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Brookhaven National Laboratory

Sampling and Analysis Data Document

This document contains uninterpreted sampling and analytical data. The data will be interpreted by the DOE Environmental Survey Team and used to modify, as appropriate, the tentative Survey findings contained in the Environmental Survey Preliminary Report. Final Survey findings will be presented in the Environmental Survey Summary Report.

DRAFT

Volume I
July 1989

DEPARTMENT OF ENERGY

ENVIRONMENTAL SURVEY

Report No. ORNL/TM-11221

BROOKHAVEN NATIONAL LABORATORY SAMPLING AND ANALYSIS DATA DOCUMENT (DRAFT)

VOLUME I

July 1989

Prepared by:
DOE Environmental Survey and
Oak Ridge National Laboratory

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LIST OF ABBREVIATIONS

AA	Atomic absorption
ACD	Analytical Chemistry Division
ACK	Analytical Chemistry Division - K25
AE	Flame atomic emission photometry
AFAN	Ammonium fluoride - ammonium nitrate solution
Ag	Silver
AgCl	Silver chloride
AGS	Alternating Gradient Synchroton
A_i	Percent relative atom abundance
ARRF	Average relative retention factor
ASTM	American Society for Testing Materials
A-WMG	Wide-mouth glass (I-Chem cleaning protocol A)
BCD	Battelle-Columbus Division
Be	Beryllium
BFB	Bromofluorobenzene
BGRR	Brookhaven Graphite Research Reactor
BHC	Benzene hexachloride
BNL	Brookhaven National Laboratory
BOD	Biochemical oxygen demand
BOM	Bureau of Mines
Br^-	Bromide
B-WMG	Wide-mouth glass (I-Chem cleaning protocol B)
C	Carbon
C	Centigrade (when preceeded by ^{o})
Ca	Calcium
Ca^{+2}	Calcium ions
CAPA	Chemical and Physical Analysis
CAS Number	Chemical Abstract System Number
CCC	Calibration check compounds
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CH_4	Methane
Cl^-	Chloride
Cl_2	Chlorine
CLP	Contract Laboratory Program
cm	Centimeter
CN	Cyanide
CNCl	Cyanogen chloride
Co	Cobalt
CO_2	Carbon dioxide
COC	Chain of custody
cpm	Counts per minute

Cr	Chromium
CRDL	Contract required detection limit
CRQL	Contract required quantitation limit
CRREL	U.S. Army Cold Regions Research and Engineering Laboratory
Cs	Cesium
CSP	Central Steam Plant
Cu	Copper
CV	Calibration verification
CVFAA	Cold vapor flameless atomic absorption
C-WMHDPE	Wide-mouth high density polyethylene (I-Chem cleaning protocol C)
D&D	Decontamination and decommissioning
DBBP	Dibutyl butyl phosphonate
DBC	Dibutylchlorendate
DDD	Dichloro diphenyl dichloroethane
DDE	Dichloro diphenyl chloroethane
DDT	Dichloro diphenyl trichloroethane
DEL	Deleted
DFTPP	Decafluorotriphenylphosphine
DMF	Dimethyl formamide
DMS	Data Management System
DO	Dissolved oxygen
DOD	Department of Defense
DOE	Department of Energy
DOE-ES	Department of Energy Environmental Survey
DOE-HQ	Department of Energy Headquarters
DOH	Department of Health
DOT	Department of Transportation
dpm	Disintegrations per minute
DW	Drinking water
DWS	Drinking Water Standards
EAL	Environmental Analysis Laboratory
ECH	Environmental Compliance and Health Protection Division
EHP	Environmental and Health Protection Division
EICP	Extracted ion current profile
EMSL-LV	Environmental Monitoring and Systems Laboratory, Las Vegas
EMR	Environmental Monitoring Report
EP	Extraction procedure
EPA	Environmental Protection Agency
EPTOX	Extraction procedure toxicity
ESD	Environmental Sciences Division
ESM	Environmental Survey Manual
Eu	Europium
EVAL	Pesticide evaluation standard mixture

F	Farenheit (when preceeded by ^{o})
F^-	Fluoride
FES	Flame emission photometry
FID	Flame ionization detector
FQC	Field quality control
FS	Fire site
FSCC	Fused silica capillary column
FW	Formula weight
g	Grams
GA	Gross alpha
GB	Gross beta
GC	Gas chromatography
GC-ECD	Gas chromatography - electron capture detector
GC-FID	Gas chromatography - flame ionization detection
GC-MS	Gas chromatography-mass spectrometry or gas chromatograph-mass spectrometer
GFAA	Graphite furnace atomic absorption
GPC	Gel permeation chromatography
GSA	General service area
GW	Groundwater
H	Hydrogen
HCl	Hydrochloric acid
HCN	Hydrocyanic acid
HD	High dispersion
HDPE(B)	High density polyethylene bottles (I-Chem cleaning protocol B)
HDPE(C)	High density polyethylene bottles (I-Chem cleaning protocol C)
He	Helium
HE	High explosive
Hg	Mercury
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HNS	Dipicrylethane
HNO_3	Nitric acid
HPLC	High performance liquid chromatography
HRGC/HRMS	High resolution gas chromatography/high resolution mass spectrometry
HWMA	Hazardous Waste Management Area
H&SO	Health and Safety Officer
H_2O	Water
H_2SO_4	Sulfuric acid
H_3	Tritium
IC	Internal standard compounds
ICP	Inductively coupled plasma
ICP-AES	Inductively coupled plasma - atomic emission spectrometry
ID	Identification

I.D.	Inside diameter
IDL	Instrument detection limit
IND	Pesticide individual standard
IS1 (BCM)	Volatile organic internal standard compound (Bromochloromethane)
IS1 (DCB)	Semivolatile internal standard compound (1,4 -Dichlorobenzene-d4)
IS2 (DFB)	Volatile organic internal standard compound (1,4 -Difluorobenzene)
IS2 (NPT)	Semivolatile internal standard compound (Naphthalene-d8)
IS3 (ANT)	Semivolatile internal standard compound (Acenaphthene-d8)
IS3 (CBZ)	Volatile organic internal standard compound (Chlorobenzene)
IS4 (PHN)	Semivolatile internal standard compound (Phenanthrene-d10)
IS5 (CRY)	Semivolatile internal standard compound (Chrysene-d12)
IS6 (PRY)	Semivolatile internal standard compound (Perylene-d12)
JMC	Soil hand-core sampling device
K	Potassium
K^+	Potassium ion
KCl	Potassium chloride
kg	Kilogram
km^2	Square kilometers
L	Liter
LCS	Laboratory control samples
LEL	Lower explosive limit
LLRA	Low-level Radiochemical Analysis
LLRAG	Low-level Radiochemical Analysis Group
LLW	Low-level waste
LWCS	Laboratory wastewater collection system
m	Meter
M	Molar
MCL	Maximum concentration level
MCLG	Maximum contaminant level goal
MDL	Method detection limit
$MeCl_2$	Methylene chloride
MEK	Methyl ethyl ketone
Mg	Magnesium
Mg^{+2}	Magnesium ion
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
Mg_2SO_4	Magnesium sulfate
MIBK	Methyl isobutyl ketone (4-methyl-2-pentanone)
mL	Milliliter
mm	Millimeter
MMES	Martin Marietta Energy Systems, Inc.

mR/hr	MilliRad per hour
m/s	Meters per second
mS/cm	milliSiemens per centimeter
MSA	Method of standard additions
MS%Rec	Matrix spike percent recovery
MSD%Rec	Matrix spike duplicate percent recovery
MW	Monitoring well
N	Nitrate or Nitrogen
N	Normal
Na	Sodium
Na^+	Sodium ion
NA	Not applicable, not available, not analyzed
NaOH	Sodium hydroxide
Na_2SO_3	Sodium sulfate
NBC	National Bureau of Calibrations
NBS	National Bureau of Standards
NEIC	National Enforcement Investigation Center
ng	Nanograms
Ni	Nickel
NIOSH	National Institute for Occupational Safety and Health
nm	Nanometers
NO_3^-	Nitrate
NPDES	National Pollution Discharge Elimination System
NR	Not required
NTS	Nevada Test Site
NYDEC	New York Department of Environmental Conservation
NYS	New York State
O&G	Oil and grease
ODS	Octadecylsilane
ORGDP	Oak Ridge Gaseous Diffusion Plant
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OVA	Organic vapor analysis
P/P	Pesticide/PCB
Pb	Lead
PBLK	Pesticide method blank
PCB	Polychlorinated biphenyl
pCi	PicoCuries
pCi/g	PicoCuries per gram
pCi/kg	PicoCuries per kilogram
pCi/L	PicoCuries per liter
pCi/mL	PicoCuries per milliliter
P.E.	Performance evaluation
PETN	Pentaerythritol tetranitrate
PID	Photoionization detector
PNA	Polynuclear Aromatics

PNL	Battelle Pacific Northwest Laboratories
PO_4^{-3}	Phosphate
POTW	Pubically owned treatment works
ppb	Parts per billion
ppm	Parts per million
ppt	Parts per trillion
Pu	Plutonium
PVC	Polyvinyl chloride
QA	Quality assurance
QA/QC	Quality assurance/quality control
QB	Quarterly blind
QC	Quality control
QD	Quality Department
r	Correlation coefficient
Rad. or RAD	Radionuclides, radioactivity, or radiological
RCRA	Resource Conservation and Recovery Act
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine or cyclonite
RE	Reanalysis
RMCL	Recommended maximum contaminant level
RPD	Relative percent difference
RRF	Relative response factor
RSD	Relative standard difference
RT	Retention time
RWCF	Radioactive Waste Concentration Facility
S&A	Sampling and analysis
S1(DCB)	Pesticide surrogate compound (Dibutylchlorendate)
S1(NBZ)	Semivolatile surrogate compound (Nitrobenzene-d5)
S1(TOL)	Volatile organic surrogate compound (Toluene-d8)
S2(BFB)	Volatile organic surrogate compound (Bromofluorobenzene)
S2(FBP)	Semivolatile surrogate compound (2-Fluorobiphenyl)
S3(DCE)	Volatile organic surrogate compound (1,2 Dichloroethane-d4)
S3(TPH)	Semivolatile surrogate compound (Terphenyl-d14)
S4(PHL)	Semivolatile surrogate compound (Phenol-d5)
S5(ZFP)	Semivolatile surrogate compound (2-Fluorophenol)
S6(TBP)	Semivolatile surrogate compound (2,4,6-Tribromophenol)
SAIC	Science Applications International Corporation
SBLK	Semivolatile method blank
SC	Surrogate compounds
SCBA	Self contained breathing apparatus
SD	Standard deviation
SDG	Sample delivery group
SFO	San Francisco Office
SIUs	International System of Units
SNLL	Sandia National Laboratories - Livermore
SO_4^{-2}	Sulfate

SOP	Standard operating procedure
SOW	Statement of work
SPCC	System performance check compounds
SRC	Solvent refined coal
SS	Suspended soils
SSTD	Semivolatile standard
STD	Standard
STP	Sewage Treatment Plant
SV	Semivolatile organic compound
SW	Surface water
SepF (Extraction)	Separatory funnel extraction
Sonc (Extraction)	Sonication extraction
TATB	Triamino-trinitro-benzene
TBP	Semivolatiles organics protocol
TC	Target compounds
TCA	Trichloroethane
TCB	Trichlorobenzene
TCDD	2,3,7,8-Tetrachloro-Dibenlo (p) Dioxin
TCE	Trichloroethylene
TCL	Target compound list
TCLP	Toxic characteristic leaching procedure
TCTNB	Trichloro-trinitro-benzene
TDS	Total dissolved solids
Tetryl	N-methyl-N-2,4,6-tetranitroanaline
TIC	Tentatively identified compounds
TICH	Total identifiable chlorinated hydrocarbons
TICP	Total ion current profile
TIMS	Thermal ionization mass spectrometry
TIP	PhotoVac OVA instrument
TNT	2,4,6-trinitrotoluene
TOC	Total organic carbon
TOPO	Trioctylphosphine oxide
TRU	Transuranic
TSCA	Toxic Substance Control Act
2,4D	2,4-Dichlorophenoxy acetic acid
2,4-DNT	2,4-dinitrotoluene
2,6-DNT	2,6-dinitrotoluene
2,4,5-T	2,4,5-Trichlorophenoxy
2,4,5-TP	Propionic acid (Silvex)
2NZN	2 N (Normal) Zinc acetate
U	Uranium
ug	Micrograms
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter
UST	Underground storage tank
V&V	Verification and validation

VBLK	Volatile organic method blank
VOA	Volatile organic analysis
VOC	Volatile organic compound
vol	Volume
VSTD	Volatile organic standard
W	Tungsten
W_i	Percent relative weight abundance
WWTF	Wastewater Treatment Facility
Y	Yttrium
Zn	Zinc

INORGANIC ANALYSIS DATA FLAGS

Concentration Qualifiers

B	Value less than the CRDL but greater than IDL
U	Analyte analyzed for but not detected

QA/QC Qualifiers

E	Value estimated or not reported because of the presence of interference
M	Duplicate injection precision not met
N	Spiked sample recovery not within control limits
S	Value determined by the Method of Standard Additions (MSA)
*	Duplicate analysis not within control limits
+	Correlation coefficient for the MSA is less than 0.995

Method Qualifiers

A	Flame AA
AS	Semiautomated spectrophotometric
AV	Automated cold vapor AA
C	Manual spectrophotometric
CV	Manual cold vapor AA
F	Furnace AA
P	ICP
T	Titrimetric
NR	Analyte is not required to be analyzed
AE	Atomic emission - ICP

ORGANIC ANALYSIS DATA FLAGS

A	TIC is a suspected aldol-condensation product
B	Analyte found in associated blank as well as in the sample
C	Pesticide identification confirmed by GC-MS
E	Concentration exceeds the calibration range of the instrument
J	Estimated value
U	Compound analyzed for but not detected
D	Compounds identified in an analysis at a secondary dilution factor
X, Y, Z	Wildcard flags (see explanation in section 4.2.2.2)

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1.0 INTRODUCTION

This document presents the Department of Energy's (DOE's) Environmental Survey with field and analytical data collected by the Oak Ridge National Laboratory (ORNL) Sampling and Analysis Team at the Brookhaven National Laboratory. The sampling for this site was done in April 1988 and the majority of sample analyses were completed by February 1989.

NOTE

> It should be noted that this document contains uninterpreted sampling and analysis data. The data will be interpreted by the DOE Environmental Survey Team and used with the tentative Survey findings contained in the Environmental Survey Preliminary Reports. Final Survey findings will be contained in the Environmental Survey Summary Report.

This BNL Sampling and Analysis Data Document includes information from the DOE Environmental Survey Sampling and Analysis Plan for the BNL Site (Ref. 1-1), the Addendum to the DOE Sampling and Analysis Plan for the BNL Site (Ref. 1-2), and field and analytical data. Please refer to the August 1987 DOE Environmental Survey Manual (Ref. 1-3) for additional detailed descriptions of field and analytical procedures. For an overview of the DOE Environmental Survey Sampling and Analysis Program and for background information on the BNL environmental setting, please refer to the BNL Preliminary Report for the DOE Environmental Survey (Ref. 1-4) and the DOE Environmental Survey Sampling and Analysis Plan for the site.

Volume I of this document contains six chapters. Chapter 1.0 provides background information on site sampling and analysis efforts. Chapter 2.0 was deemed to be redundant and unnecessary and is retained only in title. Chapter 3.0 provides a brief description of field and analytical procedures. Chapter 4.0

describes how to evaluate the sampling and analysis data and presents the main data on each environmental problem. Quality assurance (QA) data are presented and discussed in Chapter 5.0. References and bibliographic information are included in Chapter 6.0.

Volume II contains Appendices A through F. Appendix A contains a listing of sampling and analytical requests. Appendix B presents a discussion and listing of background concentrations of analytes. Appendix C includes audit findings. Appendix D contains a summary of analytical quality assurance/quality control (QA/QC) information. Appendix E includes radiological QA/QC data. Appendix F is the Addendum to the BNL Sampling and Analysis Plan which covers all Phase II sampling.

1.1 Site Sampling and Analysis

Oak Ridge National Laboratory was designated by DOE to provide a Sampling Team for the BNL Site and was responsible for the performance of the laboratory analytical services. The requests for sampling and analysis were developed by the DOE Environmental Survey Team after careful consideration of the needs of the BNL Site to identify both actual and potential environmental problems. The team based its requests on detailed and lengthy considerations of local environmental characteristics, historical environmental monitoring data, and an understanding of the production and research and development operations performed at the site.

The technical specialists of the Survey Team compared notes, reviewed objectives, and determined which actual or potential environmental problems required sampling and analysis in order to be completely and accurately evaluated. In some cases, a group of sample and analytical requests from different technical disciplines in the Survey Team supported the investigative needs for evaluating a single actual or potential environmental problem.

The purpose of the Sampling and Analysis Plan was to outline a plan for environmental field sampling and laboratory analysis in support of the DOE Environmental Survey at the BNL Site (see Figure 1.1) located near Upton, New York. The Sampling and Analysis Plan was intended to be a guide that incorporated the standard procedures, analytical protocols, field sampling protocols, and other laboratory guidance from the DOE Environmental Survey Manual.

The BNL Sampling and Analysis Team involved personnel from many organizations. ORNL managed the project and was responsible for all sampling, laboratory analyses, field analyses, data management, and report preparation. Figure 1.2 shows the DOE and ORNL organizational structure for BNL sampling and analysis personnel.

This BNL Sampling and Analysis Data Document has been prepared by ORNL and subsequently reviewed by the Environmental Protection Agency's (EPA's) Environmental Monitoring Systems Laboratory in Las Vegas (EMSL-LV) and the DOE Survey Team. All comments were addressed or considered before the final draft was issued.

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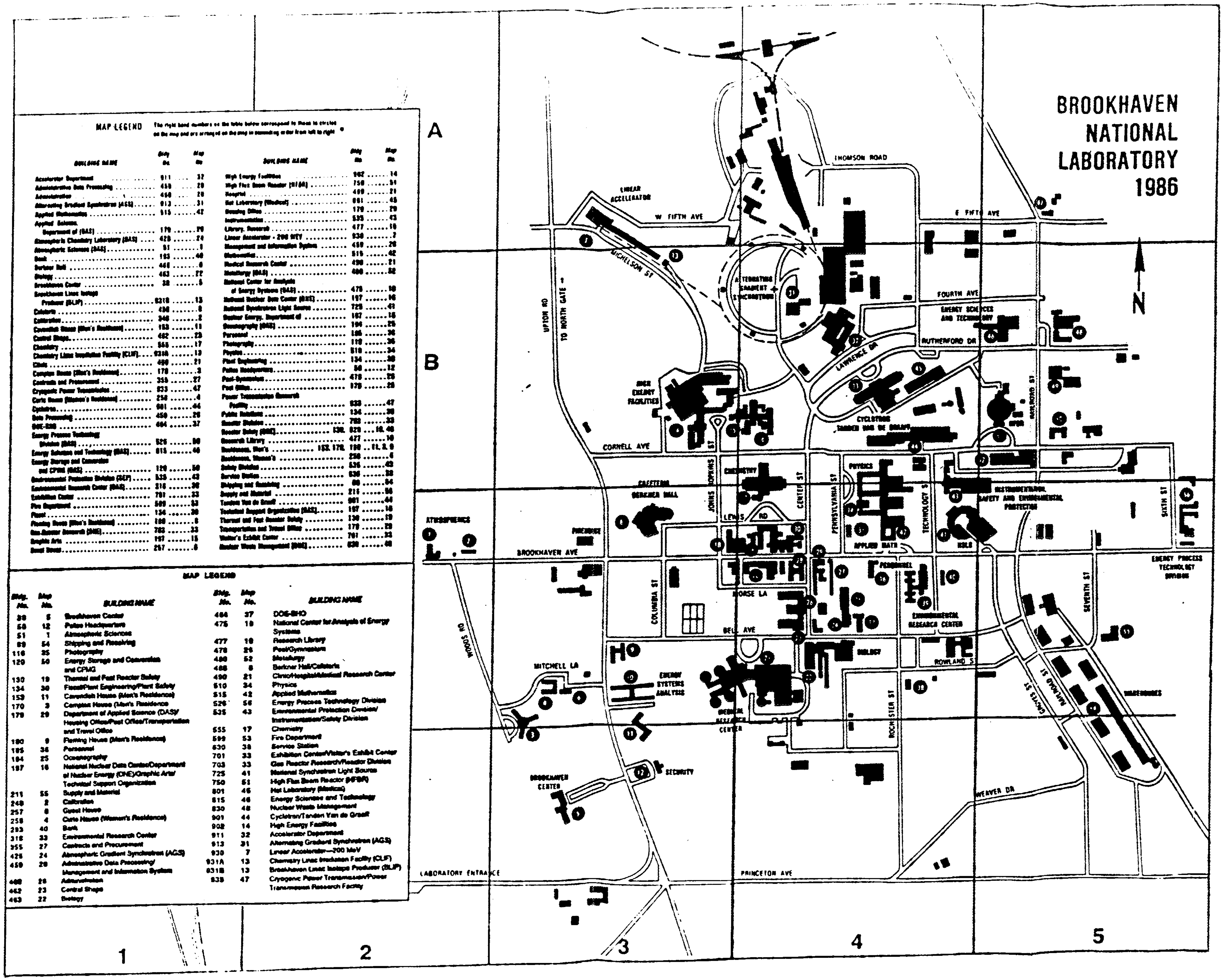
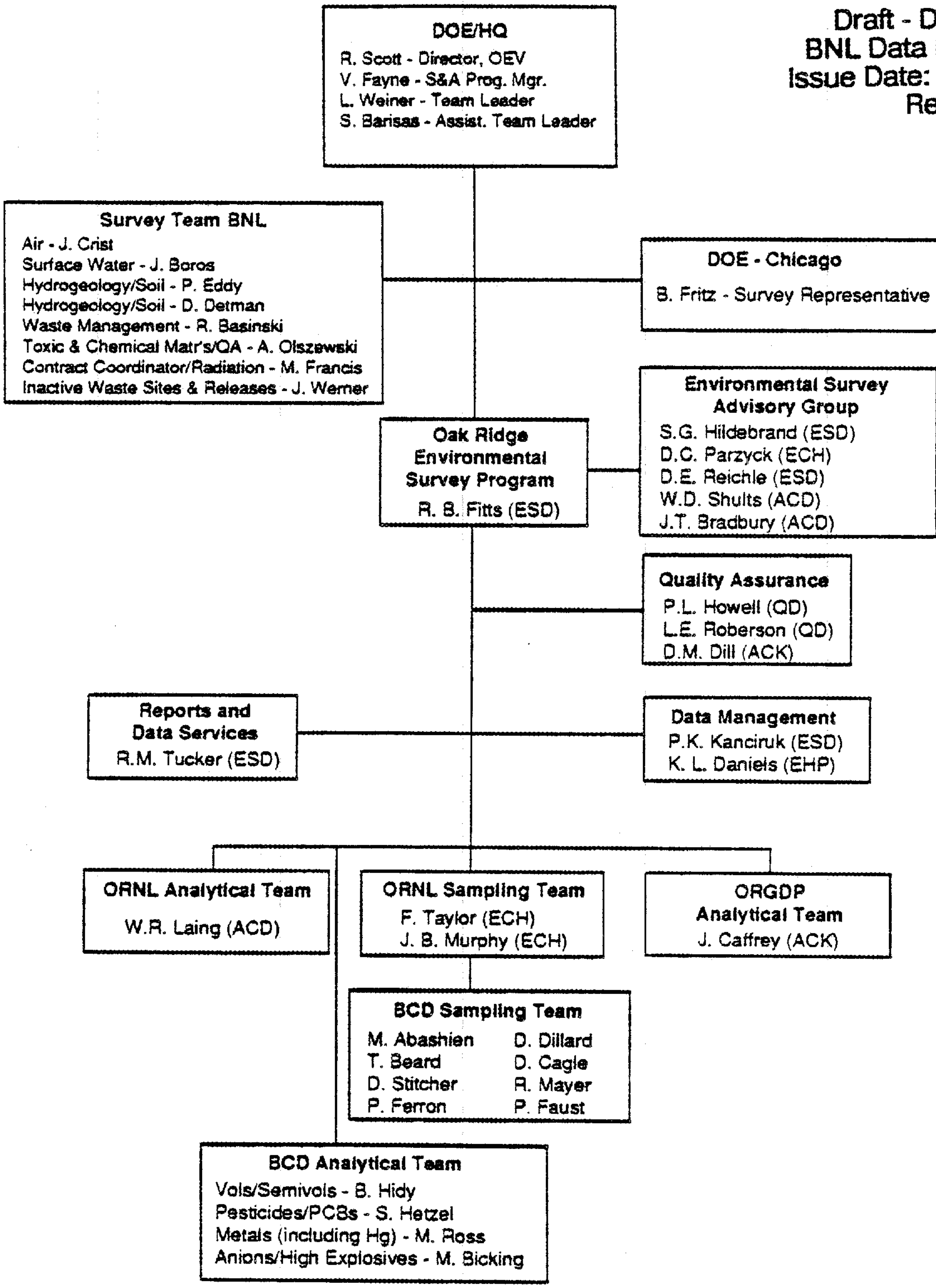


Figure 1.1. Brookhaven National Laboratory Site Map



Legend:

- ECH - Environmental Compliance and Health Protection Division
- ACD - Analytical Chemistry Division - ORNL
- ACK - Analytical Chemistry Department - ORGDP
- EHP - Environmental and Health Protection Division
- ESD - Environmental Sciences Division
- QD - Quality Department
- BCD - Battelle-Columbus Division
- ORNL - Oak Ridge National Laboratory
- ORGDP - Oak Ridge Gaseous Diffusion Plant

Figure 1.2. DOE Leaders, Team Leaders, and Sampling and Analysis Teams for BNL

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2.0 SUMMARY OF SAMPLING AND ANALYSIS

Chapter 2.0 was originally reserved for a summary of the scope and data resulting from the sampling and analysis effort. After further consideration, it was decided that the Survey Team could just as effectively accomplish its objective of modifying the findings contained in the Environmental Survey Preliminary Report by reviewing the data appearing in Chapter 4.0 (Data Presentation). Consequently, Chapter 2.0 was deemed redundant and unnecessary and is retained only in title so as to avoid inconsistencies with references in the Survey Manual and other sections within the Data Document.

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3.0 METHODS

Standard methods and procedures for sampling and analysis provide results which are representative of the site, of known analytical quality, and comparable with other Survey data. Field sampling protocols and analytical methods have been developed and documented in the DOE Environmental Survey Manual (Ref. 1-3). Appendices D and E of the DOE Environmental Survey Manual provide detailed technical descriptions of the sampling and analytical methods described in the following sections.

Sampling and analytical teams used sampling and analysis protocols developed by the American Society for Testing Materials (ASTM), The National Bureau of Standards (NBS), and the U.S. Environmental Protection Agency (EPA); EPA inorganic and organic laboratory analysis methods; and DOE radiological assessment procedures.

Standard practices to ensure sample integrity were in place for each field sampling method. Samples were handled with latex gloves, surface contamination was wiped or rinsed off, and samples were then labeled. Each sample was bagged in a zip-top bag and placed in an insulated ice chest. The samples were then logged in field books and chain-of-custody documents. Chain-of-custody documents were initiated at the time of sample collection and accompanied the samples until they arrived at the analytical laboratories.

For additional details on methods, please refer to the DOE Environmental Survey Manual in effect at the time of sampling and/or analysis. For brevity, references to this manual will be called by section only (i.e., Reference E4.2.1 refers to Section E4.2.1, "Sample Container Immersion," of Appendix E of the DOE Environmental Survey Manual).

Section 6.0 of this data document contains a bibliography of sources and references used to develop and perform analyses.

3.1 Field Sampling Methods

3.1.1 Surface Water Sampling Methods

3.1.1.1 Immersion Method

The immersion method was the preferred method for collection of grab samples from shallow streams, ponds, and effluent streams. The sample bottle was submerged below the water surface with the opening oriented upstream. The sample was collected, preserved, capped, and the container rinsed with deionized water (E4.2.1, "Sample Container Immersion").

3.1.1.2 Volatile Organic Compounds by Vial

Grab samples for volatile organics were collected in 40-mL vials with Teflon-coated septa. A vial was slowly submerged, upside down, in the water. The sample was then collected by righting the vial. The vial was removed from the water, capped, and inverted to check for air bubbles. A lack of bubbles verified an intact sample. It was then rinsed, wiped, labeled, and packed (E4.2.3A, "Volatile Organic Compounds by Vial").

3.1.1.3 Volatile Organic Compounds by Dipper

A grab sample for volatile organics was obtained by slowly submerging a stainless steel dipper in water. The dipper was retrieved and a sample decanted into a 40-mL sample vial that was slightly tipped against the dipper. The vial was filled, capped, checked for air bubbles, and packaged (E4.2.3B, "Volatile Organic Compounds by Dipper").

3.1.1.4 Field Measurements

Horiba or Yellow Springs instruments were used to monitor the water samples for pH, temperature, and conductivity. The presence of volatile organic compounds (VOCs) was determined with either a photoionization detector (PID) or a flame ionization detector (FID). A Sybron/Barnstead conductivity bridge was used to determine resistivity.

3.1.2 Groundwater Sampling Methods

3.1.2.1 Purging Wells

Well purging ensured that a sample representative of the groundwater was secured. An electronic sounder was used to indicate the depth to water, from which well volume was calculated. Typically, a submersible pump was used to purge the well of 3- to 5- well volumes. As the well was being purged, the purged water was monitored for temperature, conductivity, and pH. When these parameters stabilized, they indicated that the water being pumped was most likely representative of the aquifer and not the well casing. Samples were then collected from the pump discharge or with a bailer (narrow bucket with check valve). Other types of pumps used for purging wells included peristaltic pumps (shallow wells) and bladder pumps (E4.4.4.1, "Purging and Sampling with a Submersible Pump").

