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RCRA Facility Investigation/Remedial Investigation Report for the Gunsite 113 Access Road Unit (631-24G) - March 1996

by
E. Palmer
Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

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RCRA FACILITY INVESTIGATION/ REMEDIAL INVESTIGATION REPORT

FOR THE

GUNSITE 113 ACCESS ROAD UNIT (631-24G) (U)

PREPARED BY:
WESTINGHOUSE SAVANNAH RIVER COMPANY
SAVANNAH RIVER SITE
AIKEN, SOUTH CAROLINA

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Prepared for
U. S. Department of Energy
by
Westinghouse Savannah River Company

CERTIFICATION PAGE

Revision 1
RFI/RI Report for the
GUNSITE 113 (631-24G) ACCESS ROAD UNIT

"I certify under the penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

Date: 4/11/96

Signature: C. Bence for AMS
Title: Program Manager
Environmental Restoration
Westinghouse Savannah River Company
Contractor for the U.S. Department of
Energy, Savannah River Operations

Date: 4/15/96

Signature: Cynthia V Anderson
Title: Director
Environmental Restoration Division
U.S. Department of Energy
Savannah River Operations

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LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirements
BRA	Basic Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEC	Cation Exchange Capacity
COPC	Chemical of Potential Concern
Cw	concentration in groundwater
DAF	dilution and attenuation factors
DOE	Department of Energy
EIS	Environmental Impact Statement
EM	Electromagnetics
EPA	Environmental Protection Agency
ET	Exposure Time
FFA	Federal Facility Agreement
FS	Feasibility Study
GPR	Ground Penetrating Radar
HI	hazard index
MCL	maximum contaminant level
MCLG	maximum contaminant level goals
NEPA	National Environmental Policy Act
NPL	National Priority List
NWS	National Weather Service
OVA	Organic Vapor Analyzer
PIP	Public Involvement Plan
RCRA	Resource Conservation and Recovery Act
QA	Quality Assurance
QC	Quality Control
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SCDHEC	South Carolina Department of Health and Environmental Control

SRS	Savannah River Site
SSL	soil screening level
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCL	Target Compound List
TIC	Tentatively Identified Compounds
TOC	Total Organic Carbon
VOC	Volatile Organic Compound
WSRC	Westinghouse Savannah River Company

EXECUTIVE SUMMARY

Gunsite 113 Access Road Unit is located in the northeast corner of SRS. This RCRA/CERCLA unit, which is adjacent to the access road to Gunsite 113, is approximately 91.5 meters (300 feet) east of where Road SRS 8 crosses the facility boundary. The unit is a grassy area of weeds and small trees approximately 24.4 meters (80 feet) long x 15.2 meters (50 feet) wide within a mature pine forest. It consists of several small mounds of dirt and asphalt debris covered with a thick layer of pine straw, brush, and young trees. An open grassy area containing several downed pine trees adjacent to the east side of the mounds was identified as the area most likely impacted by possible waste disposal activities.

In the mid 1980s, sparse vegetation, dead trees, and small mounds of soil were discovered on a portion of the road leading to Gunsite 113. This area became the Gunsite 113 Access Road Unit (Gunsite 113). The unit appears to have been used as a spoil dirt and/or road construction debris disposal area. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence of any burning, excavation or recent disposal activities having occurred in this area or that disposal activities were more widespread.

Three organics species, acetone, methylene chloride, and bis(2-ethylhexyl) phthalate were detected in soil samples collected from the target (potentially-impacted) areas. Concentrations ranged from 11-230 μg/kg (acetone), 9-29 μg/kg (methylene chloride) and 450 μg/kg (bis(2-ethylhexyl) phthalate). All three of these constituents are documented laboratory artifacts and both acetone and methylene chloride were detected in laboratory blanks. The practical quantitation limit for bis(2-ethylhexyl) phthalate is 660 μg/kg and in the one sample in which it was detected, its value is only 450 μg/kg. In addition, concentrations of acetone in the soil samples are less than the maximum detected level in the unit-specific "non-impacted" background sample (GS113-04) collected across the road and remote from the suspected impacted area and the background methylene chloride content has a comparable value to the soil boring analysis. This comparison suggests that these two constituents may be laboratory-induced.

Trace levels of gross alpha and gross beta were detected in the suspected impacted area samples, but levels are not significantly different from the background sample. Low concentrations of arsenic, chromium, and lead were also detected in the potentially-impacted area, but these concentrations are less than SRS maximum soil concentrations. Trace levels of total cyanide, tin, vanadium, and zinc were also detected. Results of the Appendix IX analysis indicate that no herbicides, pesticides, PCBs, dioxins/furans, or other organic substances were detected. No chlorinated solvents other than trace levels of the laboratory artifact methylene chloride were detected in any sample.

Three metals (arsenic, chromium, and lead) and cyanide were detected at levels exceeding unit-specific background values. Although the reported levels of arsenic, chromium, and lead are slightly above unit-specific background levels, the concentrations are within the range for SRS background levels. The arsenic detected measured 1.8 mg/kg. The corresponding method detection limit was 1.7 mg/kg. Based on the quality control report, the laboratory standards for arsenic fell within the corresponding control limits of 80% to 120%. This means that values falling between 1.36 (80%) to 2.04 (120%) can be considered an artifact of the analytical method and not a contaminant.

The level of chromium, 24.3 mg/kg, at the 8 to 10 foot level exceeds the EPA 1995 soil screening level for transfer from soil to groundwater which is 19 mg/kg. Based on site specific standard groundwater modeling equations, it was estimated that chromium contaminant concentration in groundwater would peak in approximately 1707 years at a concentration of 0.18 mg/L. The calculated concentration is approximately 0.08 mg/L higher than the 0.10 mg/L accepted MCLG for chromium VI, but is equivalent to the chromium VI RBC for tap water (0.18 mg/L) resulting in a HI equal to 1. The results for chromium are considered to be conservative since chromium was detected in only one sample at the 8-10 foot sampling interval and peak concentration to groundwater is in excess of 1000 years. It should also be noted that the chromium level detected in the one sample is within the SRS soil background level.

Trace levels of cyanide, tin, zinc, and vanadium were also detected. Although no unit specific background data were obtained for these compounds, tin, zinc, and vanadium are within normal SRS background levels. No background data are available for cyanide.

However, the cyanide level detected at Gunsite 113 is well below the EPA risk-based concentration level.

A laboratory analysis of the GPR survey performed in January 1993 noted three anomalies, but found no indication of buried objects, trenches, or burial pits at Gunsite 113. Field observations at the time the survey was conducted were able to identify the cause of the three anomalies. One anomaly was an object (piece of tin) located at the ground surface. The second anomaly was caused by the GPR antenna traversing a mound located at the unit. The final anomaly was caused by the operator jerking or bouncing the antenna.

A soil gas survey also conducted in 1993 noted the levels of volatiles and diesel range organics observed are very low with most below minimum detection levels. Levels of light hydrocarbons and mercury are indicative of background concentrations in the SRS area. No evidence of contamination was found at this unit.

A review of the unit sampling plan and the resulting soil and soil gas analytical data for Gunsite 113 indicates the data are sufficient for use in a risk assessment evaluation. The results indicate that the concentrations of all hazardous materials analyzed, except for one sample of chromium as noted above, were near or below naturally occurring background levels and/or below any risk-based concentration levels. Therefore, they pose no risk to human health and the environment.

Based upon the available evidence, there are no potential contaminants of concern available for evaluation by a CERCLA baseline risk assessment. Therefore, there is no determinable health risk associated with Gunsite 113. In addition, it is also reasonable to conclude that, since contamination is below risk-based levels, the unit presents no significant ecological risk.

It is recommended that no further remedial action be performed at this unit.

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1.0 INTRODUCTION

1.1 Purpose

This report summarizes the activities and documents the results of a Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) conducted at Gunsite 113 Access Road Unit on the Savannah River Site (SRS) near Aiken, South Carolina. The RFI/RI was conducted in stages, beginning with a preliminary unit evaluation in November 1988, followed by a screening phase, and culminating in a field assessment stage in 1993.

The primary objective of the Remedial Investigation/Feasibility Study (RI/FS) is "to gather data sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site" (EPA, 1988). In order to accomplish this, it is necessary to define the nature and extent of the contamination, determine the fate and transport of the contaminants, complete a baseline risk assessment (BRA), and identify remedial action objectives. In the event that an FS is required, this information is then used to identify potential remedial action alternatives and potential applicable or relevant and appropriate requirements (ARARs). To achieve the goals of this RI, both historical data and data collected during the 1993 characterization were used.

This introductory section presents background information about the unit, outlines the regulatory requirements guiding the investigation, the unit's history, and previous investigations at the unit.

1.1.1 SRS RCRA 3004(u)/CERCLA Program Description

The United States Department of Energy (DOE) Savannah River Field Office manages waste materials regulated under the Resource Conservation and Recovery Act (RCRA). In particular, certain activities require RCRA operating or post closure permits. Savannah River Site (SRS) has received a RCRA permit from the South Carolina Department of Health and Environmental Control (SCDHEC). Part V of the permit mandates that SRS establish and implement a RCRA Facility Investigation (RFI) Program to fulfill requirements of RCRA Section 3004(u). Section V.A.1 of the permit lists solid waste management units (SWMUs) that were identified by the United States Environmental Protection Agency (EPA) Region IV through the RCRA Facility Assessment (RFA) process and are therefore subject to the RFI process.

On December 21, 1989, SRS was included on the National Priority List (NPL). A unit included on the NPL falls under the jurisdiction of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This inclusion created the need to integrate the established RFI Program with CERCLA RI requirements. In accordance with Section 120 of CERCLA, DOE has negotiated a Federal Facility Agreement (FFA) with EPA and SCDHEC to integrate remedial activities at SRS into one comprehensive strategy which fulfills these dual regulatory requirements.

SWMUs listed in the RCRA permit and the FFA Appendix are required to be further investigated to determine their actual or potential impact on the environment. Those listed units are called RCRA/ CERCLA Remedial Investigation Units in this document. Gunsite 113 Access Road Unit is one of the RCRA/CERCLA units mandated for further investigation.

In order to conduct the RI/FS, SRS developed the *RFI/RI Program Plan* (WSRC [Westinghouse Savannah River Company], 1993) (originally titled the *RFI Program Plan*) to provide guidance and delineate standard procedures. It also provides a reasonable and cost effective approach while allowing SRS flexibility in the investigation of each RCRA/CERCLA unit. The plan specifies generic methods and procedures to be used for each unit investigation. Because of continuing change in the status of facilities at SRS, the program plan is periodically reviewed and modified to keep it current.

The *RFI/RI Program Plan* (WSRC, 1993), in conjunction with *Guidance for Conducting Remedial Investigations and Feasibility Studies (FS) Under CERCLA, Interim Final* (EPA, 1988), were used as the primary sources of guidance for work plan preparation. These references are jointly referred to as RFI/RI guidance documents. The work plan for Gunsite 113 Access Road Unit conformed to the requirements specified in the RFI/RI guidance documents.

Sections 113 and 117 of CERCLA lists the requirements for public participation in the restoration process. These requirements include the establishment of an Administrative Record File that documents the selection of cleanup alternatives and provides for public review and comment on those alternatives. The DOE document, *Public Involvement, A Plan for the Savannah River Site* (DOE, 1994), is designed to facilitate public involvement in the decision-making processes for permitting, closure, and selection of remedial alternatives. The Public Involvement Plan (PIP) addresses the requirements of CERCLA, RCRA, and the National Environmental Policy Act (NEPA).

Unit-specific documentation, such as work plans and RIs, are a part of the Administrative Record File and are available to the public. Information repositories have been established at the DOE Public Reading Room located at the Gregg-Graniteville Library of the University of South Carolina in Aiken, South Carolina and the Thomas Cooper Library located at the University of South Carolina in Columbia, South Carolina. A notice will be published in local newspapers when information is compiled regarding the investigation of Gunsite 113 Access Road Unit. Additional repositories may be added and/or locations changed to better meet the needs of the public.

1.2 Site Background

1.2.1 Site Description

Gunsite 113 Access Road Unit is located in the northeast corner of SRS. Figure 1-1 shows the location of the unit in relation to major SRS facilities. This RCRA/CERCLA unit, which is adjacent to the access road to Gunsite 113, is approximately 91.5 meters (300 feet) east of where Road SRS 8 crosses the facility boundary. SRS coordinates for the unit are: between E115200, E11530, and N64900.

Gunsite 113 Access Road Unit is a grassy area of weeds and small trees approximately 24.4 meters (80 feet) long x 15.2 meters (50 feet) wide within a mature pine forest. It consists of several small mounds of dirt and asphalt debris covered with a thick layer of pine straw, brush, and young trees. An open grassy area containing several downed pine trees adjacent to the east side of the mounds was identified as the area most likely

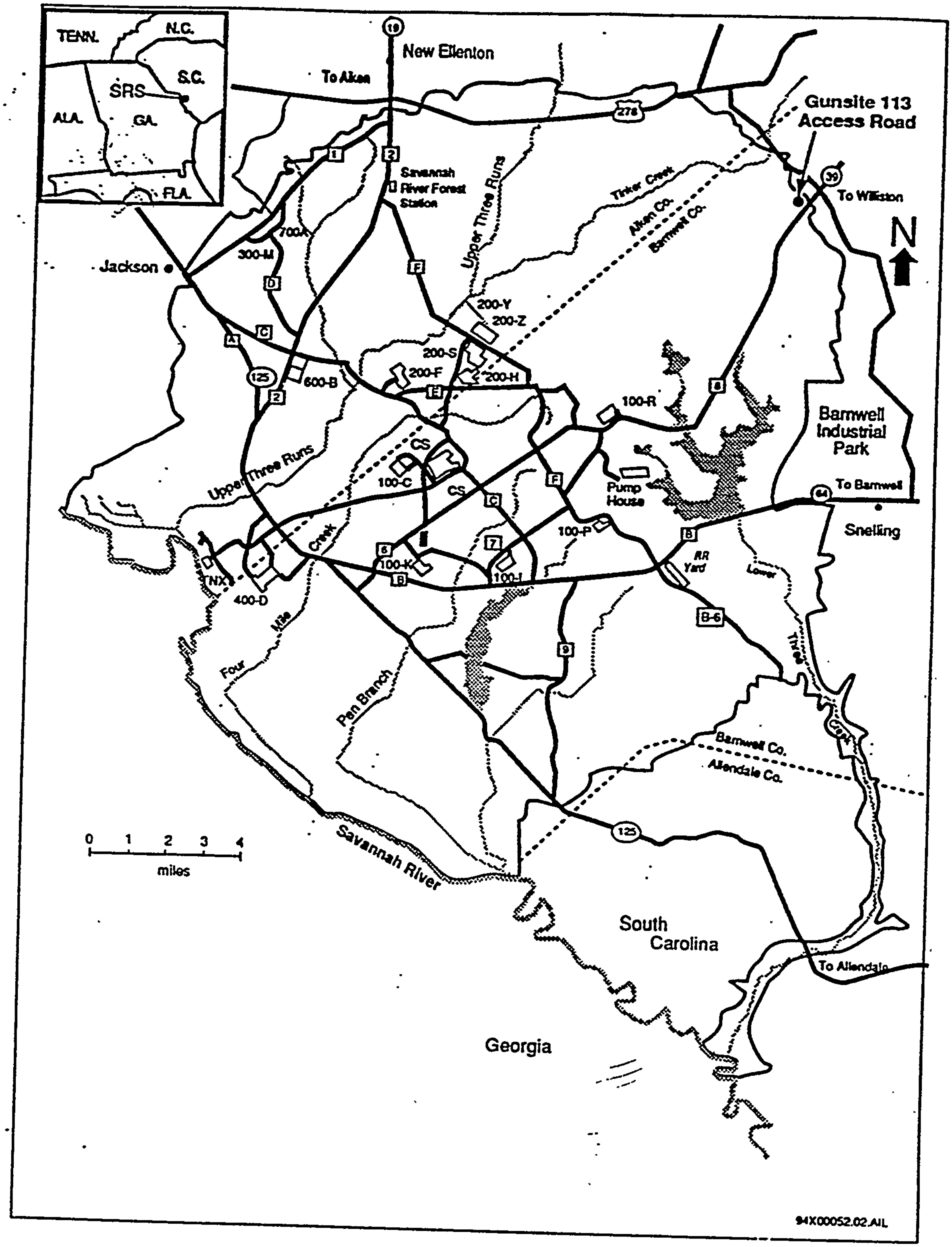


Figure 1-1 Location of Gunsite 113 in Relation to Major SRS Facilities

impacted by possible waste disposal activities. The local terrain is flat, with no major drainage features nearby. A small, unnamed tributary of Rosemary Creek located 1.3 kilometers (0.8 miles) southeast of the unit is the nearest surface water.

1.2.2 Site History

During the period from 1955 to 1960, the U. S. Army established anti-aircraft artillery gun emplacements onsite to defend SRS in the event of an air attack. A total of 19 gun emplacements with both 75 mm and 90 mm guns were constructed.

In the mid 1980s, sparse vegetation, dead trees, and small mounds of soil were discovered on a portion of the road leading to Gunsite 113. This area became the Gunsite 113 Access Road Unit (Gunsite 113). As a result, Gunsite 113 became one of the original waste units specified in the SRS RCRA Facility Assessment (RFA). When SRS was listed on the NPL, these waste units became RCRA/CERCLA waste units and were placed in Appendix C (RCRA/CERCLA units) of the FFA.

The unit appears to have been used as a surface disposal area for spoil dirt and/or road construction debris. There is no documentation or record of any hazardous substance management, disposal, or any other type of waste disposal at this unit. There is no evidence of any burning, excavation or recent disposal activities having occurred in this area or that disposal activities were more widespread.

1.3 Previous Investigations

The first step towards determining if a hazardous substance has been released from a RCRA/CERCLA unit consists of a Preliminary Unit Evaluation. The primary goal of the preliminary evaluation is to determine what hazardous substances, if any, were disposed of or released from the unit.

The only available sampling data consists of 10 soil samples and 10 soil gas samples taken in March/April 1988 as part of a survey of selected potential waste sites at SRS (Looney et al, 1988). Those soil gas sampling locations are indicated in Figure 1-2. Six of the soil

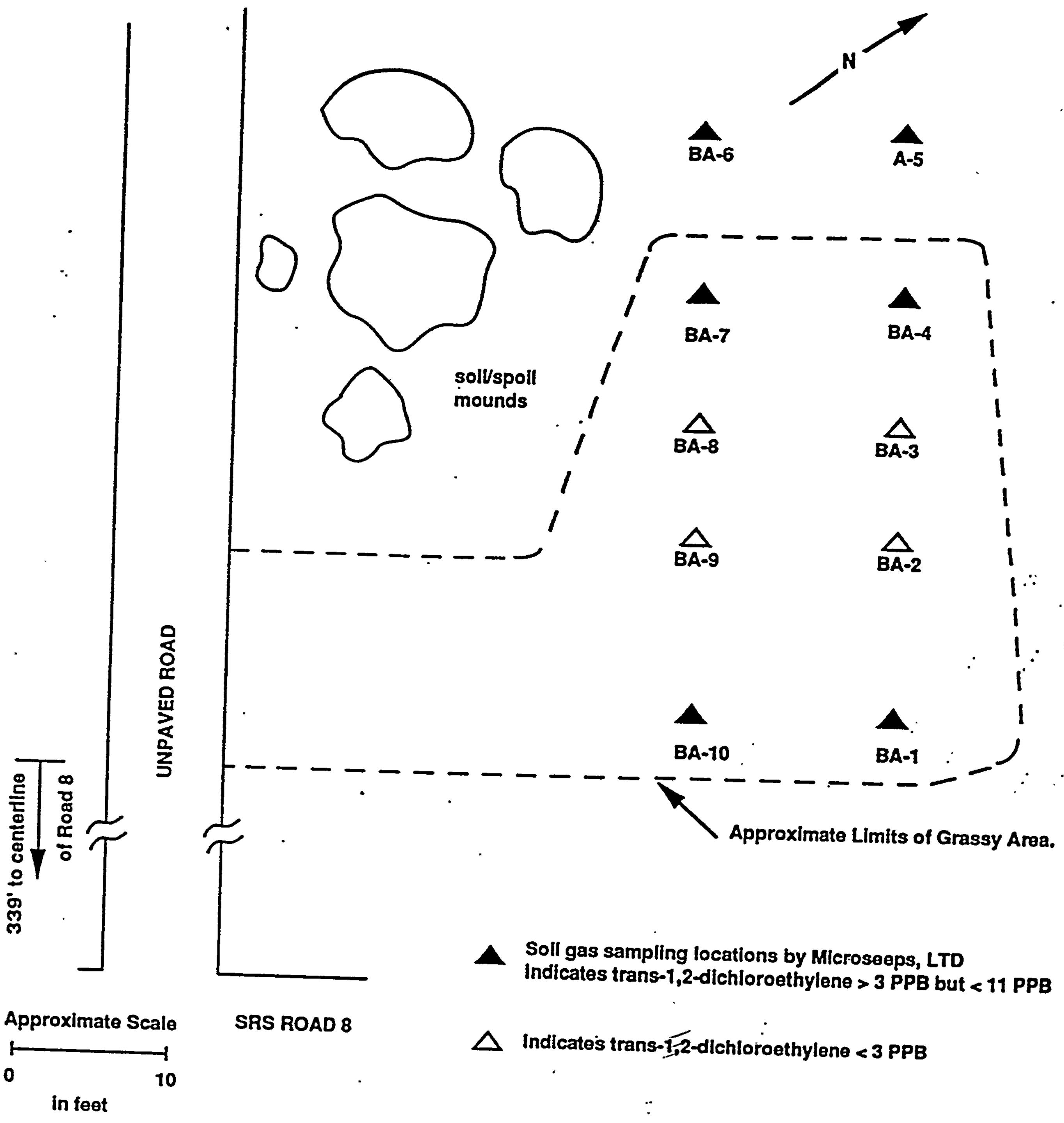


Figure 1-2 1988 Soil Gas Sampling Locations samples show trace levels of 1,2 dichloroethylene (<11 mg/kg but >3 mg/kg), suggesting the possible past disposal of chlorinated solvents at this unit. The soil gas samples also contain low levels of light hydrocarbons (< 2500 ppb methane), but these levels are within the range that could be expected to occur naturally.

Based on the preliminary evaluation results, a Unit Screening Plan for Gunsite 113 Access Road Unit was formulated. The following sections describe the Preliminary Unit Evaluation and Unit Screening procedures and results. Chapter 2 describes the activities conducted to complete the Unit Assessment.

1.3.1 Preliminary Unit Evaluation

A review of existing literature and information from Gunsite 113 Access Road Unit, conducted in accordance with the *RFI/RI Program Plan* (WSRC, 1993), included:

- Physical and chemical characteristics of the waste (hazardous and non-hazardous) known to be managed at the unit;
- Unit/disposal area characteristics;
- General hydrogeologic conditions of the unit and the current environmental setting;
- Any previous sampling and/or monitoring data for the unit.

1.3.1.1 Existing Literature and Information

Existing information specifically pertaining to the Gunsite 113 Access Road Unit was reviewed. A complete list of the documents reviewed is included in Section 5.2.1 of the *RFI/RI Plan for the Gunsite Access Unit, WSRC-RP-90-996* (WSRC, 1990)

1.3.1.2 RFI/RI Literature Review Checklist

This checklist presents RFI data and information that are specific to each individual environmental medium. Copies of the completed checklist appear in Appendix D.1 of the *RFI/RI Plan for the Gunsite 113 Access Road Unit, WSRC-RP-90-996* (WSRC, 1990).

1.3.1.3 RFI/RI Site Reconnaissance

Following a review of all existing data and information, a unit reconnaissance was performed to further assess the following field conditions:

- environmental setting;
- source characterization (RCRA\CERCLA unit conditions and waste characteristics);
- waste release potential (for each environmental medium).

The completed "Site Reconnaissance Field Data Sheet" lists unit-specific factors considered during the actual reconnaissance. This data sheet was completed in full to provide appropriate written documentation of field observations. Following the unit reconnaissance, the Literature Review Checklist was updated to include information and data collected from the field visit.

1.3.1.4 Preliminary Unit Evaluation Results

Information regarding current unit conditions is listed in the Literature Review Checklist and the Unit Reconnaissance Field Data Sheet which can be found in Appendix D.2 of the *RFI/RI Plan for the Gunsite 113 Access Road Unit, WSRC-RP-90-996* (WSRC, 1990). That information is summarized in Sections 1.3.1.4.1 through 1.3.1.4.2.

1.3.1.4.1 Waste Characteristics

No specific hazardous waste constituents were identified, but small quantities of chlorinated solvents were suspected, having been detected by previous soil gas sampling. No evidence of liquid waste management activities was visible. Visible materials included dirt and chunks of spent paving materials.

1.3.1.4.2 Unit/Disposal Area Characteristics

No documented information exists on waste management activities at the unit. Gunsite 113 Access Road Unit is not currently used for any waste disposal. The area appears to have been used as a surface disposal area for construction debris and spoil dirt. There is no evidence of excavation.

1.3.2 Unit Screening

A Unit Screening program was performed at Gunsite 113 Access Road Unit because the Preliminary Unit Evaluation indicated a possible receipt of hazardous substances. The primary goal of the Unit Screening phase is to identify if a release of hazardous substances did occur and areas potentially impacted by a hazardous substance release. The *RFI/RI Program Plan* (WSRC, 1993) specifies that Unit Screening investigative activities include one or more of the following geophysical and/or geochemical techniques:

- Geophysical investigations such as ground penetrating radar (GPR) or electromagnetics (EM);
- Soil gas analysis; and/or
- Confirmation soils analysis.

The three options listed above were first evaluated regarding their applicability at Gunsite 113 Access Road Unit and a program was then designed and implemented.

1.3.2.1 Evaluation of Unit Screening Options

A geophysical investigation using ground penetrating radar (GPR) was selected because the unit consists of several mounds of dirt and appears to have been used as a surface disposal area for construction rubble and/or spoil dirt. This technology would allow for a search of buried drums, other containers, and subsurface features.

Soil gas data (Looney et al, 1988) collected during a survey of selected potential waste sites at SRS (see Section 1.3) show trace levels of volatile organic compounds (VOCs) that suggests the possible past disposal of chlorinated solvents at this unit. Because of this, confirmation soil analysis was selected to screen for semi-volatile and volatile organic compounds, metals and radioactivity.

1.3.2.2 Unit Screening Geophysical Survey

A ground penetrating radar (GPR) survey was conducted by Site personnel in March 1989. Reports based on that survey indicate that there is no evidence of buried or underground objects in the area. Additional documentation on that survey is not available.

1.3.2.3 Unit Screening/Confirmation Soil Analysis Sampling

The goal of the unit screening effort was to evaluate whether a hazardous substance release had occurred and to identify any chemical constituents involved. Chemical parameters which indicate the presence and magnitude of a hazardous waste or hazardous substance release were selected for analysis. For screening at Gunsite 113 Access Road Unit, the following chemical parameters were analyzed at selected locations:

- Full EPA Appendix IX (40 CFR, Part 264) scan;
- Radionuclide indicators (gross alpha, gross beta);
- Total metals (for the eight EP-toxicity metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag);
- Volatile organics (EPA Method 8240);
- Semi-Volatile Organics (EPA Method 8270); and
- General indicator parameters (soil pH, TOC, CEC, Specific Conductance).

Chemical parameters were selected to obtain information on waste disposal history (waste oils, volatile organics, semi-volatile organics, and metals), waste characterization (Appendix IX, radionuclide indicators), constituents in excess of background, or to provide sufficient information to indicate constituent absence (Appendix IX, radionuclide indicators).

1.3.2.3.1 Soil Borings

Soil Samples were collected from four boreholes drilled at Gunsite 113 Access Road Unit. The locations of these boreholes are shown on Figure 1-3. Borehole GS113-04 is a "background" boring (referred to as the "unit-specific, non-impacted area" sample) located outside the unit area to the south of Access Road 113. Soil samples were taken at

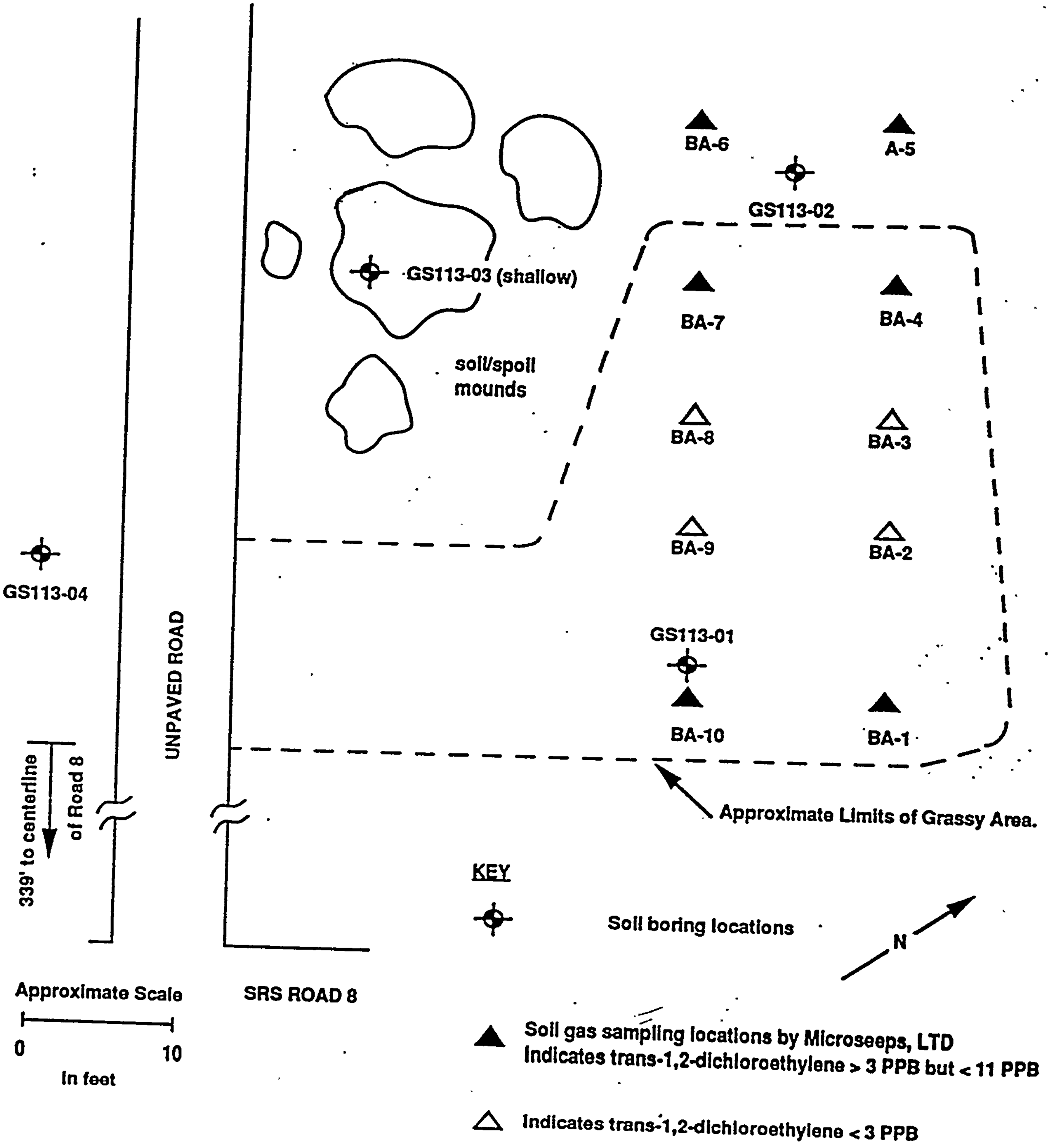


Figure 1-3 Unit Screening Sampling Locations

intervals of 0.9-1.5 meters (3-5 feet), 2.4-3.05 meters (8-10 feet), 3.9- 4.6 meters (13-15 feet), and 5.5-6.1 meters (18-20 feet) below the ground surface. No samples were collected in the 0-0.3 meters (0-1 foot) because sampling at this site predates the establishment of that protocol.

Boreholes GS113-01, GS113-02 and GS113-03 are located within the Gunsite 113 Access Road Unit (see Figure 1-3). GS113-01 and GS113-02 are adjacent to the grassy area of the unit and were drilled to a depth of 6.1 meters (20 feet). Soil samples from these two boreholes were also taken at intervals of 0.9-1.5 meters (3-5 feet), 2.4-3.05 meters (8-10 feet), 3.9- 4.6 meters (13-15 feet), and 5.5-6.1 meters (18-20 feet) below the ground surface. Borehole GS113-03, drilled through the largest dirt/construction debris pile, was augured to a depth of 0.9 meters (3 feet) below the surface of the pile. The height of this soil/spoil mound averaged 0.9 to 1.1 meters (3 to 3.5 feet). Only one sample was collected from this borehole. Sample intervals and the analyses conducted for all four boreholes are provided in Table 1-1. Split spoon samples and the borehole annulus were screened for volatile organics using an organic vapor analyzer (OVA).

1.3.2.3.2 Soil Borings Analysis

All substances detected at concentrations greater than analytical method detection limits have been reported and summarized in Table 1-2. The constituent concentrations are listed by location, borehole, interval number, and depth below ground surface.

The constituent concentrations listed in Table 1-2 are those which the contract laboratory has reported "above detection limits". Reporting of these values does not imply that these levels are above background because statistical background levels have not been quantified. The reported levels also are not "remediation trigger levels" or "clean-up levels".

Three organics species, acetone, methylene chloride, and bis(2-ethylhexyl) phthalate were detected in soil samples collected from the target (potentially-impacted) areas. Concentrations ranged from 11-230 µg/kg (acetone), 9-29 µg/kg (methylene chloride) and 450 µg/kg (bis(2-ethylhexyl) phthalate). All three of these constituents are documented laboratory artifacts and both acetone and methylene chloride were detected in laboratory

TABLE 1-1
SAMPLING INTERVALS AND CONSTITUENTS ANALYZED

Borehole Number	Sample Number	Sampling Method	Sample Depth meters (feet)	Analysis Conducted***
GS113-01	01	Split Spoon	0.9-1.5 (3-5)	2*,3**,7
GS113-01	02	Split Spoon	2.4-3.05 (8-10)	1,4
GS113-01	03	Split Spoon	3.9- 4.6 (13-15)	1,7
GS113-01	04	Split Spoon	5.5-6.1 (18-20)	1,7
GS113-01	01E	Rinsate	0.9-1.5 (3-5)	1
GS113-02	01	Split Spoon	0.9-1.5 (3-5)	1,2*
GS113-02	02	Split Spoon	2.4-3.05 (8-10)	1
GS113-02	03	Split Spoon	3.9- 4.6 (13-15)	1
GS113-02	04	Split Spoon	5.5-6.1 (18-20)	1
GS113-03	01	Hand Auger	0.6-0.9 (2-3)	1,2*
GS113-03	01A	Duplicate	0.6-0.9 (2-3)	1,2*
GS113-03	01D	Split	0.6-0.9 (2-3)	1,2*
GS113-04	01	Split Spoon	0.9-1.5 (3-5)	1,2,4,5,6,7
GS113-04	02	Split Spoon	2.4-3.05 (8-10)	1,7
GS113-04	03	Split Spoon	3.9- 4.6 (13-15)	1,7
GS113-04	04	Split Spoon	5.5-6.1 (18-20)	1,7
GS113-00	01B	Trip Blank	N/A	1,2
GS113-00	01C	Field Blank	N/A	1,2

* One composite sample was made from equal portions of the three samples from the borehole and analyzed for radionuclide indicators.

** One sample from borehole GS113-01 was analyzed for Appendix IX (40 CFR 264) parameters. The actual selection of this sample was based on the results of screening with an organic vapor analyzer (OVA flame ionization detector).

*** Analyses conducted in accordance with *Test Methods for Evaluating Solid Waste; Physical/Chemical Methods*, Third Edition (1986). Analyses are coded as follows:

1. Volatile Organics
2. Radionuclide indicators (gross alpha and gross beta using a gas proportional counter)
3. Appendix IX Compounds
4. Total metals (eight RCRA metals: As, Ba, Cd, Cr, Pb, Hg, Se, Ag)
5. Semi-Volatile Organics
6. Cation Exchange Capacity (CEC)
7. Indicator Parameters: pH, Total Organic Carbon (TOC)

Note: Headspace screening for volatile organics was performed on all samples in the field using an OVA.

TABLE 1-2
CHEMICAL ANALYSIS RESULTS

Sample ID: GS113				Physical Parameters			Organic Constituents			
Borehole Number	Sample Number	Sample Depth meters	(feet)*	pH	CEC meq/100g	TOC mg/kg	ACET µg/kg	B2EHP µg/kg	CH2CL2 µg/kg	Total Cya mg/kg
GS113-01	01	0.9-1.5	(3-5)	9.2	NA	396	NA	NA	NA	NA
GS113-01	02	2.4-3.05	(8-10)	NA	NA	NA	95***	450	17***	2.2
GS113-01	03	3.9-4.6	(13-15)	5.2	NA	834	96***	NA	25***	NA
GS113-01	04	5.5-6.1	(18-20)	5.2	NA	96.4	230	NA	22***	NA
GS113-02	01	0.9-1.5	(3-5)	NA	NA	NA	140	NA	10***	NA
GS113-02	02	2.4-3.05	(8-10)	NA	NA	NA	140	NA	11***	NA
GS113-02	03	3.9-4.6	(13-15)	NA	NA	NA	160	NA	21***	NA
GS113-02	04	5.5-6.1	(18-20)	NA	NA	NA	92***	NA	9***	NA
GS113-03	01	0.6-0.9	(2-3)	NA	NA	NA	11***	NA	14***	NA
GS113-04	01	0.9-1.5	(3-5)**	5.0	0.91	211	490	<410	< 12	NA
GS113-04	02	2.4-3.05	(8-10)**	5.2	NA	364	58***	NA	17***	NA
GS113-04	03	3.9-4.6	(13-15)**	5.2	NA	852	39***	NA	29***	NA
GS113-04	04	5.5-6.1	(18-20)**	5.4	NA	141	77***	NA	19***	NA

NA: Not Analyzed

* Depth below ground surface

** Unit-specific "non-impacted" point

*** False positive value (detected in concentrations up to 10 times the laboratory method blank concentrations)

ACET:	Acetone
B2EHP:	bis(2-ethylhexyl)phthalate
CH2CL2	methylene chloride
Total Cyan:	Total Cyanide

TABLE 1-2 (continued)
CHEMICAL ANALYSIS RESULTS

Sample ID: GS113				Radioactive Indicators		Metal Constituents					
Borehole Number	Sample Number	Sample Depth meters	(feet)*	ALPHAG pCi/g	BETAG pCi/g	As mg/kg	Cr mg/kg	Pb mg/k	Sn mg/k	V mg/kg	Zn mg/kg
GS113-01	01	0.9-1.5	(3-5)	7	6	NA	NA	NA	NA	NA	NA
GS113-01	02	2.4-3.05	(8-10)	NA	NA	1.8	24.3	4.8.	41.9	76.2	9.4
GS113-01	03	3.9-4.6	(13-15)	NA	NA	NA	NA	NA	NA	NA	NA
GS113-01	04	5.5-6.1	(18-20)	NA	NA	NA	NA	NA	NA	NA	NA
GS113-02	01	0.9-1.5	(3-5)	8	6	NA	NA	NA	NA	NA	NA
GS113-02	02	2.4-3.05	(8-10)	NA	NA	NA	NA	NA	NA	NA	NA
GS113-02	03	3.9-4.6	(13-15)	NA	NA	NA	NA	NA	NA	NA	NA
GS113-02	04	5.5-6.1	(18-20)	NA	NA	NA	NA	NA	NA	NA	NA
GS113-03	01	0.6-0.9	(2-3)	6	3	NA	NA	NA	NA	NA	NA
GS113-04	01	0.9-1.5	(3-5)**	9	3	< 1.4	2.2	2.1	NA	NA	NA
GS113-04	02	2.4-3.05	(8-10)**	NA	NA	NA	NA	NA	NA	NA	NA
GS113-04	03	3.9-4.6	(13-15)**	NA	NA	NA	NA	NA	NA	NA	NA
GS113-04	04	5.5-6.1	(18-20)**	NA	NA	NA	NA	NA	NA	NA	NA

NA:	Not Analyzed
*	Depth below ground surface
**	Unit-specific "non-impacted" point
***	False positive value (detected in concentrations up to 10 times the laboratory method blank concentrations)
ALPHAG:	gross alpha
BETAG:	gross beta
As:	Arsenic
Cr:	Chromium
Pb:	Lead
Sn:	Tin
V:	Vanadium
Zn:	Zinc

blanks. The practical quantitation limit for bis(2-ethylhexyl) phthalate is 660 µg/kg and the one sample in which is was detected, its value is only 450 µg/kg. In addition, concentrations of acetone in the soil samples are less than the maximum detected level in the unit-specific "non-impacted" background sample (GS113-04) collected across the road and remote from the suspected impacted area and the background methylene chloride content has a comparable value to the soil boring analysis. This comparison suggests that these two constituents may be laboratory-induced.

Trace levels of gross alpha and gross beta were detected in the suspected impacted area samples, but levels are not significantly different from the non-impacted area sample (GS113-04). Low concentrations of arsenic, chromium, and lead were also detected in the potentially-impacted area, but these concentrations are less than SRS maximum and southeastern U. S. mean background soil concentrations (Conner and Shacklette, 1975). Trace levels of total cyanide, tin, vanadium, and zinc were also detected. These and other analytical results are included in Table 1-2.

It was indicated in Table 1-1 that one sample (sample 01 from 3-5 feet)from borehole GS113-01 was to be analyzed for Appendix IX (40 CFR 264) parameters with the actual selection of this sample based on the results of screening with an organic vapor analyzer (OVA flame ionization detector). Based on the field screening, it was determined that the sample analyzed should be from a deeper unit (sample 02 from 8-10 feet).

Results of the Appendix IX analysis indicate that no herbicides, pesticides, PCBs, dioxins/furans, or other organic substances were detected. No chlorinated solvents other than trace levels of the laboratory artifact methylene chloride were detected in any sample.

1.3.2.4 Unit Screening Conclusions

Based on the Unit Screening data, hazardous substance concentrations detected appear to be at or below background concentrations or below EPA risk-based action levels. Although unit-specific statistical background concentrations were not calculated, a comparison of field data with unit-specific, non-impacted area data or with data from other non-impacted sites at SRS, or the southeastern United States, indicates that

Table 1-3

Comparison of Maximum Soil Concentrations (1990 data) with Unit Specific SRS Background Levels and Proposed EPA Soil Action Levels.

Constituent (mg/kg)	Gunsite 113 Soil Sample Concentration		Two Times Background	SRS Soil Background Levels*	1995 EPA-Risk Based Concentrations
	Maximum	Background			
Arsenic[a]	1.8	< 1.4	< 2.8	< 2.0	0.37[b]
Chromium (total)	24.3	2.2	4.4	1.31-105.1	390[c]
Cyanide	2.2	not tested	—	NA	1600
Lead	4.8	2.1	4.2	< 1.0-16.67	400

* Based on Looney et al, 1988

a Method Detection Level is 1.7 mg/kg

b Value is for arsenic as a carcinogen, the non-carcinogen hazard index value is 23 mg/kg

c Chromium VI compounds, value for Chromium III compounds is 78,000 mg/kg.

NA Not Available

contaminant levels at Gunsite 113 Access Road Unit are within typical background ranges. Table 1-3 contains the 1990 sampling data for the samples in which substances were detected, along with the corresponding background and EPA risk-based concentration values. It should be noted that the chromium value of 24.3 mg/kg is below the EPA risk-based level for soil ingestion, but does exceed the EPA soil screening level for transfer from soil to groundwater. Additional information on this is provided in Sections 2.5.4.1 and 6.1.1.

1.4 Report Organization

This RFI/RI Report, following EPA Guidance (EPA, 1988), consists of seven chapters for describing the rationale for the investigation, unit characterization activities conducted, data evaluation, risk assessment, and data assessment. Chapter 1 provides background information summarizing the history of the unit, and the purpose and objectives of this investigation. Chapter 2 describes the objectives of the EPA-approved work plan. Chapter 3 describes the physical characteristics of the unit including surface topography, hydrogeology, soil types, demography and land use, and ecology. Chapter 4 presents an evaluation of the contamination present at Gunsite 113. Chapter 5 evaluates the fate and transport mechanisms applicable to the contaminants detected, and Chapter 6 presents a summary of the human health and ecological baseline risk assessment. Chapter 7 summarizes the results of the RCRA/CERCLA Unit Assessment along with conclusions derived from data analysis.

2.0 STUDY AREA INVESTIGATION

2.1 Surface Feature Investigation

The general topography of Gunsite 113 Access Road Unit has been mapped and the surface drainage delineated. Figure 2-1 is a topographic map of the unit and Chapter 3.0 provides additional information on area physiography.

2.2 Contaminant Source Investigation

The general history of this area does not provide any information about its use as a waste unit. However, a unit screening program was required since the preliminary unit evaluation indicated the possible disposal of hazardous substances. The unit screening is discussed in Section 1.3.2.

2.3 Meteorological Investigation

As a nuclear facility, SRS maintains a system of seven meteorological towers located adjacent to each production area and at the WJBG-TV tower about 15 kilometers (9 miles) north of the unit. In addition, the National Weather Service maintains a station at Augusta's Bush Field airport approximately 26 kilometers (16 miles) northwest of this area.

Data from these sources have been compiled and published in numerous documents including the EIS for continued operation of K-, L-, and P- Reactors (DOE, 1990), and the Draft EIS for the Siting, Construction, and Operation of New Production Reactor Capacity (DOE, 1991). Meteorological data are summarized in Section 3.2 No ambient air sampling was performed because Gunsite 113 Access Road Unit is inactive with no potential for impact to the air.

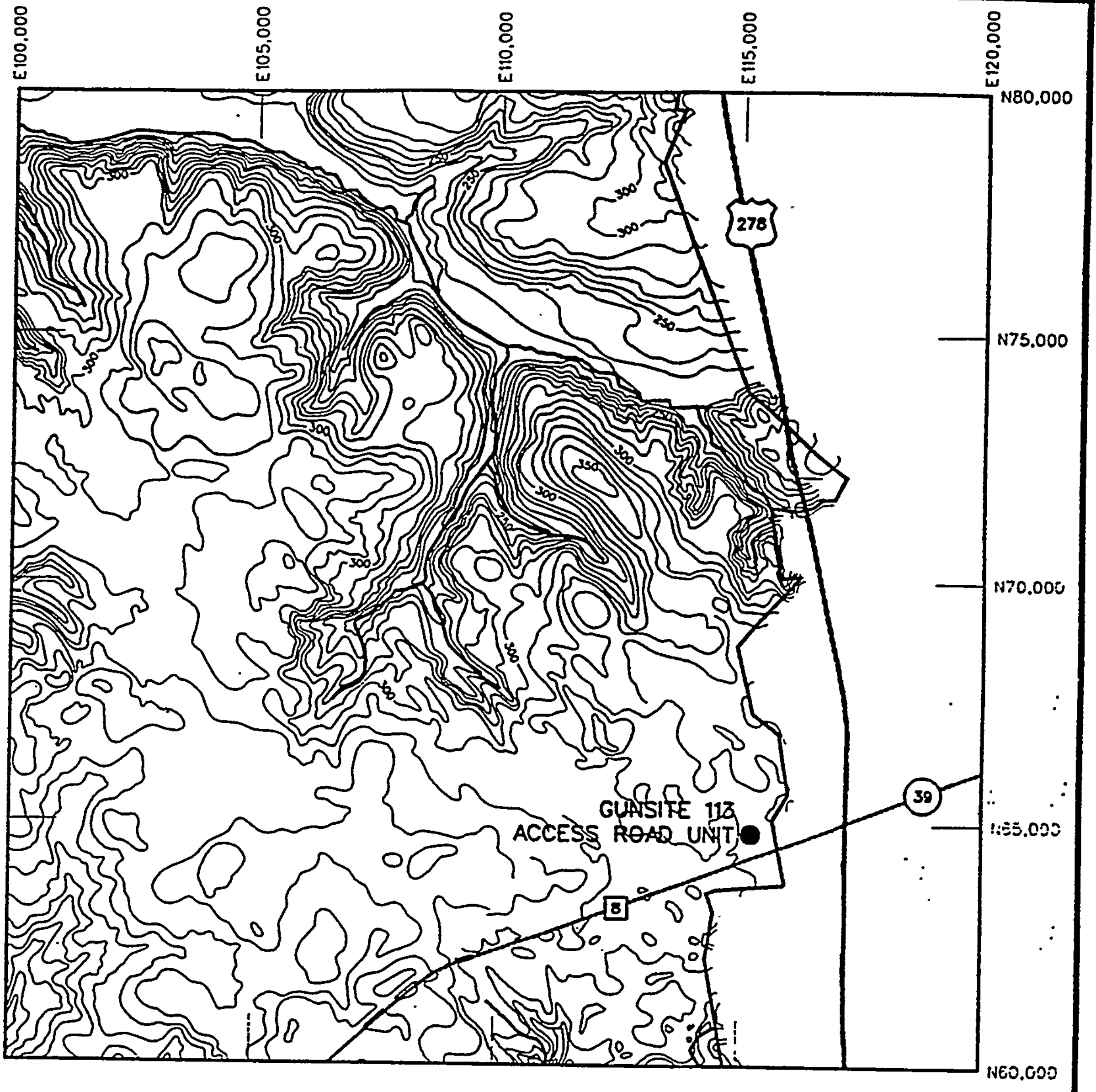
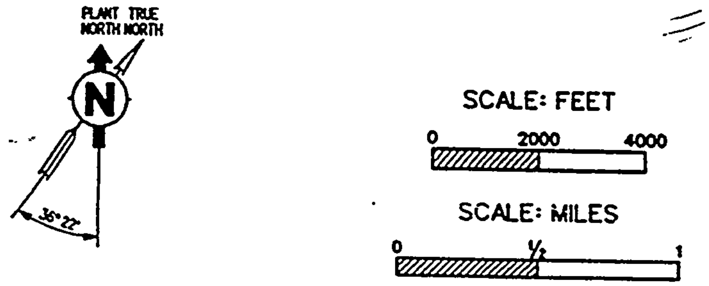


Figure 2-1 Topographic Map of Gunsite 113 Access Road Unit



GUNSITE | 0 | 3-15-95 | SITE

SRS

ENVIRONMENTAL RESTORATION

GUNSITE 113
ACCESS ROAD UNIT LOCATION

ET ALEXANDER | 3-15-95 | NA | NA
JIM KORR | 3-15-95 | NA | NA
NA | NA | NA | NA
NA | NA | NA | NA

2.4 Surface Water and Sediment Investigation

Surface water/sediment sampling was not conducted because the nearest surface water is a small, unnamed tributary of Rosemary Creek located 1.3 kilometers (0.8 miles) southeast of the unit. The distance to Rosemary Creek and the nature of the soil in this area generally precludes any surface runoff.

2.5 Soil/Vadose Zone Investigations

2.5.1 Ground Penetrating Radar Investigation

Ground penetrating radar (GPR) was run at Gunsite 113 Access Road Unit for the purpose of identifying evidence of potential excavation and determining areas where buried waste and other debris may be found. Eleven lines totaling 304.9 meters (1000 feet) were acquired in March 1993. The location of GPR lines acquired with a 300 MHz, 150 ns range antenna are shown in Figure 2-2.

2.5.2 Soil Gas Survey

An additional soil gas survey was completed at Gunsite 113 Access Road Unit in January 1993. The objective of that survey was to determine the presence and extent, or absence, of contamination in soils in and around the unit. A total of 30 sample locations were established and samples collected at each location (see Figure 2-3).

Species monitored for this survey were: light hydrocarbons (C_1-C_4); gasoline range normal paraffins (C_5-C_{10}); gasoline range aromatic hydrocarbons, (BTEX); diesel range hydrocarbons (C_{11}-C_{17}); selected organics; and mercury.

