/   Peak   Peak      ug/l
Bound   (min)       Peak Name          PPMV    Ret Time  Area   AREA %   Area       #    Height     AIR
        3.660  METHANE                 2.279    1.37%    1351   57.59   0.0016870   1     301      0.000
        4.090  VINYL CHLORIDE          1.632   -0.48%     256   10.89   0.0063868   4      49      0.000
        6.958  TRANS-1,2-DCE           0.904    1.14%      50    2.12   0.0181932  10       5      0.000
Total amt. ID. = 4.814771              Total area (all peaks) = 2345.69
```

```
File=C:\CP\D23\W23A1.72R Date printed=01-27-1999 Time= 15:38:44
Sample Name=904-111G-15
2.0 to 36.0 min. Low Y=0.389 High Y=1.892 mv Span=1.503
```



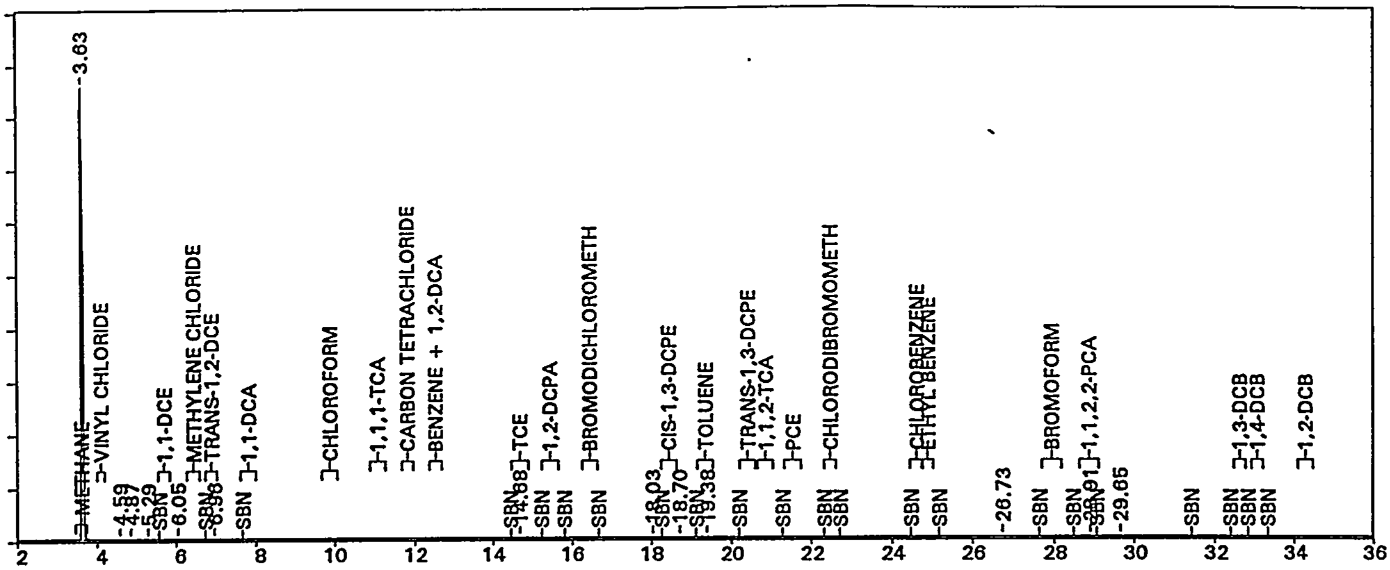
```
************************** MICROSEEPS LABORATORY **************************
*                                                                         *
* SAMPLE NAME......... 904-111G-15                      OPERATOR...ADS    *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.72R                                *
* DATE ANALYZED....... SEP 23, 1992  12:01:55                             *
* REPORT DATE.... 01-27-1999                                              *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                   *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                   *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08               *
* RUN TIME....... 53.245                 THRESHOLD..... -4                *
* AREA REJECT.... 40                     COM PORT......  1                *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1                 *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58             *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32             *
* HP REF FILE.... Q5397A34b#172          FMT FILE.. C:\CP\D23\GAS.FMT     *
***************************************************************************
Out of Ret Time                      Amount   % Delta   Peak            Amount/    Peak   Peak     ug/l
Bound   (min)       Peak Name        PPMV    Ret Time   Area   AREA %    Area        #   Height    AIR
        3.660  METHANE               9.641    1.39%     5800   64.78   0.0016624    1    1279     0.000
        4.088  VINYL CHLORIDE        4.312   -0.53%      677    7.56   0.0063714    4     122     0.000
        5.659  1,1-DCE               0.011   -0.63%       56    0.62   0.0002046    9      10     0.000
        6.950  TRANS-1,2-DCE         1.562    1.02%       86    0.96   0.0181932   12      11     0.000
       12.637  BENZENE + 1,2-DCA     0.080    0.89%       66    0.74   0.0012136   15       7     0.000
       19.441  TOLUENE               0.052    0.52%       70    0.78   0.0007390   16       5     0.000
Total amt. ID. = 15.6589                    Total area (all peaks) = 8952.604
```

```
File=C:\CP\D23\W23A1.73R Date printed=01-27-1999 Time= 15:40:09
Sample Name=904-111G-16
2.0 to 36.0 min. Low Y=0.387 High Y=1.554 mv Span=1.167
```



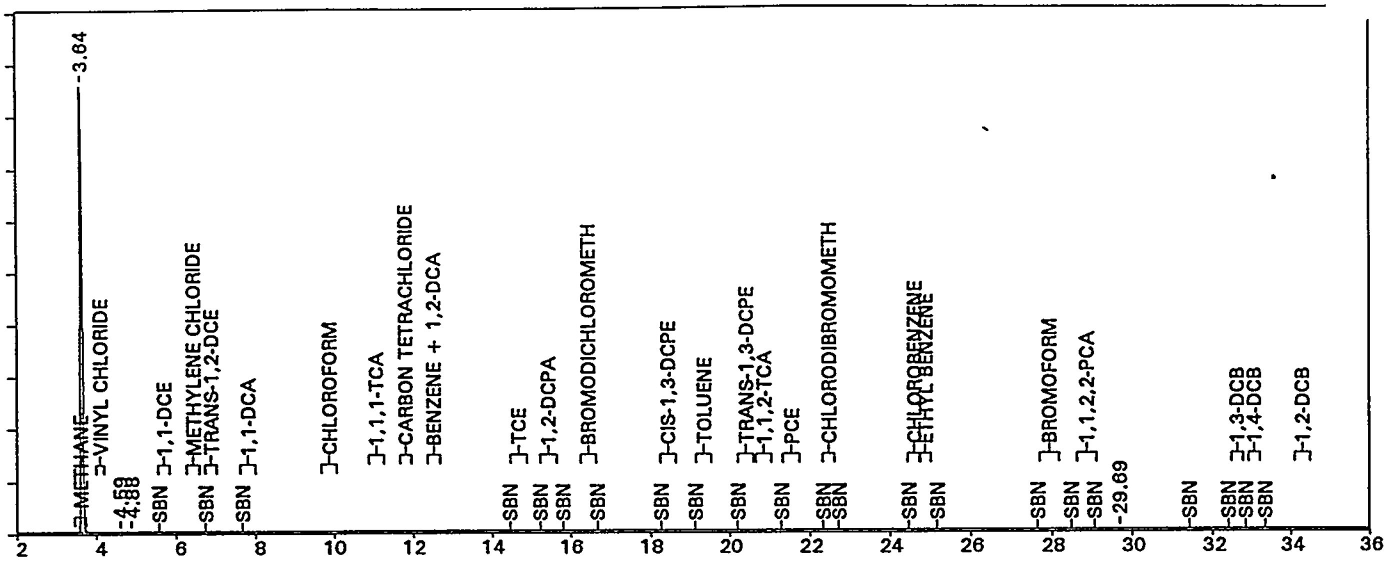
```
************************ MICROSEEPS LABORATORY ************************
*                                                                      *
* SAMPLE NAME......... 904-111G-16                     OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.73R                             *
* DATE ANALYZED....... SEP 23, 1992  13:09:25                          *
* REPORT DATE.... 01-27-1999                                           *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08              *
* RUN TIME....... 53.245               THRESHOLD..... -4               *
* AREA REJECT.... 40                   COM PORT......  1               *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58           *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32           *
* HP REF FILE.... Q5398A05b#173        FMT FILE.. C:\CP\D23\GAS.FMT    *
************************************************************************
Out of Ret Time                       Amount  % Delta   Peak                Amount/   Peak   Peak       ug/l
Bound  (min)       Peak Name          PPMV    Ret Time  Area     AREA %     Area      #      Height     AIR
         3.661  METHANE               7.484    1.41%    4469     69.01   0.0016746    1      992      0.000
         4.093  VINYL CHLORIDE        3.151   -0.41%     494      7.63   0.0063748    4       92      0.000
         6.948  TRANS-1,2-DCE         1.132    0.99%      62      0.96   0.0181932   12        7      0.000
Total amt. ID. = 11.76715              Total area (all peaks) = 6476.326
```

```
File=C:\CP\D23\W23A1.74R Date printed=01-27-1999 Time= 15:41:33
Sample Name=904-111G-17
2.0 to 36.0 min. Low Y=-70.296 High Y=14661.225 mv Span=14731.521
```



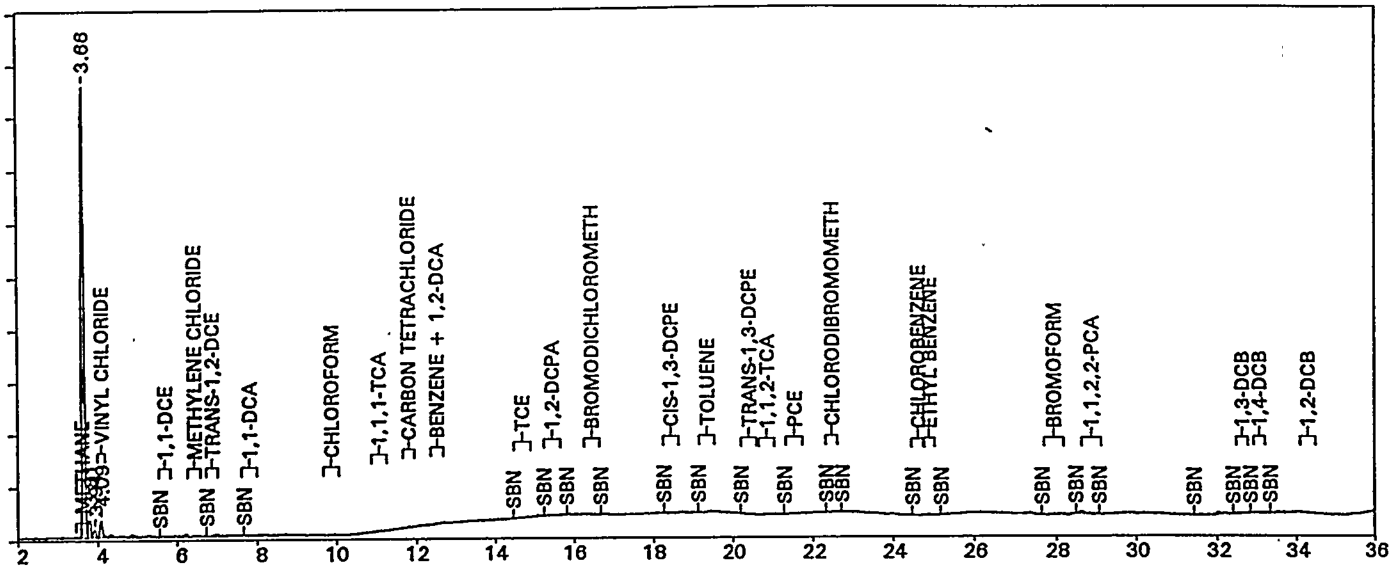
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-17                      OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.74R                              *
* DATE ANALYZED....... SEP 23, 1992  14:30:41                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q5399D12b#174        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                       Amount   % Delta    Peak              Amount/    Peak    Peak       ug/l
Bound   (min)       Peak Name          PPMV   Ret Time    Area    AREA %     Area        #    Height      AIR
         3.625  METHANE          310481.844    0.42%   43277348   100.00   0.0071742    1  %125424      0.000
         6.955  TRANS-1,2-DCE         1.072    1.09%         59     0.00   0.0181932    6        6      0.000
        14.677  TCE                   0.139    0.02%         58     0.00   0.0023937    8        6      0.000
        19.381  TOLUENE               0.035    0.21%         47     0.00   0.0007390   11        5      0.000
        28.907  1,1,2,2-PCA           0.146    0.11%         70     0.00   0.0020817   16       13      0.000
Total amt. ID. = 310483.2              Total area (all peaks) = 4.327908E+07
```

```
File=C:\CP\D23\W23A1.75R Date printed=01-27-1999 Time= 15:42:56
Sample Name=904-111G-18
2.0 to 36.0 min. Low Y=-48.888 High Y=10220.735 mv Span=10269.623
```