3.1.2.2 Groundwater Sample Collection

Well samples were collected from the pump discharge or with a bailer after adequate purging and stabilization of field parameters.

Grab samples collected using bailers were preferred for volatile organics, dissolved gases, or other samples that could be degraded by aeration.

Samples collected using submersible centrifugal pumps were not suitable for volatile organic analysis. The turbulence caused by the submersible pump may have released volatiles to vapor phase, excluding them from the sample. Logbook entries indicative of volatile organic samples collected in this manner were made by the Sampling Team Leader.

Other types of pumps used to collect samples were considered suitable for maintaining volatile sample integrity. Filtered samples were taken by connecting the pump outlet to the filter unit. Pump pressure was regulated to prevent filter breakthrough (E4.4, "Groundwater").

3.1.2.3 Field Measurements

Horiba or Yellow Springs instruments were used to monitor the purged water and water samples for pH, temperature, conductivity, and, in most cases, turbidity and dissolved oxygen. The presence of volatile organic compounds (VOCs) was determined with either a photoionization detector (PID) or a flame ionization detector (FID). A Sybron/Barnstead conductivity bridge was used to determine resistivity.

3.1.3 Solids

The method used for solid sampling (soils, sludge, and sediments) was designed to account for the heterogeneous composition of such solids. Several aliquots from systematic points were collected, pooled, homogenized in an aluminum pan using a stainless steel spoon, and bottled. A minimum of three pooled samples were collected from each sample location (E5.0, "Solids"). In instances where a sediment to be collected was limited in quantity (e.g., sediment), grab samples were collected until a suitable volume was obtained.

3.1.3.1 Surface Soils

Surface samples (top 3 in. of soil with stones and vegetation removed) were collected using stainless steel spoons, spatulas, etc.; pooled; and placed in sample bottles. Volatile samples were collected without homogenization or pooling. Nonvolatile samples were collected in an aluminum pan, mixed, and placed in sample bottles.

For trenches and ditches, samples were systematically collected at random along the centerline of the trench. For spill areas, the samples were obtained from heavily stained areas; for large surface areas, a simple random grid was used to ensure representative sampling (E5.1, "Surface Soils").

3.1.3.2 Subsurface Soils

Subsurface soil samples (less than 50 ft in depth) were collected using a variety of techniques. Augers, core samplers, and drive tubes with split-spoon samplers were used as soil conditions dictated. Soil cores were preferable to augered samples, but core samplers were useful only in areas where gravel/cobble was not abundant and where there were no high hazard wastes (E5.2, "Subsurface Soils").

3.1.3.2.1 Auger and Thin-Wall Tube Sampling

Samples were collected, following augering, to a desired sample depth by removing the auger and replacing it with a tube corer. The corer was lowered into position at the sample depth and forced into the soil. The corer was then withdrawn and the sample collected. Sometimes the sample had to be collected directly from the auger. This latter method was used when the soil contained cobble which precluded use of the corer. Continuous flight augers were used in some cases. Although samples from specific depths were difficult to collect directly off the auger, satisfactory composite samples were collected (E5.2.1, "Subsurface Solid Sampling with Auger and Thin-Wall Tube Sampler").

3.1.3.2.2 Core Sampling

The core tube was driven into the ground to a desired depth, withdrawn, and the sample placed in an aluminum tray. The core was then examined with field survey instruments for radioactivity and organic vapor concentrations. The sample site having the highest concentrations was resampled, and an undisturbed sample collected for volatile organic analysis. Three additional cores from the same sample location were collected, pooled, and placed in sample bottles. This procedure was completed three additional times to collect a total of three composite samples (E5.2.2, "Core Sample"). When sample boreholes penetrated the soil 10 ft or more, split-spoon samples were taken. The contents of the split-spoon were screened for VOCs and radioactivity. Immediately following screening, the VOC samples were taken. Following collection of the VOC samples, the split-spoon sample was emptied into a stainless steel pan and homogenized. The remaining samples were then taken from this composite.

3.1.3.3 Sludge and Sediments

Sludge is a semidry material ranging from dewatered solids to high viscosity liquids. Sediments are the deposited materials underlying a body of water. When sediments are exposed by evaporation, stream rerouting, or other means, they are collected by soil or sludge collection methods.

Sludge and sediment were usually sampled using a scoop if the liquid layer over the material was shallow (E5.3, "Sludges and Sediments").

3.1.3.3.1 Scoop Sampling

Although sample collection with a scoop may disturb the liquid-solid interface and alter the sample integrity, sample integrity can be maintained by using extreme care.

The scoop method was used to collect a composite sample by inserting the scoop and removing a sample. For sludge exposed to air, the first 1 to 2 cm of material were removed prior to collecting the sample. The sample was placed in an aluminum tray, mixed, and transferred to an appropriate bottle (E5.3.1, "Scoop").

3.1.3.4 Field Measurements

3.1.3.4.1 Photoionization Detector (PID) and Flame Ionization Detector (FID)

When used, the PID was calibrated with benzene using the headspace method. A specified volume of vapor was removed from the headspace in a benzene reagent bottle and injected into a known volume Tedlar air bag containing zero air. The benzene atmosphere in the bag was calculated from the atmospheric pressure and the vapor pressure of the benzene at the ambient temperature. The PID was adjusted to the resultant concentration and periodically checked throughout the sampling procedure. In sampling, the soil core was removed from the bore hole and a portion placed into a container to prevent loss of volatiles. The remaining portion was placed into a container fitted with a gas-tight sampling port. After 10 to 20 min, the PID sampling tube was inserted into the container through the port and the vapor concentrations measured. The results were recorded as "ppm benzene equivalent." The depth with the highest PID measurement was selected for sample submission and the portion previously placed in the container to prevent loss of volatiles constituted the sample.

When used, the FID was calibrated using a methane/air mixture. A gas chromatograph mass spectrometer (GC-MS) was used to determine the methane concentration (usually 93 ppm) in the cylinder containing the compressed methane/air mixture. Daily calibrations of the FID were performed by filling a Tedlar air bag with the calibration gas, making the necessary adjustments to the

FID, and then "locking" the instrument dials. This ensured that the readings on the FID were correct.

3.1.3.4.2 Field Radioactivity Measurements

Field radioactivity measurements were made using a portable beta/gamma meter. The instrument was calibrated at the Sampling Team's laboratory prior to the team's departure to their respective site.

3.1.3.4.3 Soil pH Measurements

Water was added to a soil sample to create a slurry. The pH was measured with either a Horiba or Orion instrument.

3.2 Analytical Methods

3.2.1 Organic Analysis Methods

3.2.1.1 Volatile Organics

Volatile organic contaminants in water, soil, or sediment are determined using the 7/87 Contract Laboratory Program Statement of Work for low- and medium-level samples and Appendix D of the U.S. DOE Environmental Survey Manual. The protocol stated in these methods is appropriate for the determination of volatile organics in typical environmental matrices, using purge and trap sample introduction into a GC-MS. Thirty-four volatile target compounds can be identified and quantitated with the technique. Table 3.1 summarizes these analytes and their respective detection limits, as specified in the U.S. DOE Environmental Survey Manual.

Volatile organics are purged from an aqueous sample at ambient temperature using an inert gas. A mixture of soil and distilled water is purged from a

Table 3.1. Analytes Determined by CLP Volatiles Analysis Method

	Analyte	CAS Number	Contract Required Detection Limits[a] Water (ug/L)	Low Soil/Sediment[b,c] (ug/kg)
1.	Chloromethane	74-87-3	10	10
2.	Bromomethane	74-83-9	10	10
3.	Vinyl Chloride	75-00-4	10	10
4.	Chloroethane	75-00-3	10	10
5.	Methylene Chloride	75-09-2	5	5
6.	Acetone	67-64-1	10	10
7.	Carbon disulfide	75-15-0	5	5
8.	1,1-Dichloroethene	75-35-4	5	5
9.	1,1-Dichloroethane	75-35-3	5	5
10.	1,2-Dichloroethene (total)	540-59-0	5	5
11.	Chloroform	67-66-3	5	5
12.	1,2-Dichloroethane	107-06-2	5	5
13.	2-Butanone	78-93-3	10	10
14.	1,1,1-Trichloroethane	71-55-6	5	5
15.	Carbon Tetrachloride	56-23-5	5	5
16.	Vinyl acetate	108-05-4	10	10
17.	Bromodichloromethane	75-27-4	5	5
18.	1,1,2,2-Tetrachloroethane	79-34-5	5	5
19.	1,2-Dichloropropane	78-87-5	5	5
20.	cis-1,3-Dichloropropene	10061-01-5	5	5
21.	Trichloroethene	79-01-6	5	5
22.	Dibromochloromethane	124-48-1	5	5
23.	1,1,2-Trichloroethane	79-00-5	5	5
24.	Benzene	71-43-2	4	6
25.	trans-1,3-Dichloropropene	10061-02-6	5	5
26.	Bromoform	75-25-2	5	5
27.	2-Hexanone	591-78-6	10	10
28.	4-Methyl-2-pentanone	108-10-1	10	10
29.	Tetrachloroethene	127-18-4	5	5
30.	Toluene	108-88-3	5	5
31.	Chlorobenzene	108-90-7	5	5
32.	Ethyl benzene	100-41-4	5	5
33.	Styrene	100-42-5	5	5
34.	Xylenes (total)	133-02-7	5	5

Table 3.1. Analytes Determined by CLP Volatiles Analysis Method (Continued)

a. Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.
b. Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.
c. Contract required detection limits (CRDL) for volatiles at medium levels in soil/sediment are 100 times the listed CRDL for volatiles at low levels in soil/sediment.

specially designed purging chamber at elevated temperatures. The vapor is swept through a sorbent column where the volatiles are trapped. After purging is completed, the sorbent column is heated and backflushed with the inert gas to desorb the volatiles onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the volatiles, which are then detected with a mass spectrometer. Target compounds are identified by: (1) elution of the sample component at the same GC relative retention time as the standard component, and (2) correspondence of the sample component and standard component mass spectra. A combined search of the National Bureau of Standards (NBS) and Wiley Mass Spectral Library is used to tentatively identify up to ten nontarget analytes of greatest concentration in the chromatogram.

Method interferences may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that could lead to artifacts and/or elevated baselines in the total ion profile. Laboratory reagent blanks are used to monitor the presence of such interferences. Interferences introduced by the sample matrix are monitored by the use of internal standards and matrix and surrogate spike recoveries.

Interpretation of volatiles data requires an assessment of the impact of holding times on data quality. The Survey protocol requires that the analysis be conducted within 14 days of sample collection. Samples which may exceed this holding time can still provide useful information, as long as the data are interpreted with caution.

3.2.1.2 Semivolatile Organics

Semivolatile organic contaminants in water, soil, or sediment samples are determined using the 7/87 Contract Laboratory Program Statement of Work and Appendix D of the DOE Environmental Survey Manual for low- and medium-level samples. The protocol described in these methods is appropriate for the determination of a number of organic compounds that are partitioned into an organic solvent and are amenable to gas chromatography. The target compound list (TCL) and required limits specified in the U.S. DOE Environmental Survey Manual are listed in Table 3.2.

Semivolatile organics are serially extracted from aqueous samples with methylene chloride at a pH greater than 11, and again at a pH less than 2. The methylene chloride extracts are dried and concentrated separately. Low-level soil samples are mixed with anhydrous powdered sodium sulfate and serially extracted with 1:1 methylene chloride/acetone using an ultrasonic probe. The methylene chloride and extracted semivolatile organics are then collected by decanting and concentrated. All extracts are stored at $4^{o}C$ in the dark until they are analyzed using GC-MS. If extracts are to be held for greater than 40 days, they are stored at $-20^{o}C$. Target compounds are identified on a cross-correlation basis of: (1) relative retention times (compound elution times) compared to internal standard retention times, and (2) correspondence of the sample component and standard component mass spectra. A combined search of the NBS and Wiley Mass Spectral Libraries and interpretation by a mass spectrometer specialist are used to provide tentative identification for up to 20 nontargeted compounds meeting U. S. EPA concentration criteria.

Method interferences may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware, that lead to artifacts or elevated baselines in the total ion profiles. Laboratory reagent blanks are used to monitor the presence of such interferences. Matrix interferences may be caused by soil acting as a sorbent for semivolatile organics, or by contaminants that are co-extracted with the sample. Sample matrix effects are monitored by internal standards, as well as surrogate and matrix spike recoveries.

Interpretation of semivolatile organics data requires an assessment of the impact of holding times on data quality. The Survey protocol requires that aqueous samples must be extracted within seven days of sample collection; soil samples

Table 3.2. Analytes Determined by CLP Semivolatiles Analysis Method

	Analyte	CAS Number	Contract Required Detection Limits[a] Water (ug/L)	Low Soil/Sediment[b,c] (ug/kg)
35.	Phenol	108-95-2	10	330
36.	bis(2-Chloroethyl) ether	111-44-4	10	330
37.	2-Chlorophenol	95-57-8	10	330
38.	1,3-Dichlorobenzene	541-73-1	10	330
39.	1,4-Dichlorobenzene	106-46-7	10	330
40.	Benzyl alcohol	100-51-6	10	330
41.	1,2-Dichlorobenzene	95-50-1	10	330
42.	2-Methylphenol	95-48-7	10	330
43.	bis(2-Chloroisopropyl) ether	39638-32-9	10	330
44.	4-Methylphenol	106-44-5	10	330
45.	N-Nitroso-di-n-propylamine	621-64-7	10	330
46.	Hexachloroethane	67-72-1	10	330
47.	Nitrobenzene	98-95-3	10	330
48.	Isophorone	78-59-1	10	330
49.	2-Nitrophenol	88-75-5	10	330
50.	2,4-Dimethylphenol	105-67-9	10	330
51.	Benzoic acid	65-85-0	50	1600
52.	bis(2-Chlorethoxy) methane	111-91-1	10	330
53.	2,4-Dichlorophenol	120-83-2	10	330
54.	1,2,4-Trichlorobenzene	120-82-1	10	330
55.	Naphthalene	91-20-3	10	330
56.	4-Chloroaniline	106-47-8	10	330
57.	Hexachlorobutadiene	87-68-3	10	330
58.	4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
59.	2-Methylnaphthalene	91-57-6	10	330
60.	Hexachlorocyclopentadiene	77-47-4	10	330
61.	2,4,6-Trichlorophenol	88-06-2	10	330
62.	2,4,5-Trichlorophenol	95-95-4	50	1600
63.	2-Chloronaphthalene	91-58-7	10	330
64.	2-Nitroaniline	88-74-4	50	1600
65.	Dimethyl phthalate	131-11-3	10	330
66.	Acenaphthylene	208-96-8	10	330
67.	2,6-Dinitrotoluene	606-20-2	10	330
68.	3-Nitroaniline	99-09-2	50	1600
69.	Acenaphthene	83-32-9	10	330

Table 3.2. Analytes Determined by CLP Semivolatiles Analysis Method (Continued)

	Analyte	CAS Number	Contract Required Detection Limits[a] Water (ug/L)	Low Soil/Sediment[b,c] (ug/kg)
70.	2,4-Dinitrophenol	51-28-5	50	1600
71.	4-Nitrophenol	100-02-7	50	1600
72.	Dibenzofuran	132-64-9	10	330
73.	2,1-Dinitrotoluene	121-14-2	10	330
74.	Diethylphthalate	84-66-2	10	330
75.	4-Chlorophenyl phenyl ether	7005-72-3	10	330
76.	Fluorene	86-73-7	10	330
77.	4-Nitroaniline	100-01-6	50	1600
78.	4,6-Dinitro-2-methylphenol	534-52-1	50	1600
79.	N-Nitrosodiphenylamine	86-30-6	10	330
80.	4-Bromophenyl phenyl ether	101-55-3	10	330
81.	Hexachlorobenzene	118-74-1	10	330
82.	Pentachlorophenol	87-86-5	50	1600
83.	Phenanthrene	85-01-8	10	330
84.	Anthracene	120-12-7	10	330
85.	Di-n-butylphthalate	84-74-2	10	330
86.	Fluoranthene	206-44-0	10	330
87.	Pyrene	129-00-0	10	330
88.	Butylbenzylphthalate	85-68-7	10	330
89.	3,3'-Dichlorobenzidine	91-94-1	20	660
90.	Benzo(a)anthracene	56-55-3	10	330
91.	Chrysene	218-01-9	10	330
92.	bis(2-Ethylhexyl)phthalate	117-81-7	10	330
93.	Di-n-octyl phthalate	117-84-0	10	330
94.	Benzo(b)fluoranthene	205-99-2	10	330
95.	Benzo(k)fluoranthene	207-08-9	10	330
96.	Benzo(a)pyrene	50-32-8	10	330
97.	Indeno(1,2,3-cd)Pyrene	193-39-5	10	330
98.	Dibenz(a,h)anthracene	53-70-3	10	330
99.	Benzo(g,h,i)perylene	191-24-2	10	330

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

b. Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

c. Contract required detection limits (CRDL) for semivolatiles at medium levels in soil/sediment are 60 times the listed CRDL for semivolatiles at low levels in soil/sediment.

must be extracted within 14 days. Samples that have exceeded this holding time can still provide useful data as long as it is interpreted with caution.

3.2.1.3 Pesticides/PCBs in Water, Soil, and Sediment

Pesticides and polychlorinated biphenyls (PCBs) in water, soil, or sediment are determined using the Contract Laboratory Program Statement of Work for low- and medium-level samples (BCD used 7/87 revision while ORGDP used 10/87 version) and the U.S. DOE Environmental Survey Manual. The analytical method involves extraction of the chlorinated hydrocarbon contaminants from the environmental matrices with methylene chloride, concentration of the extracts, and the analysis of the extracts on a gas chromatograph/electron capture detector (GC/ECD). If pesticides or PCBs are tentatively identified, a second GC/ECD analysis is performed using an alternate chromatographic column for positive identification.

The U.S. DOE protocol requires the identification of 27 target compounds at the Contract Required Detection Limits (CRDL) listed in Table 3.3.

Method interferences may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware. The presence of these artifacts is determined by running a laboratory method blank under the same conditions as the samples. Poor extraction efficiency due to sample matrix effects is monitored by the use of surrogate and matrix spike recoveries.

Interpretation of pesticide/PCB data requires an assessment of the impact of holding times on data quality. The Survey protocol requires that aqueous samples be extracted within seven days of sample collection and soil samples extracted within 14 days. Samples that have exceeded these holding times can still provide useful information as long as the data are interpreted with caution. Extracts are stored at less than $0^{o}C$ between the time of extraction and analysis to ensure that the sample quality is not compromised.

Table 3.3. Analytes Determined by CLP Pesticide/PCB Analysis Method

Analyte	CAS Number	Contract Required Detection Limits[a] Water (ug/L)	Low Soil/Sediment[b,c] (ug/kg)
100. alpha-BHC	319-84-6	0.05	8.0
101. beta-BHC	319-85-7	0.05	8.0
102. delta-BHC	319-86-8	0.05	8.0
103. gamma-BHC (Lindane)	58-89-9	0.05	8.0
104. Heptachlor	76-44-8	0.05	8.0
105. Aldrin	309-00-2	0.05	8.0
106. Heptachlor epoxide	1024-57-3	0.05	8.0
107. Endosulfan I	959-98-8	0.05	8.0
108. Dieldrin	60-57-1	0.10	16.0
109. 4,4'-DDE	72-55-9	0.10	16.0
110. Endrin	72-20-8	0.10	16.0
111. Endosulfan II	33213-65-9	0.10	16.0
112. 4,4'-DDD	72-54-8	0.10	16.0
113. Endosulfan sulfate	1031-07-8	0.10	16.0
114. 4,4'-DDT	50-29-3	0.10	16.0
115. Endrin ketone	53494-70-5	0.10	16.0
116. Methoxychlor	72-43-5	0.5	80.0
117. alpha-chlordane	5103-71-9	0.5	80.0
118. gamma-chlordane	5103-74-2	0.5	80.0
119. Toxaphene	8001-35-2	1.0	160.0
120. Aroclor-1016	12674-11-2	0.5	80.0
121. Aroclor-1221	11104-28-2	0.5	80.0
122. Aroclor-1232	11141-16-5	0.5	80.0
123. Aroclor-1242	53469-21-9	0.5	80.0
124. Aroclor-1248	12672-29-6	0.5	80.0
125. Aroclor-1254	11097-69-1	1.0	160.0
126. Aroclor-1260	11096-82-5	1.0	160.0

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

b. Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

c. Contract Required Detection Limits (CRDL) for pesticides/PCBs at medium levels in soil/sediment are 15 times the listed CRDL for pesticides/PCBs at low levels in soil/sediment.

3.2.1.4 Petroleum Hydrocarbons

This method is for the measurement of extractable petroleum hydrocarbons from surface and saline waters; industrial, domestic, and solid wastes; sludges; and soils. The method is applicable to measurement of light fuels, although loss of about half of any gasoline present during the extraction manipulations can be expected.

For waters the sample is acidified to a low pH (<2) and serially extracted with Fluorocarbon-113 in a separatory funnel. Interferences are removed with silica gel adsorbent. Infrared analysis of the extract is performed by direct comparison of its optical absorbance with standards at approximately 2950 cm^{-1}. The method is sensitive to levels of 1 mg/L and less.

For sludges and soils a 20-g sample with a known dry-solids content is acidified to pH 2 or less with concentrated HCl. After chemical drying with magnesium sulfate monohydrate, the petroleum hydrocarbons are extracted with Fluorocarbon-113 using a Soxhlet apparatus. After filtering through a sodium sulfate impregnated filter paper, interferences are removed with silica gel adsorbent, and infrared analysis of the extract is performed as described above. The method is sensitive to levels of 0.1 weight percent of dry sample.

3.2.2 Inorganic Analysis Methods

3.2.2.1 CLP Metals Determination by Atomic Emission or Absorption Techniques

The determination of low levels of metal contaminants was accomplished using a protocol based on the U.S. EPA Contract Laboratory Program (CLP) Statement of Work (SOW) No. 787 for Inorganic Analysis Multi-media, Multi-concentration and the U.S. DOE Environmental Survey Manual. Table 3.4 summarizes the analytical method and the required detection limit for a total of 23 specific

Table 3.4. Elements Determined by Atomic Emission or Absorption Techniques

Element	Contract Required Detection Level (ug/L)	DOE Method Detection Limit for ICP (ug/L)	Analytical Method
Aluminum	200	200	ICP
Antimony	60	150	ICP, GFAA*
Arsenic	10	250	ICP, GFAA*
Barium	200	200	ICP
Beryllium	5	5	ICP
Cadmium	5	20	ICP, GFAA*
Calcium	5000	5000	ICP
Chromium	10	10	ICP
Cobalt	50	50	ICP
Copper	25	25	ICP
Iron	100	100	ICP
Lead	5	200	ICP, GFAA*
Magnesium	5000	5000	ICP
Manganese	15	15	ICP
Mercury	0.2	---	CVFAA
Nickel	40	40	ICP
Potassium	5000	5000	FES, ICP
Selenium	5	400	ICP, GFAA*
Silver	10	30	ICP, GFAA*
Sodium	5000	5000	ICP
Thallium	10	100	ICP, GFAA*
Vanadium	50	50	ICP
Zinc	20	20	ICP

ICP = Inductively coupled plasma emission spectrometry.
GFAA = Graphite furnace atomic absorption spectrometry.
FES = Flame emission photometry.
CVFAA = Cold vapor flameless atomic absorption spectrometry.

* Only GFAA results performed by ORNL were reported for this element.

metal contaminants. The metals determined by the inductively coupled plasma (ICP) technique according to the full CLP technical criteria include most of the elements specified by the DOE protocol. The exception to these include potassium by flame emission photometry in ORNL analyses. In addition, three elements (arsenic, selenium, and lead) were also determined at ORNL by ICP and were reported to detection levels which exceeded the CLP requisite limits, but were significantly below the ICP method detection limits as listed in the DOE protocol. Graphite furnace atomic absorption (GFAA) was used to determine and report the concentrations of seven elements (silver, arsenic, antimony, cadmium, lead, selenium and thallium) at ORNL for BNL samples. All 22 metals (mercury not determined) were analyzed by ICP at Argonne National Laboratory (ANL).

Mercury was determined by cold vapor flameless AA (CVFAA), and cesium and lithium were analyzed using the flame atomic absorption technique.
CLP protocol was used to monitor the precision and accuracy of the individual elemental results. Calibration data were verified during the course of an analytical run. Interference check samples were used to determine the effectiveness of interelement corrections for the ICP metals. The precision of the measurements was estimated using sample duplicates. Sample digestion efficiency was assessed by including laboratory control samples with each preparation batch. Matrix spikes, analytical spikes (for GFAA only), and serial dilutions of samples (for ICP only) were made to assess the accuracy and to determine the presence of analytical interferences attributable to the sample matrix or to preparation procedures.

3.2.2.1.1 ICP-Atomic Emission Spectrometry

The basis of this method is the simultaneous multi-element measurement of atomic emission by an optical spectroscopic technique. Samples are nebulized and the aerosol that is produced is transported to a high temperature plasma where excitation occurs. Characteristic atomic-line emission spectra are produced by the radio-frequency inductively coupled plasma and are dispersed by a grating spectrometer. The line intensities, which are a measurement of elemental concentrations, are monitored by photomultiplier tubes. The photocurrents from the photomultiplier tubes are processed and controlled by a computer system.

A background correction technique is required to compensate for variable background contributions to the determination of trace elements. Background is measured adjacent to analyte lines on samples during analysis. The position selected for the background intensity measurement, on either or both sides of the analytical line, is determined by the complexity of the spectrum adjacent to the analyte line. The position used should be free of spectral interference and reflect the same change in background intensity that occurs as the analyte wavelength is measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. Additional interferences, i.e., spectral, physical, and/or chemical, are also possible. Appropriate corrections are made when required and are documented in the ICP case narrative.

Acid digestion of water, soil, sediment, and sludge samples is performed according to the CLP SOW No. 787 protocol prior to trace metal analysis by ICP. A 100-mL aliquot of an aqueous sample is digested with a mixture of nitric and hydrochloric acids. The acidified sample is heated below boiling for approximately 2 hr or until the sample volume is reduced to half of its initial volume. The sample is then cooled, filtered, and diluted volumetrically. For solid samples, a representative 1-g (wet weight) sample is digested with nitric acid and hydrogen peroxide. The digestate is then refluxed with nitric and hydrochloric acid, then allowed to cool prior to filtration and dilution. Elemental sample concentrations are reported on a dry weight basis.

3.2.2.1.2 Potassium

A direct-reading flame photometer is used for the quantitative analysis of potassium in aqueous and solid samples analyzed at ORNL. In this technique, an aspirating atomizer capillary tube is used to transfer a portion of a digested sample into a high velocity, propane-oxygen burner assembly. Ground state potassium atoms are thermally excited in the high temperature flame. Light emitted from the excited atoms as they return to ground state passes through a sodium light attenuator, then through an optical transmission filter specific for potassium emission. The light emission is detected by a phototube and is directly proportional to potassium concentration in the digested sample. The operating range for the flame photometer is 0.1 to 8 mg/L.

The same digestates prepared for ICP analysis are also used for the analysis of potassium by flame photometry.

3.2.2.1.3 Atomic Absorption, Furnace Technique

Graphite furnace atomic absorption is used to determine the concentration of arsenic, antimony, cadmium, lead, selenium, silver, and thallium in BNL samples at ORNL. When using the furnace technique in conjunction with an atomic absorption spectrophotometer, a representative aliquot of a sample is placed in the graphite tube of the furnace, evaporated to dryness, charred, and atomized. Analyte atoms are vaporized and dissociated for light absorption in the tube. Radiation from a light source, hollow cathode, or electrodeless discharge lamp of the element being determined is passed through the vapor containing ground-state atoms of that element. The intensity of the transmitted radiation decreases in proportion to the amount of the ground state element in the vapor. A grating monochromator isolates the characteristic radiation from the hollow cathode lamp and a photosensitive device measures the attenuated transmitted radiation.

Aqueous samples are prepared by digesting 100-mL aliquots with a mixture of nitric acid and hydrogen peroxide. The acidified sample is then heated below boiling for approximately 2 hr, or until the sample volume is reduced to half of its initial volume. The sample is then cooled, diluted volumetrically, and allowed to settle overnight to remove insoluble material. Representative 1-g solid samples are prepared by digesting them in nitric acid and hydrogen peroxide. The digestate is refluxed with nitric acid, cooled, diluted volumetrically, and allowed to settle overnight.

3.2.2.1.4 Mercury

Mercury is determined by cold vapor flameless atomic absorption (CVFAA). The flameless AA procedure is a physical method based on the absorption of radiation at 253.7 nm by mercury vapor. Organic mercury compounds are converted to inorganic forms by the oxidative digestion of the sample. An aliquot of the diluted digestate is transferred to a 50-mL closed reaction chamber where stannous chloride is used to reduce the mercury to the elemental form. The mercury vapor is then purged from the solution into a 90-cm absorption cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance (peak height) is measured as a function of mercury concentration.

Samples are prepared using a method developed at ORNL. The method is capable of determining two nanograms (ng) of mercury. A perchloric acid/nitric acid wet-ashing procedure is used to convert the organic mercury to an inorganic form. Reagent blanks are very low (<2 ng) for this procedure. To obtain these low blanks, acids are preselected by analytical testing and washed glassware is baked overnight at 450^{O}C. Samples are digested in a 250-mL borosilicate volumetric flask equipped with supplemental air condensers to prevent the loss of mercury. After digestion the sample volume is adjusted to 50 mL. An aliquot of this solution is introduced into the instrument reaction chamber for the subsequent determination of mercury.