The levels of VOCs detected were very low and do not suggest the presence of buried waste or contamination at the unit. Extremely low levels of methane were detected at (~200 ppbv). This is consistent with normal background levels associated with the natural decay of plant and animal matter. Levels of light hydrocarbons were very low and are

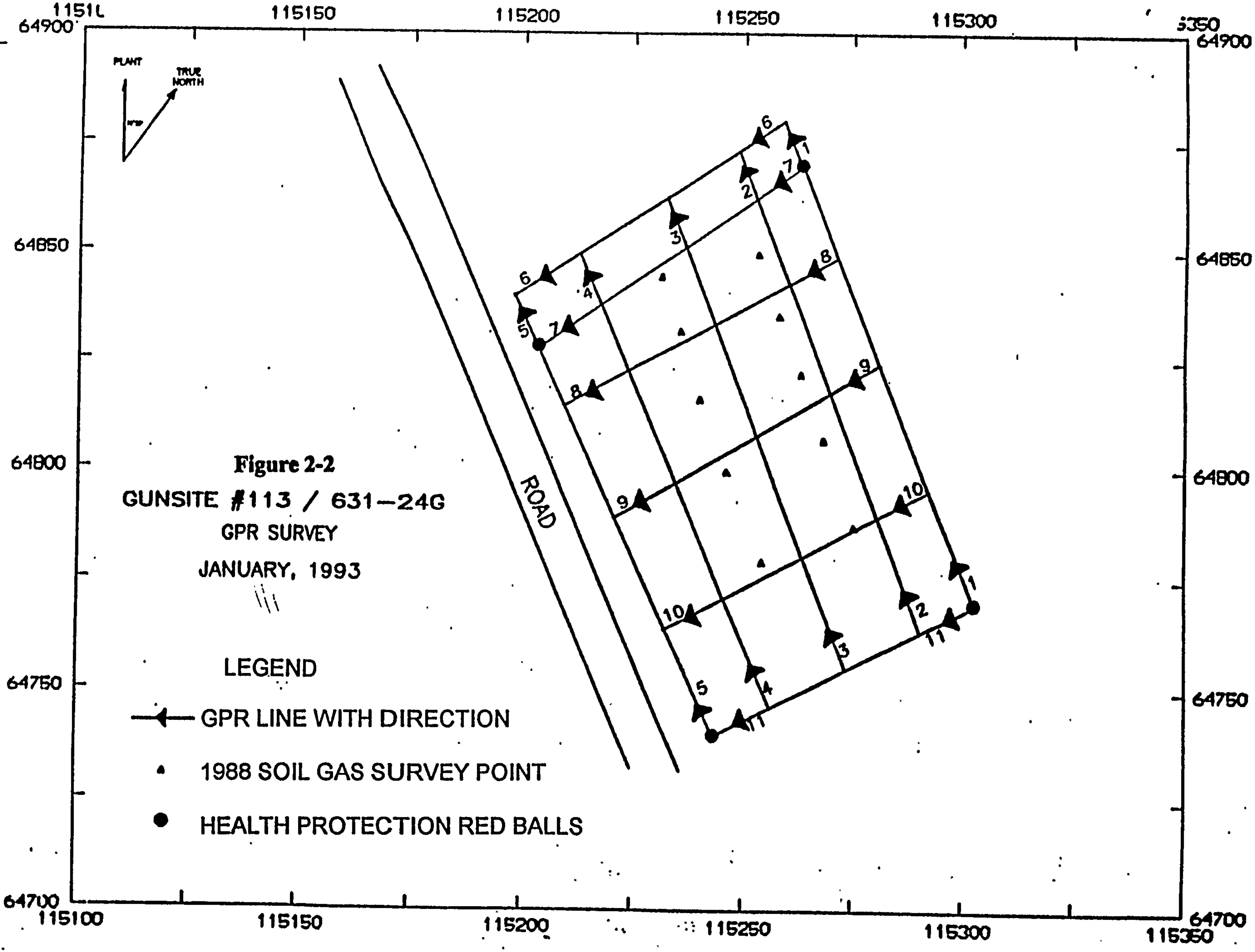


Figure 2-2
GUNSITE #113 / 631—24G
GPR SURVEY
JANUARY, 1993

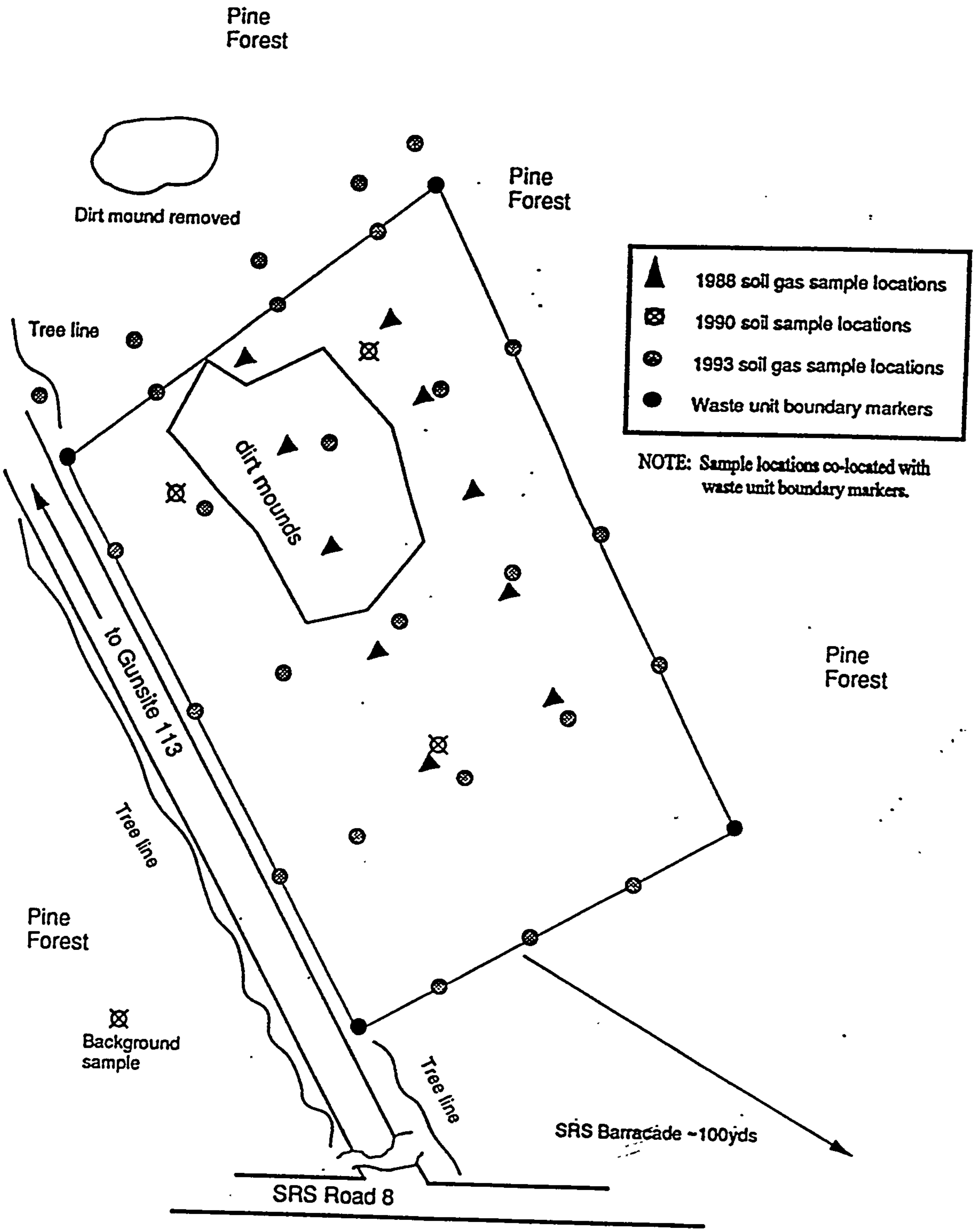


Figure 2-3 1993 Soil Gas Survey Sample Locations consistent with background levels. No diesel range hydrocarbons were detected and mercury levels were within background levels. Low concentrations of octane and o-xylene were detected at three locations; low levels of chloroform were detected at five locations. These detections are believed to be the chromatographic response to pine resin compounds that have the same retention time as o-xylene. In general terms, a naturally occurring substance creates a false reading on the instrument being used to analyze the samples. This anomaly has been observed at many locations across SRS.

Table 2-1 shows a comparison of the maximum and average substance levels as compared to regulatory action levels. Tabular results and maps of all the soils gases detected by the soil gas survey are provided in Appendix A.2.

Table 2-1
Gunsite 113 Access Road 1993 Soil Gas Survey

Compound	Maximum GS113	GS113 Average	Subpart S * Action Levels
Chloroform	0.157 ppmv	0.018 ppmv	100 ppm
o-xylenes	3.66 ppmv	0.188 ppmv	200,000 ppm
octane	0.21 ppmv	0.075 ppmv	N/A

*Federal Register, 7/27/90, Proposed Rule, 40 CFR Parts 264.521 (a)(2)(i-iv), Appendix A

2.5.3 Conclusions from GPR and Gas Survey

A GPR survey performed in January 1993 was able to obtain good quality data. The laboratory analysis of the lines noted three anomalies, but found no indication of buried objects, trenches, or burial pits at Gunsite 113. Field observations made at the time the survey was conducted were able to identify the cause of the three anomalies. One anomaly was an object (piece of tin) located at the ground surface. The second anomaly was caused by the GPR antenna traversing a mound located at the unit. The final anomaly was caused by the operator jerking or bouncing the antenna. This is commonly called a timing skip. The GPR survey lines and results are provided in Appendix A.1.

The levels of volatiles and diesel range organics observed in the survey are very low with most below minimum detection levels. Levels of light hydrocarbons and mercury are indicative of background concentrations in the SRS area.

No evidence of contamination was found at this unit.

2.5.4 Identification of Human Health Chemicals of Potential Concern (COPCs)

Analyses were performed in accordance with standard EPA protocols. An evaluation of the laboratory QA/QC documentation (1990 data) proved that adequate controls were applied and that the resulting analytical data are sufficient for use in a CERCLA risk assessment. All laboratory control samples responded within instrument and method limits.

2.5.4.1 Chemicals of Potential Concern

Three metals (arsenic, chromium, and lead) and cyanide were detected at levels exceeding unit-specific background values. Vanadium, zinc, and tin were also detected, but no unit-specific background information is available.

Although the reported levels of arsenic, chromium, and lead are slightly above unit-specific background levels, the concentrations are less than or within the range for SRS background levels. The arsenic detected measured 1.8 mg/kg. The corresponding method detection limit was 1.7 mg/kg. Based on the quality control report, the laboratory standards for arsenic fell within the corresponding control limits of 80% to 120%. Therefore, values falling between 1.36 mg/kg (80% control limit) and 2.04 mg/kg (120% control Limit) may be representative of the detection limit rather than an actual environmental results. Since the 1.8 mg/kg level of arsenic detected in one sample is essentially equivalent to the 1.7 mg/kg detection limit and is below the 2.04 mg/kg control limit, it is likely that this result is an artifact of the laboratory analysis rather than an actual environmental level. The level of chromium, 24.3 mg/kg, at the 8 to 10 foot level exceeds the EPA 1995 soil screening level for transfer from soil to groundwater which is 19 mg/kg. Because of this it was decided to evaluate any potential problems that may be associated with that amount of chromium. Details of this evaluation are provided in Section 6.1.1.

Trace levels of cyanide, tin, zinc, and vanadium were also detected. Although no unit specific background data were obtained for these compounds, tin, zinc, and vanadium are within normal SRS background levels. No background data are available for cyanide, but the cyanide level detected at Gunsite 113 is well below the EPA risk-based concentration level. Table 1-3 contains the 1990 sampling data for the samples in which substances were detected, along with the corresponding background and EPA risk-based concentration values.

A review of the unit sampling plan and the resulting soil and soil gas analytical data for Gunsite 113 indicates the data are sufficient for use in a risk assessment evaluation. The results indicate that the concentrations of all hazardous materials analyzed, except for chromium, were near or below natural occurring background levels and/or below any risk-based concentration levels and pose no risk to human health and the environment. Further evaluation of the chromium at the 8-10 foot level is discussed in detail in section 6.1.1.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 Surface Features

There are no structures of any type located at or near the Gunsite 113 Access Road Unit. The only nearby man-made features are SRS Road 8 which passes within 91.5 meters (300 feet) east of the unit and the unpaved access road to Gunsite 113 which passes by the unit. The topography is relatively flat at an elevation of about 97.6 meters (320 feet) above mean sea level (msl).

3.2 Meteorology

Climatology and meteorology of SRS are based on data collected on the unit, at Bush Field in Augusta, Georgia (DOE, 1990), and from the H-Area tower and A-Area shelter (DOE, 1991).

3.2.1 Regional Climatology

The SRS region has a temperate climate with short, mild winters and long, humid summers. The region is subject to continental influences, but is protected from the more severe winters in the Tennessee Valley by the Appalachian Mountains to the north and northwest, and is often influenced by warm and moist maritime air masses throughout the year. Gently rolling hills with no unusual topographic features that would significantly influence the general climate characterize the unit and the surrounding area.

3.2.2 Temperature and Humidity

The annual average temperature at SRS is 18°C (66.2°F). Monthly averages range from 7°C (45.3°F) in January to 27°C (83.3°F) in July. The annual average relative humidity is 66 percent. The lowest monthly average daily minimum (36 percent) occurs in April, and the highest monthly average daily maximum (98 percent) occurs in August.

3.2.3 Precipitation and Evapotranspiration

The average annual precipitation at SRS is 122 centimeters (48 inches). Precipitation is distributed fairly evenly throughout the year, with the highest precipitation in summer (36.1 cm; 14.2 in). Average precipitation totals for the fall months are less than the average totals for the other seasons, accounting for about 18 percent of the average annual total. For Augusta, precipitation totals greater than 0.025 centimeters (0.01 inches) occur, on average, about 107 days per year.

The average number of days per month with measurable precipitation range from about six in October to about 12 in July. Monthly precipitation extremes in Augusta range from a maximum of about 30 centimeters (11.8 inches), recorded in March 1980, to a trace, observed in October 1959.

The greatest observed rainfall for a 24-hour period was about 15 centimeters (5.9 Inches) in August 1964. Hourly observations from Augusta indicate that the rainfall rate is usually less than the 1.3 centimeters (0.5 inches) per hour, although rates greater than 1.3 centimeters per hour can be expected during spring and summer thunderstorms. The calculated 24-hour/100 year rainfall at SRS is 20.8 centimeters (8.2 inches; DOE, 1990)

Although snow can fall from October through March, the average annual snowfall is only 3.0 centimeters (1.2 inches). Large snowfalls are rare. The National Weather Service (NWS) station in Augusta, Georgia, observes maximum total snowfalls for 24-hour and monthly periods. From 1951 to 1987, the maximum snowfall in the SRS area was 36 centimeters (14.2 inches), recorded in February 1973 (DOE, 1990).

Evapotranspiration in the southeastern Coastal Plain physiographic province is approximately 88.9 cm/yr (35 inches/yr), which is 73 percent of the reported average annual precipitation (DOE, 1990). The remaining precipitation represents the amount available to surface streams for overland flow and to groundwater for recharge.

3.2.4 Wind

Wind data measured at the 6 meter (20 feet) level at the H-Area tower for the period 1982-1986 indicate that there is no predominant wind direction at SRS. The maximum directional frequency is from the northeast (about 9 percent of the time). Figure 3-1 shows an annual wind rose for H-Area, which is near the center of SRS. These data indicate that the observed wind directions tend to favor the southwest and northeast quadrants (28 and 30 percent of the time respectively) in relation to the northwest (20 percent) and the southeast (22 percent) quadrants. For all data, winds from the northeast sector occurred most frequently (nearly 10 percent of the time). Winds from direction sectors in the southwest quadrant also occurred with a relatively high frequency (7 to 8 percent of the time).

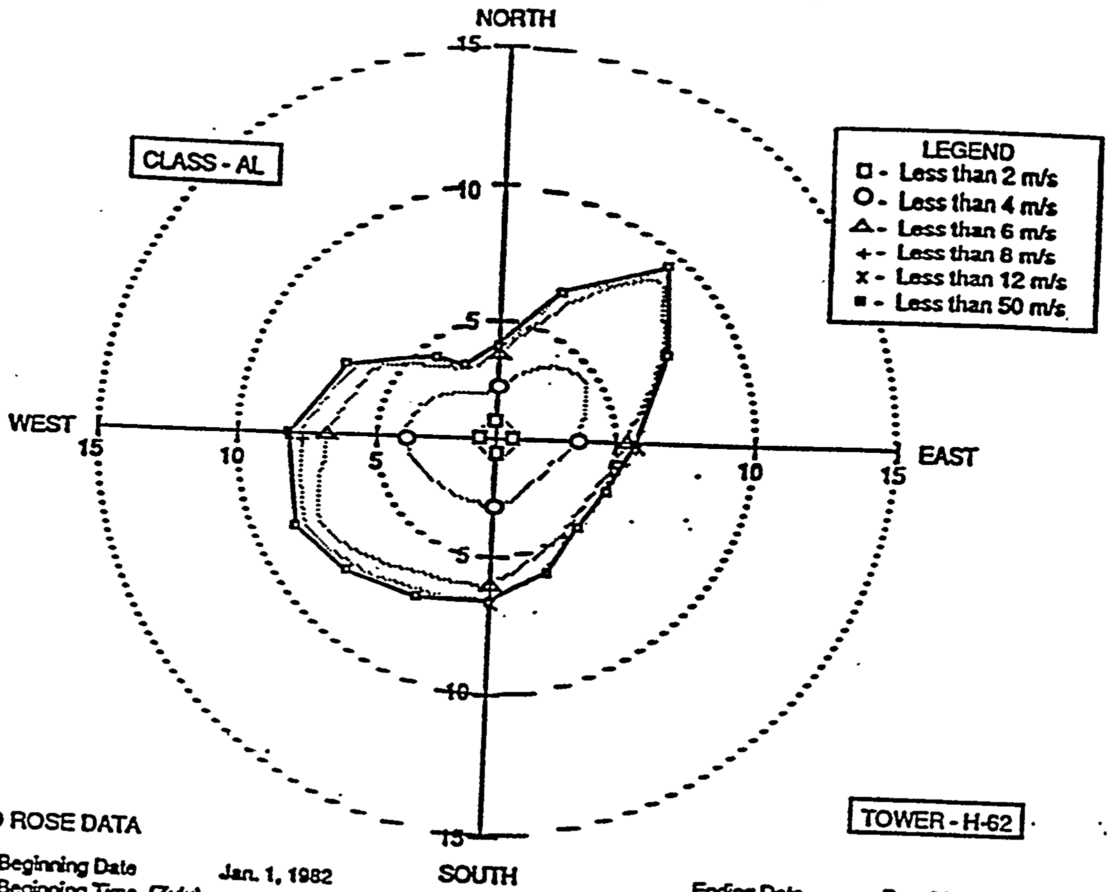
The average wind speed, from onsite data, from 1982 to 1986 was 3.25 m/s (7.3 mph). Hourly wind speeds less than 2 meters per second occurred about 9 percent of the hours. For about half of the hours, wind speeds were less than 4 m/s (9 mph). From 1975 to 1979 onsite data, the average speed was greatest during the winter (3.35 m/s; 7.5 mph) and least during the summer (2.48 m/s; 5.5 mph).

Winter storms in the SRS area occasionally bring strong and gusty winds with speeds as high as 32 m/s (72 mph). On occasion, SRS instruments have recorded winds as high as 39 m/s (87 mph) during winter storms. Thunderstorms can generate winds as high as 18 m/s (40 mph) and even stronger gusts. During the history of the Site, only Hurricane Gracie, in September 1959, had onsite winds stronger than 34 m/s (76 mph; DOE, 1990).

3.2.5 Thunderstorms

On average, 56 thunderstorm days occur per year on the site. Summer thunderstorms occur primarily during the late afternoon and evening; they can be accompanied by strong winds, heavy precipitation, or, less frequently, hail (DOE, 1990). On average, based on observations in a one-degree square of latitude and longitude, hail occurred once every two years.

Plot and Table Indicate Direction From Which the Wind Blows



WIND ROSE DATA

Beginning Date Jan. 1, 1982
Beginning Time (Zulu) 0000
Observations (All Classes) 36262

Ending Date Dec. 31, 1986
Ending Time (Zulu) 2400
Observations (This Class) 35252

Direction	Number of Observations[1] at Indicated Wind Speed[2] 0-2	2-4	4-6	6-8	8-12	>12	Average Wind Speed	Total Observ.[1]	Percent Time at Indicated Wind Speed[2] 0-2	2-4	4-6	6-8	8-12	>12	Total % Time
N	204	571	460	80	13	0	2.96	1328	0.58	1.62	1.30	0.23	0.04	0.00	3.77
NNE	190	896	911	131	13	0	3.31	2141	0.54	2.54	2.58	0.37	0.04	0.00	6.07
NE	234	1341	1559	229	18	0	3.38	3381	0.66	3.80	4.42	0.65	0.05	0.00	9.59
ENE	229	1266	1078	122	1	0	3.19	2696	0.65	3.59	3.06	0.35	0.00	0.00	7.65
E	191	980	737	85	2	0	3.13	1995	0.54	2.78	2.09	0.24	0.01	0.00	5.66
ESE	138	832	631	102	7	0	3.24	1710	0.39	2.36	1.79	0.29	0.02	0.00	4.85
SE	153	743	722	106	25	0	3.27	1749	0.43	2.11	2.05	0.30	0.07	0.00	4.96
SSE	171	861	927	140	25	0	3.21	2124	0.49	2.44	2.53	0.40	0.07	0.00	6.03
S	170	923	1050	226	18	0	3.46	2387	0.48	2.62	2.96	0.54	0.05	0.00	6.77
SSW	214	928	1051	218	33	1	3.25	2445	0.51	2.63	2.96	0.52	0.09	0.00	6.94
SW	226	1075	1105	220	31	0	3.30	2657	0.54	3.05	3.13	0.52	0.09	0.00	7.54
WSW	228	1197	1150	243	71	2	3.38	2901	0.55	3.40	3.29	0.59	0.20	0.01	8.23
W	234	1082	1074	342	124	2	3.35	2858	0.55	3.07	3.05	0.97	0.35	0.01	8.11
WNW	241	863	922	277	113	2	3.33	2438	0.56	2.50	2.52	0.79	0.32	0.01	6.92
NW	197	584	483	125	24	0	3.97	1413	0.56	1.55	1.37	0.35	0.07	0.00	4.01
NNW	175	463	299	75	17	0	2.80	1029	0.50	1.31	0.85	0.21	0.05	0.00	2.92
No Direction	0	0	0	0	0	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg. Speed[2]	1.25	3.01	4.80	6.54	9.01	13.93	3.25								
Total Observations[1]	3195	14625	14169	2721	535	7		36262							

[1] An observation is a record covering a 1-hour period of time.
[2] Wind speed in meters/sec (m/s).

Annual Wind Rose of Hourly Averaged Winds from H-Area Tower, 1982-86.
(Directions Are Sectors from Which Wind Blows.)

Source: DOE, 1990

Figure 3-1. Annual Wind Rose for H Area

3.2.6 Ice and Snow

Winter storms that produce more than 2.5 centimeters (1 inch) of ice or snow are rare. Snowfalls of 2.5 centimeters or greater occur once every five years on the average. Any accumulation of snow rarely lasts longer than three days.

For a nine year period of record, storms resulting in an accumulation of ice on exposed surfaces occurred in the SRS vicinity an average of about once every two years. Based on a 50-year period of record (1920 to 1969), a 1.3 centimeter (0.5 inches) accumulation of ice would occur once every 25 years (DOE, 1990).

3.2.7 Fog

Heavy fog, reducing visibility to less than 0.4 kilometer, occurred at Augusta on a average of about 28 days per year (1951 to 1969). Occurrences averaged about three days per month during the fall and winter and slightly more that one day per month during spring and summer. Most of the heavy fog observed at Augusta is caused by its proximity to the Savannah River.

3.2.8 Tornadoes

The estimated probability of a tornado striking a point at SRS is 7.0E-5/yr. (DOE, 1991). About half the total number of observed tornadoes, and most of the tornadoes resulting in severe or devastating damage, occurred in March , April, and May. However, tornadoes have been observed in the SRS area in every month of the year. Investigations of tornadoes occurring near the Site in 1975 and 1976 indicated wind speeds between about 45 m/s (100 mph) and 78 m/s (174 mph; DOE, 1990)

Since operations began at SRS in 1953, six tornadoes have been confirmed on or near SRS. Nothing more than light damage was reported from any of these storms, with the sole exception of a tornado in October 1989. That tornado caused considerable damage to timber resources in an unpopulated wooded area of SRS (DOE, 1991).

3.2.9 Hurricanes

Thirty-six hurricanes caused damage in South Carolina from 1700 to 1987. From 1899 to 1980, 13 hurricanes were experienced in South Carolina and Georgia, for an average frequency of about one hurricane every six years; however, the observed interval between hurricane occurrence has ranged from two months to 27 years. Three of these hurricanes were classified as major. Instruments at SRS measured winds associated with Hurricane Gracie, which passed to the north of the Site on September 29, 1959, as high as 34 m/s (76 mph). No other hurricane-force wind has been measured on the Site. On September 22, 1989, Hurricane Hugo struck the coast of South Carolina near Charleston; sustained winds recorded at SRS were 17 m/s (38 mph).

Because the Site is approximately 161 kilometers (100 miles) inland, winds associated with tropical weather systems usually have diminished below hurricane force (sustained speeds of 121 kilometers per hour (75 mph) or greater). Extreme rainfall and tornadoes, which frequently accompany tropical weather systems, usually have the most significant impact on facility operations (DOE, 1990)

3.3 Surface Water Hydrology

Gunsite 113 Access Road Unit is situated on soil mapped as part of the Blanton Series. The Blanton Series consists of somewhat excessively drained, moderately permeable soils that formed in sandy and loamy sediments of the Coastal Plain. These soils are on low ridges and side slopes and in broad swales adjacent to the low side slopes Any surface water drainage from the unit would be generally to the southeast. Based on the soil description and the absence of perennial or intermittent streams in close proximity to the unit, it is unlikely that hazardous constituents would be carried from the unit by surface water runoff. The local terrain is flat, with no major drainage features nearby. A small, unnamed tributary of Rosemary Creek located 1.3 kilometers (0.8 miles) southeast of the unit is the nearest surface water. Based on the apparent lack of surface water runoff, Rosemary Creek should not be affected by Gunsite 113 Access Road Unit.

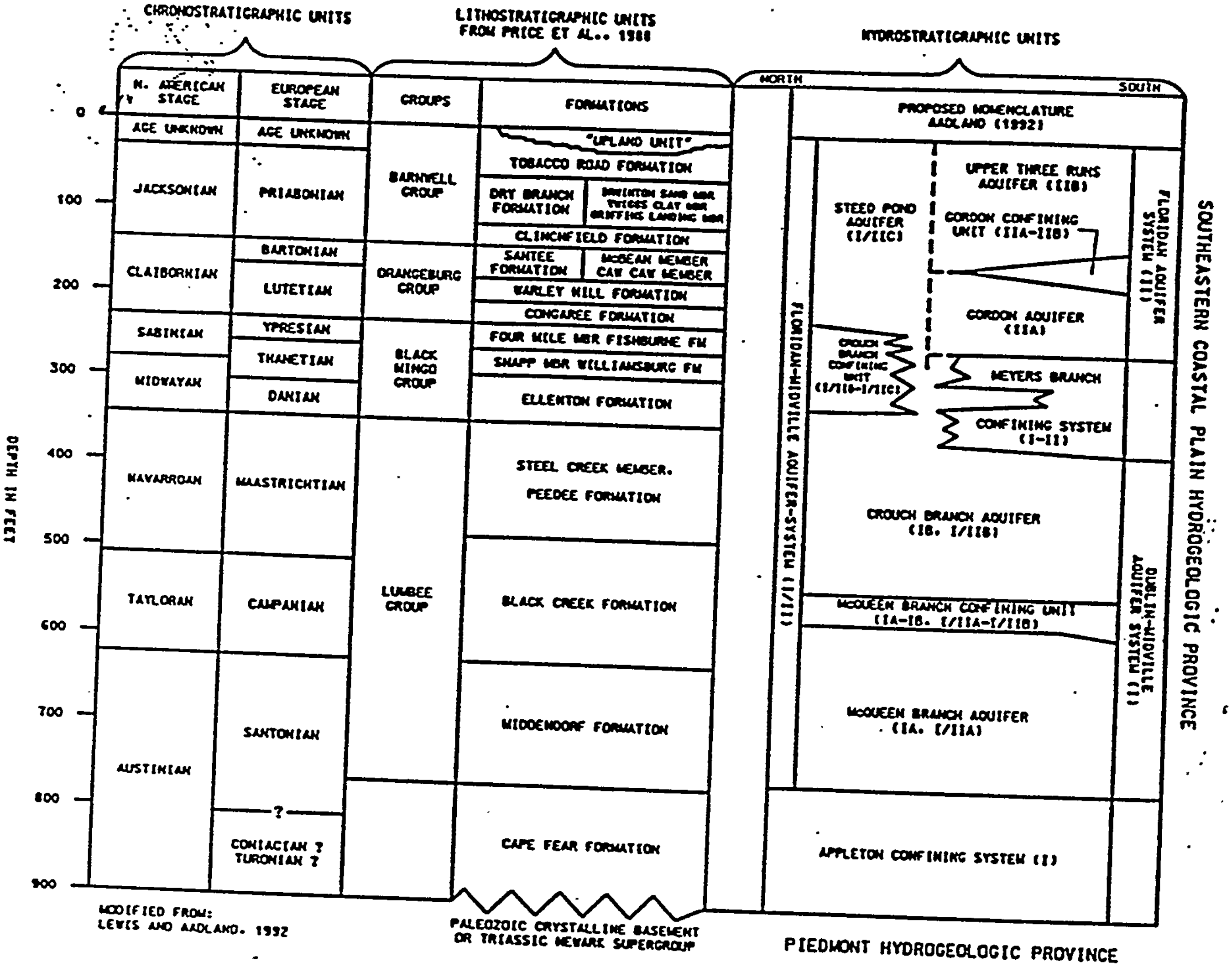
3.4 Geology of SRS

The subsurface geology underlying SRS includes crystalline basement rock and Triassic sediments which are overlain by Cretaceous and younger Coastal Plain sediments (Price, 1988). The crystalline basement rock is composed of chlorite-hornblende schist, hornblende gneiss, and lesser amounts of other types of crystalline rock. This bedrock is buried beneath approximately 274.4 meters (900 feet) of sediments. The Triassic sediments occur in the southern portion of SRS. Sediments of the Triassic bedrock are composed of poorly sorted conglomerate, sandstone and mud-rock, and are generally dark red in color. The stratigraphic units of the Coastal Plain, from oldest to youngest, are the Cape Fear Formation, the Lumbee Group, the Black Mingo Group, the Orangeburg Group, the Barnwell Group, and the Upland Unit (Figure 3-2).

The Cape Fear Formation is composed of Upper Cretaceous, poorly sorted, silty to clayey quartz sands and interbedded clays. The Cape Fear thickens across SRS, ranging from 9.2 meters (30 feet) at the northwest SRS site boundary to more than 54.9 meters (180 feet) at the southeast SRS site boundary.

The Lumbee Group (Upper Cretaceous) is subdivided into the Middendorf and the Black Creek Formations, and the Steel Creek Member of the Peedee Formation. The lower contact between the Middendorf and the Cape Fear Formations is a sharp erosional unconformity. The Middendorf Formation is dominantly made up of medium to coarse sand with some thin kaolinitic clay lenses. The Black Creek Formation is generally comprised of interbedded sands, silts and clays. The Peedee Formation (Steel Creek Member) contains poorly to well-sorted, silty-to-clayey sands in the lower section and interbedded clayey-sands in the upper section. The thickness of the Lumbee Group is from 115.9 meters (380 feet) to more than 213.4 meters (700 feet) from the northwestern SRS boundary to the southeastern SRS boundary, respectively.

The Lumbee Group formations are overlain unconformably by the Paleocene to Eocene aged Black Mingo Group. Locally, the Black Mingo Group Formations dip to the southeast, and range in thickness from 21.3 meters (70 feet) at the northwestern boundary of the SRS to approximately 45.7 meters (150 feet) near the southeastern boundary. The Black Mingo Group at the SRS is comprised of, from older to younger, the Ellenton



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LEWIS AND AADLAND, 1992

Figure 3-2 Comparison of Chronostratigraphic, Lithostratigraphic, and Hydrostratigraphic Units at SRS

Formation (Early Paleocene), the Snapp Member of the Williamsburg Formation (Late Paleocene), and the Fourmile Member of the Fishburne Formation (Early Eocene).

The Ellenton Formation consists mostly of gray, poorly sorted, micaceous, lignitic, silty and clayey quartz sand interbedded with gray clays. The Ellenton is approximately 12.2 meters (40 feet) thick at the northwestern SRS boundary and thickens to approximately 30.5 meter (100 feet) at the southeastern SRS boundary.

The Snapp Member of the Williamsburg Formation is typically comprised of silty, medium to coarse grained quartz sand interbedded with clay. The Williamsburg thickens from 9.2 meters (30 feet) at the northwestern SRS boundary to 15.2 meters (50 feet) at the southeastern SRS boundary. The Fourmile Member of the Fishburne Formation consists of tan, orange, yellow, brown, and white clayey and micaceous sand (Fallaw, 1991). The Fishburne has been traced from well PBF-3 into the A/M area, the only locale of known distribution at SRS. The Fourmile section is 4.6 meters (15 feet) to 22.9 meters (75 feet) thick in this area.

The Black Mingo Group is overlain by the Middle Eocene age Orangeburg Group. The Orangeburg Group outcrops at many areas of low elevation around the SRS. The thickness of the Group ranges from approximately 30.5 meters (100 feet) at the northwestern SRS boundary to 48.8 meters (160 feet) at the southeastern boundary. The Orangeburg Group is made up of the lower Middle Eocene Congaree Formation and the upper Middle Eocene Santee Limestone Formation.

The Congaree Formation consists of yellow, orange, tan, gray and greenish gray, well sorted, quartz sands with thin clay laminae. The top section of the Congaree Formation is cemented with silica in may areas of the SRS and is slightly calcareous in other areas. The Congaree Formation is approximately 18.3 meters (60 feet) thick at the northwestern SRS boundary and thickens to approximately 25.9 meters (85 feet) near the southeastern SRS boundary.

The Warley Hill Formation is a fine-grained, often glauconitic sandstone occurring at or near the base of the Santee Formation at SRS (Aadland et al, 1992). The Warley Hill Formation and the Caw Caw Member of the overlying Santee Formation make up what has been informally referred to in many SRS reports as the "green clay". The "green clay" is composed of glauconitic, silty and clayey quartz sands and silty clays. Clay beds in this interval are laterally discontinuous in the northernmost SRS areas (Lewis and Aadland, 1992). The overlying Santee Formation is subdivided into the Caw Caw and the McBean Members, and varies in lithology from carbonates and calcareous quartz sands to quartz and glauconitic sands and clays. The uppermost member, McBean, consists of limestone overlain by quartz sand. The thickness of the formation ranges from 12.2 meters (40 feet) to more than 24.4 meters (80 feet) from the northwestern SRS boundary to the southeastern SRS boundary, respectively.

The Orangeburg Group is overlain by the Late Eocene deposits of the Barnwell Group. The Barnwell Group at the SRS is subdivided into the Clinchfield, Dry Branch, and Tobacco Road Formations. The Clinchfield Formation is present at some SRS locations, but it is not continuous enough to be correlated across the site. The quartz sand of the Clinchfield Formation has been identified at the SRS only when the contrasting carbonates of both the Griffins Landing Member of the Dry Branch Formation (stratigraphically above) and the McBean Member of the Santee Formation (stratigraphically below) are present, with the sand between them. The Dry Branch Formation is divided into (from oldest to youngest) the Griffins Landing, Twiggs Clay, and Irwinton Sand Member. This formation outcrops in several places across the SRS and ranges in thickness from 15.2 meters (50 feet) from the northwest boundary to 24.4 meters (80 feet) near the southeastern SRS boundary.

The Griffins Landing Member of the Dry Branch Formation is composed of carbonates that occur sporadically at the SRS. The Irwinton Sand Member contains tan, yellow, and orange, moderately sorted quartz sand with interlaminated clays. The Twiggs Clay Member of the Dry Branch Formation is informally called the "tan clay." This clay lithofacies, which is tan, light gray, and brown, varies in thickness up to 3.7 meters (12 feet) at the SRS, but is not laterally continuous.

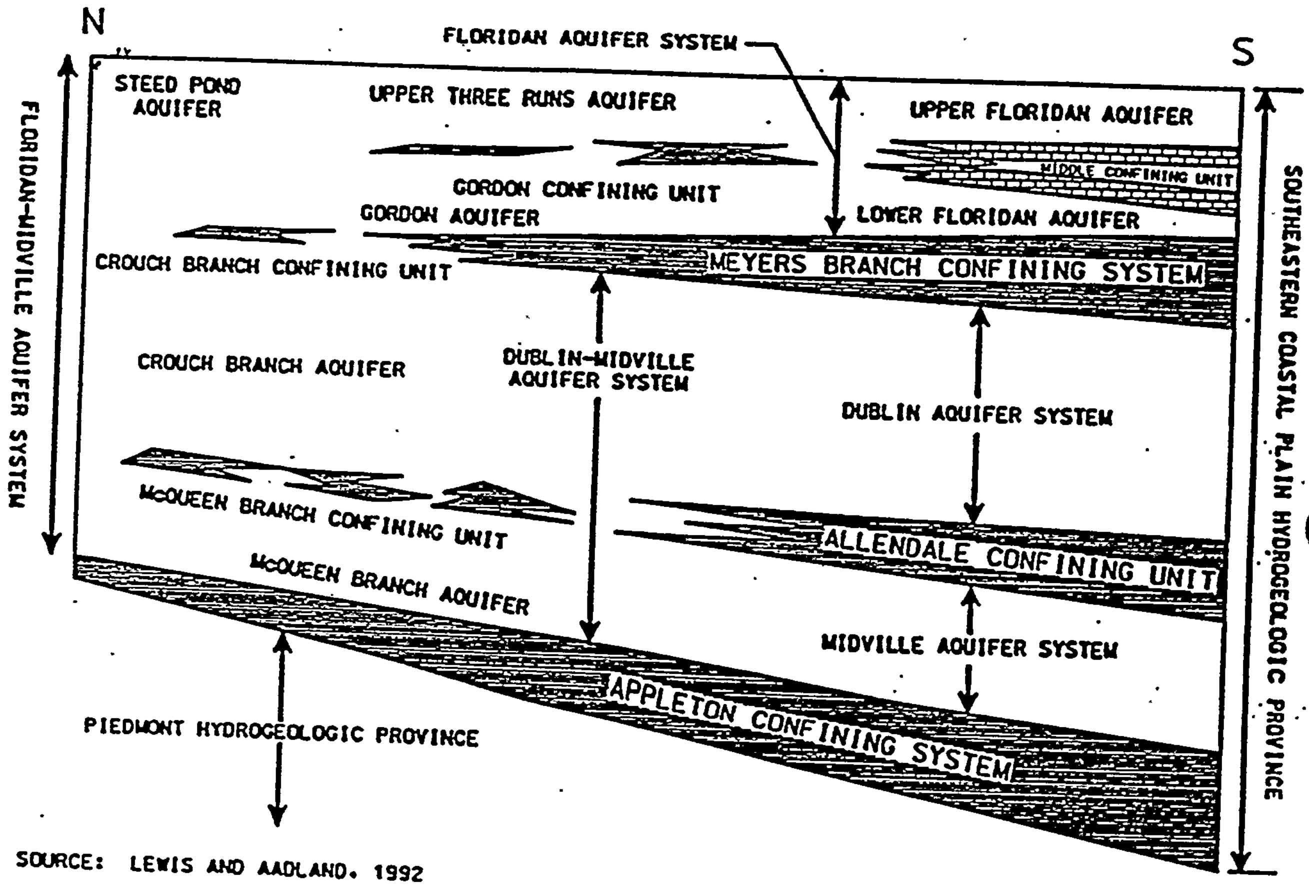
The Tobacco Road Formation, which overlies the Dry Branch Formation, consists of red, fine to coarse, moderately to poorly sorted, clayey quartz sand with minor clay laminae. The Tobacco Road outcrops at the surface at many locations throughout the site and ranges in thickness from 6.1 to 9.1 meters (20 to 30 feet).

The Upland Unit (previously mapped at SRS as the Hawthorn Formation) is composed of poorly sorted, clay-to-silty sands, with lenses and layers of pebbly and cobbly quartz sands with extreme lateral and vertical variation. (Price, 1988). The presence of the Upland Unit in this area is inconsistent, occurring predominantly at higher elevations around SRS.

3.5 Hydrogeology

A multilayer hydrologic system exists in the Coastal Plain sediments at the SRS. Confining units within the system are interspersed with more transmissive units. Aadland and Bledsoe (1990) developed an alpha numeric hydrostratigraphic nomenclature system for SRS and Aadland et al (1992) introduced proposed names for the systems, units and zones (Figure 3-2). Within this nomenclature, the basement complex underlying the Coastal Plain deposits is referred to as the Piedmont Hydrogeologic System. This system is overlain by three aquifer systems of Coastal Plain deposits, the Midville, the Dublin, and the Floridan Aquifer Systems, separated by the Allendale and Meyers Branch Confining Systems. These Aquifer systems are separated from the lower Piedmont Hydrogeologic System by the Appleton Confining System. The Appleton Confining System is composed of poorly sorted, clayey sediments of the Cape Fear Formation. Confining clay sediments of the middle Black Creek Formation make up the Allendale Confining Unit which separates the Midville and Dublin Aquifers. The Midville Aquifer is composed of sands of the Middendorf Formation and the lower sands of the Black Creek and lower Peedee Formations. As the confining systems and units thin and become discontinuous in a northerly direction at the SRS, the Midville and Dublin Aquifer Systems are combined to form a single Dublin-Midville Aquifer System. Figure 3-3 is a graphic illustration of the hydrogeologic nomenclature for the SRS region. The reader is referred to Aadland et al (1992) for the most recent description of SRS hydrogeology.

The Floridan Aquifer System is divided into the Gordon Aquifer and the Upper Three Runs Aquifer by the Gordon Confining Unit. Congaree/Fourmile sands comprise the Gordon Aquifer, and sands of the Santee Limestone and Tobacco Road Formation comprise the Upper Three Runs Aquifer. Warley Hill and Caw Caw clays (including the "green clay") comprise the Gordon Confining Unit. Northwest of Upper Three Runs



SOURCE: LEWIS AND AADLAND, 1992

Figure 3-3 Hydrogeologic Nomenclature for the SRS Region

Creek (UTRC), the individual confining beds separating the two Aquifer Systems become thin and discontinuous.

3.6 Geology and Hydrology of the Gunsite 113 Access Road Unit

The amount of detailed geologic and hydrogeologic information on the Gunsite 113 Access Road Unit is limited. There has been no need to make a detailed investigation of the geology and hydrology of this area mainly because of its location on the northern edge of the site, its distance from the more heavily industrialized site locations, and its lack of history as a waste area.

3.7 Demography and Land Use

3.7.1 Demographics

SRS is located approximately 40 kilometers (25 miles) southeast of Augusta, Georgia, and 32 kilometers (20 miles) south of Aiken, South Carolina. According to 1990 census data (Rand McNalley, 1992) the average population densities (in 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 population within an 80.5 kilometer (50 mile) radius of SRS is 634,784 people.

The estimated population for the area in the year 2000 is projected to be 852,000 (Rand McNalley, 1992). This estimate was calculated utilizing the 1970 to 1980 growth rate of each county in an 80.5 kilometer (50 miles) radius, assuming that the same rate of growth would continue into the future. The calculation assumed that the population would remain constant for counties that experienced a negative population growth between 1970 and 1980.

Calibrated demographic data is available for the six-county area that provides 90 percent of the SRS work force (DOE, 1994). These are Aiken, Allendale, Bamberg and Barnwell

Counties in South Carolina and Richmond and Columbia Counties in Georgia. The population in those six counties increased 13 percent between 1980 and 1990, from 376,000 to 425,607 and is expected to increase to 474,820 by the year 2000 (DOE, 1992). A disproportionate share of the six county population increase was concentrated in Columbia County where the population increased more that 55 percent to 66,031 between 1980 and 1991.

3.7.2 Land Use

Less than 5 percent of the existing land in the area surrounding SRS is devoted to urban and developed uses (DOE, 1990). Most of the urbanized development in the area has occurred in and around the cities of Augusta, Georgia and Aiken, South Carolina. Agriculture accounts for 24 percent of total land use; forests, 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.

Less than 5 percent of the total SRS land area is used by facilities engaged in the production of special nuclear materials. Reservoirs and ponds comprise approximately 13 square kilometers (5 square miles) of SRS. The remainder of the 780+ square kilometers (300+ square miles) area is undeveloped.

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 Results of Data Usability Evaluation

The field investigation for Gunsite 113 Access Road Unit was conducted prior to the establishment of a formal data validation program at SRS. Data collected were subjected to the QA/QC standards in use at that time and considered to be acceptable by EPA Level 3 criteria. Information on the QA/QC methods employed during the investigation are provided in the *RFI/RI Plan for the* Gunsite 113 Access Road Unit, *WSRC-RP-90-996* (WSRC, 1990). Additional information on the QA/QC procedures used for this unit are provided in Appendix B.

4.2 Results of Site Characterization

Data collected during Preliminary Unit Evaluation, Unit Screening, and field investigations found no evidence of contamination at Gunsite 113 Access Road Unit. GPR surveys showed no signs of any buried materials and a gas survey found no evidence of any substances beyond background levels. An analysis of soil samples collected in 1990 indicate that contaminant levels are within typical background levels. No chemicals of concern were identified as a result of the investigations at this unit. The general conclusion reached is that this unit has no contamination.

Figure 4-1 shows the concentrations of acetone, methylene chloride and bis(2-ethylhexyl)phthalate that were detected in the soil borings and the background (GS113-04) boring. As already noted in Section 1.3.2.3.2, all three of these constituents are documented laboratory artifacts and both acetone and methylene chloride were found in laboratory blanks. The practical quantitation limit of bis(2-ethylhexyl)phthalate is 660 µg/kg and the amount found in soil boring GS113-01 was 450 µg/kg. No other samples were found to contain bis(2-ethylhexyl)phthalate.

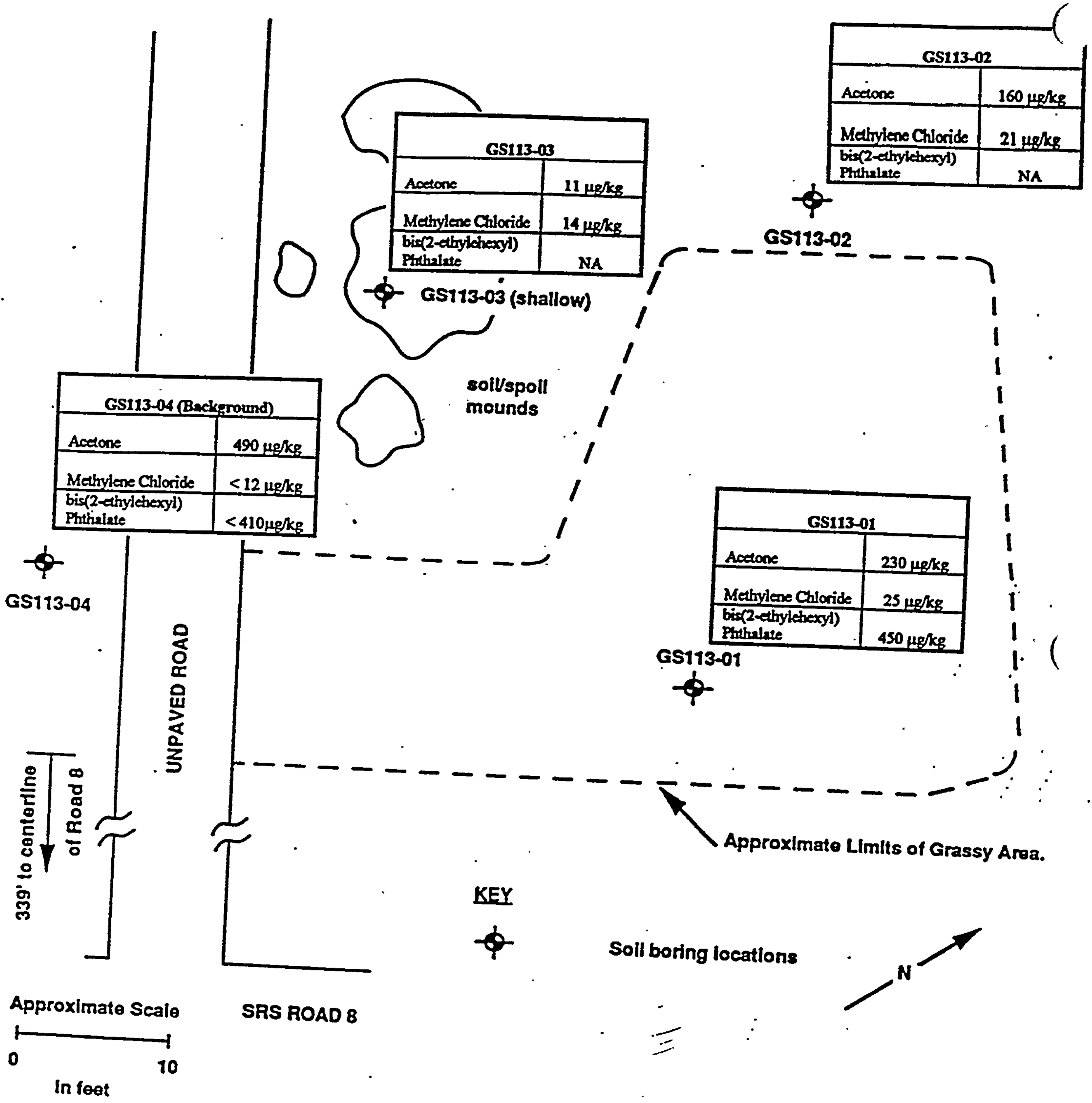


Figure 4-1 Distribution of Organic Chemicals Found in GS113 Soil Borings

5.0 CONTAMINANT FATE AND TRANSPORT

Contaminants may migrate in environmental media following release from secondary sources by any of several release or transport mechanisms, including:

- suspension and dispersal by the wind of particulate contaminants or contaminants adsorbed to surface soil particles (fugitive dust generation);
- direct volatilization of volatile organic compounds from surface soil to air
- uptake of soil contaminants by vegetation;
- transport of soil contaminants by storm water runoff to surface water and sediments;
- leaching of deep soil contaminants into groundwater.

In addition to the exposure pathways which result from the above secondary release and transport mechanisms, potential receptors also may be exposed directly to contaminants present in surface soils.

Data collected during Preliminary Unit Evaluation, Unit Screening, and field investigations indicate that materials found in the soils at Gunsite 113 Access Road Unit are within normal background levels found at SRS. Since there is no contamination at this unit there is no need for a model on contaminant fate and transport.

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6.0 RISK ASSESSMENT

6.1 Human Health Assessment

A review of the unit sampling plan and the resulting soil and soil gas analytical data for Gunsite 113 indicates the data are sufficient for use in a risk assessment evaluation. The results indicate that, except for one chromium sample at the 8 to 10 foot level, the concentrations of all hazardous materials analyzed were near or below natural occurring background levels and/or below any health-based action levels. Therefore, they pose no risk to human health and the environment.

Based upon the available evidence, there are no chemicals of potential of concern available for evaluation by a CERCLA baseline risk assessment. Therefore, there is no determinable risk associated with Gunsite 113.

6.1.1 Chromium Leachability

The chromium level found in one soil sample at the 8-10 foot depth at Gunsite 113 Access Road Unit (631-24G) is 24.3 mg/kg. This value exceeds EPA's generic soil screening level for migration from soil to groundwater which is 19 mg/kg. This suggests that the chromium could migrate to the groundwater and pose an unacceptable risk to a future hypothetical resident.

The screening process used to evaluate chromium leachability was as follows:

1. Compare average soil contaminant concentration to the EPA published soil screening level (SSL). If the average soil contaminant concentration exceed EPA's SSL then;
2. Perform a simplified site-specific screening calculation to estimate the SSL based on site specific data. Basic assumptions employed by EPA's SSL methodology will still be used;
3. If the average soil concentration exceeds the site-specific calculated SSL, further evaluation of the migration to groundwater pathway to estimate the groundwater (pore

water) concentration of the contaminant and the time (years) for that concentration to reach the groundwater will be used.

6.1.2 Assumptions

An important assumption in this calculation is that contamination which reaches the groundwater travels in the water table only. No consideration is made for downward migration of contaminants below the confining unit underlying the water table.

6.1.3 Inputs

6.1.3.1 Generic Screening Inputs

Input used in the generic screening of the soil contaminants includes the average concentration of the contaminants reported above two times the background level and the EPA published SSLs. For this site, only one detect of chromium was found in the soil. EPA has published SSLs for various contaminants (EPA, 1994) for dilution and attenuation factors (DAF) of 1 and 10. EPA guidance (EPA, 1994) states that a DAF of 10 is appropriate in most cases except when the waste unit area is greater than 30 acres, the waste unit contaminated zone is within the aquifer, or if karst or fractured rock exists below the waste unit. For sites where conditions may result in little or no dilution or attenuation between the source and the receptor well, a DAF of 1 may be more appropriate. A DAF of 1 was used for initial comparison to EPA generic SSLs because a DAF of 3.38 was calculated during the simplified site specific screening step (Appendix C, Section 1). The soil concentration for chromium, and the EPA published SSL (for a DAF of 1 and 10) are provided in Table 6-1.

6.1.3.2 Simplified Site Specific Screening Inputs

The inputs required to perform a simplified site-specific screening in accordance with EPA guidance (EPA, 1994) include site specific parameters for the calculation of site specific screening levels to compare to the average concentration of the contaminants that failed the generic screening process or for which generic SSLs were not available.

Chromium that is labeled in Table 6-1 as "Fail" in the last column was evaluated in the simplified site specific screening.

Table 6-1. Comparison of Average Soil Concentration to EPA Published SSLs

	Gunsite Average Concentration	Units	SSL (with 10 DAF)	SSL (with 1 DAF)	Gunsite Pass/Fail
CHROMIUM TOTAL	24.3	mg/kg	19	2	fail
pass - Concentrations<SSL					
fail - Concentrations > SSL					

Site data and chemical specific data were used in EPA standardized equations (EPA, 1994) to derive the site specific SSL for chromium (see Appendix C). Site specific parameters required to calculate the site specific screening levels include the fraction of organic carbon in soil, water-filled soil porosity, average soil moisture content, dry soil bulk density, soil porosity, soil particle density, air-filled soil porosity, soil organic carbon/water partition coefficient, soil-water partition coefficient, and the dilution attenuation factor. Additional inputs included Henry's Law Constant , maximum contaminant level goals (MCLG), and the maximum contaminant levels (MCL) (EPA, 1995b).

Once derived, the site specific screening level was compared to the average concentration of chromium for the Gunsite Unit. If the average concentration had not exceeded the site specific SSL, the contaminant would have been excluded from further evaluation. However, the soil concentration of chromium (24.3 mg/kg) exceeded the site-specific calculated SSL (13.5 mg/kg) requiring further evaluation of the migration to groundwater pathway in order to estimate the pore water concentration, and transport time (years) for the contaminant to reach the groundwater.

6.1.3.3 Site-Specific Method Considering Transport Time For Migration To Groundwater

The inputs required to estimate the pore water concentration of the contaminant and the transport time (years) for the contaminant to reach the groundwater include additional site specific parameters (see Appendix C, Section 2).

6.1.3.4 Risk Characterization Inputs

Carcinogenic risk calculations were not performed for chromium since no slope factors exist for this compound. However, the non-carcinogenic hazard index (HI) was determined for the adult ingestion and dermal contact of chromium in groundwater to assess the potential for adverse noncarcinogenic health effects. Inhalation, through volatilization, was not considered to be a viable pathway since chromium as a metal does not volatilize under conditions of normal residential use. Since RBCs for non-carcinogens are based on adult exposure, only the future resident adult receptor was considered (EPA 1995a). Calculations are represented in Appendix C, Section 2.

It was assumed that the chemical form of the contaminant was chromium VI to provide the most conservative evaluation. However, the HI for both chromium III and chromium VI was determined since the speciation of chromium at the Gunsite 113 is not known. The soluble form of chromium, chromium III, occurs naturally in the environment. The insoluble form, chromium VI, is generally produced by industrial processes. However, the known harmful effects of chromium in humans have been attributed to the nonsoluble, hexavalent form (WSRC, 1992).

Inputs for the Calculation of HI for Dermal Contact with Groundwater

The concentration in groundwater (Cw) was determined as shown in Appendix C, Section 2, Part II. A dermal permeability of 0.001 cm/hr was used for chromium (EPA, 1992). A dermal reference dose for chromium was not provided but was calculated by assuming 20% of the oral reference dose for chromium III and IV (EPA, 1995c). The remaining input parameters were obtained from EPA guidance (EPA, 1989) and are represented in Appendix C, Table C-1.

Inputs for the Calculation of HI for Ingestion of Groundwater

The concentration in groundwater (Cw) was determined as shown in Appendix C, Section 2, Part II. The remaining input parameters were obtained from EPA guidance (EPA, 1989) and are shown in Appendix C, Table C-2.

6.1.4 Analytical Methods and Calculations

Some analytical methods and calculations were performed as part of each step of the soil screening process. The following sections describe these methods and calculations.

6.1.4.1 Simplified Site-Specific Analytical Methods and Calculations

Calculations necessary to compare the average soil concentrations to SSLs computed using site-specific parameters are provided in Appendix C. The analytical methods used are those recommended by EPA (1994).

6.1.4.2 Site-Specific Method Considering Transport Time For Migration To Groundwater and Calculations

The contaminant that failed the simplified site-specific screening was evaluated using standard groundwater modeling equations to determine the transport time for migration to groundwater and the pore water concentration. The input parameters are provided in Appendix C and the equations are described below.