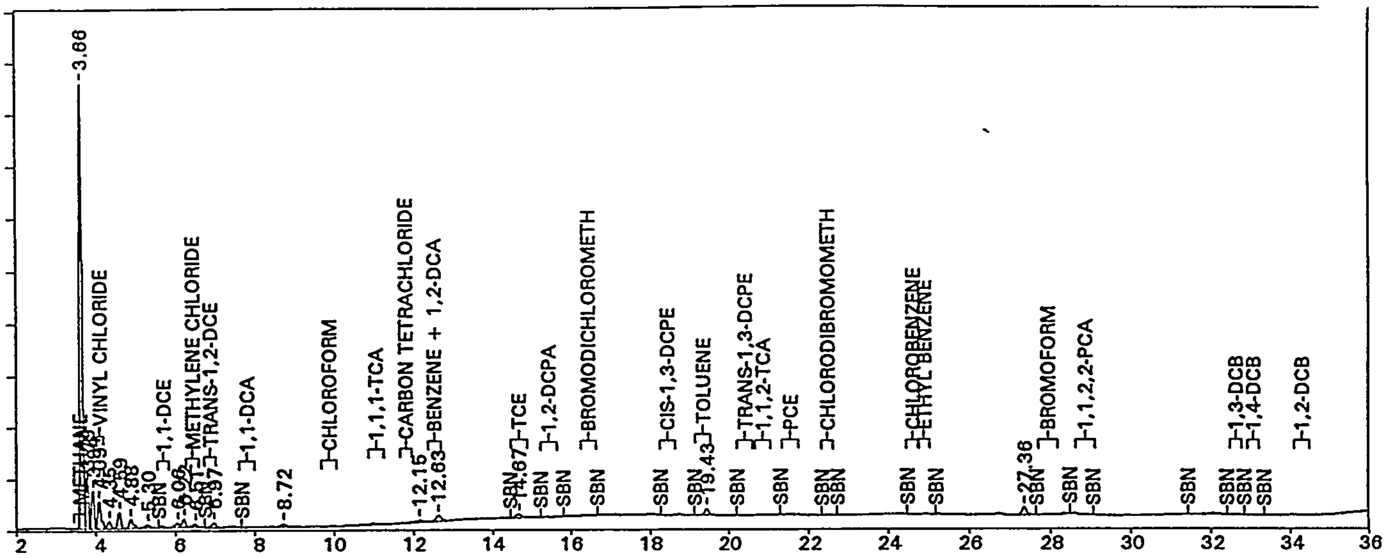
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-18                       OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.75R                              *
* DATE ANALYZED....... SEP 23, 1992  15:41:35                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q539ADB0b#175        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                    Amount   % Delta    Peak            Amount/  Peak   Peak       ug/l
Bound  (min)        Peak Name       PPMV    Ret Time   Area    AREA %   Area     #    Height      AIR
       3.636  METHANE           217467.781   0.73%   31791856  100.00  0.0068404  1 8787764      0.000
Total amt. ID. = 217467.8            Total area (all peaks) = 3.179249E+07
```

```
File=C:\CP\D23\W23A1.76R Date printed=01-27-1999 Time= 15:44:18
Sample Name=904-111G-19
2.0 to 36.0 min. Low Y=0.397 High Y=1.081 mv Span=0.684
```



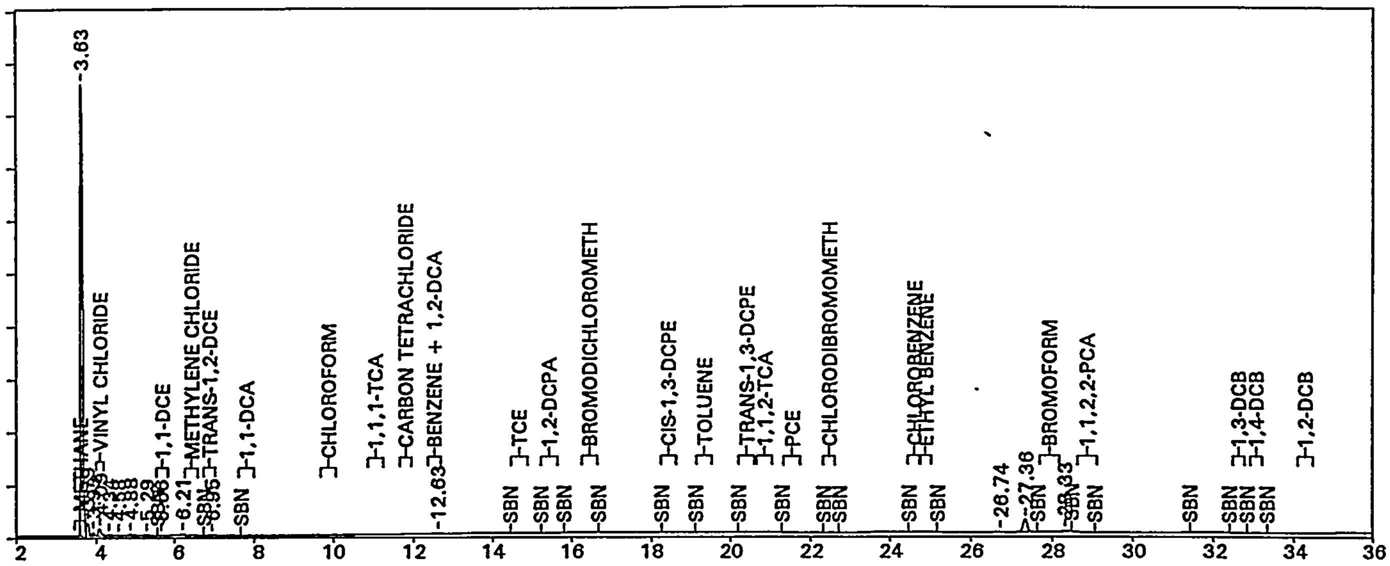
```
************************ MICROSEEPS LABORATORY ************************
*                                                                     *
* SAMPLE NAME......... 904-111G-19                     OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.76R                            *
* DATE ANALYZED....... SEP 23, 1992  16:48:45                         *
* REPORT DATE.... 01-27-1999                                          *
* METHOD FILE.... C:\CP\D23\W23A624.MET                               *
* CAL FILE....... C:\CP\D23\W23A624.CAL                               *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08             *
* RUN TIME....... 53.245               THRESHOLD..... -4              *
* AREA REJECT.... 40                   COM PORT......  1              *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1               *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333        *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58          *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32          *
* HP REF FILE.... Q539BD6Eb#176        FMT FILE.. C:\CP\D23\GAS.FMT   *
***********************************************************************
Out of Ret Time                   Amount   % Delta    Peak             Amount/    Peak   Peak     ug/l
Bound  (min)       Peak Name       PPMV    Ret Time   Area   AREA %    Area        #    Height    AIR
       3.661  METHANE             4.389    1.40%     2610    90.99    0.0016814   1     581     0.000
       4.094  VINYL CHLORIDE      0.696   -0.38%      108     3.78    0.0064205   4      21     0.000
Total amt. ID. = 5.084581              Total area (all peaks) = 2868.616
```

```
File=C:\CP\D23\W23A1.77R Date printed=01-27-1999 Time= 15:45:41
Sample Name=904-111G-20
2.0 to 36.0 min. Low Y=0.39 High Y=1.639 mv Span=1.25
```



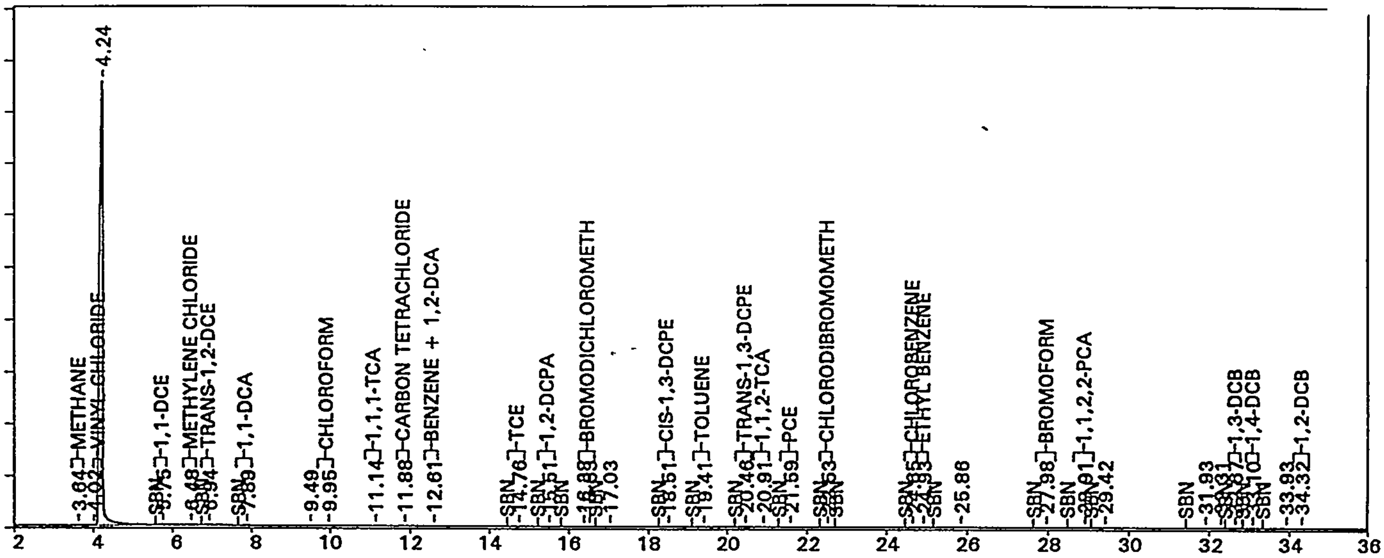
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-20                    OPERATOR...ADS    *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.77R                              *
* DATE ANALYZED....... SEP 23, 1992  17:55:21                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                THRESHOLD..... -4               *
* AREA REJECT.... 40                    COM PORT......  1               *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q539CD0Bb#177         FMT FILE.. C:\CP\D23\GAS.FMT    *
*************************************************************************
Out of Ret Time                        Amount  % Delta   Peak           Amount/   Peak   Peak     ug/l
Bound  (min)        Peak Name          PPMV   Ret Time   Area   AREA %    Area      #   Height    AIR
        3.660  METHANE                 8.018    1.39%    4759   62.04  0.0016847   1    1063     0.000
        4.091  VINYL CHLORIDE          2.468   -0.46%     387    5.04  0.0063784   4      65     0.000
        6.514  METHYLENE CHLORIDE      0.427    1.38%      70    0.92  0.0060595  12       9     0.000
        6.974  TRANS-1,2-DCE           1.534    1.36%      84    1.10  0.0181932  13      11     0.000
       12.631  BENZENE + 1,2-DCA       0.167    0.84%     138    1.80  0.0012136  18      14     0.000
       14.673  TCE                     0.228   -0.01%      95    1.24  0.0023937  19       9     0.000
       19.430  TOLUENE                 0.093    0.46%     125    1.63  0.0007390  20      15     0.000
Total amt. ID. = 12.93388              Total area (all peaks) = 7671.48
```

```
File=C:\CP\D23\W23A1.78R Date printed=01-27-1999 Time= 15:47:06
Sample Name=904-111G-20A
2.0 to 36.0 min. Low Y=0.371 High Y=6.382 mv Span=6.011
```



```
************************** MICROSEEPS LABORATORY **************************
*                                                                         *
* SAMPLE NAME......... 904-111G-20A                      OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.78R                                *
* DATE ANALYZED....... SEP 23, 1992  19:01:50                             *
* REPORT DATE.... 01-27-1999                                              *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                   *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                   *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08                 *
* RUN TIME....... 53.245               THRESHOLD..... -4                  *
* AREA REJECT.... 40                   COM PORT......  1                  *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                   *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333            *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58             *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32             *
* HP REF FILE.... Q539DCA0b#178        FMT FILE.. C:\CP\D23\GAS.FMT       *
***************************************************************************
Out of Ret Time                    Amount   % Delta    Peak              Amount/    Peak   Peak      ug/l
Bound   (min)      Peak Name        PPMV    Ret Time   Area    AREA %     Area       #    Height     AIR
       3.634  METHANE              38.580    0.66%    22101    87.26  0.0017456    1     5119     0.000
       4.094  VINYL CHLORIDE        2.947   -0.39%      462     1.82  0.0063757    4       78     0.000
       5.659  1,1-DCE               0.009   -0.63%       43     0.17  0.0002046    9        7     0.000
       6.949  TRANS-1,2-DCE         1.030    1.01%       57     0.22  0.0181932   11        7     0.000
      12.631  BENZENE + 1,2-DCA     0.102    0.85%       84     0.33  0.0012136   15        7     0.000
Total amt. ID. = 42.66712            Total area (all peaks) = 25328.19
```

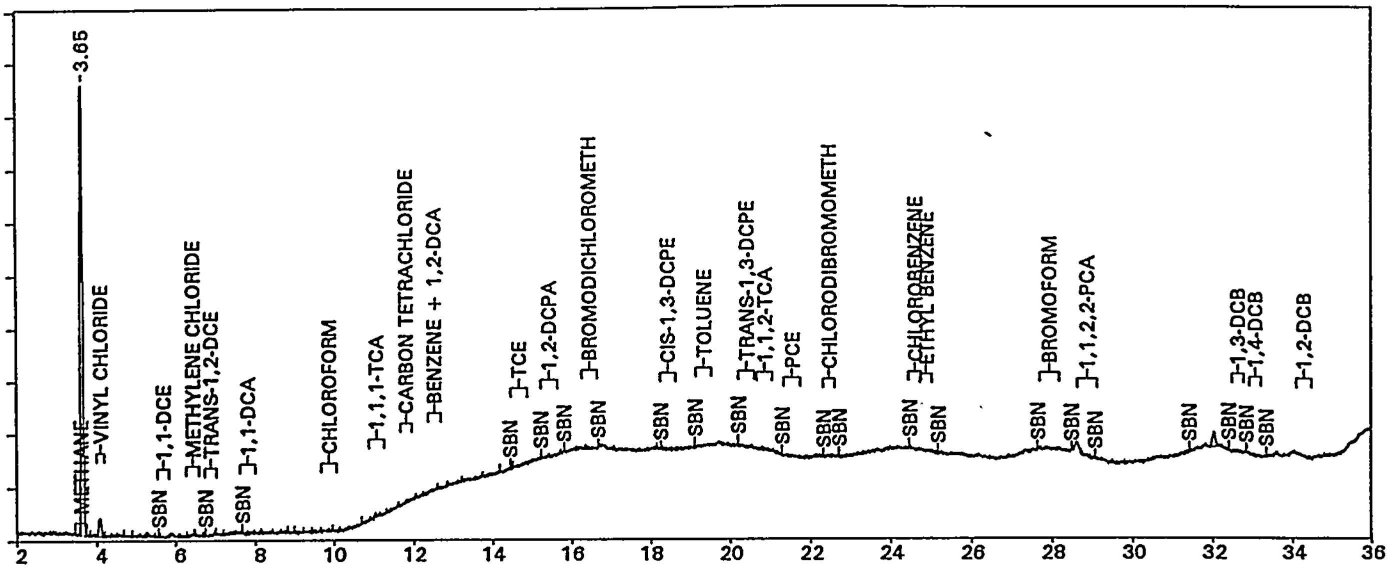
```
File=C:\CP\D23\W23A2.44R Date printed=01-27-1999 Time= 16:17:45
Sample Name=STD 624-4
2.0 to 36.0 min. Low Y=-11.584 High Y=2480.9 mv Span=2492.484
```



```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... STD 624-4                        OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A2.44R                              *
* DATE ANALYZED....... SEP 26, 1992  20:48:25                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53DEA1Ab#244        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
```