3.2.2.2 Nontarget List Parameters

3.2.2.2.1 Cyanide

Cyanide is determined spectrophotometrically in drinking, surface, and saline waters; domestic and industrial wastes; and in sediments and other solids. Cyanide as hydrocyanic acid (HCN) is released from cyanide complexes by performing a reflux-distillation of the sample in the presence of a mineral acid and magnesium ion. (Magnesium prevents the codistillation of thiocyanate.) The evolved HCN is absorbed in a scrubber solution containing sodium hydroxide. Cyanide is then determined spectrophotometrically by first converting HCN to cyanogen chloride (CNCl) by reaction with chloramine-T under controlled pH conditions. Upon completion of the chemical reaction, pyridinebarbituric acid reagent is added to form a chromophore, which absorbs at 578 nm. Concentration is read from a standard curve of absorbance versus cyanide concentration. The holding time for cyanide is limited to 14 days from the date of sample collection.

The spectrophotometric procedure has a detection limit of 0.002 mg/L and can be used for solutions containing up to 1 mg/L cyanide. A silver nitrate titration procedure using p-dimethylaminobenzalrhodanine indicator can be used for samples containing higher amounts of cyanide.

3.2.2.2.2 Recoverable Oil and Grease

Extractable matter from surface and saline waters and industrial and domestic wastes is determined gravimetrically after sample extraction with trichlorotrifluoroethane (Fluorocarbon-113). The oil and grease present in a sample are extracted from an acidified, 1-L aliquot with Fluorocarbon-113 using a 2-L separatory funnel. The entire specimen container must be extracted to avoid sidewall loss of oils. The extract is evaporated from a constant weight-tared crucible and the oil/grease residue weighed. A concentration range of 5 to 1000 mg/L of extractable oil/grease may be directly determined from 1-L specimens.

For wet sludges, a 20-g sample with a known dry-solids content is acidified to pH 2.0 with HCl. After drying with magnesium sulfate monohydrate, the oil and grease are extracted from the sample with Fluorocarbon-113 using a Soxhlet apparatus. The extract is filtered into a preweighed boiling flask, the solvent is evaporated, and the oil and grease, which were extracted, are weighed.

The nature of the oil or grease, and the presence of extractable nonoily matter, will influence the material measured and the interpretation of the results. Vegetable oils, waxes, soaps, greases, animal fats, and relatively nonvolatile hydrocarbons can be measured with this procedure. The method is not applicable to light hydrocarbons that volatilize below 70^{o}C, gasoline, and petroleum fuels through No. 2 fuel oil.

3.2.2.3 Percent Solids

To determine the percent solids in a sample, a portion of the material is placed on a weighed dish; the difference in weight represents the wet sample weight. The sample is dried at 103^{o} to 105^{o}C overnight, cooled, and reweighed. The difference between the dried sample and the dish represents the dry weight. The ratio of dry weight to wet weight is multiplied by 100 to obtain the percent solids contained in a solid sample. A single determination of percent solids was performed for a sample at ORGDP, at ORNL duplicate determinations were performed at a sample frequency of 20%, and duplicate determinations for each sample were performed by Battelle-Columbus Division (BCD).

3.2.2.4 Total Dissolved Solids

Total dissolved solids (or filterable residues) in drinking, surface, and saline waters or domestic and industrial wastes are determined gravimetrically after sample filtration and drying. The total dissolved solids present in a sample are determined by filtering 100 mL of sample through a glass fiber filter. The filtrate is transferred to a constant weight-tared dish and evaporated to dryness with a heat lamp. The evaporated sample is weighed to a constant weight. The practical range of this determination is 10 mg/L to 20,000 mg/L. Holding times for sample analysis are limited to seven days.

This procedure is susceptible to some interferences. High mineral content waters containing significant concentrations of calcium, magnesium, chloride, and/or sulfate may be hygroscopic in nature and require careful and prolonged drying, desiccation, and rapid weighing. Samples containing high concentrations of bicarbonate will also require careful and possibly prolonged drying at 180^{o}C to ensure that all the bicarbonate is converted to carbonate. Total residue should be limited to about 200 mg since the presence of too much residue in the evaporating dish will crust over and trap water that will not be driven off during drying.

3.2.2.5 Toxicity Characteristic Leaching Procedure

EPA has proposed to amend the Extraction Procedure Toxicity Characteristic (EPTC) to include 38 additional compounds and a modified leaching procedure, known as the Toxicity Characteristic Leaching Procedure (TCLP). A description and background information for TCLP is found in "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Notification Requirements; Reportable Quantity Adjustments: Proposed Rule" (40 CFR Parts 261, 271, and 302) in Volume 51 of the Federal Register. Under the proposed rule, a leaching test is used to determine whether an unacceptably high level of groundwater contamination might result from improper waste management of wastes containing any one of the 52 listed toxicants. Regulatory level concentrations for the individual toxicants are based on chronic toxicity reference levels, combined with a compound-specific dilution/attenuation factor (derived from application of a groundwater transport equation).

The TCLP is intended to be a first order approximation of the leaching of low-molecular weight carboxylic acids generated in actively decomposing sanitary landfills. Acetic acid is one of the more dominant carboxylic acids present in municipal waste leachate. As such, approximately 100 g of a soil sample is extracted with a buffered acetic acid extraction fluid 20 times the weight of the solid phase. The liquid extract is separated from the solid phase prior to chemical analysis. Waste samples containing less than 0.5% solids are defined as the TCLP extract. Two-phase waste samples are filtered with 0.6 to 0.8 um glass fiber filters; the solid phase then is extracted with the acetic acid extraction fluid. The leachate, if compatible, is then recombined with the liquid phase prior to analysis. If incompatible, the liquids are analyzed separately and the results are mathematically combined to yield a volume weighted average concentration. Analytical results above the proposed regulatory limits for the individual compounds will define the sample as a hazardous waste. TCLP need not be run on samples if a total analysis of the original sample demonstrates that individual contaminants are not present in the waste, or that they are present, but at such low concentrations that the appropriate regulatory thresholds could not possibly be exceeded. Tables 3.5 and 3.6 list the regulatory levels for semivolatile and metal analytes determined using CLP analysis protocol.

3.2.2.6 Radiological

Radiochemical contamination in soil and water is determined by either direct counting or by radiochemical separations and specific counting to ascertain radionuclide activity. Water samples (other than those for tritium analysis) are acidified to pH 2 at collection time. Samples that are not acidified in the field are acidified when they are received and allowed to equilibrate overnight before sample aliquots are removed. Soil samples are dried at 105^{o}C to a constant weight, then pulverized and blended well before sample aliquots are removed. All soil samples are analyzed on a dry weight basis.

Table 3.5. TCLP Limits for CLP Semivolatile Compounds

Semivolatile	CAS Number	Reg. Level (mg/L)
Bis (2-chloroethyl)ether	111-44-4	0.05
o-Cresol	95-48-7	10.0
m-Cresol	108-39-4	10.0
p-Cresol	106-44-5	10.0
1,2 - Dichlorobenzene	95-50-1	4.3
1,4 - Dichlorobenzene	106-46-7	10.8
2,4 - Dinitrotoluene	121-14-2	0.13
Hexachlorobenzene	118-74-1	0.13
Hexachlorobutadiene	87-68-3	0.72
Hexachloroethane	67-72-1	4.3
Nitrobenzene	98-95-3	0.13
Pentachlorophenol	87-86-5	3.6
Phenol	108-95-2	14.4
2,4,5 - Trichlorophenol	95-95-4	5.8
2,4,6 - Trichlorophenol	88-06-2	0.30
2,3,4,6 - Tetrachlorophenol	108-88-3	14.4
Pyridine	110-86-1	5.0

Table 3.6. TCLP Limits for ICP Metals

Metals	CAS Number	Reg. Level (mg/L)
Arsenic	7440-38-2	5.0
Barium	7440-39-3	100
Cadmium	7440-43-9	1.0
Chromium	1330-82-0	5.0
Lead	7439-91-1	5.0
Mercury	7439-97-6	0.2
Selenium	7782-49-2	1.0
Silver	7440-22-4	5.0

3.2.2.6.1 Determination of Gross Alpha and Beta Activity in Water

An aliquot of a preserved water sample is evaporated to a small volume and transferred quantitatively to a tared 2-in. stainless steel counting planchet. The sample residue is dried to constant weight, then reweighed to determine dry residue weight. The sample is then counted for gross alpha and gross beta activity.

Counting is performed on a Tennelec LB-4000 system that is comprised of 12 gas-flow proportional counters and an IBM-PC controller. Counting efficiencies for both alpha and beta particle activities are determined according to the amount of sample solids from a standard curve of counting efficiency versus sample solids.

3.2.2.6.2 Isotopic Composition of Uranium by Mass Spectrometry

Uranium isotope ratios are measured at ORGDP by thermal ionization mass spectrometry (TIMS). These ratios are used for computing the relative abundance of each isotope in the sample. The procedure presumes that the element has been previously isolated from the sample matrix and is in purified form for TIMS analysis. Isolation and purification of uranium from a sample matrix may be accomplished by such methods as solvent extraction or ion exchange chromatography depending on the nature of the sample matrix.

A uranium solution is evaporated on filaments, which are installed in the TIMS. Isotopic ratios are measured automatically by the instrument, and relative isotope abundances are calculated from the ratios.

3.2.2.6.3 Total Uranium in Water and Soil

Total uranium concentration in water and soil is determined at ORGDP by fluorometric analysis. For water samples, an aliquot is extracted with tri-n-octyl-phosphine oxide dissolved in varsol. An aliquot of this organic phase is fused in a flux of anhydrous sodium fluoride. The uranium fluorescence of the pellet is measured using a fluorophotometer and compared to the fluorescence of known uranium standards. The fluorophotometer, which was made by the Oak Ridge Y-12 Instrument Department, is an automated fluorescence analyzer controlled by a Hewlett-Packard 85B computer.

For soils, a dried weighed sample is heated to about 600^{o}C in a muffle furnace for a minimum of 4 hr, then further treated to assure that organics are destroyed. The sample is dissolved in nitric acid and brought to volume. An aliquot of this solution is extracted and carried through the procedure as described above for water.

3.2.2.6.4 Plutonium Isotopes in Water

Plutonium concentration in natural and industrial waters is analyzed according to protocol defined in Appendix D of the U.S. DOE Environmental Survey Manual. Plutonium in the sample is equilibrated with plutonium-242 tracer, coprecipitated with bismuth phosphate, adsorbed on an anion exchange resin, selectively eluted from the resin, coprecipitated with praseodymium hydroxide, and extracted with thenoyltrifluoroacetone-xylene. The plutonium extract is dried on a stainless steel disc, which is analyzed by alpha pulse-height analysis to determine the plutonium concentration.

The lowest concentration reported is 4×10^{-5} pCi/mL when analyzing a 1-L sample, using 10 disintegration per minute (dpm) of plutonium-242 tracer, counting for 1000 min on an alpha pulse-height analyzer with a detector efficiency of 20% and a 0.005-cpm background over each energy level of interest, and realizing an 80% chemical recovery.

Interferences from other alpha-emitting nuclides are generally eliminated by alpha pulse-height analysis, except for plutonium-240, which cannot be resolved from the plutonium-239 by this means. Mass spectrometric analysis is required if independent measurements of both of these isotopes are desired.

3.2.2.6.5 Plutonium Isotopes in Sediment and Soil

A known quantity of plutonium-242 tracer, which is used as the internal standard, is added to the sample that is leached by hot nitric acid and hot nitric acid-hydrogen peroxide treatment. After leaching, plutonium is adjusted to Pu^{+4}, adsorbed onto anion exchange resin, reduced to Pu^{+3}, and selectively eluted from the resin. Subsequently, plutonium is coprecipitated with praseodymium hydroxide, dissolved, and oxidized to Pu^{+4}, which is then extracted with thenoyltrifluoroacetone-xylene. The organic extract is deposited on a stainless steel disc, and the plutonium is determined by alpha pulse-height analysis.

The lowest concentration reported is 0.004 pCi/g when analyzing a 10-g sample, using 10 dpm of plutonium-242 tracer, counting for 1000 min on an alpha pulse-height analyzer with a detector having a 20% efficiency and a 0.005-cpm background over each energy region of interest, and realizing an 80% chemical recovery of plutonium.

Samples that are refractory, such as test-site material, are not apt to release plutonium in the leaching process; therefore, more rigorous treatment is recommended for decomposition of these samples. Plutonium-240 cannot be distinguished from plutonium-239 by alpha pulse-height analysis. However, alpha spectrometry eliminates most other alpha interferences.

3.2.2.6.6 Total Radioactive Strontium in Water

Stable strontium carrier is added to an aliquot of water and the strontium precipitated from the sample as the carbonate. Interferences from calcium and some radionuclides are removed by one or more precipitations of the strontium carrier as strontium nitrate. Barium and radium are removed as the chromate;

the yttrium-90 daughter of strontium-90 is removed by hydroxide precipitation. The separated strontium is counted immediately for beta particle activity. The counting result represents the total strontium activity (strontium-89 and strontium-90) plus an insignificant fraction of the yttrium-90 that has grown into the separated strontium-90. Counting performed at ORNL uses a Tennelec Model LB 4000 computer-controlled system. The lowest reported concentration is 0.5 pCi/L for 250-mL samples.

3.2.2.6.7 Total Radioactive Strontium in Soil

Stable strontium carrier is added to a 10-g sample, which then is leached by hot nitric acid, followed by a hot nitric acid-hydrogen peroxide treatment. The leachate is reduced in volume and the strontium is precipitated from the solution as the nitrate salt. Interferences from calcium and some radionuclides are removed by one or more precipitations of the strontium carrier as strontium nitrate. Barium and radium are removed as the chromate; the yttrium-90 daughter of strontium-90 is removed by hydroxide precipitation. The separated strontium is counted immediately for beta particle activity. The counting result represents the total strontium activity (strontium-89 and strontium-90) plus an insignificant fraction of yttrium-90 that has grown into the separated strontium-90. Counting performed at ORNL uses a Tennelec Model LB 4000 computer-controlled system. The lowest reported concentration is 0.2 pCi/g for 10-g samples.

3.2.2.6.8 Gamma-Ray Emitting Nuclides in Water and Soil

Nine hundred mL of water sample is transferred to a polyethylene Marinelli beaker, placed on a high purity germanium detector, and counted for gamma activity. Soil samples are weighed into a 3-in. petri dish, placed on a high purity germanium detector, and counted for gamma activity. The efficiencies of the six detectors used at ORNL in this determination are between 20% and 35%. The gamma spectra are reduced and reports generated by a Nuclear Data

MicroVAX-based analyzer system. The lowest reported concentration for cesium-137 is 3 pCi/L for a 900-mL water sample and 50 pCi/kg for a 75-g soil sample.

3.2.2.6.9 Tritium in Water and Soil

Soil samples are prepared by leaching with equal or double portions of distilled water; water samples require no pretreatment. An aliquot of water or soil leachate is treated with a small amount of sodium hydroxide and potassium permanganate and distilled. The alkaline treatment prevents other radionuclides, such as radioiodine and radiocarbon from codistilling over with the tritium. Some water supplies will contain trace quantities of organic compounds (especially surface water sources that contain biota.) The permanganate treatment oxidizes trace organics in the sample aliquot, which could distill over and cause quenching interferences. A middle fraction of the distillate is collected for tritium analysis because the early and late fractions are more apt to contain materials that might interfere with the liquid scintillation counting process. The collected distillate fraction is thoroughly mixed and a portion is mixed with a liquid scintillator solution. After dark adapting, the aliquot is counted in a liquid scintillation counter for tritium beta particle activity.

4.0 DATA PRESENTATION

4.1 Introduction

This section presents the data collected as part of the DOE Environmental Survey of the BNL Site. Findings generated by the Survey Team were divided into units called environmental problems. This chapter presents the environmental problem sampling and analysis data. Sections 4.2 through 4.4 describe the format and content of data tables, data qualifiers, and the criteria for reporting values.

> **NOTE:** The lists of acronyms and data flags at the end of the Table of Contents can be removed from their location and referenced as the data for each environmental problem are examined.

Data are presented in order by environmental problem. Sample request numbers and the name of the Survey Team member who requested the sample collection and analysis are presented for each problem. The reason for examination of a certain site or sites is given in the Finding and Basis section. The Sampling and Analysis Objectives define the Survey's goal for that environmental problem. The Sampling and Analysis Design section describes the sampling design and methods, the analytes of interest and in some cases specific testing methods for each sample, and changes from the design and methods reported in the BNL Sampling and Analysis Plan (Ref. 1-1) and Addendum (Ref. 1-2). Sampling methods addressed in the individual environmental problems refer to the DOE Environmental Survey Manual. For brevity, only the section in this manual is called out (i.e. Reference E4.2.1 refers to Section E4.2.1, "Sampling Container Immersion" of Appendix E of the DOE Environmental Survey Manual). The field and analytical data are then presented in text and tabular form with statements of the level of data quality. Italicized text indicates a summary of sampling and analytical data for the environmental problem.

The data tables are organized by analysis type. The analysis type is further divided into specific analytes. Analytes are presented only if a positive determination has been reported for the specific analyte in the specific set of samples. A complete listing of non-rad data is available in Appendix D in tabular form. A discussion of the QA/QC results can be found in Chapter 5.0.

Other appendices include an updated listing of sampling and analytical requests (Appendix A); background concentrations (Appendix B); results of field, analytical chemistry, documentation, and data management audits (Appendix C); the radiological QC section (Appendix E); and the addendum to the Sampling and Analysis Plan (Appendix F).

4.2 Data Tables, Data Flags, and Restrictions on Data Reporting

This section presents descriptions of the structure and contents of the five basic types of data tables that may appear in Chapter 4. Explanations for the types of data flags that appear in the tables are given. The basis for inclusion/exclusion of entries to tables is discussed.

4.2.1 Sampling and Analytical Data Tables

Table 4.1 summarizes field and analytical completion data for sampling and analysis requests for the BNL Site. The summary is organized by request number. For each request number, the status, date collected, location, type of location, media, number of samples planned and actually collected, the type of sample, and the number of samples planned and analyzed for each parameter are given. In each section presenting an environmental problem, a table with a similar format is provided if samples were requested. Table 4.1 can be used as a guide to the level of activity that appears in the environmental problem-specific Table 4.2 series of tables.

TABLE 4.1 BROOKHAVEN SITE ENVIRONMENTAL SURVEY S&A REQUESTS
WITH FIELD AND ANALYTICAL COMPLETION DATA

REQUEST	STAT	DATE	LOCATION	TYPE	MEDIA	NUMB SAMP		TYPE	ANIONS		METALS		O&G		PET HYDRO		PES/H/PCB		SEMIVOLS		VOLS		RADS	
NUMBER		COLL.		LOCATION		ACT	PLAN		ACT	PLAN	ACT	PLAN	ACT	PLAN	ACT	PLAN	ACT	PLAN	ACT	PLAN	ACT	PLAN	ACT	PLAN
		DD/MM/YY				COLL	COLL		ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL	ANAL
BR300		12/04/88	PRIMARY PD	HNMA POND	SUR WATER	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR301		12/04/88	PRIMARY PD	POND	SUR WATER	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	0	3	3	3	3	3
BR301		12/04/88	PRIMARY PD	POND	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	1	1	0	1	1	1	1	1
BR301		17/04/88	PRIMARY PD	POND	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	3	3	3	0	0	0	0
BR302		12/04/88	WOODED PD	POND	SUR WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
BR302		12/04/88	WOODED PD	POND	SUR WATER	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	0	3	3	3	3	3
BR302		17/04/88	WOODED PD	POND	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	3	3	3	0	0	0	0
BR303		12/04/88	S PRIM. PD	POND	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR304		12/04/88	N PRIM. PD	POND	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR304		12/04/88	N PRIM. PD	POND	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	1	1	0	1	1	1	1	1
BR305		12/04/88	N WOODED P	POND	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR306		18/04/88	B. 479	CESSPOOL	SUR WATER	1	1	QC FL	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
BR306		18/04/88	B. 479	CESSPOOL	SUR WATER	2	2	GRAB	2	2	2	2	2	2	0	0	0	0	2	2	2	2	0	0
BR306		18/04/88	B. 975	CESSPOOL	SUR WATER	1	1	GRAB	1	1	1	1	1	1	0	0	0	0	1	1	1	1	0	0
BR307	DELETED		B. 244	CESSPOOL	SUR WATER	0	3	GRAB	0	3	0	3	0	3	0	0	0	0	0	3	0	3	0	0
BR308		18/04/88	B. 422	CESSPOOL	SUR WATER	3	3	GRAB	3	3	3	3	3	3	0	0	0	0	3	3	3	3	0	0
BR308		18/04/88	B. 422	CESSPOOL	SUR WATER	1	1	QC RN	1	1	1	1	1	1	0	0	0	0	0	1	1	1	0	0
BR309	DELETED		B. 197	CESSPOOL	SUR WATER	0	3	GRAB	0	3	0	3	0	3	0	0	0	0	0	3	0	3	0	0
BR310		18/04/88	B. 905	CESSPOOL	SUR WATER	3	3	GRAB	3	3	3	3	3	3	0	0	0	0	3	3	3	3	0	0
BR311		19/04/88	B. 479	CESSPOOL	SEDIMENT	1	1	GRAB	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1
BR311		19/04/88	B. 479	CESSPOOL	SUR WATER	1	1	QC RN	0	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1
BR312	DELETED		B. 244	CESSPOOL	SEDIMENT	0	1	GRAB	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	1
BR313		19/04/88	B. 422	CESSPOOL	SEDIMENT	1	1	GRAB	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1
BR314	DELETED		B. 197	CESSPOOL	SEDIMENT	0	1	GRAB	0	0	0	1	0	0	0	1	0	1	0	1	0	1	0	1
BR315		19/04/88	B. 905	CESSPOOL	SEDIMENT	1	1	GRAB	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1
BR316		25/06/88	W UPTON RD	WELL	GRN WATER	4	4	PUMP	0	0	4	4	0	0	0	0	0	0	4	4	4	4	4	4
BR500		13/04/88	BNL LANDF	LEACHATE	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR500		13/04/88	BNL LANDF	LEACHATE	SUR WATER	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	0	3	3	3	3	3
BR500		16/04/88	BNL LANDF	LEACHATE	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	3	3	3	0	0	0	0
BR501	DELETED		B. 811	SLURRY	SEDIMENT	0	4	GRAB	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
BR501		12/04/88	B. 811	SLURRY	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
BR501		13/04/88	B. 811	SLURRY	SEDIMENT	4	4	GRAB	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0
BR502	DELETED		B. 811	SLUDGE	SEDIMENT	0	9	GRAB	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	9
BR503		14/04/88	B. 444	RELEASES	SOIL	4	4	GRAB	0	0	4	4	4	4	0	0	0	0	4	4	4	4	4	4
BR503		14/04/88	B. 444	RELEASES	SUR WATER	1	1	QC RN	0	0	1	1	1	1	0	0	0	0	1	1	1	1	1	1
BR504		14/04/88	B. 444	RELEASES	SOIL	3	3	GRAB	0	0	3	3	3	3	0	0	0	0	3	3	3	3	3	3
BR505		14/04/88	AGS AREA	RELEASES	SOIL	6	6	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
BR506		14/04/88	HWMA SPRAY	AERATION	SOIL	7	7	GRAB	0	0	0	0	0	0	0	0	0	0	1	7	1	7	7	7
BR507		30/06/88	CURR. LNDF	WELL	GRN WATER	8	8	PUMP	0	0	8	8	0	0	0	0	0	0	8	8	8	8	8	8
BR508	DELETED		U/D CUR LF	WELL AT LND	SOIL	0	4	GRAB	0	0	0	4	0	0	0	0	0	0	0	4	0	4	0	4
BR508		28/06/88	U/D CUR LF	WELL AT LND	SOIL	6	6	GRAB	0	0	6	6	0	0	0	0	0	0	6	6	6	6	6	6
BR508		28/06/88	U/D CUR LF	WELL AT LND	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
BR800		15/04/88	STP	DREDGE MATL	SOIL	5	5	GRAB	0	0	5	5	0	0	0	0	5	5	5	5	5	5	5	5
BR800		15/04/88	STP	DREDGE MATL	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	1	1	0	1	1	1	1	1
BR801		15/04/88	STP	TANK	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	1	1	1	1	1	1	1	1

TABLE 4.1 BROOKHAVEN SITE ENVIRONMENTAL SURVEY S&A REQUESTS
WITH FIELD AND ANALYTICAL COMPLETION DATA

REQUEST NUMBER	STAT	DATE COLL. DD/MM/YY	LOCATION	TYPE LOCATION	MEDIA	NUMB SAMP ACT COLL	NUMB SAMP PLAN COLL	TYPE	ANIONS ACT ANAL	ANIONS PLAN ANAL	METALS ACT ANAL	METALS PLAN ANAL	O&G ACT ANAL	O&G PLAN ANAL	PET HYDRO ACT ANAL	PET HYDRO PLAN ANAL	PES/H/PCB ACT ANAL	PES/H/PCB PLAN ANAL	SEMIVOLS ACT ANAL	SEMIVOLS PLAN ANAL	VOLS ACT ANAL	VOLS PLAN ANAL	RADS ACT ANAL	RADS PLAN ANAL
BR801		15/04/88	STP	TANK	UNSEAL CO	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR802		18/04/88	STP	TANK	SEDIMENT	1	1	GRAB	0	0	1	1	0	0	0	0	1	1	1	1	1	1	1	1
BR802		19/04/88	STP	TANK	SEDIMENT	2	2	GRAB	0	0	2	2	0	0	0	0	2	2	2	2	2	2	2	2
BR803		18/04/88	STP	SLUDGE BEDS	SOIL	4	4	GRAB	0	0	4	4	0	0	0	0	4	4	4	4	4	4	4	4
BR804		20/04/88	AGS I&II	SCARPYARD	SOIL	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
BR804		20/04/88	AGS I&II	SCRAPYARD	SOIL	5	5	GRAB	0	0	5	5	0	0	0	0	0	0	0	0	0	0	5	5
BR805		20/04/88	AGS SCRAP.	WELL	GRN WATER	4	4	WELWZ	0	0	3	4	0	0	0	0	0	0	3	4	3	4	3	4
BR806		20/04/88	B. 975	BUBBLE ARE	SOIL	14	14	GRAB	0	0	14	14	0	0	0	0	0	0	14	14	14	14	14	14
BR806		20/04/88	B. 975	BUBBLE ARE	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
BR807		21/04/88	B-975	WELL	GRN WATER	3	3	BAILR	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR807		21/04/88	B-975	WELL	GRN WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
BR808		21/04/88	B. 481	LEACH PIT	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR809		17/04/88	BOUNDRY RD	WELL	GRN WATER	3	3	BKGRN	0	0	3	3	0	0	0	0	0	3	3	3	3	3	3	3
BR809		16/06/88	B-975	WELL	GRN WATER	2	2	PUMP	0	0	2	2	0	0	0	0	0	0	2	2	2	2	2	2
BR809		23/06/88	B-975	WELL	GRN WATER	2	2	PUMP	0	0	2	2	0	0	0	0	0	0	2	2	2	2	2	2
BR809		24/06/88	B-975	WELL	GRN WATER	4	4	PUMP	0	0	4	4	0	0	0	0	0	0	4	4	4	4	4	4
BR809		25/06/88	B-975	WELL	WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
BR809		25/06/88	B-975	WELL	WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
BR810	DELETED		B. 975	WELLS	SOIL	0	5	GRAB	0	0	0	5	0	5	0	0	0	5	0	5	0	5	0	5
BR810		17/04/88	BOUNDRY RD	BACKGROUND	SEDIMENT	3	3	BKGRN	0	0	3	3	3	3	0	0	3	3	3	3	4	3	3	3
					TOTAL	161	191		11	17	138	169	22	33	4	6	55	75	120	157	125	148	135	156

NOTE: When data are formatted into problem-specific tables, the last digit in a three-digit table numbering system is used to specify the applicability of that data to a specific environmental problem. For example, Table 4.3.4 is the analytical data summary by medium series table that applies specifically to Environmental Problem 4. Problem-specific tables are located in the appropriate environmental problem section of this chapter. The problem-specific data series tables are:

4.2.0-4.2.11	Sampling and Analysis Data Summary
4.3.0-4.3.11	Analytical Data Summary by Medium for Environmental Problem
4.4.0-4.4.10	Groundwater Sample Locations and Sample Volumes

The Table 4.2 series of tables displays sampling and analytical activities and the level of activity for each type of analysis for each environmental problem. On a problem-specific basis, the Table 4.2 series presents a consistent grouping by medium, location, and sampling and analysis request number. In all cases, the problem-specific 4.2 series tables will include a pair of numbers for each analysis type for which at least one analyte was requested. The numbers represent the number of samples analyzed and the number of samples with analytes detected, respectively. As shown in Table 4.1, each table will also include descriptive sampling and analytical information on a sample-specific basis. More detailed sample-analyte data are presented in the problem-specific Table 4.2 series. Table 4.1 can be used as a guide to the level of activity that appears in the Table 4.2 series.

The Table 4.3 series illustrates sample-specific analyte data, listed by analytical chemistry method, for each environmental problem. (The data presentation for radiological analysis using gamma spectrometry is discussed separately.) The 4.3 series provides a consistent grouping by sampling and analysis request number, location, medium, and type of analysis on a problem-specific basis. Although the basic format is constant, the exact manner in which the data are displayed was determined by first having sampling and analytical personnel identify the logical groupings of the data, then having data management determine an easily readable format for the data presentation. Field measurements for OVAs in the 4.3 series tables show only the highest OVA reading for a particular sample.