Calculation of Transport Time For Migration to Groundwater

Determination of the transport time (T) for migration to groundwater is dependent on the distance (L) of the contaminant to the groundwater table, the contaminant migration velocity through the vadose zone (V), and retardation effects (R).

$$T = \frac{L}{V / R}$$

Retardation is based on the assumption that adsorption of hydrophobic contaminants is due to sorption to organic carbon in the soil. Input parameters to determine the retardation factor for migration from soil to groundwater include the soil water partition coefficient (K_d), the dry soil bulk density (P_b), and the effective porosity (p_t).

$$R = 1 + \frac{P_b}{p_t} * K_d$$

The velocity of the contaminant migration through the vadose zone (V) is dependent on the infiltration rate (I), the effective porosity (p_t), and the average soil saturation (S_a).

$$V = \frac{I}{p_t * S_a}$$

Calculation of the Contaminant Concentration in Groundwater

The concentration of the contaminant in the groundwater (C_w) is determined based on the concentration of the contaminant in the soil (C_s), the soil water partition coefficient (K_d), and the dilution attenuation factor (DAF).

$$C_w = \left(\frac{Cs}{K_d}\right) \div DAF$$

6.1.4.3 Risk Characterization Methods and Calculations

The HI for chromium was evaluated using standard EPA risk equations (EPA, 1989). The input parameters and calculations used to derive the inventory of the contaminants are provided in Appendix C, Section 2.

6.1.4.4 Results

Results from the site specific soil screening, calculation of the transport time and contaminant pore water concentration, and risk characterization are provided in Appendix

C, Sections 1 and 2. The associated hazard index is summarized in Table 6- 2. Chromium III is provided for comparison.

Table 6- 2. Summary of Detailed Site Specific Analysis of Gunsite 113

Contaminants	Maximum Concentration (mg/L)	MCLG and RBC (mg/L)	Time of Max Concentration (yrs)	Risk	Hazard Index
Chromium III	0.18	0.10 (MCL) 37.0 (RBC)	1707	NC	4.9E-3
Chromium VI	0.18	0.10 (MCL) 0.18 (RBC)	1707	NC	0.99

NC- not calculated

6.1.5 Conclusions

The concentration of chromium in the soil (24.3 mg/L) exceed both the EPA Generic Soil Screening Level (19 mg/L) and Site Specific Soil Screening Level (13.5 mg/L). Based on site specific standard groundwater modeling equations, it was estimated that contaminant concentration in groundwater would peak in approximately 1707 years at a concentration of 0.18 mg/L. The calculated concentration is approximately 0.08 mg/L higher than the 0.10 mg/L accepted MCLG for chromium VI, but is equivalent to the chromium VI RBC for tap water (0.18 mg/l) resulting in a HI equal to 1. The results for chromium are considered to be conservative since chromium was detected in only one sample at the 8-10 foot sampling interval and peak concentration to groundwater is in excess of 1000 years. It should also be noted that the chromium level is within the SRS soil background level as provided in Looney et al (1990).

A comparison to chromium III was provided because the exact chemical state of the detected chromium at the waste unit is not known. The most conservative evaluation of chromium VI was used for risk based calculations. However, this approach does not consider the possible transformation of chromium VI to chromium III in soils or groundwater which would result in a significantly lower HI as indicated in Table 6-2.

6.2 Ecological Assessment

Information utilized included recorded existing unit history, preliminary unit evaluation, and unit characterization data. These informational sources form the basis for this ecological characterization. That information can be summarized as follows:

- There is no evidence of contaminant associated vegetation stress or ecological impact related to the unit;
- Review of the unit characterization data indicates that there are no constituents in the physical media analyzed at Gunsite 113 that are different from the specific background.

Based on the physical and analytical data obtained for this unit, there appears to be no compelling evidence that waste materials were managed or disposed at Gunsite 113. Therefore, it is reasonable to conclude that the unit, as it is currently characterized, presents no significant ecological risk. A further detailed ecological risk assessment and characterization would not be warranted.

7.0 SUMMARY AND CONCLUSION

7.1 Summary

An analysis of data collected as a result of the studies performed at Gunsite 113 Access Road Unit indicates that there is essentially no contamination at that unit. Survey data indicate that the substances found in the soils at the unit are within the levels normally associated with SRS background levels.

In addition, it is also reasonable to conclude that, since the contamination is below risk-based values, the unit presents no significant ecological risk.

7.2 Conclusion

Based on the review of the analytical data and screening techniques used to evaluate all the chemicals of potential concern at Gunsite 113 Access Road Unit, it is recommended that no further remedial action be performed at this unit.

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APPENDIX A

TECHNICAL MEMORANDA ON FIELD ACTIVITIES

Appendix A.1 **Ground Penetrating Radar Survey**
Appendix A.2 **Soil Gas Survey**

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APPENDIX A.1
GROUND PENETRATING RADAR SURVEY

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Final Report

GROUND PENETRATING RADAR INVESTIGATIONS

at

GUNSITE 113
(631-24G)

SAVANNAH RIVER SITE

March, 1993

G.Boyd Sexton
Robert J. Pirkle

Task 22
Subcontract #AA38232N

EXECUTIVE SUMMARY

Ground penetrating radar surveys were executed at Gunsite #113 for the purpose of locating disturbed soil, trenches, pipelines and other targets of interest. The survey was conducted on January 27, 1993.

Numerous areas of disturbed soil were observed, several of which contain prominent diffractions thought to represent pipelines or other targets of interest. A 300 MHz transmitter and antenna were used in the acquisition of the data.

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III. Acquisition and Processing Parameters 2

IV. Results 2

V. Conclusions 3

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Table 2. Acquisition and Processing Parameters

I. INTRODUCTION

Ground Penetrating Radar (GPR) surveys were run at Gunsite #113 for the purpose of locating trenches, pipelines and subsurface targets of interest related to the gunsite. GPR data were acquired on a total of 11 lines totaling 1000 feet as shown on Figure 1, and listed on Table 1. Lines 1-11 contain data recorded inside and around the red ball markers at the gunsite. All lines were recorded with the 300 MHz antenna, 150 ns range.

II. BACKGROUND AND OBSERVATIONS

At Gunsite #113, anti-aircraft guns were mounted and used for protection against a possible invasion or attack. The guns have been removed and the area is overgrown with brush and trees. There is little or no visual indication that would characterize this as a gunsite.

The weather during field acquisition was cool, windy and cloudy. Personnel on-site during data acquisition were Ken Grace, Clark Sharlock and Art Carion.

III. ACQUISITION AND PROCESSING PARAMETERS

The equipment and software used in the acquisition and processing of the GPR data are listed on Table 2.

IV. RESULTS

The results of the GPR surveys at Gunsite 113 are shown on Figures 3 - 13. A sample GPR section with labeled interpretive information is shown on Figure 2. A typical signature of an area of disturbed soil is labeled so that similar anomalous areas on the actual lines presented on Figures 3 - 13 can be easily recognized. The horizontal scale, vertical time scale, and maximum depth of penetration are also shown on each line. The radar velocity in this area is 6-7 ns per foot.

The gunsite was generally a good data area. Lines 1-11, shown on Figure 1 and 3 - 13, contain prominent diffractions possibly indicating pipes or buried metallic objects along the GPR transect. Areas within the red ball markers are distinguished by chaotic returns indicating disturbed soil where trenching or back filling has occurred.

The high amplitude event (red, blue, red, etc.) at 25-30 ns, which occurs almost continuosly on each line, may indicate the water table at this site. If this event does represent the water table, it is doubtful that any of the data below this event is valid.

V. CONCLUSIONS

The quality of the data recorded at Gunsite 113 was good. It contains numerous prominent diffractions which represent shallow subsurface targets. Areas of disturbed soil are present indicating previous trenching or excavation. The high amplitude event seen relatively continuous on all lines at about 25-30 ns could possibly be the water table at this location.

TABLE #1
GUNSITE 113 / 631-24G
TABLE OF COORDINATES, BEARINGS, AND DISTANCES

FIGURE	NAME		X EASTING	Y NORTHING	BEARING	DISTANCE	LINE
3	1	START	115302	64768	N 21.6232 W	108	1
	1	END	115258	64879			
4	2	START	115290	64763	N 20.8978 W	109	2
	2	END	115248	64873			
5	3	START	115273	64754	N 21.2505 W	109	3
	3	END	115231	64862			
6	4	START	115256	64745	N 22.9321 W	121	4
	4	END	115212	64849			
7	5	START	115243	64739	N 24.7024 W	124	5
	5	END	115197	64839			
8	6	START	115258	64879	S 56.7456 W	74	6
	6	END	115197	64839			
9	7	START	115263	64869	S 55.0080 W	84	7
	7	END	115203	64827			
10	8	START	115271	64848	S 61.6450 W	72	8
	8	END	115208	64814			
11	9	START	115281	64823	S 60.8657 W	72	9
	9	END	115220	64789			
12	10	START	115292	64795	S 62.3189 W	58	10
	10	END	115231	64763			
13	11	START	115302	64768	S 63.8247 W	69	11
	11	END	115243	64739			

TOTAL FOOTAGE IN SURVEY 1000

Table 2

Acquisition and Processing Parameters

at the

Gunsite 113 / 631-24G

Date Data Acquired	1/27/93
Instrument Type	GSSI (SIR 10) S/N 1158
Antenna Type	300 MHz
Calibration Numbers	Supplied by GSSI PG-90-177 Version 2.05 Max 141 Min 20 Diff 121
Post Processing Software	GSSI (RADANIII)
Range	150 ns
Start Position	-10 ns
End Position	140 ns
Survey Wheel	129.25 ticks/foot
Scans/Foot	4
Samples/Scan	512
Transmit Pulse Rate	50 KHz
Vertical IIR Low Pass Filter	N=2 F=80
Vertical IIR High Pass Filter	N=2 F=11
Horizontal Low Pass Filter	TC=0
Scans/Meter	13.1234
Marks/Meter (on plot)	approximately 5 meters/mark

Figure 1

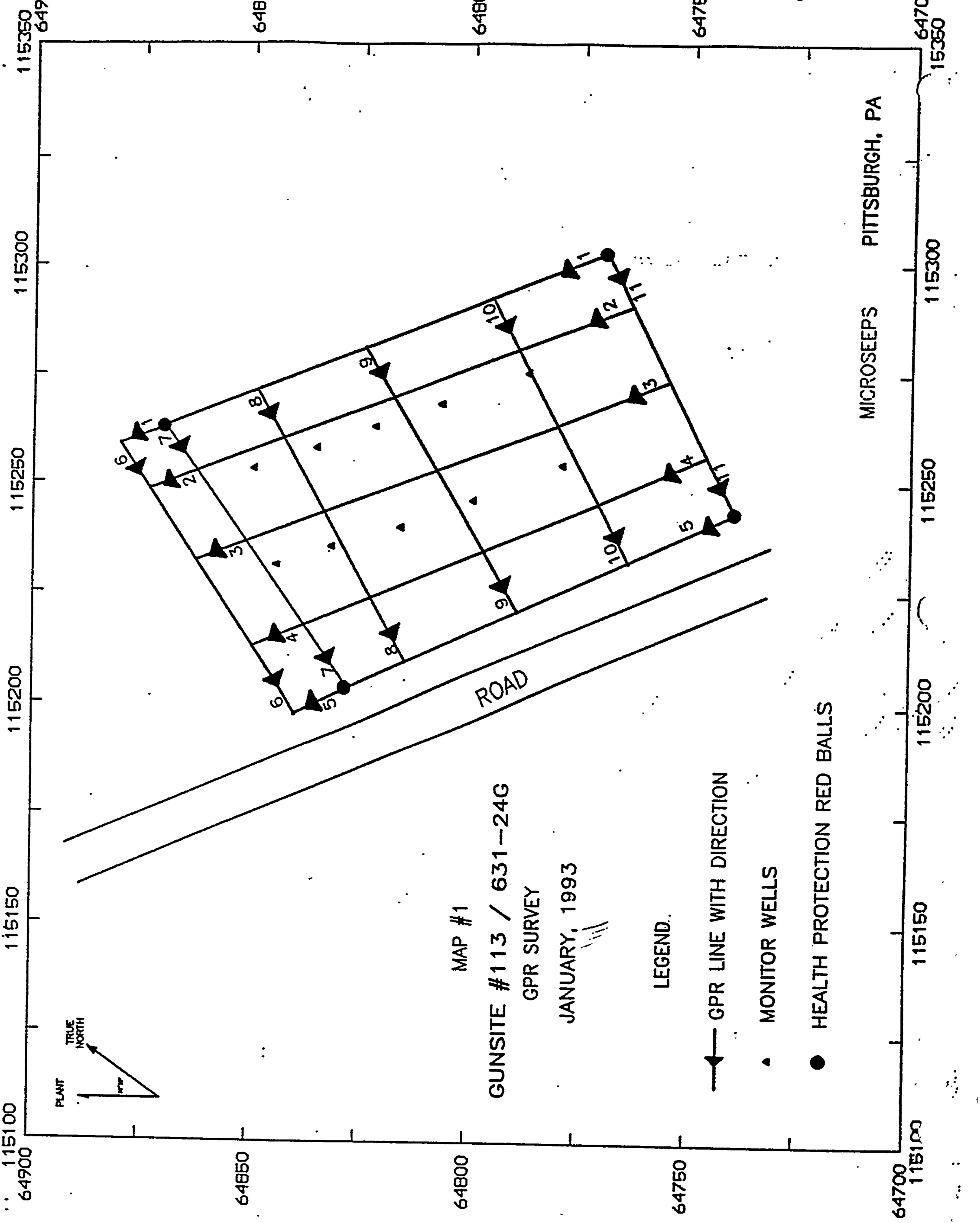
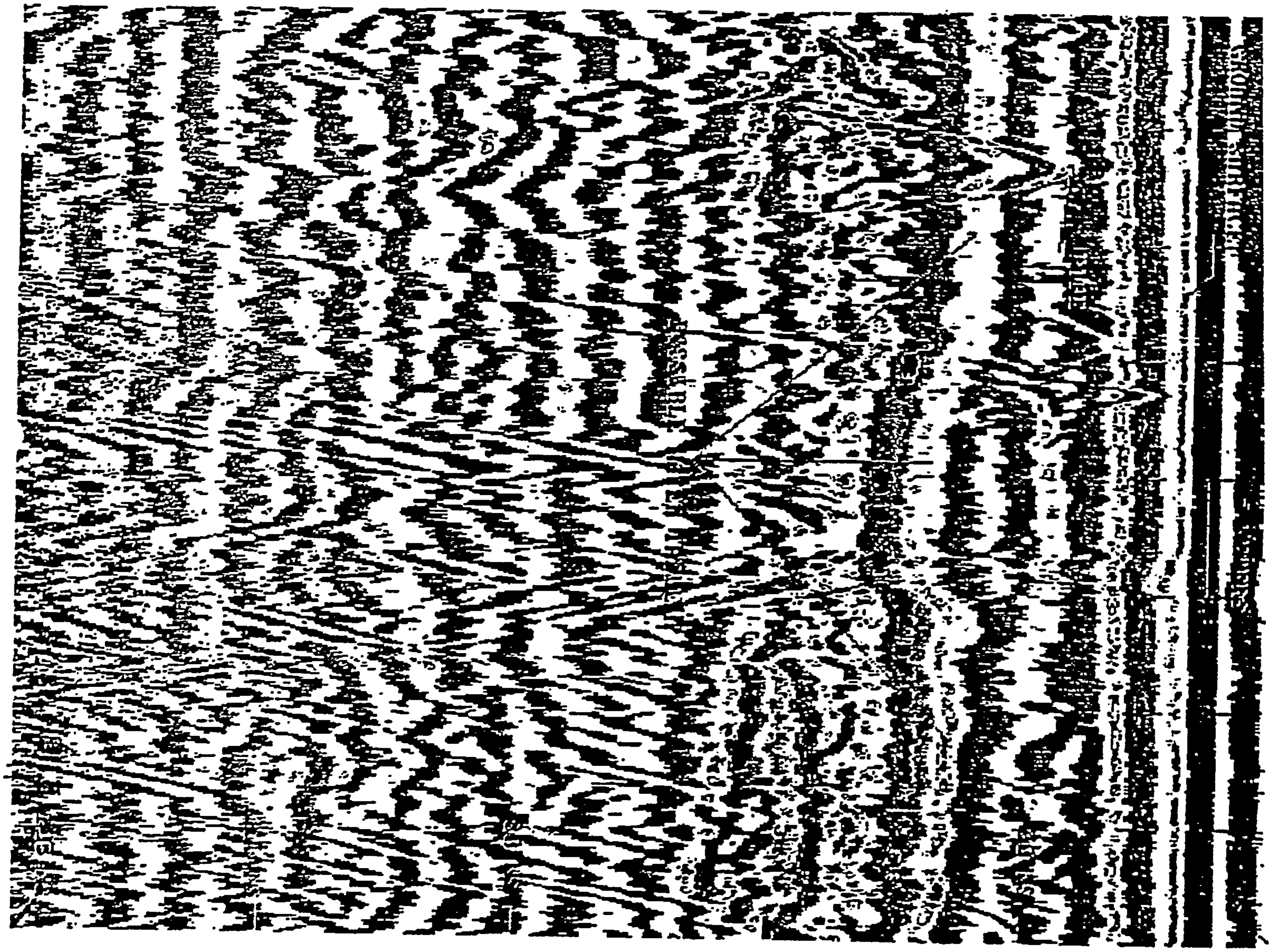

MAP #1
GUNSITE #113 / 631—24G
GPR SURVEY
JANUARY, 1993
LEGEND.
GPR LINE WITH DIRECTION
MONITOR WELLS
HEALTH PROTECTION RED BALLS
MICROSEEPS
PITTSBURGH, PA
ROAD
TRUE NORTH
PLANT
1
2
3
4
5
6
7
8
9
10
11
115100
115150
115200
115250
115300
115350
64900
64850
64800
64750
64700

Figure 2

INTER Created Jan 26,1993 09:53 Modified Mar 8,1993 09:34
512 samples/scan 30.0019 scans/sec position: -10 nS range: 150 nS
Vert. IIR low pass N=2 F=80
Vert. IIR high pass N=2 F=11

GUNSITE 113 / 631-24G
ACCESS ROAD SITE
SAVANNAH RIVER SITE



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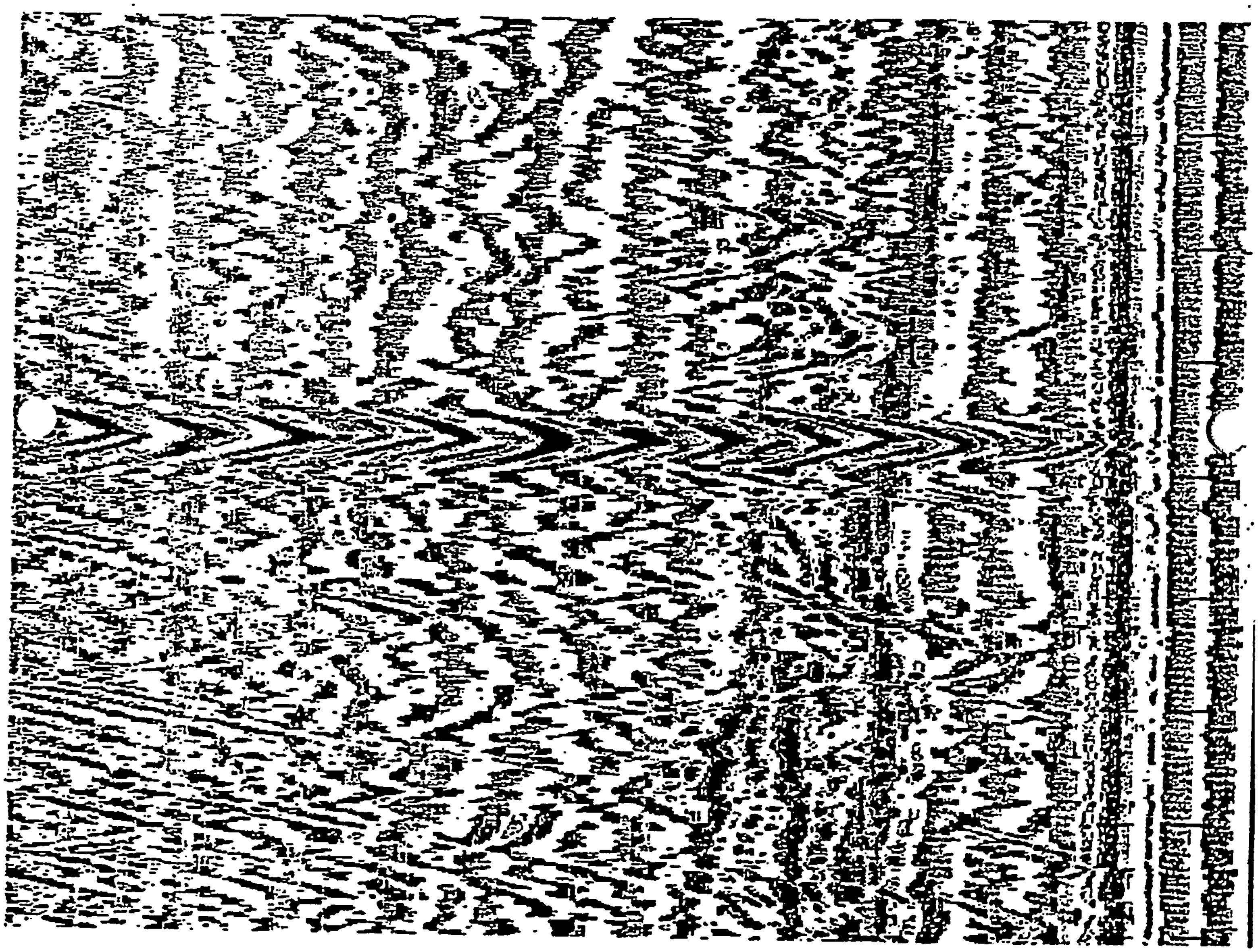
SAVANNAH RIVER SITE



2 Created Jan 26,1993 09:53 Modified Date Unknown
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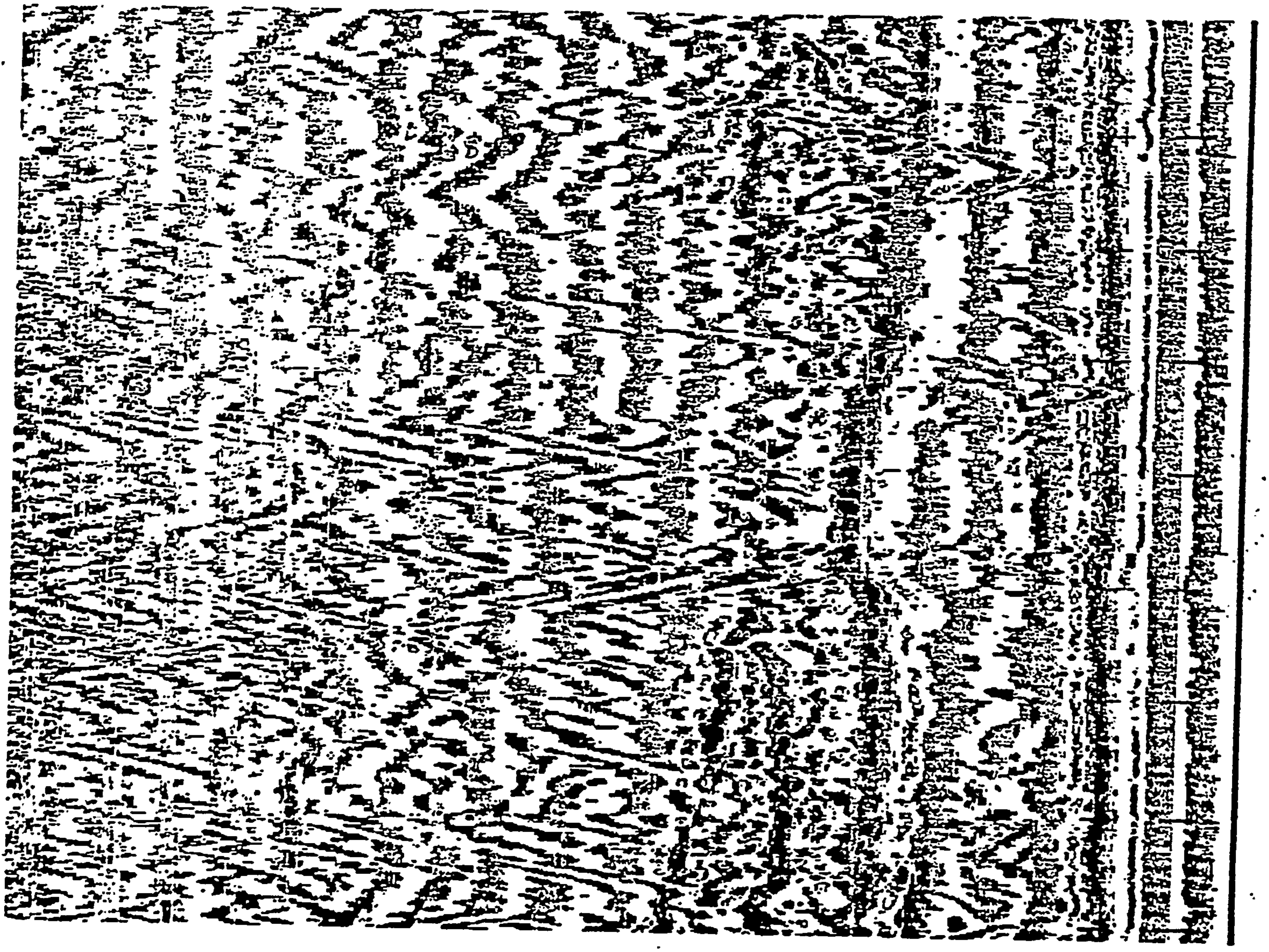
Vert. IIR high pass N=2 F=11

GUNSITE 113 / 631-24G
ACCESS ROAD SITE
SAVANNAH RIVER SITE



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ACCESS ROAD SITE
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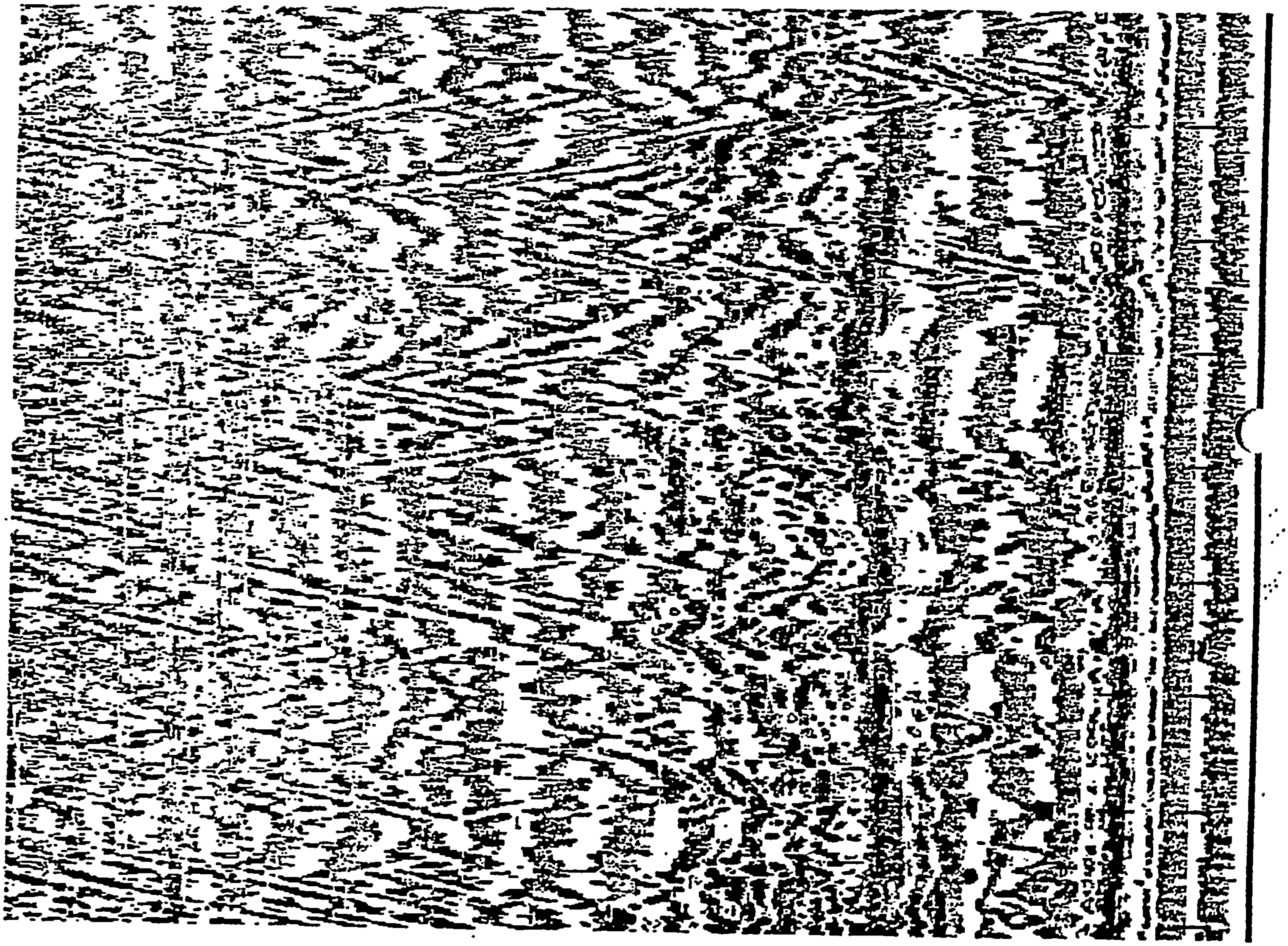

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SAVANNAH RIVER SITE

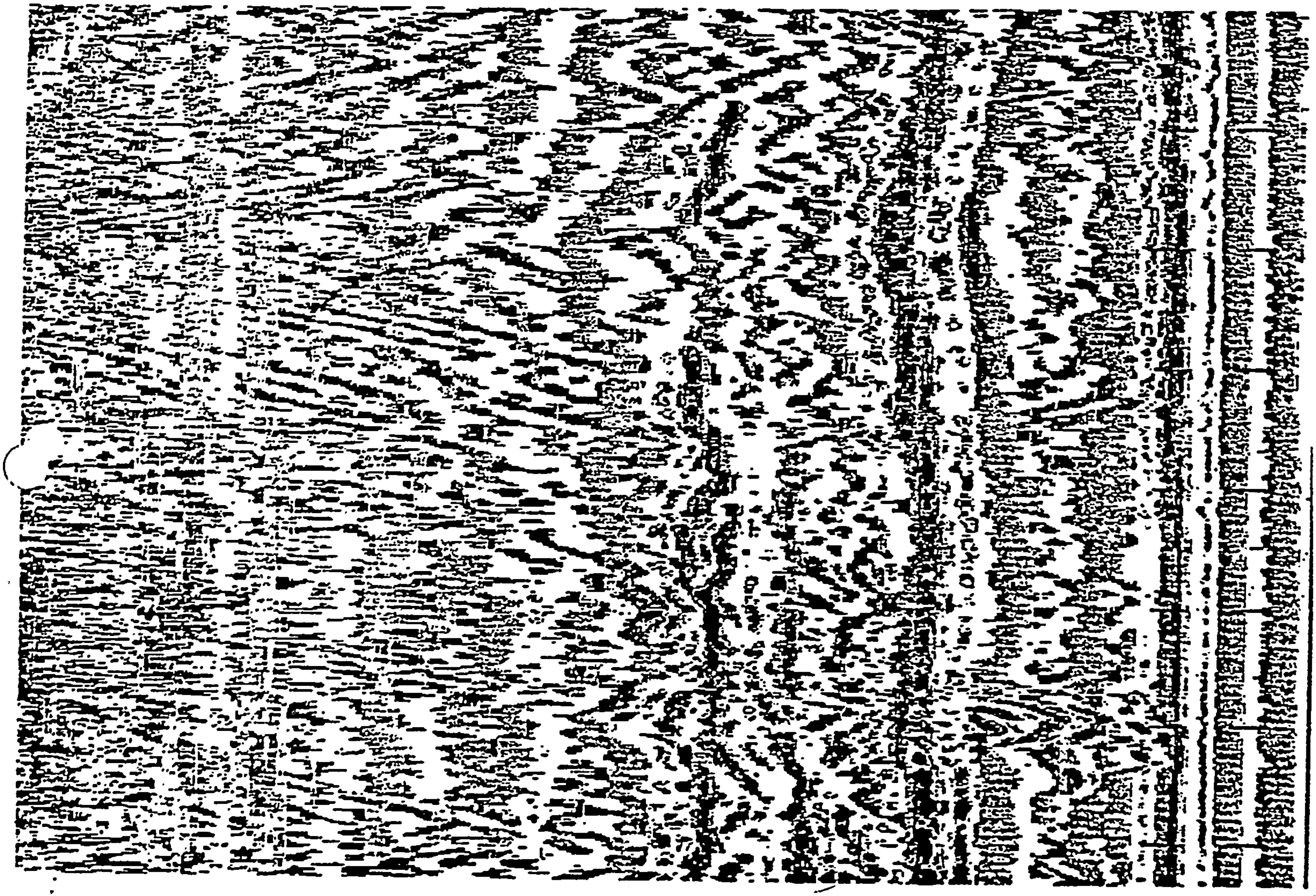

Figure 7

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ACCESS ROAD SITE
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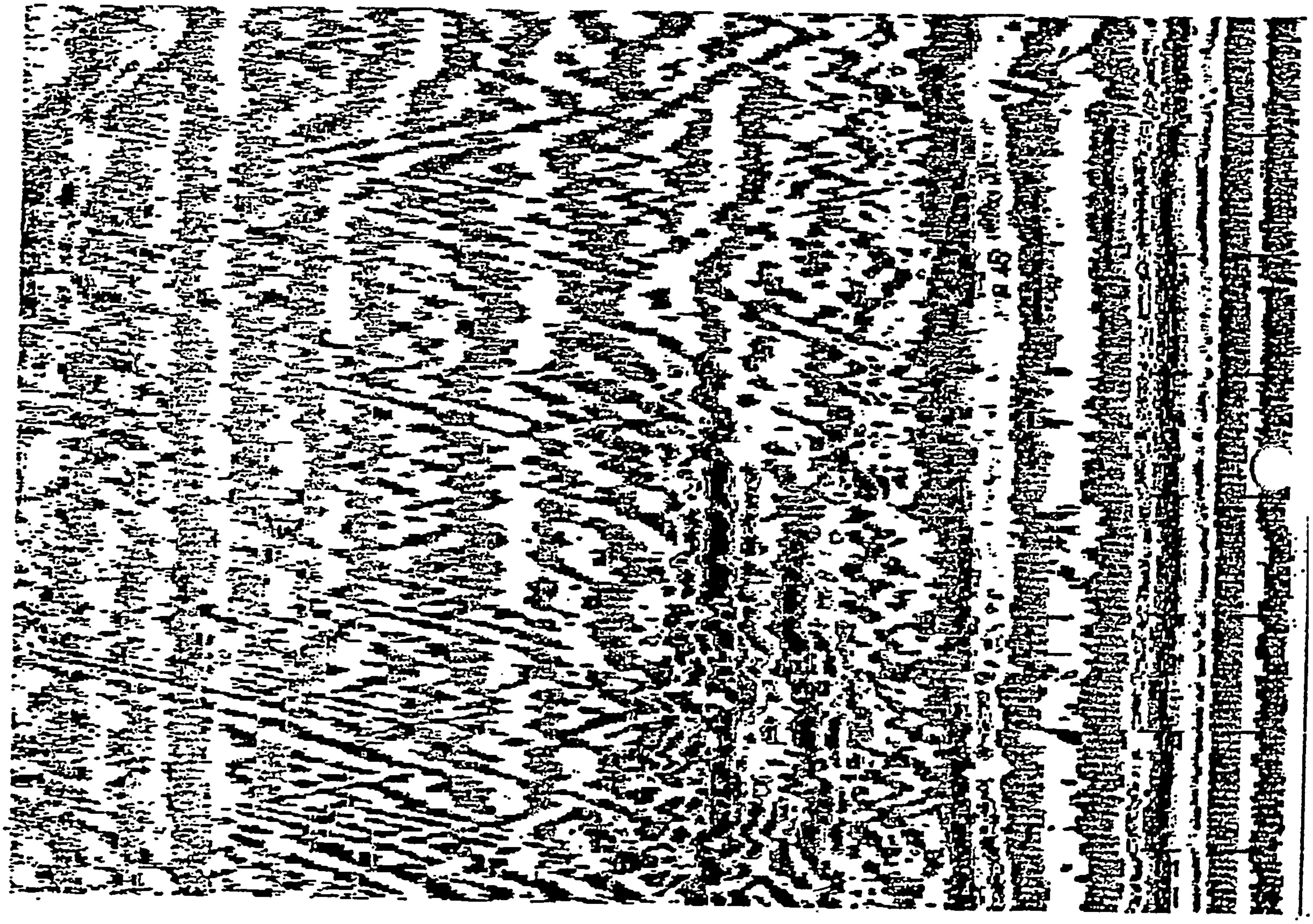

Figure 8

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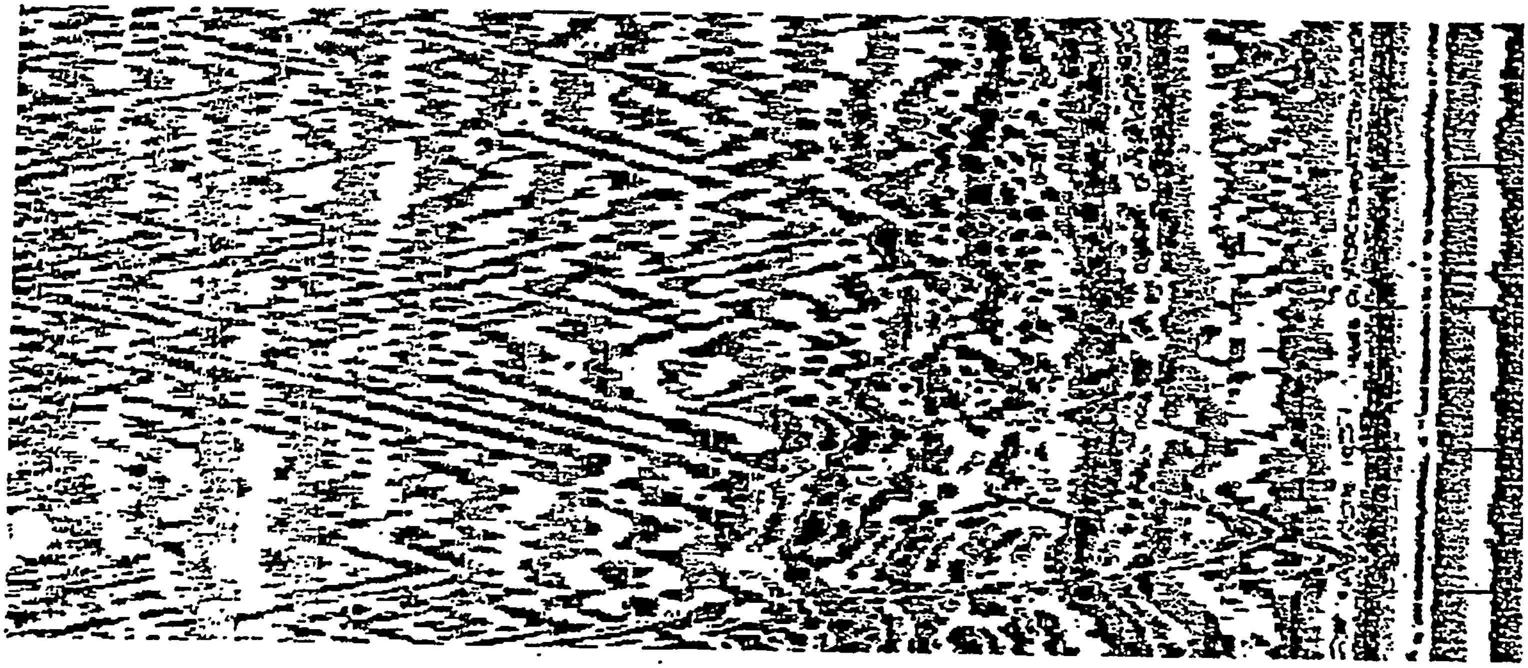

Figure

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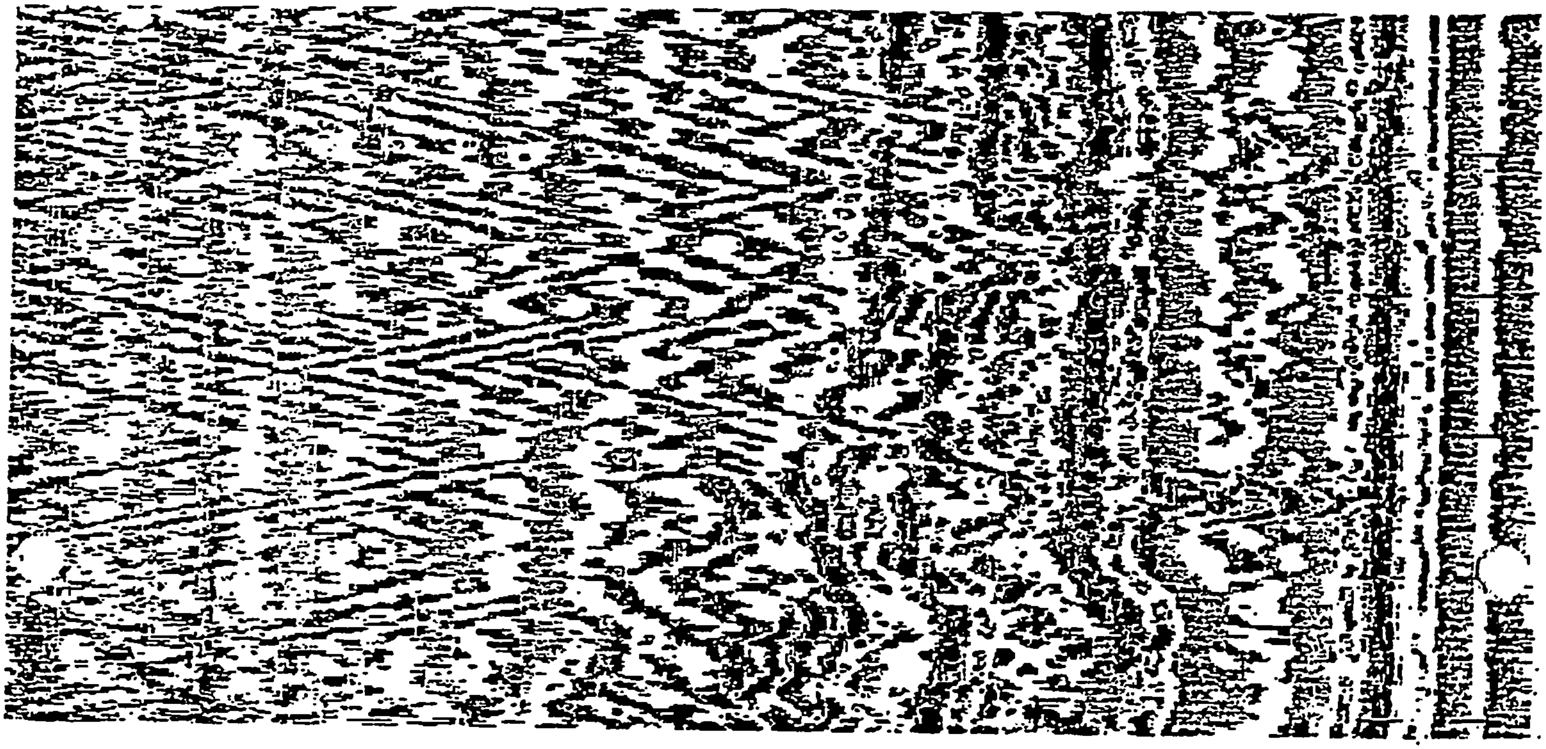

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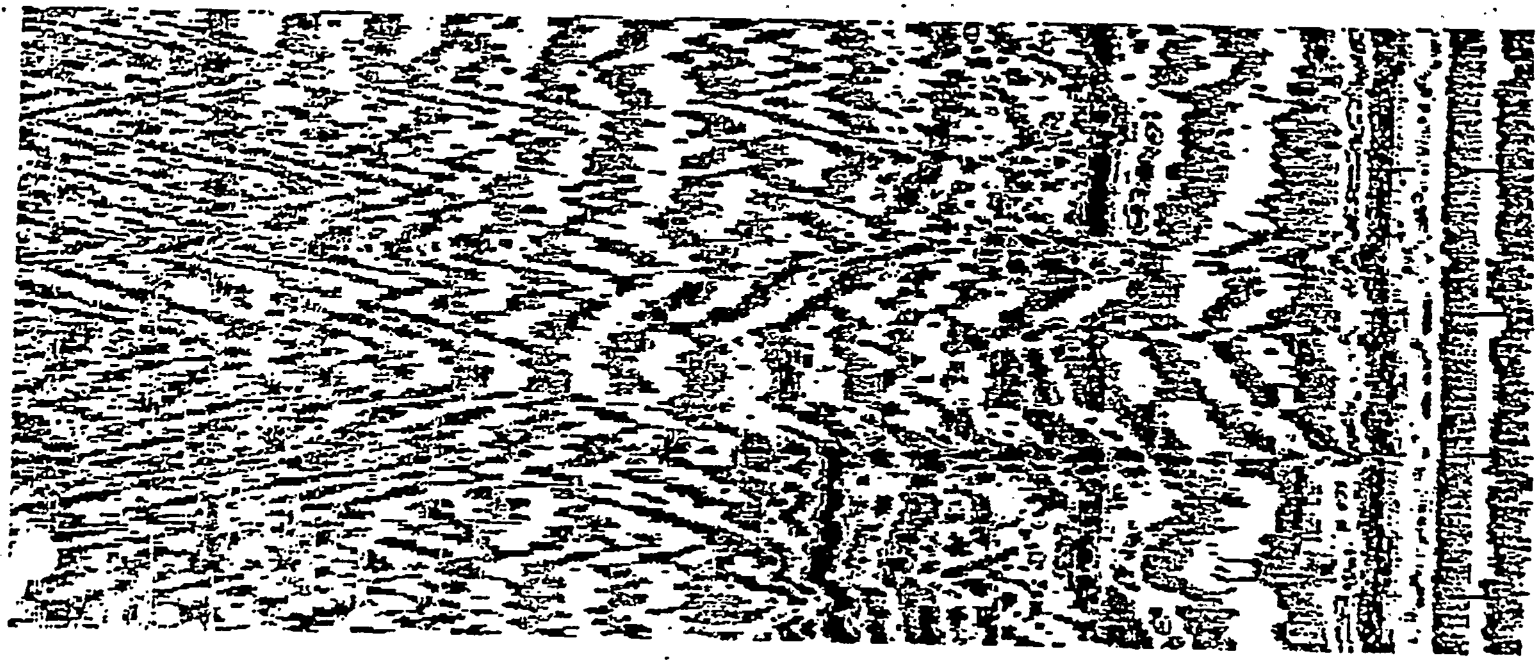

Figure 1

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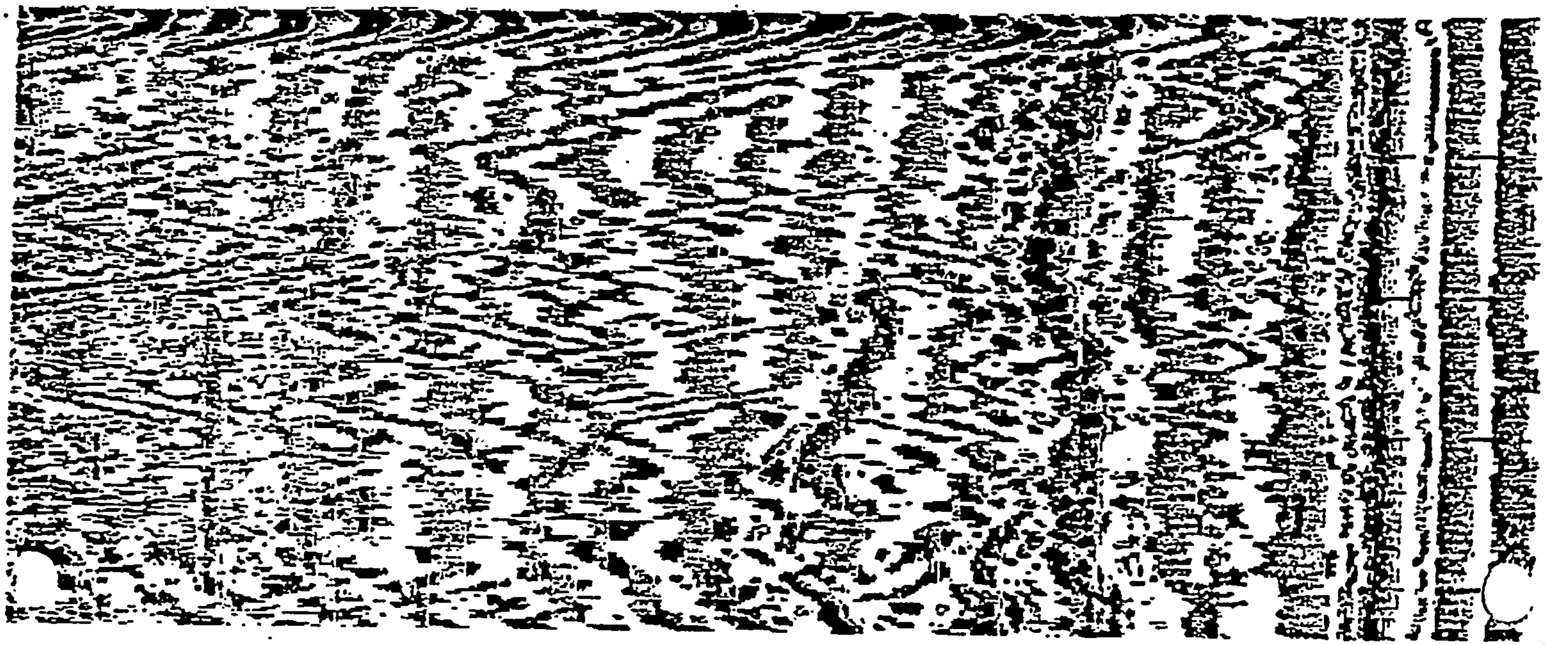
SAVANNAH RIVER SITE



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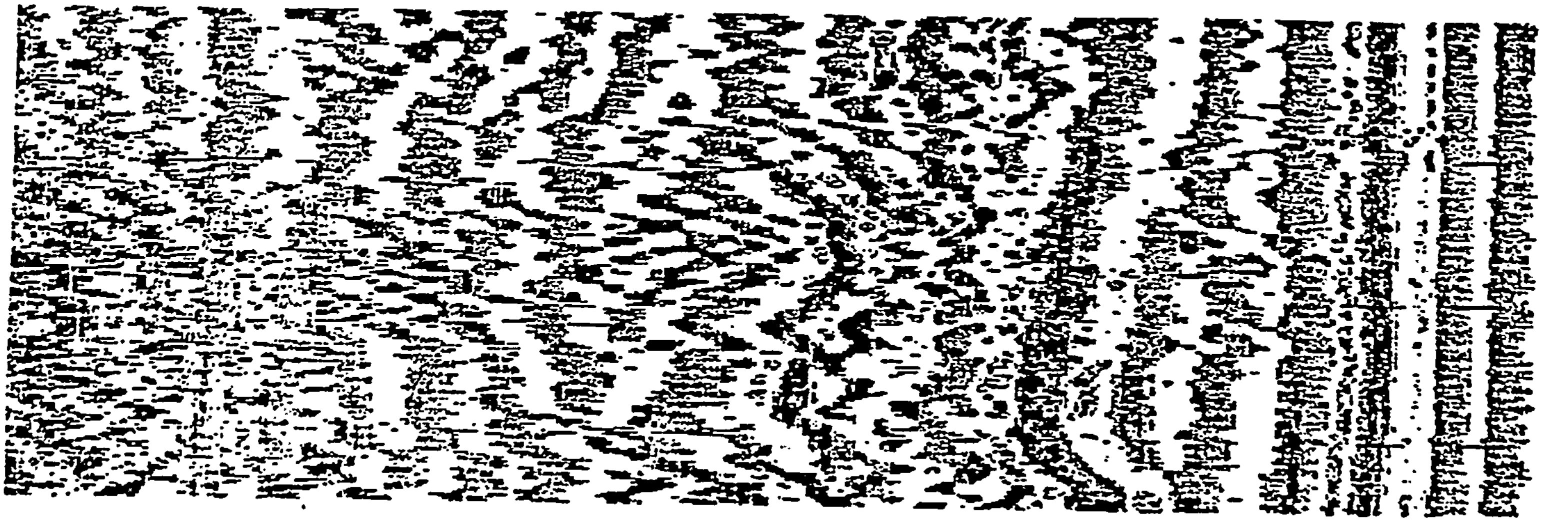

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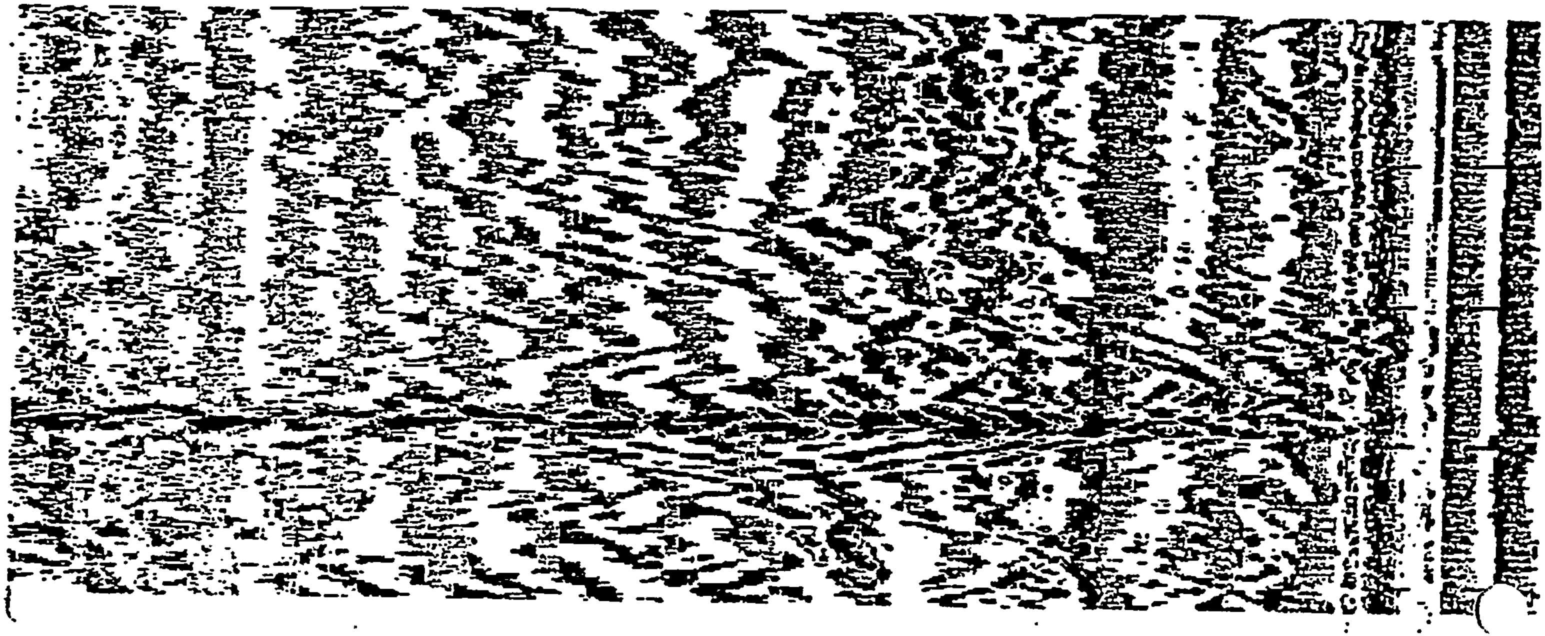

APPENDIX A.2
SOIL GAS SURVEY RESULTS

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Final Report

SOIL GAS INVESTIGATIONS
at
GUN SITE 113 ACCESS ROAD SITE
(631-24G)

SAVANNAH RIVER SITE

April, 1993

Robert J. Pirkle
David J. Masdea

Task 22
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 Gunsite 113 Access Road Site (631-24G) during January, 1993. The survey monitored the presence and distribution of the C_1-C_4 hydrocarbons; the C_5-C_{10} normal paraffins; the aromatic hydrocarbons, BTXE; the diesel range hydrocarbons, C_{11}-C_{18}; selected chlorinated hydrocarbons; and mercury at a total of 30 sample locations.