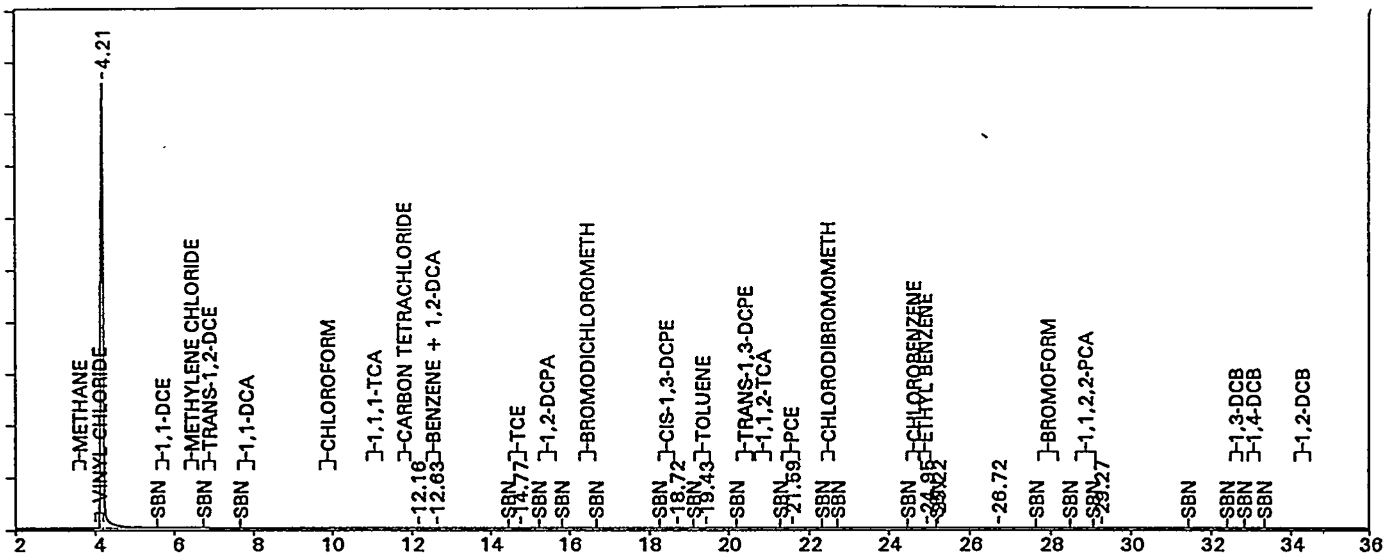
```
Out of Ret Time                       Amount  % Delta   Peak              Amount/   Peak   Peak      ug/l
Bound  (min)      Peak Name           PPMV    Ret Time  Area    AREA %    Area      #      Height    AIR
        3.636  METHANE                 0.152    0.73%      77    0.00   0.0019827   1        19     0.000
        4.025  VINYL CHLORIDE          3.985   -2.08%     625    0.00   0.0063721   2       142     0.000
        5.750  1,1-DCE                 3.891    0.96%   18753    0.15   0.0002075   4      3545     0.000
        6.485  METHYLENE CHLORIDE      4.055    0.93%     694    0.01   0.0058439   5       140     0.000
        6.940  TRANS-1,2-DCE           3.841    0.87%     232    0.00   0.0165346   6        43     0.000
        7.890  1,1-DCA                 3.783    0.87%    1334    0.01   0.0028357   7       197     0.000
        9.955  CHLOROFORM              3.069    0.87%     531    0.00   0.0057798   9        68     0.000
       11.140  1,1,1-TCA               2.856    0.87%    1153    0.01   0.0024772   10      114     0.000
       11.876  CARBON TETRACHLORID     2.106    0.56%     103    0.00   0.0203802   11       11     0.000
       12.615  BENZENE + 1,2-DCA       8.794    0.72%    7029    0.05   0.0012511   12      646     0.000
       14.756  TCE                     2.919    0.55%    1158    0.01   0.0025204   13      152     0.000
       15.514  1,2-DCPA                3.436    0.51%    2093    0.02   0.0016416   14      265     0.000
       16.380  BROMODICHLOROMETH       4.680   -0.42%     245    0.00   0.0191242   15       36     0.000
       18.513  CIS-1,3-DCPE            3.490    0.39%    1872    0.01   0.0018641   18      269     0.000
       19.411  TOLUENE                 4.164    0.37%    5513    0.04   0.0007553   19      790     0.000
       20.464  TRANS-1,3-DCPE          3.442    0.32%    1483    0.01   0.0023207   20      234     0.000
       20.913  1,1,2-TCA               2.854    0.30%    1279    0.01   0.0022313   21      198     0.000
       21.590  PCE                     2.236    0.28%    1093    0.01   0.0020458   22      165     0.000
       22.534  CHLORODIBROMOMETH       1.843    0.28%     129    0.00   0.0142855   23       22     0.000
```

```
File=C:\CP\D23\W23A1.79R Date printed=01-27-1999 Time= 15:48:30
Sample Name=904-111G*SB3
2.0 to 36.0 min. Low Y=0.397 High Y=0.555 mv Span=0.157
```



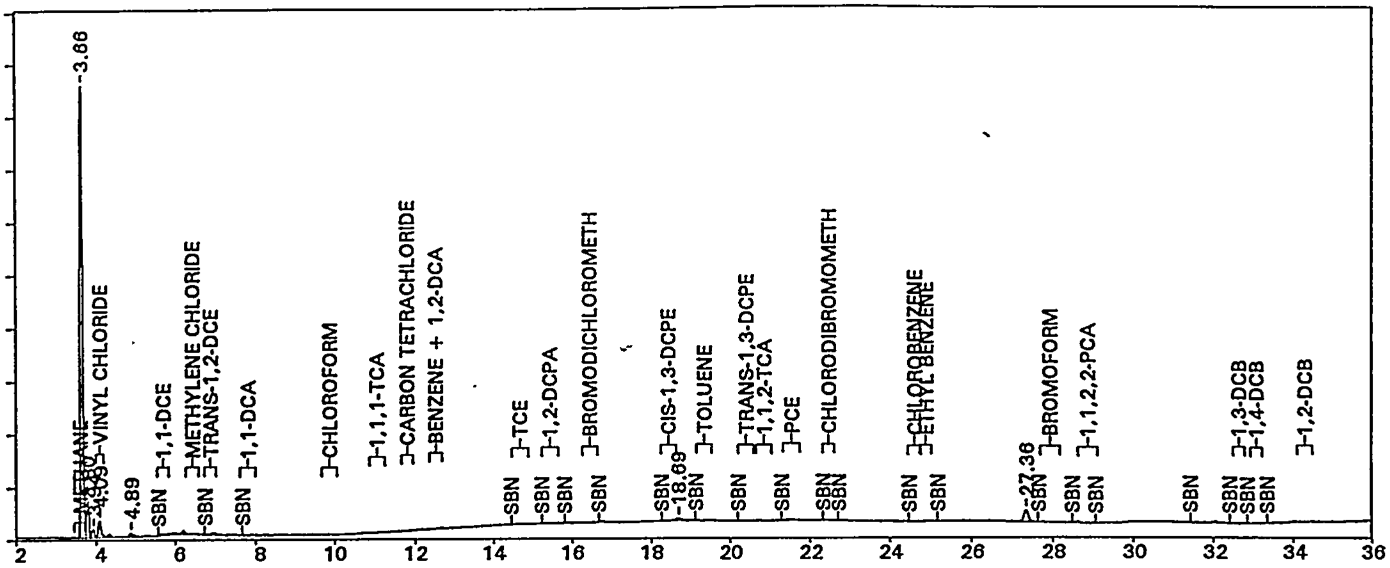
```
************************* MICROSEEPS LABORATORY *************************
*                                                                        *
* SAMPLE NAME......... 904-111G*SB3                    OPERATOR...ADS    *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.79R                               *
* DATE ANALYZED....... SEP 23, 1992  20:07:58                            *
* REPORT DATE.... 01-27-1999                                             *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                  *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                  *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08                *
* RUN TIME....... 53.245               THRESHOLD..... -4                 *
* AREA REJECT.... 40                   COM PORT......  1                 *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                  *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333           *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58             *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32             *
* HP REF FILE.... Q539EC20b#179        FMT FILE.. C:\CP\D23\GAS.FMT      *
**************************************************************************
Out of Ret Time                   Amount  % Delta   Peak            Amount/   Peak   Peak     ug/l
Bound  (min)      Peak Name       PPMV    Ret Time  Area   AREA %   Area       #    Height    AIR
       3.648 METHANE              1.011    1.06%    585   100.00   0.0017276  1     133     0.000
Total amt. ID. = 1.010612              Total area (all peaks) = 584.9884
```

```
File=C:\CP\D23\W23A1.80R Date printed=01-27-1999 Time= 15:49:51
Sample Name=STD K4 R5
2.0 to 36.0 min. Low Y=-7.839 High Y=1708.664 mv Span=1716.502
```



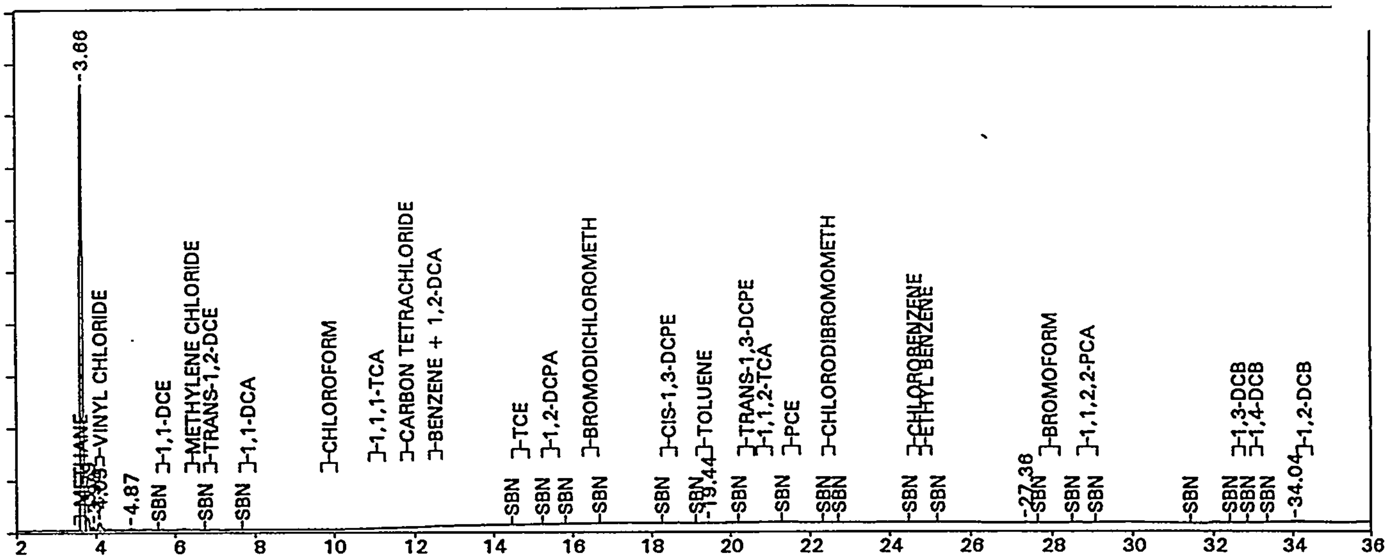
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... STD K4 R5                        OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.80R                              *
* DATE ANALYZED....... SEP 23, 1992  21:14:05                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q539FB9Fb#180        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                      Amount   % Delta    Peak               Amount/    Peak    Peak       ug/l
Bound   (min)      Peak Name         PPMV    Ret Time    Area     AREA %     Area        #    Height      AIR
         4.210  VINYL CHLORIDE     45338.594   2.42%   7126489    99.98   0.0063620    2 1461086      0.000
        12.630  BENZENE + 1,2-DCA      0.172   0.84%       141     0.00   0.0012136    4      17      0.000
        14.771  TCE                    0.135   0.65%        57     0.00   0.0023937    5       7      0.000
        19.430  TOLUENE                0.167   0.46%       227     0.00   0.0007390    7      27      0.000
        21.588  PCE                    0.090   0.27%        46     0.00   0.0019709    8       7      0.000
        24.946  ETHYL BENZENE          0.089   0.26%       119     0.00   0.0007523    9      19      0.000
Total amt. ID. = 45339.25             Total area (all peaks) = 7127704
```

```
File=C:\CP\D23\W23A1.81R Date printed=01-27-1999 Time= 15:51:15
Sample Name=904-111G-21
2.0 to 36.0 min. Low Y=0.393 High Y=1.49 mv Span=1.097
```



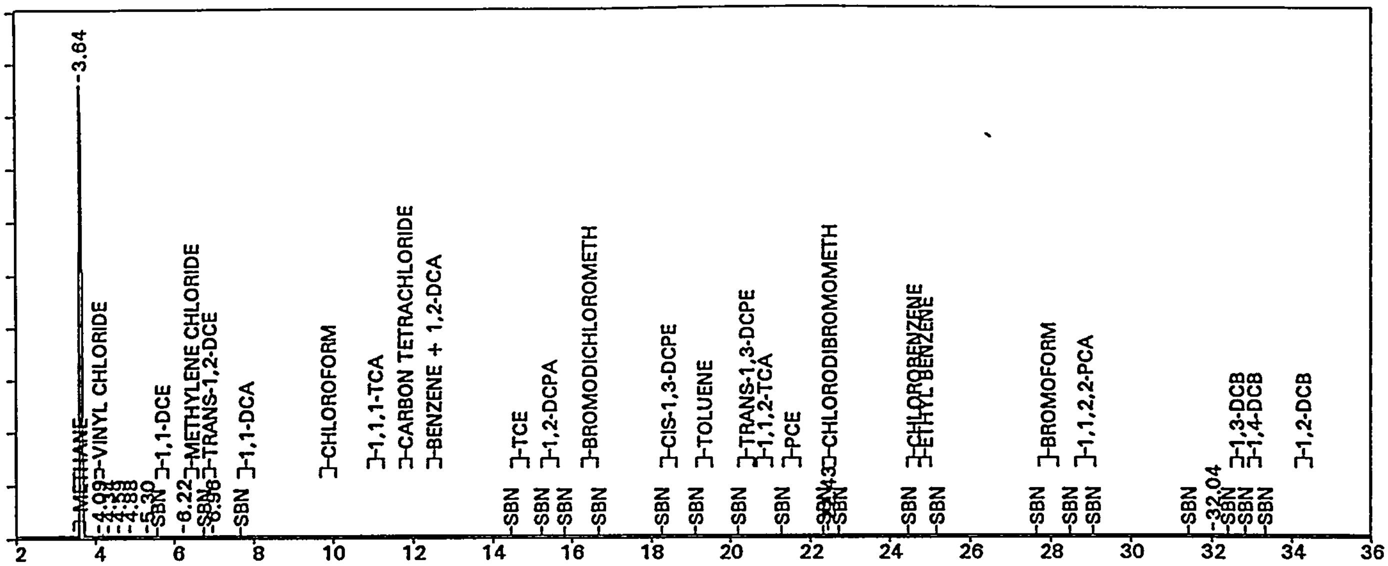
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-21                     OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.81R                              *
* DATE ANALYZED....... SEP 23, 1992  22:20:16                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53A0B22b#181        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                 Amount  % Delta   Peak            Amount/   Peak   Peak     ug/l
Bound  (min)     Peak Name      PPMV    Ret Time  Area    AREA %   Area      #    Height    AIR
        3.661  METHANE          7.046   1.42%     4153    83.87  0.0016964   1     934     0.000
        4.093  VINYL CHLORIDE   1.158  -0.42%      181     3.66  0.0063970   4      34     0.000
Total amt. ID. = 8.203704            Total area (all peaks) = 4952.029
```

```
File=C:\CP\D23\W23A1.82R Date printed=01-27-1999 Time= 15:52:37
Sample Name=904-111G-22
2.0 to 36.0 min. Low Y=0.388 High Y=2.47 mv Span=2.082
```