The headings on the Table 4.3 series includes a row designated "SDG Number." Sample delivery group (SDG) is a term that evolved out of EPA-CLP terminology. An SDG number is used to uniquely identify an analytical batch of samples within a given type of analysis. This is important because the QA/QC data qualifiers appearing in 4.3 tables are specific to an SDG (analytical batch) and not necessarily to a particular environmental problem. QA/QC data presented in Appendix D are grouped by SDG within analysis type. For each analysis type listed in the 4.3 series tables, a directory for sample numbers and SDGs is provided (Tables D.n.1). The directories include a list of sample numbers grouped by environmental problem, each sample number's corresponding SDG number (QA/QC table), and the table and page number of the QA/QC table in Appendix D on which that sample number's data are located. The SDG number provides the link between the concentration data in the 4.3 tables and the applicable QA/QC data in Appendix D. For a given sample, look up the Appendix D table number for the SDG in the directory for QA/QC tables in Volume II.

The 4.4 series of tables provides information on groundwater sample locations and sample volumes for those environmental problems that call for the collection of groundwater samples. The well identification, the sample number, the date the sample was collected, the sampling method used or the type of sample (e.g., bailer, QC rinsate), and the bore volume of the well in liters are provided. The purge volume was at least three times the bore volume. Purging was continued until the parameters (pH, temperature, and conductivity) stabilized.

4.2.2 Data Flags

In many of the data tables, the reported value is accompanied by a flag that represents a qualifying condition for a reported result, e.g., a problem with the analytical instrument or control value was encountered, or a specific method or dilution factor was used to obtain the result. This section offers a detailed explanation of the qualifying data flags listed in the data flag reference guide found at the end of the Table of Contents.

4.2.2.1 Data Flags: Inorganic Analysis

Inorganic analysis data tables have concentrations reported in milligrams per kilogram (mg/kg) for solid samples and micrograms per liter (ug/L) for multiphasic (liquids and solids) or aqueous samples.

For each reported concentration, the types of qualifiers and the designated groups are as follows:

Concentration Qualifiers: Relate the data to detection limits and to the detection or lack of detection of analytes.

- B — This qualifier indicates that the reported value is less than the contract required detection limit (CRDL) but greater than the instrument detection limit (IDL).

- U — This qualifier indicates the analyte was analyzed for but not detected.

QA/QC Qualifiers: Relate to specific QA/QC problems. They are only presented in Volume II, Appendix D, QC tables.

E	Value estimated or not reported because of the presence of interference.
M	Duplicate injection precision not met.
N	Spiked sample recovery not within control limits.
S	The reported value was determined by the Method of Standard Additions (MSA).
*	Duplicate analysis not within control limits.
+	Correlation coefficient for the MSA is less than 0.995.

The use of **S** or + is mutually exclusive. No combination of these qualifiers can accompany a single reported analyte combination.

Method Qualifiers: Analytical method used for determination of analyte concentration.

P	ICP
A	Flame AA
F	Graphite furnace AA
CV	Manual cold vapor AA
AV	Automated cold vapor AA

AS Semiautomated spectrophotometric

C Manual spectrophotometric

T Titrimetric

NR If analyte is not required to be analyzed.

AE Atomic emission - ICP

4.2.2.2 Data Flags: Organic Analysis

In data tables, organic analysis analyte concentrations are reported in ug/L for liquid or multiphasic samples or micrograms per kilogram (ug/kg) for solid samples.

Ten notations are used to qualify the results from organic analysis. The qualifiers are as follows:

U Indicates the compound was analyzed for but not detected. The sample quantitation limit must be corrected for dilution and for percent moisture.

J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds (TIC) 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 sample detection limit (CRDL), but greater than zero. For example, if the sample quantitation limit is 10 ug/L but a concentration of 3 ug/L is calculated, it is reported as 3 J. The sample quantitation limit is adjusted for both dilution and percent moisture as discussed for the **U** flag. If a sample with 24% moisture and a 1:10 dilution factor has a calculated concentration of 300 ug/L and a sample quantitation limit of 430 ug/kg, the concentration is reported as 300 J.

C This flag applies to pesticide results where the identification has been confirmed by GC-MS. Single component pesticides $\geq$ 10 ng/ul in the final extract shall be confirmed by GC-MS.

B This flag is used when the analyte is found in the associated analytical blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action. This flag is used for a TIC and a positively identified TCL compound.

E This flag identifies compounds whose concentrations exceed the calibration range of the instrument for that specific analysis.

D This flag identifies all compounds identified in an analysis at a secondary dilution factor. If a sample or extract is reanalyzed at a higher dilution factor, as in the E flag above, the DL suffix is appended to the sample number on the Form I for the diluted sample, and <u>all</u> concentration values reported on that Form I are flagged with the **D** flag.

A This flag indicates that a TIC is a suspected aldol-condensation product.

X,Y,Z Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the Sample Data Summary Package and the Case Narrative. If more than one is required, use "Y" and "Z", as needed. If more than five qualifiers are required for a sample result, use the "X" flag to combine several flags, as needed. For instance, the "X" flag might combine the "A", "B", and "D" flags for some sample.

The combination of flags **BU** or **UB** is expressly prohibited. Blank contaminants are flagged **B** only when they are also detected in the sample.

4.2.3 Restrictions on Data Reporting

The general rule for data appearing in the 4.3 series tables is that analyte-specific results are presented in the table for all analytes for which at least one sample's detected concentration was not accompanied by any QC data flag or the analyst determines that the flagged data should be included. A consistent, partially subjective method was employed in determining which analytical data would appear in the tables.

Data are not presented in the summary data when an analyte has been conclusively attributed to external contamination. For example, detection of acetone in a laboratory method blank, at levels corresponding to those found in applicable field samples, indicates that the acetone should be attributed to a laboratory contamination problem. As a result, the value would not be reported in the problem-specific summary data table.

The complete data set, with QC data included, is found in Appendix D. The types of contamination which require an analyst to make a determination as to whether or not an analyte can be attributed to external contamination include: travel blank cross contamination, decontamination procedure contamination, method blank contamination, preparation blank contamination, and reagent contamination. Investigation of these possible sources of contamination is an integral part of the data quality assessment process conducted by the analytical chemist.

Exceptions to the above rule can occur when the analyst determines that additional data should be reported. For example, a specific analyte is detected in a blank (e.g., method blank) and in field samples, yet the relative magnitude of the levels makes it impossible to conclusively attribute the presence of the analyte to contamination. In this case, the appropriately flagged data are included in data summary tables, and an assessment of the impact on data quality is provided in the accompanying text. For example, if acetone is detected in a method blank at 20 ug/L, and in a field sample at 350 ug/L, the value of 350 ug/L flagged with a **B** to indicate method blank contamination would be provided in the data table. In addition, the data quality assessment would provide an explanation of the fact that despite acetone being detected in the method blank, it is likely that the elevated levels detected in field samples are representative of the actual field samples. The guidelines discussed above for reporting data apply to the following types of analysis: organics, inorganics, anions, and cations. Additional restrictions on what data appear in the table for each type of analysis are presented below.

4.2.4 Radiological Data Tables

For some environmental problems, radiological (RAD) analysis of samples was performed. Data for RAD analysis are presented in problem-specific tables (the 4.3 series). The QC data relevant to each sample are retrievable and appear in Appendix E.

4.3 Analytical Data Quality Evaluation

Each problem-specific table is accompanied by a discussion of its contents, significant data points, and the reasons data have been interpreted as such.

An assessment of the quality level for the field and analytical data is made at the end of the discussion of each environmental problem. The assessments are made relative to the three Data Utility Levels developed as part of the DOE Environmental Survey. The three levels are designated as Level I, Level II, and Level III and are in descending order regarding their usefulness in making either quantitative or qualitative (judgmental) decisions regarding an environmental problem. A rating of Quality Level I signifies the highest standard of documentation and reliability of results. Quality Level II compliance to QC requirements . is less than that of Quality Level I, but indicates that the information is usable. A rating of Quality Level III implies serious deficiencies requiring further evaluation of the results or the problem as defined. The three levels are discussed in detail in Appendix A of the DOE Environmental Survey Manual (Ref.1-3).

4.4 Background Values

A discussion and presentation of information on background levels of contaminants for environmental media in the BNL Site area, derived directly from BNL site environmental reports, are presented in Appendix B. The data will be interpreted by the Department of Energy, and final survey findings will be contained in the Environmental Survey Summary Report.

4.5 Data Tables for Additional Analysis Types

All analysis types are presented in the Table 4.3 series.

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4.6 Environmental Problem 0: Samples From Well Number 6458 and the Surrounding Area.

Request Numbers: 809 and 810.
Requester: Not Applicable.
Findings and Basis: Not Applicable.

4.6.1 Sampling and Analysis Objectives

Statement: Not Applicable.

Supporting Information: Requests 809 and 810 were assigned to these samples by the Sampling Team. No sampling and analytical design for these samples was listed in the BNL Sampling and Analysis Plan.

4.6.2 Sampling and Analytical Design

4.6.2.1 Sampling Design

Request 809: Well Number 6458 (Water)(Fig. 4.0a). The Sampling Team arrived on-site at 0915 on 17APR88. Well 6458 was located in the northeast corner of the Brookhaven National Laboratory property. The sky was clear, with gusting winds and an ambient temperature of approximately 40^{o}F. The well depth was 168 ft. The water surface was 21 ft below ground level. By comparing the volume purged over a 2-hr period, it was estimated that, without recharging, it would take 14 hr to hand bail one well volume. Therefore, the collection of samples was done based on the uniformity of the water pH. The water was rust colored. Measurements for radioactivity, temperature, pH, conductivity, dissolved oxygen, and turbidity were taken and recorded at 1145. Three grab water samples (BR809016, BR809027, and BR809038) were collected between 1145 and 1220.

Request 810: Field South of Well Number 6458 (Soil) (Fig. 4.0b). The Sampling Team arrived on-site at 1245 on 17APR88. The site was a field located across the road and due south of Well 6458. The sky was clear, with gusting winds and temperatures near 40^{O}F. A RAD scan showed 40 cpm. The area was divided into 60 segments. Three segments were randomly selected for sampling. Soil samples BR810019 (grid 18), BR810020 (grid 28), and BR810031 (grid 50) were collected at 1250, 1300, and 1330, respectively. All samples were a moist, reddish-orange sand.

4.6.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 0 were as follows:

Request 809: The parameters analyzed were volatiles, semivolatiles, PCBs, pesticides, ICP-metals, total strontium, AA-lead, gamma scan, strontium-90, and tritium. The field measurements requested were radiation, temperature, pH, specific conductance, dissolved oxygen, and turbidity.

Request 810: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, AA-lead, total uranium, oil and grease, tritium, and RADs. The field measurement requested was for radiation.

4.6.3 Field and Analytical Data

Field Data:

Request 809: *The conductivity, dissolved oxygen, PID readings, pH, radioactivity, temperature, and turbidity measurements for the water in Well 6458 are shown in Table 4.3.0. A noticeable feature of the measurements is the identical readings obtained for all three samples. This may be because the three samples were* *taken within a 35 minute period. The outstanding property is the relatively high pH of 9.5.*

Request 810: *For the soil samples taken in the vicinity of Well 6458, field measurements for radioactivity were made and recorded at 40 cpm.*

Field Data Evaluation:

Request 809: The instrument used to measure dissolved oxygen, turbidity, conductivity, pH, and temperature was calibrated about one-half month earlier for dissolved oxygen and turbidity and three days earlier for conductivity, pH, and temperature. No data were available on the calibration for the PID and radioactivity readings. All calibrations were in compliance with the turbidity readings being the least accurate at +/- 25 RPD. Conductivity, pH, PID, and temperature were the measurements requested in the Sampling and Analysis Plan. The pH, conductivity, and temperature readings are particularly reliable.

Request 810: No data were available for the radioactivity calibration.

Analytical Data:

Request 809:

Metals. *Analytical results for metals in groundwater are presented in Table 4.3.0. Of the 16 metals detected, the following eight were below either the CRDL or the IDL in all three samples: barium, chromium, cobalt, magnesium, nickel, potassium, sodium, and vanadium. Of the remaining metals detected, cadmium was 2 ug/L, copper ranged from 42 to 50 ug/L, lead from 68 to 81 ug/L, and zinc from 429 to 493 ug/L. Other metals detected were aluminum, calcium, iron, and manganese.*

PCBs and other extractables. The sample volume was too small to perform both semivolatile and PCB analyses. Therefore, PCB analysis was not performed.

Extractable organics. Analytical data for semivolatile organic compounds are presented in Table 4.3.0. There were two compounds detected in one sample, three in another, and six in the remaining reference groundwater sample. A compound tentatively identified as hydrocinnamic acid had estimated concentrations of 0.150 to 0.160 mg/L in each of the samples. All other compounds detected were TICs in estimated quantities of less than 0.015 mg/L, except for an estimated 0.008 mg/L of benzoic acid found in sample BR809038.

Volatile organics. Analytical results for volatile organics are given in Table 4.3.0. There were two volatiles detected in one of these ground water samples and one volatile in the remaining sample. Acetone and toluene were detected in these samples and in the associated blanks. Acetone was present in concentrations of 0.013 mg/L or less, and toluene was estimated in concentrations of 0.002 mg/L or less in two samples.

Radiochemistry. Analytical results are presented in Table 4.3.0. Two of the three water samples contained tritium (1200 and 1600 pCi/L) and all three samples contained strontium (0.3 to 8.4 pCi/L).

Request 810:

Metals. Analytical results for metals in sediment are presented in Table 4.3.0. Of the 17 metals detected, the following eight were below either the CRDL or the IDL in all three samples: barium, beryllium, calcium, cobalt, copper, magnesium, potassium, and sodium. Of the remaining metals detected, chromium ranged from 5.7 to 6.3 mg/kg, lead from 3.6 to 4.5 mg/kg, mercury was .04 mg/kg, nickel from 7.4 to 7.9 mg/kg, and zinc from 9.5 to 11 mg/kg. Other metals detected were aluminum, iron, manganese, and vanadium.

Total uranium analysis was requested for the soil samples from Request 810. However no results are shown in Table 4.3.0 because the analyte was not detected.

Oil and grease. The oil and grease concentrations in the soil samples from Request 810 are shown in Table 4.3.0. Values range from 160 to 380 mg/kg.

PCBs and other extractables. The sample volume was too small to perform both semivolatile and PCB analyses. Therefore, PCB analysis was not performed.

Extractable organics. Analytical data for semivolatile organic compounds are presented in Table 4.3.0. There were 16 compounds detected in one of these sediment samples, 23 in another, and 24 in the remaining sample. No compound was positively identified in measurable concentrations. There were four phthalates identified in estimated concentrations of 0.200 mg/L or less. Some tentatively identified compounds had estimated concentrations exceeding 10 mg/kg in each of the samples.

Volatile organics. Analytical results for volatile organics are given in Table 4.3.0. From three to six volatile compounds were detected in individual samples, of the four sediment samples in this request. Chloroform was present in amounts below the quantitation limit, in estimated concentrations of 0.024 mg/kg or less, and also in the blank. Methylene chloride was detected in one sample, below quantitation limit, in estimated concentration of 0.024 mg/kg, and was also present in the blank. No positively identified volatile compound was present in measurable quantities, and estimated concentrations were always less than 0.10 mg/kg. TICs were all probable hydrocarbons, with estimated concentrations always less than 0.40 mg/kg.

Radiochemistry. Analytical results are presented in Table 4.3.0. All three soil samples contained tritium (300 to 700 pCi/kg), total strontium (29 to 64 pCi/kg) and potassium-40 (4100 to 4900 pCi/kg) from natural sources.

Analytical Data Evaluation:

Request 809:

Metals. Four metals of interest (cadmium, copper, lead, and zinc) were detected above the CRDL in the samples for this request.

PCBs and other extractables. The sample volume was too small to perform both semivolatile and PCB analyses. Therefore, PCB analysis was not performed.

Extractable organics. Hydrocinnamic acid was tentatively identified in estimated concentrations of 0.150 to 0.160 mg/L in each of the samples. All other compounds detected were TICs in estimated quantities of less than 0.015 mg/L, except for an estimated 0.008 mg/L of benzoic acid found in sample BR809038.

Volatile organics. Acetone and methylene chloride were detected in these samples and in the associated blanks. Concentrations were measured or estimated at 0.013 mg/L or less.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 810:

Metals. Five metals of interest (chromium, lead, mercury, nickel, and zinc) were detected above the CRDL for this request.

For total uranium, all holding times were met and the preparation blanks were all in compliance. The calibration verification data and the spike results were also within total compliance. The precision of the analysis duplicate results were 50% of actual compliance.

Oil and grease. Holding times were exceeded; and no method duplicate was analyzed. The extraction technique on soil matrix may remove soil components and can bias the results high.

PCBs and other extractables. The sample volume was too small to perform both semivolatile and PCB analyses. Therefore, PCB analysis was not performed.

Extractable organics. No compound was positively identified in measurable concentrations. There were four phthalates identified in estimated concentrations of 0.200 mg/L or less. Tentatively identified compounds with estimated concentrations exceeding 10 mg/kg occurred in each of the samples.

Volatile organics. Chloroform and methylene chloride were present in amounts below the quantitation limit in both the samples and the blank. No positively identified volatile compound was present in measurable quantities, and estimated concentrations were always less than 0.10 mg/kg. TICs were all probable hydrocarbons, with estimated concentrations always less than 0.40 mg/kg.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.6.4 Limitations and Qualifications

Data Quality Level: The sampling plan cannot be rated since Problem 0 was not included in the S&A Plan. The field sampling is rated Quality Level I. The overall analytical rating is Quality Level II.

Field Data:

Request 809: The basis for rating the sampling plan and field sampling is discussed for all problems only if ratings of II or III are assigned to them. Obviously, in this case the sampling plan cannot be evaluated since no preestablished design for taking these samples was developed.

Request 810: The basis for rating the sampling plan and field sampling is discussed for all problems only if ratings of II or III are assigned to them. Obviously, in this case the sampling plan cannot be evaluated since no preestablished design for taking these samples was developed.

Analytical Data:

Request 809:

Metals. Analytical results were Quality Level I except for thallium at Quality Level II because of a spectral interference and iron at Quality Level III due to poor reproducibility of duplicates.

PCBs and other extractables. The sample volume was too small to perform both semivolatile and PCB analyses. Therefore, PCB analysis was not performed.

Extractable organics. Data are of Quality Level II due to holding times exceeded by two days.

Volatile organics. Data are of Quality Level II because estimated levels were very low.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 810:

Metals. Analytical results were Quality Level II because a spike was not analyzed. Beryllium and lead were Quality Level III. Beryllium laboratory control results were outside the upper control limit. The lead results were below the control limit for the calibration verification standard and results were below the recovery value for the interference checks standard.

Oil and grease. The data are Quality Level III based on exceeding holding times and no method duplicate analyzed.

PCBs and other extractables. The sample volume was too small to perform both semivolatile and PCB analyses. Therefore, PCB analysis was not performed.

Extractable organics. Data are of Quality Level I.

Volatile organics. Data are of Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 0
Request Number: 809

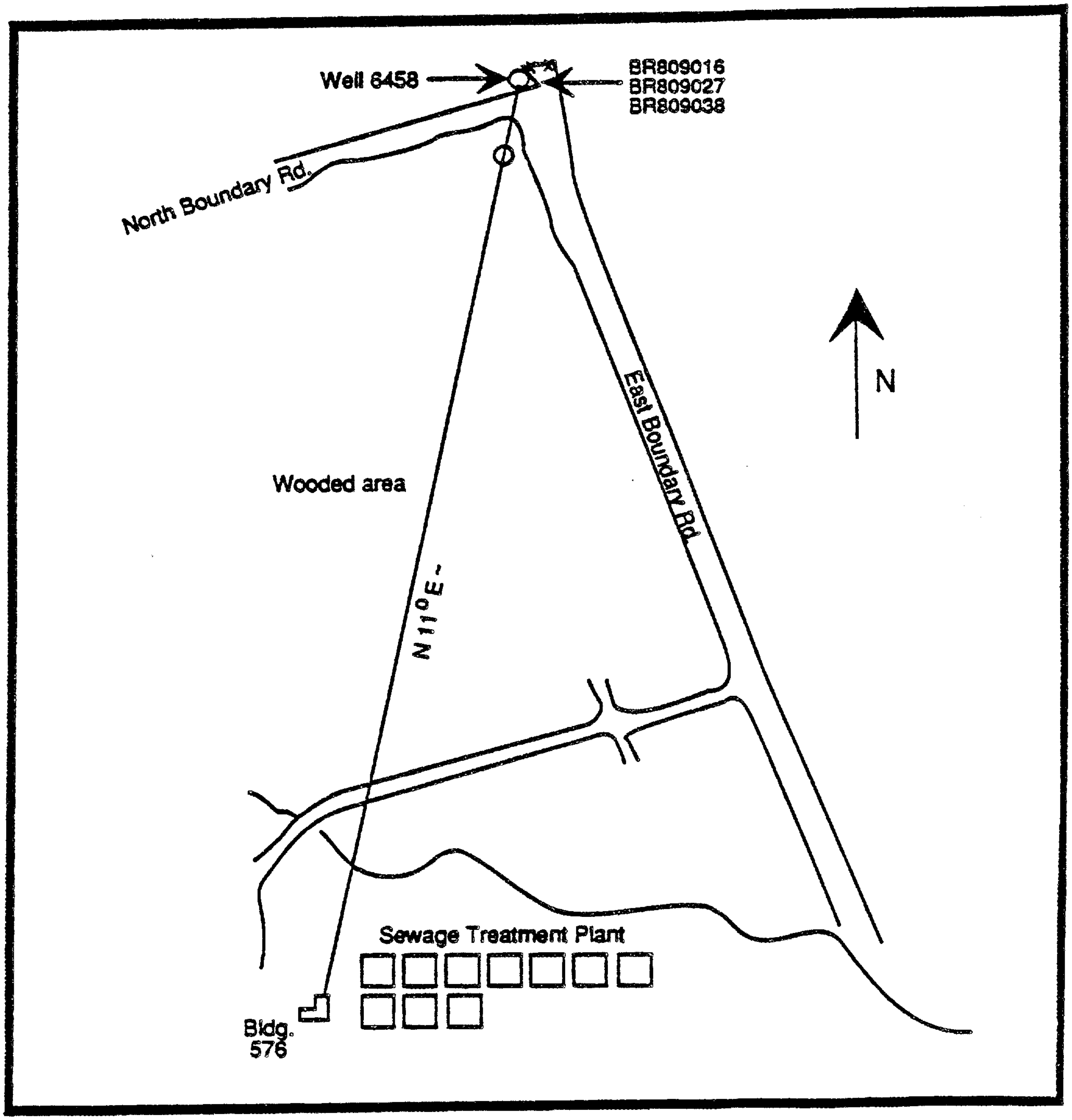

Figure 4.0a. Well Number 6458 Water Samples (Request 809)

Environmental Problem: 0
Request Number: 810

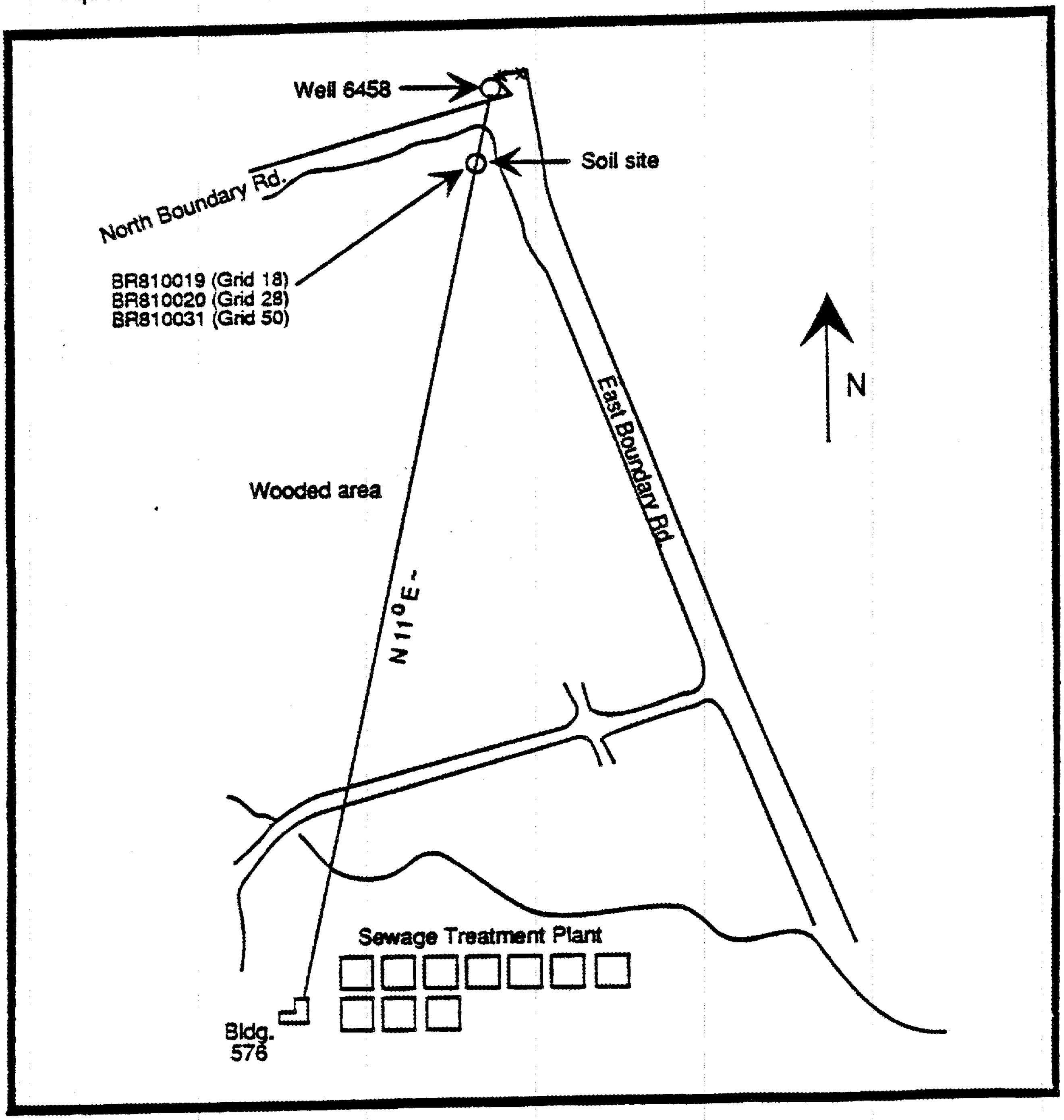

Figure 4.0b. Field South of Well Number 6458 Soil Samples (Request 810)

TABLE 4.2.0 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 0

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS		METALS		O&G		PET HYDRO		PES/H/PCB		SEMIVOLS		VOLS		RADS	
							NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL
BR810	BOUNDRY RD	BACKGROUND	SEDIMENT	3	3	BKGRN	0	0	3	3	3	3	0	0	0	3	3	3	4	4	3	3
			MED TOTAL	3	3		0	0	3	3	3	3	0	0	0	3	3	3	4	4	3	3
BR809	BOUNDRY RD	WELL	GRN WATER	3	3	BKGRN	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
			MED TOTAL	3	3		0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
			EP TOTAL	6	6		0	0	6	6	3	3	0	0	0	3	6	6	7	7	6	6

TABLE 4.3.0 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 0 DRAFT DO NOT CITE
SAMPLES FROM WELL NUMBER 6458 AND THE SURROUNDING AREA

S&A REQUEST: 809
LOCATION: WELL 6458 AREA
MEDIUM: GROUND WATER

FIELD MEASUREMENTS	SAMP NO: BR809016	BR809027	BR809038			
CONDUCTIVITY (MS/CM)	0.2	0.2	0.2			
DO (PPM)	7	7	7			
PH (UNITS)	9.4	9.4	9.4			
RADIOACTIVIT (CPM)	40	40	40			
TEMPERATURE (DEG C)	13	13	13			
TURBIDITY (PPM)	24	24	24			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR809016F SDG NO: BR303015K TYPE: BACKGROUND	BR809016F BR308010F BACKGROUND	BR809016G BR800119G BACKGROUND	BR809027F BR303015K BACKGROUND	BR809027F BR308010F BACKGROUND	BR809027G BR800119G BACKGROUND
ALUMINUM		180 B			251	
BARIUM		24 B			26 B	
CADMIUM		2 U			2.2 B	
CALCIUM		4810 B			5060	
CHROMIUM		7.5 B			8.6 B	
COBALT		3.2 B			3 U	
COPPER		43			42	
IRON		26200			27400	
LEAD			75			81
MAGNESIUM		1520 B			1590 B	
MANGANESE		185			183	
NICKEL		24 B			31 B	
POTASSIUM	790 B			690 B		
SODIUM		3430 B			3400 B	
VANADIUM		4 U			4.4 B	
ZINC		436			429	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR809038F SDG NO: BR303015K TYPE: BACKGROUND	BR809038F BR308010F BACKGROUND	BR809038G BR800119G BACKGROUND			
ALUMINUM		229				
BARIUM		26 B				
CADMIUM		2				
CALCIUM		5160				
CHROMIUM		8.5 B				
COBALT		4.1 B				
COPPER		50				
IRON		28900				
LEAD			68			
MAGNESIUM		1630 B				

TABLE 4.3.0 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 0 DRAFT DO NOT CITE
SAMPLES FROM WELL NUMBER 6458 AND THE SURROUNDING AREA

S&A REQUEST: 809
LOCATION: WELL 6458 AREA
MEDIUM: GROUND WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	BR809038F	BR809038F	BR809038G			
	SDG NO:	BR303015K	BR308010F	BR800119G			
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND			
MANGANESE			198				
NICKEL			30 B				
POTASSIUM		640 B					
SODIUM			3320 B				
VANADIUM			4 U				
ZINC			493				