Only very low levels of selected saturated and aromatic hydrocarbons and chloroform were observed. No evidence of diesel range hydrocarbons was found which exceeded the minimum detection levels for these compounds. Light hydrocarbons, particularly methane were extremely low. Levels of soil mercury found are attributable to background concentrations in this area.

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- B. Analytical Methods 4
- C. Accuracy 4
- D. Precision 5
- E. Minimum Detection Levels 6
- F. Blanks 7
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- Final Report AX-720887: Selected Data, March 1989.

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I. INTRODUCTION

A soil gas survey was designed and executed at Gunsite 113 Access Road Site (631-24G) at the Savannah River Site in January, 1993. 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 30 sample locations were established, as shown on Figure 1, where soil and soil gas samples were taken 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); the diesel range normal paraffins, C_{11}-C_{18}; selected chlorinated organics; and mercury. Analyses of mercury and C_1-C_4 hydrocarbon samples were carried out in an on-site laboratory staffed and equipped by Microseeps. Analyses of samples for volatile and diesel range organics were carried out in Microseeps' laboratory in Pittsburgh, PA. The results of all analyses are shown on Tables 1, 2, 3 and 4, and selected data are mapped as shown on Figures 11 - 20.

II. BACKGROUND

Gunsite 113 Access Road Site (631-24G) is an area of stressed vegetation along the access road to Gunsite 113 (631-15G) where it is suspected that a spill of fuel, possibly diesel fuel has occurred. Documentation of this site is contained on page A-25 of Volume I: Waste Management Unit Worksheets (October, 1990; WSRC-RP-90-1046). A copy of the worksheet is attached in Appendix II. This document indicates that soil gas and ground penetrating radar (GPR) surveys were performed at this site in 1988. The referenced soil gas survey was performed by Microseeps. Selected pages from the report, entitled "Soil and soil gas sampling in Nine Potential New Waste Sites, Central Shops Diesel Loading Area, and SRP Fault Areas", are included in Appendix III. In that survey, which consisted of 10 sites, only selected chlorinated hydrocarbons and light hydrocarbons were monitored. Trace levels of trans 1,2-dichloroethylene were reported as the only observed VOC. Light hydrocarbon levels were very low.

In addition to the reported GPR survey in 1988, Microseeps has recently performed an additional GPR survey at this site. The title page and executive summary of the report of this survey are also included in Appendix III.

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.

Soil samples for diesel range hydrocarbon and mercury analyses were taken from a depth of 12 to 18 inches using the methods documented in Sample Method SM4 in Appendix I. A duplicate sample for mercury analysis, from a separate location approximately 1 ft. away, was taken for every ten samples. No duplicate samples were collected or analyzed for diesel range organics. Details of the collection of soil samples for diesel range hydrocarbons and mercury are contained in the Diesel Sample Collection and the Mercury Sample Collection Logs in Appendix II.

B. Analytical Methods

In Appendix I are methods and quality assurance procedures for the analysis of light hydrocarbon soil gas samples are documented in Analytical Method AM1; for VOC soil gas samples in Analytical Method AM4; for soil mercury analyses in Analytical Method AM8; and for soil core diesel range hydrocarbons in Analytical Method AM12. Methods AM1 and AM4 are modifications of EPA Headspace Method 5030 and GC Method 8000. Representative chromatograms of a sample and a blank from this data set are shown on Figures 2 - 5 and Figures 9 and 10.

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". A chromatogram of standard "M" is 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 5. 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 3 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.

Calibration of the gas chromatograph for diesel range hydrocarbons was achieved was achieved using Hewlett Packard Mix #2 and pure diesel fuel as described in Analytical Method AM12. A chromatogram of standard H.P. Mix #2 is shown on Figure 11 and the pure diesel fuel standard on Figure 12.

Methods and quality assurance procedures for the analysis of mercury in soils are documented in Analytical Method AM8 in Appendix I. Mercury analysis logs which document analyses of blanks and duplicates run to assure the quality of the data are included in Appendix II.

D. Precision

The analytical precision was calculated using the repetitive analysis of standards as shown in Tables 6 - 9. In order to derive a more meaningful estimate of precision for the VOC's, 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 Gunsite 113 Access Road Site data reside in data directory 26. Standards, which were run with the samples and blanks from the Gunsite 113 survey are designated as area "631-24G".

For the VOC standards in general, percent standard deviations are less than 10%. The percent standard deviation for 1,1,1-trichloroethylene at the 10 ppbv level is abnormally high. For all light hydrocarbons, the precision is better than 3% for analyses of standard "M".

E. 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 13.

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 ≥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 calibration factors to calculate the amount of each compound corresponding to 40 area counts as shown on Table 10. 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.

F. 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 "W26" are shown on Table 11. The symbol "ND" means "not detected" and suggests an area of less than 40 area counts as discussed above. For the calculation of means and standard deviations, the amounts indicated on Table 10 under "ideal MDL" (40 area counts) were used when "ND" is indicated. Results of the analyses of blank samples for the 631-24G data set are also included on Tables 1, 2, and 3, and a representative chromatogram is shown on Figures 4 and 5.

G. 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, ppbv or ng/g as reported on Tables 1, 2, and 3.

All data are in Lotus 123 spreadsheet format using DOS. All analytical data are accumulated and processed via Microseeps gas chromatographic data system.

V. RESULTS

The results of the surveys are recorded in Tables 1, 2, 3 and 4 and selected data are mapped on Figures 14 - 21. In general, levels of volatile organics detected in this survey are very low. Methane, as shown on Figure 14 and Table 3, is found in extremely low levels over the area. The other light hydrocarbons are also extremely low as shown on Table 3.

Octane and o-xylene were each found in low concentrations at two and three sites, respectively, as shown on Figures 15 - 18. Both hydrocarbons have been found widely distributed in the SRS area (SRS Background Study to be reported). The observations of these compounds at this site are not thought to be derived from buried waste. It is believed that the chromatographic response observed at the retention time of o-xylene may in fact be a naturally occurring compound related to pine resins since the response has been observed together with α-pinene.

Chloroform was observed in low concentrations at 5 sites, as shown on Figures 19 and 20. Chloroform, or a compound with the same retention time which responds on the ECD, has also been observed widely distributed at SRS in the same concentration range observed in this survey.

No diesel range hydrocarbons were observed above the minimum detection level.

Mercury observed in soil cores, shown in Figure 21, is attributable to background levels in the SRS area.

V. CONCLUSIONS

Only very low levels of octane, o-xylene and chloroform were found at the Gunsite 113 Access Road Site (631-24G). These observations do not suggest the presence of buried waste or contamination at this site. Levels of light hydrocarbons were extremely low. No diesel range hydrocarbons were observed. Levels of mercury observed are attributable to background in this area.

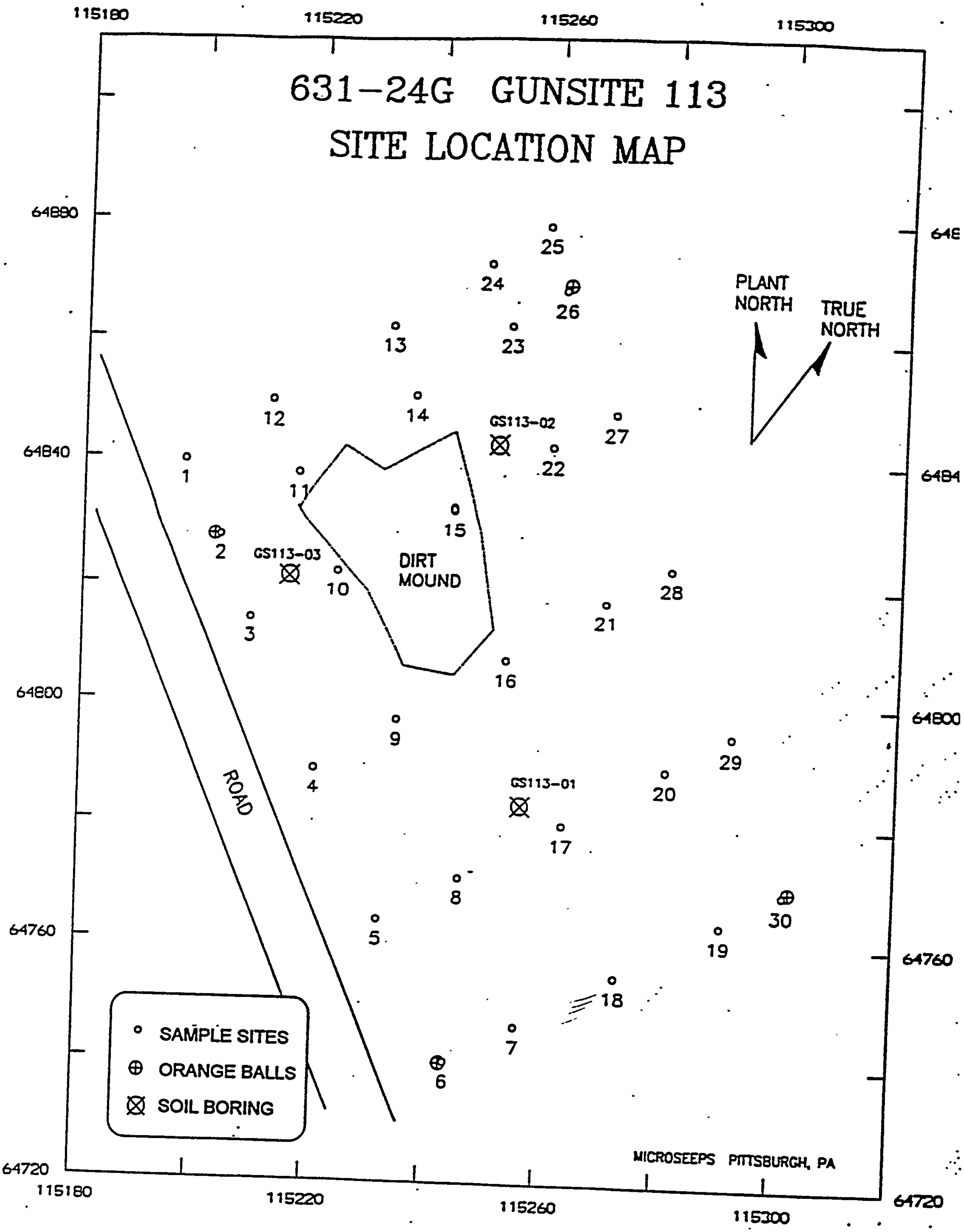


Figure 1. Gunsite 113 (631-24G) Site Location Map

File=C:\CP\D26\W26A2.55R Sample name=631-24G-20 Date printed= 04-07-1993 Time= 16:34:36
3.50 to 30.00 min. Low Y = 0.18524 mv High Y = 9.43982 mv Span = 9.25458 mv

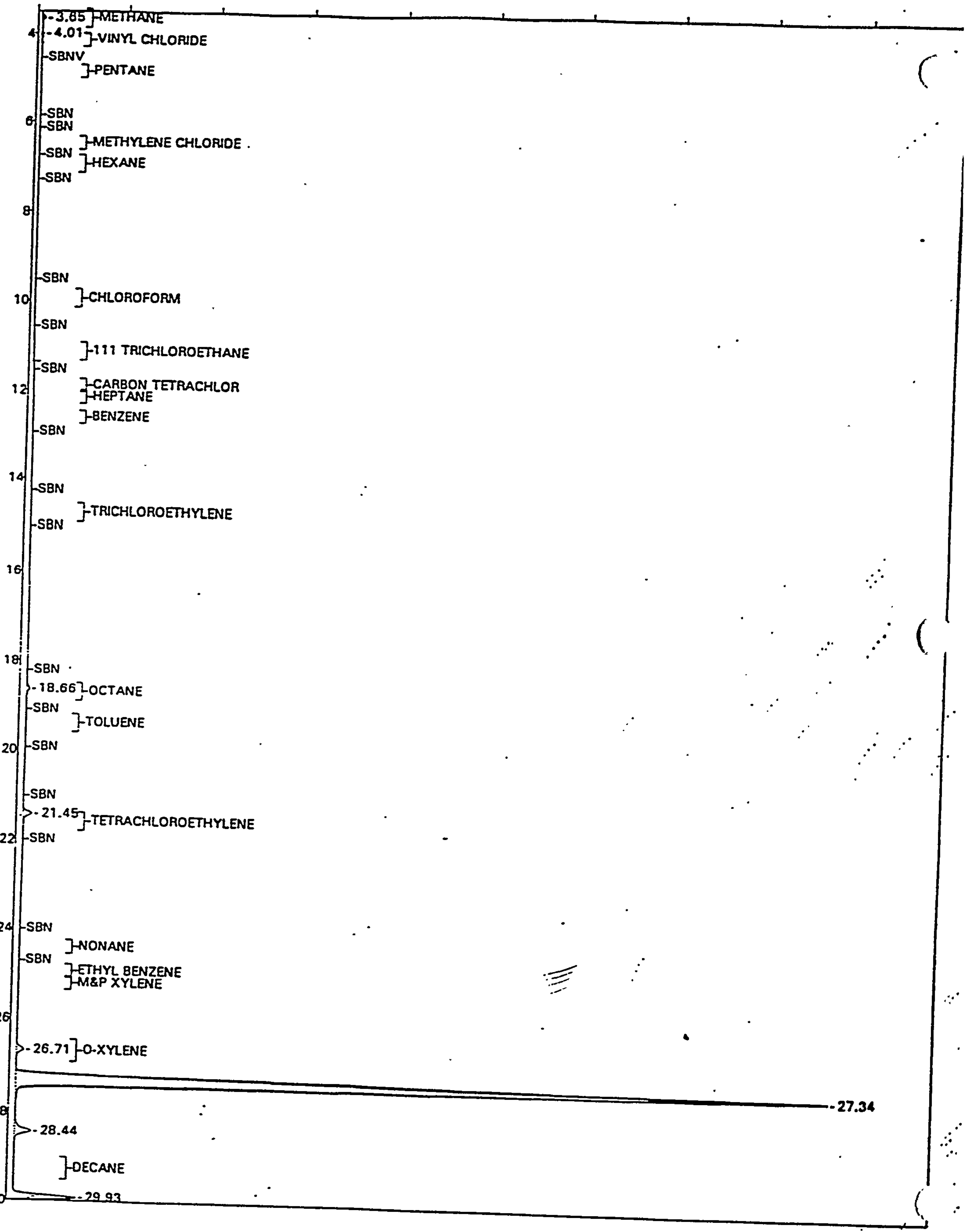


Figure 2. Gas Chromatogram of Soil Gases at Site 20 from the Flame Ionization Detector

File=C:\CP\D26\W2682.55R Sample name=631-24G-20 Date printed= 04-07-1993 Time= 16:35:46
3.85 to 30.00 min. Low Y = -0.02152 mv High Y = 0.94940 mv Span = 0.97092 mv

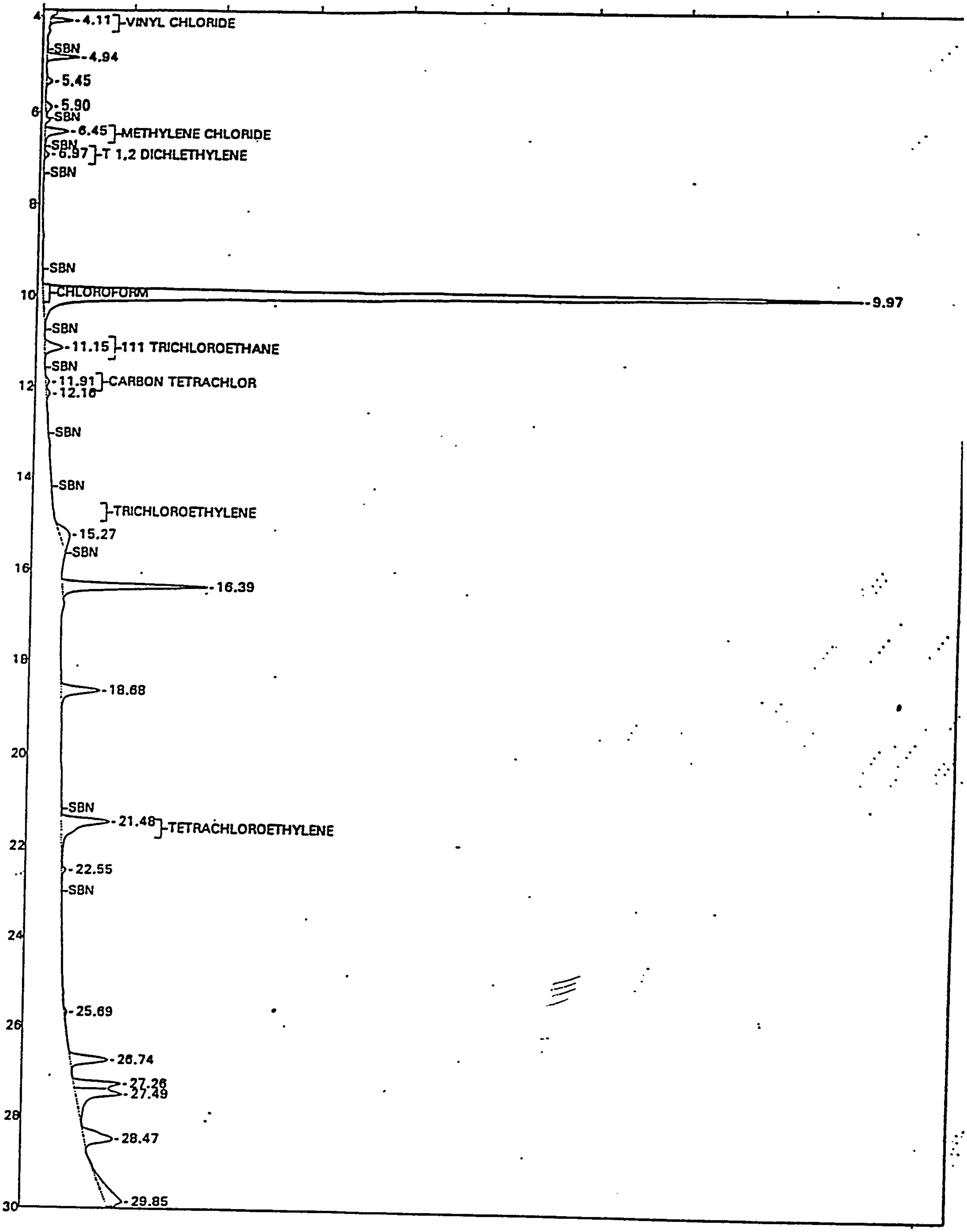


Figure 3. Gas Chromatogram of Soil Gases at Site 20 from the Electron Capture Detector

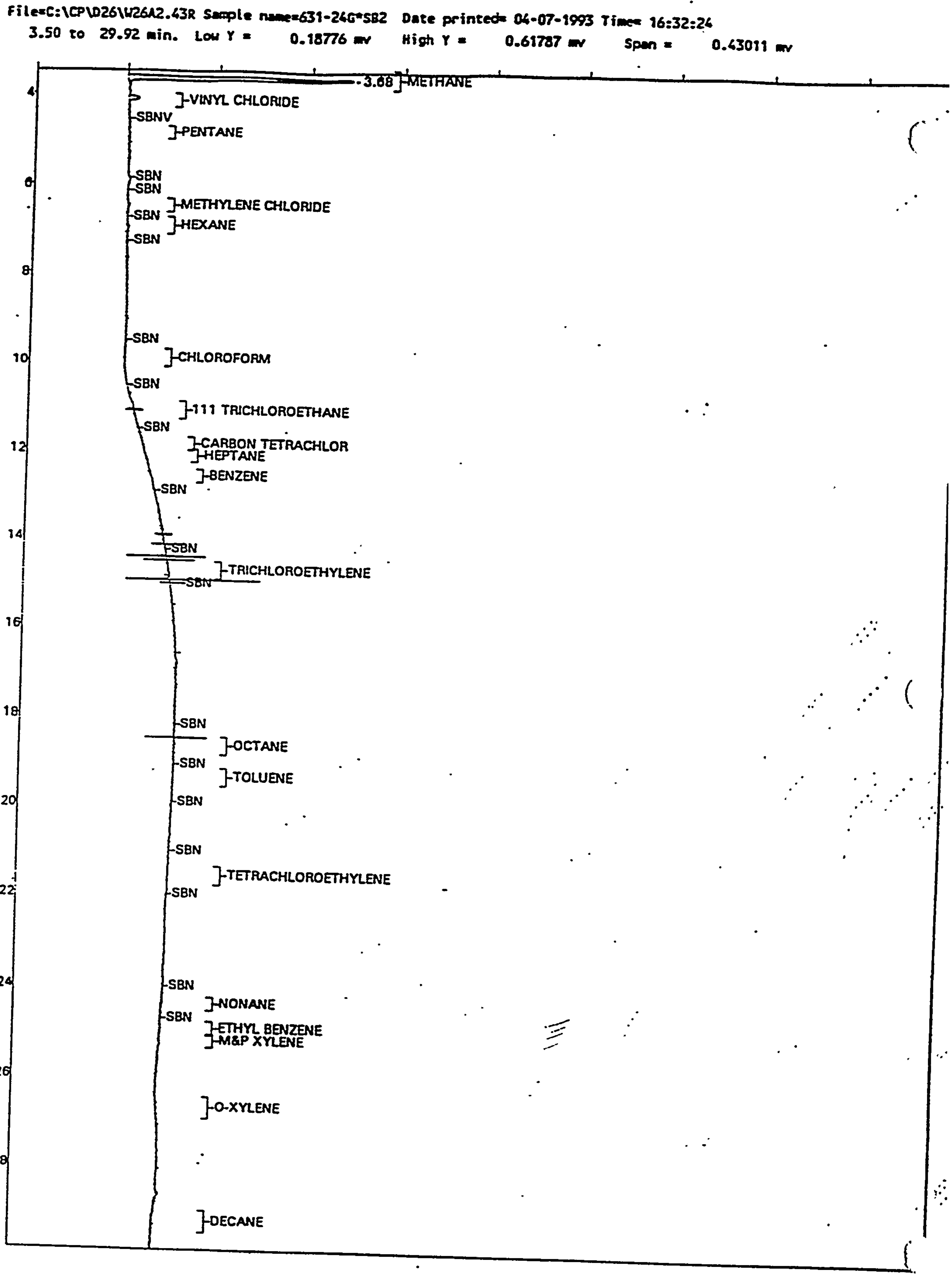


Figure 4. Gas Chromatogram of System Blank # 2 on the Flame Ionization Detector

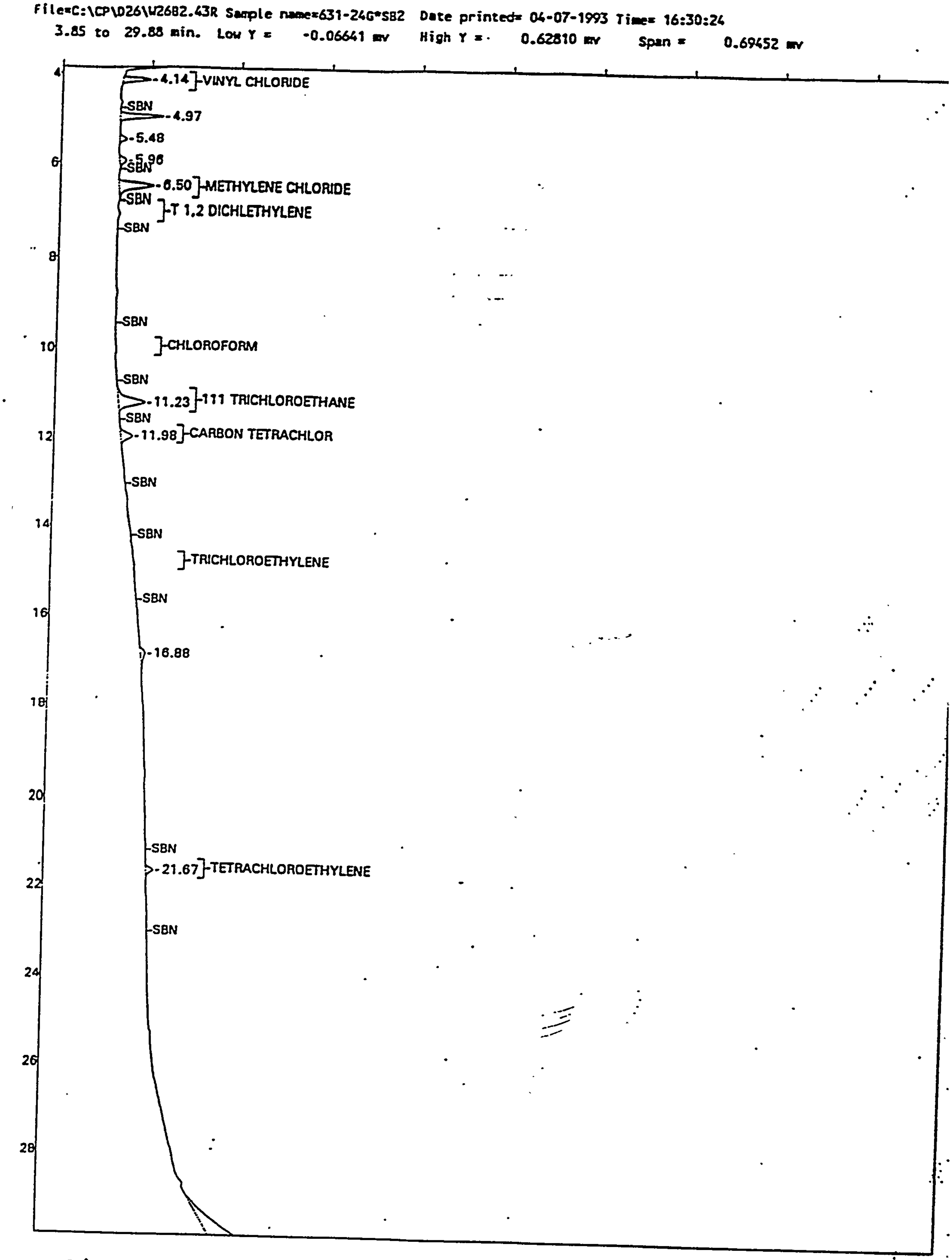
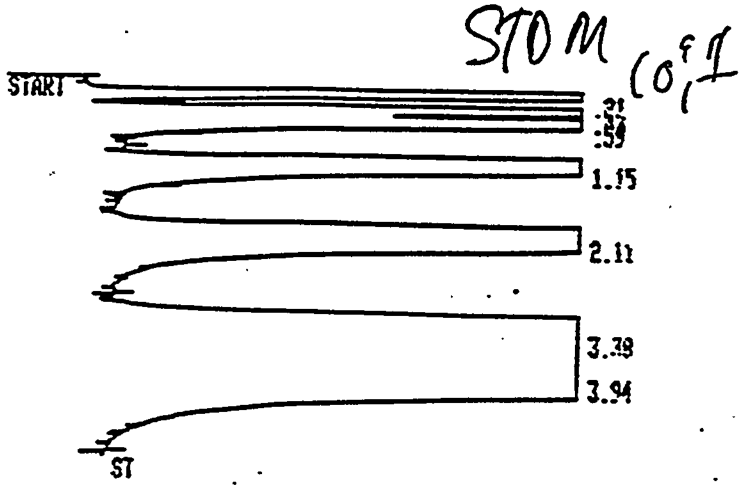


Figure 5. Gas Chromatogram of System Blank # 2 on the Electron Capture Detector

```
TOTAL AREA=     422730
MUL FACTOR= 1.0000E+00
```



```
RUN #  526               JAN/29/93  13:38:58
WORKFILE ID: B
WORKFILE NAME:

ESTD
  RT          AREA TYPE  CAL #        AMOUNT
  0.21     2445200   PB    1          10.146
  0.43      500520   BV    2           1.028
  0.59      626200   VB    3           1.019
  1.15      661260   BB    4R          1.021
  2.11      538500   PV    5           1.013
  3.38      744710   VV    6           1.018
  3.94      683410   VV    7           1.024

TOTAL AREA=    6199900
MUL FACTOR= 1.0000E+00


CALIB  @
RECALIBRATION
ESTD                      CALIB RUNS  5
REF % RTW=   5.00         % RTW=   5.00

CAL #      RT        AMT          AMT/AREA
  1       0.21    1.0000E+01    4.1373E-06
  2       0.42    1.0000E+00    2.0292E-05
  3       0.58    1.0000E+00    1.6205E-06
  4R      1.13    1.0000E+00    1.5378E-06
  5       2.08    1.0000E+00    1.8835E-06
  6       3.46    1.0000E+00    1.3618E-06
  7       3.79    1.0000E+00    1.4913E-05
```

Figure 6. Gas Chromatogram of C_1-C_4 Standard M

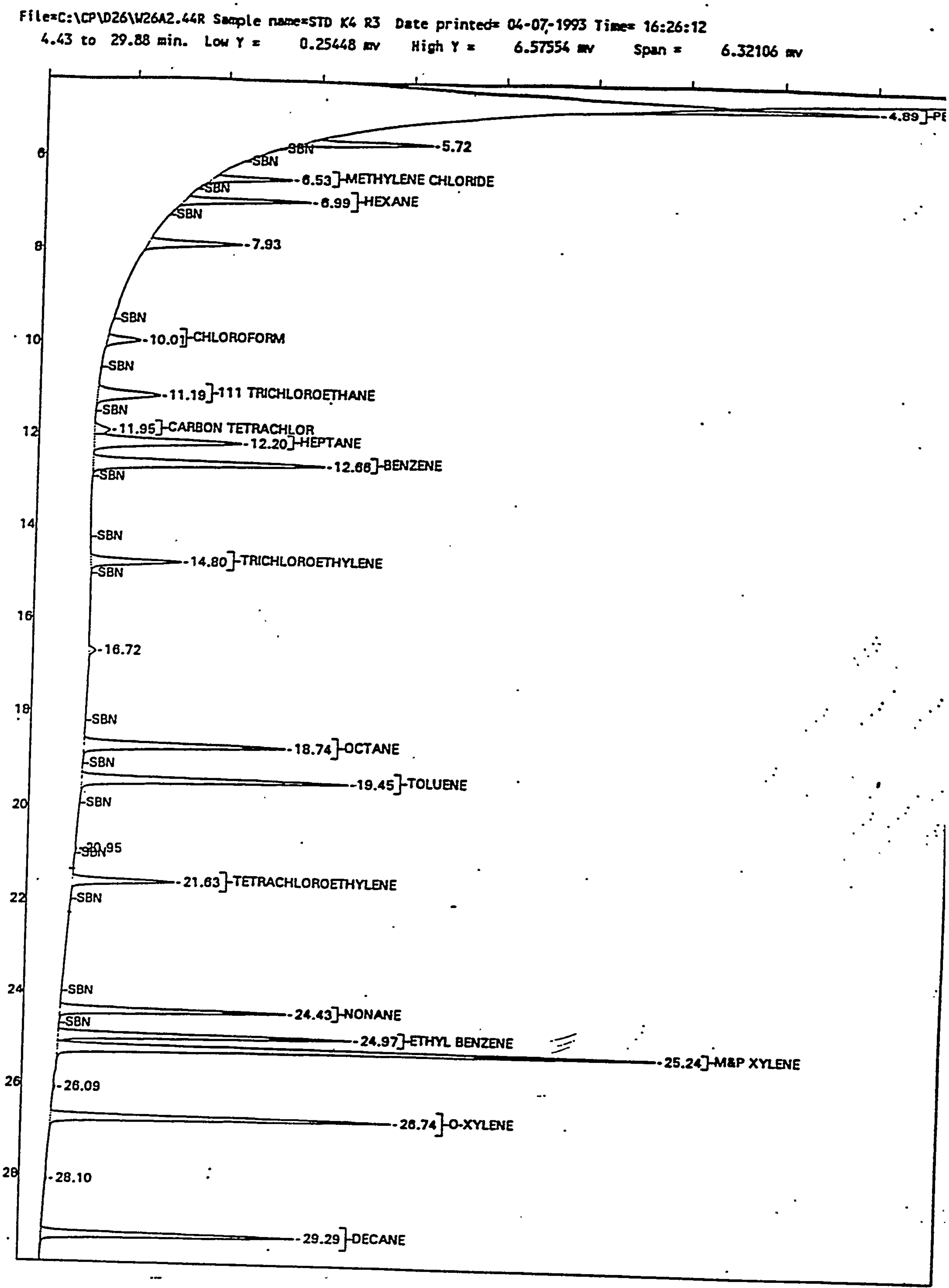


Figure 7. Gas Chromatogram (FID) of VOC Standard "K4", Level 3

```
File=C:\CP\D26\W2682.44R Sample name=STD K4 R3  Date printed= 04-07-1993 Time= 16:28:16
   3.85 to  29.96 min.  Low Y =    -1.84433 mv    High Y =   424.58844 mv     Span =   426.43274 mv
```

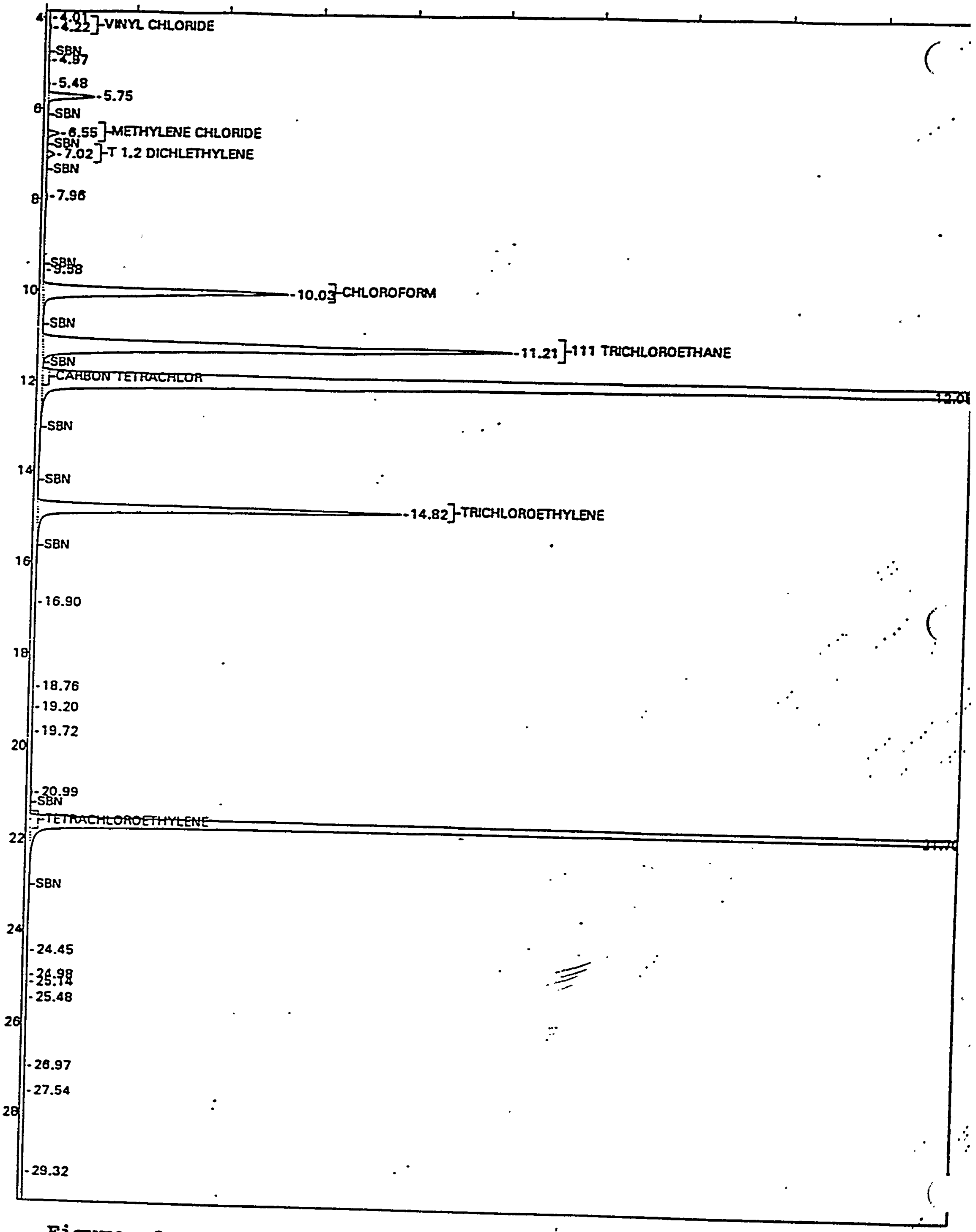


Figure 8. Gas Chromatogram (ECD) of VOC Standard "K4", Level 3.

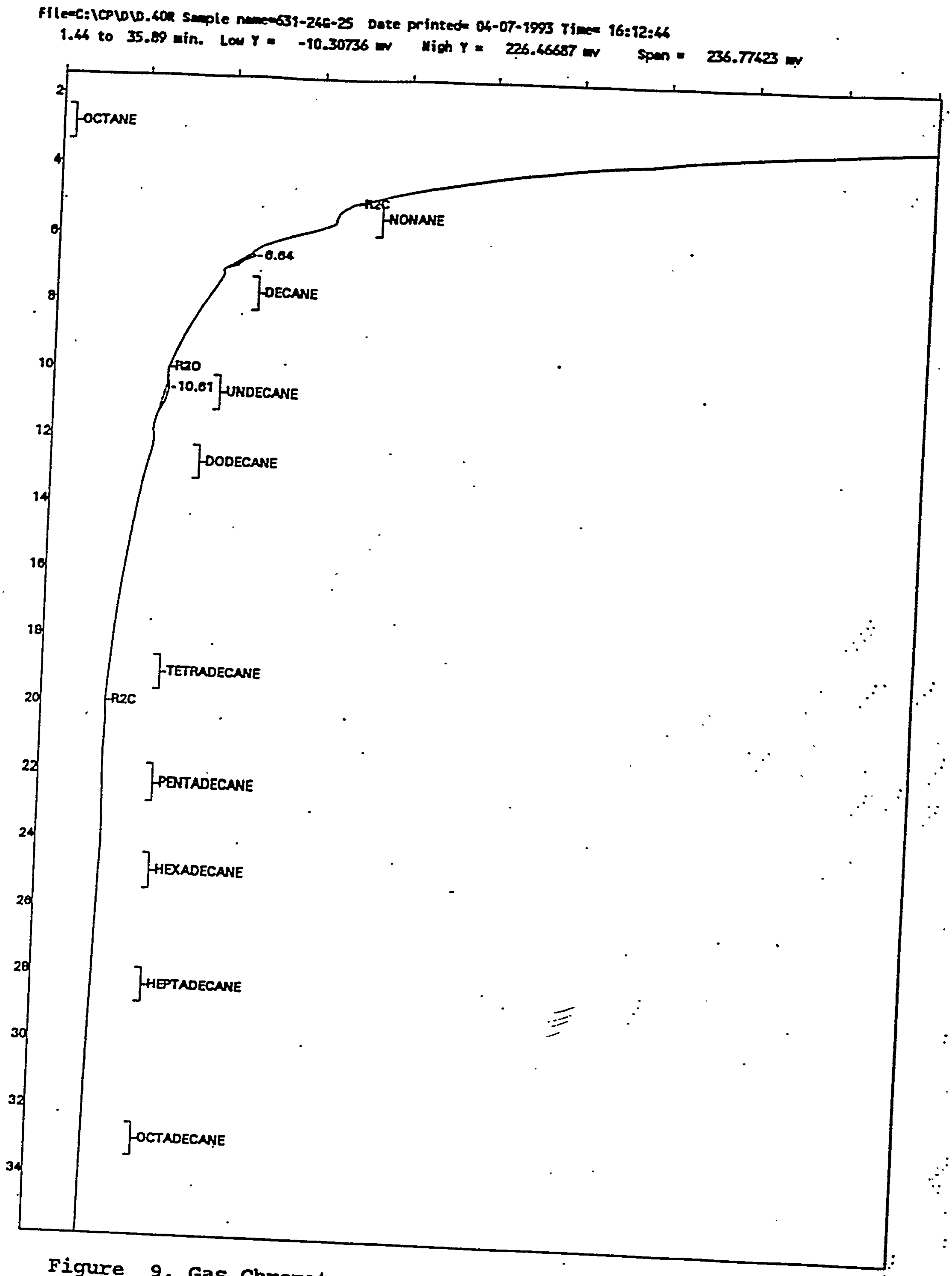
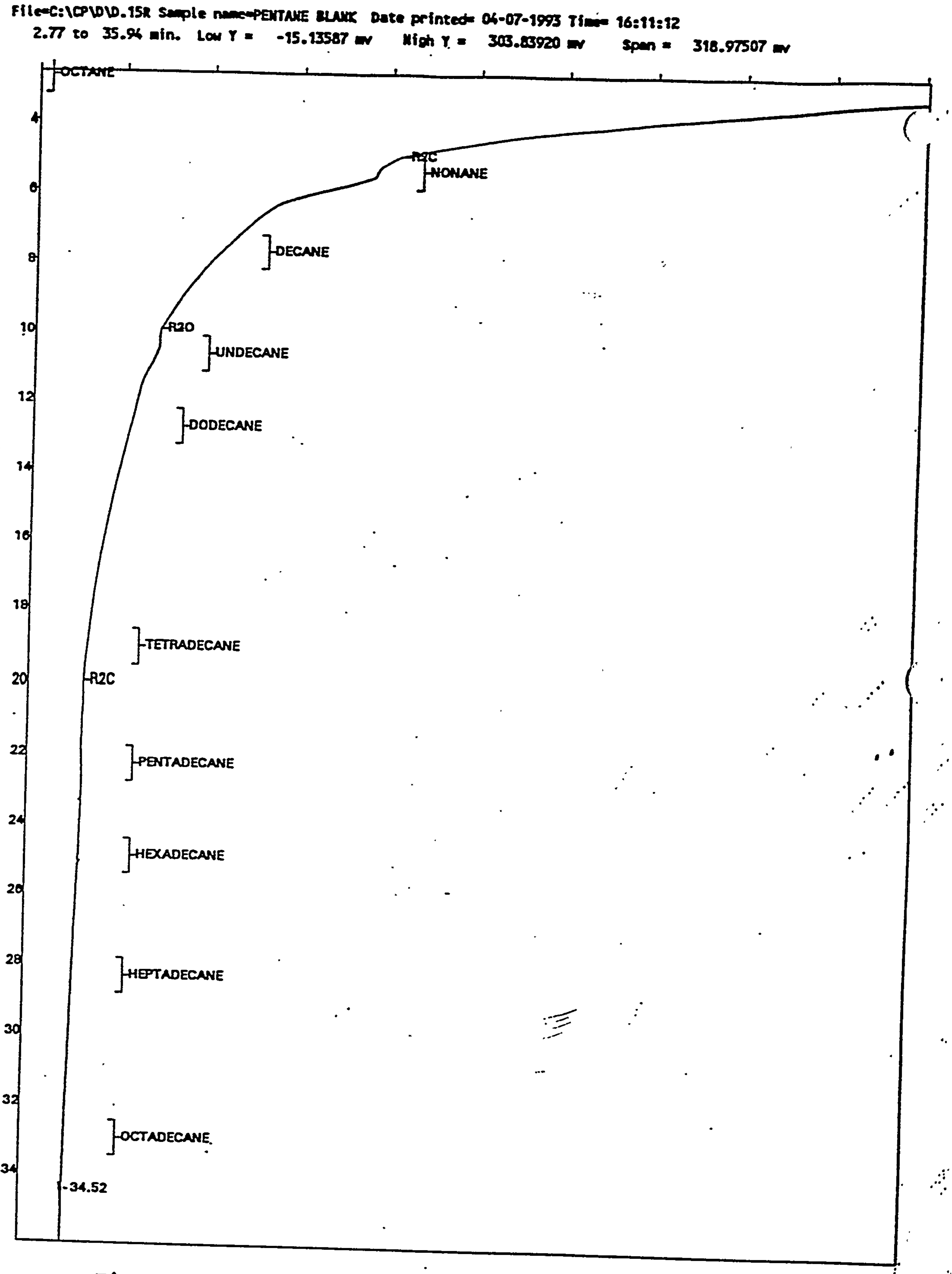


Figure 9. Gas Chromatogram of Soil Sample from Site 25 in the Diesel Hydrocarbon Range



File=C:\CP\D\D.15R Sample name=PENTANE BLANK Date printed= 04-07-1993 Time= 16:11:12
2.77 to 35.94 min. Low Y = -15.13587 mv High Y = 303.83920 mv Span = 318.97507 mv

Figure 10. Gas Chromatogram of Diesel Range Pentane Blank

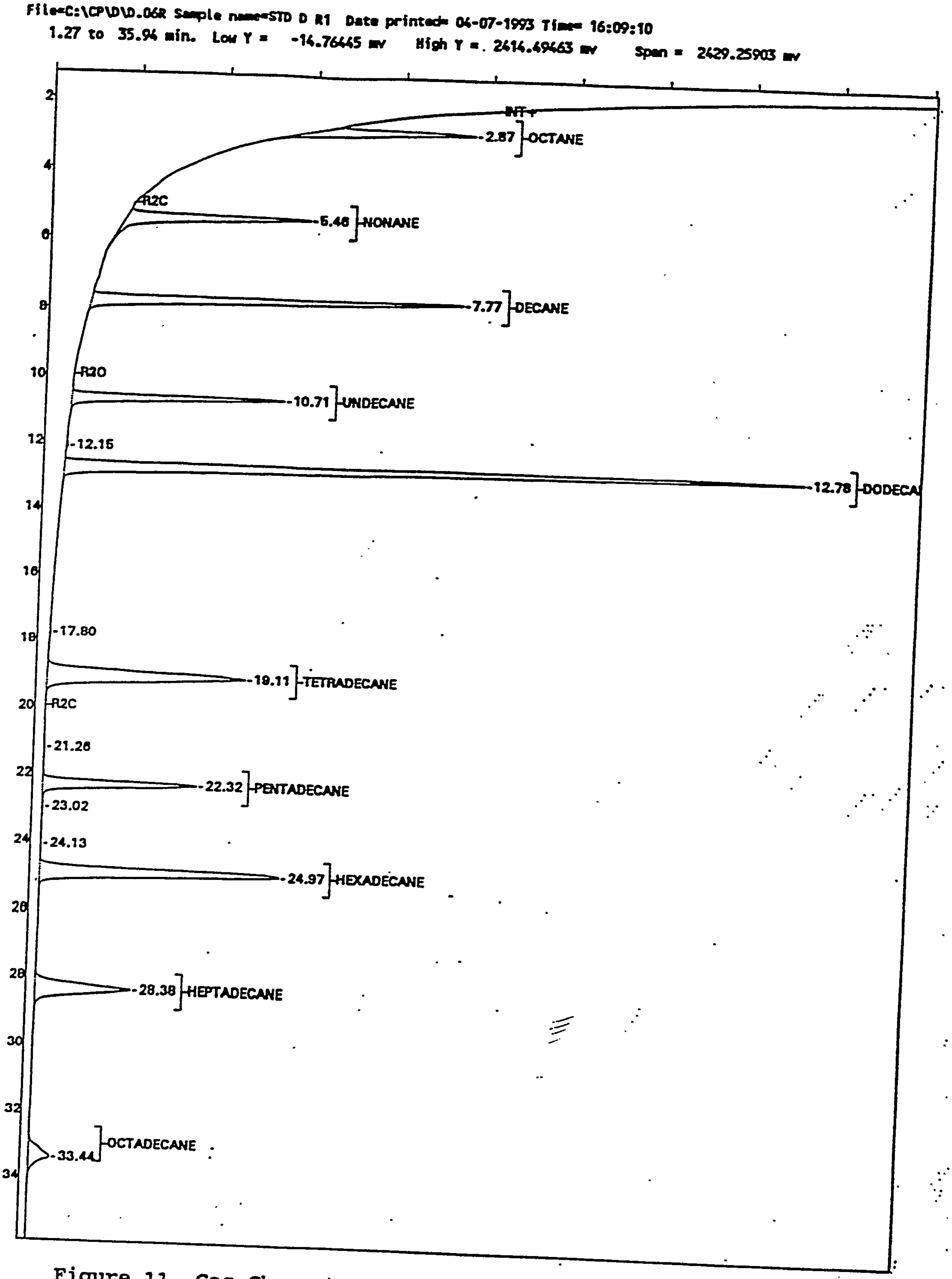


Figure 11. Gas Chromatogram of Diesel Range Normal Hydrocarbon Standard, HP Mix #2, Level 1

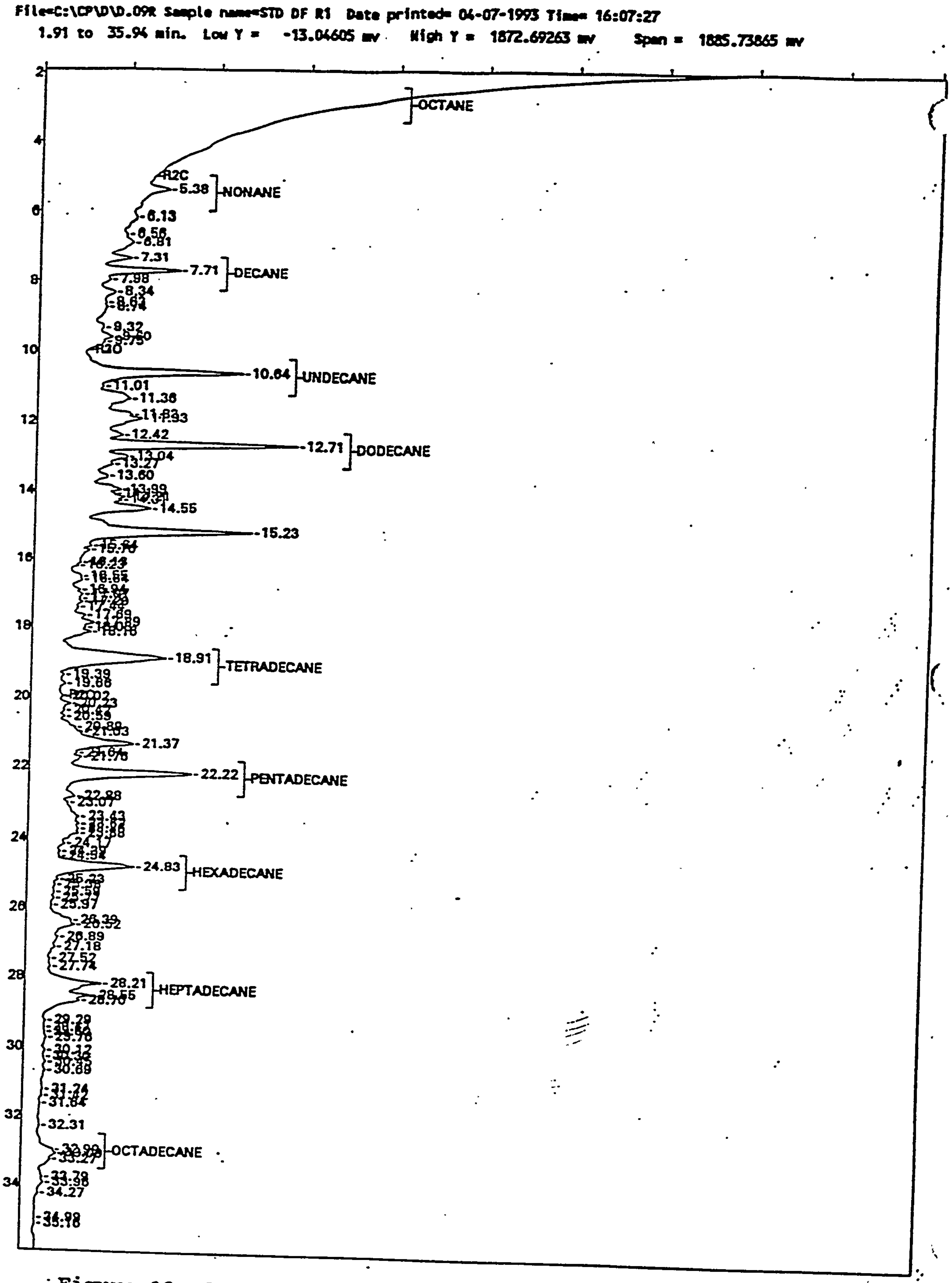

File=C:\CP\D\D.09R Sample name=STD DF R1 Date printed= 04-07-1993 Time= 16:07:27
1.91 to 35.94 min. Low Y = -13.04605 mv High Y = 1872.69263 mv Span = 1885.73865 mv