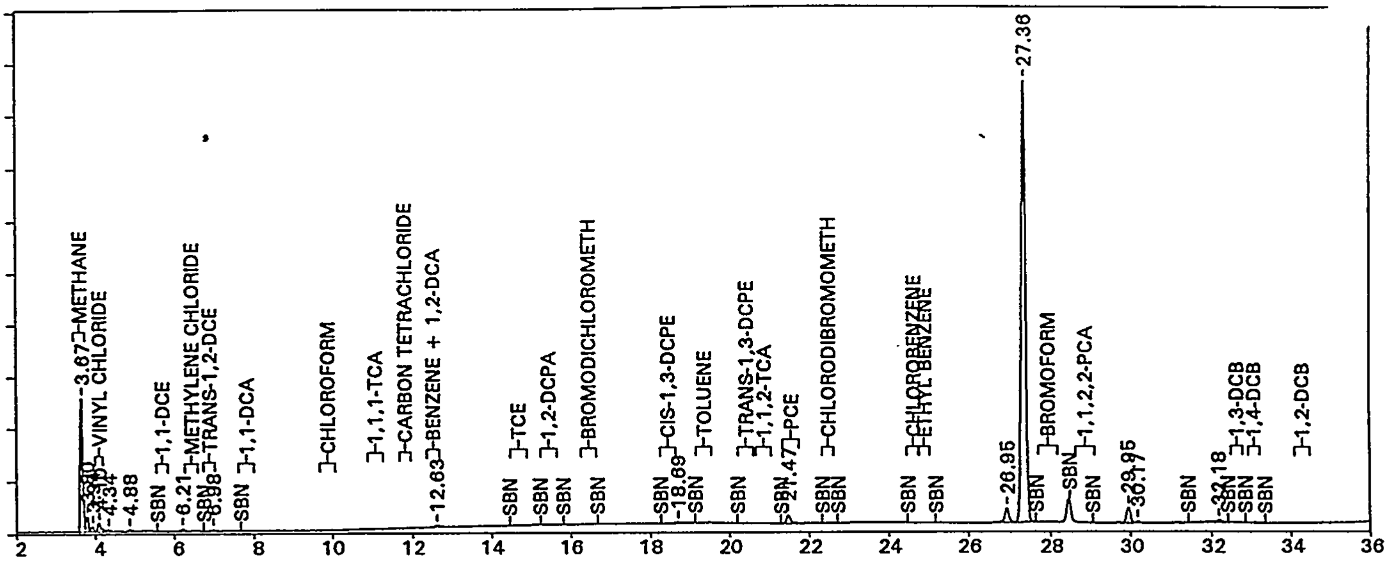
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-22                       OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.82R                              *
* DATE ANALYZED....... SEP 23, 1992  23:26:15                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53A1A99b#182        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                      Amount   % Delta    Peak            Amount/   Peak   Peak      ug/l
Bound  (min)       Peak Name          PPMV    Ret Time   Area   AREA %    Area       #    Height     AIR
        3.659  METHANE               13.356     1.36%    7808    90.84  0.0017105    1    1772      0.000
        4.092  VINYL CHLORIDE         1.236    -0.44%     193     2.25  0.0063948    4      31      0.000
       19.440  TOLUENE                0.032     0.52%      43     0.50  0.0007390   12       3      0.000
Total amt. ID. = 14.62317            Total area (all peaks) = 8594.886
```

```
File=C:\CP\D23\W23A1.83R Date printed=01-27-1999 Time= 15:54:01
Sample Name=904-111G-23
2.0 to 36.0 min. Low Y=-0.967 High Y=283.604 mv Span=284.571
```



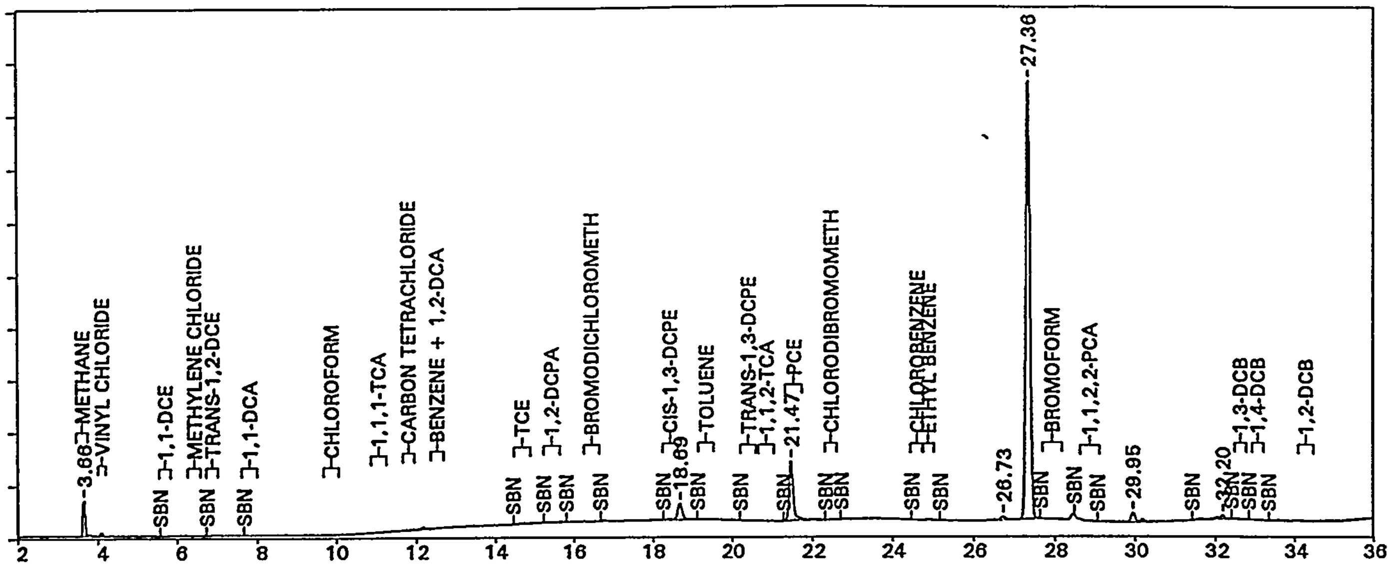
```
************************** MICROSEEPS LABORATORY **************************
*                                                                         *
* SAMPLE NAME......... 904-111G-23                          OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.83R                                *
* DATE ANALYZED....... SEP 24, 1992  00:32:22                             *
* REPORT DATE.... 01-27-1999                                              *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                   *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                   *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08               *
* RUN TIME....... 53.245                 THRESHOLD..... -4                *
* AREA REJECT.... 40                     COM PORT......  1                *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1                 *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58             *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32             *
* HP REF FILE.... Q53A2A18b#183          FMT FILE.. C:\CP\D23\GAS.FMT     *
***************************************************************************
Out of Ret Time                     Amount   % Delta    Peak               Amount/   Peak   Peak      ug/l
Bound  (min)        Peak Name       PPMV     Ret Time   Area     AREA %    Area      #      Height    AIR
        3.637  METHANE              5810.916   0.76%    1022627   99.92   0.0056823   1   243894    0.000
        4.092  VINYL CHLORIDE          2.184  -0.45%        342    0.03   0.0063805   2       57    0.000
        6.960  TRANS-1,2-DCE           0.826   1.16%         45    0.00   0.0181932   9        5    0.000
       22.434  CHLORODIBROMOMETH       0.816  -0.16%         63    0.01   0.0128895  12        9    0.000
Total amt. ID. = 5814.743                  Total area (all peaks) = 1023460
```

```
File=C:\CP\D23\W23A1.84R Date printed=01-27-1999 Time= 15:55:25
Sample Name=904-111G-24
2.0 to 36.0 min. Low Y=0.388 High Y=2.581 mv Span=2.193
```



```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-24                     OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.84R                              *
* DATE ANALYZED....... SEP 24, 1992  01:38:37                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                THRESHOLD..... -4               *
* AREA REJECT.... 40                    COM PORT......  1               *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58           *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32           *
* HP REF FILE.... Q53A399Fb#184         FMT FILE.. C:\CP\D23\GAS.FMT    *
*************************************************************************
Out of Ret Time                         Amount   % Delta   Peak            Amount/    Peak   Peak      ug/l
Bound   (min)        Peak Name           PPMV    Ret Time   Area    AREA %    Area       #    Height     AIR
          3.665  METHANE                 4.184    1.53%     2522    13.87   0.0016591   1     554      0.000
          4.103  VINYL CHLORIDE          1.429   -0.18%      224     1.23   0.0063904   4      35      0.000
          6.980  TRANS-1,2-DCE           0.818    1.45%       45     0.25   0.0181932  10       7      0.000
         12.625  BENZENE + 1,2-DCA       0.085    0.80%       70     0.38   0.0012136  11       8      0.000
         21.474  PCE                     0.508   -0.26%      258     1.42   0.0019709  14      33      0.000
Total amt. ID. = 7.023867              Total area (all peaks) = 18187
```

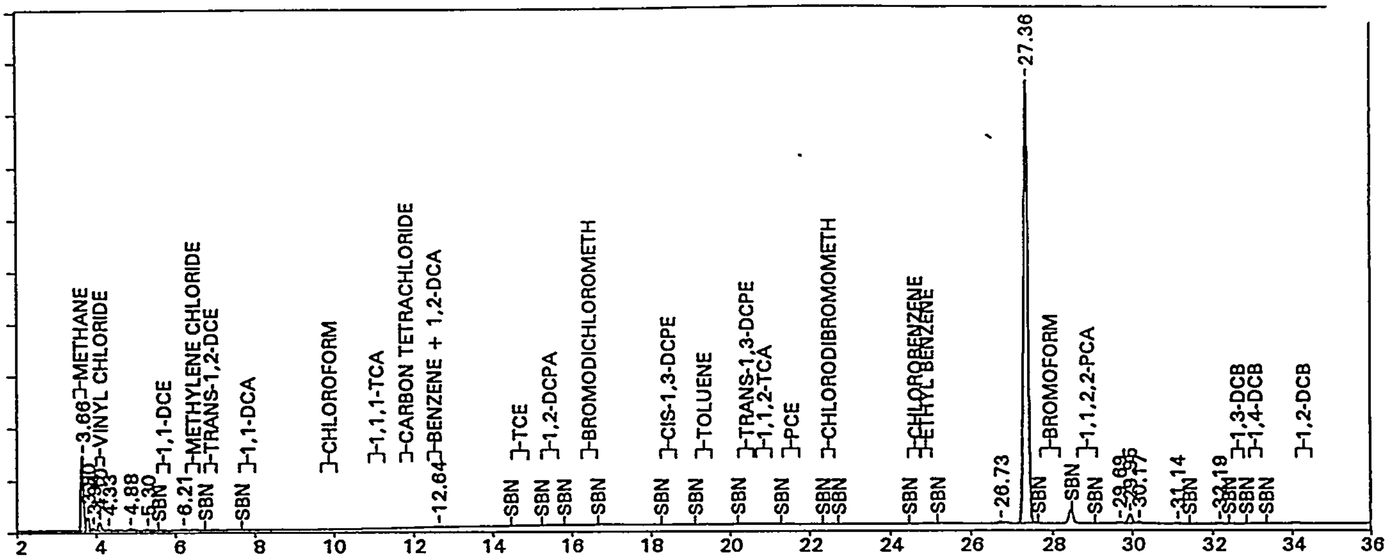
```
File=C:\CP\D23\W23A1.85R Date printed=01-27-1999 Time= 15:56:50
Sample Name=904-111G-25
2.0 to 36.0 min. Low Y=0.394 High Y=1.363 mv Span=0.968
```