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	BR809016E	BR809027E	BR809038E			
	SDG NO:	BR306018E	BR306018E	BR306018E			
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND			
BENZOIC ACID		50 U	8 J	50 U			
* HYDROCINNAMIC ACID(17.30)		160 J	150 J	150 J			
* POSS UNSAT. HYDROCARBON(24.10)				14 J			
* POSS. PYRRODIAZOLE CPD(24.40)				2 J			
* UNKNOWN ACID(26.20)		5 J					
* UNKNOWN(11.60)				2 J			
* UNKNOWN(17.60)				2 J			
* UNKNOWN(24.10)		3 J	3 J				
* UNKNOWN(26.20)				2 J			

VOLATILE ORGANICS (UG/L)	SAMP NO:	BR809016A	BR809027A	BR809038A			
	SDG NO:	BRN28015A	BRN28015A	BRN28015A			
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND			
ACETONE		13 B	11 B	11 B			
TOLUENE		2 JB	1 JB	5 U			

RADIOCHEMISTRY (PCI/L)	SAMP NO:	BR809016I	BR809016J	BR809027I	BR809027J	BR809038I	BR809038J
	SDG NO:	LLL8308	LLL8308	LLL8308	LLL8308	LLL8308	LLL8308
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
H-3			-450		1600		1200
SR-TOT		0.3		8.4		0.8	

TABLE 4.3.0 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 0 DRAFT DO NOT CITE
SAMPLES FROM WELL NUMBER 6458 AND THE SURROUNDING AREA

S&A REQUEST: 810
LOCATION: WELL 6458 AREA
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR810019C / BR313017C / BACKGROUND	BR810019C / BR313017K / BACKGROUND	BR810019D / BR810019D / BACKGROUND	BR810019E / BR800062D / BACKGROUND	BR810020C / BR313017C / BACKGROUND	BR810020C / BR313017K / BACKGROUND
ALUMINUM		6350 E				6710 E	
BARIUM		11 B				10 B	
BERYLLIUM		0.37 B				0.4 B	
CALCIUM		68 B				70 B	
CHROMIUM		5.7				6.1	
COBALT		1.1 B				1.3 B	
COPPER		1.5 U				1.5 U	
IRON		5850 E				5800 E	
LEAD					4.5		
MAGNESIUM		470 BE				507 BE	
MANGANESE		26				24	
MERCURY				0.04 B			
NICKEL		7.4				5.8 B	
POTASSIUM			210 B				230 B
SODIUM		30 U				54 B	
VANADIUM		11				11	
ZINC		11				9.5	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR810020D / BR810019D / BACKGROUND	BR810020E / BR800062D / BACKGROUND	BR810031C / BR313017C / BACKGROUND	BR810031C / BR313017K / BACKGROUND	BR810031D / BR810019D / BACKGROUND	BR810031E / BR800062D / BACKGROUND
ALUMINUM				7070 E			
BARIUM				11 B			
BERYLLIUM				0.4 B			
CALCIUM				63 B			
CHROMIUM				6.3			
COBALT				1.5 B			
COPPER				1.8 B			
IRON				6490 E			
LEAD			3.6				4.1
MAGNESIUM				531 BE			
MANGANESE				25			
MERCURY		0.04				0.04 B	
NICKEL				7.9			
POTASSIUM					260 B		
SODIUM				70 B			
VANADIUM				12			
ZINC				10			

TABLE 4.3.0 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 0 DRAFT DO NOT CITE
SAMPLES FROM WELL NUMBER 6458 AND THE SURROUNDING AREA

S&A REQUEST: 810
LOCATION: WELL 6458 AREA
MEDIUM: SEDIMENT

OIL AND GREASE (MG/KG)	SAMP NO:	BR810019G	BR810020G	BR810031G
	SDG NO:	BR503017C	BR503017C	BR503017C
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
OIL AND GREASE		160	380	290

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR810019B	BR810020B	BR810031B
	SDG NO:	BR311015B	BR311015B	BR311015B
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
BUTYLBENZYLPHTHALATE		57 JB	170 JB	200 JB
DI-N-BUTYLPHTHALATE		57 JB	130 JB	150 JB
DI-N-OCTYLPHTHALATE		360 U	360 U	5 JB
DIETHYLPHTHALATE		360 U	76 JB	84 JB
* ALKYL HYDROCARBON(6.66)		910 JB		
* ALKYL HYDROCARBON(6.69)			1000 JB	
* ALKYL HYDROCARBON(6.70)				1200 JB
* ALKYL HYDROCARBON(6.86)		850 JB		
* ALKYL HYDROCARBON(6.89)			960 JB	
* ALKYL HYDROCARBON(6.90)				1100 JB
* DIACETONE ALCOHOL(6.07)		13000 JAB		
* DIACETONE ALCOHOL(6.11)			12000 JAB	
* DIACETONE ALCOHOL(6.13)				15000 JAB
* POSS ALKYL HYDROCARBON(6.45)			440 J	
* POSSIBLE ALKYL HYDROCAR(6.42)		370 J		
* POSSIBLE KETONE(5.35)				410 J
* POSSIBLE KETONE(8.87)		130 J		
* POSSIBLE UNSAT HYDROCAR(4.98)			150 J	
* POSSIBLE UNSAT HYDROCAR(5.00)				200 J
* POSSIBLE UNSAT HYDROCAR(24.10)			100 J	320 J
* PROB ALDOL-CONDENSATION(4.82)		8800 JAB		
* PROB ALDOL-CONDENSATION(4.85)			8700 JAB	
* PROB ALDOL-CONDENSATION(4.87)				8500 JAB
* UNKNOWN KETONE(6.45)		1900 J		
* UNKNOWN KETONE(6.50)			2100 J	2700 J
* UNKNOWN PHTHALATE ESTER(24.90)				430 J
* UNKNOWN PHTHALATE ESTER(25.00)		160 J	430 J	
* UNKNOWN(3.54)		420 JB		
* UNKNOWN(3.55)			450 JB	
* UNKNOWN(3.59)				390 JB
* UNKNOWN(5.32)		380 J		
* UNKNOWN(5.33)			330 J	
* UNKNOWN(6.14)			110 J	
* UNKNOWN(7.97)		110 J		
* UNKNOWN(8.00)			88 J	

TABLE 4.3.0 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 0 DRAFT DO NOT CITE
SAMPLES FROM WELL NUMBER 6458 AND THE SURROUNDING AREA

S&A REQUEST: 810
LOCATION: WELL 6458 AREA
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR810019B / BR311015B / BACKGROUND	BR810020B / BR311015B / BACKGROUND	BR810031B / BR311015B / BACKGROUND
* UNKNOWN(8.37)		410 J		
* UNKNOWN(8.38)				510 J
* UNKNOWN(8.41)			220 J	
* UNKNOWN(8.88)			180 J	
* UNKNOWN(10.00)			440 J	520 J
* UNKNOWN(11.20)				840 J
* UNKNOWN(11.30)		900 J	1100 J	
* UNKNOWN(17.60)				110 J
* UNKNOWN(21.20)				190 J
* UNKNOWN(21.30)			200 J	
* UNKNOWN(25.70)			95 J	
* UNKNOWN(26.90)				120 J
* UNKNOWN(37.30)				140 J
* UNKNOWN(39.00)				540 J
* UNKNOWN(39.60)				120 J
* UNKNOWN(42.50)		540 J		
* UNKNOWN(42.60)			860 J	2900 J

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR810019A / BR305028A / BACKGROUND	BR810020A / BR305028A / BACKGROUND	BR810031A / BR806013A / BACKGROUND	BR810031A / BR305028A / BACKGROUND
CHLOROFORM		16 JB	12 JB	24 JB	15 JB
ETHYLBENZENE		7 J	28 U	13 JB	28 U
METHYLENE CHLORIDE		27 U	28 U	24 JB	28 U
XYLENE (TOTAL)		27 U	28 U	7 JB	28 U
2-BUTANONE		54 U	55 U	51 J	56 U
* PROBABLE HYDROCARBON #1(26.75)		33 J			
* PROBABLE HYDROCARBON #1(27.05)					49 J
* PROBABLE HYDROCARBON #1(29.48)			71 J		
* PROBABLE HYDROCARBON #2(29.48)		90 J			
* PROBABLE HYDROCARBON #2(29.67)					150 J
* PROBABLE HYDROCARBON #2(32.36)			200 J		
* PROBABLE HYDROCARBON #3(31.41)					29 J
* PROBABLE HYDROCARBON #3(32.36)		160 J			
* PROBABLE HYDROCARBON #4(31.55)					37 J
* PROBABLE HYDROCARBON #5(32.49)					380 J

TABLE 4.3.0 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 0 DRAFT DO NOT CITE
SAMPLES FROM WELL NUMBER 6458 AND THE SURROUNDING AREA

S&A REQUEST: 810
LOCATION: WELL 6458 AREA
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR810019H LLL8303 BACKGROUND	BR810019I LLL8303 BACKGROUND	BR810020H LLL8303 BACKGROUND	BR810020I LLL8303 BACKGROUND	BR810031H LLL8303 BACKGROUND	BR810031I LLL8303 BACKGROUND
CS-137		140		76		81	
H-3			300		500		700
K-40		4400		4900		4100	
SR-TOT		33		29		64	

TABLE 4.4.0 SAMPLE LOCATIONS AND SAMPLE VOLUMES
ENVIRONMENTAL PROBLEM 0

WELL ID	SAMPLE NUMBER	DATE	SAMPLING METHOD	VOLUME (L)
6458	BR809016	17APR88	BAILER	393.3
6458	BR809027	17APR88	BAILER	393.3
6458	BR809038	17APR88	BAILER	393.3

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4.7 Environmental Problem 1: Surface Water Runoff from the Hazardous Waste Management Area (HWMA).

Request Numbers: 300, 301, 302, 303, 304, and 305.

Requester: J. Boros.

Finding and Basis: Surface water runoff from the HWMA may have been contaminated with hazardous and radioactive constituents and may have contaminated soil and groundwater. The HWMA was the central receiving, processing, and storage area for all BNL hazardous radioactive wastes and PCB wastes. Radioactive oils, radioactive solidified evaporator sludge, and oil-contaminated sands were stored outdoors. According to BNL records, as many as several hundred drums (some in deteriorating condition) were stored outdoors on the paved area. Oil spills have occurred, as evidenced by oily stains. Spills in the acid/base neutralization area from the previous practice of dumping neutralization supernatant on the ground have occurred. Surface water runoff was diverted to an unlined pond adjacent to the paved areas of the HWMA. The pond was bisected by a fence, so contaminants may leave the HWMA while still in the pond. Pond water has crossed under the driveway pavement and reappeared as surface water in the woodlot between the HWMA and the current landfill. Runoff and pond waters were not adequately monitored by BNL to determine if they are contaminated. Four wells in the area were reported to contain volatile organics, iron, and manganese at levels up to 300 times New York State Drinking Water Standards (DWS). Conductivity measurements at these wells were 10 to 18 times higher than background readings, indicating the presence of dissolved contaminants. However, the source of these elevated readings was not obvious. Leachates from landfills adjacent to the area may have been exerting an influence.

4.7.1 Sampling and Analysis Objectives

Statement: Water and sediment samples were collected to determine if contaminants listed in section 4.6.2.2 were present above analytical detection levels in surface water and sediments adjacent to the HWMA.

Supporting Information: Organics identified in nearby wells include:

Well WR: 1,1 Dichloroethane, chloroethane, benzene, toluene
Well WS: 1,1 Dichloroethane
Well W9: 1,1 Dichloroethane, chloroethane
Well 2C: 1,1 Dichloroethane, ethyl benzene

Zinc in Wells WS and W9 ranged from 5.4 to 7.5 mg/L. Iron was present at up to 300 times DWS; manganese at 20 times. Because the presence of contaminants in surface water may be ephemeral, this request also covered sand and sediment, where a longer-lasting impact was anticipated.

4.7.2 Sampling and Analytical Design

4.7.2.1 Sampling Design

Request 300: Southeast Corner of the Primary Pond (Water)(Fig. 4.1a). Three grab water samples (Sampling Method: Reference E.4.2.3 and E4.2.4) were to be collected from the southeast corner of the primary pond near the mouth of the storm drain. The pond was to be considered heterogeneous with respect to different areas in the HWMA draining into it.

The Sampling Team arrived at the site on 12APR88 at 0945 to begin sampling. The weather was sunny, with a clear sky and slight southeasterly breeze (3 to 5 mph). The ambient temperature was approximately 50^{O}F. The area was vegetated by zones, with permanent standing water in the bulrush zone. The outer zone was primarily fescue grass, suggesting seasonal flooding. The sediment was about 30 cm deep under about 15 cm of water. A gamma scan of the area indicated approximately 500 cpm.

The Sampling Team chose an area of 100 m^2 for sample collection. This area was considered homogeneous, and it was divided into a 6 x 10 grid. Three segments were selected at random, and samples BR300012 (grid 23), BR300023 (grid 58), and BR300034 (grid 60) were collected at each selected segment, respectively. Field measurements were taken for pH, conductivity, and temperature (Field Method: Reference E4.5). Collection for sample BR300012 started at 1017 and ended at 1030; collection for sample BR300023 started at 1005 and ended at 1015; and collection for sample BR300034 started at 0952 and ended at 1002.

Request 301: North Corner of the Primary Pond (Water) (Fig. 4.1b). Three grab water samples (Sampling Method: Reference E4.2.3B and E4.2.4) were to be collected from the north corner of the primary pond outside the fence. The pond was to be considered heterogeneous with respect to different areas in the HWMA draining into it.

The Sampling Team arrived at the site on 12APR88 at 0940 to begin sampling. The temperature was approximately 50^{o}F. The sky was partially cloudy; however, the sun was shining and the few white clouds overhead were clearing. Winds were 5 mph from the northeast. Collection for QC rinsate BR301046 began at 0950.

The pond was approximately 260 ft long by 90 ft wide. The pond water had a yellow (Scotch color) tint, with the depth ranging from 3 in. to 18 in. The pond supported vegetation ranging from grasses to mosses. There was no apparent inlet or outlet. No animal tracks or pond life were noted in or around the sample area.

The Sampling Team chose an area of 100 m^2 for sample collection. This area was considered homogeneous, and it was divided into a 6 x 10 grid with each segment 1 m x 1.67 m. Three segments were selected at random, and samples BR301013 (grid 25), BR301024 (grid 46), and BR301035 (grid 50) were collected between 1012 and 1051. Field measurements were taken for pH, conductivity, and temperature (Field Method: Reference E4.5).

In addition to the three samples taken originally, on 17APR88 samples BR301057 (grid 25), BR301068 (grid 46), and BR301079 (grid 50) were collected due to the need for extra volume in the laboratory. For this additional sampling, the Team arrived on-site at 1420. The temperature was 40°F. The sky was clear with winds gusting. The water looked the same as it did for the earlier sampling on 12APR88. Samples BR301057, BR301068, and BR301079 were collected between 1420 and 1431.

Request 302: Northeast Corner of the "Wooded Pond" (Water) (Fig. 4.1c). Three grab water samples (Sampling Method: Reference E4.2.3B and E4.2.4) were to be collected from the northeast corner of the wooded pond across the driveway. The pond was to be considered heterogeneous with respect to different areas in the HWMA draining into it.

The Sampling Team arrived just north of the sampling location at 0930 on 12APR88. The sky was clear and the temperature was 50°F. Northwest winds were blowing up to 10 mph.

The site was heavily wooded with approximately 8 in. of standing water in most of the pond area. The remaining area around the pond had native grasses from 6 to 12 in. high. The water contained abundant dead organics from trees, which included red maple, pitch pine, and pussy willow. There was no noticeable odor around the pond, and the water was relatively clear. A RAD scan of the area showed 100 cpm.

The Sampling Team chose an area of 100 m^2 for sample collection. This area was considered homogeneous, and it was divided into a 6 x 10 grid. Three segments were selected at random, and samples BR302014 (grid 16), BR302025 (grid 19), and BR302036 (grid 36) were collected. Field measurements were taken for pH, conductivity, and temperature (Field Method: Reference E4.5). Samples were rust to gray-brown and contained some suspended solids. These samples were collected between 0945 and 1020. QC field blank BR302047 was collected at 1035.

In addition to the three samples taken originally, on 17APR88 samples BR302058 (grid 16), BR302069 (grid 19), and BR302070 (grid 36) were collected due to the need for extra volume in the laboratory. For this additional sampling, the Sampling Team arrived on-site at 1350. The temperature was 40^{o}F. The sky was clear with gusty winds. The water looked basically the same as it did for the earlier sampling for Requests 301 and 302. A RAD scan of the area showed 100 cpm. Sampling was completed at 1410.

Request 303: Southeast Corner of the Primary Pond (Sediment) (Fig. 4.1d). Three grab sediment samples (Sampling Method: Reference E5.3.1) were to be collected from the southeast corner of the primary pond near the mouth of the storm drain (the same area as Request 300). The pond and its sediment were to be considered heterogeneous with respect to different areas in the HWMA draining into it. Following the collection of water samples for Request 300 on 12APR88, the Sampling Team began to collect sediment samples for Request 303. The starting time was 1043. The sky was clear and sunny, and the temperature was approximately 50^{o}F. Winds were from the southeast at approximately 2 to 3 mph.

The pond area was vegetated in zones, with bulrush in the water area and fescue grass in the dryer outer border.

The Sampling Team chose an area of 100 m^2 for sample collection. This area was considered homogeneous, and it was divided into a 6 x 10 grid. Three segments were selected at random, and samples BR303015 (grid 6), BR303026 (grid 11), and BR303037 (grid 35) were collected to the depth of the sediment. The sediment was black and approximately 30 cm deep. A RAD scan of the area indicated approximately 500 cpm. Collection for sample BR303015 started at 1043 and ended at 1055; collection for sample BR303026 started at 1058 and ended at 1106; and collection for sample BR303037 started at 1108 and ended at 1117.

Request 304: North Corner of the Primary Pond (Sediment) (Fig. 4.1e). Three grab sediment samples (Sampling Method: Reference E5.3.1) were to be collected from the north corner of the primary pond outside the fence (the same area as Request 301). The pond, and its sediment, were to be considered heterogeneous with respect to different areas in the HWMA draining into it.

The Sampling Team arrived at the site on 12APR88 at 1238. The sky was overcast with several white and one or two dark clouds. No precipitation was falling. Winds were from the northeast at 5 to 12 mph with gusts of 10 to 15 mph. The temperature was approximately 48^{o}F.

The Sampling Team chose a homogeneous area of 100 m^2 at the northeast corner of the pond, divided it into a 6 x 10 grid, and randomly selected three segments for sampling. Samples BR304016 (grid 1), BR304027 (grid 4), and BR304038 (grid 20) were collected between 1340 and 1420. All samples were collected to the depth of the sediment. At each sample location, the top inch of the sample was a thick, dark-brown, organic layer with moss. Below this layer was 2 to 3 in. of gray and buff sandy silt. Visible moss was removed from each of the samples before the samples were placed inside containers. QC rinsate BR304049 was collected at 1247.

Request 305: Northeast Corner of the "Wooded Pond" (Sediment) (Fig 4.1f). Three grab sediment samples (Sampling Method: Reference E5.3.1) were to be collected from the northeast corner of the wooded pond across the driveway (the same area as Request 302). The pond and its sediment were to be considered heterogeneous with respect to different areas in the HWMA draining into it.

The Sampling Team began sampling site 305 on 12APR88 at 1050. The sampling site was located just north of the site indicated in the Sampling and Analysis Plan. The sky was partly cloudy and the temperature was 55^{o}F. Winds were gusting up to 20 mph. The sampling area was near a large stand of trees in the water. The trees included pitch pine, pussy willow, and red maple. It was necessary to remove a 4- to 5-in. layer of dead organics and roots from the pond bottom before retrieving the sediment samples.

The Sampling Team chose a homogeneous area of 100 m^2 and divided it into a 6 x 10 grid. Three segments were selected at random, and samples BR305017 (grid 8), BR305028 (grid 18), and BR305039 (grid 27) were collected to the depth of the sediment from 1055 to 1130.

Sample BR305017 was very sandy, with 4- to 10-mm pebbles. Abundant organics and some water bugs were present at this location. Sample BR305028 was very sandy, with 5-mm pebbles. Abundant organics and roots were present. Sample BR305039 was sandy, with scattered pebbles.

4.7.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 1 were as follows:

Request 300: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, AA-mercury, total dissolved solids, tritium, total uranium, and gamma scan. Field measurements for pH, conductivity, and temperature were taken.

Request 301: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, AA-mercury, total dissolved solids, tritium, total uranium, and gamma scan. Field measurements for pH, conductivity, and temperature were taken.

Request 302: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, AA-mercury, total dissolved solids, tritium, total uranium, and gamma scan. Field measurements for pH, conductivity, and temperature were taken.

Request 303: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, AA-mercury, tritium, isotopic uranium, total uranium, strontium-90, and total strontium. No field measurements were required.

Request 304: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, AA-mercury, tritium, isotopic uranium, total uranium, strontium-90, and total strontium. No field measurements were required.

Request 305: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, AA-mercury, tritium, isotopic uranium, total uranium, strontium-90, and total strontium. No field measurements were required.

4.7.3 Field and Analytical Data

Field Data:

Request 300: *The field data results are shown in Table 4.3.1. The conductivity, pH, and temperature were identical for the water samples taken from the southeast corner of the primary pond. The conductivity was 0.17 mS/cm, pH was 7.2, and the water temperature was 12^{o}C.*

Request 301: *The field data results are shown in Table 4.3.1. The water samples were taken from the northern corner of the primary pond. The conductivity of the water is lower at this location--0.03 mS/cm as compared with 0.17 mS/cm in the southeast corner. The pH was 6.2 for one of the samples and 6.6 for the remaining two samples; these pHs are lower than the samples taken in the southeast corner which showed a pH of 7.2. The temperature was slightly lower, averaging 11.3^{o}C.*

Request 302: *The field data results are shown in Table 4.3.1. The samples for this request are from the northeast corner of the "Wooded Pond" which is separated from the primary pond by a driveway. The field measurements were taken on the same day as the samples for Request 300 and 301. The conductivity is 0.14 mS/cm; the pH ranged from 4.8 to 5.2 which is more acid than the primary pond samples, and the temperature ranged from 9.4 to 12 averaging 10.8^{o}C.*

Field Data Evaluation:

Request 300: The instrument used to take the three measurements was calibrated in the morning prior to taking the sample readings. The measurements are reliable.

Request 301: The instrument used to take the measurements was calibrated in the morning prior to taking the sample readings. The results are reliable. It should be noted that the measurements were taken for samples BR301013, BR301024, and BR301035. Five days later, more water samples were collected for laboratory needs; these later samples were coded BR301057, BR301068, and BR301079.

Request 302: The instrument used to take the measurements was calibrated prior to taking field readings. The results are reliable. As in Request 301, insufficient samples were collected initially and more samples were taken five days later. The readings for all three water samples in this problem were taken on April 12, 1988. Samples BR302058, BR302069, and BR302070 were taken five days later on April 17, 1988.

Analytical Data:

Request 300:

<u>Metals</u>. Analytical results for metals in surface water are presented in Table 4.3.1. Of the 13 metals detected, the following seven metals were below either the CRDL or the IDL in all three samples: aluminum, barium, magnesium, mercury, sodium, uranium, and vanadium. Copper was below the IDL in two samples. One metal of interest, zinc, ranged from 43 to 62 ug/L. Other metals detected were calcium, iron, manganese, and potassium.

For total uranium, analytical results are shown in Table 4.3.1. All samples are reported to be 10 x 10-4 mg/L; however, sample BR300012 is at or below the detection limit, which is 10 x 10-4 mg/L.

The total dissolved solids in the samples from Requests 300 are shown in Table 4.3.1. Request 300 samples were taken from the southeast corner of the primary pond; the average of the three samples is 65.5 mg/L.

<u>PCBs and other extractables</u>. This analyte was not detected for this request.

<u>Extractable organics</u>. Analytical Data for semivolatile organic compounds are presented in Table 4.3.1. There were five compounds detected in one sample, seven in another, and nine in the remaining surface water sample. There were two phthalates identified in concentrations estimated at below 0.002 mg/L. Tentatively identified compounds were estimated in concentrations of less than 0.12 mg/L.

<u>Volatile organics</u>. Analytical results for volatile organics are presented in Table 4.3.1. There were three volatile compounds detected in one of these surface water samples, two in another, and none in the remaining sample. Acetone and toluene were identified in some of the samples and also in the blanks. Concentrations were all below quantitation limits and were always estimated at 0.010 mg/L or less. One freon was also tentatively identified with estimated concentrations of less than 0.010 mg/L, in two of the samples.

<u>Radiochemistry</u>. Analytical results are presented in Table 4.3.1. Cesium-137 in three water samples ranged from 42 to 104 pCi/L. Only sample BR300012 contained tritium (140 pCi/L). No uranium was found.

Request 301:

<u>Metals</u>. Analytical results for metals in surface water are presented in Table 4.3.1. Of the 11 metals detected, the following six were below either the CRDL or the IDL in all three samples: aluminum, barium, calcium, magnesium, sodium, and uranium. Zinc ranged from 21 to 43 ug/L; mercury was 0.2 ug/L in one sample, but was below either the CRDL in the other two samples. Other metals detected were iron, manganese, and potassium.

For total uranium, analytical results are shown in Table 4.3.1. All samples are reported to be 10 x 10-4 mg/L; two of the three samples are reported at or below the detection limit. A rinsate sample (BR301046) was also at or below detection.

The total dissolved solids in the samples from Request 301 are shown in Table 4.3.1. Request 301 samples were taken from the northern corner of the primary pond and had an average concentration of 94.0 mg/L.

<u>PCBs and other extractables</u>. This analyte was not detected for this request.

<u>Extractable organics</u>. Analytical Data for semivolatile organic compounds are presented in Table 4.3.1. There were 18 compounds detected in one of these surface water samples, 21 in another, and 20 in the remaining sample. Diethylphthalate was identified in one sample in estimated concentration of less than 0.001 mg/L. Other compounds were tentatively identified in concentrations estimated at less than 0.100 mg/L.

<u>Volatile organics</u>. Analytical results for volatile organics are presented in Table 4.3.1. A freon was tentatively identified in one sample with concentration below the quantitation limit and was estimated at 0.005 mg/L. Acetone and toluene were present in another sample and also in the blank. Acetone concentration was 0.015 mg/L. Toluene concentration was below the quantitation limit and was estimated at 0.002 mg/L. No volatile compounds were detected in the other two samples for this request.

<u>Radiochemistry</u>. Analytical results are presented in Table 4.3.1. Cesium-137 in three water samples ranged from 11 to 14 pCi/L. Tritium was found (470 pCi/L) in sample BR301013. No uranium was found.

Request 302:

<u>Metals</u>. Analytical results for metals in surface water are presented in Table 4.3.1. Of the 14 metals detected, the following seven were below either the CRDL or the IDL in all three samples: barium, beryllium, calcium, magnesium, mercury, nickel, and vanadium. Of the remaining metals detected, chromium ranged from 13 to 17 ug/L and zinc ranged from 31 to 50 ug/L. Other metals detected were aluminum, iron, manganese, potassium, and sodium.

For total uranium, analytical results are shown in Table 4.3.1. All samples were found to be at or below the detection limit of 10 x 10-4 mg/L; therefore, no results are shown in Table 4.3.1.

The total dissolved solids in the samples from Request 302 are shown in Table 4.3.1. These samples from the northeast corner of the "wooded pond" had an average concentration of 123.5 mg/L."

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Analytical Data for semivolatile organic compounds are presented in Table 4.3.1. There were 22 compounds detected in one of these surface water samples, 23 in another, and 25 in the remaining sample. Four phthalates were identified in concentrations always less than 0.050 mg/L. Phenol was identified in sample BR302070 with an estimated concentration of 0.002 mg/L. All tentatively identified compounds were estimated in concentrations of less than 1 mg/L.

Volatile organics. Analytical results for volatile organics are presented in Table 4.3.1. There were two volatiles detected in each of these surface water samples. Acetone, methylene chloride, and toluene were each detected in at least one sample and also in the associated blanks. A freon was tentatively identified in sample BR302014. All concentrations were below quantitation limits and were always estimated at less than 0.010 mg/L.

Radiochemistry. Analytical results are presented in Table 4.3.1. Only tritium (160 pCi/L) was found in sample BR302036.

Request 303:

Metals. Analytical results for metals in sediment are presented in Table 4.3.1. Of the 19 metals detected, the following nine were below either the CRDL or the IDL in all three samples: barium, beryllium, cadmium, calcium, cobalt, magnesium, nickel, potassium, and sodium. Of the remaining metals detected, chromium ranged from 6.6 to 10 mg/kg, copper 8.6 to 11 mg/kg, lead 63 to 212 mg/kg, mercury 0.1 to 0.19 mg/kg, and zinc 29 to 34 mg/kg. Uranium was *detected at 8 to 10 ug/g. Other metals detected were aluminum, iron, manganese, and vanadium.*

For total uranium analytical results are shown in Table 4.3.1. The sediment samples of this request contained 10, 8, and 8 ug/g of uranium. Of the three location sampled in the ponds in the HWMA, this location contained the highest concentration.

<u>PCBs and other extractables</u>. Aroclor-1260 was detected up to 0.246 mg/kg in the 3 sediment samples for Request 303. Some 4,4'-DDE was also measured (up to 0.080 mg/kg) in these samples.

<u>Extractable organics</u>. Analytical Data for semivolatile organic compounds are presented in Table 4.3.1. There were 19, 20, and 21 compounds detected in these three respective sediment samples. Phenol was detected in two samples with estimated concentrations of 0.026 and 0.034 mg/kg. Of four phthalates detected, three were also present in the blank. No semivolatile organic compounds were identified in measurable concentrations and all estimated concentrations were less than 1 mg/kg with the following exceptions. In samples BR303015 and BR303026 diacetone alcohol was tentatively identified in concentrations of 20 mg/kg; and in sample BR303037, diacetone alcohol was tentatively identified at 4.9 mg/kg. Also, dioctyl adipate was tentatively identified in all three samples at estimated concentrations from 2.4 to 2.6 mg/kg.