Figure 12. Gas Chromatogram of Diesel Fuel Standard, Level 1

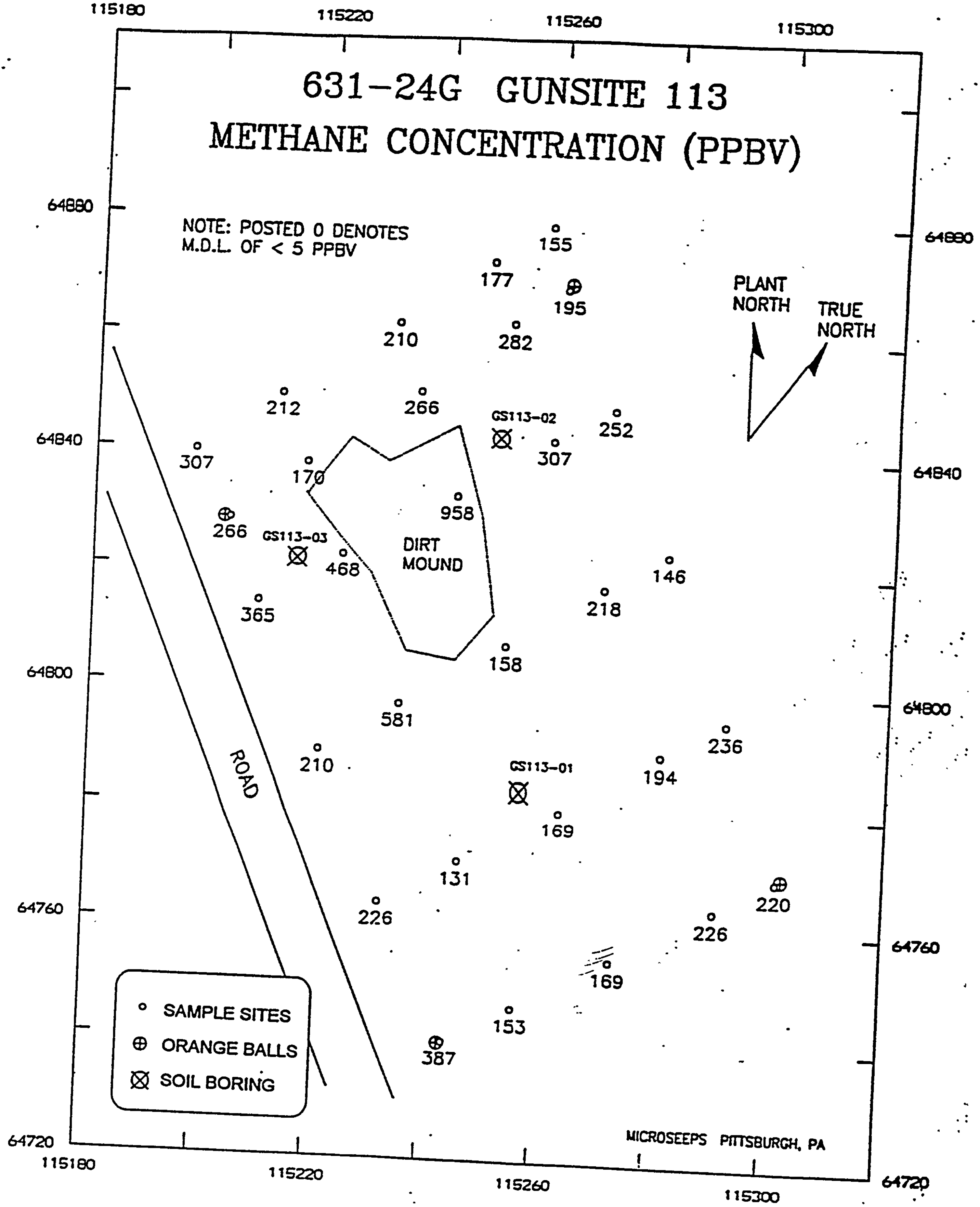


Figure 14. Methane (ppmv) Map

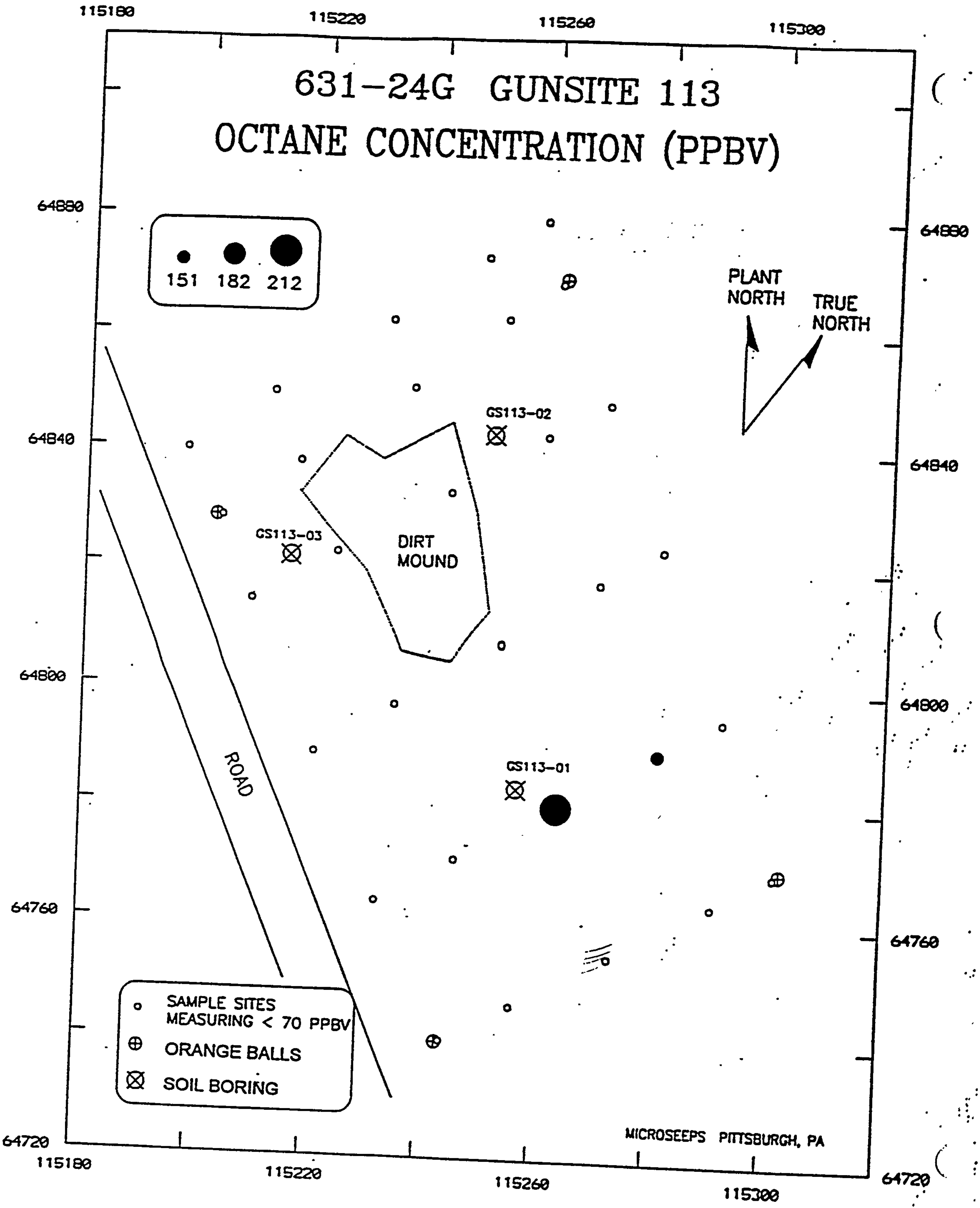


Figure 15. Octane Symbol Map

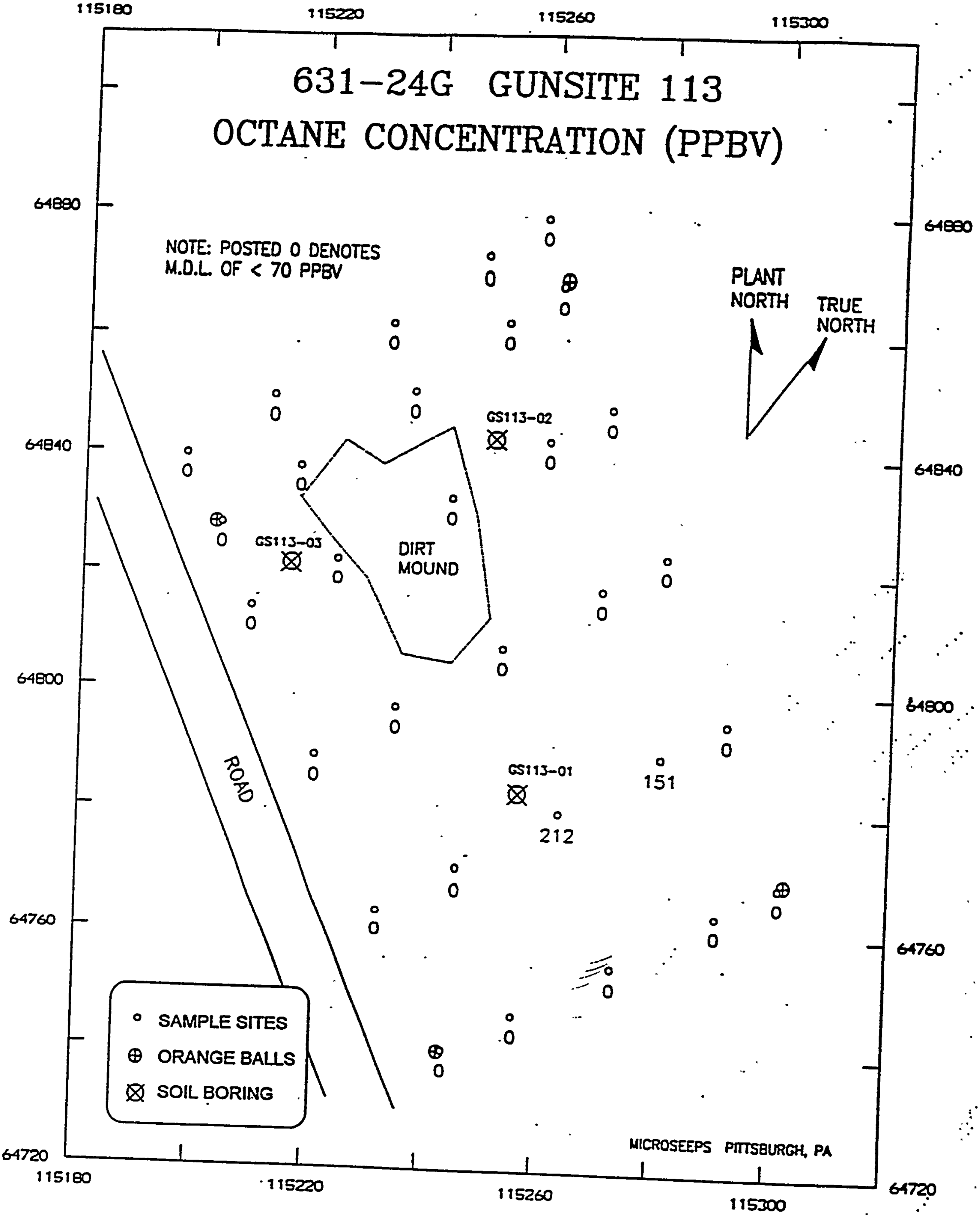


Figure 16. Octane (ppbv) Map

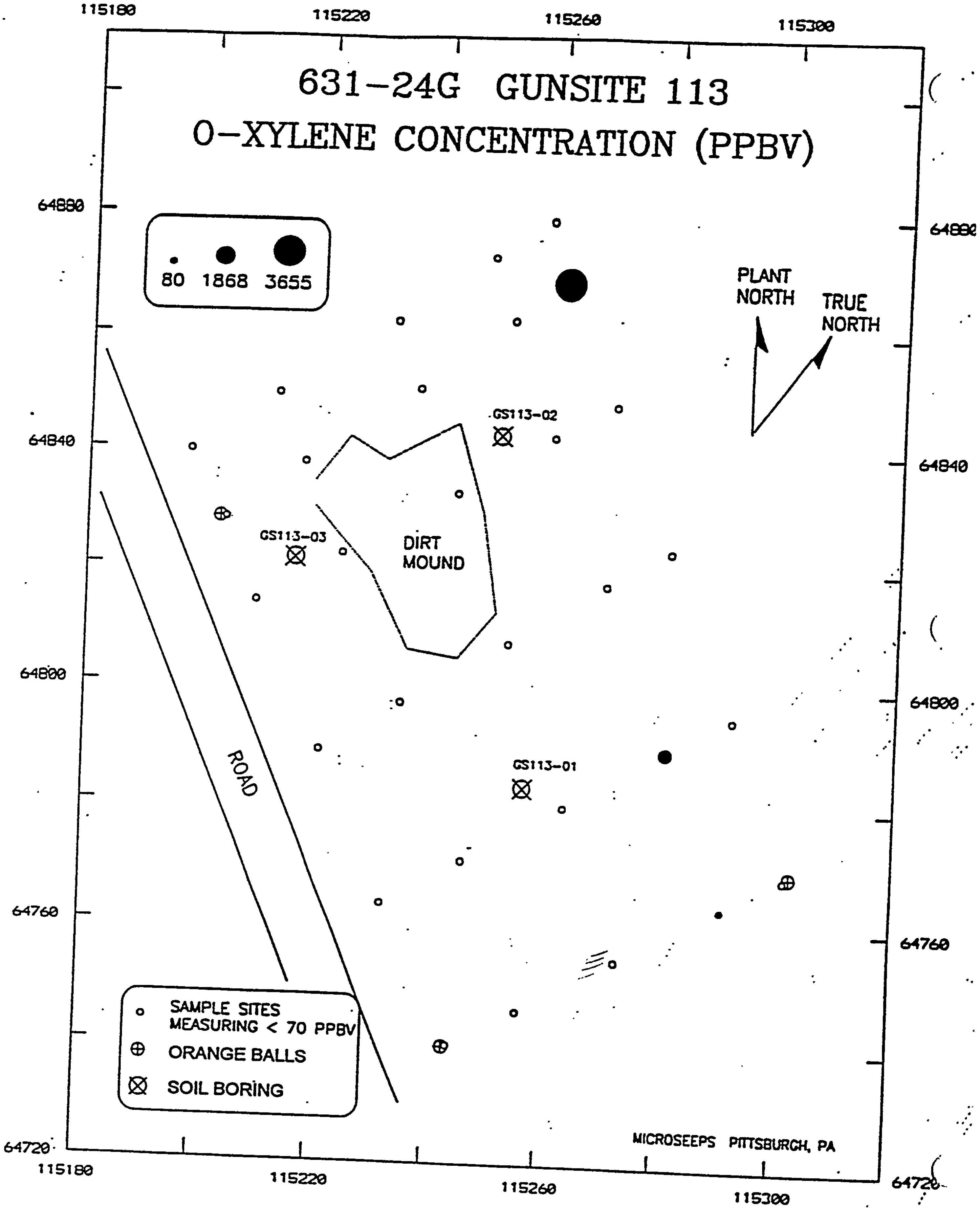


Figure 17. o-Xylene Symbol Map

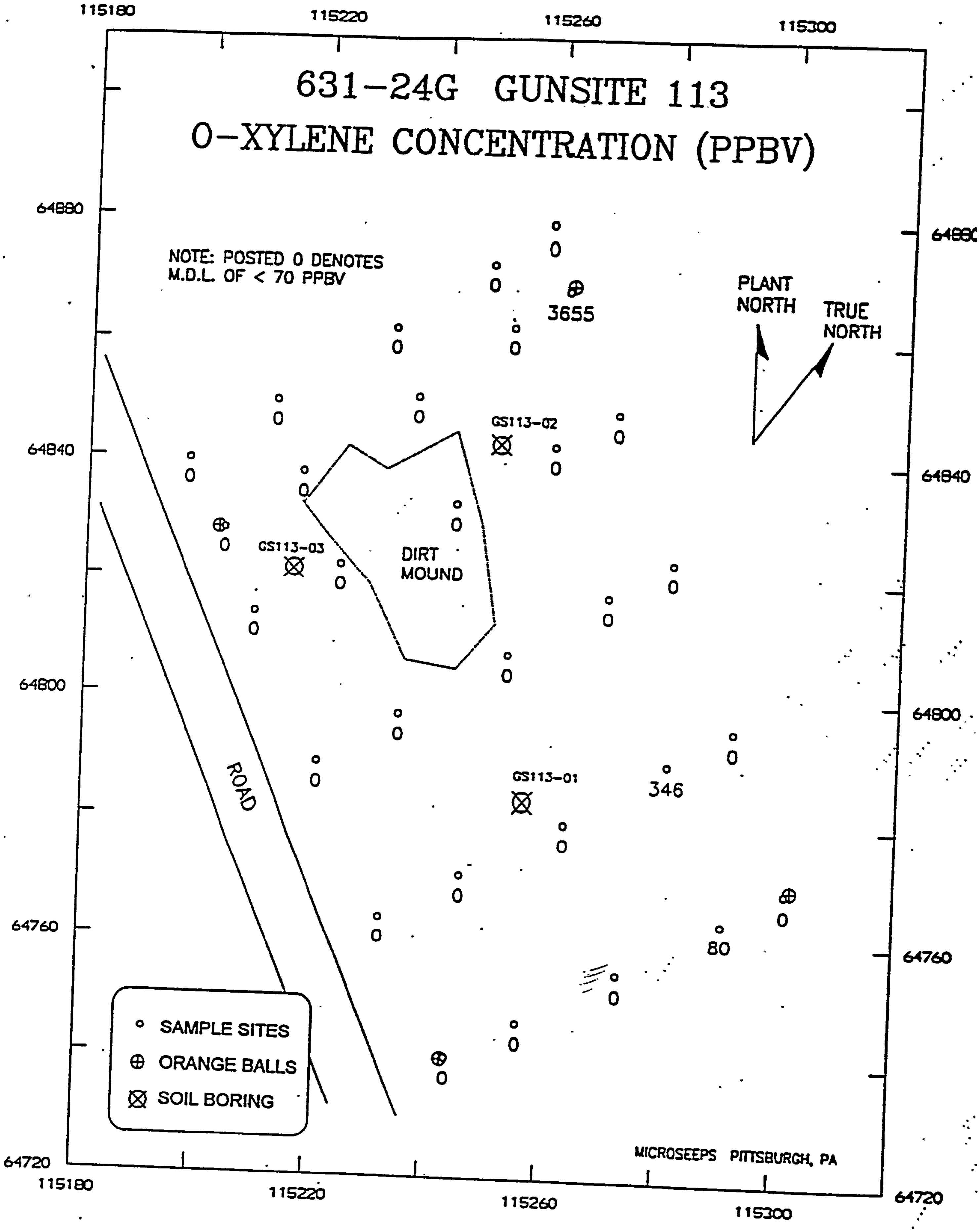


Figure 18. o-Xylene (ppbv) Map

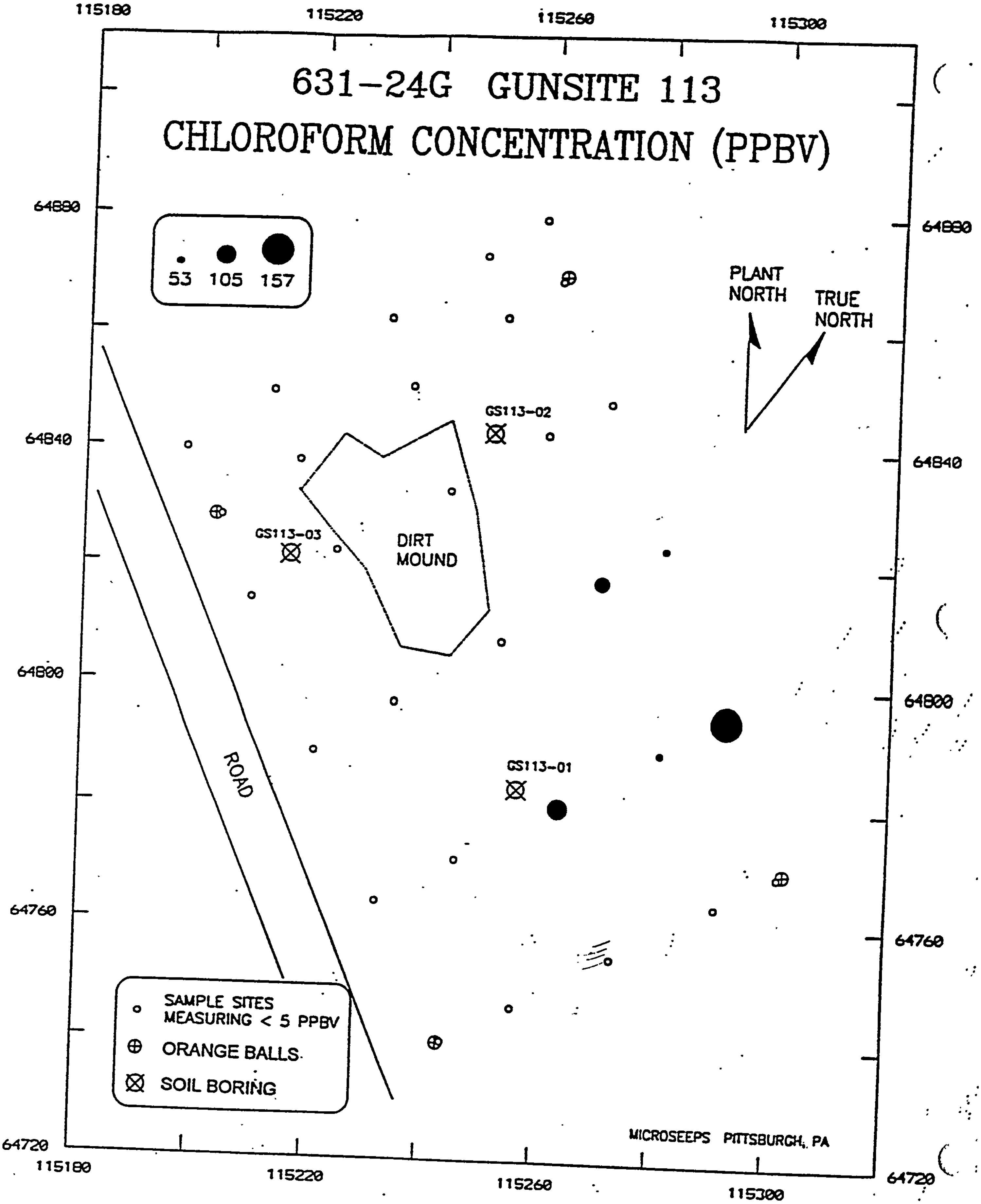


Figure 19. Chloroform Symbol Map

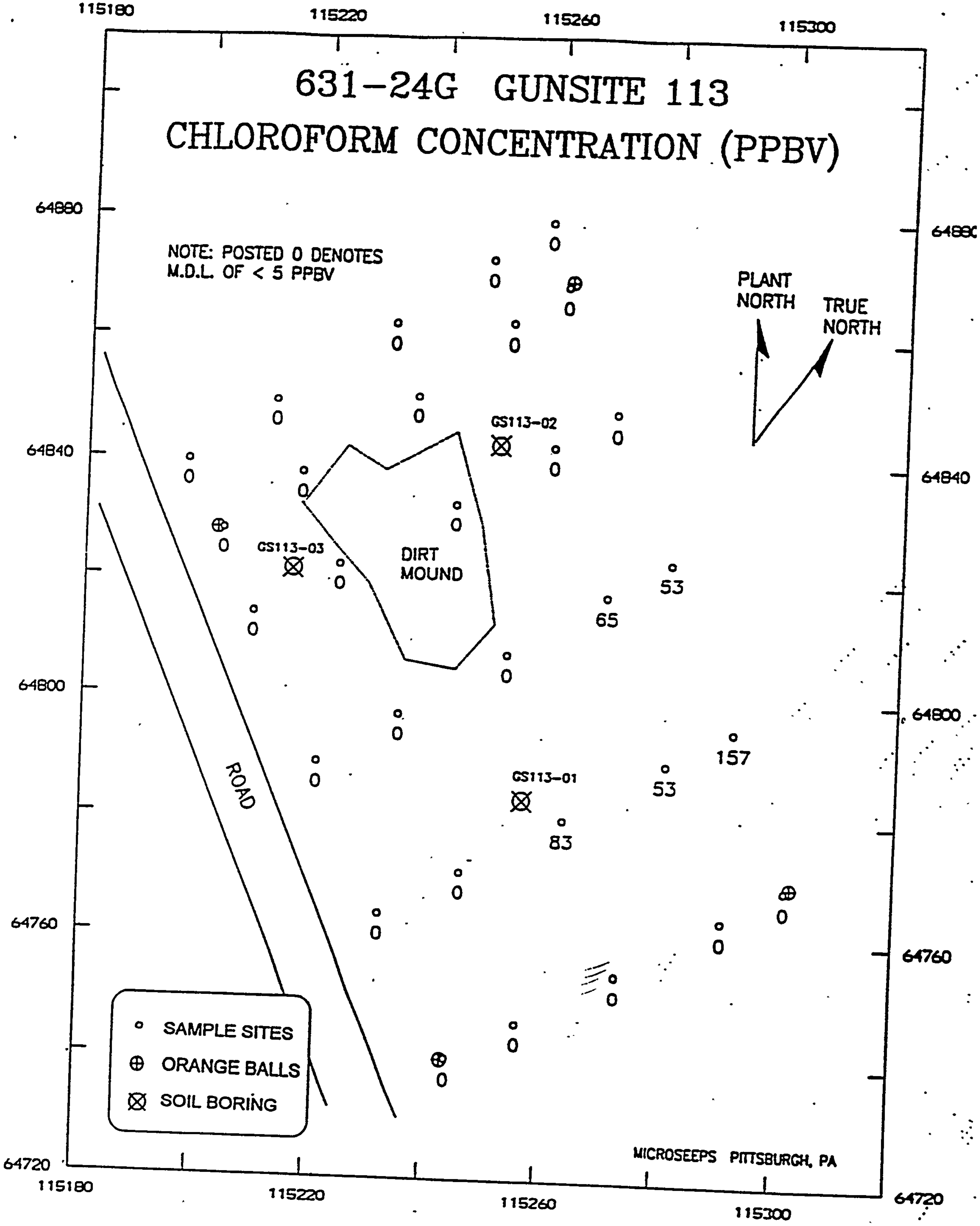


Figure 20. Chloroform (ppbv) Map

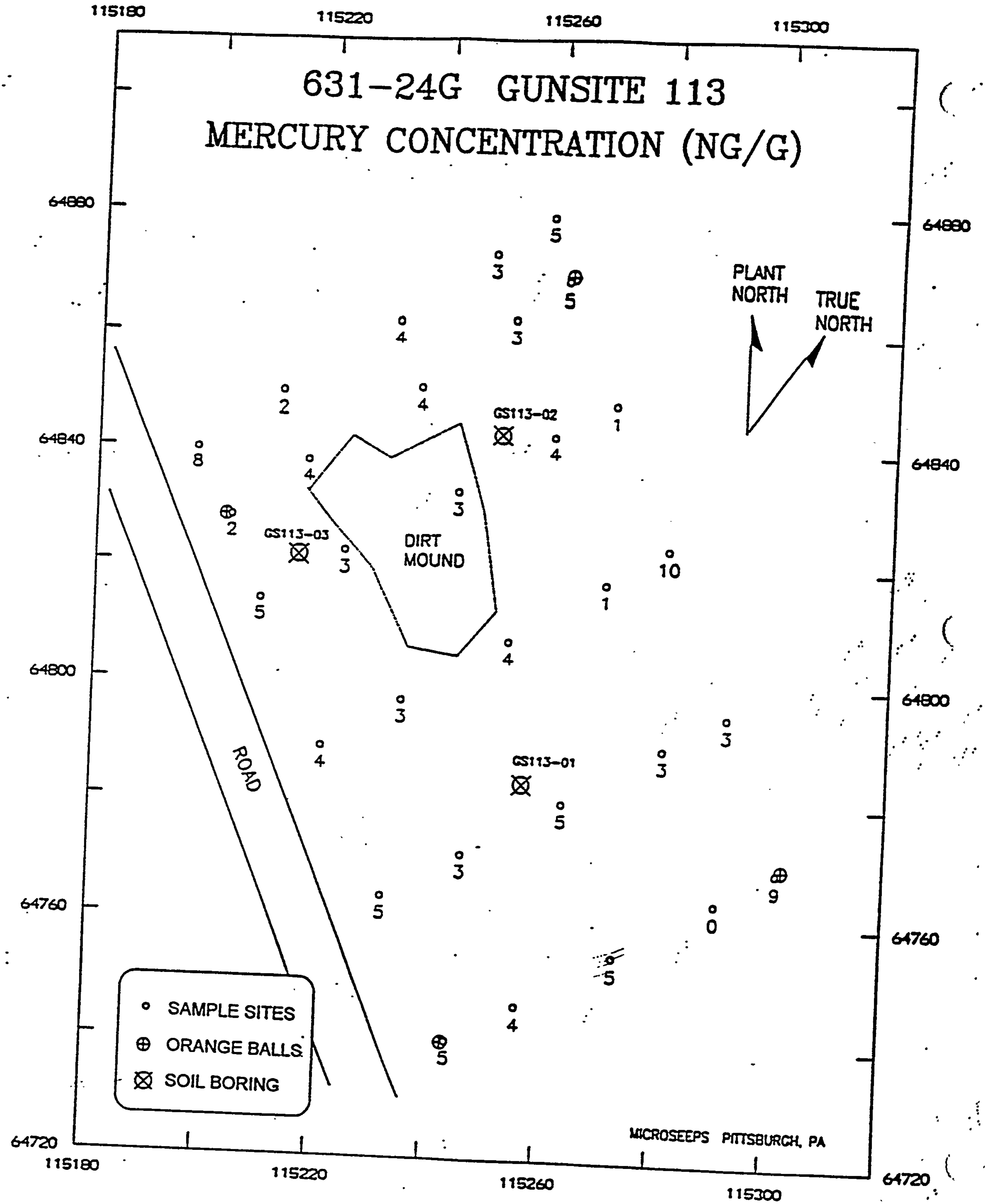


Figure 21. Mercury (ng/g) Map

----- SAVANNAH RIVER SITE -----
----- GUNSITE 113 (631-24G) -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	PENTANE	HEXANE	HEPTANE	BENZENE	OCTANE	TOLUENE	NONANE	ETHYL BENZENE	M&P-XYLENE	O-XYLENE	DECANE
631-24G-1	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-2	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-3	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-4	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-5	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-6	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-7	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-8	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-9	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-10	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-10A	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-11	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-12	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-13	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-14	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-15	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-16	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-17	<.07	<.07	<.07	<.07	0.21	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-18	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-19	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-20	<.07	<.07	<.07	<.07	0.15	<.07	<.07	<.07	<.07	0.08	<.07
631-24G-20A	<.07	<.07	<.07	<.07	0.10	<.07	<.07	<.07	<.07	0.35	<.07
631-24G-21	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-22	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-23	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-24	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-25	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-26	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-27	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	3.66	<.07
631-24G-28	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-29	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-30	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G-30A	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G*SB1	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G*SB2	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07
631-24G*SB3	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07	<.07

Table 1. Hydrocarbon Soil Gas Concentrations and System Blanks at Gunsite 113(631-24G)

----- SAVANNAH RIVER SITE -----
----- GUNSITE 113 (631-24G) -----
----- 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 #
631-24G-1	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 232
631-24G-2	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 233
631-24G-3	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 234
631-24G-4	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 235
631-24G-5	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 236
631-24G-6	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 237
631-24G-7	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 238
631-24G-8	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 239
631-24G-9	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 240
631-24G-10	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 241
631-24G-10A	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 242
631-24G-11	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 246
631-24G-12	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 247
631-24G-13	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 248
631-24G-14	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 249
631-24G-15	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 250
631-24G-16	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 251
631-24G-17	<3	<2	<.1	0.083	<.005	<.005	<.005	<.005	W26 252
631-24G-18	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 253
631-24G-19	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 254
631-24G-20	<3	<2	<.1	0.053	<.005	<.005	<.005	<.005	W26 255
631-24G-20A	<3	<2	<.1	0.041	<.005	<.005	<.005	<.005	W26 256
631-24G-21	<3	<2	<.1	0.065	<.005	<.005	<.005	<.005	W26 260
631-24G-22	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 261
631-24G-23	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 262
631-24G-24	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 263
631-24G-25	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 264
631-24G-26	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 265
631-24G-27	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 266
631-24G-28	<3	<2	<.1	0.053	<.005	<.005	<.005	<.005	W26 267
631-24G-29	<3	<2	<.1	0.157	<.005	<.005	<.005	<.005	W26 268
631-24G-30	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 269
631-24G-30A	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 270
631-24G*SB1	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 230
631-24G*SB2	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 243
631-24G*SB3	<3	<2	<.1	<.005	<.005	<.005	<.005	<.005	W26 257

Table 2. Chlorinated Hydrocarbon Soil Gas Concentrations and System Blanks at Gunsite 113(631-24G)

----- SAVANNAH RIVER SITE -----
----- GUNSITE 113 (631-24G) -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	METHANE (PPBV)	ETHANE (PPBV)	PROPANE (PPBV)	I-BUTANE (PPBV)	N-BUTANE (PPBV)	ETHYLENE (PPBV)	PROPYLENE (PPBV)	MERCURY (ng/g)	SAMPLE NAME
631-24G-1	307	14	5	<5	<5	12	5	8	631-24G-1
631-24G-2	266	20	13	<5	<5	11	13	2	631-24G-2
631-24G-3	365	27	18	<5	<5	20	18	5	631-24G-3
631-24G-4	210	20	11	<5	<5	12	11	4	631-24G-4
631-24G-5	226	18	<5	<5	<5	12	<5	5	631-24G-5
631-24G-6	387	17	5	<5	<5	15	5	5	631-24G-6
631-24G-7	153	16	<5	<5	<5	9	<5	4	631-24G-7
631-24G-8	131	17	8	<5	<5	12	8	3	631-24G-8
631-24G-9	581	18	<5	<5	<5	13	<5	3	631-24G-9
631-24G-10	468	20	7	<5	<5	18	7	3	631-24G-10
631-24G-10A	565	24	11	<5	<5	13	11	3	631-24G-10A
631-24G-11	170	18	<5	<5	<5	13	<5	4	631-24G-11
631-24G-12	212	16	<5	<5	<5	12	<5	2	631-24G-12
631-24G-13	210	17	<5	<5	<5	15	<5	4	631-24G-13
631-24G-14	266	20	10	<5	<5	10	10	4	631-24G-14
631-24G-15	958	88	62	<5	<5	4	62	3	631-24G-15
631-24G-16	158	11	<5	<5	<5	13	<5	4	631-24G-16
631-24G-17	169	14	<5	<5	<5	10	<5	5	631-24G-17
631-24G-18	169	16	9	<5	<5	9	9	5	631-24G-18
631-24G-19	226	24	20	<5	<5	17	20	<1	631-24G-19
631-24G-20	194	13	5	<5	<5	11	6	3	631-24G-20
631-24G-20A	194	16	<5	<5	<5	10	<5	3	631-24G-20A
631-24G-21	218	18	13	<5	<5	13	9	1	631-24G-21
631-24G-22	307	41	14	<5	<5	26	26	4	631-24G-22
631-24G-23	282	26	14	<5	<5	17	18	3	631-24G-23
631-24G-24	177	20	8	<5	<5	13	10	3	631-24G-24
631-24G-25	155	14	<5	<5	<5	12	<5	5	631-24G-25
631-24G-26	195	18	106	<5	<5	11	6	5	631-24G-26
631-24G-27	252	23	8	<5	<5	14	8	1	631-24G-27
631-24G-28	146	14	9	<5	<5	10	7	10	631-24G-28
631-24G-29	236	7	<5	<5	<5	6	<5	3	631-24G-29
631-24G-30	220	11	<5	<5	<5	7	<5	9	631-24G-30
631-24G-30A	203	11	6	<5	<5	8	<5	7	631-24G-30A
631-24G*SB1	1815	12	6	<5	<5	6	<5		
631-24G*SB2	1888	9	<5	<5	<5	<5	<5		
631-24G*SB3	1890	9	<5	<5	<5	<5	<5		

Table 3. Light Hydrocarbon Soil Gas Concentrations, Mercury Concentrations and System Blanks at Gunsite 113(631-24G)

MICROSEEPS

----- WESTINGHOUSE SAVANNAH RIVER COMPANY -----
----- GUNSITE 113 (631-24G) -----
----- GAS CONCENTRATIONS IN PPM BY WEIGHT -----

SAMPLE NAME	UN-DECANE	DO-DECANE	TETRA-DECANE	PENTA-DECANE	HEXA-DECANE	HEPTA-DECANE	OCTA-DECANE	TOTAL C11-C18	FILE NAME
631-24G-1	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.12
631-24G-2	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.13
631-24G-3	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.14
631-24G-4	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.16
631-24G-5	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.17
631-24G-6	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.18
631-24G-7	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.19
631-24G-8	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.20
631-24G-9	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.21
631-24G-10	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.22
631-24G-11	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.23
631-24G-12	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.25
631-24G-13	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.26
631-24G-14	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.27
631-24G-15	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.28
631-24G-16	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.29
631-24G-17	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.30
631-24G-18	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.31
631-24G-19	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.33
631-24G-20	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.34
631-24G-21	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.35
631-24G-22	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.36
631-24G-23	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.37
631-24G-24	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.38
631-24G-25	<.40	<.40	<.40	<.40	<.40	<.40	<.40	0.44	D.40
631-24G-26	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.41
631-24G-27	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.42
631-24G-28	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.44
631-24G-29	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.45
631-24G-30	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.46
BLANK	<.40	<.40	<.40	<.40	<.40	<.40	<.40	<.40	D.15

Table 4. Diesel Range Hydrocarbon Concentrations in Soil Cores and System Blanks at Gunsite 113(631-24G)

— 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	0.0125
CHLOROFORM	1356.81	131.80	13.14	1.31	0.131	0.0131
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 5. VOC Prepared "K4" Standard Concentrations

----- FEBRUARY, 1993 (W26) 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	W26 179	NA	NA	<ND	0.119	0.069	0.089	0.066	0.083	0.165	0.089	0.054
STD K4 R5	BS	W26 428	NA	NA	<ND	0.117	0.066	0.086	0.062	0.077	0.183	0.085	0.056
STD K4 R4	ALL	W26 12	NA	NA	0.719	1.169	0.664	0.998	0.614	0.885	1.774	0.883	0.588
STD K4 R4	ALL	W26 25	NA	NA	0.719	1.174	0.66	1.014	0.621	0.893	1.788	0.882	0.591
STD K4 R4	131-4L	W26 28	NA	NA	0.611	1.213	0.659	1.012	0.618	0.882	1.775	0.876	0.595
STD K4 R4	131-4L	W26 52	NA	NA	0.714	1.136	0.652	0.984	0.596	0.85	1.705	0.848	0.578
STD K4 R4	ALL	W26 74	NA	NA	0.608	1.066	0.609	0.948	0.581	0.84	1.697	0.837	0.564
STD K4 R4	ALL	W26 83	NA	NA	0.623	1.085	0.618	0.965	0.589	0.848	1.715	0.853	0.567
STD K4 R4	643-7E	W26 120	NA	NA	0.624	1.092	0.613	0.958	0.577	0.839	1.673	0.835	0.539
STD K4 R4	ALL	W25 149	NA	NA	0.611	1.092	0.616	0.962	0.602	0.862	1.73	0.852	0.575
STD K4 R4	ALL	W26 175	NA	NA	0.637	1.122	0.642	0.991	0.606	0.875	1.768	0.871	0.589
STD K4 R4	ALL	W26 177	NA	NA	0.624	1.114	0.628	0.98	0.6	0.866	1.764	0.865	0.583
STD K4 R4	ALL	W26 180	NA	NA	0.626	1.106	0.634	0.974	0.6	0.867	1.752	0.874	0.587
STD K4 R4	ALL	W26 196	NA	NA	0.669	1.138	0.652	1.002	0.621	0.886	1.796	0.938	0.593
STD K4 R4	ALL	W26 205	NA	NA	0.643	1.372	0.628	0.985	0.6	0.871	1.75	0.881	0.583
STD K4 R4	ALL	W26 210	NA	NA	0.619	1.073	0.612	0.946	0.583	0.847	1.702	0.853	0.567
STD K4 R4	631-24G	W26 227	NA	NA	0.628	1.09	0.632	0.966	0.593	0.868	1.734	0.869	0.581
STD K4 R4	631-24G	W26 258	NA	NA	0.608	1.074	0.61	0.93	0.566	0.822	1.644	0.832	0.521
STD K4 R4	643-7E	W26 285	NA	NA	0.616	1.075	0.626	0.941	0.585	0.853	1.714	0.844	0.561
STD K4 R4	643-7E	W26 308	NA	NA	0.618	1.093	0.612	0.946	0.574	0.843	1.677	0.838	0.534
STD K4 R4	BS	W26 334	NA	NA	0.584	1.051	0.595	0.906	0.555	0.802	1.615	0.806	0.512
STD K4 R4	ALL	W26 349	NA	NA	0.612	1.068	0.61	0.932	0.567	0.834	1.681	0.836	0.558
STD K4 R4	BS	W26 386	NA	NA	0.719	1.169	0.646	0.951	0.56	0.79	1.569	0.781	0.49[illegible]
STD K4 R4	BS	W26 413	NA	NA	0.596	1.056	0.602	0.945	0.58	0.829	1.647	0.853	0.551
STD K4 R4	ALL	W26 446	NA	NA	0.626	1.11	0.624	0.964	0.588	0.849	1.71	0.842	0.558
MEAN	....	....	....	....	0.64	1.12	0.63	0.97	0.59	0.85	1.71	0.85	0.56
STD DEV	....	....	....	....	0.04	0.07	0.02	0.03	0.02	0.03	0.06	0.03	0.03
% STD DEV	....	....	....	....	6.32	6.07	3.11	2.80	3.15	3.00	3.29	3.50	4.86
STD K4 R3	131-4L	W26 40	9.24	NA	7.294	11.976	6.622	10.1	6.116	8.832	17.637	8.872	5.737
STD K4 R3	643-7E	W26 137	8.764	NA	6.869	11.14	6.228	9.451	5.707	8.255	16.419	8.286	5.281
STD K4 R3	ALL	W26 176	8.925	NA	7.068	11.482	6.478	9.842	6.052	8.661	17.394	8.729	5.802
STD K4 R3	ALL	W26 181	8.94	NA	7.063	11.47	6.468	9.823	6.05	8.662	17.385	8.716	5.781
STD K4 R3	631-24G	W26 244	8.953	NA	6.937	11.249	6.311	9.589	5.824	8.417	16.79	8.446	5.439
STD K4 R3	643-7E	W26 321	8.499	NA	6.531	10.645	5.931	9.001	5.393	7.843	15.618	7.868	4.923
STD K4 R3	BS	W26 399	8.858	NA	6.864	11.157	6.29	9.55	5.877	8.435	16.95	8.49	5.628
STD K4 R3	ALL	W26 456	8.711	NA	6.879	11.186	6.271	9.521	5.811	8.353	16.757	8.418	5.48
MEAN	....	....	8.86	NA	6.94	11.29	6.32	9.61	5.85	8.43	16.87	8.48	5.51
STD DEV	....	....	0.20	NA	0.21	0.36	0.19	0.31	0.22	0.29	0.60	0.29	0.28
% STD DEV	....	....	2.28	NA	2.97	3.15	3.07	3.18	3.74	3.38	3.58	3.46	5.08

Table 6. Analyses of VOC Standard "K4": Hydrocarbons

----- FEBRUARY, 1993 (W26) STANDARDS -----
----- GAS CONCENTRATIONS IN (PPMV) -----

STANDARD NAME	AREA	GC CYCLE	PENTANE	HEXANE	HEPTANE	BENZENE	OCTANE	TOLUENE	NONANE	ETHYL BENZENE	M&P-XYLENE	O-XYLENE	DECAN
STD 220	ALL	W26 14	40.93	40.81	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	131-4L	W26 30	91.46	93.87	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	131-4L	W26 51	91.85	94.85	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W26 82	90.87	94.10	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	643-7E	W26 121	91.49	94.19	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	643-7E	W26 138	91.55	95.04	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W26 197	93.14	97.47	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W26 206	92.29	95.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W26 211	90.68	92.93	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	631-24G	W26 245	91.47	94.86	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W26 278	91.42	95.49	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W26 350	91.49	94.39	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	BS	W26 358	91.37	95.04	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	BS	W26 400	91.78	95.32	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	BS	W26 429	91.37	95.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W26 442	88.33	89.54	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD 220	ALL	W26 457	89.70	93.46	NA	NA	NA	NA	NA	NA	NA	NA	NA
MEAN			88.30	91.26	NA	NA	NA	NA	NA	NA	NA	NA	NA
STD DEV			1.22	1.71									
% STD DEV			1.38	1.88									
STD 224	ALL	W26 295	900.098	997.884	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6. Analyses of VOC Standard "K4": Hydrocarbons

----- FEBRUARY, 1993 (W26) 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	643-7E	W26 294	NA	NA	NA	0.014	0.053	0.011	0.012	0.011
STD K4 R6	BS	W26 373	NA	NA	NA	0.013	0.027	0.011	0.011	0.010
STD K4 R5	ALL	W26 179	NA	NA	0.15	0.138	0.116	0.117	0.129	0.113
STD K4 R5	BS	W26 428	NA	NA	0.14	0.138	0.142	0.117	0.123	0.107
STD K4 R4	ALL	W26 12	NA	1.64	1.48	1.363	1.202	1.138	1.258	1.104
STD K4 R4	ALL	W26 25	NA	1.78	1.40	1.322	1.159	1.114	1.237	1.087
STD K4 R4	131-4L	W26 28	NA	2.09	1.52	1.367	1.166	1.142	1.286	1.113
STD K4 R4	131-4L	W26 52	NA	1.55	1.45	1.329	1.096	1.130	1.240	1.082
STD K4 R4	ALL	W26 74	NA	1.29	1.23	1.231	1.024	1.029	1.145	1.028
STD K4 R4	ALL	W26 83	NA	1.34	1.28	1.261	1.034	1.046	1.191	1.059
STD K4 R4	643-7E	W26 120	NA	1.31	1.32	1.379	1.095	1.104	1.221	1.070
STD K4 R4	ALL	W26 149	NA	1.36	1.33	1.339	1.059	1.101	1.234	1.089
STD K4 R4	ALL	W26 175	NA	1.39	1.41	1.417	1.146	1.138	1.302	1.131
STD K4 R4	ALL	W26 177	NA	1.42	1.31	1.327	1.065	1.074	1.216	1.075
STD K4 R4	ALL	W26 180	NA	1.32	1.30	1.314	1.058	1.078	1.209	1.076
STD K4 R4	ALL	W26 196	NA	1.55	1.37	1.402	1.172	1.135	1.282	1.121
STD K4 R4	ALL	W26 205	NA	1.47	1.30	1.316	1.136	1.092	1.219	1.084
STD K4 R4	ALL	W26 210	NA	1.45	1.34	1.344	1.113	1.103	1.244	1.095
STD K4 R4	631-24G	W26 227	NA	1.35	1.34	1.352	1.169	1.117	1.255	1.104
STD K4 R4	631-24G	W26 258	NA	1.28	1.32	1.333	1.105	1.097	1.201	1.050
STD K4 R4	643-7E	W26 285	NA	1.40	1.35	1.385	1.158	1.129	1.264	1.111
STD K4 R4	643-7E	W26 308	NA	1.29	1.37	1.410	1.203	1.139	1.261	1.096
STD K4 R4	BS	W26 334	NA	1.33	1.38	1.401	1.129	1.122	1.248	1.078
STD K4 R4	ALL	W26 349	NA	1.33	1.33	1.378	1.137	1.122	1.244	1.097
STD K4 R4	BS	W26 386	NA	1.67	1.55	1.399	1.203	1.212	1.262	1.063
STD K4 R4	BS	W26 413	NA	1.46	1.30	1.346	1.095	1.102	1.198	1.060
STD K4 R4	ALL	W26 446	NA	1.80	1.40	1.446	1.144	1.153	1.287	1.115
MEAN	....			1.47	1.37	1.355	1.125	1.114	1.239	1.086
STD DEV	....			0.20	0.08	0.049	0.052	0.037	0.036	0.024
% STD DEV	....			13.55	5.51	3.594	4.592	3.285	2.873	2.235
STD K4 R3	131-4L	W26 40	NA	17.23	14.95	13.656	11.184	10.841	12.547	10.837
STD K4 R3	643-7E	W26 137	NA	15.05	14.91	13.940	11.161	10.856	12.473	9.485
STD K4 R3	ALL	W26 176	NA	15.42	14.83	13.693	11.024	10.858	12.575	10.034
STD K4 R3	ALL	W26 181	NA	15.34	14.32	13.463	10.853	11.362	12.337	9.948
STD K4 R3	631-24G	W26 244	NA	15.01	15.23	13.902	11.320	11.316	12.710	9.592
STD K4 R3	643-7E	W26 321	NA	14.49	14.77	13.592	11.023	10.021	12.175	9.083
STD K4 R3	BS	W26 399	NA	15.08	14.93	13.917	11.223	10.878	12.642	9.743
STD K4 R3	ALL	W26 456	NA	15.39	15.27	14.096	11.311	10.201	12.624	9.776
MEAN	....			15.38	14.90	13.782	11.137	10.792	12.510	9.812
STD DEV	....			0.75	0.28	0.199	0.150	0.442	0.166	0.476
% STD DEV	....			4.91	1.85	1.446	1.348	4.094	1.324	4.849

Table 7. Analyses of VOC Standard "K4": Chlorinated Hydrocarbons

----- FEBRUARY, 1993 (W26) 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 VC-99.6	131-4L	W26 29	96.49	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	ALL	W26 50	96.71	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	643-7E	W26 124	96.58	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	ALL	W26 164	94.75	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	ALL	W26 188	95.08	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	ALL	W26 214	94.26	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	631-24G	W26 231	97.49	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	631-24G	W26 259	95.45	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	643-7E	W26 286	96.95	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	BS	W26 361	95.83	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	BS	W26 387	96.07	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	BS	W26 414	95.70	NA	NA	NA	NA	NA	NA	NA
STD VC-99.6	ALL	W26 445	94.19	NA	NA	NA	NA	NA	NA	NA
MEAN	....		95.81	....						
STD DEV	....		1.00	....						
% STD DEV	....		1.04	....						

Table 7. Analyses of VOC Standard "K4": Chlorinated Hydrocarbons

— SAVANNAH RIVER SITE —
— STANDARD "M" ANALYSIS FOR 631-24G (GUNSITE 113) —

SAMPLE	RUN #	DATE ANALYZED	METHANE PPBV	ETHANE PPBV	PROPANE PPBV	I-BUTANE PPBV	N-BUTANE PPBV	ETHYLENE PPBV	PROPYLENE PPBV
STD M	513	1-29-93	10446	1050	1052	1048	1070	1051	1060
STD M	514	1-29-93	10207	1022	1019	1018	1032	1021	1030
STD M	515	1-29-93	10137	1018	1018	1018	1021	1018	1021
STD M	526	1-29-93	10146	1020	1021	1018	1024	1019	1018
STD M	537	1-29-93	10087	1008	1005	1005	1022	1008	1008
STD M	549	1-30-93	10043	1005	998	1004	999	1008	995
STD M	550	1-30-93	10054	1009	1011	1008	994	1008	1004
STD M	558	1-30-93	10074	1008	1006	1014	1022	1008	1011
STD M	577	1-30-93	10075	1000	1000	998	982	1000	1007
STD M	588	1-30-93	10005	1003	1002	995	997	1004	1007
STD M	590	2-5-93	10584	1061	1058	1067	1052	1073	1076
STD M	591	2-5-93	10624	1063	1062	1056	1045	1077	1072
		MEAN	10207	1022	1021	1021	1022	1025	1026
		STD DEV	209	22	22	22	25	26	27
		% STD DEV	2.04	2.13	2.18	2.20	2.43	2.52	2.61

Table 8. Analyses of Light Hydrocarbon Standard "M"

----- WESTINGHOUSE SAVANNAH RIVER COMPANY -----
----- GUNSITE 113 (631-24G) -----
----- GAS CONCENTRATIONS IN PPM BY WEIGHT -----

SAMPLE NAME	UN-DECANE	DO-DECANE	TETRA-DECANE	PENTA-DECANE	HEXA-DECANE	HEPTA-DECANE	OCTA-DECANE	TOTAL C11-C18	FILE NAME
STD D R3	1.88	8.77	3.26	1.74	3.53	1.51	0.29	NA	D.08A
STD D R3	2.32	9.44	3.44	1.62	3.15	1.36	0.44	NA	D.24A
STD D R3	1.86	8.17	3.09	1.50	3.01	1.36	0.47	NA	D.39A
MEAN	2.02	8.79	3.26	1.62	3.23	1.41	0.40	NA	
STD DEV	0.21	0.52	0.14	0.10	0.22	0.07	0.08	NA	
% STD DEV	10.51	5.90	4.38	6.05	6.80	5.01	19.69	NA	
STD DF R3	NA	NA	NA	NA	NA	NA	NA	22.36	D.43

Table 9. Analyses of Diesel Range Hydrocarbon Standard

— SAVANNAH RIVER SITE —
— MINIMUM DETECTION LEVELS for 631-24G (GUNSITE 113) —
— 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 DICHLOROETHYLENE	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 10. Minimum Detection Levels

----- SAVANNAH RIVER SITE -----
-----DATA DIRECTORY D26 BLANKS -----
----- SOIL GAS CONCENTRATIONS (PPMV) -----

SAMPLE NAME	PENTANE	HEXANE	HEPTANE	BENZENE	OCTANE	TOLUENE	NONANE	ETHYL BENZENE	M&P-XYLENE	O-XYLENE	DECANE
131-4L*SB5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
131-4L*SB6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
131-4L*SB7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
643-7E*SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
643-7E*SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
643-7E*SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
643-7E*SB4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
643-7E*SB5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
643-7E*SB6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
631-24G*SB1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
631-24G*SB2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
631-24G*SB3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BS*SB1X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BS*SB2X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BS*SB3X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BS*SB4X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BS*SB5X	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.054	ND
BS*SB6X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BS*SB7X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AVERAGE	0.040	0.033	0.026	0.032	0.023	0.028	0.021	0.024	0.025	0.026	0.020
STD DEV	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000
AVG+2STD DEV	0.040	0.033	0.026	0.032	0.023	0.028	0.021	0.024	0.025	0.039	0.020

Table 11. System Blanks for Data Director D26: a) Hydrocarbons

----- SAVANNAH RIVER SITE -----
-----DATA DIRECTORY D26 BLANKS -----
----- 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
131-4L*SB5	ND	ND	ND	ND	ND	ND	ND	ND	W26 34
131-4L*SB6	ND	ND	ND	ND	ND	ND	ND	ND	W26 39
131-4L*SB7	ND	ND	ND	ND	ND	ND	ND	ND	W26 63
643-7E*SB1	ND	ND	ND	ND	ND	ND	ND	ND	W26 123
643-7E*SB2	ND	ND	ND	ND	ND	ND	ND	ND	W26 136
643-7E*SB3	ND	ND	ND	ND	ND	ND	ND	ND	W26 293
643-7E*SB4	ND	ND	0.008	ND	0.001	ND	ND	0.001	W26 307
643-7E*SB5	ND	ND	ND	ND	ND	ND	ND	ND	W26 320
643-7E*SB6	ND	ND	ND	ND	ND	ND	ND	ND	W26 333
631-24G*SB1	ND	ND	ND	ND	0.001	ND	ND	ND	W26 230
631-24G*SB2	ND	ND	ND	ND	ND	ND	ND	ND	W26 243
631-24G*SB3	ND	ND	ND	ND	ND	ND	ND	ND	W26 257
BS*SB1X	0.018	ND	ND	ND	ND	ND	ND	ND	W26 360
BS*SB2X	0.018	ND	0.008	ND	0.001	ND	ND	ND	W26 372
BS*SB3X	0.017	ND	ND	ND	ND	ND	ND	ND	W26 385
BS*SB4X	0.018	ND	ND	ND	ND	ND	ND	ND	W26 398
BS*SB5X	ND	ND	ND	ND	ND	ND	ND	ND	W26 412
BS*SB6X	ND	ND	0.009	ND	ND	ND	ND	ND	W26 427
BS*SB7X	0.012	ND	ND	ND	ND	ND	ND	ND	W26 439
AVERAGE	0.078	0.030	0.011	0.00019	0.00022	0.00004	0.00015	0.00010	
STD DEV	0.037	0.000	0.001	0.00000	0.00034	0.00000	0.00000	0.00021	
AVG+2STD DEV	0.152	0.030	0.013	0.00019	0.00090	0.00004	0.00015	0.00052	

Table 11. System Blanks for Data Director D26: b) Chlorinated Hydrocarbons

APPENDIX I

SAMPLING METHODS

SAMPLING METHOD

SM1

SOIL GAS PROBE SAMPLING

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.