```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-25                       OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.85R                              *
* DATE ANALYZED....... SEP 24, 1992  02:44:51                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID       PEAK WIDTH.... .08                *
* RUN TIME....... 53.245              THRESHOLD..... -4                 *
* AREA REJECT.... 40                  COM PORT......  1                 *
* SAMPLE WEIGHT.. 1                   DIL FACTOR.... 1                  *
* AMT INJECTED... 1                   SAMPLE RATE... 3.333333           *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53A4925b#185       FMT FILE.. C:\CP\D23\GAS.FMT      *
*************************************************************************
```

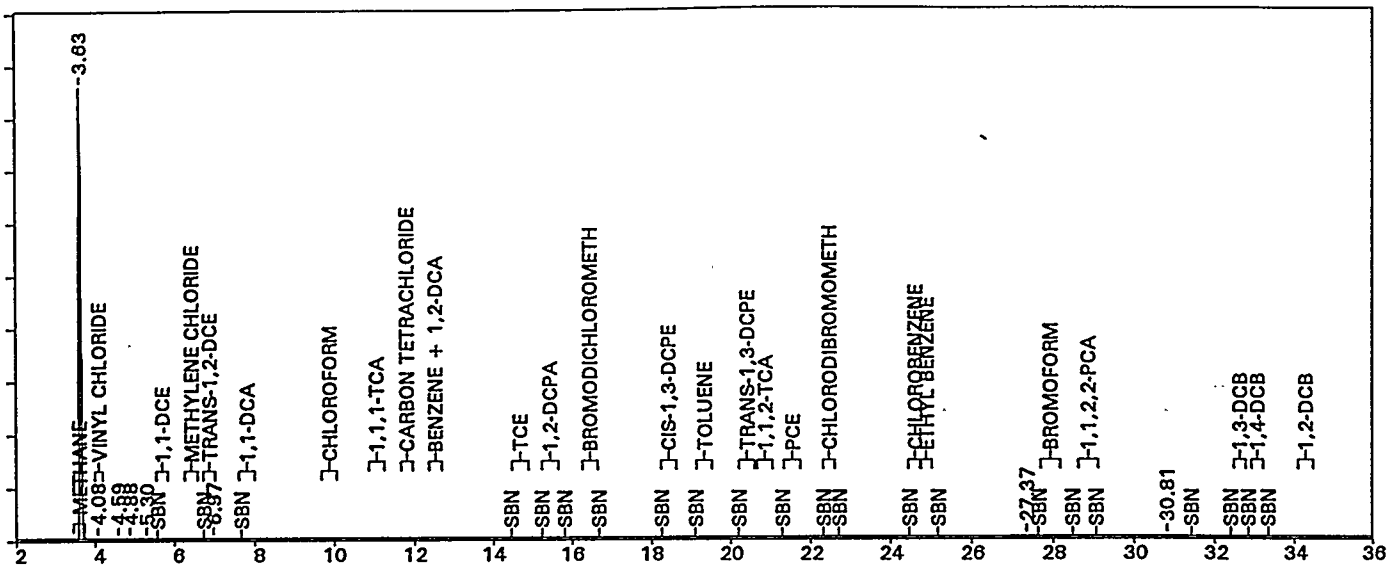
```
Out of Ret Time                  Amount   % Delta   Peak            Amount/    Peak   Peak    ug/l
Bound  (min)      Peak Name      PPMV     Ret Time  Area   AREA %   Area        #     Height  AIR
        3.661  METHANE           0.500    1.42%     290    3.94     0.0017201   1     65      0.000
       21.472  PCE               1.565    -0.27%    782    10.61    0.0020016   5     109     0.000
Total amt. ID. = 2.064294              Total area (all peaks) = 7364.514
```

```
File=C:\CP\D23\W23A1.86R Date printed=01-27-1999 Time= 15:58:12
Sample Name=904-111G-26
2.0 to 36.0 min. Low Y=0.384 High Y=3.402 mv Span=3.017
```



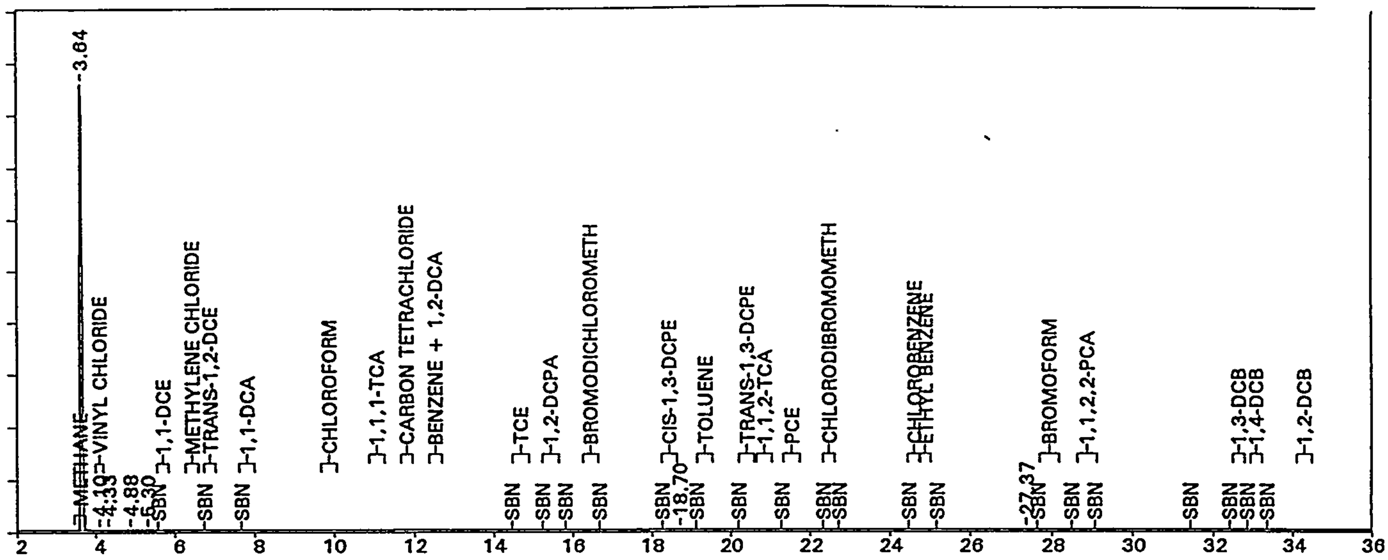
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-26                       OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.86R                              *
* DATE ANALYZED....... SEP 24, 1992  03:51:02                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08             *
* RUN TIME....... 53.245                 THRESHOLD..... -4              *
* AREA REJECT.... 40                     COM PORT......  1              *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1               *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333        *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53A58A8b#186          FMT FILE.. C:\CP\D23\GAS.FMT   *
*************************************************************************
Out of Ret Time                        Amount   % Delta    Peak            Amount/   Peak   Peak      ug/l
Bound   (min)        Peak Name          PPMV    Ret Time   Area    AREA %   Area      #    Height    AIR
        3.663  METHANE                 3.259     1.46%     1943     8.75  0.0016774   1     432     0.000
        4.098  VINYL CHLORIDE          1.587    -0.29%      248     1.12  0.0063875   4      43     0.000
       12.639  BENZENE + 1,2-DCA       0.056     0.91%       46     0.21  0.0012136  12       5     0.000
Total amt. ID. = 4.902425              Total area (all peaks) = 22209.55
```

```
File=C:\CP\D23\W23A1.87R Date printed=01-27-1999 Time= 15:59:37
Sample Name=904-111G-27
2.0 to 36.0 min. Low Y=-17.863 High Y=3788.006 mv Span=3805.869
```



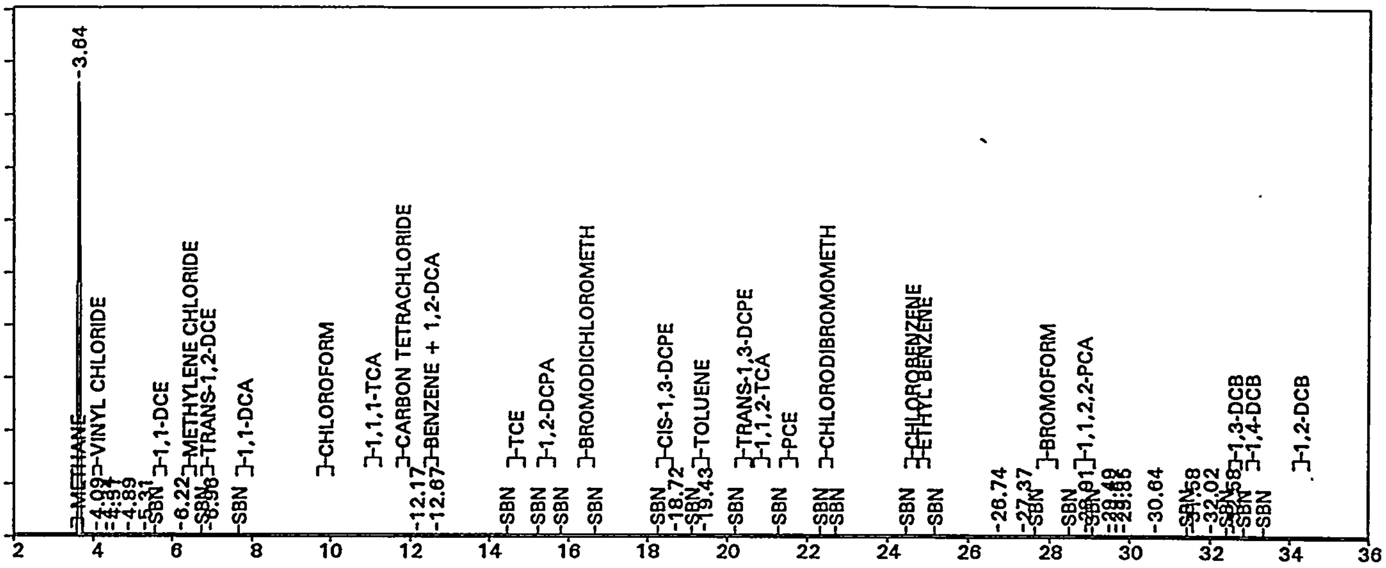
```
************************** MICROSEEPS LABORATORY **************************
*                                                                         *
* SAMPLE NAME......... 904-111G-27                        OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.87R                                *
* DATE ANALYZED....... SEP 24, 1992  04:57:18                             *
* REPORT DATE.... 01-27-1999                                              *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                   *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                   *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08                 *
* RUN TIME....... 53.245               THRESHOLD..... -4                  *
* AREA REJECT.... 40                   COM PORT......  1                  *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                   *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333            *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58              *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32              *
* HP REF FILE.... Q53A6830b#187      FMT FILE.. C:\CP\D23\GAS.FMT         *
***************************************************************************
Out of Ret Time                 Amount   % Delta    Peak              Amount/   Peak   Peak      ug/l
Bound  (min)      Peak Name      PPMV    Ret Time   Area     AREA %    Area      #    Height     AIR
        3.632  METHANE        81249.039   0.62%   12448470   99.99  0.0065268   1 3289075     0.000
        4.077  VINYL CHLORIDE     4.457  -0.81%        700    0.01  0.0063711   2      89     0.000
        6.970  TRANS-1,2-DCE      0.804   1.31%         44    0.00  0.0181932   8       6     0.000
Total amt. ID. = 81254.3               Total area (all peaks) = 1.244979E+07
```

```
File=C:\CP\D23\W23A1.88R Date printed=01-27-1999 Time= 16:00:59
Sample Name=904-111G-28
2.0 to 36.0 min. Low Y=-0.717 High Y=231.783 mv Span=232.5
```



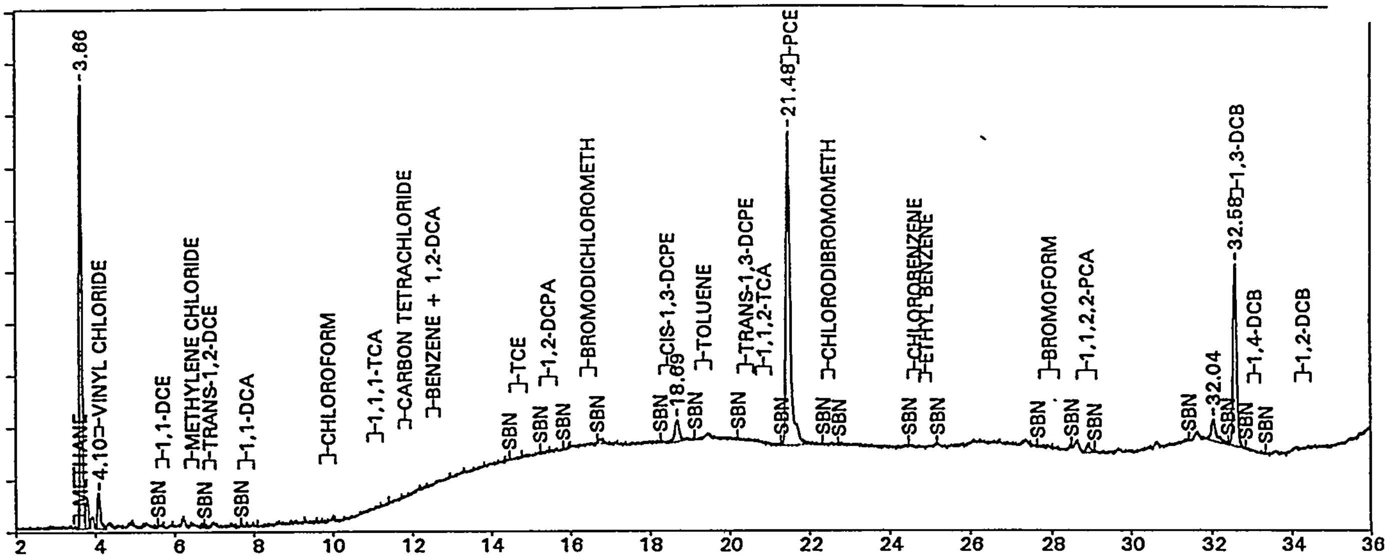
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-28                      OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.88R                              *
* DATE ANALYZED....... SEP 24, 1992  06:03:23                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID       PEAK WIDTH.... .08                *
* RUN TIME....... 53.245              THRESHOLD..... -4                 *
* AREA REJECT.... 40                  COM PORT......  1                 *
* SAMPLE WEIGHT.. 1                   DIL FACTOR.... 1                  *
* AMT INJECTED... 1                   SAMPLE RATE... 3.333333           *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53A77ADb#188       FMT FILE.. C:\CP\D23\GAS.FMT      *
*************************************************************************
Out of Ret Time                    Amount   % Delta    Peak            Amount/   Peak    Peak      ug/l
Bound  (min)        Peak Name       PPMV    Ret Time   Area    AREA %   Area      #     Height     AIR
        3.638  METHANE            4678.412   0.77%    832804   99.93  0.0056177   1   198178     0.000
        4.102  VINYL CHLORIDE        1.862  -0.20%       292    0.03  0.0063837   2       48     0.000
Total amt. ID. = 4680.274             Total area (all peaks) = 833414.2
```