<u>Volatile organics</u>. Analytical results for volatile organics are presented in Table 4.3.1. Nine volatiles were detected in one of these sediment samples, 13 in another, and 16 in the remaining sample for this request. No volatile compounds were identified in measurable quantities. Carbon tetrachloride was below the quantitation limit, but estimated in concentrations of 0.003 and 0.005 mg/kg in two of the samples. Chloroform was present in all samples and also in the blank. Sample concentrations were below the quantitation limit and were all estimated at 0.032 mg/kg or less. Toluene was present in all samples and in

the blank. Concentrations were below the quantitation limit, but always estimated at less than 0.010 mg/L. Several probable hydrocarbons were tentatively identified with estimated concentrations being 1.1 mg/kg or less.

Radiochemistry. Analytical results are presented in Table 4.3.1. Tritium was found in two sediment samples (1000 and 1100 pCi/kg). Uranium-235 in very small quantities (0.72 and 0.76 pCi/kg) was found in two samples. Total strontium (1400-1500 pCi/kg) was found in all three samples.

Request 304:

Metals. Analytical results for metals in sediment are presented in Table 4.3.1. Of the 19 metals detected, the following nine were below either the CRDL or the IDL in all three samples: barium, beryllium, calcium, cobalt, magnesium, nickel, potassium, selenium, and sodium. Of the remaining metals detected, chromium ranged from 7.2 to 16 mg/kg, copper from 19 to 42 mg/kg, mercury from 0.06 to 0.13 mg/kg, and zinc from 34 to 85 mg/kg. Lead was at 150 mg/kg in one sample. Uranium was detected at 4 ug/g. Other metals detected were aluminum, iron, manganese, and vanadium.

For total uranium, analytical results are shown in Table 4.3.1. All three samples from the north corner of the primary pond showed 4 ug/g.

PCBs and other extractables. In Request 304, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were found in two of the three samples, but none of those compounds occurred in sample BR304038. Measured concentrations of these compounds ranged from 0.044 to 0.195 mg/kg.

Extractable organics. Analytical Data for semivolatile organic compounds are presented in Table 4.3.1. There were 14, 17, and 31 semivolatile organic compounds detected in these three respective sediment samples. There were four phthalates detected in the samples, and three of these were also detected in the *blank. No compound was identified in measurable quantities. All estimated concentrations were less than 1 mg/kg except for the following tentatively identified compounds: aliphatic hydrocarbon (1.1 mg/kg in BR304027), diacetone alcohol (1.9 to 6.1 mg/kg in all three samples), dioctyl adipate (1.9 to 2.6 mg/kg in all samples), and something identified as probably aldol-condensation that was estimated as from 14 to 46 mg/kg in all samples.*

Volatile organics. Analytical results for volatile organics are presented in Table 4.3.1. There were 11 volatiles detected in one of these sediment samples, 15 volatiles in another, and 16 in the remaining sample. No volatiles were identified in measurable quantities. Carbon tetrachloride, detected in one sample in concentration below quantitation limits, was estimated at 0.003 mg/kg. Chloroform and toluene were present in the samples and also in the blank. Concentrations of these volatiles were estimated to be 0.050 mg/kg (for chloroform) or less. Several probable hydrocarbons were tentatively identified in estimated concentrations of 1.4 mg/kg or less.

Radiochemistry. Analytical results are presented in Table 4.3.1. Tritium was found in two sediment samples (900 and 1500 pCi/kg). All three samples contained small amounts of uranium-235 (0.72 to 0.76 pCi/kg) and total strontium (160 to 350 pCi/kg). One rinsate sample (BR304049) contained uranium-235 (0.35 pCi/L).

Request 305:

Metals. Analytical results for metals in sediment are presented in Table 4.3.1. Of the 19 metals detected, the following eleven were below either the CRDL or the IDL in all three samples: barium, beryllium, cobalt, copper, lead, magnesium, mercury, nickel, potassium, selenium, and sodium. Of the remaining metals detected, chromium ranged from 6.6 to 9.7 mg/kg and zinc ranged from 23 to 27 mg/kg. Uranium ranged from 2 to 8 ug/g. Other metals detected were aluminum, calcium, iron, manganese, and vanadium.

For total uranium, analytical results are shown in Table 4.3.1. The sediment from the "wooded" pond showed that two of the samples contained uranium at 2 ug/g; the third sample contained 8 ug/g.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Analytical Data for semivolatile organic compounds are presented in Table 4.3.1. There were 14, 22, and 25 semivolatile organic compounds detected in the three respective sediment samples. With the exception of benzo(B)fluoranthene, measured at 0.630 mg/kg in sample BR305039, no semivolatile organics were identified in measurable quantities. Two of the phthalates identified were also in the blank. Several of the tentatively identified compounds were also present in the blank. Estimated concentrations were always less than 3 mg/kg except for something identified as probably aldol-condensation, which had estimated concentrations ranging from 20 to 22 mg/kg in these samples.

Volatile organics. Analytical results for volatile organics are presented in Table 4.3.1. There were five volatiles detected in one of these sediment samples, and 10 volatiles detected in the other two samples. Chloroform was present in all samples and also in the blanks. All chloroform concentrations were below quantitation limits and were estimated at 0.031 mg/kg or less. Toluene was present in all three samples and in one of the blanks in estimated concentrations of 0.015 mg/kg or less. All concentrations of positively identified compounds were below quantitation limits and were always 0.031 mg/kg or less. Several probable hydrocarbons were identified in estimated concentrations of 1.2 mg/kg or less.

Radiochemistry. Analytical results are presented in Table 4.3.1. Two sediment samples each contained 0.73 pCi/kg of uranium-235. All three samples contained total strontium (70 to 160 pCi/kg).

Analytical Data Evaluation:

Request 300:

Metals. Two metals of interest, copper and zinc, were detected above the IDL and the CRDL for this request.

Analysis of uranium was in compliance regarding preparation blanks, calibration verification, and spike recoveries.

Based on EPA and Environmental Survey protocols, calibration verification, calibration or preparation blanks, laboratory control, samples, and sample spikes were not required for total dissolved solid analyses. No sample duplicates were analyzed because of an oversight. All holding times were met.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. There were two phthalates identified in concentrations estimated at below 0.002 mg/L. Tentatively identified compounds were estimated in concentrations of less than 0.12 mg/L.

Volatile organics. Acetone and toluene were identified in some of the samples and also in the blanks. Concentrations were all below quantitation limits and were always estimated at 0.010 mg/L or less. One freon was also tentatively identified with estimated concentrations of less than 0.010 mg/L in two of the samples.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 301:

Metals. Two metals of interest, zinc and mercury, were detected above the IDL and the CRDL for this request.

Analysis of uranium was in compliance regarding preparation blanks, calibration verification, and spike recoveries.

Due to the limited number of samples analyzed for total dissolved solids, calibration verification, calibration or preparation blanks, laboratory control, and sample spikes were not required. No sample duplicates were analyzed because of an oversight; all holding times were met.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Diethylphthalate was identified in one sample in estimated concentration of less than 0.001 mg/L. All other compounds were tentatively identified in concentrations of estimated at less than 0.100 mg/L.

Volatile organics. A freon was tentatively identified in one sample with concentration below the quantitation limit and was estimated at 0.005 mg/L. Acetone and toluene were present in another sample and also in the blank. No volatile compounds were detected in the other two samples for this request.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 302:

Metals. Two metals of interest, chromium and zinc, were detected above the IDL and the CRDL for this request.

Analysis of uranium was in compliance regarding preparation blanks, calibration verification, and spike recoveries.

Due to the limited number of samples analyzed for total dissolved solids, calibration verification, calibration or preparation blanks, laboratory control, and sample spikes were not required. No sample duplicates were analyzed because of an oversight; all holding times were met.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Four phthalates were identified. Phenol was identified in sample BR302070 with an estimated concentration of 0.002 mg/L. All tentatively identified compounds were estimated in concentrations of less than 1 mg/L.

Volatile organics. Acetone, methylene chloride, and toluene were each detected in at least one sample and also in the associated blanks. A freon was tentatively identified in one sample. All concentrations were below quantitation limits and were always estimated at less than 0.010 mg/L.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 303:

Metals. Five metals of interest, chromium, copper, lead, mercury, and zinc, were detected above either the IDL or the CRDL for this request.

Sediment duplicate was in compliance and all samples met the holding time requirement. Sediment samples were analyzed under SDG 303015.

PCBs and other extractables. PCBs and other extractables were identified in sediment samples from Request 303.

Extractable organics. Phenol was detected in two samples with estimated concentrations of 0.026 and 0.034 mg/kg. Of four phthalates detected, three were also present in the blank. No semivolatile organic compounds were identified in measurable concentrations and all estimated concentrations were less than 1 mg/kg with the following exceptions: Diacetone alcohol was tentatively identified in concentrations of 4.9 mg/kg or greater in all samples. Dioctyl adipate was tentatively identified in all three samples, at estimated concentrations from 2.4 to 2.6 mg/kg.

Volatile organics. No volatile compounds were identified in measurable quantities. Carbon tetrachloride was below the quantitation limit in two of the samples. Chloroform was present in all samples and also in the blank. Sample concentrations were all below the quantitation limit. Toluene was present in all samples and in the blank. Sample concentrations were all below the quantitation limit. Probable hydrocarbons were detected, with estimated concentrations being 1.1 mg/kg or less.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 304:

Metals. Five metals of interest, chromium, copper, lead, mercury, and zinc, were detected above either the IDL or the CRDL for this request.

The sediment duplicate was in compliance and all samples met the holding time requirement. Sediment samples were analyzed under SDG 303015.

PCBs and other extractables. PCBs and other extractables were identified in sediment samples from Request 304.

Extractable organics. No compound was identified in measurable quantities. All estimated concentrations were less than 10 mg/kg, except for something identified as probably aldol-condensation that was estimated as from 14 to 46 mg/kg in all samples.

Volatile organics. No volatiles were identified in measurable quantities. Carbon tetrachloride was detected in one sample in concentration below quantitation limits. Chloroform and toluene were present in the samples and also in the blank. Several probable hydrocarbons were detected in estimated concentrations of 1.4 mg/kg or less.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 305:

Metals. Two metals of interest, chromium and zinc, were detected above either the IDL or the CRDL for this request.

The sediment duplicate was in compliance and all samples met the holding time requirement. Sediment samples were analyzed under SDG 303015.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. With the exception of benzo(b)fluoranthene, measured at 0.630 mg/kg in sample BR305039, no semivolatile organics were identified in measurable quantities. Two of the phthalates identified were also in the blank. Several compounds were also present in the blank. Estimated concentrations were always less than 3 mg/kg, except for something identified as probably aldol-condensation, which had estimated concentrations ranging from 20 to 22 mg/kg in these samples.

Volatile organics. Chloroform was present in all samples and also in the blanks. All chloroform concentrations were below quantitation limits. Toluene was present in all three samples and in one of the blanks. All concentrations of positively identified compounds were below quantitation limits. Several probable hydrocarbons were detected in estimated concentrations of 1.2 mg/kg or less.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.7.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level I; the field sampling is rated Quality Level II. The overall analytical quality level rating is I.

Field Data:

Request 300: The field sampling for this request is Quality Level I. Sufficient samples were collected at the initial sampling

Request 301: The samples for Request 301 were taken on two separate days. Field measurements should have been made of the water samples on the second sampling to establish the properties of the water so that comparisons could be made with the original samples taken five days earlier.

Request 302: The samples for Request 302 were taken on two separate days. Field measurements should have been made of the water samples on the second sampling to establish the properties of the water so that comparisons could be made with the original samples taken five days earlier.

Analytical Data:

Request 300:

Metals. Analytical results were Quality Level I with the following exceptions: aluminum and calcium were Quality Level II, and arsenic was Quality Level III. Both aluminum and calcium fell outside the control limits for a calibration verification standard and the laboratory control standard. The spike recovery for arsenic was less than 30%.

The data quality level for total uranium in Request 300 is Quality Level II mainly because the duplicate analysis did not meet the 80% compliance; however, other quality control measures were in compliance. Holding times were met for all samples obtained from Brookhaven.

For total dissolved solids, the data of this straightforward gravimetric analysis sensitive down to 10 mg/L are Quality Level I.

PCBs and other extractables. No PCBs/Pesticides were detected. The Quality Level was I for all QC results.

Extractable organics. Data for Request 300 were given as Quality Level I. All QC results were in compliance but no MS/MSD samples were analyzed.

Volatile organics. Data from surface water samples are of Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 301:

Metals. Analytical results were Quality Level I with the following exceptions: aluminum and calcium were Quality Level II, and arsenic was Quality Level III. Both aluminum and calcium fell outside the control limits for a calibration verification standard and the laboratory control standard. The spike recovery for arsenic was less than 30%.

The data quality level for total uranium in Request 301 is Quality Level II mainly because the duplicate analysis did not meet the 80% compliance; however, other quality control measures were in compliance. Holding times were met for all samples obtained from Brookhaven.

For total dissolved solids, the data of this straightforward gravimetric analysis sensitive down to 10 mg/L are Quality Level I.

PCBs and other extractables. No PCBs/Pesticides were detected. The Quality Level was I for all QC results.

Extractable organics. Data for this request were given as Quality Level I.

Volatile organics. Data from surface water samples are of Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 302:

Metals. Analytical results were Quality Level I with the following exceptions: aluminum and calcium were Quality Level II, and arsenic was Quality Level III. Both aluminum and calcium fell outside the control limits for a calibration verification standard and the laboratory control standard. The spike recovery for arsenic was less than 30%.

The data quality level for total uranium in Request 302 is Quality Level II mainly because the duplicate analysis did not meet the 80% compliance; however, other quality control measures were in compliance. Holding times were met for all samples obtained from Brookhaven.

For total dissolved solids, the data of this straightforward gravimetric analysis sensitive down to 10 mg/L are Quality Level I.

PCBs and other extractables. No PCBs/Pesticides were detected. The Quality Level was I for all QC results.

Extractable organics. Data for this request were given as Quality Level I.

Volatile organics. Data from surface water samples are of Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 303:

Metals. Analytical results were Quality Level I with the following exceptions: antimony was Quality Level II, and arsenic and beryllium were Quality Level III. Antimony was recovered in the range of 30 to 74% in the spiked sample. Arsenic had a spike recovery of less than 30% and beryllium results for the laboratory control standard were outside the upper control limit.

The data quality level for total uranium in Request 303 is Quality Level I as preparation blanks, calibration verification, spike recoveries, and duplicate analysis were all in compliance. Holding times were met for all samples obtained from Brookhaven.

PCBs and other extractables. These data are of Quality Level I.

Extractable organics. Data for this request were given as Quality Level I.

Volatile organics. Data for the sediment samples are of Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 304:

Metals. Analytical results for sample BR304016 were Quality Level I with the following exceptions: antimony was Quality Level II, and arsenic and beryllium were Quality Level III. Antimony was recovered in the range of 30 to 74% in the spiked sample. Arsenic had a spike recovery of less than 30% and beryllium results for the laboratory control standard were outside the upper control limit. Results for sample BR304027 were Quality Level I with the following exceptions: antimony, silver, and vanadium were Quality Level II, and arsenic and beryllium were Quality Level III. Antimony was recovered in the range of 30 to 74% in the spiked sample. Silver and vanadium were recovered in the range of 30 to 79% in the interference check standard. Arsenic had a spike recovery of less than 30% and beryllium results for the laboratory control standard were outside the upper control limit. Results for sample BR304038 were Quality Level I with the following exceptions: antimony was Quality Level II, and arsenic, beryllium, and selenium were Quality Level III. Antimony was recovered in the range of 30 to 74% in the spiked sample. Arsenic had a spike recovery of less than 30% and beryllium results for the laboratory control standard were outside the upper control limit. The selenium percent recovery exceeded the upper control limit for the laboratory control standard. For sample BR304049 results were Quality Level I, except for arsenic at Quality Level III because the spike recovery was less than 30%.

The data quality level for total uranium in Request 304 is Quality Level I as preparation blanks, calibration verification, spike recoveries, and duplicate analysis were all in compliance. Holding times were met for all samples obtained from Brookhaven.

PCBs and other extractables. These data are of Quality Level I.

Extractable organics. Data for this request were given as Quality Level I.

Volatile organics. Data for the sediment samples are of Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 305:

Metals. Under request 305, there were three samples analyzed all having the above quality levels. Analytical results were Quality Level I with the following exceptions: antimony was Quality Level II, and arsenic, beryllium, and selenium were Quality Level III. The exception to the above quality level assignments is that selenium in sample BR305039C has a quality level of I. Antimony was recovered in the range of 30 to 74% in the spiked sample. Arsenic had a spike recovery of less than 30% and beryllium results for the laboratory control standard were outside the upper control limit. The selenium percent recovery exceeded the upper control limit for the laboratory control standard.

The data quality level for total uranium in Request 305 is Quality Level I as preparation blanks, calibration verification, spike recoveries, and duplicate analysis were all in compliance. Holding times were met for all samples obtained from Brookhaven.

<u>PCBs and other extractables</u>. No PCBs/Pesticides were detected. The Quality Level was I for all QC results.

<u>Extractable organics</u>. Data for this request were given as Quality Level I.

<u>Volatile organics</u>. Data for the sediment samples are of Quality Level II because holding times were exceeded.

<u>Radiochemistry</u>. Radiological results were assigned a Quality Level I.

Environmental Problem: 1
Request Number: 300

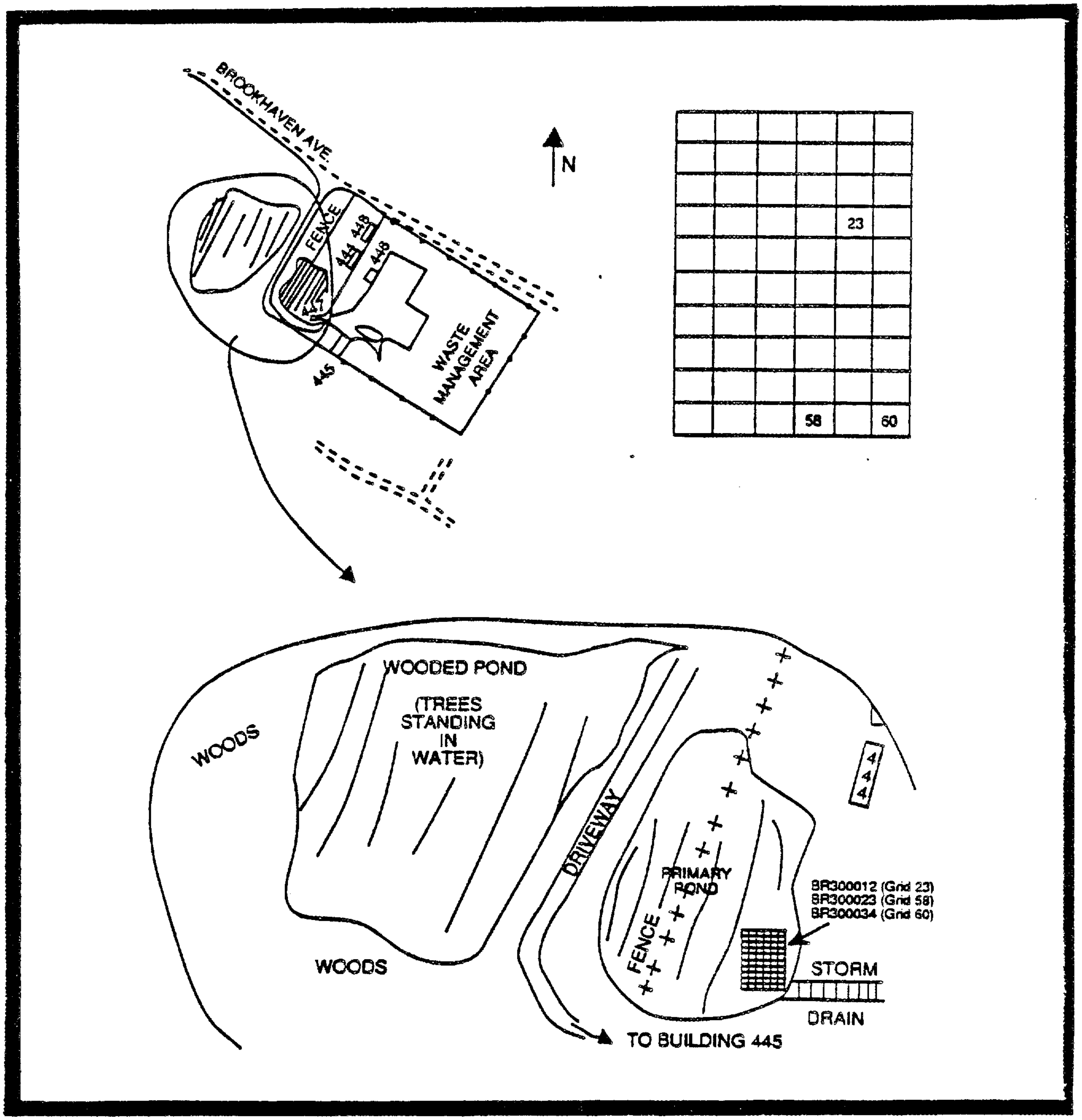

Figure 4.1a. Southeast Corner of Primary Pond Water (Request 300)

Environmental Problem: 1
Request Number: 301

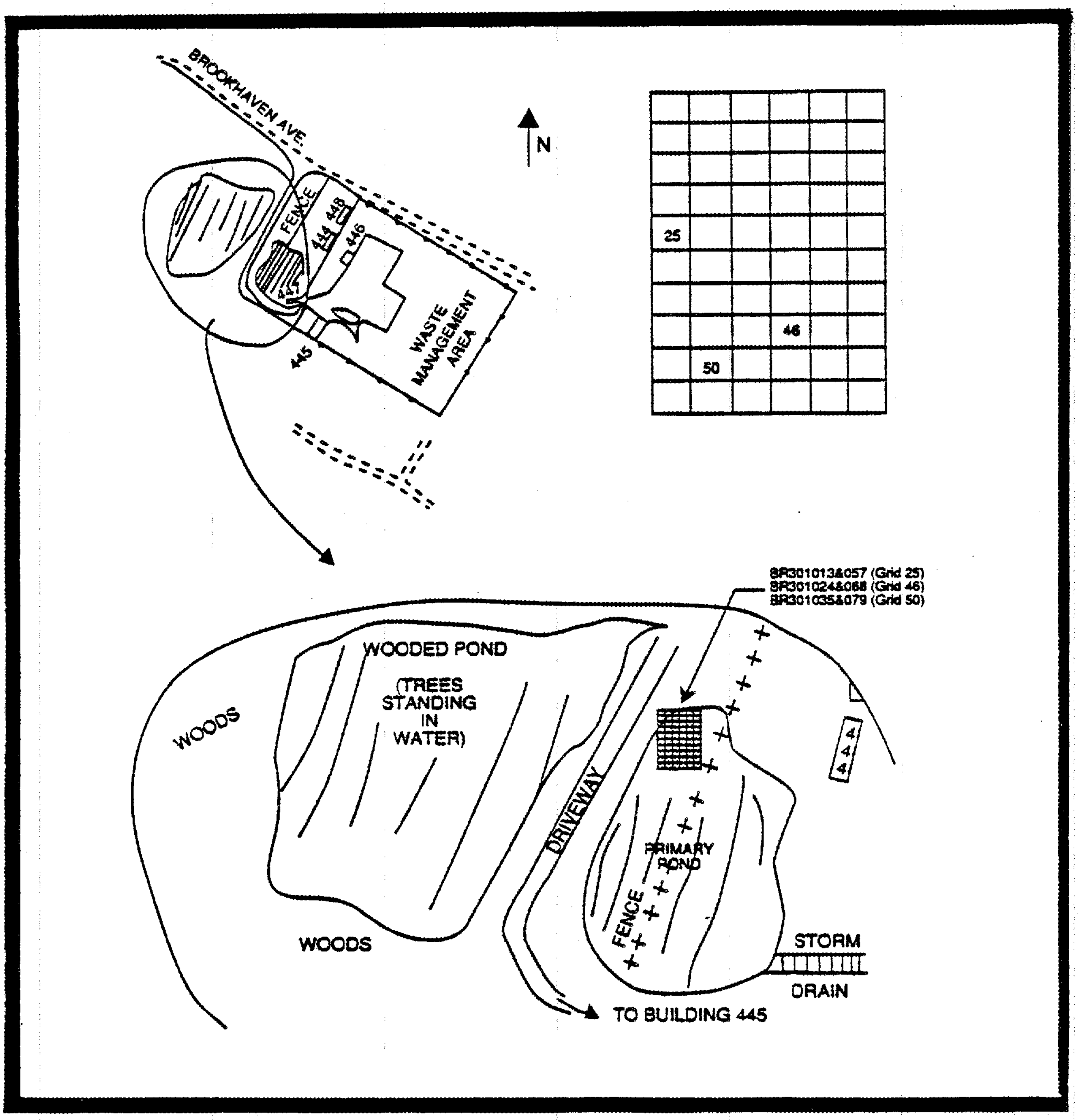

Figure 4.1b. North Corner of Primary Pond Water (Request 301)

Environmental Problem: 1
Request Number: 302

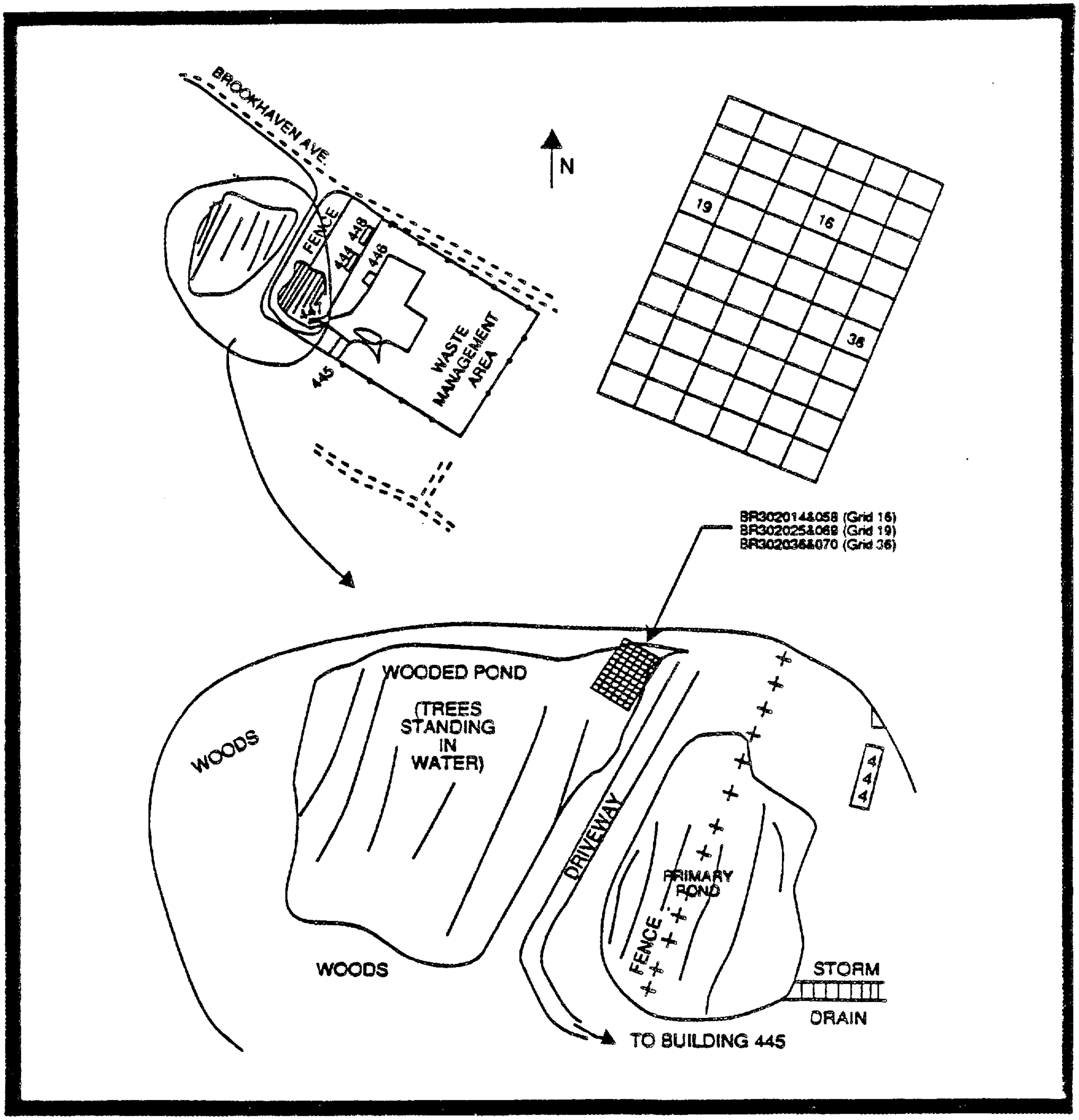

Figure 4.1c. Northeast Corner of "Wooded Pond" Water (Request 302)