SAMPLING METHOD

SM4

SOIL GAS PROBE SAMPLING

SAMPLING METHOD SM4

SOIL PLUG SAMPLING FOR MERCURY

Soil plugs of 6 inches in length are collected between the depths of 12 and 18 inches. A 1.25 inch stainless steel pipe is driven 12 inches, removed from the hole and the 12 inch core discarded. The pipe is re-inserted into the hole and the 6 inch soil plug is obtained between 12 and 18 inches.

A portion of this six inch soil plug is then placed directly into a plastic sample bag and labeled. A duplicate sample is collected for every 10 sites.

A field collection log is maintained which lists the sample name, date and time of collection, collection sequence number, sample depth, sample type, and comments.

APPENDIX I

ANALYTICAL METHODS

ANALYTICAL METHOD

AM1

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

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 dilution.

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

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.

ANALYTICAL METHOD

AM8

ANALYSIS OF MOBILE MERCURY IN SOILS

ANALYTICAL METHOD AM8

ANALYSIS OF MOBILE MERCURY IN SOILS

1.0 Scope and Application

1.1 Method AM8 is used to determine the concentration of mobile (low temperature, adsorbed) mercury in soil samples.

1.2 This method is recommended for use by, or under the supervision of, analysts experienced in the operation of mercury analyzers and in the interpretation of mercury concentration data.

2.0 Summary of Method

2.1 Mobile (low temperature, adsorbed) mercury is analyzed using a Jerome Model 411 Gold Film Mercury Analyzer. A weighed soil sample (dried and sieved < 35 mesh) is placed in a silica test tube (6 mm id x 65mm) which has the bottom inside surface coated with a thin gold film. The soil in the tube is heated at 175 degrees centigrade for 1 hour. The soil is then discarded and each tube is heated individually to 600 degrees centigrade in a resistance heater. At 600 degrees C, vapors in the tube are caused to flow into the mercury analyzer where mercury is adsorbed onto the calibrated gold film . This gold film changes resistance proportional to the amount of mercury adsorbed. The resistance change is converted to weight of mercury adsorbed.

3.0 Interferences

3.1 The analyst should demonstrate that the gold coated test tubes are mercury free before soil is added. This may be accomplished by heating each tube to 600 degrees centigrade and flowing the heated vapors in the tube into the mercury analyzer. Temperature of the tube should be kept at 600 degrees centigrade until no mercury is detected on successive analyses.

3.2 In order to prevent interferences from sulfur gases, other compounds generated when soil is heated, and dust, the analyst should ensure that Malcosorb and dust filters are connected in series with the analyzer as shown in the instrument operation manual.

3.3 The analyst should demonstrate that the system is mercury free at the beginning of the analysis of a sample set. This may be accomplished by heating an uncoated test tube to 600 degrees centigrade and flowing the heated vapors into the analyzer for measurement. The temperature should be maintained and the flow should be repeated until no mercury is detected on successive runs.

3.4 The analyst should regularly check the status of the gold film detector and burn of the accumulated mercury when appropriate.

4.0 Materials and Equipment

4.1 Sample test tubes: fused silica (6 mm id x 65 mm) with bottom half of inner surface coated with a thin gold film.

4.2 Heating block: aluminum block (12 x 12 x 2.5 inches) with sixty four 5/16 x 2 inch holes for holding gold coated silica tubes.

4.3 Hot plate: Thermodyne Sybron, Model 2200

4.4 Resistance heater: Nichrome wire coil to hold one silica test tube and heat to 600 degrees centigrade.

4.5 Mercury Analyzer: Jerome Model 411 Gold Film Mercury Analyzer including Malcosorb and dust filters.

4.6 Balance: Fisher Model 50 with +/- 0.005 gram accuracy.

5.0 Sample Preparation and Analysis

5.1 Sample test tube preparation: All sample test tubes should meet specifications as noted in sections 3.1 and 4.1 above.

5.2 The sample should be air dried overnight(8-10 hours), then sieved using a 35 mesh sieve. The < 35 mesh fraction should be collected, placed in a clean sample envelope and labeled.

5.3 A weighed, 0.25 - 0.50 gram, portion of the dried, sieved soil sample is placed into a gold coated silica test tube and the test tube number is recorded with the sample number.

5.4 The gold coated silica test tubes containing the weighed, sieved soil samples are placed in the heating block (4.2) and heated to 175 degrees centigrade for 1 hour.

5.5 After removal from the heating block, the soil is discarded from the gold coated silica test tubes. Excess dust may be removed from the vial with compressed air at room temperature.

5.6 Each empty gold coated silica tube is heated to 600 degrees centigrade in the resistance heater and the mercury vapor is caused to flow into the analyzer where it is absorbed on the gold film.

5.7 The change in film resistance is recorded as the number of counts which may be related to the amount of mercury absorbed.

6.0 Standards and Calibrations

6.1 Calibration of the mercury analyzer is achieved by injecting a known amount of mercury vapor directly into a stream of air flowing into the analyzer.

6.2 Mercury metal is maintained at known temperature inside each of six 125 ml sample bottles which are capped with septa.

6.3 A chart of mercury vapor pressure in air vs temperature is maintained.

6.4 A 1 ml volume of air saturated with mercury vapor at a known temperature from one or more of the 125 ml bottles (6.2) is injected into the input air flow to the analyzer and a reading is taken.

6.5 After three or more such procedures, the analyzer calibration is derived as average counts/ng mercury. Typical range is 5 - 8 counts per ng. mercury.

6.6 The analyst should ensure that each bottle of mercury is left at atmospheric pressure after calibration so that temperature and vapor pressure equilibration can occur before the next use. This is achieved by puncturing the septum with a syringe needle after several calibration volumes are removed from a bottle.

7.0 Quality Control

7.1 The analyzer should be calibrated before and after each set of 50 samples is analyzed.

7.2 The instrument response should not vary by more that 20% between any two successive calibrations.

7.3 One blank gold coated vial should be analyzed with every ten samples. The blank vial should be representative of background contamination that could be obtained in the sample vials.

7.4 The instrument detector status should be monitored and recorded during sample analysis.

ANALYTICAL METHOD 12

ANALYSIS OF DIESEL RANGE HYDROCARBONS
AND
TOTAL DIESEL RANGE HYDROCARBONS
IN SOIL BY PENTANE EXTRACTION AND DIRECT INJECTION

ANALYTICAL METHOD AM12

ANALYSIS OF DIESEL RANGE HYDROCARBONS/TOTAL DIESEL RANGE HYDROCARBONS IN SOIL USING PENTANE EXTRACTION AND DIRECT INJECTION

1.0 Scope and Application

1.1 Method AM12 is used to determine the concentration of diesel range hydrocarbons and total C8-C18 in soil samples. Specifically, this method is used to detect the following compounds:

- octane
- nonane
- decane
- undecane
- dodecane
- tetradecane
- pentadecane
- hexadecane
- heptadecane
- octadecane

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 diesel range hydrocarbons are analyzed using an SRI Model 8610 Gas Chromatograph equipped with a Restek MXT-1 glass lined stainless steel 15M by 0.53mm I.D. capillary column. Samples are extracted using pentane at ambient temperature and manually injected onto the column. The SRI GC is used in conjunction with an integral flame ionization detector. The data is transferred to a microcomputer where it is converted to digital format, stored, and analyzed using a chromatography data system (Chrom Perfect Direct, Justice Innovations).

3.0 Interferences

3.1 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. The GC injection port is continuously flushed with carrier gas and is heated to column temperature as it is inside the oven. The sampling syringe is flushed three times to capacity with pentane and the plunger removed to allow evaporation between injections.

3.2 The analyst should demonstrate the absence of carryover contamination by analyzing a solvent filled clean syringe. 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 or when the column conditioning program described in section 3.4 is not adequate. The SRI 8610 is equipped with a temperature programmable oven which can be utilized to minimize this interference.

3.4 The analyst should be certain that all compounds 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.

3.5 Other interferences that affect the sample analysis can come from sample vials, vial septums, and equipment used to collect the sample. Before and during sample analysis, sample blanks (sample vials with 5ml of pentane) should be analyzed to ensure the absence of interferences.

4.0 Materials and Equipment

4.1 Sample vials: 22cc glass vials (Hewlett Packard #9301-0716 or equivalent). Vials should be free of interferences 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 Septa: Teflon lined septa (Wheaton #224168 or equivalent) may be used provided vials are capped within two weeks prior to use.

4.3 Gas Chromatograph: An SRI Model 8610 Gas Chromatograph equipped with a Restek MXT-1 glass lined stainless steel 15M by 0.53mm I.D. capillary column and an SRI supplied flame ionization detector.

4.5 Data Collection: The output of the chromatograph is directed to a microcomputer where the signal is converted to digital format, stored, and analyzed using a chromatography data system (Chrom Perfect Direct, Justice Innovations).

4.6 Pentane: pesticide grade (Fisher Scientific), interference free.

4.7 Scale: Capable of .01 gram resolution.

4.8 Pipette: Corning 7078D, 10mL

4.9 Syringe: Hamilton Model 701N, 10uL.

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.

5.2 To a clean empty vial add 5 grams of soil sample.

5.3 Pipette 5 ml of pentane onto soil in vial.

5.4 Immediately cap the vial with a crimp on septum as described in section 4.2.

5.5 Place the 22 cc sample vials into heated sonic bath for 10 minutes.

5.6 Using a clean 10uL syringe, remove 2uL of sample in pentane from the sample vial and immediately inject into GC.

6.0 Standards and Calibrations

6.1a C8 - C18: Hewlett Packard Low Boiling Point Hydrocarbon Mix #2 diluted in methanol to make three calibration levels.

6.1b Total diesel range hydrocarbons: pure Gulf diesel fuel diluted in methanol.

6.2 The liquid standards are injected into vials that meet specifications described in sections 4.1 and 4.2. The vials used should contain 5ml of pentane, be capped, and the liquid standard injected directly into the pentane. The standard vial is then analyzed in the same manner as sample vials (as described in section 5.3).

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

6.4 Calibration tables should be set up using an external standard method with the Chrom Perfect data system. It is recommended that the calibration table for individual compounds contain at least three standard concentration levels.

6.5 During the course of analyzing samples at least one standard should be run for every 10 samples.

6.6 The instrument response (for any one subsequent standard in section 6.3 above) must not vary by more than 25% from the mean of the initial calibration.

7.0 Quality Control

7.1 If the parameters set forth in section 6.4 are not met the analytical program will be terminated until the cause is determined and a solution is effected.

7.2 Before and during sample analysis, syringe blanks (2uL of pure pentane) should be analyzed to assure the absence of interferences as described in section 3.0 above.

7.3 Before and during sample analysis, sample blanks (sample vials with 5ml of pentane) should be analyzed to assure the absence of interferences.

7.4 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.

7.5 Standards analyzed during the course of analyzing samples are used to monitor individual compound calibration and peak retention time stability. All chromatograms should be examined by an experienced analyst.

7.6 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

SRI 8610 Gas Chromatograph:

Oven temperature program:

initial temperature: 70 deg C
step to 80 deg C at 0.01 min.
step to 120 deg C at 5.0 min.
step to 160 deg C at 10.0 min.
step to 200 deg C at 20.0 min.
return to initial at 44.9 min.

Carrier gas: helium.

Carrier gas flow rate: 12mL/min. (dial reading: 375)

Column head pressure: 6.5 psi.

FID gain: MED

FID attenuation: 1

FID H2 flow rate: 20.6mL/min. (display reading: 12.6)

FID air flow rate: 273mL/min. (display reading: 12.0)

9.0 SAFETY

9.1 Pentane is extremely flammable and is a severe irritant. All handling of pentane is to be done under the fume hood with eye protection and gloves. Transporting sample vials with pentane within the laboratory should be done with extra care and with secondary containment. If pentane is spilled by breaking sample vials, immediately extinguish all open flames (FID) until pentane has evaporated and room is thoroughly ventilated. If any symptoms of overexposure to pentane is noticed (headache, nausea, tightness is the chest), immediately close all open sources of pentane and evacuate to fresh air.

9.2 The GC oven is heated to high temperature during analysis. Prior to performing any work on the GC, turn off GC and allow to cool.

9.3 Compressed Hydrogen, used for FID fuel gas is extremely combustible. Perform leak checks on cylinder and supply lines to the GC prior to lighting FID flame. If FID flame is extinguished during analysis, close H2 cylinder and ventilate room prior to re-igniting flame.

APPENDIX I

STANDARD PREPARATION METHODS

STANDARD PREPARATION METHOD SP3

GAS STANDARD PREPARATION FOR VOC'S

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 / Howard Hicky
LOCATION: Gunsite 113
PROJECT(#): 631-~~15G~~ CDS 24G
PAGE: 1 OF: 2

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

SAMPLER NAME(S): KaB/AgC/CdS

SAMPLE ID# 24G	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	SAMPLE TYPE S	SAMPLE TYPE W	SAMPLE SIZE	COMMENTS
631-~~15G~~ CDS -SB-1	1-22-93	1020	1	-0-	✓			22ML	
631-15G-SB-1		1021	2	-0-				125ML	
-1		1024	3	3'				22ML	
-1		1625	4					125 ML	
-2		1034	5						
-2		1035	6						
-3		1039	7						
-3		1040	8						
-4		1044	9						
-4		1045	10						
-5		1049	11						
-5		1050	12						
-6		1654	13						
-6		1055	14						
-7		1059	15						
-7		1100	16						
-8		1104	17						
-8		1105	18						
-9		1109	19						
-9		1110	20						
10		1113	21						
10		1114	22						
10A		1119	23						
10A		1120	24						
SB-2		1124	25	-0-					
SB-2		1125	26	-0-					
-11		1129	27	3'					
-11		1130	28						
12		1134	29						
12		1135	30						
13		1139	31						
13		1140	32						
14		1144	33						
14		1145	34						
15		1149	35						
15		1150	36						
16		1154	37						
16		1155	38						
17		1159	39						
17		1200	40						
18		1201	41						
18		1202	42						
↓ 19		1203	43	↓	↓			↓	

USE A NEW SHEET WHEN RESTARTING SEQUENCE # .

MICROSEEPS LTD.

CLIENT: SRS / Howard Hicky
LOCATION: Gunsite, 113
PROJECT(#): ~~631-15G~~ 631-24G
PAGE: 2 OF: 2

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

SAMPLER NAME(S): Kab / A.C / CdS

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	SAMPLE TYPE S	SAMPLE TYPE W	SAMPLE SIZE	COMMENTS
631-~~15G~~24G-19	1-22-93	1204	44	3'	✓			125	
-20		1205	45					22	
20		1206	46						
20A		1207	47						
20A		1208	48						
SB-3		1209	49	0					
SB-3		1210	50	0					
21		1211	51	3'					
21		1212	52						
22		1213	53						
22		1214	54						
23		1215	55						
23		1216	56						
24		1217	57						
24		1218	58						
25		1219	59						
25		1220	60						
26		1221	61						
26		1222	62						
27		1223	63						
27		1224	64						
28		1225	65						
28		1226	66						
29		1227	67						
29		1228	68						
30		1229	69						
30		1230	70						
30A		1231	71						
↓ 30A	↓	1232	72	↓	↓			↓	

USE A NEW SHEET WHEN RESTARTING SEQUENCE # .

APPENDIX II

MERCURY COLLECTION LOGS

MICROSEEPS LTD.

CLIENT: SRS / Howard Hicky
LOCATION: Access Road Site
PROJECT(#): 631-24G / Gunsite 113
PAGE: 1 OF: 1

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

MERCURY

SAMPLER NAME(S): KaB / AqC

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE			SAMPLE SIZE	COMMENTS
					G	S	W		
631-24G-1	1-25-93	0900	1	1'		✓		—	
2		thru	2						
3		1230	3						
4			4						
5			5						
6			6						
7			7						
8			8						
9			9						
10			10						
10A			11						
11			12						
12			13						
13			14						
14			15						
15			16						
16			17						
17			18						
18			19						
19			20						
20			21						
20A			22						
21			23						
22			24						
23			25						
24			26						
25			27						
26			28						
27			29						
28			30						
29			31						
30			32						
↓ 30A	↓	↓	33	↓		↓		↓	

USE A NEW SHEET WHEN RESTARTING SEQUENCE #

APPENDIX II

DIESEL COLLECTION LOGS

MICROSEEPS LTD.

CLIENT: SRS / Howard Hicky
LOCATION: Access Road Site
PROJECT(#): 631-24G /Gunsite 113
PAGE: 1 OF: 1

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

SAMPLER NAME(S): KaB / AqC

"Soil Plug" – For Diesel Range Analysis

SAMPLE ID#	DATE	TIME	SEQ.#	SAMPLE DEPTH	SAMPLE TYPE G	SAMPLE TYPE S	SAMPLE TYPE W	SAMPLE SIZE	COMMENTS
631-24G-1	1-25-93	0900	1	18"		✓		1-2" Plug	
·2		thru	2						
3		1230	3						
4			4						
5			5						
6			6						
7			7						
8			8						
9			9						
10			10						
11			11						
12			12						
13			13						
14			14						
15			15						
16			16						
17			17						
18			18						
19			19						
20			20						
21			21						
22			22						
23			23						
24			24						
25			25						
26			26						
27			27						
28			28						
29			29						
30			30						
			31						
			32						

USE A NEW SHEET WHEN RESTARTING SEQUENCE #

APPENDIX II

MERCURY COLLECTION LOGS

Bake StarT 1030 Oven Temp 177°

Project ID Access Road
Project # 631-24
Date Jan 30.

Std Count Verification: Vial# 3 Time 1045 Temp 23

Cts: 104-0 104-0 107-0 108-0 102-0 110-0 = 105.83 = $\boxed{5.88}$

Verified Clear Vial: Counts -0--0-

Machine Status 23 . Notes/Other Comments

Page 1of 2

Spl. wt.	Vial #	Spl ID	Counts /comments	STATUS 23
.61	63	631-24G-1	21-6-0	
.63	2	-2	7-0	
.63	49	-3	20-0-0	
.67	53	-4	14-0	
67	24	-5	18-2-0	Status 26
65	28	-6	16-1-1-2-1-2-0	
68	46	-7	13-1-2-3-2-0	
69	5	-8	14-0	
67	4	-9	11-0	
68	50	-10	8-1-1-1-0	Status 28
0	30	Blank	1-0	
68	6	631-24G 10A	8-3-0	
Kgb ~~67~~(66)	57	11	12-3-0	
69	60	12	9-1-0	
67	21	13	12-2-1-2-2-0	
70	11	14	13-4-0	Status 31
68	17	15	11-0	
65	~~154~~(14)	16	14-2-0	
68	36	17	12-4-2-3-2-	
67	48	18	13-2-3-3-	
66	16	19	3-0	
0	62	Blank	0	Status
66	45	631-24G- 20	8-1-1-	
66	1	20A	9-3-1-2-2-0	
68	30	21	3-1-1-	

Bake Start______ Oven Temp______

Std Count Verification: Vial#____ Time_____ Temp_____

Cr ts: ________________________________

Verified Clear Vial: Counts____.________________

Machine Status________. Notes/Other Comments____________

Project ID Access Roa

Project # 631-24G

Date Jan 30,

For PaRT Data See Page 1

Page 2of2

Spl. Wt.	Vial #	Spl ID	Counts /comments	STATUS _____
65	26	631-24G-22	12-2-0	
68	44	-23	7-2-3-2-1-3-3-0	
67	15	-24	8-2-1-1-2-2-2-0	
66	27	-25	16-1-2-2-2-3-1-3-0	
67	10	-26	11-6-2-2-	Status _____
66	39	-27	3-2-0	
62	7	-28	28-6-1-0	
0	14	Blank	2-2-0	
65	40	631-24G- 29	6-1-4-3-1-0	
61	18	30	24-3-6-0	Status _____
65	29	30A	25-0-	
				Status _____
				Status _____

APPENDIX II

WASTE MANAGEMENT UNIT WORKSHEETS

APPENDIX A

UNIT NAME: GUNSITE 113 ACCESS ROAD SITE

DG. NO.: 631-24G

SRS COORDINATES: N66000 E118000

STATUS: INACTIVE

CAPACITY: N/A

DIMENSIONS: 150 FT X 80 FT

MATERIALS OF CONSTRUCTION: EARTHEN AREA

OTHER: DATES OF WASTE RECEIPT: UNKNOWN. THIS SITE IS INACTIVE.

WASTE DESCRIPTION: THIS SITE IS AN AREA OF STRESSED VEGETATION.

WASTE COMPONENTS: ALL SUBSTANCES DETECTED ARE BELOW BACKGROUND LEVELS.

WASTE QUANTITY:

GROUNDWATER MONITORING: ONGOING: GROUND PENETRATING RADAR WAS CONDUCTED IN APRIL 1988. SOIL GAS SURVEY WAS CONDUCTED IN APRIL 1988.

PLANNED: THIS SITE IS IN THE RFI/RI PROGRAM.

WELL DATA CODE: NONE

SUMMARY OF DATA: DPST-88-DRAFT. SOIL GAS SURVEYS AT SELECTED POTENTIAL WASTE SITES AT THE SAVANNAH RIVER PLANT.

CORRECTIVE TIONS: COMPLETED: GPR (3/89). LAND SURVEYING (7/90). SOIL SAMPLING FOR SITE SCREENING (2/90). WORK PLAN DUE 9/20/90.

ONGOING: NONE.

PLANNED: THIS SITE IS IN THE RFI/RI PROGRAM.

INSPECTIONS AND FREQUENCY:

APPENDIX III

Final Report

GROUND PENETRATING RADAR INVESTIGATIONS

at

GUNSITE 113
(631-24G)

SAVANNAH RIVER SITE

March, 1993

G.Boyd Sexton
Robert J. Pirkle

Task 22
Subcontract #AA38232N

MICROSEEPS

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

EXECUTIVE SUMMARY

Ground penetrating radar surveys were executed at Gunsite #113 for the purpose of locating disturbed soil, trenches, pipelines and other targets of interest. The survey was conducted on January 27, 1993.

Numerous areas of disturbed soil were observed, several of which contain prominent diffractions thought to represent pipelines or other targets of interest. A 300 MHz transmitter and antenna were used in the acquisition of the data.

MICROSEEPS

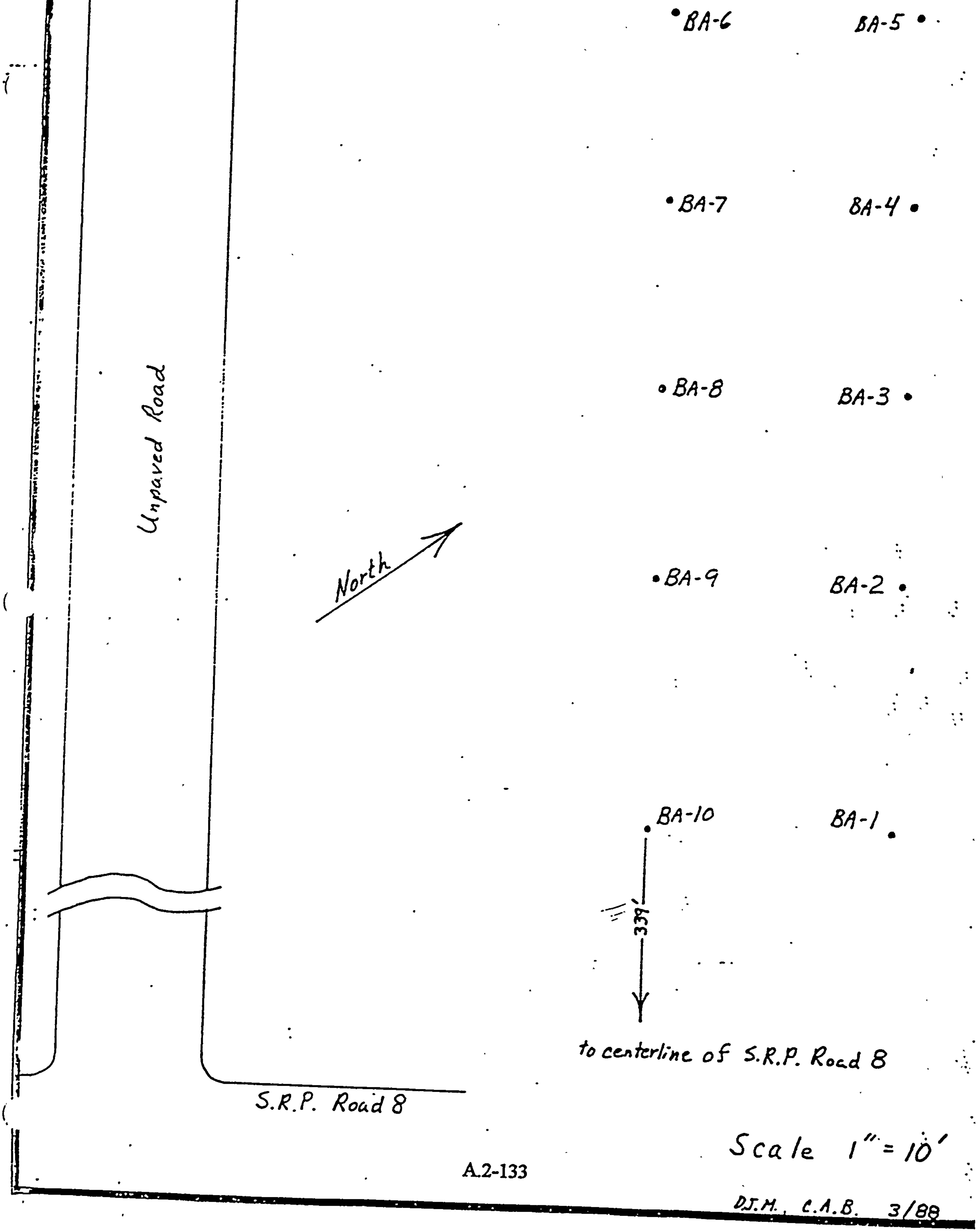
FINAL REPORT AX-720887 EXTENSION

"SOIL AND SOIL GAS SAMPLING IN NINE POTENTIAL NEW WASTE SITES, CENTRAL SHOPS DIESEL LOADING AREA AND S.R.P. FAULT AREAS"

Geochemical and Environmental Surveying for Government and Industry

GUNSITE 113

Sample Locations



Scale 1" = 10'

DJ.M., C.A.B. 3/88

TABLE 2
(continued)

---- E. I. DUPONT DE NEMOURS CO. INC., S.R.P., AIKEN, SC. ----
---- VARIOUS WASTE/DUMP SITES -- 1.5 FT. SOIL SAMPLES, MARCH 1988 ----
---- SOIL CONCENTRATION BY WEIGHT IN PPB ----

SAMPLE NUMBER	1.1-DiCl ETHYLENE	DiCl METHANE	T1,2-DiCl ETHYLENE	1,1-DiCl ETHANE	TriCl METHANE	1,2-DiCl ETHANE	TriCl ETHYLENE	TetraCl ETHYLENE	SAMPLE NUMBER
KP 27	-	-	-	-	-	-	-	0.06	KP 27
KP 28	-	-	-	-	-	-	-	-	KP 28
KP 29	-	-	-	-	-	-	-	-	KP 29
BA 1	-	-	3.8	-	-	-	-	-	BA 1
BA 2	-	-	-	-	-	-	-	-	BA 2
BA 3	-	-	-	-	-	-	-	-	BA 3
BA 4	-	-	3.5	-	-	-	-	-	BA 4
BA 5	-	-	4.0	-	-	-	-	-	BA 5
BA 6	-	-	4.8	-	-	-	-	-	BA 6
BA 7	-	-	4.8	-	-	-	-	-	BA 7
BA 8	-	-	-	-	-	-	-	-	BA 8
BA 9	-	-	-	-	-	-	-	-	BA 9
BA 10	-	-	11.0	-	-	-	-	-	BA 10
GS 1	-	-	6.6	-	-	-	-	-	GS 1
GS 2	-	-	6.2	-	-	-	-	-	GS 2
GS 3	-	-	11.0	-	-	-	-	-	GS 3
GS 4	-	-	-	-	-	-	-	-	GS 4
GS 5	-	-	-	-	-	-	-	-	GS 5
GS 6	-	-	-	-	-	-	-	-	GS 6
GS 7	-	-	-	-	-	-	-	-	GS 7
GS 8	-	-	-	-	-	-	-	-	GS 8
GS 9	-	-	-	-	-	-	-	-	GS 9
GS 10	-	-	-	-	-	-	-	-	GS 10
GS 11	-	-	3.5	-	-	-	-	-	GS 11
TX 1	-	-	-	-	-	-	-	0.01	TX 1
TX 2	-	4.5	-	-	-	-	-	-	TX 2
TX 3	-	2.2	-	-	-	-	-	-	TX 3
TX 4	-	1.6	-	-	-	-	-	-	TX 4
TX 5	-	-	-	-	-	-	-	-	TX 5
TX 6	-	-	-	-	-	-	-	-	TX 6
TX 7	-	1.1	4.8	-	-	-	-	-	TX 7
TX 8	-	3.4	-	-	-	-	-	-	TX 8
TX 9A	-	-	-	-	-	-	-	-	TX 9A
TX 9B	-	2.5	-	-	-	-	-	-	TX 9B
TX 9C	-	-	-	-	-	-	-	-	TX 9C
TX 10A	-	-	-	-	-	-	-	-	TX 10A
TX 10B	-	2.2	-	-	-	-	-	-	TX 10B
TX 10C	-	-	-	-	-	-	-	-	TX 10C
TX 11A	-	-	-	-	-	-	-	-	TX 11A
TX 11B	-	-	-	-	-	-	-	-	TX 11B
TX 11C	-	-	-	-	-	-	-	-	TX 11C
TX 12	-	2;8	-	-	-	-	-	-	TX 12
TX 13A	-	-	-	-	-	-	-	-	TX 13A
TX 13B	-	-	-	-	-	-	-	-	TX 13B
TX 13C	-	1.3	-	-	-	-	-	-	TX 13C
TX 14	-	1.1	-	-	-	-	-	-	TX 14
TX 15	-	1.6	-	-	-	-	-	-	TX 15
TX 16A	-	-	-	-	-	-	-	-	TX 16A

TABLE 3

---- E. I. DUPONT DE NEMOURS CO. INC., S.R.P., AIKEN, S.C. ----
---- VARIOUS WASTE/DUMP SITES -- 3 FT. PROBE SURVEY, MARCH 1988 ----
---- SOIL GAS CONCENTRATIONS ----

SAMPLE #	METHANE PPB	ETHANE PPB	PROPANE PPB	I-BUTANE PPB	N-BUTANE PPB	ETHYLENE PPB	PROPYLENE PPB	SAMPLE #
GR 1	431	24	10	-	-	14	18	GR 1
GR 2	435	21	7	-	-	13	14	GR 2
GR 3	264	10	5	-	-	6	-	GR 3
GR 4	480	20	8	-	-	11	-	GR 4
BA 1	375	17	6	-	-	7	-	BA 1
BA 2	325	13	-	-	-	7	-	BA 2
BA 3	312	22	12	-	-	12	19	BA 3
BA 4	393	30	13	-	-	19	23	BA 4
BA 5	599	35	14	16	-	19	21	BA 5
BA 6	311	17	5	-	-	8	9	BA 6
BA 7	2197	8	-	-	-	-	-	BA 7
BA 8	346	22	6	-	-	12	11	BA 8
BA 9	396	18	6	-	-	7	-	BA 9
BA 10	350	16	6	-	-	9	-	BA 10
GS 1	348	21	7	-	-	12	15	GS 1
GS 2	946	104	35	17	-	52	63	GS 2
GS 3	561	45	15	-	-	24	27	GS 3
GS 4	241	20	9	-	-	14	19	GS 4
GS 5	306	15	5	-	-	7	-	GS 5
GS 6	369	16	6	-	-	8	10	GS 6
GS 7	708	204	14	16	-	21	25	GS 7
GS 8	901	56	19	22	-	28	31	GS 8
GS 9	1425	118	42	11	-	67	77	GS 9
GS 10	352	19	11	2	-	11	11	GS 10
GS 11	552	40	40	-	-	23	26	GS 11
TX 1	859	64	22	7	-	40	48	TX 1
TX 2	391	21	5	3	-	11	15	TX 2
TX 3	365	25	9	-	-	12	16	TX 3
TX 4	1088	47	15	13	-	21	30	TX 4
TX 5	1159	43	13	-	-	21	30	TX 5
TX 6	593	21	9	-	-	11	12	TX 6
TX 7	957	33	14	4	-	18	24	TX 7
TX 8	547	27	11	-	-	11	17	TX 8
TX 9B	458	24	8	-	-	12	16	TX 9B
TX 9C	701	42	15	-	-	23	24	TX 9C
TX 10B	1849	41	19	-	-	28	35	TX 10B
TX 10C	381	23	13	-	-	13	18	TX 10C
TX 11A	2640	37	30	4	-	15	20	TX 11A
TX 11B	616	27	12	-	-	14	14	TX 11B
TX 11C	1517	64	23	15	-	30	35	TX 11C
TX 12	1449	49	16	2	-	25	27	TX 12
TX 13B	402	22	8	-	-	9	-	TX 13B
TX 13C	1662	78	104	9	-	39	41	TX 13C
TX 14	793	20	6	-	-	9	-	TX 14
TX 15	1507	28	7	-	-	12	11	TX 15
TX 16B	1494	30	12	-	-	21	15	TX 16B
TX 16C	722	12	5	-	-	6	-	TX 16C
TX 17	2458	111	37	20	-	62	67	TX 17
TX 18	759	29	7	8	-	14	14	TX 18

UNIT NAME: GUNSITE 113 ACCESS ROAD SITE

BLDG. NO.: 631-24G

SRS COORDINATES: N66000 E118000

STATUS: INACTIVE

CAPACITY: N/A

DIMENSIONS: 150 FT X 80 FT

MATERIALS OF CONSTRUCTION: EARTHEN AREA

OTHER: DATES OF WASTE RECEIPT: UNKNOWN. THIS SITE IS INACTIVE.

WASTE DESCRIPTION: THIS SITE IS AN AREA OF STRESSED VEGETATION.

WASTE COMPONENTS: ALL SUBSTANCES DETECTED ARE BELOW BACKGROUND LEVELS.

WASTE QUANTITY:

GROUNDWATER MONITORING: ONGOING: GROUND PENETRATING RADAR WAS CONDUCTED IN APRIL 1988. SOIL GAS SURVEY WAS CONDUCTED IN APRIL 1988.

PLANNED: THIS SITE IS IN THE RFI/RI PROGRAM.

WELL DATA CODE: NONE

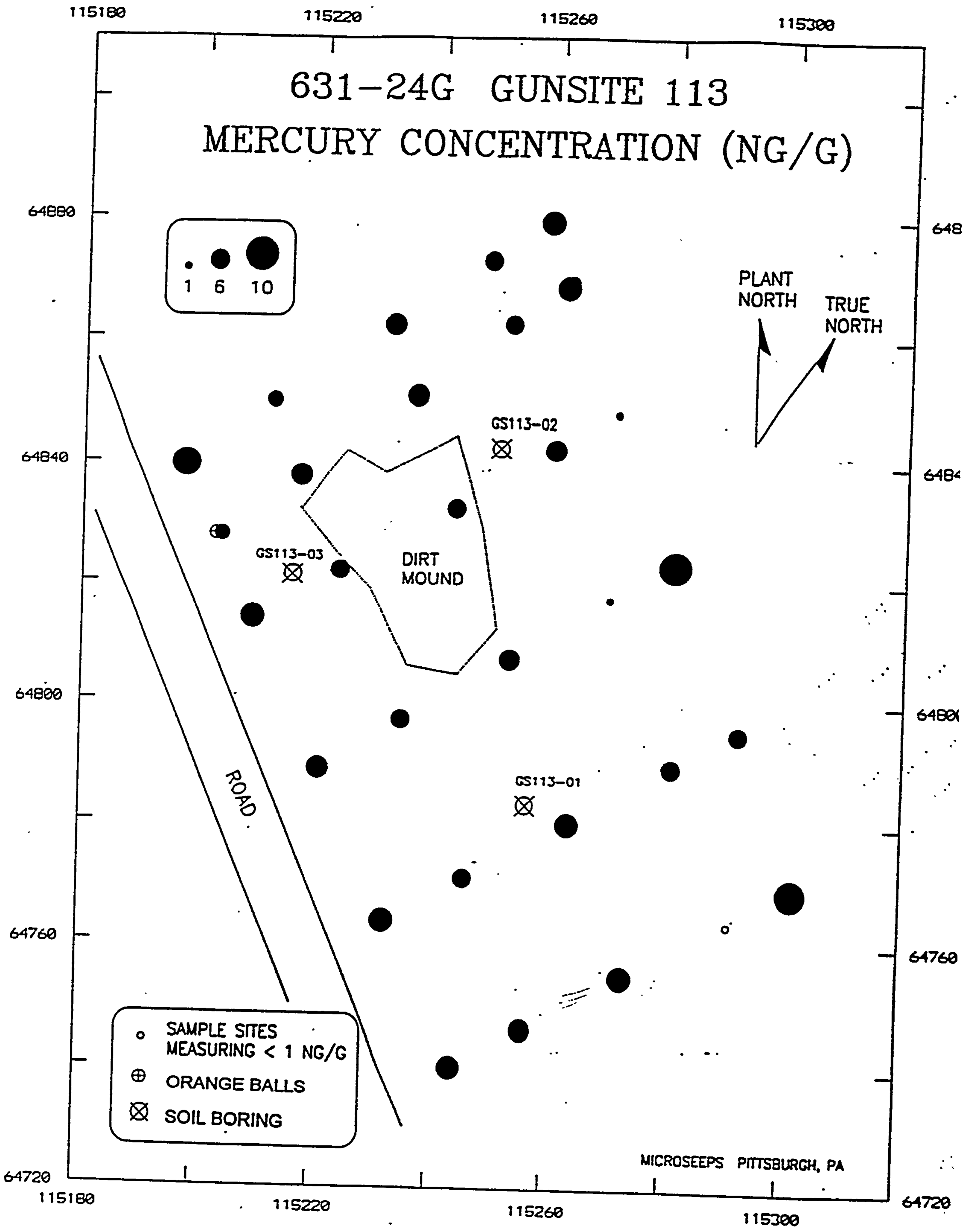
SUMMARY OF DATA: DPST-88-DRAFT. SOIL GAS SURVEYS AT SELECTED POTENTIAL WASTE SITES AT THE SAVANNAH RIVER PLANT.

CORRECTIVE ACTIONS: COMPLETED: GPR (3/89). LAND SURVEYING (7/90). SOIL SAMPLING FOR SITE SCREENING (2/90). WORK PLAN DUE 9/20/90.

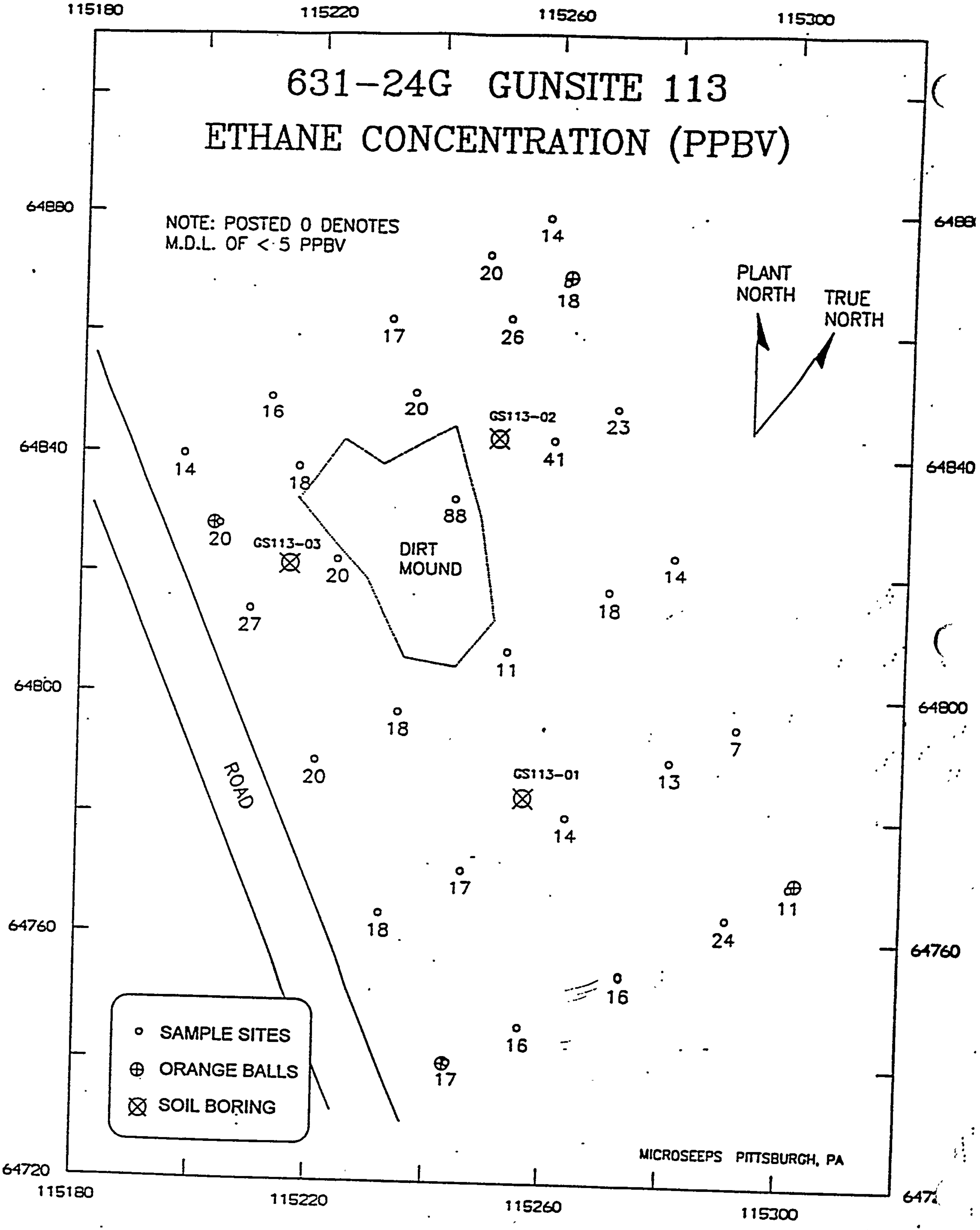
ONGOING: NONE.

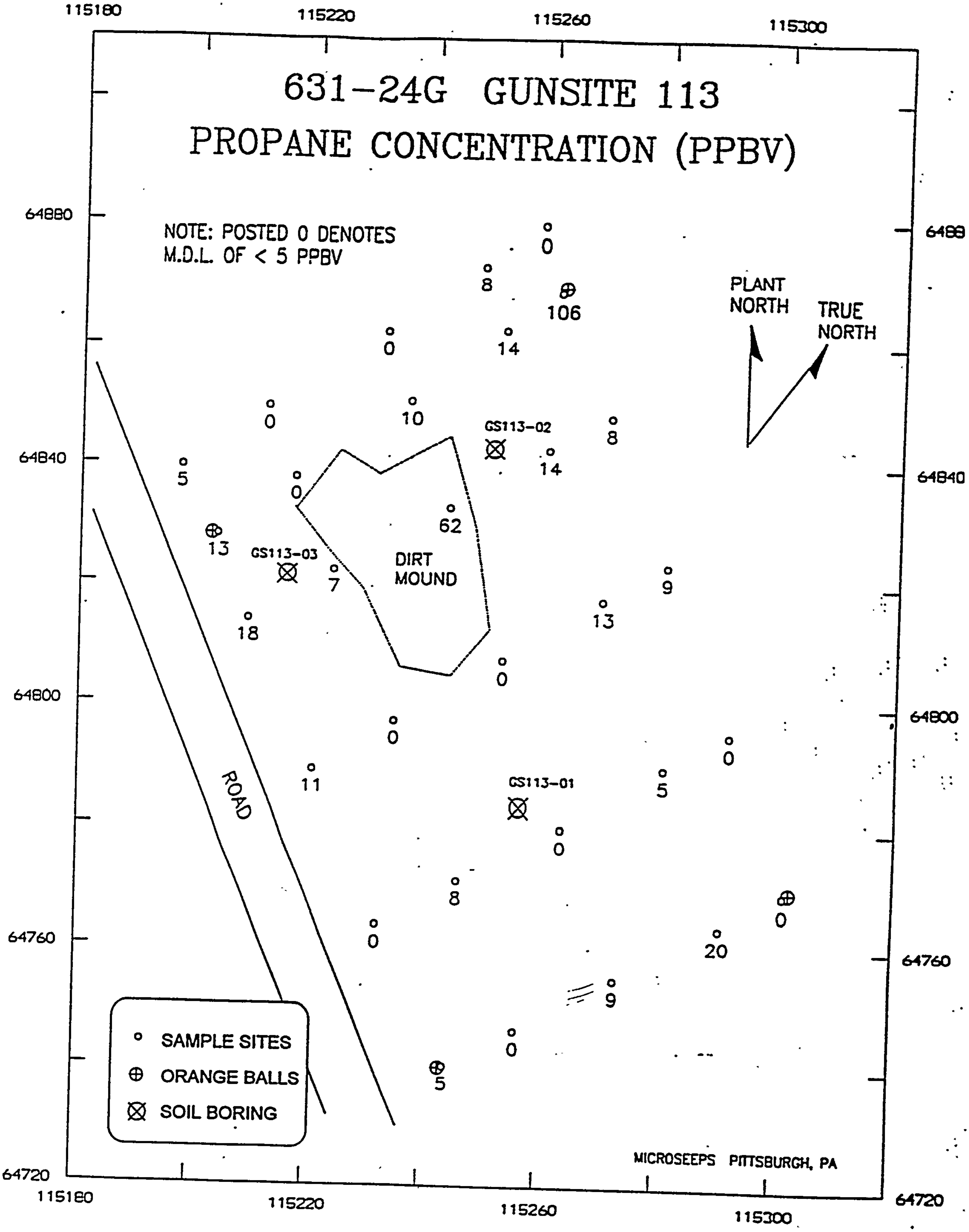
PLANNED: THIS SITE IS IN THE RFI/RI PROGRAM.

INSPECTIONS AND FREQUENCY:

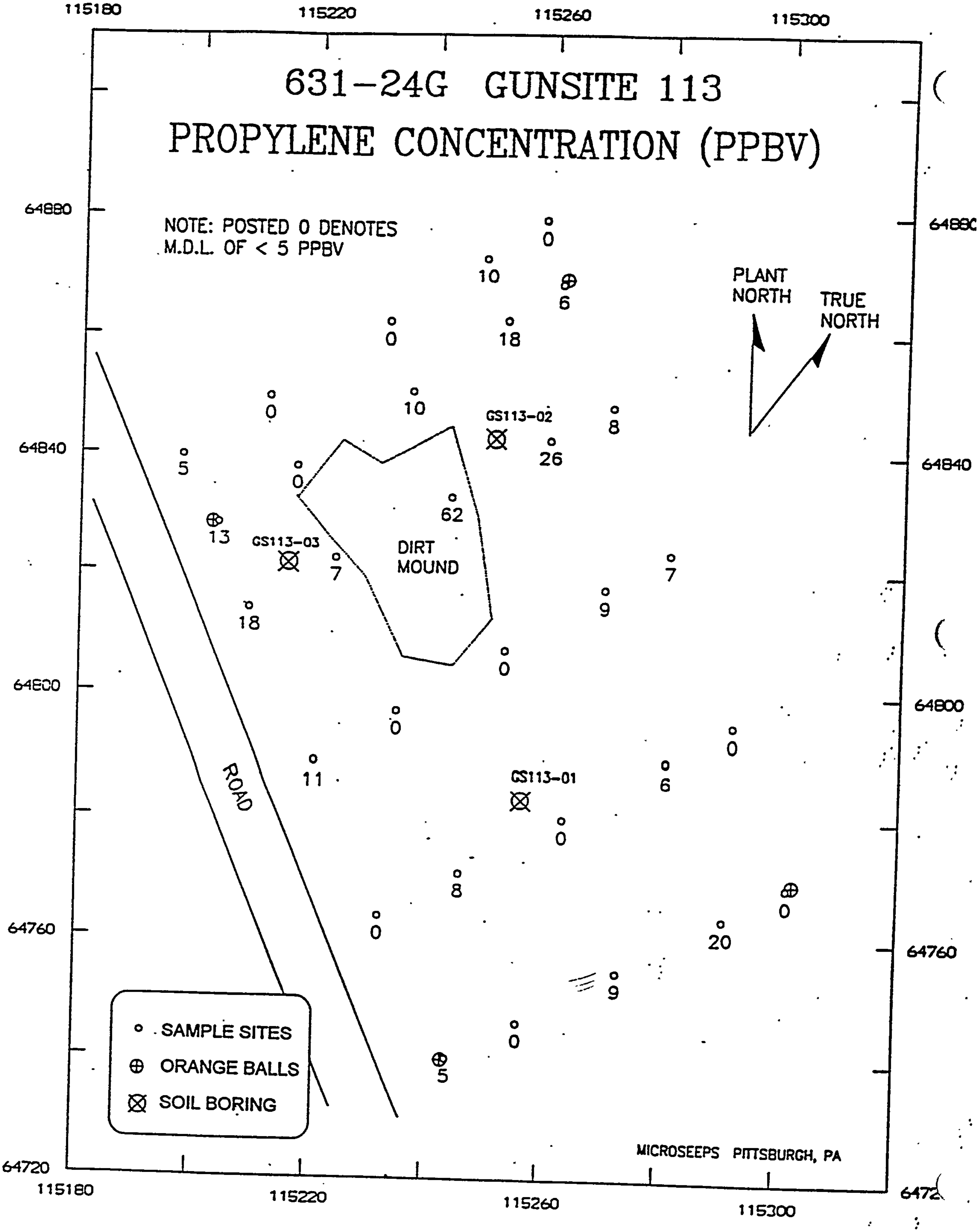

115180
115220
115260
115300
631-24G GUNSITE 113
MERCURY CONCENTRATION (NG/G)
64880
648
64840
6484
64800
6480(
64760
64760
64720
64720
1
6
10
PLANT NORTH
TRUE NORTH
GS113-02
GS113-03
DIRT MOUND
GS113-01
ROAD
SAMPLE SITES MEASURING < 1 NG/G
ORANGE BALLS
SOIL BORING
MICROSEEPS PITTSBURGH, PA
115180
115220
115260
115300

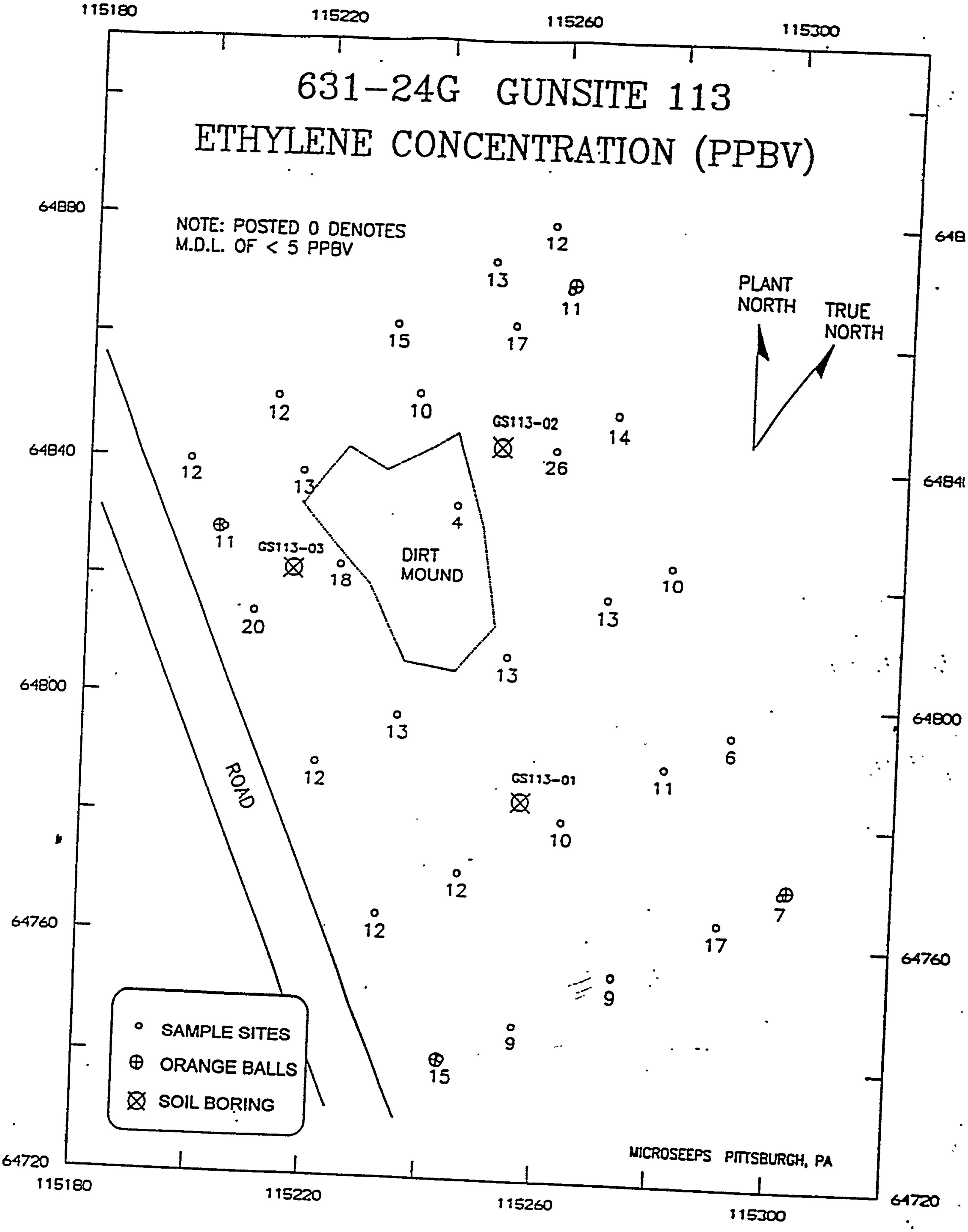
631-24G GUNSITE 113
ETHANE CONCENTRATION (PPBV)




631-24G GUNSITE 113
PROPANE CONCENTRATION (PPBV)
NOTE: POSTED 0 DENOTES
M.D.L. OF < 5 PPBV
PLANT NORTH
TRUE NORTH
115180
115220
115260
115300
64880
64840
64800
64760
64720
0
8
106
0
14
0
10
GS113-02
8
14
5
0
62
13
GS113-03
7
DIRT MOUND
9
13
18
0
0
0
11
GS113-01
5
0
8
0
0
20
9
0
5
ROAD
SAMPLE SITES
ORANGE BALLS
SOIL BORING
MICROSEEPS PITTSBURGH, PA

631-24G GUNSITE 113
PROPYLENE CONCENTRATION (PPBV)





631-24G GUNSITE 113

ETHYLENE CONCENTRATION (PPBV)

NOTE: POSTED 0 DENOTES M.D.L. OF < 5 PPBV

APPENDIX B

ANALYTICAL DATA AND QA/QC EVALUATION RESULTS

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WESTON℠

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC GUNSITE 113 **SAMPLES RECEIVED:** 02-09-90
RFW #: 9002L481
W.O. #: 0630-28-10

METALS NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards from Inorganic Ventures, Inc.
3. All preparation blanks were analyzed below the required detection limit.
4. All laboratory control standards were within the control limits of 80-120% with the exception of silver at 13%.