```
File=C:\CP\D23\W23A1.89R Date printed=01-27-1999 Time= 16:02:21
Sample Name=904-111G-29
2.0 to 36.0 min. Low Y=-6.731 High Y=1479.246 mv Span=1485.977
```



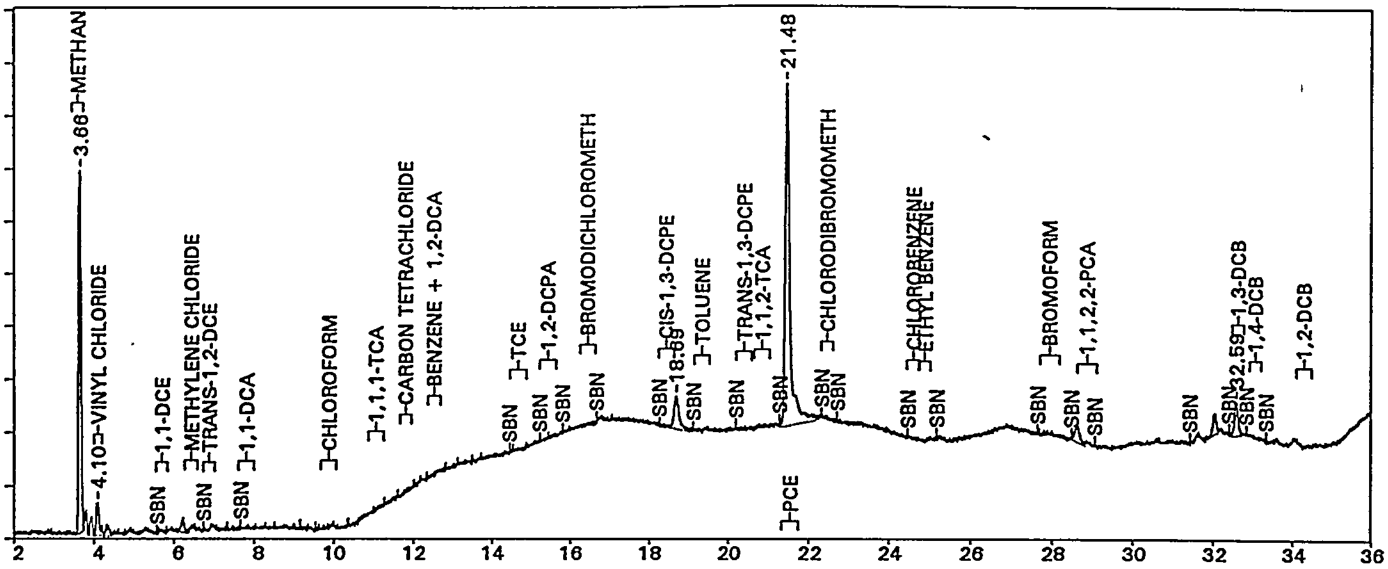
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-29                     OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.89R                              *
* DATE ANALYZED....... SEP 24, 1992  07:09:34                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53A8730b#189        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                       Amount    % Delta    Peak               Amount/   Peak   Peak      ug/l
Bound   (min)       Peak Name          PPMV    Ret Time    Area    AREA %      Area       #    Height    AIR
        3.641  METHANE             31116.195    0.86%    5364405    99.81   0.0058005   1  1265382    0.000
        4.086  VINYL CHLORIDE          3.110   -0.59%        488     0.01   0.0063750   2       67    0.000
        6.960  TRANS-1,2-DCE           1.053    1.17%         58     0.00   0.0181932  10        8    0.000
       12.674  BENZENE + 1,2-DCA       0.051    1.19%         42     0.00   0.0012136  12        5    0.000
       19.432  TOLUENE                 1.185    0.48%       1604     0.03   0.0007390  15      218    0.000
       28.912  1,1,2,2-PCA             2.011    0.13%        937     0.02   0.0021449  18      146    0.000
       32.578  1,3-DCB                 3.588    0.13%       3943     0.07   0.0009101  27      678    0.000
Total amt. ID. = 31127.19              Total area (all peaks) = 5374715
```

```
File=C:\CP\D23\W23A1.90R Date printed=01-27-1999 Time= 16:03:47
Sample Name=904-111G-30
2.0 to 36.0 min..Low Y=0.398 High Y=0.552 mv Span=0.154
```



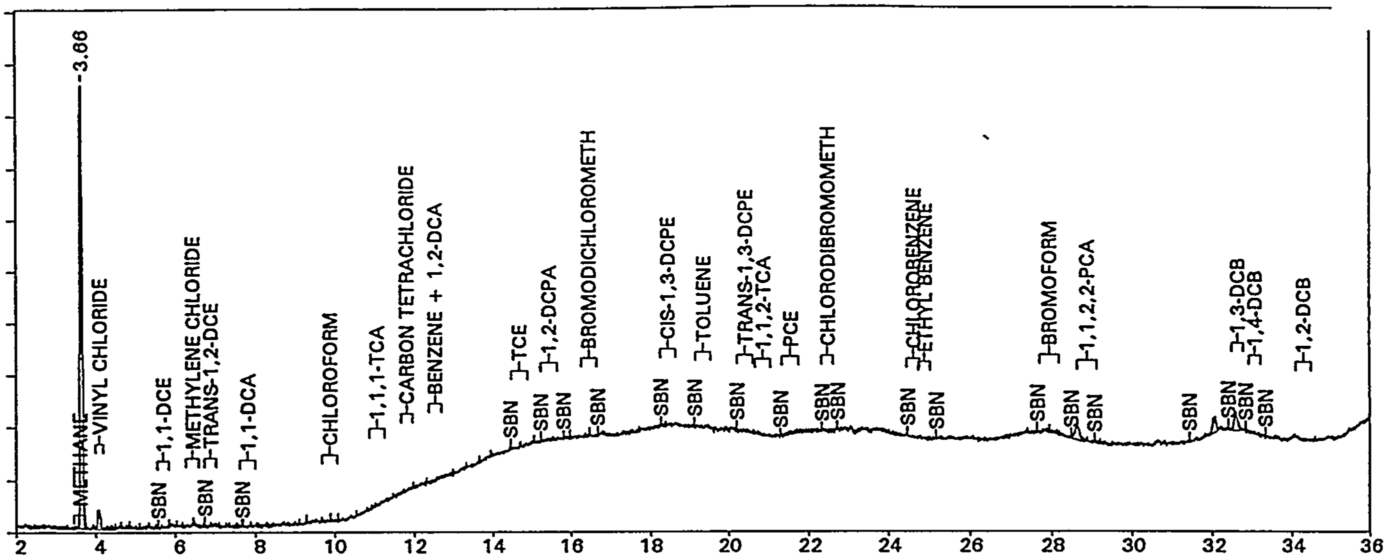
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-30                      OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.90R                              *
* DATE ANALYZED....... SEP 24, 1992  08:15:25                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                THRESHOLD..... -4               *
* AREA REJECT.... 40                    COM PORT......  1               *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53A969Fb#190         FMT FILE.. C:\CP\D23\GAS.FMT    *
*************************************************************************
Out of Ret Time                     Amount  % Delta    Peak            Amount/  Peak   Peak     ug/l
Bound   (min)       Peak Name        PPMV   Ret Time   Area   AREA %    Area      #   Height    AIR
        3.662  METHANE               0.997    1.45%     590    33.16  0.0016884   1    131     0.000
        4.098  VINYL CHLORIDE        0.367   -0.30%      57     3.19  0.0064739   3     11     0.000
       21.475  PCE                   1.380   -0.25%     696    39.11  0.0019826   6     92     0.000
       32.583  1,3-DCB               0.287   -0.25%     326    18.30  0.0008815   9     53     0.000
Total amt. ID. = 3.031211            Total area (all peaks) = 1780.046
```

```
File=C:\CP\D23\W23A1.91R Date printed=01-27-1999 Time= 16:05:10
Sample Name=904-111G-30A
2.0 to 36.0 min. Low Y=0.397 High Y=0.52 mv Span=0.123
```



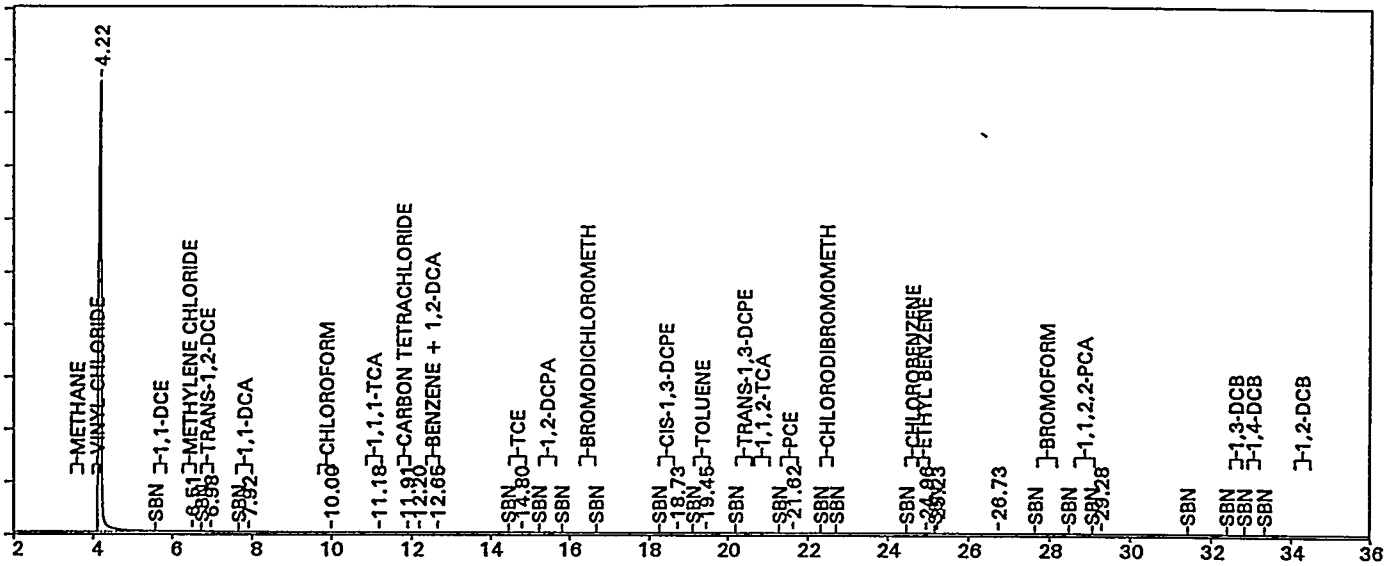
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-30A                      OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.91R                              *
* DATE ANALYZED....... SEP 24, 1992  09:21:43                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53AA629b#191        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                    Amount  % Delta   Peak          Amount/   Peak  Peak      ug/l
Bound  (min)      Peak Name        PPMV   Ret Time   Area  AREA %   Area      #   Height     AIR
         3.664  METHANE            0.637    1.51%     372   31.05  0.0017130   1    84      0.000
         4.099  VINYL CHLORIDE     0.380   -0.28%      59    4.90  0.0064702   3     8      0.000
        21.480  PCE                1.280   -0.23%     649   54.19  0.0019709   6    79      0.000
        32.592  1,3-DCB            0.043   -0.23%      48    4.03  0.0008815   9     8      0.000
Total amt. ID. = 2.338838             Total area (all peaks) = 1197.975
```

```
File=C:\CP\D23\W23A1.92R.Date printed=01-27-1999 Time= 16:06:33
Sample Name=904-111G*SB4
2.0 to 36.0 min. Low Y=0.391 High Y=0.53 mv Span=0.139
```



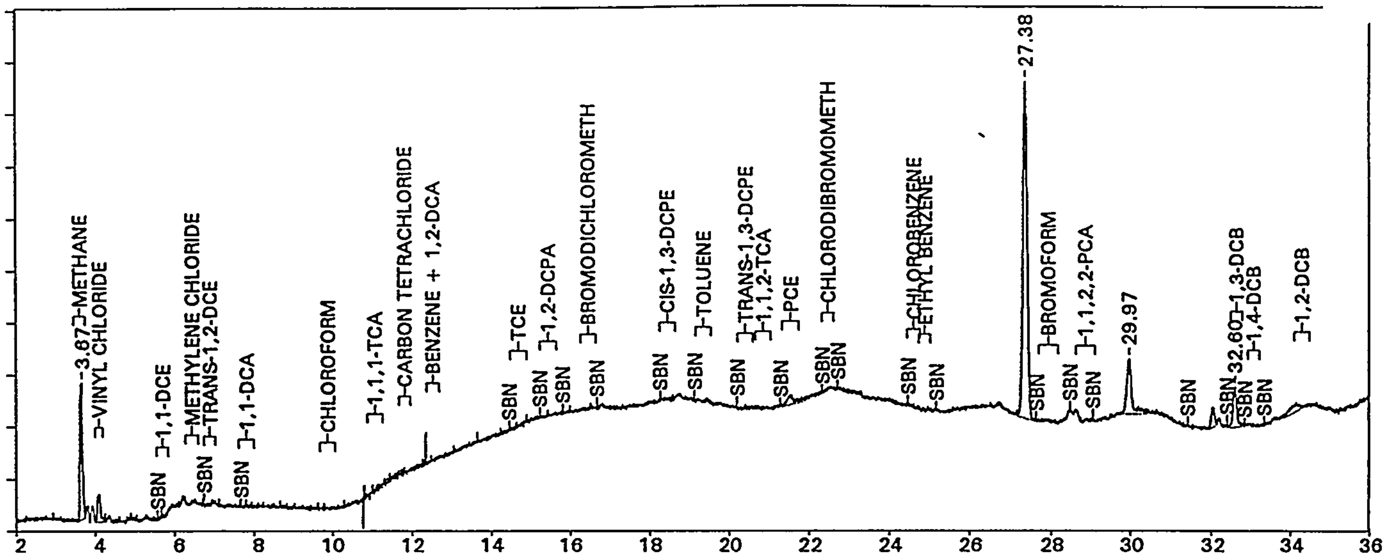
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G*SB4                     OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.92R                              *
* DATE ANALYZED....... SEP 24, 1992  10:28:04                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08             *
* RUN TIME....... 53.245                 THRESHOLD..... -4              *
* AREA REJECT.... 40                     COM PORT......  1              *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1               *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333        *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58           *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32           *
* HP REF FILE.... Q53AB5B6b#192          FMT FILE.. C:\CP\D23\GAS.FMT   *
*************************************************************************
Out of Ret Time                  Amount   % Delta   Peak            Amount/   Peak   Peak      ug/l
Bound  (min)       Peak Name      PPMV    Ret Time  Area   AREA %    Area      #    Height     AIR
        3.659  METHANE            0.895    1.37%     519   100.00  0.0017235   1     118      0.000
Total amt. ID. = .8945804              Total area (all peaks) = 519.0404
```