Environmental Problem: 1
Request Number: 303

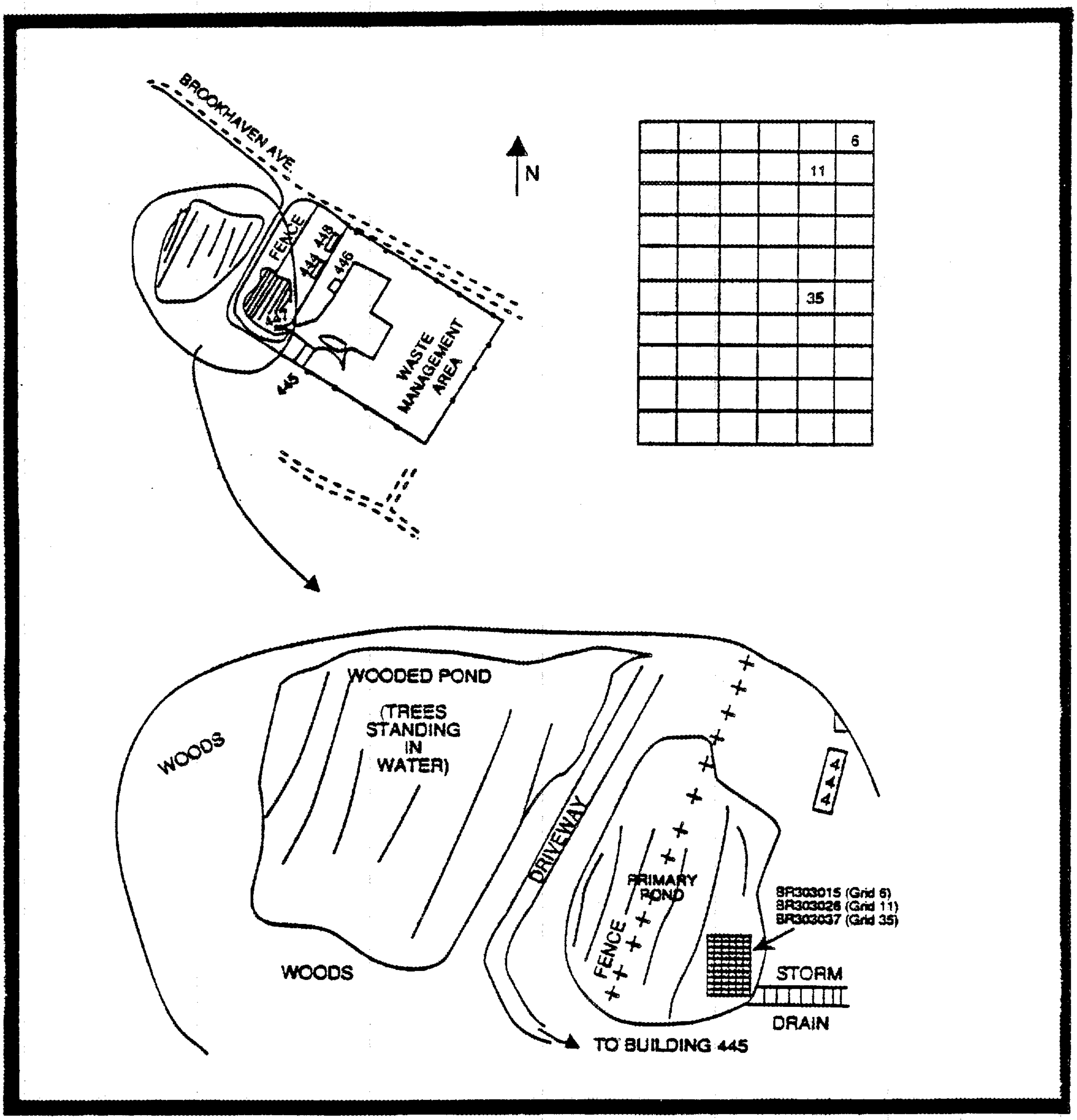

Figure 4.1d. Southeast Corner of Primary Pond Sediment (Request 303)

Environmental Problem: 1
Request Number: 304

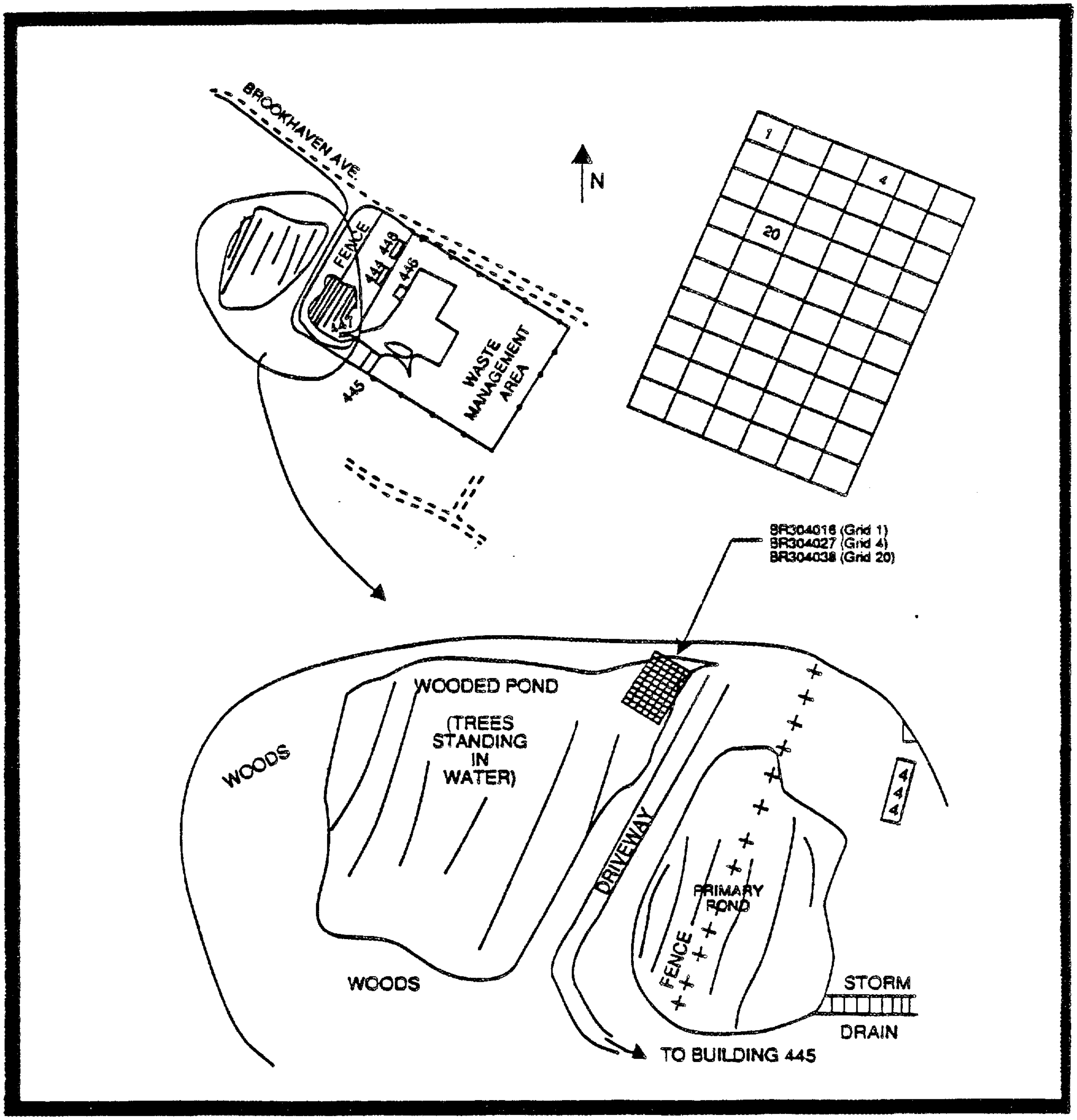

Figure 4.1e. North Corner of Primary Pond Sediment (Request 304)

Environmental Problem: 1
Request Number: 305

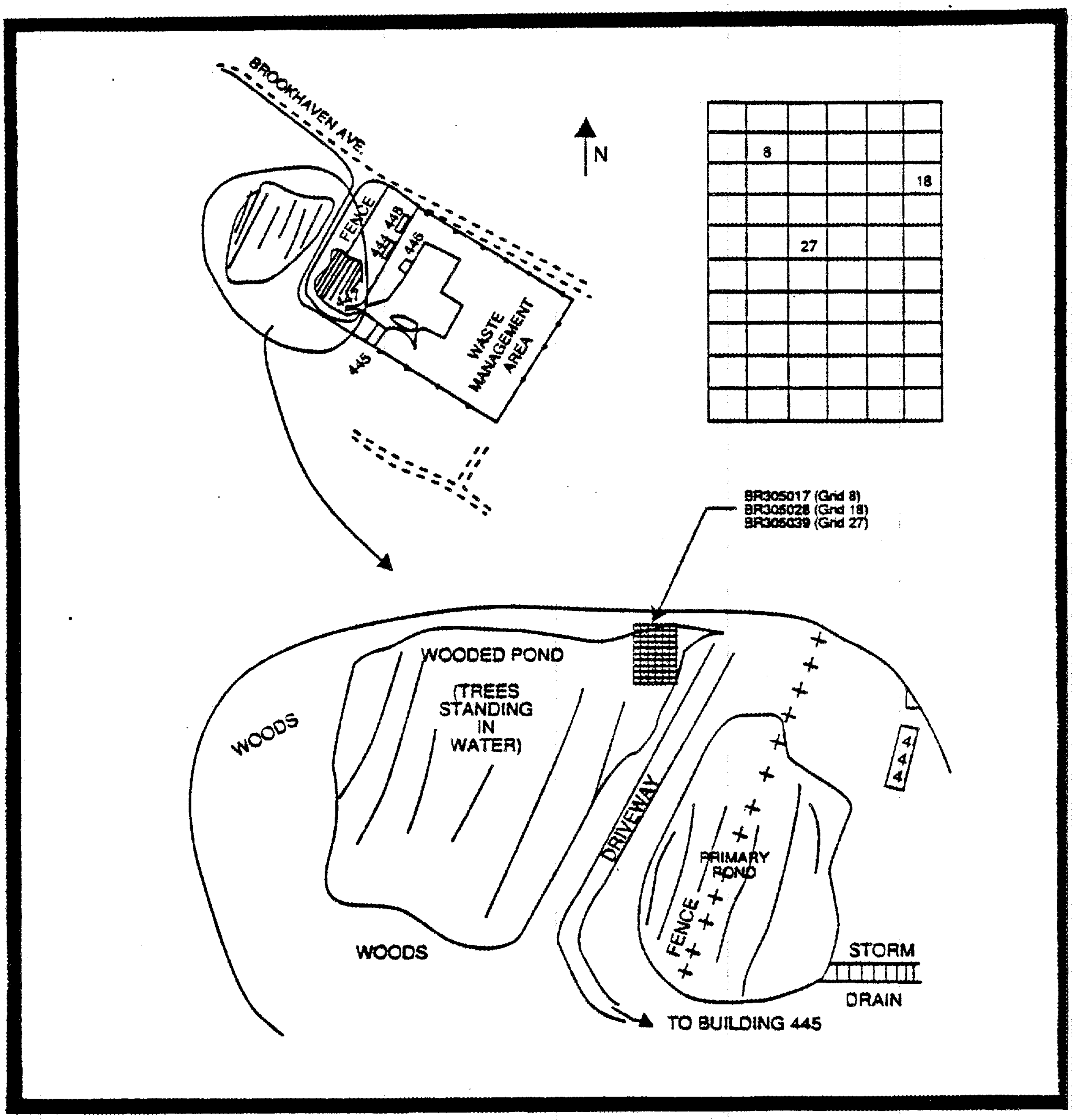

Figure 4.1f. Northeast Corner of "Wooded Pond" Sediment (Request 305)

TABLE 4.2.1 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 1

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS NUMB HITS	ANIONS NUMB ANAL	METALS NUMB HITS	METALS NUMB ANAL	O&G NUMB HITS	O&G NUMB ANAL	PET HYDRO NUMB HITS	PET HYDRO NUMB ANAL	PES/H/PCB NUMB HITS	PES/H/PCB NUMB ANAL	SEMIVOLS NUMB HITS	SEMIVOLS NUMB ANAL	VOLS NUMB HITS	VOLS NUMB ANAL	RADS NUMB HITS	RADS NUMB ANAL
BR303	S PRIM. PD	POND	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR304	N PRIM. PD	POND	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	2	3	3	3	3	3	3	3
BR305	N HOODED P	POND	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	3	3	3	3	3	3	3
		MED TOTAL		9	9		0	0	9	9	0	0	0	0	5	9	9	9	9	9	9	9
BR300	PRIMARY PD	HWMA POND	SUR WATER	3	3	GRAB	0	0	3	3	0	0	0	0	0	3	3	3	2	3	3	3
BR301	PRIMARY PD	POND	SUR WATER	6	6	GRAB	0	0	3	3	0	0	0	0	0	3	3	3	1	3	3	3
BR301	PRIMARY PD	POND	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	1	0	0	1	1	1	1
BR302	HOODED PD	POND	SUR WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1
BR302	HOODED PD	POND	SUR WATER	6	6	GRAB	0	0	3	3	0	0	0	0	0	3	3	3	3	3	3	3
BR304	N PRIM. PD	POND	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	1	0	0	1	1	1	1
		MED TOTAL		18	18		0	0	12	12	0	0	0	0	0	11	9	9	8	11	11	12
		EP TOTAL		27	27		0	0	21	21	0	0	0	0	5	20	18	18	17	20	20	21

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 300
LOCATION: SOUTHEAST CORNER OF THE PRIMARY POND
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	BR300012	BR300023	BR300034			
CONDUCTIVITY (MS/CM)		0.17	0.17	0.17			
PH (UNITS)		7.2	7.2	7.2			
TEMPERATURE (DEG C)		12	12	12			

METALS, INCLUDING CR+6 (MG/L)							
	SAMP NO:	BR300012I	BR300023I	BR300034I			
	SDG NO:	BR300012I	BR300012I	BR300012I			
	TYPE:	GRAB	GRAB	GRAB			
URANIUM, TOTAL		10E-04 U	10E-04	10E-04			

METALS, INCLUDING CR+6 (UG/L)							
	SAMP NO:	BR300012G	BR300012G	BR300012H	BR300012J	BR300023G	BR300023G
	SDG NO:	BR300012G	BR300012K	BR300012H	BR300012J	BR300012G	BR300012K
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		186 B				127 B	
BARIUM		10 BE				5.2 BE	
CALCIUM		4200 B				4830 B	
COPPER		10 U				10 U	
IRON		289				185	
MAGNESIUM		1340 B				1380 B	
MANGANESE		146				25	
MERCURY				0.12 B			
POTASSIUM			2100				1800
SODIUM		1610 BE				1460 BE	
TOT. DISSOLVED SOLIDS					73000		
VANADIUM		4 B				4 U	
ZINC		62				43	

METALS, INCLUDING CR+6 (UG/L)							
	SAMP NO:	BR300023H	BR300023J	BR300034G	BR300034G	BR300034H	BR300034J
	SDG NO:	BR300012H	BR300012J	BR300012G	BR300012K	BR300012H	BR300012J
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM				135 B			
BARIUM				7.6 BE			
CALCIUM				5640			
COPPER				10			
IRON				174			
MAGNESIUM				1550 B			
MANGANESE				28			
MERCURY		0.14 B				0.11 B	
POTASSIUM					1800		

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 300
LOCATION: SOUTHEAST CORNER OF THE PRIMARY POND
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR300023H / BR300012H / GRAB	BR300023J / BR300012J / GRAB	BR300034G / BR300012G / GRAB	BR300034G / BR300012K / GRAB	BR300034H / BR300012H / GRAB	BR300034J / BR300012J / GRAB
SODIUM				1180 BE			
TOT. DISSOLVED SOLIDS			61000				63000
VANADIUM				4 U			
ZINC				59			

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR300012F / BR300012F / GRAB	BR300023F / BR300012F / GRAB	BR300034F / BR300012F / GRAB			
DI-N-OCTYLPHTHALATE		0.8 J	2 J	0.5 J			
DIETHYLPHTHALATE		10 U	0.8 J	0.7 J			
* ALIPHATIC HYDROCARBON(6.76)			6 JB				
* ALIPHATIC HYDROCARBON(6.95)			7 JB				
* DIACETONE ALCOHOL(6.05)		12 JAB					
* DIACETONE ALCOHOL(6.06)				8 JAB			
* DIACETONE ALCOHOL(6.07)			9 JAB				
* DIOCTYL ADIPATE(31.20)				6 J			
* HEXAMETHYLCYCLOTRISILOX(5.79)		4 JB					
* POSSIBLE ALIPHATIC HYDR(6.95)		3 J					
* PROB ALDOL-CONDENSATION(4.86)		77 JAB		68 JAB			
* PROB ALDOL-CONDENSATION(4.88)			110 JAB				
* UNKNOWN(3.62)		4 J					
* UNKNOWN(3.64)			5 J				
* UNKNOWN(4.98)		7 J					
* UNKNOWN(5.89)		4 J					
* UNKNOWN(6.74)		3 J					

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR300012A / BR301046A / GRAB	BR300023A / BR301046A / GRAB	BR300034A / BR301046A / GRAB			
ACETONE		10 U	10 U	7 JB			
TOLUENE		5 U	0.9 JB	0.4 JB			
* FREON 113(12.00)			6 JB	7 JB			

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 300
LOCATION: SOUTHEAST CORNER OF THE PRIMARY POND
MEDIUM: SURFACE WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	BR300012K	BR300012L	BR300023K	BR300023L	BR300034K	BR300034L
	SDG NO:	LLL8258	LLL8258	LLL8258	LLL8258	LLL8258	LLL8258
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CS-137			104		70		42
H-3		140		-200		-160	

S&A REQUEST: 301
LOCATION: NORTH CORNER OF THE PRIMARY POND
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	BR301013	BR301024	BR301035			
CONDUCTIVITY (MS/CM)		0.03	0.03	0.03			
PH (UNITS)		6.6	6.6	6.2			
TEMPERATURE (DEG C)		12	11	11			

METALS, INCLUDING CR+6 (MG/L)	SAMP NO:	BR301013H	BR301024H	BR301035H	BR301046H		
	SDG NO:	BR300012I	BR300012I	BR300012I	BR300012I		
	TYPE:	GRAB	GRAB	GRAB	RINSATE		
URANIUM, TOTAL		10E-04	10E-04 U	10E-04	10E-04 U		

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	BR301013F	BR301013F	BR301013G	BR301013I	BR301024F	BR301024F
	SDG NO:	BR300012G	BR300012K	BR300012H	BR300012J	BR300012G	BR300012K
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		163 B				122 B	
BARIUM		9.1 BE				7.2 BE	
CALCIUM		3560 B				3150 B	
IRON		1250				1520	
MAGNESIUM		1200 B				1280 B	
MANGANESE		59				33	
MERCURY				0.17 B			
POTASSIUM			1300				1300
SODIUM		3420 BE				3490 BE	
TOT. DISSOLVED SOLIDS					86000		
ZINC		43				37	

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 — DRAFT DO NOT CITE

SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 301
LOCATION: NORTH CORNER OF THE PRIMARY POND
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: SDG NO: TYPE:	BR301024G BR300012H GRAB	BR301024I BR300012J GRAB	BR301035F BR300012G GRAB	BR301035F BR300012K GRAB	BR301035G BR300012H GRAB	BR301035I BR300012J GRAB
ALUMINUM				119 B			
BARIUM				11 BE			
CALCIUM				3470 B			
IRON				2230			
MAGNESIUM				1360 B			
MANGANESE				48			
MERCURY		0.17 B				0.2	
POTASSIUM					1500		
SODIUM				3870 BE			
TOT. DISSOLVED SOLIDS			98000				98000
ZINC				38			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: SDG NO: TYPE:	BR301046F BR300012G RINSATE	BR301046F BR300012K RINSATE	BR301046G BR300012H RINSATE	BR301046I BR300012J RINSATE		
ALUMINUM		60 U					
BARIUM		13 BE					
CALCIUM		200 U					
IRON		20 U					
MAGNESIUM		10 U					
MANGANESE		5 U					
MERCURY				0.12 B			
POTASSIUM			100 U				
SODIUM		200 UE					
TOT. DISSOLVED SOLIDS					30000		
ZINC		21					

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: SDG NO: TYPE:	BR301057A BR301057A GRAB	BR301068A BR301057A GRAB	BR301079A BR301057A GRAB			
DIETHYLPHTHALATE		10 U	0.5 J	10 U			
* DECAMETHYLCYCLOPENTASIL(13.70)				4 J			
* DIOCTYL ADIPATE(31.10)		9 J		47 J			
* DIOCTYL ADIPATE(31.20)			81 J				
* METHYL BENZENE(3.82)		4 J					
* METHYL BENZENE(3.84)			9 J				
* METHYL BENZENE(3.89)				3 J			
* OCTAMETHYLCYCLOTETRASIL(10.40)			23 J				

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 301
LOCATION: NORTH CORNER OF THE PRIMARY POND
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	BR301057A	BR301068A	BR301079A			
	SDG NO:	BR301057A	BR301057A	BR301057A			
	TYPE:	GRAB	GRAB	GRAB			
* POSS ALIPHATIC HYDROCAR(23.30)				5 J			
* POSS UNSAT. HYDROCARBON(24.10)				16 J			
* UNKNOWN ACID(20.80)				20 J			
* UNKNOWN ACID(20.90)		37 J	32 J				
* UNKNOWN SILOXANE(13.70)			5 J				
* UNKNOWN SILOXANE(13.80)		8 J					
* UNKNOWN SILOXANE(19.80)			4 J	4 J			
* UNKNOWN SILOXANE(22.40)		8 JB	11 JB	9 JB			
* UNKNOWN SILOXANE(24.60)		7 JB	13 JB	11 JB			
* UNKNOWN SILOXANE(26.50)				7 JB			
* UNKNOWN SILOXANE(26.60)		6 JB	10 JB				
* UNKNOWN SILOXANE(28.30)				20 JB			
* UNKNOWN SILOXANE(28.40)		12 JB	19 JB				
* UNKNOWN SILOXANE(30.00)		10 JB	19 JB	16 JB			
* UNKNOWN SILOXANE(31.50)		11 JB	17 JB	14 JB			
* UNKNOWN SILOXANE(32.90)				13 JB			
* UNKNOWN SILOXANE(33.00)		9 JB	17 JB				
* UNKNOWN SILOXANE(34.30)		17 JB	27 JB	21 JB			
* UNKNOWN SILOXANE(35.50)		15 J	24 J	22 J			
* UNKNOWN SILOXANE(36.70)		11 JB	21 JB	23 JB			
* UNKNOWN SILOXANE(37.80)		10 J	16 J	14 J			
* UNKNOWN SILOXANE(39.00)			12 J				
* UNKNOWN(5.70)		4 J					
* UNKNOWN(23.60)				2 J			
* UNKNOWN(24.10)		4 J					
* UNKNOWN(24.20)			4 J				
* UNKNOWN(24.40)				2 J			
* UNKNOWN(35.30)		9 J	17 J				

VOLATILE ORGANICS (UG/L)	SAMP NO:	BR301013A	BR301024A	BR301035A	BR301046A		
	SDG NO:	BR301046A	BR301046A	BR301046A	BR301046A		
	TYPE:	GRAB	GRAB	GRAB	RINSATE		
ACETONE		10 U	10 U	10 U	15 B		
TOLUENE		5 U	5 U	5 U	2 JB		
* FREON 113(12.00)				5 JB			

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 301
LOCATION: NORTH CORNER OF THE PRIMARY POND
MEDIUM: SURFACE WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR301013J / LLL8259 / GRAB	BR301013K / LLL8259 / GRAB	BR301024J / LLL8259 / GRAB	BR301024K / LLL8259 / GRAB	BR301035J / LLL8259 / GRAB	BR301035K / LLL8259 / GRAB
CS-137			14		11		11
H-3		470		-270		-94	

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR301046J / LLL8259 / RINSATE	BR301046K / LLL8259 / RINSATE				
CS-137			2 U				
H-3		-840					

S&A REQUEST: 302
LOCATION: NORTHEAST CORNER OF "WOODED POND"
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	BR302014	BR302025	BR302036			
CONDUCTIVITY (MS/CM)		0.13	0.14	0.14			
PH (UNITS)		5.2	4.9	4.8			
RADIOACTIVIT (CPM)		100					
TEMPERATURE (DEG C)		12	9.4	11			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR302014F / BR300012G / GRAB	BR302014F / BR300012K / GRAB	BR302014G / BR300012H / GRAB	BR302014I / BR300012J / GRAB	BR302025F / BR300012G / GRAB	BR302025F / BR300012K / GRAB
ALUMINUM		656				536	
BARIUM		10 BE				8.5 BE	
BERYLLIUM		0.3 U				0.3 U	
CALCIUM		3800 B				3460 B	
CHROMIUM		17				13	
IRON		2610				1960	
MAGNESIUM		1660 B				1540 B	
MANGANESE		120				115	
MERCURY				0.09 B			
NICKEL		10 B				7.1 B	
POTASSIUM			1400				1300

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 302
LOCATION: NORTHEAST CORNER OF "WOODED POND"
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR302014F BR300012G GRAB	BR302014F BR300012K GRAB	BR302014G BR300012H GRAB	BR302014I BR300012J GRAB	BR302025F BR300012G GRAB	BR302025F BR300012K GRAB
SODIUM		6870 E				6300 E	
TOT. DISSOLVED SOLIDS					136000		
VANADIUM		9 B				7.5 B	
ZINC		50				37	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR302025G BR300012H GRAB	BR302025I BR300012J GRAB	BR302036F BR300012G GRAB	BR302036F BR300012K GRAB	BR302036G BR300012H GRAB	BR302036I BR300012J GRAB
ALUMINUM				610			
BARIUM				9 BE			
BERYLLIUM				0.3 U			
CALCIUM				3700 B			
CHROMIUM				6 U			
IRON				2160			
MAGNESIUM				1590 B			
MANGANESE				119			
MERCURY		0.07 B				0.07 B	
NICKEL				6.5 B			
POTASSIUM					1400		
SODIUM				6770 E			
TOT. DISSOLVED SOLIDS			121000				114000
VANADIUM				7.6 B			
ZINC				37			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR302047A BR300012G FIELD BLANK	BR302047A BR300012K FIELD BLANK	BR302047B BR300012H FIELD BLANK			
ALUMINUM		60 U					
BARIUM		2.1 BE					
BERYLLIUM		0.36 B					
CALCIUM		200 U					
CHROMIUM		6 U					
IRON		23 B					
MAGNESIUM		18 B					
MANGANESE		5 U					
MERCURY				0.04 B			
NICKEL		6 U					
POTASSIUM			150				

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 302
LOCATION: NORTHEAST CORNER OF "WOODED POND"
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)			
SAMP NO:	BR302047A	BR302047A	BR302047B
SDG NO:	BR300012G	BR300012K	BR300012H
TYPE:	FIELD BLANK	FIELD BLANK	FIELD BLANK
SODIUM	337 BE		
TOT. DISSOLVED SOLIDS			
VANADIUM	4 U		
ZINC	15 B		

EXTRACTABLE ORGANICS (UG/L)			
SAMP NO:	BR302058A	BR302069A	BR302070A
SDG NO:	BR301057A	BR301057A	BR301057A
TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE	7 J	46	10 U
BUTYLBENZYLPHTHALATE	3 J	10 U	10 U
DI-N-BUTYLPHTHALATE	3 J	10 U	0.7 J
DIETHYLPHTHALATE	2 J	10 U	10 U
PHENOL	10 U	10 U	2 J
4-METHYLPHENOL	3 J	4 J	6 J
* ALIPHATIC HYDROCARBON(24.10)		3 J	
* DECAMETHYLCYCLOPENTASIL(13.70)		11 J	
* DIOCTYL ADIPATE(31.10)		150 J	24 J
* DIOCTYL ADIPATE(31.20)	960 J		
* HEXAMETHYLCYCLOTRISILOX(5.71)		5 J	7 J
* HEXAMETHYLCYCLOTRISILOX(5.72)	6 J		
* METHYL BENZENE(3.84)			5 J
* OCTAMETHYLCYCLOTETRASIL(10.40)	70 J	33 J	70 J
* UNKNOWN ACID(20.90)	200 J	100 J	93 J
* UNKNOWN ACID(23.60)	52 J	4 J	5 J
* UNKNOWN PHTHALATE ESTER(25.00)	14 J		
* UNKNOWN SILOXANE(13.70)			12 J
* UNKNOWN SILOXANE(19.80)		5 J	6 J
* UNKNOWN SILOXANE(22.40)	26 JB	17 JB	18 JB
* UNKNOWN SILOXANE(24.60)	28 JB	18 JB	20 JB
* UNKNOWN SILOXANE(26.60)	23 JB	14 JB	17 JB
* UNKNOWN SILOXANE(28.30)		27 JB	
* UNKNOWN SILOXANE(28.40)	41 JB		37 JB
* UNKNOWN SILOXANE(30.00)	37 JB	24 JB	34 JB
* UNKNOWN SILOXANE(31.50)	40 JB	23 JB	30 JB
* UNKNOWN SILOXANE(32.90)	40 JB	24 JB	28 JB
* UNKNOWN SILOXANE(34.30)			43 JB
* UNKNOWN SILOXANE(35.50)	31 J	30 J	41 J
* UNKNOWN SILOXANE(36.70)	28 JB	24 JB	31 JB
* UNKNOWN SILOXANE(37.80)	20 J	19 J	27 J
* UNKNOWN SILOXANE(39.00)	15 J	16 J	19 J

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 302
LOCATION: NORTHEAST CORNER OF "WOODED POND"
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR302058A / BR301057A / GRAB	BR302069A / BR301057A / GRAB	BR302070A / BR301057A / GRAB			
* UNKNOWN SILOXANE(40.40)		11 J					
* UNKNOWN(13.70)		9 J					
* UNKNOWN(19.80)		8 J					
* UNKNOWN(25.00)			4 J				