   Note: The USEPA-CLP has dropped control limits for silver and antimony due to documented difficulties in obtaining reliable results. WESTON Analytics has adopted the same policy.

5. The analytical methods applied by the laboratory for the determination of metals are:

   As: EPA 206.2
   Se: EPA 270.2
   Pb: EPA 239.2
   Tl: EPA 279.2
   Hg: EPA 245.1
   ICP Scan: EPA 200.7
   All Others: EPA 200.7
   EP Leachates (except Hg): 200.7

NOTE: For solid samples, all results are reported on a dry weight basis.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

3-19-90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 04/08/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L482

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK1	90L0226-MB1	SILVER, TOTAL	2.0	u	MG/KG	2.0
		BARIUM, TOTAL	40.0	u	MG/KG	40.0
		BERYLLIUM, TOTAL	1.0	u	MG/KG	1.0
		CADMIUM, TOTAL	1.0	u	MG/KG	1.0
		COBALT, TOTAL	10.0	u	MG/KG	10.0
		CHROMIUM, TOTAL	2.0	u	MG/KG	2.0
		COPPER, TOTAL	5.0	u	MG/KG	5.0
		NICKEL, TOTAL	8.0	u	MG/KG	8.0
		ANTIMONY, TOTAL	12.0	u	MG/KG	12.0
		TIN, TOTAL	20.0	u	MG/KG	20.0
		VANADIUM, TOTAL	10.0	u	MG/KG	10.0
		ZINC, TOTAL	4.0	u	MG/KG	4.0
BLANK1	90L0225-MB1	ARSENIC, TOTAL	2.0	u	MG/KG	2.0
		LEAD, TOTAL	0.60	u	MG/KG	0.60
		SELENIUM, TOTAL	1.0	u	MG/KG	1.0
		THALLIUM, TOTAL	2.0	u	MG/KG	2.0
BLANK1	90C035B-MB1	MERCURY, TOTAL	0.10	u	MG/KG	0.10
BLANK2	90C035B-MB2	MERCURY, TOTAL	0.10	u	MG/KG	0.10
BLANK3	90C035B-MB3	MERCURY, TOTAL	0.10	u	MG/KG	0.10

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 04/08/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L482

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
LCS2	90L0226-LC2	SILVER, LCS	59.0	107	57.6
		BARIUM, LCS	102	101	0.74
		BERYLLIUM, LCS	107	108	1.3
		CADMIUM, LCS	106	106	0.30
		COBALT, LCS	104	104	0.029
		CHROMIUM, LCS	112	111	0.50
		COPPER, LCS	109	110	0.95
		NICKEL, LCS	104	105	0.48
		ANTIMONY, LCS	93.1	93.7	0.64
		TIN, LCS	92.6	93.0	0.41
		VANADIUM, LCS	116	118	1.7
		ZINC, LCS	103	103	0.058
LCS2	90L0225-LC2	ARSENIC, LCS	94.0	97.7	3.8
		LEAD, LCS	113	112	0.89
		SELENIUM, LCS	111	113	1.5
		THALLIUM, LCS	107	109	1.2
LCS2	90C035B-LC2	MERCURY, LCS	96.1	102	6.3

ROY F. WESTON INC.

INORGANICS LABORATORY CONTROL STANDARDS REPORT 04/08/90

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	90L0226-LC1	SILVER, LCS	59.0	100	MG/KG	59.0
		BARIUM, LCS	1020	1000	MG/KG	102
		BERYLLIUM, LCS	53.3	50.0	MG/KG	107
		CADMIUM, LCS	53.1	50.0	MG/KG	106
		COBALT, LCS	520	500	MG/KG	104
		CHROMIUM, LCS	112	100	MG/KG	112
		COPPER, LCS	271	250	MG/KG	109
		NICKEL, LCS	417	400	MG/KG	104
		ANTIMONY, LCS	559	600	MG/KG	93.1
		TIN, LCS	926	1000	MG/KG	92.6
		VANADIUM, LCS	580	500	MG/KG	116
		ZINC, LCS	205	200	MG/KG	103
LCS2	90L0226-LC2	SILVER, LCS	107	100	MG/KG	107
		BARIUM, LCS	1010	1000	MG/KG	101
		BERYLLIUM, LCS	54.1	50.0	MG/KG	108
		CADMIUM, LCS	53.0	50.0	MG/KG	106
		COBALT, LCS	520	500	MG/KG	104
		CHROMIUM, LCS	111	100	MG/KG	111
		COPPER, LCS	274	250	MG/KG	110
		NICKEL, LCS	419	400	MG/KG	105
		ANTIMONY, LCS	562	600	MG/KG	93.7
		TIN, LCS	930	1000	MG/KG	93.0
		VANADIUM, LCS	590	500	MG/KG	118
		ZINC, LCS	206	200	MG/KG	103
LCS1	90L0225-LC1	ARSENIC, LCS	5.6	6.0	MG/KG	94.0
		LEAD, LCS	6.8	6.0	MG/KG	113
		SELENIUM, LCS	6.7	6.0	MG/KG	111
		THALLIUM, LCS	6.4	6.0	MG/KG	107
LCS2	90L0225-LC2	ARSENIC, LCS	5.9	6.0	MG/KG	97.7
		LEAD, LCS	6.7	6.0	MG/KG	112
		SELENIUM, LCS	6.8	6.0	MG/KG	113
		THALLIUM, LCS	6.5	6.0	MG/KG	109
LCS1	90C035B-LC1	MERCURY, LCS	0.96	1.0	MG/KG	96.1
LCS2	90C035B-LC2	MERCURY, LCS	1.0	1.0	MG/KG	102
LCS3	90C035B-LC3	MERCURY, LCS	0.99	1.0	MG/KG	99.3

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 04/08/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L482

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	GS113 01-02	SILVER, TOTAL	2.1	u	MG/KG	2.1
		ARSENIC, TOTAL	1.8		MG/KG	1.7
		BARIUM, TOTAL	41.1	u	MG/KG	41.1
		BERYLLIUM, TOTAL	1.0	u	MG/KG	1.0
		CADMIUM, TOTAL	1.0	u	MG/KG	1.0
		COBALT, TOTAL	10.3	u	MG/KG	10.3
		CHROMIUM, TOTAL	24.3		MG/KG	2.1
		COPPER, TOTAL	5.1	u	MG/KG	5.1
		MERCURY, TOTAL	0.11	u	MG/KG	0.11
		NICKEL, TOTAL	8.2	u	MG/KG	8.2
		LEAD, TOTAL	4.8		MG/KG	0.50
		ANTIMONY, TOTAL	12.3	u	MG/KG	12.3
		SELENIUM, TOTAL	0.83	u	MG/KG	0.83
		TIN, TOTAL	41.9		MG/KG	20.6
		THALLIUM, TOTAL	1.7	u	MG/KG	1.7
		VANADIUM, TOTAL	76.2		MG/KG	10.3
		ZINC, TOTAL	9.4		MG/KG	4.1

Roy F. Weston, Inc. - Lionville Laboratory
INORGANIC ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L482

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 01-02						
SILVER, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
ARSENIC, TOTAL	001	S	90L0225	02/06/90	03/09/90	03/30/90
BARIUM, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
BERYLLIUM, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
CADMIUM, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
COBALT, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
CHROMIUM, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
COPPER, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
MERCURY, TOTAL	001	S	90C035B	02/06/90	03/06/90	03/07/90
NICKEL, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
LEAD, TOTAL	001	S	90L0225	02/06/90	03/09/90	04/05/90
ANTIMONY, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
SELENIUM, TOTAL	001	S	90L0225	02/06/90	03/09/90	04/01/90
TIN, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
THALLIUM, TOTAL	001	S	90L0225	02/06/90	03/09/90	04/04/90
VANADIUM, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90
ZINC, TOTAL	001	S	90L0226	02/06/90	03/09/90	03/23/90

LAB QC:

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
SILVER LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
BARIUM LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
BERYLLIUM LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
CADMIUM LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
COBALT LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
CHROMIUM LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
COPPER LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
NICKEL LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
ANTIMONY LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
TIN LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
VANADIUM LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
ZINC LABORATORY	LC1 BS	S	90L0226	N/A	03/09/90	03/23/90
SILVER LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
BARIUM LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
BERYLLIUM LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
CADMIUM LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
COBALT LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90

Roy F. Weston, Inc. - Lionville Laboratory
INORGANIC ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90 RFW LOT # :9002L482

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
CHROMIUM LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
COPPER LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
NICKEL LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
ANTIMONY LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
TIN LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
VANADIUM LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
ZINC LABORATORY	LC2 BS	S	90L0226	N/A	03/09/90	03/23/90
SILVER, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
BARIUM, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
BERYLLIUM, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
CADMIUM, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
COBALT, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
CHROMIUM, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
COPPER, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
NICKEL, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
ANTIMONY, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
TIN, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
VANADIUM, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
ZINC, TOTAL	MB1	S	90L0226	N/A	03/09/90	03/23/90
ARSENIC LABORATORY	LC1 BS	S	90L0225	N/A	03/09/90	03/30/90
LEAD LABORATORY	LC1 BS	S	90L0225	N/A	03/09/90	04/05/90
SELENIUM LABORATORY	LC1 BS	S	90L0225	N/A	03/09/90	04/01/90
THALLIUM LABORATORY	LC1 BS	S	90L0225	N/A	03/09/90	04/04/90
ARSENIC LABORATORY	LC2 BS	S	90L0225	N/A	03/09/90	03/30/90
LEAD LABORATORY	LC2 BS	S	90L0225	N/A	03/09/90	04/05/90
SELENIUM LABORATORY	LC2 BS	S	90L0225	N/A	03/09/90	04/01/90
THALLIUM LABORATORY	LC2 BS	S	90L0225	N/A	03/09/90	04/04/90
ARSENIC, TOTAL	MB1	S	90L0225	N/A	03/09/90	03/30/90
LEAD, TOTAL	MB1	S	90L0225	N/A	03/09/90	04/05/90
SELENIUM, TOTAL	MB1	S	90L0225	N/A	03/09/90	04/01/90
THALLIUM, TOTAL	MB1	S	90L0225	N/A	03/09/90	04/04/90
MERCURY LABORATORY	LC1 BS	W	90C035B	N/A	03/06/90	03/07/90
MERCURY LABORATORY	LC2 BS	W	90C035B	N/A	03/06/90	03/07/90
MERCURY LABORATORY	LC3 BS	W	90C035B	N/A	03/06/90	03/07/90
MERCURY, TOTAL	MB1	W	90C035B	N/A	03/06/90	03/07/90
MERCURY, TOTAL	MB2	W	90C035B	N/A	03/06/90	03/07/90
MERCURY, TOTAL	MB3	W	90C035B	N/A	03/06/90	03/07/90

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 03/15/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L481

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	GS113 04-01	SILVER, TOTAL	1.4	u	MG/KG	1.4
		ARSENIC, TOTAL	1.4	u	MG/KG	1.4
		BARIUM, TOTAL	27.5	u	MG/KG	27.5
		CADMIUM, TOTAL	0.69	u	MG/KG	0.69
		CHROMIUM, TOTAL	2.2		MG/KG	1.4
		MERCURY, TOTAL	0.10	u	MG/KG	0.10
		LEAD, TOTAL	2.1		MG/KG	0.41
		SELENIUM, TOTAL	0.69	u	MG/KG	0.69

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 03/15/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L481

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK1	90L0156-MB1	SILVER, TOTAL	2.0	u	MG/KG	2.0
		BARIUM, TOTAL	40.0	u	MG/KG	40.0
		CADMIUM, TOTAL	1.0	u	MG/KG	1.0
		CHROMIUM, TOTAL	2.0	u	MG/KG	2.0
BLANK2	90L0156-MB2	SILVER, TOTAL	2.0	u	MG/KG	2.0
		BARIUM, TOTAL	40.0	u	MG/KG	40.0
		CADMIUM, TOTAL	1.0	u	MG/KG	1.0
		CHROMIUM, TOTAL	2.0	u	MG/KG	2.0
BLANK1	90L0155-MB1	ARSENIC, TOTAL	2.0	u	MG/KG	2.0
		SELENIUM, TOTAL	1.0	u	MG/KG	1.0
BLANK2	90L0155-MB2	ARSENIC, TOTAL	2.0	u	MG/KG	2.0
		SELENIUM, TOTAL	1.0	u	MG/KG	1.0
BLANK1	90C035B-MB1	MERCURY, TOTAL	0.10	u	MG/KG	0.10
BLANK2	90C035B-MB2	MERCURY, TOTAL	0.10	u	MG/KG	0[illegible]
BLANK3	90C035B-MB3	MERCURY, TOTAL	0.10	u	MG/KG	0.10

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 03/15/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L481

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
LCS2	90L0156-LC2	SILVER, LCS	106	12.8	157
		BARIUM, LCS	109	109	0.65
		CADMIUM, LCS	106	107	0.26
		CHROMIUM, LCS	106	106	0.00
LCS2	90L0155-LC2	ARSENIC, LCS	94.3	96.0	1.8
		SELENIUM, LCS	95.3	96.7	1.4
LCS2	90C035B-LC2	MERCURY, LCS	96.1	102	6.3

ROY F. WESTON INC.

INORGANICS LABORATORY CONTROL STANDARDS REPORT 03/15/90

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	90L0156-LC1	SILVER, LCS	106	100	MG/KG	106
		BARIUM, LCS	1090	1000	MG/KG	109
		CADMIUM, LCS	53.2	50.0	MG/KG	106
		CHROMIUM, LCS	106	100	MG/KG	106
LCS2	90L0156-LC2	SILVER, LCS	12.8	100	MG/KG	12.8
		BARIUM, LCS	1090	1000	MG/KG	109
		CADMIUM, LCS	53.3	50.0	MG/KG	107
		CHROMIUM, LCS	106	100	MG/KG	106
LCS3	90L0156-LC3	SILVER, LCS	107	100	MG/KG	107
		BARIUM, LCS	1090	1000	MG/KG	109
		CADMIUM, LCS	51.5	50.0	MG/KG	103
		CHROMIUM, LCS	105	100	MG/KG	105
LCS1	90L0155-LC1	ARSENIC, LCS	5.7	6.0	MG/KG	94.3
		SELENIUM, LCS	5.7	6.0	MG/KG	95.3
LCS2	90L0155-LC2	ARSENIC, LCS	5.8	6.0	MG/KG	96.0
		SELENIUM, LCS	5.8	6.0	MG/KG	96.7
LCS3	90L0155-LC3	ARSENIC, LCS	5.5	6.0	MG/KG	91.7
		SELENIUM, LCS	5.9	6.0	MG/KG	98.0
LCS1	90C035B-LC1	MERCURY, LCS	0.96	1.0	MG/KG	96.1
LCS2	90C035B-LC2	MERCURY, LCS	1.0	1.0	MG/KG	102
LCS3	90C035B-LC3	MERCURY, LCS	0.99	1.0	MG/KG	99.3

Roy F. Weston, Inc. - Lionville Laboratory
INORGANIC ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L481

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 04-01						
SILVER, TOTAL	001	S	90L0156	02/06/90	02/16/90	02/28/90
ARSENIC, TOTAL	001	S	90L0155	02/06/90	02/16/90	02/27/90
BARIUM, TOTAL	001	S	90L0156	02/06/90	02/16/90	02/28/90
CADMIUM, TOTAL	001	S	90L0156	02/06/90	02/16/90	02/28/90
CHROMIUM, TOTAL	001	S	90L0156	02/06/90	02/16/90	02/28/90
MERCURY, TOTAL	001	S	90C035B	02/06/90	03/06/90	03/07/90
LEAD, TOTAL	001	S	90L0155	02/06/90	02/16/90	02/26/90
SELENIUM, TOTAL	001	S	90L0155	02/06/90	02/16/90	02/17/90
LAB QC:						
SILVER LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
ALUMINUM LABORTORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
BARIUM LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
BERYLLIUM LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
CADMIUM LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
COBALT LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
CHROMIUM LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
COPPER LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
IRON LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
MOLYBDENUM LABORATOR	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
NICKEL LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
ANTIMONY LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
TIN LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
VANADIUM LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
ZINC LABORATORY	LC1 BS	S	90L0156	N/A	02/16/90	02/28/90
SILVER LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
ALUMINUM LABORTORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
BARIUM LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
BERYLLIUM LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
CADMIUM LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
COBALT LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
CHROMIUM LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
COPPER LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
IRON LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
MOLYBDENUM LABORATOR	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
NICKEL LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90

Roy F. Weston, Inc. - Lionville Laboratory
INORGANIC ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L481

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
ANTIMONY LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
TIN LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
VANADIUM LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
ZINC LABORATORY	LC2 BS	S	90L0156	N/A	02/16/90	02/28/90
SILVER LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
ALUMINUM LABORTORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
BARIUM LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
BERYLLIUM LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
CADMIUM LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
COBALT LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
CHROMIUM LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
COPPER LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
IRON LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
MOLYBDENUM LABORATOR	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
NICKEL LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
ANTIMONY LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
TIN LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
VANADIUM LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
ZINC LABORATORY	LC3 BS	S	90L0156	N/A	02/16/90	02/28/90
SILVER, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
ALUMINUM, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
BARIUM, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
BERYLLIUM, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
CADMIUM, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
COBALT, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
CHROMIUM, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
COPPER, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
IRON, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
MOLYBDENUM, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
NICKEL, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
ANTIMONY, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
TIN, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
VANADIUM, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
ZINC, TOTAL	MB1	S	90L0156	N/A	02/16/90	02/28/90
SILVER, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
ALUMINUM, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
BARIUM, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
BERYLLIUM, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
CADMIUM, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
COBALT, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90

Roy F. Weston, Inc. - Lionville Laboratory
INORGANIC ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90 RFW LOT # :9002L481

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
CHROMIUM, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
COPPER, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
IRON, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
MOLYBDENUM, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
NICKEL, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
ANTIMONY, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
TIN, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
VANADIUM, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
ZINC, TOTAL	MB2	S	90L0156	N/A	02/16/90	02/28/90
ARSENIC LABORATORY	LC1 BS	S	90L0155	N/A	02/16/90	02/27/90
SELENIUM LABORATORY	LC1 BS	S	90L0155	N/A	02/16/90	02/16/90
ARSENIC LABORATORY	LC2 BS	S	90L0155	N/A	02/16/90	02/27/90
SELENIUM LABORATORY	LC2 BS	S	90L0155	N/A	02/16/90	02/16/90
ARSENIC LABORATORY	LC3 BS	S	90L0155	N/A	02/16/90	02/27/90
SELENIUM LABORATORY	LC3 BS	S	90L0155	N/A	02/16/90	02/16/90
ARSENIC, TOTAL	MB1	S	90L0155	N/A	02/16/90	02/27/90
SELENIUM, BENCH SPIK	MB1	S	90L0155	N/A	02/16/90	02/16/90
SELENIUM, TOTAL	MB1	S	90L0155	N/A	02/16/90	02/16/90
ARSENIC, TOTAL	MB2	S	90L0155	N/A	02/16/90	02/27/90
SELENIUM, BENCH SPIK	MB2	S	90L0155	N/A	02/16/90	02/16/90
SELENIUM, TOTAL	MB2	S	90L0155	N/A	02/16/90	02/16/90
MERCURY LABORATORY	LC1 BS	W	90C035B	N/A	03/06/90	03/07/90
MERCURY LABORATORY	LC2 BS	W	90C035B	N/A	03/06/90	03/07/90
MERCURY LABORATORY	LC3 BS	W	90C035B	N/A	03/06/90	03/07/90
MERCURY, TOTAL	MB1	W	90C035B	N/A	03/06/90	03/07/90
MERCURY, TOTAL	MB2	W	90C035B	N/A	03/06/90	03/07/90
MERCURY, TOTAL	MB3	W	90C035B	N/A	03/06/90	03/07/90

WESTON℠
MANAGERS DESIGNERS/CONSULTANTS
208 WELSH POOL ROAD
PICKERING CREEK INDUSTRIAL PARK
LIONVILLE, PA 19353
PHONE: (215) 524-7360
TELEX: 83-5348

30 April 1990

Mr. Howard Hickey
Westinghouse Savannah River Company
Building 740-3A
Aiken, SC 29802

Re: Analytical results for samples collected from Gunsite 113 Access road, release order 11.

Dear Mr. Hickey:

Enclosed are the analytical results for the above referenced release order. (Weston Analytics batch numbers 9002L481 and 482.)

These results are in the form of an electronic deliverable diskette, and a standard commercial report which includes a case narrative.

If I can provide any further information, please do not hesitate to call either myself or Ben Shapiro.

Very truly yours,

ROY F. WESTON, INC.

Jack R. Tuschall
Laboratory Manager
Analytics Division

JRT/clk

Enclosure:

cc: Michelle Wilson (Letter only)
David Oliphant (Sirrine)
Ben Shapiro (Letter only)

SHEET 1 OF 1
DISK 1 OF 1

WESTON ANALYTICS
LIONVILLE, PA
DATA TRANSFER RECORD

LIMS _
WALIS X
INITIAL X
CORRECTED _
OTHER _

CLIENT: WSRC GUNSITE 113

PROJECT MANAGER: BEN SHAPIRO

ELECTRONIC X
HARD COPY _

ANALYSIS	RFW #	FILE NAME	SITE	W.O. #
VOA BNA METALS RAD INORGANICS	9002L481	W9002481.DAT	GUNSITE 113	0630-28-10
VOA BNA P/PCB HERBICIDES TDF OP PEST METALS INORGANICS	9002L482	W9002482.DAT	GUNSITE 113	0630-28-10

ELECTRONIC TRANSFER BY: DATE OF TRANSFER: 4/27/9

HARD COPY TRANSFER BY: ____________ DATE OF TRANSFER: ______

RECEIVED BY: ____________ DATE OF TRANSFER: ______

Roy F. Weston, Inc. - Lionville Laboratory
BNA ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/08/90

RFW LOT # :9002L482

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 01-02	001	S	90LE0222	02/06/90	02/16/90	02/22/90
GS113 01-02	001 REP	S	90LE0222	02/06/90	02/16/90	02/22/90
GS113 01-02	001 MS	S	90LE0222	02/06/90	02/16/90	02/22/90
LAB QC:						
SBLK	MB1	S	90LE0222	N/A	02/16/90	02/20/90
SBLK	MB1 BS	S	90LE0222	N/A	02/16/90	02/20/90

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC-GUNSITE 113 **SAMPLES RECEIVED:** 02-08-90
RFW #: 9002L482, SEMIVOLATILE
W.O. #: 0630-28-10

NARRATIVE

The set of samples consisted of one soil sample collected on 02-06-90.

The sample was extracted on 02-16-90 and analyzed according to criteria set forth in SW 846 Method 8270 for Appendix IX Semivolatile target compounds on 02-20,22-90.

The following is a summary of the QC results accompanying these sample results and a description of any problems encountered during their analysis:

1. Non-target compounds were detected in this sample and the blank.
2. All surrogate recoveries are within EPA QC limits.
3. All soil blank spike and matrix recovery criteria are met.
4. This standard package contained a matrix spike and sample replicate along with a blank spike.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

4-30-90
Date

maj/wpmemo/02-482s.cn

GLOSSARY OF BNA DATA

DATA QUALIFIERS

U = Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

J = Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero; for example, if the limit of detection is 10 ug/L and a concentration of 3 ug/L is calculated, it is reported as 3J.

B = This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination. This flag is also used for a TIC as well as for a positively identified TCL compound.

E = Indicates that the compound was detected beyond the calibration range and was subsequently analyzed at a dilution.

I = Interference.

A = Aldol Condensation Product.

X = Additional qualifiers used as required are explained in the case narrative.

NQ = Result qualitatively confirmed but not able to quantify.

ABBREVIATIONS

BS = Indicates blank spike in which reagent grade water is spiked with the CLP matrix spiking solutions and carried through all the steps in the method. Spike recoveries are reported.

BSD = Indicates blank spike duplicate.

MS = Indicates matrix spike.

MSD = Indicates matrix spike duplicate.

DL = Indicates that surrogate recoveries were not obtained because the extract had to be diluted for analysis.

NA = Not applicable.

DF = Dilution factor.

NR = Not required.

Roy F. Weston, Inc. - Lionville Laboratory
Semivolatiles by GC/MS, Appendix IX List

RFW Batch Number: 9002L482 Client: WSRC GUNSITE 113 Work Order: 0630-28-10-0000

Report Date: 04/06/90 15:47
Page: 1a

Sample Information										
Cust ID:	GS113 01-02		GS113 01-02		GS113 01-02		SBLK		SBLK BS	
RFW#:	001		001 REP		001 MS		90LE0222-MB1		90LE0222-MB1	
Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL	
D.F.:	1.11		1.11		1.11		1.11		1.11	
Units:	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Surrogate Recovery										
Nitrobenzene-d5	39	%	49	%	53	%	52	%	58	%
2-Fluorobiphenyl	41	%	49	%	57	%	55	%	62	%
p-Terphenyl-d14	62	%	71	%	75	%	89	%	82	%
Phenol-d5	45	%	54	%	63	%	54	%	65	%
2-Fluorophenol	47	%	57	%	62	%	55	%	63	%
2,4,6-Tribromophenol	56	%	55	%	69	%	79	%	83	%
		fl		fl		fl		fl		fl
Phenol	440	U	440	U	67	%	370	U	63	%
bis(2-Chloroethyl)ether	440	U	440	U	440	U	370	U	370	U
2-Chlorophenol	440	U	440	U	66	%	370	U	63	%
1,3-Dichlorobenzene	440	U	440	U	440	U	370	U	370	U
1,4-Dichlorobenzene	440	U	440	U	57	%	370	U	60	%
Benzyl alcohol	440	U	440	U	440	U	370	U	370	U
1,2-Dichlorobenzene	440	U	440	U	440	U	370	U	370	U
2-Methylphenol	440	U	440	U	440	U	370	U	370	U
bis(2-Chloroisopropyl)ether	440	U	440	U	440	U	370	U	370	U
4-Methylphenol	440	U	440	U	440	U	370	U	370	U
N-Nitroso-Di-n-propylamine	440	U	440	U	62	%	370	U	61	%
Hexachloroethane	440	U	440	U	440	U	370	U	370	U
Nitrobenzene	440	U	440	U	440	U	370	U	370	U
Isophorone	440	U	440	U	440	U	370	U	370	U
2-Nitrophenol	440	U	440	U	440	U	370	U	370	U
2,4-Dimethylphenol	440	U	440	U	440	U	370	U	370	U
Benzoic acid	2200	U	2200	U	2200	U	1800	U	1800	U
bis(2-Chloroethoxy)methane	440	U	440	U	440	U	370	U	370	U
2,4-Dichlorophenol	440	U	440	U	440	U	370	U	370	U
1,2,4-Trichlorobenzene	440	U	440	U	63	%	370	U	68	%
Naphthalene	440	U	440	U	440	U	370	U	370	U
4-Chloroaniline	440	U	440	U	440	U	370	U	370	U
Hexachlorobutadiene	440	U	440	U	440	U	370	U	370	U
4-Chloro-3-methylphenol	440	U	440	U	64	%	370	U	69	%
2-Methylnaphthalene	440	U	440	U	440	U	370	U	370	U
Hexachlorocyclopentadiene	440	U	440	U	440	U	370	U	370	U

%= Outside of EPA CLP QC limits.

RFW Batch Number: 9002L482 Client: WSRC GUNSITE 113 Work Order: 0630-28-10-0000

Cust ID:	GS113 01-02		GS113 01-02		GS113 01-02		SBLK		SBLK BS	
RFW#:	001		001 REP		001 MS		90LE0222-MB1		90LE0222-MB1	
2,4,6-Trichlorophenol	440	U	440	U	440	U	370	U	370	U
2,4,5-Trichlorophenol	2200	U	2200	U	2200	U	1800	U	1800	U
2-Chloronaphthalene	440	U	440	U	440	U	370	U	370	U
2-Nitroaniline	2200	U	2200	U	2200	U	1800	U	1800	U
Dimethylphthalate	440	U	440	U	440	U	370	U	370	U
Acenaphthylene	440	U	440	U	440	U	370	U	370	U
2,6-Dinitrotoluene	440	U	440	U	440	U	370	U	370	U
3-Nitroaniline	2200	U	2200	U	2200	U	1800	U	1800	U
Acenaphthene	440	U	440	U	66	*	370	U	75	*
2,4-Dinitrophenol	2200	U	2200	U	2200	U	1800	U	1800	U
4-Nitrophenol	2200	U	2200	U	95	*	1800	U	83	*
Dibenzofuran	440	U	440	U	440	U	370	U	370	U
2,4-Dinitrotoluene	440	U	440	U	63	*	370	U	66	*
Diethylphthalate	440	U	440	U	440	U	370	U	370	U
4-Chlorophenyl-phenylether	440	U	440	U	440	U	370	U	370	U
Fluorene	440	U	440	U	440	U	370	U	370	U
4-Nitroaniline	2200	U	2200	U	2200	U	1800	U	1800	U
4,6-Dinitro-2-methylphenol	2200	U	2200	U	2200	U	1800	U	1800	U
N-Nitrosodiphenylamine (1)	440	U	440	U	440	U	370	U	370	U
4-Bromophenyl-phenylether	440	U	440	U	440	U	370	U	370	U
Hexachlorobenzene	440	U	440	U	440	U	370	U	370	U
Pentachlorophenol	2200	U	2200	U	78	*	1800	U	73	*
Phenanthrene	440	U	440	U	440	U	370	U	370	U
Anthracene	440	U	440	U	440	U	370	U	370	U
Di-n-Butylphthalate	440	U	440	U	440	U	370	U	370	U
Fluoranthene	440	U	440	U	440	U	370	U	370	U
Pyrene	440	U	440	U	83	*	370	U	97	*
Butylbenzylphthalate	440	U	440	U	440	U	370	U	370	U
3,3'-Dichlorobenzidine	880	U	880	U	870	U	740	U	740	U
Benzo(a)anthracene	440	U	440	U	440	U	370	U	370	U
Chrysene	440	U	440	U	440	U	370	U	370	U
bis(2-Ethylhexyl)phthalate	440		260	J	450		370	U	370	U
Di-n-Octyl phthalate	440	U	440	U	440	U	370	U	370	U
Benzo(b)fluoranthene	440	U	440	U	440	U	370	U	370	U
Benzo(k)fluoranthene	440	U	440	U	440	U	370	U	370	U
Benzo(a)pyrene	440	U	440	U	440	U	370	U	370	U
Indeno(1,2,3-cd)pyrene	440	U	440	U	440	U	370	U	370	U
Dibenzo(a,h)anthracene	440	U	440	U	440	U	370	U	370	U
Benzo(g,h,i)perylene	440	U	440	U	440	U	370	U	370	U
1,4-Dioxane	440	U	440	U	440	U	370	U	370	U

*= Outside of EPA CLP QC limits.

RF atch Number: 9002L482 Client: WSRC GUNSI 113 Work Order: 0630-28-10-0000 age: 1c

Cust ID:	GS113 01-02		GS113 01-02		GS113 01-02		SBLK		SBLK BS	
RFW#:	001		001 REP		001 MS		90LE0222-MB1		90LE0222-MB1	
Methyl methacrylate	440	U	440	U	440	U	370	U	370	U
Pyridine	440	U	440	U	440	U	370	U	370	U
N-Nitrosodimethylamine	440	U	440	U	440	U	370	U	370	U
Ethyl methacrylate	440	U	440	U	440	U	370	U	370	U
2-Picoline	440	U	440	U	440	U	370	U	370	U
N-Nitrosomethylethylamine	440	U	440	U	440	U	370	U	370	U
Methyl methanesulfonate	440	U	440	U	440	U	370	U	370	U
N-Nitrosodiethylamine	440	U	440	U	440	U	370	U	370	U
Ethyl methanesulfonate	440	U	440	U	440	U	370	U	370	U
Aniline	440	U	440	U	440	U	370	U	370	U
Pentachloroethane	440	U	440	U	440	U	370	U	370	U
3-Methylphenol	440	U	440	U	440	U	370	U	370	U
N-Nitrosopyrrolidine	440	U	440	U	440	U	370	U	370	U
Acetophenone	440	U	440	U	440	U	370	U	370	U
N-Nitrosomorpholine	440	U	440	U	440	U	370	U	370	U
o-Toluidine	440	U	440	U	440	U	370	U	370	U
N-Nitrosopiperidine	2200	U	2200	U	2200	U	1800	U	1800	U
a,a-Dimethylphenethylamine	440	U	440	U	440	U	370	U	370	U
2,6-Dichlorophenol	440	U	440	U	440	U	370	U	370	U
Hexachloropropene	440	U	440	U	440	U	370	U	370	U
p-Phenylenediamine	440	U	440	U	440	U	370	U	370	U
N-Nitroso-di-n-butylamine	440	U	440	U	440	U	370	U	370	U
Safrole	440	U	440	U	440	U	370	U	370	U
1,2,4,5-Tetrachlorobenzene	440	U	440	U	440	U	370	U	370	U
Isosafrole	440	U	440	U	440	U	370	U	370	U
1,4-Naphthoquinone	440	U	440	U	440	U	370	U	370	U
1,3-Dinitrobenzene	440	U	440	U	440	U	370	U	370	U
Pentachlorobenzene	440	U	440	U	440	U	370	U	370	U
1-Naphthylamine	440	U	440	U	440	U	370	U	370	U
2-Naphthylamine	440	U	440	U	440	U	370	U	370	U
2,3,4,6-Tetrachlorophenol	440	U	440	U	440	U	370	U	370	U
1,3,5-Trinitrobenzene	440	U	440	U	440	U	370	U	370	U
Diallate	440	U	440	U	440	U	370	U	370	U
Phenacetin	440	U	440	U	440	U	370	U	370	U
Diphenylamine	440	U	440	U	440	U	370	U	370	U
5-Nitro-o-toluidine	440	U	440	U	440	U	370	U	370	U
4-Aminobiphenyl	440	U	440	U	440	U	370	U	370	U
Pronamide	440	U	440	U	440	U	370	U	370	U
2-sec-Butyl-4,6-dinitrophenol	440	U	440	U	440	U	370	U	370	U
Pentachloronitrobenzene	2200	U	2200	U	2200	U	1800	U	1800	U
	2200	U	2200	U	2200	U	1800	U	1800	U

*= Outside of EPA CLP QC limits.

Cust ID:	GS113 01-02		GS113 01-02		GS113 01-02		SBLK		SBLK BS	
RFW#:	001		001 REP		001 MS		90LE0222-MB1		90LE0222-MB1	
4-Nitroquinoline-1-oxide	880	U	880	U	870	U	740	U	740	U
Methapyrilene	440	U	440	U	440	U	370	U	370	U
Aramite	880	U	880	U	870	U	740	U	740	U
Chlorobenzilate	440	U	440	U	440	U	370	U	370	U
p-Dimethylaminoazobenzene	440	U	440	U	440	U	370	U	370	U
3,3'-Dimethylbenzidine	440	U	440	U	440	U	370	U	370	U
2-Acetylaminofluorene	440	U	440	U	440	U	370	U	370	U
7,12-Dimethylbenz(a)anthracene	440	U	440	U	440	U	370	U	370	U
Hexachlorophene	3900	U	4000	U	3900	U	3300	U	3300	U
3-Methylcholanthrene	440	U	440	U	440	U	370	U	370	U

(1) - Cannot be separated from Diphenylamine. *= Outside of EPA CLP QC limits.

1F

SEMIVOLATILE ORGANICS ANALYSIS SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

GS113 01-02

Lab Name: Roy F. Weston, Inc. Work Order: 0630-28-10-0000

Client: WSRC GUNSITE 113

Matrix: SOIL

Lab Sample ID: 9002L482-001

Sample wt/vol: 30.2 (g/mL) G

Lab File ID: L022208

Level: (low/med) LOW

Date Received: 02/09/90

% Moisture: not dec. 16 dec.

Date Extracted: 02/16/90

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 02/22/90

GPC Cleanup: (Y/N) N pH: 5.8

Dilution Factor: 1.11

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	ALDOL CONDENSATE	6.23	300	JAB
2.	ALDOL CONDENSATE	6.97	200	JA
3.	UNKNOWN	19.70	400	JB

FORM 1 SV-TIC 12/88 Rev.

1F

SEMIVOLATILE ORGANICS ANALYSIS SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

GS113 01-02REP

Lab Name: Roy F. Weston, Inc. Work Order: 0630-28-10-0000

Client: WSRC GUNSITE 113

Matrix: SOIL

Lab Sample ID: 9002L482-001 REP

Sample wt/vol: 30.0 (g/mL) G

Lab File ID: L022209

Level: (low/med) LOW

Date Received: 02/09/90

% Moisture: not dec. 16 dec.

Date Extracted: 02/16/90

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 02/22/90

GPC Cleanup: (Y/N) N pH: 5.8

Dilution Factor: 1.11

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	ALDOL CONDENSATE	6.23	300	JAB
2.	ALDOL CONDENSATE	6.97	400	JA
3.	UNKNOWN	19.70	300	JB

1F
SEMIVOLATILE ORGANICS ANALYSIS SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

SBLK

Lab Name: Roy F. Weston, Inc. Work Order: 0630-28-10-0000

Client: WSRC GUNSITE 113

Matrix: SOIL

Lab Sample ID: 90LE0222-MB1

Sample wt/vol: 30.0 (g/mL) G

Lab File ID: L022013

Level: (low/med) LOW

Date Received: 02/16/90

% Moisture: not dec. 0 dec.

Date Extracted: 02/16/90

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 02/20/90

GPC Cleanup: (Y/N) N pH: 7.0

Dilution Factor: 1.11

Number TICs found: 4

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	ALDOL CONDENSATE	5.88	200	JA
2.	ALDOL CONDENSATE	6.18	100	JA
3.	UNKNOWN	19.63	300	J
4.	ALKANE	23.28	200	J

FORM 1 SV-TIC 12/88 Rev.

WESTON℠

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC GUNSITE 113
RFW #: 9002L482
W.O. #: 0630-28-10

SAMPLES RECEIVED: 02-09-90

METALS NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All calibration verification checks were within the required control limits of 90-100% (85-115% for Hg). Calibration verification is performed using independent standards from Inorganic Ventures, Inc.

3. All preparation blanks were analyzed below the required detection limit.

4. Laboratory control standards were within the control limits of 80-120% with the exception of silver (59%) for site ID# 90L0226-LC1. The blank spike reproducibility was outside the 20% window for silver at 58%.

   Note: The USEPA-CLP has dropped control limits for silver and antimony due to documented difficulties in obtaining reliable results. WESTON Analytics has adopted the same policy.

5. The analytical methods applied by the laboratory for the determination of metals are:

   As: EPA 206.2
   Se: EPA 270.2
   Pb: EPA 239.2
   Tl: EPA 279.2

   Hg: EPA 245.1
   ICP Scan: EPA 200.7
   All Others: EPA 200.7
   EP Leachates (except Hg): 200.7

NOTE: For solid samples, all results are reported on a dry weight basis.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

4-9-90
Date

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

WESTON
ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC GUNSITE 113 **SAMPLES RECEIVED:** 02/09/90
RFW #: 9002L482
W.O. #: 0630-28-10

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.
2. All preparation blanks were analyzed below the required detection limit.
3. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.
4. All laboratory control standards (blank spikes) were within the control limits of 80-120%.
5. The analytical methods applied by the laboratory, unless otherwise requested, for all inorganic analyses are derived from the USEPA Method for Chemical Analysis of Water and Wastes (USEPA 600/4-79-020), and Standard Methods for the Examination of Water and Wastewater 16 ed. Methods for the analysis of solid samples are derived from Test Methods for Evaluating Solid Waste (USEPA SW846).
6. USEPA-CLP SOW 787 was followed for the analysis of cyanide.

NOTE: For solid samples, all results are reported on a dry weight basis.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

3-16-90
Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 03/08/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L482

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	GS113 01-02	% SOLIDS	87.6	%	0.10
		CYANIDE, TOTAL	2.2	MG/KG	1.1
		SULFIDE	0.28 u	MG/KG	0.28

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 03/08/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L482

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK1	90LC070-MB1	CYANIDE, TOTAL	1.0 u	MG/KG	1.0
BLANK10	90LSD016-MB1	SULFIDE	0.25 u	MG/KG	0.25
BLANK20	90LSD016-MB2	SULFIDE	0.25 u	MG/KG	0.25
BLANK30	90LSD016-MB3	SULFIDE	0.25 u	MG/KG	0.25

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 03/08/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L482

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	90LSD016-MB1	SULFIDE	1.1	0.25u	1.0	106
BLANK20	90LSD016-MB2	SULFIDE	1.1	0.25u	1.0	107
BLANK30	90LSD016-MB3	SULFIDE	1.1	0.25u	1.0	110

ROY F. WESTON INC.

INORGANICS LABORATORY CONTROL STANDARDS REPORT 03/08/90

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCSS1	90LC070-LCS1	CYANIDE, TOTAL LCS	9.5	10.0	MG/KG	95.4
LCSS2	90LC070-LCS2	CYANIDE, TOTAL LCS	6.1	5.6	MG/KG	108

Roy F. Weston, Inc. - Lionville Laboratory
INORGANIC ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L482

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 01-02						
% SOLIDS	001	S	90L%S033	02/06/90	02/20/90	02/20/90
TOTAL CYANIDE	001	S	90LC070	02/06/90	02/16/90	02/17/90
SULFIDE	001	S	90LSD016	02/06/90	03/02/90	03/02/90

LAB QC:

TOTAL CYANIDE	CCB	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	CCB	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	CCV L	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	CCV L	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	ICB	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	ICV L	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	ICV L	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	LCS L	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	LCS L	W	90LC070	N/A	02/16/90	02/17/90
TOTAL CYANIDE	MB1	W	90LC070	N/A	02/16/90	02/17/90
SULFIDE	MB1	S	90LSD016	N/A	03/02/90	03/02/90
SULFIDE	MB1 BS	S	90LSD016	N/A	03/02/90	03/02/90
SULFIDE	MB2	S	90LSD016	N/A	03/02/90	03/02/90
SULFIDE	MB2 BS	S	90LSD016	N/A	03/02/90	03/02/90
SULFIDE	MB3	S	90LSD016	N/A	03/02/90	03/02/90
SULFIDE	MB3 BS	S	90LSD016	N/A	03/02/90	03/02/90

Roy F. Weston, Inc. - Lionville Laboratory
VOA ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L482

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 01-02	001	S	90LVW025	02/06/90	N/A	02/20/90
LAB QC:						
VBLK	MB1	S	90LVW025	N/A	N/A	02/20/90

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC GUNSITE 113 **SAMPLES RECEIVED:** 02-09-90
RFW #: 9002L482, GC/MS VOLATILE
W.O. #: 0630-28-10

NARRATIVE

The set of samples consisted of one soil sample collected on 02-06-90.

The sample was analyzed according to criteria set forth in SW 846 Method 8240 for Appendix IX Volatile target compounds on 02-20-90.

The following is a summary of the QC results accompanying these sample results and a description of any problems encountered during their analysis:

1. Non-target compounds were not detected in this sample.
2. All surrogate recoveries are within EPA QC limits.

3-22-90
Jack R. Tuschall, Ph.D. Date
Laboratory Manager
Lionville Analytical Laboratory

Roy F. Weston, Inc. - Lionville Laboratory
Volatiles by GC/MS, Appendix IX List

RFW Batch Number: 9002L482 Client: WSRC GUNSITE 113 Report Date: 03/21/90 11:31
Work Order: 0630-28-10-0000 Page: 1a

	Cust ID:	GS113 01-02		VBLK	
Sample Information	RFW#:	001		90LVW025-MB1	
	Matrix:	SOIL		SOIL	
	D.F.:	1.00		1.00	
	Units:	UG/KG		UG/KG	
	Toluene-d8	101	%	98	%
Surrogate	Bromofluorobenzene	106	%	99	%
Recovery	1,2-Dichloroethane-d4	108	%	96	%
Chloromethane		11	U	10	U
Bromomethane		11	U	10	U
Vinyl Chloride		11	U	10	U
Chloroethane		11	U	10	U
Methylene Chloride		17	B	11	
Acetone		95		10	U
Carbon Disulfide		6	U	5	U
1,1-Dichloroethene		6	U	5	U
1,1-Dichloroethane		6	U	5	U
1,2-Dichloroethene (total)		6	U	5	U
Chloroform		6	U	5	U
1,2-Dichloroethane		6	U	5	U
2-Butanone		11	U	10	U
1,1,1-Trichloroethane		1	J	5	U
Carbon Tetrachloride		6	U	5	U
Vinyl Acetate		11	U	10	U
Bromodichloromethane		6	U	5	U
1,2-Dichloropropane		6	U	5	U
cis-1,3-Dichloropropene		6	U	5	U
Trichloroethene		6	U	5	U
Dibromochloromethane		6	U	5	U
1,1,2-Trichloroethane		6	U	5	U
Benzene		6	U	5	U
Trans-1,3-Dichloropropene		6	U	5	U
Bromoform		6	U	5	U
4-Methyl-2-pentanone		11	U	10	U
2-Hexanone		11	U	10	U
Tetrachloroethene		6	U	5	U
1,1,2,2-Tetrachloroethane		6	U	5	U

*= Outside of EPA CLP QC limits.

WESTON

GLOSSARY OF VOA DATA

DATA QUALIFIERS

U = Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

J = Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero; for example, if the limit of detection is 10 ug/L and a concentration of 3 ug/L is calculated, it is reported as 3J.

B = This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination. This flag is also used for a TIC as well as for a positively identified TCL compound.

E = Indicates that the compound was detected beyond the calibration range and was subsequently analyzed at a dilution.

I = Interference.

X = Additional qualifiers used as required are explained in the case narrative.

NQ = Result qualitatively confirmed but not able to quantify.

ABBREVIATIONS

BS = Indicates blank spike in which reagent grade water is spiked with the CLP matrix spiking solutions and carried through all the steps in the method. Spike recoveries are reported.

BSD = Indicates blank spike duplicate.

MS = Indicates matrix spike.

MSD = Indicates matrix spike duplicate.

DL = Indicates that surrogate recoveries were not obtained because the extract had to be diluted for analysis.

NA = Not applicable.

DF = Dilution factor.

NR = Not required.

Cust ID:	GS113 01-02	VBLK
RFW#:	001	90LVW025-MB1
Toluene	6 U	5 U
Chlorobenzene	6 U	5 U
Ethylbenzene	6 U	5 U
Styrene	6 U	5 U
Xylene (total)	6 U	5 U
Acrolein	11 U	10 U
Acrylonitrile	11 U	10 U
Trichlorofluoromethane	6 U	5 U
Dichlorodifluoromethane	11 U	10 U
Acetonitrile	23 U	20 U
Iodomethane	11 U	10 U
Propionitrile (Ethyl Cyanide)	57 U	50 U
3-Chloropropene	23 U	20 U
Methacrylonitrile	23 U	20 U
Dibromomethane	11 U	10 U
Isobutyl alcohol	23 U	20 U
1,2-Dibromoethane	23 U	20 U
1,1,1,2-Tetrachloroethane	11 U	10 U
1,2,3-Trichloropropane	11 U	10 U
trans-1,4-Dichloro-2-butene	57 U	50 U
1,2-Dibromo-3-chloropropane	23 U	20 U
2-Chloro-1,3-Butadiene	110 U	100 U

*= Outside of EPA CLP QC limits.

WESTON℠

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WRSC-GUNSITE 113
RFW #: 9002L482 HERBICIDE
W.O. #: 0630-28-10

SAMPLES RECEIVED: 02-09-90

NARRATIVE

The set of samples consisted of one soil sample collected on 02-06-90.

The sample was extracted on 02-16-90 and analyzed according to criteria set forth in the Method 8150 for Chlorinated Phenoxy Acid Herbicide target compounds on 03-08-90.

The following is a summary of the QC results accompanying these sample results and a description of any problems encountered during their analysis:

1. All of the blank and matrix spike recoveries are within laboratory control chart warning limits.
2. No problems were encountered during the analysis.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

3-15-90
Date

Weston, Inc. - Lionville Laboratory
Herbicides by GC

RFW Batch Number: 9002L482 Client: WSRC GUNSITE 113 Work Order: 0630-28-10-0000 Report Date: 03/12/90 12:17 Page: 1

	Cust ID:	GS113 01-02	PBLK	PBLK BS	GS218-02-01
Sample Information	RFW#:	001	90LE0224-MB1	90LE0224-MB1	494-002 MS
	Matrix:	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	1.00	1.00
	Units:	UG/KG	UG/KG	UG/KG	UG/KG
2,4-D		24 U	7.7 J	86 %	69 %
2,4,5-TP (Silvex)		12 U	17 U	65 %	103 %
2,4,5-T		1.2 J	17 U	78 %	102 %

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Lionville Laboratory
HB ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90 RFW LOT # :9002L482

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 01-02	001	S	90LE0224	02/06/90	02/16/90	03/08/90
LAB QC:						
PBLK	MB1	S	90LE0224	N/A	02/16/90	03/08/90
PBLK	MB1 BS	S	90LE0224	N/A	02/16/90	03/08/90

Roy F. Weston, Inc. - Lionville Laboratory
OPP ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L482

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 01-02	001	S	90LE0250	02/06/90	02/20/90	02/22/90
LAB QC:						
PBLK	MB1	S	90LE0250	N/A	02/20/90	02/22/90

WESTON
ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC - GUN SITE 113 **SAMPLES RECEIVED:** 02-06-90
RFW #: 9002L482, ORGANOPHOSPHORUS PESTICIDE
W.O. #: 0630-28-10

NARRATIVE

The set of samples consisted of one soil sample collected on 02-06-90.

The sample was extracted on 02-20-90 and analyzed according to criteria set forth in Method 8140 for Appendix IX Organophosphorus Pesticide target compounds on 02-22-90.

All surrogate recoveries were within the laboratory control limits and no problems were encountered during the analysis.

2-27-90

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

Date

GLOSSARY OF GC VOA DATA

DATA QUALIFIERS

U = Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

J = Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero; for example, if the limit of detection is 10 ug/L and a concentration of 3 ug/L is calculated, it is reported as 3J.

B = This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination. This flag is also used for a TIC as well as for a positively identified TCL compound.

E = Indicates that the compound was detected beyond the calibration range and was subsequently analyzed at a dilution.

I = Interference.

N = Not Confirmed.

Y = Confirmed Positive.

ABBREVIATIONS

BS = Indicates blank spike in which reagent grade water is spiked with the CLP matrix spiking solutions and carried through all the steps in the method. Spike recoveries are reported.

BSD = Indicates blank spike duplicate.

MS = Indicates matrix spike.

MSD = Indicates matrix spike duplicate.

DL = Indicates that surrogate recoveries were not obtained because the extract had to be diluted for analysis.

NA = Not applicable.

DF = Dilution factor.

NR = Not required.

METHOD CONTROL LIMITS

(method 601)
8010

Column Used: carbopack C

COMPOUND NAME	QC LIMITS(ppb)	QC LIMITS(%)
Bromochloromethane	12.0 - 26.0	60.0 - 130.0
aaa-Trifluorotoluene	-	-
Chloromethane	11.9 - 28.1	59.5 - 140.5
Bromomethane	11.7 - 28.3	58.5 - 141.5
Vinyl Chloride	13.7 - 26.3	68.5 - 131.5
Chloroethane	15.4 - 24.6	77.0 - 123.0
Methylene Chloride	15.5 - 24.5	77.5 - 122.5
Trichlorofluoromethane	13.3 - 26.7	66.5 - 133.5
1,1-Dichloroethene	12.6 - 27.4	63.0 - 137.0
1,1-Dichloroethane	16.8 - 23.2	84.0 - 116.0
Chloroform	15.0 - 25.0	75.0 - 125.0
Trans-1,2-Dichloroethene	12.8 - 27.2	64.0 - 136.0
1,1,1-Trichloroethane	14.2 - 25.8	71.0 - 129.0
Carbon Tetrachloride	13.7 - 26.3	68.5 - 131.5
1,2-Dichloropropane	14.8 - 25.2	74.0 - 126.0
Trichloroethene	15.4 - 24.6	77.0 - 123.0
Dibromochloromethane	13.1 - 26.9	65.5 - 134.5
1,1,2-Trichloroethane	15.7 - 24.3	78.5 - 121.5
2-chloroethylvinylether	12.0 - 28.0	60.0 - 140.0
Tetrachloroethene	14.0 - 26.0	70.0 - 130.0
Chlorobenzene	14.4 - 25.6	72.0 - 128.0
1,3-Dichlorobenzene	9.9 - 30.1	49.5 - 150.5
1,2-Dichlorobenzene	14.0 - 26.0	70.0 - 130.0
1,4-Dichlorobenzene	13.9 - 26.1	69.5 - 130.5
Bromoform	14.7 - 25.3	73.5 - 126.5
1,1,2,2-Tetrachloroethane	9.8 - 30.2	49.0 - 151.0
1,2-Dichloroethane	14.3 - 25.7	71.5 - 128.5
Bromodichloromethane	15.2 - 24.8	76.0 - 124.0
Trans-1,3-Dichloropropene	12.8 - 27.2	64.0 - 136.0
Cis-1,3-Dichloropropene	12.8 - 27.2	64.0 - 136.0
Benzene	-	-
Toluene	-	-
Ethylbenzene	-	-
Xylenes (total)	-	-

GC-VOA

METHOD CONTROL LIMITS

(method 602)

Column Used: carbopack B P

COMPOUND NAME	QC LIMITS(ppb)	QC LIMITS(%)
Bromochloromethane		
aaa-Trifluorotoluene	-	-
Chloromethane	14.0 - 26.0	70.0 - 130.0
Bromomethane	-	-
Vinyl Chloride	-	-
Chloroethane	-	-
Methylene Chloride	-	-
Trichlorofluoromethane	-	-
1,1-Dichloroethene	-	-
1,1-Dichloroethane	-	-
Chloroform	-	-
Trans-1,2-Dichloroethene	-	-
1,1,1-Trichloroethane	-	-
Carbon Tetrachloride	-	-
1,2-Dichloropropane	-	-
Trichloroethene	-	-
Dibromochloromethane	-	-
1,1,2-Trichloroethane	-	-
2-chloroethylvinylether	-	-
Tetrachloroethene	-	-
Chlorobenzene	-	-
1,3-Dichlorobenzene	16.1 - 23.9	80.5 - 119.5
1,2-Dichlorobenzene	14.5 - 25.5	72.5 - 127.5
1,4-Dichlorobenzene	13.6 - 26.4	68.0 - 132.0
Bromoform	13.9 - 26.1	69.5 - 130.5
1,1,2,2-Tetrachloroethane	-	-
1,2-Dichloroethane	-	-
Bromodichloromethane	-	-
Trans-1,3-Dichloropropene	-	-
Cis-1,3-Dichloropropene	-	-
Benzene	-	-
Toluene	15.4 - 24.6	77.0 - 123.0
Ethylbenzene	15.5 - 24.5	77.5 - 122.5
Xylenes (total)	12.6 - 27.4	63.0 - 137.0
	-	-

ORTHOPHOSP[illegible] PESTICIDES

RFW Batch Number: 9002L482 Client: WSRC GUNSITE 113 Report Date: 02/23/9[illegible]7:00

Work Order: 0630-28-10-0000 Page: 1

Cust ID: GS113 01-02 PBLK

Sample Information	RFW#:	001		90LE0250-MB1	
	Matrix:	SOIL		SOIL	
	D.F.:	0.500		0.500	
	Units:	ug/Kg		ug/Kg	
Surrogate:	Ethion	117	%	95	%

===fl===========fl===========fl===========fl===========fl===========fl

Diazinon	7.9	U	6.7	U
Methyl Parathion	7.9	U	6.7	U
0,0,0-Triethyl Phosphorothioat	40	U	33	U
Thionazin (Zinophos)	40	U	33	U
Phorate	7.9	U	6.7	U
Sulfotepp	40	U	33	U
Disulfoton	7.9	U	6.7	U
Dimethoate	40	U	33	U
Ethyl Parathion	7.9	U	6.7	U
Famphur (Famophos)	79	U	67	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Lionville Laboratory
PEST/PCB ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/06/90

RFW LOT # :9002L482

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 01-02	001	S	90LE0222	02/06/90	02/16/90	03/28/90
GS113 01-02	001 REP	S	90LE0222	02/06/90	02/16/90	03/28/90
GS113 01-02	001 MS	S	90LE0222	02/06/90	02/16/90	03/28/90
LAB QC:						
SBLK	MB1	S	90LE0222	N/A	02/16/90	03/28/90
SBLK	MB1 BS	S	90LE0222	N/A	02/16/90	03/28/90

WESTON℠

Roy F. Weston, Inc.
Lionville Laboratory

Client: WSRC Gunsite 218
RFW#: 9002L482, Pesticide and PCB
W.O.#: 0630-28-11

Date Received: 02/06/90

The set of samples consisted of 1 soil sample collected on 02/06/90.