```
File=C:\CP\D23\W23A1.93R Date printed=01-27-1999 Time= 16:07:56
Sample Name=STD K4 R4
2.0 to 36.0 min. Low Y=-7.427 High Y=1621.712 mv Span=1629.139
```



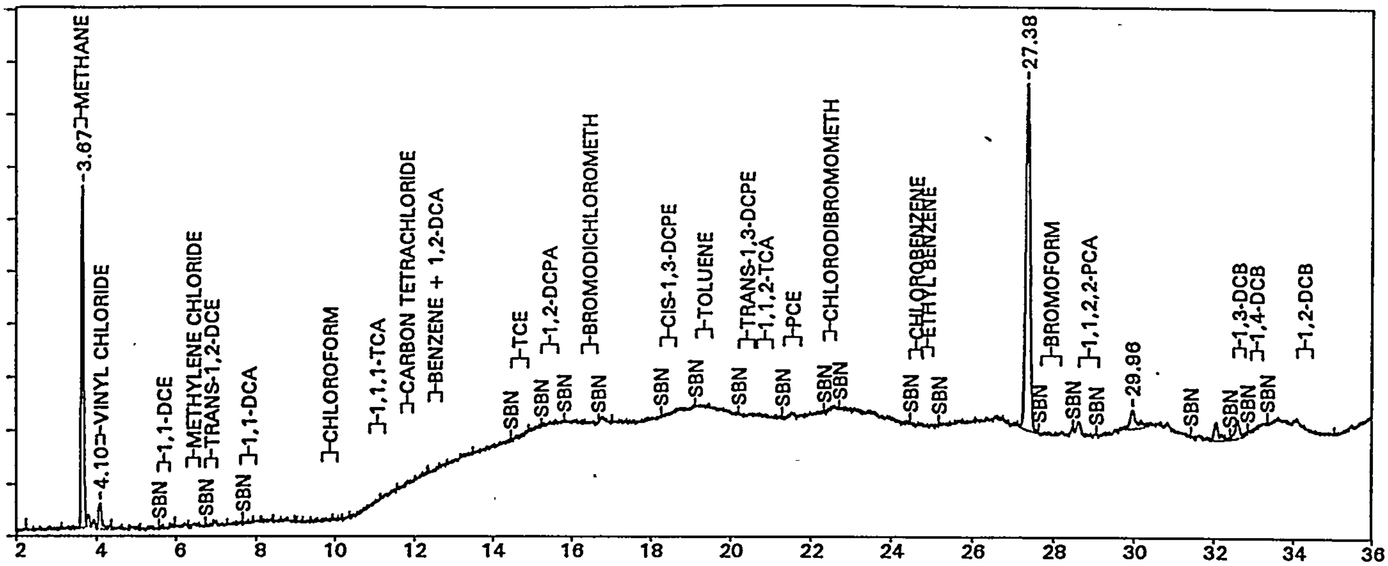
```
************************* MICROSEEPS LABORATORY **************************
*                                                                        *
* SAMPLE NAME......... STD K4 R4                         OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.93R                               *
* DATE ANALYZED....... SEP 24, 1992  11:34:34                            *
* REPORT DATE.... 01-27-1999                                             *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                  *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                  *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                 THRESHOLD..... -4               *
* AREA REJECT.... 40                     COM PORT......  1               *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1                *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58             *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32             *
* HP REF FILE.... Q53AC54Cb#193          FMT FILE.. C:\CP\D23\GAS.FMT    *
**************************************************************************
Out of Ret Time                        Amount  % Delta  Peak          Amount/    Peak  Peak     ug/l
Bound  (min)     Peak Name             PPMV    Ret Time Area   AREA %  Area       #    Height   AIR
        6.506  METHYLENE CHLORIDE      1.394   1.26%     230   0.00   0.0060595   3     45     0.000
        6.981  TRANS-1,2-DCE           7.412   1.47%     427   0.01   0.0173513   4     78     0.000
        7.919  1,1-DCA                 1.151   1.47%     420   0.01   0.0027437   5     62     0.000
        9.999  CHLOROFORM              0.890   1.47%     162   0.00   0.0054980   6     22     0.000
       11.179  1,1,1-TCA               1.026   1.47%     430   0.01   0.0023861   7     43     0.000
       11.905  CARBON TETRACHLORID     2.061   0.81%      82   0.00   0.0250274   8     10     0.000
       12.655  BENZENE + 1,2-DCA       1.610   1.04%    1327   0.02   0.0012136  10    157     0.000
       14.798  TCE                     1.158   0.84%     484   0.01   0.0023937  11     61     0.000
       19.446  TOLUENE                 0.961   0.55%    1301   0.02   0.0007390  14    179     0.000
       21.624  PCE                     0.889   0.44%     451   0.01   0.0019709  15     69     0.000
       24.960  ETHYL BENZENE           0.831   0.32%    1105   0.02   0.0007523  16    184     0.000
Total amt. ID. = 19.38369                    Total area (all peaks) = 6762330
```

File=C:\CP\D23\W23A1.94R Date printed=01-27-1999 Time= 16:09:22
Sample Name=904-111G-31
2.0 to 36.0 min. Low Y=0.387 High Y=0.517 mv Span=0.13



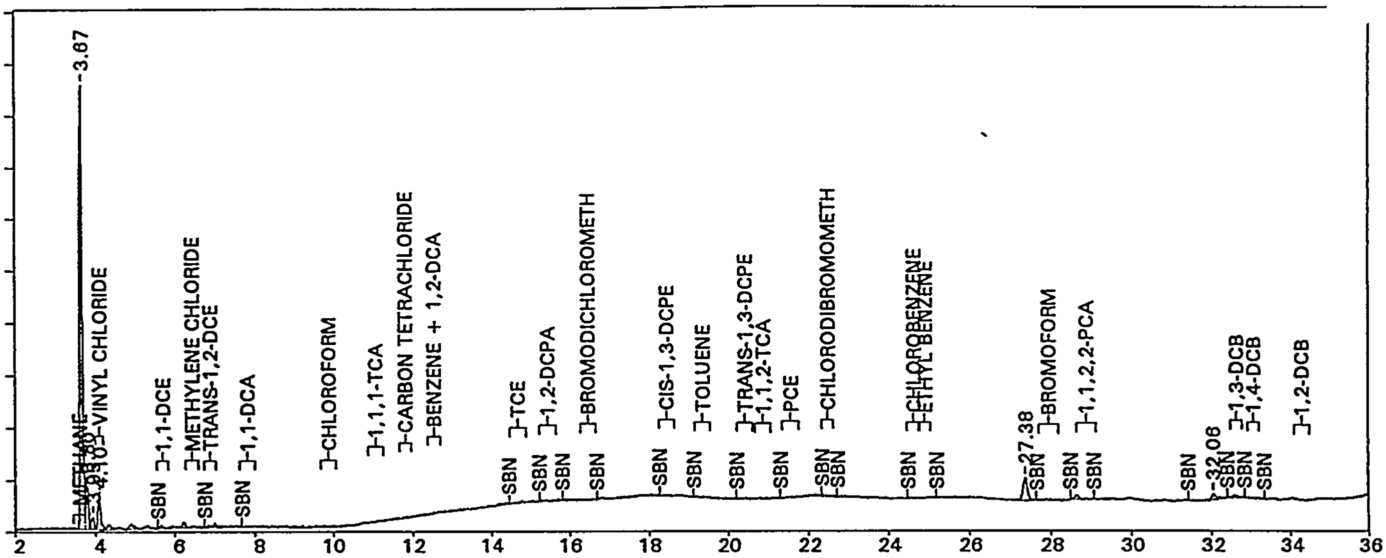
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-31                   OPERATOR...ADS     *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.94R                              *
* DATE ANALYZED....... SEP 24, 1992  12:41:03                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID         PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                THRESHOLD..... -4               *
* AREA REJECT.... 40                    COM PORT......  1               *
* SAMPLE WEIGHT.. 1                     DIL FACTOR.... 1                *
* AMT INJECTED... 1                     SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53AD4E1b#194         FMT FILE.. C:\CP\D23\GAS.FMT    *
*************************************************************************
Out of Ret Time                   Amount   % Delta   Peak             Amount/    Peak   Peak     ug/l
Bound   (min)       Peak Name     PPMV    Ret Time   Area    AREA %    Area       #    Height    AIR
         3.669  METHANE           0.264    1.63%      152    15.94  0.0017419    1     34     0.000
        32.602  1,3-DCB           0.057    1.63%       64     6.76  0.0008815    7     10     0.000
Total amt. ID. = .3209273              Total area (all peaks) = 951.6958
```

```
File=C:\CP\D23\W23A1.95R Date printed=01-27-1999 Time= 16:10:44
Sample Name=904-111G-32
2.0 to 36.0 min. Low Y=0.387 High Y=0.516 mv Span=0.13
```



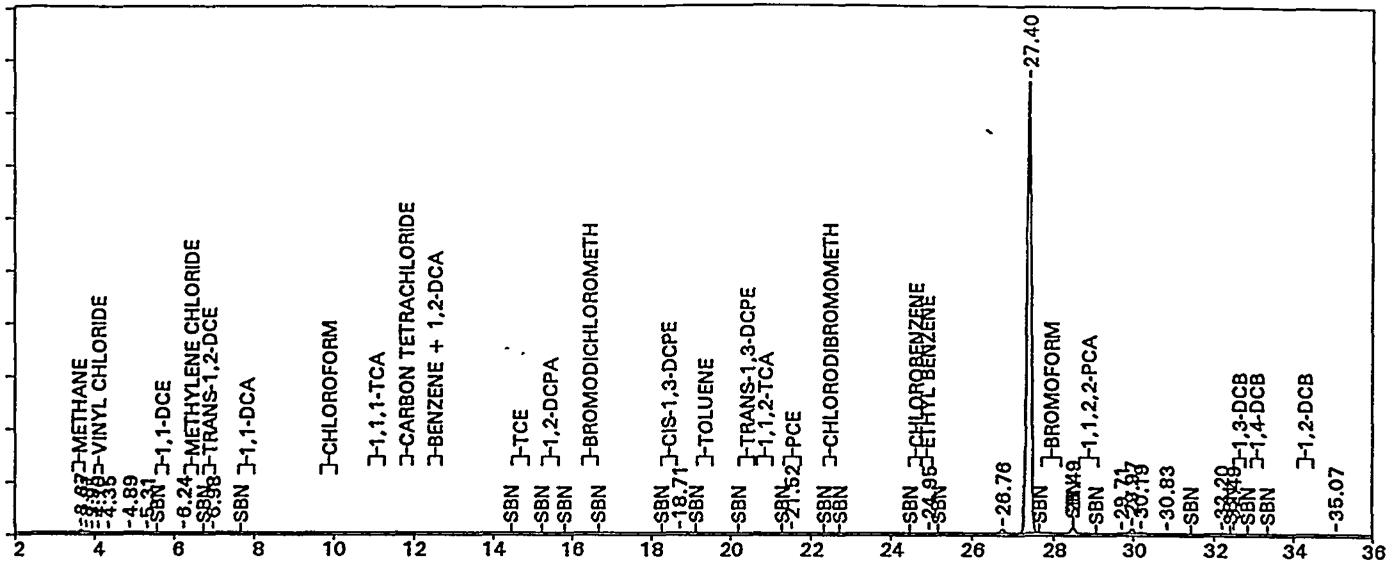
```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-32                      OPERATOR...ADS  *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.95R                              *
* DATE ANALYZED....... SEP 24, 1992  13:47:40                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53AE47Eb#195        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                 Amount  % Delta  Peak           Amount/   Peak  Peak     ug/l
Bound  (min)      Peak Name      PPMV   Ret Time Area   AREA %  Area       #   Height    AIR
       3.666  METHANE            0.636   1.55%    371   34.12  0.0017175   1    83      0.000
       4.103  VINYL CHLORIDE     0.300  -0.18%     46    4.25  0.0064995   2     7      0.000
Total amt. ID. = .9363132             Total area (all peaks) = 1085.981
```

```
File=C:\CP\D23\W23A1.96R Date printed=01-27-1999 Time= 16:12:06
Sample Name=904-111G-33
2.0 to 36.0 min. Low Y=0.385 High Y=0.829 mv Span=0.445
```



```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-33                       OPERATOR...ADS *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.96R                              *
* DATE ANALYZED....... SEP 24, 1992  14:54:18                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58           *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32           *
* HP REF FILE.... Q53AF41Cb#196        FMT FILE.. C:\CP\D23\GAS.FMT     *
*************************************************************************
Out of Ret Time                  Amount   % Delta   Peak            Amount/   Peak   Peak     ug/l
Bound  (min)     Peak Name        PPMV    Ret Time  Area    AREA %   Area      #    Height    AIR
         3.670  METHANE           2.856    1.66%    1700    76.18  0.0016798   1     378     0.000
         4.100  VINYL CHLORIDE    0.815   -0.25%     127     5.69  0.0064119   4      23     0.000
Total amt. ID. = 3.670303           Total area (all peaks) = 2231.506
```

File=C:\CP\D23\W23A1.97R Date printed=01-27-1999 Time= 16:13:29
Sample Name=904-111G-34
2.0 to 36.0 min. Low Y=-0.231 High Y=128.351 mv Span=128.582

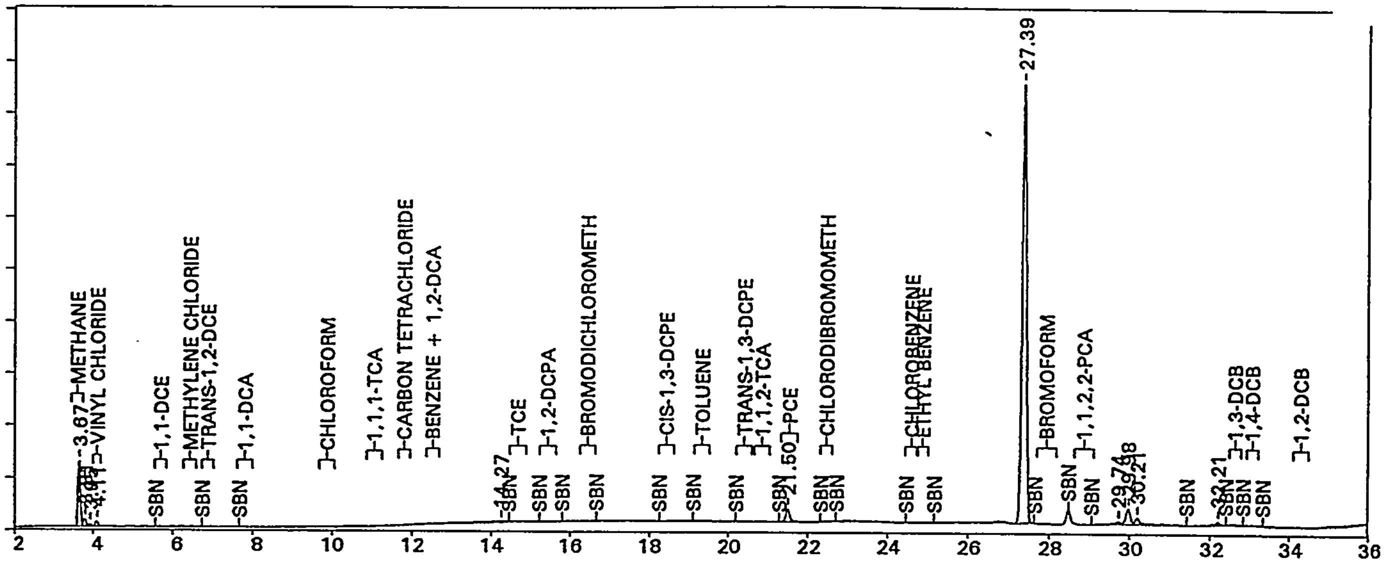


```
************************* MICROSEEPS LABORATORY *************************
*                                                                        *
* SAMPLE NAME......... 904-111G-34                     OPERATOR...ADS    *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.97R                               *
* DATE ANALYZED....... SEP 24, 1992  16:02:26                            *
* REPORT DATE.... 01-27-1999                                             *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                  *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                  *
* INSTRUMENT..... 7000/5890/FID          PEAK WIDTH.... .08              *
* RUN TIME....... 53.245                 THRESHOLD..... -4               *
* AREA REJECT.... 40                     COM PORT......  1               *
* SAMPLE WEIGHT.. 1                      DIL FACTOR.... 1                *
* AMT INJECTED... 1                      SAMPLE RATE... 3.333333         *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58             *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32             *
* HP REF FILE.... Q53B0413b#197          FMT FILE.. C:\CP\D23\GAS.FMT    *
**************************************************************************
```

Out of Bound	Ret Time (min)	Peak Name	Amount PPMV	% Delta Ret Time	Peak Area	AREA %	Amount/ Area	Peak #	Peak Height	ug/l AIR
	3.673	METHANE	4.310	1.75%	2616	0.32	0.0016477	1	571	0.000
	4.101	VINYL CHLORIDE	2.532	-0.22%	397	0.05	0.0063780	4	73	0.000
	6.976	TRANS-1,2-DCE	0.886	1.39%	49	0.01	0.0181932	10	6	0.000
	21.525	PCE	0.168	-0.02%	85	0.01	0.0019709	13	7	0.000
	24.947	ETHYL BENZENE	0.039	0.27%	52	0.01	0.0007523	15	7	0.000
	32.489	1,3-DCB	0.109	0.27%	123	0.01	0.0008815	26	23	0.000

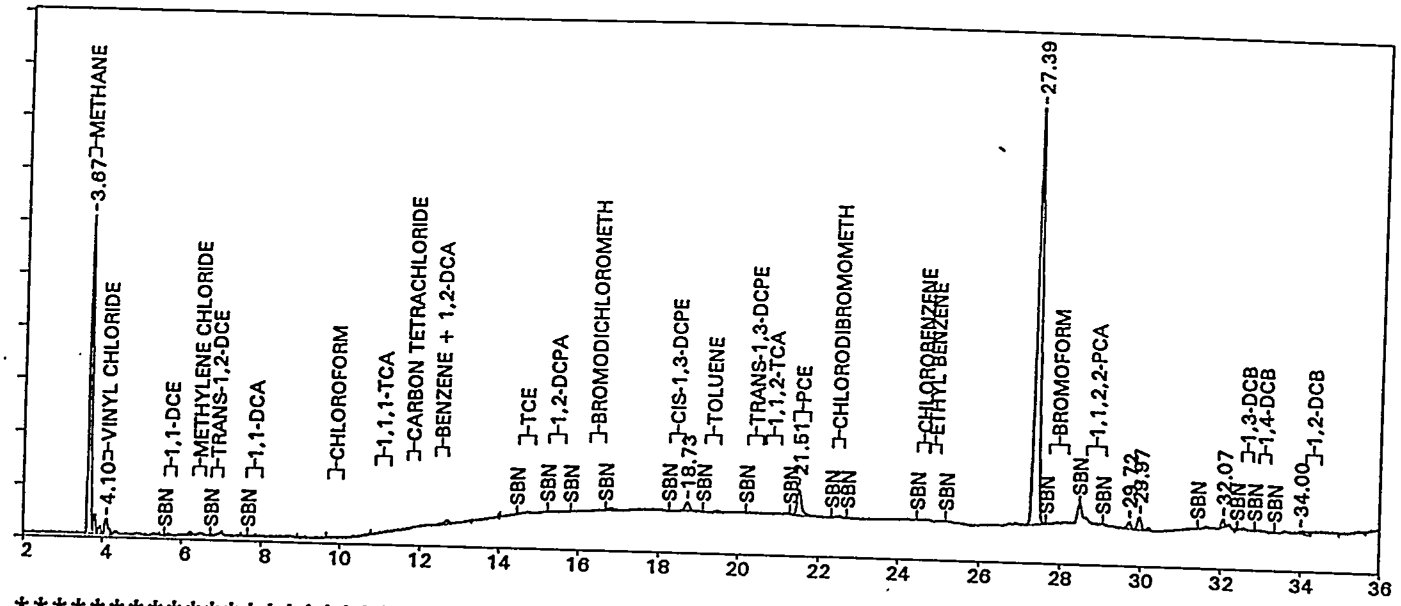
Total amt. ID. = 8.043763   Total area (all peaks) = 822683.5

```
File=C:\CP\D23\W23A1.98R Date printed=01-27-1999 Time= 16:14:55
Sample Name=904-111G-35
2.0 to 36.0 min. Low Y=0.379 High Y=2.041 mv Span=1.663
```



```
************************* MICROSEEPS LABORATORY *************************
*                                                                       *
* SAMPLE NAME......... 904-111G-35                     OPERATOR...ADS   *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.98R                              *
* DATE ANALYZED....... SEP 24, 1992  17:10:15                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID           PEAK WIDTH.... .08            *
* RUN TIME....... 53.245                  THRESHOLD..... -4             *
* AREA REJECT.... 40                      COM PORT......  1             *
* SAMPLE WEIGHT.. 1                       DIL FACTOR.... 1              *
* AMT INJECTED... 1                       SAMPLE RATE... 3.333333       *
* METHOD VERSION.  11   -- LAST MODIFIED... 09/15/92 11:36:58           *
* CAL VERSION....  15   -- LAST MODIFIED... 06/04/92 09:28:32           *
* HP REF FILE.... Q53B13F8b#198           FMT FILE.. C:\CP\D23\GAS.FMT  *
*************************************************************************
Out of Ret Time                      Amount   % Delta    Peak              Amount/    Peak   Peak      ug/l
Bound  (min)      Peak Name          PPMV     Ret Time   Area    AREA %    Area       #      Height    AIR
       3.672  METHANE                1.578    1.71%      950     7.47      0.0016609  1      208       0.000
       4.115  VINYL CHLORIDE         0.578    0.11%      90      0.71      0.0064326  4      17        0.000
      21.501  PCE                    0.595    -0.13%     302     2.37      0.0019709  7      41        0.000
Total amt. ID. = 2.751949             Total area (all peaks) = 12715.91
```

```
File=C:\CP\D23\W23A1.99R Date printed=01-27-1999 Time= 16:16:20
Sample Name=904-111G-36
2.0 to 36.0 min. Low Y=0.389 High Y=0.851 mv Span=0.462
```



```
************************ MICROSEEPS LABORATORY ************************
*                                                                      *
* SAMPLE NAME......... 904-111G-36                                      *
* RAW DATA FILE NAME.. C:\CP\D23\W23A1.99R             OPERATOR...ADS   *
* DATE ANALYZED....... SEP 24, 1992  18:30:19                           *
* REPORT DATE.... 01-27-1999                                            *
* METHOD FILE.... C:\CP\D23\W23A624.MET                                 *
* CAL FILE....... C:\CP\D23\W23A624.CAL                                 *
* INSTRUMENT..... 7000/5890/FID        PEAK WIDTH.... .08               *
* RUN TIME....... 53.245               THRESHOLD..... -4                *
* AREA REJECT.... 40                   COM PORT......  1                *
* SAMPLE WEIGHT.. 1                    DIL FACTOR.... 1                 *
* AMT INJECTED... 1                    SAMPLE RATE... 3.333333          *
* METHOD VERSION.  11  -- LAST MODIFIED... 09/15/92 11:36:58            *
* CAL VERSION....  15  -- LAST MODIFIED... 06/04/92 09:28:32            *
* HP REF FILE.... Q53B26BDb#199        FMT FILE.. C:\CP\D23\GAS.FMT     *
************************************************************************
Out of Ret Time                     Amount   % Delta    Peak              Amount/   Peak    Peak      ug/l
Bound   (min)      Peak Name        PPMV     Ret Time   Area    AREA %    Area       #      Height    AIR
        3.673   METHANE             2.098    1.76%      1256    28.19     0.0016704   1      277      0.000
        4.096   VINYL CHLORIDE      0.565   -0.33%        88     1.97     0.0064342   3       14      0.000
       21.510   PCE                 0.361   -0.09%       183     4.11     0.0019709  10       23      0.000
Total amt. ID. = 3.023804                  Total area (all peaks) = 4455.209
```

```
  24.648  CHLOROBENZENE    3.350   0.21%    4064   0.03   0.0008243   24   666     0.000
  24.931  ETHYL BENZENE    3.559   0.21%    4595   0.04   0.0007746   25   750     0.000
  27.979  BROMOFORM        1.922   0.12%      67   0.00   0.0287557   27     9     0.000
  28.915  1,1,2,2-PCA      2.239   0.14%    1039   0.01   0.0021559   28   184     0.000
  32.667  1,3-DCB          2.400   0.14%    2660   0.02   0.0009020   32   492     0.000
  33.097  1,4-DCB          2.365   0.14%    2716   0.02   0.0008709   33   506     0.000
  34.318  1,2-DCB          2.398   0.14%    2876   0.02   0.0008340   35   521     0.000
Total amt. ID. = 83.83321               Total area (all peaks) = 1.284605E+07
```

Appendix F

Radiological Survey

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Back of
OSR4-17A8 (Rev 3-23-90)

Long Form—Radiation Survey Logsheet

Initials
Survey No. 989
Page 3 of 5

Transferable Contamination dpm/100 cm²			
	α	β/γ	γ/δ
1	NA	NA	N/A
2	NA	NA	N/A
3	NA	NA	N/A
4	NA	NA	N/A
5	NA	NA	N/A
6	NA	NA	N/A
7	NA	NA	N/A
8	NA	NA	N/A
9	NA	NA	N/A
10	NA	NA	N/A
11	NA	NA	N/A
12	NA	NA	N/A
13	NA	NA	N/A
14	NA	NA	N/A
15	NA	NA	N/A

Large Area dpm (maximum)
N/A

Airborne Radioactivity

1	N/A
2	N/A
3	N/A
4	N/A
5	N/A
6	N/A
7	N/A
8	N/A
9	N/A

Diagram

Soil Sample Analysis Index

Soil Sample Number	Alpha Activity (pCi/gm)	Beta Activity (pCi/gm)	Soil Sample Number	Alpha Activity (pCi/gm)	Beta Activity (pCi/gm)	Soil Sample Number	Alpha Activity (pCi/gm)	Beta Activity (pCi/gm)
#1	34	13						
#2	21	11						
#3	79	27						
#4	90	20						
#5	25	10						
#6	25	9.2						
#7	8	11.94						
#8	15	6						
#9	40	16						
#10	18	7						
#11	0	17						
#12	4	14						
#13	55	9						
#14	9	9.2						
#15	41	5						
#16	0	14						
#17	25	0						
#18	25	2.2						
#19	38	22						
#20	52	21.03						

(#) Whole Body Dose Rate CW + n or OW + n for X-ray
(#/E) Extremity Dose Rate [(OW-CW) x BCF$_\beta$] + CW + n
(#/S) Skin Dose Rate [(OW-CW) x BCF$_\beta$] + CW + n
(#/GA) General Area Whole Body
△ Neutron Dose Rate
[#] Air Sample Location
* Fixed Contamination

INFORMATION ONLY

Long Form—Radiation Survey Logsheet

Procedure Ref 5Q1.2-1

Page 1 of 3

RWP No.	Date	Time	Facility	Building No.	Level/Room	Survey No.
NA	8/2/97	0700	Rd. A chemical basin	NA	NA	989

Purpose
Performed a site evaluation survey of Rd. A Chemical Basin.

Instruments

Dose Rate		Count Rate	
Model	Serial	Model	Serial
Bicron	6992	496/110c	3881
NA	NA	Lud/12-AC3	5453
NA	NA		
NA	NA	N	A
Laboratory Counters		**Air Samplers**	
Model	Serial	Model	Serial
LUD1000	4278	NA	NA
MS-3	9362	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA

Surveyors

Print	Sign
Elaine Mills	Elaine Mills
Davis Barton	
NA	N
NA	A
NA	

Comments/Additional Information:

Performed Site Evaluation of the area shown on page #2

Results of the probed area was: ND alpha dpm per 100cm2, ND beta-gamma dpm per 100cm2

Exposure rate survey: 10 micro-rem/hr. (bkgd)

Soil Samples were taken- see diagram page #3

N/A

Reviewed By (Print Name) Brown

Signature

Date 8/6/97