The sample was extracted on 02/16/90 and analyzed according to criteria set forth in the Contract Lab Program for Pesticide and PCB target compounds on 03/28/90.

The following is a summary of the QC results accompanying these sample results and a description of any problem encountered during their analysis.

1. All surrogate recoveries are within EPA QC limits.
2. All blank and matrix spike recoveries are within EPA QC limits.

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

4-13-90
Date

GLOSSARY OF PEST/PCB DATA

DATA QUALIFIERS

U - Indicates that the compounds was analyzed for but not detected. The minimum detection limit for the sample (not the method detection limit) is reported with the U (e.g., 10U).

J - Indicates an estimated value. This flag is used in cases where a target analyte is detected at a level less than the lower quantification level. If the limit of quantification is 10 ug/L and a concentration of 3 ug/L is calculated, it is reported as 3J.

B - This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination. This flag is also used for a TIC as well as for a positively identified TCL compound.

E - Indicates that the compound was detected beyond the calibration range and was subsequently analyzed at a dilution.

I - Interference.

ABBREVIATIONS

BS - Indicates blank spike in which reagent grade water is spiked with the CLP matrix spiking solutions and carried through all the steps in the method. Spike recoveries are reported.

BSD - Indicates blank spike duplicate.

MS - Indicates matrix spike.

MSD - Indicates matrix spike duplicate.

DL - Indicates that recoveries were not obtained because the extract had to be diluted for analysis.

NA - Not applicable.

DF - Dilution factor.

NR - Not required.

Roy F. Weston, Inc. Lionville Laboratory
Pesticide/PCBs by [illegible], Appendix IX List

RFW Batch Number: 9002L482 Client: WSRC GUNSITE 113 Work Order: 0630-28-10-0000 Report Date: 03/30/90 11:24 Page: 1

	Cust ID:	GS113 01-02		GS113 01-02		GS113 01-02		SBLK		SBLK BS	
Sample Information	RFW#:	001		001 REP		001 MS		90LE0222-MB1		90LE0222-MB1	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL	
	D.F.:	0.500		0.500		0.500		0.500		0.500	
	Units:	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Surrogate: Di-n-butylchlorendate		37	%	76	%	84	%	122	%	91	%
			fl		fl		fl		fl		fl
Alpha-BHC		4.7	U	4.8	U	4.7	U	4.0	U	4.0	U
Beta-BHC		4.7	U	4.8	U	4.7	U	4.0	U	4.0	U
Delta-BHC		4.7	U	4.8	U	4.7	U	4.0	U	4.0	U
gamma-BHC (Lindane)		4.7	U	4.8	U	4.7	U	4.0	U	4.0	U
Heptachlor		4.7	U	4.8	U	75	%	4.0	U	98	%
Aldrin		4.7	U	4.8	U	51	%	4.0	U	49	%
Heptachlor epoxide		4.7	U	4.8	U	52	%	4.0	U	42	%
Endosulfan I		4.7	U	4.8	U	4.7	U	4.0	U	4.0	U
Dieldrin		9.5	U	9.5	U	4.7	U	4.0	U	4.0	U
4,4'-DDE		9.5	U	9.5	U	44	%	8.0	U	61	%
Endrin		9.5	U	9.5	U	9.4	U	8.0	U	8.0	U
Endosulfan II		9.5	U	9.5	U	51	%	8.0	U	70	%
4,4'-DDD		9.5	U	9.5	U	9.4	U	8.0	U	8.0	U
Endosulfan sulfate		9.5	U	9.5	U	9.4	U	8.0	U	8.0	U
4,4'-DDT		9.5	U	9.5	U	9.4	U	8.0	U	8.0	U
Methoxychlor		9.5	U	9.5	U	60	%	8.0	U	76	%
Endrin aldehyde		47	U	48	U	47	U	40	U	40	U
Kepone		9.5	U	9.5	U	9.4	U	8.0	U	8.0	U
alpha-Chlordane		9.5	U	9.5	U	9.4	U	8.0	U	8.0	U
gamma-Chlordane		47	U	48	U	47	U	40	U	40	U
Toxaphene		47	U	48	U	47	U	40	U	40	U
Aroclor-1016		95	U	95	U	94	U	80	U	80	U
Aroclor-1221		47	U	48	U	47	U	40	U	40	U
Aroclor-1232		47	U	48	U	47	U	40	U	40	U
Aroclor-1242		47	U	48	U	47	U	40	U	40	U
Aroclor-1248		47	U	48	U	47	U	40	U	40	U
Aroclor-1254		47	U	48	U	47	U	40	U	40	U
Aroclor-1260		95	U	95	U	94	U	80	U	80	U
Isodrin		95	U	95	U	94	U	80	U	80	U
		9.5	U	9.5	U	9.4	U	8.0	U	8.0	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked. %= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC GUNSITE 113
RFW #: 9002L482, PCDD/PCDF
W.O. #: 0630-28-10

SAMPLES RECEIVED: 02/06/90

NARRATIVE

The set of samples consisted of 1 soil sample collected on 02/06/90.

The samples were extrcted on 02/12/90 and analyzed according to criteria set forth in Method 8280 for Tetra through Hexa PCDD/PCDF target compound on 03/09/90.

All surrogate recoveries are within EPA QC limits.

3-29-90

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

Date

WESTON ANALYTICS
BLANK SPIKE/BLANK SPIKE DUPLICATE RECOVERY

CLIENT: WSRC GUNSITE 113
BS GC/MS FILE NAME: Z0309007
BSD GC/MS FILE NAME: NA
EXTRACTION BATCH NO: 90SP238
SAMPLE ID : BS

CONTRACTOR: WESTON
DATE EXTRACTED: 02/12/90
DATE ANALYZED: 03/09/90
CLIENT ID: BS

COMPOUND	AMOUNT SPIKED ng	SAMPLE WT./VOL.	SPIKE CONC. Ng/g	CONC. FOUND Ng/g	BLANK CONC.	% REC
2,3,7,8-TCDD	50	5.0	10	6.6	ND	66
1,2,3,6,7,8-HXCDD	50	5.0	10	8.7	ND	87
OCDD	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDF	50	5.0	10	3.1	ND	31
1,2,3,6,7,8-HXCDF	50	5.0	10	8.5	ND	85
OCDF	NA	NA	NA	NA	NA	NA

WESTON ANALYTICS
DIOXINS/FURANS DATA SUMMARY

RFW Batch Number: 9002L482 Client: WSRC GUNSITE 113 Page:

Sample Information						
	Client ID:	GS113-01 -01	BLANK	BLK SPIKE		
	RFW#:	001	MB1	MB1 S		
	D.F.:	1	1	1		
	Matrix:	Soil	Soil	Soil		
	Units:	Ng	Ng	Ng		
C-13 TCDD RECOVERY:		99 %	59 %	78 %	%	%
C-13 HxCDD RECOVERY:		58 %	10 %	12 %	%	%

	CONC	LOD	CONC	LOD	CONC	LOD	CONC	LOD	CONC	LOD
2,3,7,8-TCDD..............	ND	0.10	ND	0.10	6.6	NA				
TOTAL TCDD...............	ND	0.10	ND	0.10	6.6	NA				
TOTAL PeCDD..............	ND	0.10	ND	0.10	ND	0.10				
TOTAL HxCDD..............	ND	0.10	ND	0.10	8.7	NA				
TOTAL TCDF...............	ND	0.10	ND	0.10	3.1	NA				
TOTAL PeCDF..............	ND	0.10	ND	0.10	ND	0.10				
TOTAL HxCDF..............	ND	0.10	ND	0.10	8.5	NA				

CONC	CONCENTRATION
ND	NONE DETECTED
NA	NOT APPLICABLE
LOD	LIMIT OF DETECTION

Roy F. Weston, Inc. - Lionville Laboratory
VOA ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L481

CLIENT ID	RFW #		MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 04-01	001		S	90LVX025	02/06/90	N/A	02/13/90
GS113 04-01	001	D1	S	90LVX025	02/06/90	N/A	02/13/90
GS113 04-02	002		S	90LVX025	02/06/90	N/A	02/13/90
GS113 04-03	003		S	90LVX025	02/06/90	N/A	02/13/90
GS113 04-04	004		S	90LVX025	02/06/90	N/A	02/13/90
GS113 01-01E	005		W	90LVK026	02/06/90	N/A	02/19/90
GS113 01-02	007		S	90LVX025	02/06/90	N/A	02/13/90
GS113 01-03	008		S	90LVX025	02/06/90	N/A	02/13/90
GS113 01-04	009		S	90LVX025	02/06/90	N/A	02/13/90
GS113 02-01	010		S	90LVX025	02/06/90	N/A	02/13/90
GS113 02-02	011		S	90LVX025	02/06/90	N/A	02/13/90
GS113 02-03	012		S	90LVX025	02/06/90	N/A	02/13/90
GS113 02-04	013		S	90LVX025	02/06/90	N/A	02/13/90
GS113 03-01	014		S	90LVX025	02/06/90	N/A	02/13/90
GS113 03-01A	015		S	90LVX025	02/06/90	N/A	02/13/90
GS113 00-01B	016		W	90LVK026	02/06/90	N/A	02/19/90
GS113 00-01C	017		W	90LVK026	02/06/90	N/A	02/19/90

LAB QC:

VBLK	MB1		S	90LVX025	N/A	N/A	02/13/90
VBLK	MB1		W	90LVK026	N/A	N/A	02/19/90

WESTON
ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC GUNSITE 113 **SAMPLES RECEIVED:** 02/09/90
RFW #: 9002L481, GC/MS Volatile
W.O. #: 0630-28-10

NARRATIVE

The set of samples consisted of 3 water samples and 13 soil samples collected on 02/06/90.

The samples were analyzed according to criteria set forth in SW 846 Method 8240 for TCL Volatile target compounds on 02/13,19/90.

The following is a summary of the QC results accompanying these sample results and a description of any problems encountered during their analysis:

1. Non-target compounds were not detected in these samples.
2. Sample GS113-04-01 required a 2 fold dilution because it contained high levels of target compounds.
3. Three of 57 surrogate recoveries are out of the EPA QC limits. Samples with surrogate recoveries outside EPA CLP QC limits were inspected for data quality and reported.
4. The blanks contain Methylene Chloride and Acetone at levels less than 5x the CRQL.

3-21-90
Date

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

GLOSSARY OF VOA DATA

DATA QUALIFIERS

U = Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

J = Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero; for example, if the limit of detection is 10 ug/L and a concentration of 3 ug/L is calculated, it is reported as 3J.

B = This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination. This flag is also used for a TIC as well as for a positively identified TCL compound.

E = Indicates that the compound was detected beyond the calibration range and was subsequently analyzed at a dilution.

I = Interference.

X = Additional qualifiers used as required are explained in the case narrative.

NQ = Result qualitatively confirmed but not able to quantify.

ABBREVIATIONS

BS = Indicates blank spike in which reagent grade water is spiked with the CLP matrix spiking solutions and carried through all the steps in the method. Spike recoveries are reported.

BSD = Indicates blank spike duplicate.

MS = Indicates matrix spike.

MSD = Indicates matrix spike duplicate.

DL = Indicates that surrogate recoveries were not obtained because the extract had to be diluted for analysis.

NA = Not applicable.

DF = Dilution factor.

NR = Not required.

Roy F. Weston, Inc. - Lionville Laboratory
Volatiles by GC/MS, HSL List

RFW Batch Number: 9002L481
Client: WSRC GUNSITE 113
Report Date: 03/21/90 13:16
Work Order: 0630-28-10-0000
Page: 1a

		Cust ID:	GS113 04-01	GS113 04-01	GS113 04-02	GS113 04-03	GS113 04-04	GS113 01-01E
Sample Information		RFW#:	001	001 DL	002	003	004	005
		Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	WATER
		D.F.:	0.926	2.38	0.962	1.00	0.926	1.00
		Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/L
		Toluene-d8	97 %	104 %	104 %	109 %	102 %	108 %
Surrogate		Bromofluorobenzene	99 %	100 %	103 %	107 %	102 %	94 %
Recovery		1,2-Dichloroethane-d4	112 %	98 %	113 %	118 %	112 %	97 %
			fl	fl	fl	fl	fl	fl
Chloromethane			10 U	NA	11 U	11 U	10 U	10 U
Bromomethane			10 U	NA	11 U	11 U	10 U	10 U
Vinyl Chloride			10 U	NA	11 U	11 U	10 U	10 U
Chloroethane			10 U	NA	11 U	11 U	10 U	10 U
Methylene Chloride			11 B	NA	17 B	29 B	19 B	8 B
Acetone			E	490 B	58 B	39 B	77 B	41 B
Carbon Disulfide			5 U	NA	5 U	1 J	5 U	5 U
1,1-Dichloroethene			5 U	NA	5 U	5 U	5 U	5 U
1,1-Dichloroethane			5 U	NA	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)			5 U	NA	5 U	5 U	5 U	5 U
Chloroform			5 U	NA	5 U	5 U	5 U	5 U
1,2-Dichloroethane			5 U	NA	5 U	5 U	5 U	5 U
2-Butanone			10 U	NA	11 U	11 U	10 U	19
1,1,1-Trichloroethane			5 U	NA	5 U	5 U	5 U	5 U
Carbon Tetrachloride			5 U	NA	5 U	5 U	5 U	5 U
Vinyl Acetate			10 U	NA	11 U	11 U	10 U	10 U
Bromodichloromethane			5 U	NA	5 U	5 U	5 U	5 U
1,2-Dichloropropane			5 U	NA	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene			5 U	NA	5 U	5 U	5 U	5 U
Trichloroethene			5 U	NA	5 U	5 U	5 U	5 U
Dibromochloromethane			5 U	NA	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane			5 U	NA	5 U	5 U	5 U	5 U
Benzene			5 U	NA	5 U	5 U	5 U	5 U
Trans-1,3-Dichloropropene			5 U	NA	5 U	5 U	5 U	5 U
Bromoform			5 U	NA	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone			10 U	NA	11 U	11 U	10 U	10 U
2-Hexanone			10 U	NA	11 U	11 U	10 U	10 U
Tetrachloroethene			5 U	NA	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane			5 U	NA	5 U	5 U	5 U	5 U

*= Outside of EPA CLP QC limits.

RFW Batch Number: 9002L481 Client: WSRC GUNSITE 113 Work Order: 0630-28-10-0000 Page: 1b

Cust ID:	GS113 04-01	GS113 04-01	GS113 04-02	GS113 04-03	GS113 04-04	GS113 01-01E
RFW#:	001	001 DL	002	003	004	005
Toluene	5 U	NA	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	NA	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	NA	5 U	5 U	5 U	5 U
Styrene	5 U	NA	5 U	5 U	5 U	5 U
Xylene (total)	5 U	NA	5 U	5 U	5 U	5 U

*= Outside of EPA CLP QC limits.

Roy F. Weston, Inc. - Lionville Laboratory
Volatiles by GC/MS, HSL List

RFW Batch Number: 9002L481
Client: WSRC GUNSITE 113
Report Date: 03/21/90 13:16
Work Order: 0630-28-10-0000

	Cust ID:	GS113 01-02		GS113 01-03		GS113 01-04		GS113 02-01		GS113 02-02		GS113 02-03	
Sample Information	RFW#:	007		008		009		010		011		012	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
	D.F.:	0.943		0.980		0.909		0.962		0.980		1.00	
	Units:	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
	Toluene-d8	105	%	111	%	107	%	106	%	106	%	98	%
Surrogate	Bromofluorobenzene	98	%	108	%	100	%	107	%	101	%	98	%
Recovery	1,2-Dichloroethane-d4	114	%	110	%	105	%	120	%	111	%	106	%
			fl		fl		fl		fl		fl		fl
Chloromethane		10	U	11	U	11	U	11	U	11	U	12	U
Bromomethane		10	U	11	U	11	U	11	U	11	U	12	U
Vinyl Chloride		10	U	11	U	11	U	11	U	11	U	12	U
Chloroethane		10	U	11	U	11	U	11	U	11	U	12	U
Methylene Chloride		28	B	25	B	22	B	10	B	11	B	21	B
Acetone		110	B	96	B	230		140	B	140	B	160	B
Carbon Disulfide		5	U	6	U	5	U	5	U	5	U	1	J
1,1-Dichloroethene		5	U	6	U	5	U	5	U	5	U	6	U
1,1-Dichloroethane		5	U	6	U	5	U	5	U	5	U	6	U
1,2-Dichloroethene (total)		5	U	6	U	5	U	5	U	5	U	6	U
Chloroform		5	U	6	U	5	U	5	U	5	U	6	U
1,2-Dichloroethane		5	U	6	U	5	U	5	U	5	U	6	U
2-Butanone		10	U	11	U	11	U	11	U	11	U	12	U
1,1,1-Trichloroethane		5	U	6	U	5	U	5	U	5	U	6	U
Carbon Tetrachloride		5	U	6	U	5	U	5	U	5	U	6	U
Vinyl Acetate		10	U	11	U	11	U	11	U	11	U	12	U
Bromodichloromethane		5	U	6	U	5	U	5	U	5	U	6	U
1,2-Dichloropropane		5	U	6	U	5	U	5	U	5	U	6	U
cis-1,3-Dichloropropene		5	U	6	U	5	U	5	U	5	U	6	U
Trichloroethene		5	U	6	U	5	U	5	U	5	U	6	U
Dibromochloromethane		5	U	6	U	5	U	5	U	5	U	6	U
1,1,2-Trichloroethane		5	U	6	U	5	U	5	U	5	U	6	U
Benzene		5	U	6	U	5	U	5	U	5	U	6	U
Trans-1,3-Dichloropropene		5	U	6	U	5	U	5	U	5	U	6	U
Bromoform		5	U	6	U	5	U	5	U	5	U	6	U
4-Methyl-2-pentanone		10	U	11	U	11	U	11	U	11	U	12	U
2-Hexanone		10	U	11	U	11	U	11	U	11	U	12	U
Tetrachloroethene		5	U	6	U	5	U	5	U	5	U	6	U
1,1,2,2-Tetrachloroethane		5	U	6	U	5	U	5	U	5	U	6	U

*= Outside of EPA CLP QC limits.

Cust ID:	GS113 01-02	GS113 01-03	GS113 01-04	GS113 02-01	GS113 02-02	GS113 02-03
RFW#:	007	008	009	010	011	012
Toluene	5 U	6 U	5 U	5 U	5 U	6 U
Chlorobenzene	5 U	6 U	5 U	5 U	5 U	6 U
Ethylbenzene	5 U	6 U	5 U	5 U	5 U	6 U
Styrene	5 U	6 U	5 U	5 U	5 U	6 U
Xylene (total)	5 U	6 U	5 U	5 U	5 U	6 U

*= Outside of EPA CLP QC limits.

Roy F. Weston, Inc. - Lionville Laboratory
Volatiles by GC/MS, HSL List

RFW Batch Number: 9002L481
Client: WSRC GUNSITE 113
Report Date: 03/21/90 13:16
Work Order: 0630-28-10-0000

	Cust ID:	GS113 02-04	GS113 03-01	GS113 03-01A	GS113 00-01B	GS113 00-01C	VBLK
Sample Information	RFW#:	013	014	015	016	017	90LVX025-MB1
	Matrix:	SOIL	SOIL	SOIL	WATER	WATER	SOIL
	D.F.:	0.962	0.980	0.980	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/L	ug/L	ug/Kg
	Toluene-d8	108 %	105 %	100 %	120 * %	115 * %	102 %
Surrogate	Bromofluorobenzene	113 %	111 %	106 %	103 %	100 %	101 %
Recovery	1,2-Dichloroethane-d4	121 %	134 * %	118 %	113 %	110 %	113 %
Chloromethane		10 U	11 U	10 U	10 U	10 U	10 U
Bromomethane		10 U	11 U	10 U	10 U	10 U	10 U
Vinyl Chloride		10 U	11 U	10 U	10 U	10 U	10 U
Chloroethane		10 U	11 U	10 U	10 U	10 U	10 U
Methylene Chloride		9 B	14 B	10 U	10 U	10 U	10 U
Acetone		92 B	11 U	11 B	10 B	3 JB	9
Carbon Disulfide		5 U	5 U	10 U	22 B	11 B	3 J
1,1-Dichloroethene		5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane		5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)		5 U	5 U	5 U	5 U	5 U	5 U
Chloroform		5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane		5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone		10 U	11 U	10 U	10 U	5 U	5 U
1,1,1-Trichloroethane		5 U	5 U	5 U	5 U	70	10 U
Carbon Tetrachloride		5 U	5 U	5 U	5 U	5 U	5 U
Vinyl Acetate		10 U	11 U	10 U	10 U	5 U	5 U
Bromodichloromethane		5 U	5 U	5 U	5 U	10 U	10 U
1,2-Dichloropropane		5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene		5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene		5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane		5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane		5 U	5 U	5 U	5 U	5 U	5 U
Benzene		5 U	5 U	5 U	5 U	5 U	5 U
Trans-1,3-Dichloropropene		5 U	5 U	5 U	5 U	5 U	5 U
Bromoform		5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone		10 U	11 U	10 U	10 U	5 U	5 U
2-Hexanone		10 U	11 U	10 U	10 U	10 U	10 U
Tetrachloroethene		5 U	5 U	5 U	5 U	10 U	10 U
1,1,2,2-Tetrachloroethane		5 U	5 U	5 U	5 U	5 U	5 U

*= Outside of EPA CLP QC limits.

Cust ID:	GS113 02-04	GS113 03-01	GS113 03-01A	GS113 00-01B	GS113 00-01C	VBLK
RFW#:	013	014	015	016	017	90LVX025-MB1
Toluene	5 U	5 U	5 U	1 J	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U
Xylene (total)	5 U	5 U	5 U	5 U	5 U	5 U

*= Outside of EPA CLP QC limits.

Roy F. Weston, Inc. - Lionville Laboratory
Volatiles by GC/MS, HSL List

RFW Batch Number: 9002L481 Client: WSRC GUNSITE 113 Report Date: 03/21/90 13:16
Work Order: 0630-28-10-0000 Page: 4a

	Cust ID:	VBLK	
Sample Information	RFW#:	90LVK026-MB1	
	Matrix:	WATER	
	D.F.:	1.00	
	Units:	ug/L	
	Toluene-d8	110	%
Surrogate	Bromofluorobenzene	98	%
Recovery	1,2-Dichloroethane-d4	111	%
====================		fl	============fl============fl============fl============fl============fl
Chloromethane		10	U
Bromomethane		10	U
Vinyl Chloride		10	U
Chloroethane		10	U
Methylene Chloride		6	
Acetone		12	
Carbon Disulfide		5	U
1,1-Dichloroethene		5	U
1,1-Dichloroethane		5	U
1,2-Dichloroethene (total)		5	U
Chloroform		5	U
1,2-Dichloroethane		5	U
2-Butanone		10	U
1,1,1-Trichloroethane		5	U
Carbon Tetrachloride		5	U
Vinyl Acetate		10	U
Bromodichloromethane		5	U
1,2-Dichloropropane		5	U
cis-1,3-Dichloropropene		5	U
Trichloroethene		5	U
Dibromochloromethane		5	U
1,1,2-Trichloroethane		5	U
Benzene		5	U
Trans-1,3-Dichloropropene		5	U
Bromoform		5	U
4-Methyl-2-pentanone		10	U
2-Hexanone		10	U
Tetrachloroethene		5	U
1,1,2,2-Tetrachloroethane		5	U

*= Outside of EPA CLP QC limits.

Cust ID: VBLK

RFW#: 90LVK026-MB1

Toluene	5	U
Chlorobenzene	5	U
Ethylbenzene	5	U
Styrene	5	U
Xylene (total)	5	U

*= Outside of EPA CLP QC limits.

Roy F. Weston, Inc. - Lionville Laboratory
BNA ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/08/90

RFW LOT # :9002L481

CLIENT ID	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 04-01	001	S	90LE0222	02/06/90	02/16/90	02/20/90
LAB QC:						
SBLK	MB1	S	90LE0222	N/A	02/16/90	02/20/90
SBLK	MB1 BS	S	90LE0222	N/A	02/16/90	02/20/90

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC-GUNSITE 113 **SAMPLES RECEIVED: 02-08-90**
RFW #: 9002L481, SEMIVOLATILE
W.O. #: 0630-28-10

NARRATIVE

The set of samples consisted of one soil sample collected on 02-06-90.

The sample was extracted on 02-16-90 and analyzed according to criteria set forth in SW 846 Method 8270 for TCL Semivolatile target compounds on 02-20-90.

The following is a summary of the QC results accompanying these sample results and a description of any problems encountered during their analysis:

1. Non-target compounds were detected in this sample and the blank.
2. Matrix spike requirements are fulfilled by sample GS113-01-02 (9002L482-001) also extracted in batch 90LE0222.
3. All surrogate and blank spike recoveries are within EPA QC limits.

4-10-90

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

Date

maj/wpmemo/02-481s.cn

GLOSSARY OF BNA DATA

DATA QUALIFIERS

U = Compound was analyzed for but not detected. The associated numerical value is the estimated sample quantitation limit which is included and corrected for dilution and percent moisture.

J = Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero; for example, if the limit of detection is 10 ug/L and a concentration of 3 ug/L is calculated, it is reported as 3J.

B = This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination. This flag is also used for a TIC as well as for a positively identified TCL compound.

E = Indicates that the compound was detected beyond the calibration range and was subsequently analyzed at a dilution.

I = Interference.

A = Aldol Condensation Product.

X = Additional qualifiers used as required are explained in the case narrative.

NQ = Result qualitatively confirmed but not able to quantify.

ABBREVIATIONS

BS = Indicates blank spike in which reagent grade water is spiked with the CLP matrix spiking solutions and carried through all the steps in the method. Spike recoveries are reported.

BSD = Indicates blank spike duplicate.

MS = Indicates matrix spike.

MSD = Indicates matrix spike duplicate.

DL = Indicates that surrogate recoveries were not obtained because the extract had to be diluted for analysis.

NA = Not applicable.

DF = Dilution factor.

NR = Not required.

Roy F. Weston, Inc. - Lionville Laboratory
Semivolatiles by GC/MS, HSL List

RFW Batch Number: 9002L481 Client: WSRC GUNSITE 113 Report Date: 04/05/90 12:52
Work Order: 0630-28-10-0000 Page: 1a

	Cust ID:	GS113 04-01		SBLK		SBLK BS	
Sample Information	RFW#:	001		90LE0222-MB1		90LE0222-MB1	
	Matrix:	SOIL		SOIL		SOIL	
	D.F.:	1.11		1.11		1.11	
	Units:	ug/Kg		ug/Kg		ug/Kg	
Surrogate Recovery	Nitrobenzene-d5	53	%	52	%	58	%
	2-Fluorobiphenyl	56	%	55	%	62	%
	p-Terphenyl-d14	97	%	89	%	82	%
	Phenol-d5	58	%	54	%	65	%
	2-Fluorophenol	58	%	55	%	63	%
	2,4,6-Tribromophenol	81	%	79	%	83	%
Phenol		410	U	370	U	63	%
bis(2-Chloroethyl)ether		410	U	370	U	370	U
2-Chlorophenol		410	U	370	U	63	%
1,3-Dichlorobenzene		410	U	370	U	370	U
1,4-Dichlorobenzene		410	U	370	U	60	%
Benzyl alcohol		410	U	370	U	370	U
1,2-Dichlorobenzene		410	U	370	U	370	U
2-Methylphenol		410	U	370	U	370	U
bis(2-Chloroisopropyl)ether		410	U	370	U	370	U
4-Methylphenol		410	U	370	U	370	U
N-Nitroso-Di-n-propylamine		410	U	370	U	61	%
Hexachloroethane		410	U	370	U	370	U
Nitrobenzene		410	U	370	U	370	U
Isophorone		410	U	370	U	370	U
2-Nitrophenol		410	U	370	U	370	U
2,4-Dimethylphenol		410	U	370	U	370	U
Benzoic acid		2100	U	1800	U	1800	U
bis(2-Chloroethoxy)methane		410	U	370	U	370	U
2,4-Dichlorophenol		410	U	370	U	370	U
1,2,4-Trichlorobenzene		410	U	370	U	68	%
Naphthalene		410	U	370	U	370	U
4-Chloroaniline		410	U	370	U	370	U
Hexachlorobutadiene		410	U	370	U	370	U
4-Chloro-3-methylphenol		410	U	370	U	69	%
2-Methylnaphthalene		410	U	370	U	370	U
Hexachlorocyclopentadiene		410	U	370	U	370	U

*= Outside of EPA CLP QC limits.

Cust ID:	GS113 04-01		SBLK		SBLK BS	
RFW#:	001		90LE0222-MB1		90LE0222-MB1	
2,4,6-Trichlorophenol	410	U	370	U	370	U
2,4,5-Trichlorophenol	2100	U	1800	U	1800	U
2-Chloronaphthalene	410	U	370	U	370	U
2-Nitroaniline	2100	U	1800	U	1800	U
Dimethylphthalate	410	U	370	U	370	U
Acenaphthylene	410	U	370	U	370	U
2,6-Dinitrotoluene	410	U	370	U	370	U
3-Nitroaniline	2100	U	1800	U	1800	U
Acenaphthene	410	U	370	U	75	*
2,4-Dinitrophenol	2100	U	1800	U	1800	U
4-Nitrophenol	2100	U	1800	U	83	*
Dibenzofuran	410	U	370	U	370	U
2,4-Dinitrotoluene	410	U	370	U	66	*
Diethylphthalate	410	U	370	U	370	U
4-Chlorophenyl-phenylether	410	U	370	U	370	U
Fluorene	410	U	370	U	370	U
4-Nitroaniline	2100	U	1800	U	1800	U
4,6-Dinitro-2-methylphenol	2100	U	1800	U	1800	U
N-Nitrosodiphenylamine (1)	410	U	370	U	370	U
4-Bromophenyl-phenylether	410	U	370	U	370	U
Hexachlorobenzene	410	U	370	U	370	U
Pentachlorophenol	2100	U	1800	U	73	*
Phenanthrene	410	U	370	U	370	U
Anthracene	410	U	370	U	370	U
Di-n-Butylphthalate	410	U	370	U	370	U
Fluoranthene	410	U	370	U	370	U
Pyrene	410	U	370	U	97	*
Butylbenzylphthalate	410	U	370	U	370	U
3,3'-Dichlorobenzidine	830	U	740	U	740	U
Benzo(a)anthracene	410	U	370	U	370	U
Chrysene	410	U	370	U	370	U
bis(2-Ethylhexyl)phthalate	74	J	370	U	370	U
Di-n-Octyl phthalate	410	U	370	U	370	U
Benzo(b)fluoranthene	410	U	370	U	370	U
Benzo(k)fluoranthene	410	U	370	U	370	U
Benzo(a)pyrene	410	U	370	U	370	U
Indeno(1,2,3-cd)pyrene	410	U	370	U	370	U
Dibenzo(a,h)anthracene	410	U	370	U	370	U
Benzo(g,h,i)perylene	410	U	370	U	370	U

(1) - Cannot be separated from Diphenylamine. *= Outside of EPA CLP QC limits.

1F

SEMIVOLATILE ORGANICS ANALYSIS SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.

GS113 04-01

Lab Name: Roy F. Weston, Inc. Work Order: 0630-28-10-0000

Client: WSRC GUNSITE 113

Matrix: SOIL

Lab Sample ID: 9002L481-001

Sample wt/vol: 30.0 (g/mL) G

Lab File ID: L022015

Level: (low/med) LOW

Date Received: 02/09/90

% Moisture: not dec. 11 dec.

Date Extracted: 02/16/90

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 02/20/90

GPC Cleanup: (Y/N) N pH: 5.6

Dilution Factor: 1.11

Number TICs found: 6

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	ALDOL CONDENSATE	5.88	300	JAB
2.	ALDOL CONDENSATE	6.18	200	JAB
3.	ALDOL CONDENSATE	6.92	200	JA
4.	ALDOL CONDENSATE	7.95	200	JA
5.	UNKNOWN	19.63	800	JB
6.	UNKNOWN	23.32	300	JB

FORM 1 SV-TIC 12/88 Rev.

1F
SEMIVOLATILE ORGANICS ANALYSIS SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT SAMPLE NO.
SBLK

Lab Name: Roy F. Weston, Inc. Work Order: 0630-28-10-0000

Client: WSRC GUNSITE 113

Matrix: SOIL

Lab Sample ID: 90LE0222-MB1

Sample wt/vol: 30.0 (g/mL) G

Lab File ID: L022013

Level: (low/med) LOW

Date Received: 02/16/90

% Moisture: not dec. 0 dec.

Date Extracted: 02/16/90

Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed: 02/20/90

GPC Cleanup: (Y/N) N pH: 7.0

Dilution Factor: 1.11

Number TICs found: 4

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	ALDOL CONDENSATE	5.88	200	JA
2.	ALDOL CONDENSATE	6.18	100	JA
3.	UNKNOWN	19.63	300	J
4.	ALKANE	23.28	200	J

WESTON
ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: WSRC GUNSITE 113 **SAMPLES RECEIVED:** 02-09-90
RFW #: 9002L481
W.O. #: 0630-28-10

INORGANIC NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All preparation blanks were analyzed below the required detection limit.

2. All calibration verification checks were within the required control limits of 90-100%. Calibration verification is performed using independent standards.

3. All replicate results were within the 20% guidance limit.

4. The analytical methods applied by the laboratory, unless otherwise requested, for all inorganic analyses are derived from the USEPA Method for Chemical Analysis of Water and Wastes (USEPA 600/4-79-020), and Standard Methods for the Examination of Water and Wastewater 16 ed. Methods for the analysis of solid samples are derived from Test Methods for Evaluating Solid Waste (USEPA SW846).

NOTE: For solid samples, all results are reported on a dry weight basis.

3-21-90

Jack R. Tuschall, Ph.D.
Laboratory Manager
Lionville Analytical Laboratory

Date

ROY F. WESTON, INC.

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples where this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO- This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO- This type of code indicates a soluble metal analysis. (eg. MAGSO indicates an analysis for soluble silver).

M**EP- This type of code indicates an EPTOXICITY metals analysis (eg. MAGEP indicates an analysis for eptox silver).

I**TO- This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicates a replicate or spike analysis respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 03/20/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L481

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
-001	GS113 04-01	% SOLIDS	97.1	%	0.10
		CATION EXCHANGE CAPACIT	0.91	meq/100g	0.01
		EXCHANGEABLE BASES	0.11	meq/100g	0.01
		EXCHANGEABLE ACIDS	0.80	meq/100g	0.20
		TOTAL ORGANIC CARBON	211	MG/KG	41.0
		PH	5.0	pH UNITS	0.10
-002	GS113 04-02	% SOLIDS	90.5	%	0.10
		TOTAL ORGANIC CARBON	364	MG/KG	34.0
		PH	5.2	pH UNITS	0.10
-003	GS113 04-03	% SOLIDS	84.6	%	0.10
		TOTAL ORGANIC CARBON	852	MG/KG	44.0
		PH	5.2	pH UNITS	0.10
-004	GS113 04-04	% SOLIDS	96.0	%	0.10
		TOTAL ORGANIC CARBON	141	MG/KG	35.0
		PH	5.4	pH UNITS	0.10
-006	GS113 01-01	% SOLIDS	94.2	%	0.10
		TOTAL ORGANIC CARBON	396	MG/KG	22.0
		PH	9.2	pH UNITS	0.10
-008	GS113 01-03	% SOLIDS	75.4	%	0.10
		TOTAL ORGANIC CARBON	834	MG/KG	43.0
		PH	5.2	pH UNITS	0.10
-009	GS113 01-04	% SOLIDS	90.0	%	0.10
		TOTAL ORGANIC CARBON	96.4	MG/KG	37.0
		PH	5.2	pH UNITS	0.10

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 03/20/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L481

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	90LTZ001-MB1	TOTAL ORGANIC CARBON	20.0	u	MG/KG	20.0
BLANK20	90LTZ001-MB2	TOTAL ORGANIC CARBON	20.0	u	MG/KG	20.0

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 03/20/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L481

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	90LTZ001-MB1	TOTAL ORGANIC CARBON	410	20.0 u	400	102
		TOTAL ORGANIC CARBON	412	20.0 u	400	103
BLANK20	90LTZ001-MB2	TOTAL ORGANIC CARBON	395	20.0 u	400	98.8

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 03/20/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L481

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK10	90LTZ001-MB1	TOTAL ORGANIC CARBON	102	103	0.50

ROY F. WESTON INC.

INORGANICS PRECISION REPORT 03/20/90

CLIENT: WSRC GUNSITE 113
WORK ORDER: 0630-28-10-0000

WESTON BATCH #: 9002L481

SAMPLE	SITE ID	ANALYTE	INITIAL RESULT	REPLICATE	% DIFF
-006REP	GS113 01-01	% SOLIDS	94.2	93.6	0.66
		PH	9.2	9.2	0.11

Roy F. Weston, Inc. - Lionville Laboratory
INORGANIC ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L481

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
GS113 04-01						
% SOLIDS	001	S	90L%S033	02/06/90	02/19/90	02/20/90
CATION EXCHANGE CAPA	001	S	90LCE002	02/06/90	03/15/90	03/15/90
CEC BASE	001	S	90LCE002	02/06/90	03/12/90	03/12/90
CEC PREP	001	S		02/06/90		03/06/90
CEC TITRATION	001	S	90LCE002	02/06/90	03/08/90	03/08/90
TOTAL ORGANIC CARBON	001	S	90LTZ001	02/06/90	03/01/90	03/01/90
PH	001	S	90LPH029	02/06/90	02/13/90	02/13/90
SUB-OUT TEST FOR SUB	001	S		02/06/90		
GS113 04-02						
% SOLIDS	002	S	90L%S039	02/06/90	03/07/90	03/08/90
TOTAL ORGANIC CARBON	002	S	90LTZ001	02/06/90	03/01/90	03/01/90
PH	002	S	90LPH029	02/06/90	02/13/90	02/13/90
GS113 04-03						
% SOLIDS	003	S	90L%S039	02/06/90	03/07/90	03/08/90
TOTAL ORGANIC CARBON	003	S	90LTZ001	02/06/90	03/01/90	03/01/90
PH	003	S	90LPH029	02/06/90	02/13/90	02/13/90
GS113 04-04						
% SOLIDS	004	S	90L%S039	02/06/90	03/07/90	03/08/90
TOTAL ORGANIC CARBON	004	S	90LTZ001	02/06/90	03/01/90	03/01/90
PH	004	S	90LPH029	02/06/90	02/13/90	02/13/90
GS113 01-01						
% SOLIDS	006	S	90L%S035	02/06/90	03/01/90	03/02/90
% SOLIDS	006 REP	S	90L%S035	02/06/90	03/01/90	03/02/90
TOTAL ORGANIC CARBON	006	S	90LTZ001	02/06/90	03/01/90	03/01/90
PH	006	S	90LPH042	02/06/90	03/08/90	03/08/90
PH	006 REP	S	90LPH042	02/06/90	03/08/90	03/08/90
SUB-OUT TEST FOR SUB	006	S		02/06/90		
GS113 01-03						
% SOLIDS	008	S	90L%S039	02/06/90	03/07/90	03/08/90

Roy F. Weston, Inc. - Lionville Laboratory
INORGANIC ANALYTICAL DATA PACKAGE FOR
WSRC GUNSITE 113

DATE RECEIVED: 02/09/90

RFW LOT # :9002L481

CLIENT ID /ANALYSIS	RFW #	MTX	PREP #	COLLECTION	EXTR/PREP	ANALYSIS
TOTAL ORGANIC CARBON	008	S	90LTZ001	02/06/90	03/01/90	03/01/90
PH	008	S	90LPH029	02/06/90	02/13/90	02/13/90
GS113 01-04						
% SOLIDS	009	S	90L%S039	02/06/90	03/07/90	03/08/90
TOTAL ORGANIC CARBON	009	S	90LTZ001	02/06/90	03/01/90	03/01/90
PH	009	S	90LPH029	02/06/90	02/13/90	02/13/90
GS113 02-01						
SUB-OUT TEST FOR SUB	010	S		02/06/90		
GS113 03-01						
SUB-OUT TEST FOR SUB	014	S		02/06/90		
GS113 03-01A						
SUB-OUT TEST FOR SUB	015	S		02/06/90		
GS113 00-01B						
SUB-OUT TEST FOR SUB	016	W		02/06/90		
GS113 00-01C						
SUB-OUT TEST FOR SUB	017	W		02/06/90		

LAB QC:

TOTAL ORGANIC CARBON	MB1	S	90LTZ001	N/A	03/01/90	03/01/90
TOTAL ORGANIC CARBON	MB1 BS	S	90LTZ001	N/A	03/01/90	03/01/90
TOTAL ORGANIC CARBON	MB1 BSD	S	90LTZ001	N/A	03/01/90	03/01/90
TOTAL ORGANIC CARBON	MB2	S	90LTZ001	N/A	03/01/90	03/01/90
TOTAL ORGANIC CARBON	MB2 BS	S	90LTZ001	N/A	03/01/90	03/01/90

ALBUQUERQUE LABORATORY

REPORT OF ANALYS

CUSTOMER Weston - SRP
ATTENTION Mark T. Carkhuff
ADDRESS 208 Welsh Pool Rd.
CITY Lionville, Pa 19353
W.O. NO. E-1515
Lab Code : BE

TYPE OF ANALYSIS

15-101
CUSTOMER ORDER NUMBER

SAMPLES RECEIVED 02/13/90

Customer Identification	DATE TIME ANALY.	Date Collected	Type of Analysis	ACTIVITY/ERROR		UNTS	ACCRCY	INST/INI
GS1130101 E1421	030290 1255	02/06/90	ALPHA	7.00	5.00	pCi/g	1.03	47 C A
GS1130101 E1421	030290 1255	02/06/90	BETA	6.00	3.00	pCi/g	1.14	47 C A
GS1130201 E1422	030290 1703	02/06/90	ALPHA	8.00	5.00	pCi/g	1.03	39 PMP
GS1130201 E1422	030290 1703	02/06/90	BETA	6.00	3.00	pCi/g	1.14	39 PMP
GS1130301 E1423	030290 1703	02/06/90	ALPHA	6.00	5.00	pCi/g	1.03	40 PMP
GS1130301 E1423	030290 1703	02/06/90	BETA	3.00	3.00	pCi/g	1.14	40 PMP
GS1130301A E1424	030290 1703	02/06/90	ALPHA	8.00	6.00	pCi/g	1.03	42 PMP
GS1130301A E1424	030290 1703	02/06/90	BETA	3.00	2.00	pCi/g	1.14	42 PMP
GS1130401 E1420	030290 1255	02/06/90	ALPHA	9.00	6.00	pCi/g	1.03	46 C A
GS1130401 E1420	030290 1255	02/06/90	BETA	3.00	2.00	pCi/g	1.14	46 C A

Jim Lovoito

REPORTED VIA TELEPHONE ☐ FAX

PAGE 1 OF 1

TMA Eberline
Thermo Analytical Inc.
7021 PAN AMERICAN FREEWAY, N.E.
ALBUQUERQUE, NEW MEXICO 87109
PHONE (505) 345-3461
FAX (505) 761-5416

APPROVED BY R. Melgard

03-12-1990
DATE

Rod Melgard, Mgr.

ALBUQUERQUE LABORATORY

REPORT OF ANAL

CUSTOMER Weston - SRP
ATTENTION Mark T. Carkhuff
ADDRESS 208 Welsh Pool Rd.
CITY Lionville, Pa 19353
W.O. NO. E-1516
Lab Code : BE

TYPE OF ANALYSIS

CUSTOMER ORDER NUMBER 15-101

SAMPLES RECEIVED 02/13/90

Customer Identification	DATE TIME ANALY.	Date Collected	Type of Analysis	ACTIVITY/ERROR		UNTS	ACCRCY	INST/INI
1130001BTB E1425	022890 1940	02/06/90	ALPHA	0.00	2.00	pCi/l	1.03	39 PMP
1130001BTB E1425	022890 1940	02/06/90	BETA	0.00	3.00	pCi/l	1.14	39 PMP
1130001CTB E1426	022890 1940	02/06/90	ALPHA	0.00	2.00	pCi/l	1.03	41 PMP
1130001CTB E1426	022890 1940	02/06/90	BETA	0.00	3.00	pCi/l	1.14	41 PMP

☐ REPORTED VIA TELEPHONE ☐ FAX

PAGE 1 OF 1

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APPROVED BY R. Melgard

Rod Melgard, Mgr.

DATE 03-12-1990

APPENDIX C

RISK ASSESSMENT METHODS

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SECTION 1

SOIL SCREENING LEVEL PARTITIONING EQUATION FOR MIGRATION TO GROUNDWATER

Screening Level in Soil = Cw[Kd+(Ow + OaH')/Pb]

Variable	Value	Units	Parameter	Source
Cw =	Variable	mg/L	Chemical specific - MCL, MCLG, HBL x DAF	EPA 1995
Kd =	Variable	L/kg	Soil-water partition coefficient, Koc x Foc	EPA 1994
Koc =	Variable	L/kg	Soil organic carbon/water partition coefficient	EPA 1995
Foc =	0.001	g/g	Fraction organic carbon in soil	Looney et al. 1987
Ow =	0.2	(Lwater/Lsoil)	Water-filled soil porosity	Looney et al. 1987
w =	0.2	(KGwater/KGsoil or Lwater/KGsoil)	Average soil moisture content	EPA 1994, default value
Pb =	1.6	kg/L	Dry soil bulk density Ps	Looney et al. 1987
n =	0.4	(Lpore/Lsoil)	Soil porosity (loam)	Looney et al. 1987
Ps =	2.65	kg/L	Soil particle density	EPA 1994,default value
Oa =	0.2	(Lair/Lsoil)	Air-filled soil porosity (n-Ow)	Calculated
H' =	Variable	Unitless	Henry's Law Constant (H x 41)	Calculated
H =	Variable	atm-m^3/mol	Henry's Law Constant (Chemical specific)	EPA 1995

DILUTION ATTENUATION FACTOR

DAF = 1 + Kid/IL

Variable	Value	Units	Parameter	Source
K =	1668.78	m/yr	Aquifer hydraulic conductivity	WSRC 1995
i =	0.003	m/m	hydraulic gradient	WSRC 1995
d =	2.20	m	mixing zone depth	Calculated
I =	0.38	m/yr	Infiltration rate	Hubbard et al. 1988
L =	12.192	m	Source length parallel to groundwater flow	WSRC 1987
DAF =	3.381723136			

ESTIMATION OF MIXING ZONE DEPTH

d = (.0112L^2)^.5 + da(1-exp((-LI)/(Kida))

Variable	Value	Units	Parameter	Source
L =	12.192	m	Source length parallel to groundwater flow	WSRC 1987
I =	0.38	m/yr	Infiltration rate	Hubbard et al. 1988
K =	1668.78	m/yr	Aquifer hydraulic conductivity	WSRC 1995
da =	36.58	m	Aquifer thickness	WSRC 1987
i =	0.003	m/m	Hydraulic gradient	WSRC 1995
d =	2.204090817			

TABLE C-1
MEAN SOIL CONCENTRATIONS COMPARED TO SOIL SCREENING LEVELS

	Basin								Basin	
Analyte Name	Soil Mean Detection (mg/kg or pCi/kg)	MCL (mg/L or pCi/l))	MCLG (mg/l)	RBC (mg/L or pCi/l))	Cw*(w/o DAF) (mg/l or pCi/l)	Koc (L/kg)	Kd (L/kg)	Henry's Law Constant (atm-m^3/mol)	SSL (mg/kg or pCi/kg)	SSL TEST
chromium	24.30000	0.100000	0.100000	0.180000	0.100000	N/A	3.98E+01	0.000E+00	13.498	Fail

All metal Kds pH 6.8

All Koc and Henry Law Constants from Electronic Handbook of Risk Assessment Values, June 1995

* Order for choosing Cw: (1) MCLG, (2) MCL, and (3) RBCs

The Cw column does not include multiplication to the DAF. This step is completed in the SSL calculation.

Soil Screening Level (SSL) = Cw[Kd+(Ow + OaH')/Pb]

where: Cw = MCLG, MCL, or RBC x DAF, mg/L

Kd = soil water partition (chemical specific), L/Kg

Ow =0.2 (unitless)

Oa=0.2 unitless

H' = Henry's Law Constant x 41 (chemical specific)

Pb = 1.6 kg/L

SECTION 2

Part I: Calculation of Transport Time

Transport Time (T) = $L/(V/R)$

Variable	Value	Units	Parameter	Source
L=	33.83	m	Distance from contaminant to water table	WSRC 1990
V=	6.33	m/yr	Velocity through vadose zone	calculated
R=	319.4	unitless	Retardation factor	calculated
T=	1706.998736	years	Transport Time	calculated

Calculation of Retardation Factor

Retardation Factor(R) = $1 + (Pb/Pe)*Kd$

Variable	Value	Units	Parameter	Source
Pb	1.6	kg/L	Dry soil bulk density	Looney et al 19
Pe	0.2	unitless	Effective porosity	Looney et al 19
Kd	3.98E+01	L/kg	Soil-water partition coefficient for chromium	Appendix A
R	319.4	unitless	retardation factor	calculated

Calculation of Vadose Zone Velocity

Velocity(V) = $I/(Pe*Sa)$

Variable	Value	Units	Parameter	Source
I	0.38	m/yr	infiltration rate	Hubbard et al. 1
Pe	0.2	unitless	Effective porosity	Looney et al 19
Sa	0.3	unitless	Average soil saturation	
V	6.333	m/yr	velocity	calculated

Part II: Calculation of Groundwater (Pore Water Concentration)

Pore Water Concentration (Cw) = (Cs/Kd)/DAF

Variable	Value	Units	Parameter	Source
Cs	24.3	mg/kg	Concentration of chromium in soil	WSRC 1990
Kd	3.98E+01	L/kg	Soil-water partition coefficient for chromium	Attachment A
DAF	3.38	unitless	Dilution attenuation factor	Attachment A
Cw	0.180636912	mg/L	Pore water concentration	calculated

TABLE C-2

DERMAL CONTACT WITH CHEMICALS IN THE GROUNDWATER

HYPOTHETICAL FUTURE RESIDENTIAL ADULT

			Carcinogenic Risk Calculation				Non-Carcinogenic Hazard Calculation			
Chemicals of Potential Concern	RME CW (mg/L)	PC (cm/hr)	Intake (mg/kg-day)	Slope Factor (kg-day/mg)	Risk (1)	% of Total Risk	Intake (mg/kg-day)	Reference Dose (mg/kg-day)	Hazard Quotient (2)	% of Total Hazard
Chromium III	1.80E-01	1.00E-03	1.35E-06	N/A	N/A	N/A	3.95E-06	0.2	1.97E-05	100
Chromium IV	1.80E-01	1.00E-03	1.35E-06	N/A	N/A	N/A	3.95E-06	0.001	3.95E-03	100
				Total Risk =	N/A		Hazard Index	= 1.97e-5 or 3.95e-3		

(1) Risk = Intake * Slope Factor

(2) Hazard Index = Intake/Reference Dose

RME = Reasonable Maximum Exposure; NA/ND - Not Available/Not Determined

METHODOLOGY

$$\text{Intake (mg/kg-day)} = \frac{CW*SAa*PC*ET*EF*EDa*CF}{BWa*AT*AD}$$

Where:

			Adult
CW	=	Chemical concentration in water (mg/L)	See above
SAa and SAc	=	Skin surface area available for contact (cm^2)	20000
PC	=	Dermal permeability constant (cm/hr)	See above
ET	=	Exposure time (hr/day)	0.08
EF	=	Exposure frequency (days/yr)	350
EDa and EDc	=	Exposure duration (yr)	24
CF	=	Conversion factor (1 Liter/1000cm^3)	1.00E-03
BWa and BWc	=	Body weight (kg)	70
AT	=	Averaging time (days/yr)	365
AD	=	Averaging duration (yr): for noncarcinogens	ED
		for carcinogens	70

Reference dose (dermal) = 20% of oral reference dose

Dermal permeability constant from Dermal Exposure Assessment, Table 5-3, EPA 1992

TABLE C-3
INGESTION OF CHEMICALS IN GROUNDWATER
HYPOTHETICAL FUTURE RESIDENTIAL ADULT

Chemicals of Potential Concern	RME CW (mg/L)	Carcinogenic Risk Calculation				Non-Carcinogenic Hazard Calculation			
		Intake (mg/kg-day)	Slope Factor (kg-day/mg)	Risk (1)	% of Total Risk	Intake (mg/kg-day)	Reference Dose (mg/kg-day)	Hazard Quotient (2)	% of Total Hazard
Chromium III	1.80E-01	1.69E-03	N/A	N/A	N/A	4.93E-03	1.00E+00	4.93E-03	N/A
Chromium VI	1.80E-01	1.69E-03	N/A	N/A	N/A	4.93E-03	5.00E-03	9.86E-01	N/A
		Total Risk = N/A				Hazard Index = 4.93e-3 or 9.86e-01			

(1) Risk = Intake * Slope Factor

(2) Hazard Index = Intake/Reference Dose

RME = Reasonable Maximum Exposure; NA/ND - Not Available/Not Determined

METHODOLOGY

$$\text{Intake (mg/kg-day)} = \frac{CW*IRa*EF*EDa}{BWa*AT*AD}$$

Where:

			Adult
CW	=	Chemical concentration in water (mg/L)	See above
IRa and IRc	=	Ingestion rate (L/day)	2.0
EF	=	Exposure frequency (days/yr)	350
EDa and EDc	=	Exposure duration (yr)	24
BWa and BWc	=	Body weight (kg)	70
AT	=	Averaging time (days/yr)	365
AD	=	Averaging duration (yr): for noncarcinogens	ED
		for carcinogens	70

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