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR302014A / BR301046A / GRAB	BR302025A / BRN11016A / GRAB	BR302036A / BRN11016A / GRAB			
ACETONE		10 U	10 U	5 JB			
METHYLENE CHLORIDE		5 U	0.6 JB	5 U			
TOLUENE		0.3 JB	0.3 JB	0.9 JB			
* FREON 113(12.00)		5 JB					

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR302014J / LLL8260 / GRAB	BR302025J / LLL8260 / GRAB	BR302036J / LLL8260 / GRAB			
H-3		-58	-58	160			

S&A REQUEST: 303
LOCATION: SOUTHEAST CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR303015C / BR303015C / GRAB	BR303015C / BR303015K / GRAB	BR303015D / BR303015D / GRAB	BR303026C / BR303015C / GRAB	BR303026C / BR303015K / GRAB	BR303026D / BR303015D / GRAB
ALUMINUM		4740			9240		
BARIUM		17 B			23 B		
BERYLLIUM		0.44 B			0.63 B		
CADMIUM		0.67 B			0.87 U		
CALCIUM		670 B			360 B		
CHROMIUM		6.6			10		
COBALT		0.79 U			1.6 B		
COPPER		8.6			11		

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 303
LOCATION: SOUTHEAST CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR303015C / BR303015C / GRAB	BR303015C / BR303015K / GRAB	BR303015D / BR303015D / GRAB	BR303026C / BR303015C / GRAB	BR303026C / BR303015K / GRAB	BR303026D / BR303015D / GRAB
IRON		1470			3470		
LEAD		63			100		
MAGNESIUM		306 B			520 B		
MANGANESE		16			23		
MERCURY				0.1			0.19
NICKEL		2.8 B			5.4 B		
POTASSIUM			300 B			480 B	
SODIUM		115 B			151 B		
VANADIUM		11 B			32		
ZINC		29			29		

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR303037C / BR303015C / GRAB	BR303037C / BR303015K / GRAB	BR303037D / BR303015D / GRAB			
ALUMINUM		8890					
BARIUM		23 B					
BERYLLIUM		0.63 B					
CADMIUM		0.7 U					
CALCIUM		287 B					
CHROMIUM		8.1					
COBALT		1.1 U					
COPPER		9.5					
IRON		3210					
LEAD		212					
MAGNESIUM		360 B					
MANGANESE		16					
MERCURY				0.11			
NICKEL		4.5 B					
POTASSIUM			350 B				
SODIUM		125 B					
VANADIUM		19					
ZINC		34					

METALS, INCLUDING CR+6 (UG/G)	SAMP NO: / SDG NO: / TYPE:	BR303015E / BR303015E / GRAB	BR303026E / BR303015E / GRAB	BR303037E / BR303015E / GRAB			
URANIUM, TOTAL		10	8	8			

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 303
LOCATION: SOUTHEAST CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR303015B / BR303015B / GRAB	BR303026B / BR303015B / GRAB	BR303037B / BR303015B / GRAB
AROCLOR-1260		246	144 J	229
4,4'-DDE		42	42	80

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR303015B / BR303015B / GRAB	BR303026B / BR303015B / GRAB	BR303037B / BR303015B / GRAB
BENZO(A)ANTHRACENE		110 J	45 J	130 J
BENZO(A)PYRENE		140 J	50 J	170 J
BENZO(B)FLUORANTHENE		170 J	66 J	230 J
BENZO(G,H,I)PERYLENE		110 J	610 U	110 J
BIS(2-ETHYLHEXYL)PHTHALATE		160 J	180 J	120 J
CHRYSENE		200 J	610 U	200 J
DI-N-BUTYLPHTHALATE		140 JB	310 JB	170 JB
DI-N-OCTYLPHTHALATE		51 JB	18 JB	39 JB
DIETHYLPHTHALATE		37 JB	40 JB	50 JB
FLUORANTHENE		360 J	98 J	320 J
INDENO(1,2,3-CD)PYRENE		140 J	610 U	110 J
PHENANTHRENE		130 J	40 J	120 J
PHENOL		34 J	26 J	650 U
PYRENE		330 J	110 J	390 J
* ALIPHATIC HYDROCARBON(6.73)		340 JB		73 JB
* ALIPHATIC HYDROCARBON(6.93)			530 JB	110 JB
* ALIPHATIC HYDROCARBON(6.94)		520 JB		
* ALIPHATIC HYRDOCARBON(6.72)			320 JB	
* DIACETONE ALCOHOL(6.29)			20000 JAB	
* DIACETONE ALCOHOL(6.37)		20000 JAB		
* DIACETONE ALCOHOL(6.46)				4900 JAB
* DIOCTYL ADIPATE(31.20)		2400 JB	2400 JB	2600 JB
* POSSIBLE KETONE(9.23)				95 J
* POSSIBLE KEYTONE(9.25)		450 J		
* PROB ALDO-CONDENSATION (4.86)				610 JA
* PROB ALDOL-CONDENSATION(4.78)			390 JA	
* PROB ALDOL-CONDENSATION(4.79)		290 JA		
* UNKNOWN(5.26)			600 JB	
* UNKNOWN(5.61)				96 JB
* UNKNOWN(5.72)		340 J		
* UNKNOWN(8.05)			250 J	
* UNKNOWN(9.21)			690 J	

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 303
LOCATION: SOUTHEAST CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR303015A / BR303015A / GRAB	BR303026A / BR303015A / GRAB	BR303037A / BR303015A / GRAB
CARBON TETRACHLORIDE		3 J	5 J	39 U
CHLOROFORM		32 JB	27 JB	30 JB
ETHYLBENZENE		13 JB	10 JB	11 JB
TETRACHLOROETHENE		11 J	5 J	39 U
TOLUENE		7 JB	6 JB	5 JB
XYLENE (TOTAL)		36 U	6 J	39 U
2-BUTANONE		73 U	44 J	78 U
* PROBABLE HYDROCARBON #1(16.59)				42 J
* PROBABLE HYDROCARBON #1(20.40)			38 J	
* PROBABLE HYDROCARBON #1(26.43)		35 JB		
* PROBABLE HYDROCARBON #1(35.91)				84 J
* PROBABLE HYDROCARBON #2(23.59)			34 J	38 J
* PROBABLE HYDROCARBON #2(29.17)		95 JB		
* PROBABLE HYDROCARBON #3(26.54)			140 JB	140 JB
* PROBABLE HYDROCARBON #3(31.95)		230 JB		
* PROBABLE HYDROCARBON #4(28.36)			35 J	
* PROBABLE HYDROCARBON #4(29.28)				320 JB
* PROBABLE HYDROCARBON #4(34.53)		36 J		
* PROBABLE HYDROCARBON #5(29.28)			310 J	
* PROBABLE HYDROCARBON #5(30.81)				81 J
* PROBABLE HYDROCARBON #6(31.00)			47 J	85 J
* PROBABLE HYDROCARBON #7(31.18)				45 J
* PROBABLE HYDROCARBON #7(32.08)			880 J	
* PROBABLE HYDROCARBON #8(32.08)				1100 J
* PROBABLE HYDROCARBON #8(34.74)			54 J	
* PROBABLE HYDROCARBON #9(34.76)				65 J
* PROBABLE HYDROCARBON #9(35.93)			78 JB	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR303015F / BR303015F / GRAB	BR303015G / LLL8265 / GRAB	BR303015H / LLL8265 / GRAB	BR303026F / BR303015F / GRAB	BR303026G / LLL8265 / GRAB	BR303026H / LLL8265 / GRAB
H-3				1100			-900
SR-TOT			1500			1400	
U-235		0.76			0		

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 303
LOCATION: SOUTHEAST CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR303037F / BR303015F / GRAB	BR303037G / LLL8265 / GRAB	BR303037H / LLL8265 / GRAB			
H-3				1000			
SR-TOT			1400				
U-235		0.72					

S&A REQUEST: 304
LOCATION: NORTH CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR304016C / BR303015C / GRAB	BR304016C / BR303015K / GRAB	BR304016D / BR303015D / GRAB	BR304027C / BR303015C / GRAB	BR304027C / BR303015K / GRAB	BR304027D / BR303015D / GRAB
ALUMINUM		7840			11900		
BARIUM		13 B			31 B		
BERYLLIUM		0.51 B			0.82 B		
CALCIUM		192 B			743 B		
CHROMIUM		7.2			16		
COBALT		2 B			5.4 B		
COPPER		6.1 B			42		
IRON		2500			54300		
LEAD		33 B			100 B		
MAGNESIUM		299 B			655 B		
MANGANESE		14			98		
MERCURY				0.13			0.06
NICKEL		6 B			17 B		
POTASSIUM			310 B			660 B	
SELENIUM		20 U			44 U		
SODIUM		128 B			319 B		
VANADIUM		18			66		
ZINC		34			85		

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR304038C / BR303015C / GRAB	BR304038C / BR303015K / GRAB	BR304038D / BR303015D / GRAB			
ALUMINUM		13600					
BARIUM		34 B					

DRAFT DO NOT CITE

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 304
LOCATION: NORTH CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: SDG NO: TYPE:	BR304038C BR303015C GRAB	BR304038C BR303015K GRAB	BR304038D BR303015D GRAB			
BERYLLIUM		1.1 B					
CALCIUM		1190 B					
CHROMIUM		16					
COBALT		2.1 B					
COPPER		19					
IRON		6660					
LEAD		150					
MAGNESIUM		880 B					
MANGANESE		84					
MERCURY				0.06			
NICKEL		11 B					
POTASSIUM			800 B				
SELENIUM		43 B					
SODIUM		313 B					
VANADIUM		52					
ZINC		78					

METALS, INCLUDING CR+6 (UG/G)	SAMP NO: SDG NO: TYPE:	BR304016E BR303015E GRAB	BR304027E BR303015E GRAB	BR304038E BR303015E GRAB			
URANIUM, TOTAL		4	4	4			

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO: SDG NO: TYPE:	BR304016B BR303015B GRAB	BR304027B BR303015B GRAB	BR304038B BR303015B GRAB			
4,4'-DDD		50	50	16 U			
4,4'-DDE		44	98	16 U			
4,4'-DDT		75	195	16 U			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: SDG NO: TYPE:	BR304016B BR303015B GRAB	BR304027B BR303015B GRAB	BR304038B BR303015B GRAB			
BENZO(A)PYRENE		570 U	53 J	460 U			
BENZOIC ACID		230 J	260 J	110 J			
BIS(2-ETHYLHEXYL)PHTHALATE		570 U	430 J	210 J			
BUTYLBENZYLPHTHALATE		570 U	40 J	19 J			

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 304
LOCATION: NORTH CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG) SAMP NO: / SDG NO: / TYPE:	BR304016B / BR303015B / GRAB	BR304027B / BR303015B / GRAB	BR304038B / BR303015B / GRAB
CHRYSENE	570 U	75 J	460 U
DI-N-BUTYLPHTHALATE	220 JB	180 JB	310 JB
DI-N-OCTYLPHTHALATE	16 JB	40 JB	16 JB
DIETHYLPHTHALATE	40 JB	59 JB	42 JB
FLUORANTHENE	570 U	150 J	22 J
ISOPHORONE	570 U	640 U	15 J
PHENANTHRENE	570 U	74 J	460 U
PYRENE	53 J	150 J	30 J
* ALIPHATIC HYDROCARBON(6.71)		910 JB	
* ALIPHATIC HYDROCARBON(6.72)	530 JB		
* ALIPHATIC HYDROCARBON(6.73)			320 JB
* ALIPHATIC HYDROCARBON(6.92)		1100 JB	400 JB
* ALIPHATIC HYDROCARBON(6.93)	680 JB		
* DIACETONE ALCOHOL(6.11)		6100 JAB	
* DIACETONE ALCOHOL(6.15)	2300 JAB		
* DIACETONE ALCOHOL(6.16)			1900 JAB
* DIOCTYL ADIPATE(31.20)	2300 JB	2600 JB	1900 JB
* POSS ALIPHATIC HYDROCAR(5.03)		1200 J	
* POSS ALIPHATIC HYDROCAR(32.40)		150 J	
* POSSIBLE KETONE(10.10)		1200 J	
* PROB ALDO-CONDENSATION (3.53)	800 JA		
* PROB ALDO-CONDENSATION (3.54)		1400 JA	
* PROB ALDO-CONDENSATION (4.96)		46000 JA	
* PROB ALDO-CONDENSATION (5.02)	22000 JA		
* PROB ALDOL-CONDENSATION(3.55)			560 JA
* PROB ALDOL-CONDENSATION(5.02)			14000 JA
* PROB ALIPHATIC HYDROCAR(37.50)		170 J	
* TRIMETHYLBENZENE(9.36)		480 J	
* UNKNOWN ALKYL/HYDROXYL (28.30)		100 J	
* UNKNOWN ALKYL/HYDROXYL (34.30)		220 J	
* UNKNOWN ALKYL/HYDROXYL (36.10)		150 J	
* UNKNOWN(3.68)		550 J	
* UNKNOWN(5.07)			430 J
* UNKNOWN(5.08)	650 J		
* UNKNOWN(8.96)			190 J
* UNKNOWN(10.10)	350 J		
* UNKNOWN(24.70)		650 J	
* UNKNOWN(25.00)		640 J	
* UNKNOWN(35.30)		100 J	
* UNKNOWN(39.00)		610 J	
* UNKNOWN(39.10)	280 J		
* UNKNOWN(42.70)		180 J	

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 304
LOCATION: NORTH CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR304016A / BR303015A / GRAB	BR304027A / BR303015A / GRAB	BR304038A / BR303015A / GRAB			
CARBON TETRACHLORIDE		53 U	62 U	3 J			
CHLOROFORM		41 JB	50 JB	43 JB			
ETHYLBENZENE		21 JB	22 JB	12 JB			
TETRACHLOROETHENE		53 U	62 U	12 J			
TOLUENE		30 JB	27 JB	10 JB			
XYLENE (TOTAL)		53 U	62 U	9 J			
2-BUTANONE		85 J	120 U	90 J			
* PROBABLE HYDROCARBON #1(23.60)		50 J					
* PROBABLE HYDROCARBON #1(23.61)				47 J			
* PROBABLE HYDROCARBON #1(26.71)			150 J				
* PROBABLE HYDROCARBON #1(34.75)		100 J					
* PROBABLE HYDROCARBON #1(35.94)		140 J					
* PROBABLE HYDROCARBON #2(26.55)		170 JB					
* PROBABLE HYDROCARBON #2(26.57)				170 JB			
* PROBABLE HYDROCARBON #2(29.37)			420 J				
* PROBABLE HYDROCARBON #3(28.36)				47 J			
* PROBABLE HYDROCARBON #3(28.37)		47 J					
* PROBABLE HYDROCARBON #3(30.86)			120 J				
* PROBABLE HYDROCARBON #4(29.29)		450 J					
* PROBABLE HYDROCARBON #4(29.30)				470 J			
* PROBABLE HYDROCARBON #4(31.09)			86 J				
* PROBABLE HYDROCARBON #5(30.89)		60 J					
* PROBABLE HYDROCARBON #5(31.03)				79 J			
* PROBABLE HYDROCARBON #5(31.23)			76 J				
* PROBABLE HYDROCARBON #6(31.18)				71 J			
* PROBABLE HYDROCARBON #6(32.15)			1300 J				
* PROBABLE HYDROCARBON #7(31.03)		140 J					
* PROBABLE HYDROCARBON #7(31.17)		110 J					
* PROBABLE HYDROCARBON #7(32.10)				1400 J			
* PROBABLE HYDROCARBON #7(34.59)			100 J				
* PROBABLE HYDROCARBON #8(34.74)				93 J			
* PROBABLE HYDROCARBON #8(35.98)			140 J				
* PROBABLE HYDROCARBON #9(34.57)		74 J					
* PROBABLE HYDROCARBON #9(35.94)				110 J			
* PROBABLE HYDROCRABON #8(32.09)		1400 J					

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR304016F / BR303015F / GRAB	BR304016G / LLL8266 / GRAB	BR304016H / LLL8266 / GRAB	BR304027F / BR303015F / GRAB	BR304027G / LLL8266 / GRAB	BR304027H / LLL8266 / GRAB
H-3				900			1500

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 304
LOCATION: NORTH CORNER OF PRIMARY POND
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR304016F / BR303015F / GRAB	BR304016G / LLL8266 / GRAB	BR304016H / LLL8266 / GRAB	BR304027F / BR303015F / GRAB	BR304027G / LLL8266 / GRAB	BR304027H / LLL8266 / GRAB
SR-TOT			350			160	
U-235		0.76			0.73		

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR304038F / BR303015F / GRAB	BR304038G / LLL8266 / GRAB	BR304038H / LLL8266 / GRAB			
H-3				-400			
SR-TOT			220				
U-235		0.72					

S&A REQUEST: 304
LOCATION: NORTH CORNER OF PRIMARY POND
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR304049F / BR300012G / RINSATE	BR304049G / BR500014G / RINSATE				
BARIUM		6.5 BE					
MERCURY			0.12 B				

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR304049A / BRN11016A / RINSATE					
ACETONE		12 B					
TOLUENE		2 JB					

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR304049K / LLL8266 / RINSATE					
H-3		-980					

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 304
LOCATION: NORTH CORNER OF PRIMARY POND
MEDIUM: SURFACE WATER

RADIOCHEMISTRY (PCI/L)		
SAMP NO:	BR304049I	BR304049J
SDG NO:	BR303015F	LLL8266
TYPE:	RINSATE	RINSATE
SR-TOT		0.3
U-235	0.35	

S&A REQUEST: 305
LOCATION: NORTHEAST OF "WOODED POND"
MEDIUM: SEDIMENT

FIELD MEASUREMENTS	
SAMP NO:	BR305017
FID/PID (PPM)	1.9

METALS, INCLUDING CR+6 (MG/KG)						
SAMP NO:	BR305017C	BR305017C	BR305017D	BR305028C	BR305028C	BR305028D
SDG NO:	BR303015C	BR303015K	BR303015D	BR303015C	BR303015K	BR303015D
TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM	6880			10100		
BARIUM	17 B			20 B		
BERYLLIUM	0.6 B			0.63 B		
CALCIUM	2260			348 B		
CHROMIUM	6.6			9.7		
COBALT	1.8 B			2.1 B		
COPPER	4.7 B			4.3 B		
IRON	4260			4130		
LEAD	16 B			19 B		
MAGNESIUM	743 B			766 B		
MANGANESE	50			31		
MERCURY			0.03 B			0.04 B
NICKEL	4.2 B			4.4 B		
POTASSIUM		350 B			400 B	
SELENIUM	15 B			16 B		
SODIUM	98 B			92 B		
VANADIUM	12 B			15		
ZINC	23			27		

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 305
LOCATION: NORTHEAST OF "WOODED POND"
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR305039C / BR303015C / GRAB	BR305039C / BR303015K / GRAB	BR305039D / BR303015D / GRAB			
ALUMINUM		7030					
BARIUM		16 B					
BERYLLIUM		0.52 B					
CALCIUM		264 B					
CHROMIUM		7					
COBALT		1.7 B					
COPPER		4.9 B					
IRON		4190					
LEAD		13 B					
MAGNESIUM		680 B					
MANGANESE		30					
MERCURY				0.03 B			
NICKEL		4.5 B					
POTASSIUM			370 B				
SELENIUM		14 U					
SODIUM		118 B					
VANADIUM		13					
ZINC		25					

METALS, INCLUDING CR+6 (UG/G)	SAMP NO: / SDG NO: / TYPE:	BR305017E / BR303015E / GRAB	BR305028E / BR303015E / GRAB	BR305039E / BR303015E / GRAB			
URANIUM, TOTAL		2	8	2			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR305017B / BR303015B / GRAB	BR305028B / BR303015B / GRAB	BR305039B / BR303015B / GRAB			
ACENAPHTHYLENE		12 J	490 U	49 J			
BENZO(A)ANTHRACENE		87 J	490 U	230 J			
BENZO(A)PYRENE		88 J	21 J	290 J			
BENZO(B)FLUORANTHENE		200 J	490 U	630			
BENZO(G,H,I)PERYLENE		81 J	490 U	210 J			
BENZOIC ACID		2300 U	36 J	2800 U			
BIS(2-ETHYLHEXYL)PHTHALATE		100 J	490 U	570 U			
CHRYSENE		120 J	29 J	300 J			
DI-N-BUTYLPHTHALATE		380 JB	99 JB	95 JB			
DIBENZ(A,H)ANTHRACENE		460 U	490 U	77 J			
DIETHYLPHTHALATE		55 JB	29 JB	40 JB			

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 305
LOCATION: NORTHEAST OF "WOODED POND"
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR305017B	BR305028B	BR305039B
	SDG NO:	BR303015B	BR303015B	BR303015B
	TYPE:	GRAB	GRAB	GRAB
FLUORANTHENE		150 J	43 J	390 J
INDENO(1,2,3-CD)PYRENE		91 J	490 U	260 J
PHENANTHRENE		35 J	490 U	110 J
PYRENE		140 J	41 J	380 J
* ALIPHATIC HYDROCARBON(6.71)				280 JB
* ALIPHATIC HYDROCARBON(6.72)		580 JB		
* ALIPHATIC HYDROCARBON(6.92)				370 JB
* ALIPHATIC HYDROCARBON(6.93)		730 JB		
* DIACETONE ALCOHOL(6.10)			2000 JAB	
* DIACETONE ALCOHOL(6.11)				2300 JAB
* DIACETONE ALCOHOL(6.12)		1800 JAB		
* DIOCTYL ADIPATE(31.20)		1800 JB	2000 JB	2300 JB
* POSS ALIPHATIC HYDROCAR(6.47)		180 J		
* POSSIBLE KETONE(10.10)				510 J
* PROB ALDO-CONDENSATION (3.52)		870 JA		
* PROB ALDO-CONDENSATION (5.01)		22000 JA		
* PROB ALDOL-CONDENSATION(3.57)			840 JA	
* PROB ALDOL-CONDENSATION(3.59)				920 JA
* PROB ALDOL-CONDENSATION(4.99)				22000 JA
* PROB ALDOL-CONDENSATION(5.00)			20000 JA	
* PROB ALIPHATIC HYDROCAR(35.90)				130 J
* PROB ALIPHATIC HYDROCAR(37.50)				92 J
* TRIMETHYLBENZENE(9.35)		190 J		
* UNKNOWN ALKYL/HYDROXYL (34.40)				110 J
* UNKNOWN(5.04)			400 J	
* UNKNOWN(5.05)				650 J
* UNKNOWN(6.54)		240 J		
* UNKNOWN(10.10)			390 J	
* UNKNOWN(11.30)			210 J	340 J

VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR305017A	BR305028A	BR305039A
	SDG NO:	BR303015A	BR305028A	BR305028A
	TYPE:	GRAB	GRAB	GRAB
CHLOROFORM		31 JB	23 JB	21 JB
ETHYLBENZENE		11 JB	46 U	45 U
TOLUENE		7 JB	14 J	15 J
* PROBABLE HYDROCARBON #1(22.33)			52 J	
* PROBABLE HYDROCARBON #1(26.57)		83 J		
* PROBABLE HYDROCARBON #1(26.77)				74 J
* PROBABLE HYDROCARBON #2(26.75)			170 J	

TABLE 4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 — DRAFT DO NOT CITE
SURFACE WATER RUNOFF FROM THE HAZARDOUS WASTE MANAGEMENT AREA (HWMA)

S&A REQUEST: 305
LOCATION: NORTHEAST OF "WOODED POND"
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR305017A / BR303015A / GRAB	BR305028A / BR305028A / GRAB	BR305039A / BR305028A / GRAB			
* PROBABLE HYDROCARBON #2(29.31)		230 J					
* PROBABLE HYDROCARBON #2(29.50)				220 J			
* PROBABLE HYDROCARBON #3(28.57)			45 J				
* PROBABLE HYDROCARBON #3(30.89)		68 J					
* PROBABLE HYDROCARBON #3(32.38)				540 J			
* PROBABLE HYDROCARBON #4(29.49)			500 J				
* PROBABLE HYDROCARBON #4(31.18)		57 J					
* PROBABLE HYDROCARBON #5(31.27)			75 J				
* PROBABLE HYDROCARBON #5(32.10)		520 J					
* PROBABLE HYDROCARBON #6(31.42)			100 J				
* PROBABLE HYDROCARBON #6(34.61)		42 J					
* PROBABLE HYDROCARBON #7(32.36)			1200 J				
* PROBABLE HYDROCARBON #7(35.94)		60 J					
* PROBABLE HYDROCARBON #8(35.10)			48 J				

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR305017F / BR303015F / GRAB	BR305017G / LLL8267 / GRAB	BR305017H / LLL8267 / GRAB	BR305028F / BR303015F / GRAB	BR305028G / LLL8267 / GRAB	BR305028H / LLL8267 / GRAB
H-3				-1500			-100
SR-TOT			70			81	
U-235		0			0.73		

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR305039F / BR303015F / GRAB	BR305039G / LLL8267 / GRAB	BR305039H / LLL8267 / GRAB			
H-3				-800			
SR-TOT			160				
U-235		0.73					

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4.8 Environmental Problem 2: Active Cesspools

Request Numbers: 306, 307, 308, 309, 310, 311, 312, 313, 314, and 315.

Requester: J. Boros.

Finding and Basis: Active cesspools from certain BNL operations may have been contaminating groundwater with organics, metals, or radionuclides. Historical data were very limited and contradictory. Although most remaining cesspools were scheduled for closure within the next few years, several operations continued to use cesspools. Machine shops, assembly buildings, and other buildings were not on the list of cesspool users slated to be connected to the Sewage Treatment Plant. At least seven cesspools that may have been potential sources of contamination have been identified, and others may exist. Little was known about the fate of contaminants released to these cesspools. They may have been contributing to the organic pollution detected in certain groundwater monitoring wells and to the metals content, especially iron, found in certain parts of the aquifer.

4.8.1 Sampling and Analysis Objectives

Statement: Water and sludge samples were to be collected to determine if contaminants listed in section 4.8.2.2 were present above analytical detection levels in the water and sludge phases of selected, active cesspools.

Supporting Information: Limited previous data from cesspool sampling showed the following:

Building 197	(component cleaning facility) - High trichloroethane 43,000 ppb)
Building 244	(paint/carpenter shop) - High trichloroethylene, iron, toxic metals
Building 422	(paint/carpenter shop) - High volatile organics
Building 914	[Alternating Gradient Synchrotron (AGS) beam component assembly] - High metals, toluene

On rare attempts to sample certain cesspools, dissimilar analytical results were obtained on samples split between BNL and Suffolk County. At Buildings 244 and 422, paired results for volatile organics differed by two orders of magnitude, with Suffolk County data citing the higher concentrations. Cesspools sampled were selected from three categories: active cesspools slated for closure in 1987 (Buildings 244 and 422); active cesspools slated for closure, but no definite date for closure (Buildings 197 and 905); and a cesspool for which no closure plans currently exist (Building 479).

4.8.2 Sampling and Analytical Design

4.8.2.1 Sampling Design

Request 306: Building 479 Cesspool (Fig. 4.2a). Three grab water samples (Sampling Method: Reference E4.2.3B and E4.2.4) were to be taken consecutively from the cesspool for Building 479. The cesspool was to be mixed to the extent possible before collecting these samples. However, this cesspool was filled in. With the concurrence of S. Barisas, in its place samples BR306018, BR306029, and BR306030, along with a QC field blank BR306041, were taken from the cesspool for Building 975. These water samples were collected before the sludge samples for Request 311.

The Sampling Team arrived at the site on 18APR88 at 1630. The weather was partly cloudy until just before the third sample (BR306030) was taken, then it began to rain. The temperature was 50°F, and a slight breeze was blowing from the northwest. The rainfall increased during the collection of QC field blank BR306041 at 1744. The temperature dropped to approximately 40°F. The samples were filled inside the van.

The lid for the cesspool was located approximately 75 ft south of Thomson Road and approximately 100 ft west of the driveway leading into the former bubble area waste site. The cesspool lid was also about 12 ft north of the fence that surrounds the waste site. The Sampling Team opened the cesspool lid, which was 6 in. in diameter and about 2 ft above ground level, and took a TIP reading (0 cpm).

The water level was approximately 14 ft from the cesspool lid, and the water appeared to be about 1 ft deep. Toilet paper was floating in the cesspool. Water could be heard running into the tank just before sample BR306030 was collected at 1730.

Sample BR306018, collected at 1643, was a slightly cloudy liquid with a strong odor and floating toilet paper. Waters taken for samples BR306029, collected at 1704, and BR306030, collected at 1730, had a slightly brown color and a strong odor.

Horiba readings were taken and recorded for each sample (Field Method: Reference E4.5 for pH, and temperature). Decontamination of all equipment was performed between each sampling. Sampling was completed at 1758.

Request 307: Building 244 Cesspool (Fig. 4.2b). Three grab water samples (Sampling Method: Reference E4.2.3B and E4.2.4) were to be collected from the cesspool for Building 244. Temperature and pH were to be taken for each sample (Field Method: Reference E4.5). However, upon inspection by the Sampling Team on 18APR88, it appeared that the cesspool had been decommissioned by removing its contents and filling it with sand. This was verified with BNL personnel, who stated that samples (probably water) were analyzed prior to dumping. During a phone conversation with J. Boros, it was decided to substitute the cesspool at Building 930A. On inspection of that cesspool, it was discovered to also be decommissioned. Request 307 was deleted with the concurrence of S. Barisas since Building 930A was primarily sanitary waste and would afford little information to the sampling effort.

Request 308: Building 422 Cesspool (Fig. 4.2c). Three grab water samples (Sampling Method: Reference E4.2.3B and E4.2.4) were to be collected consecutively from the cesspool for Building 422. These samples were to be collected before the sludge samples for Request 313 and after mixing the cesspool to the extent possible. The exact location of the cesspool was not certain, and the Sampling Team was to check with BNL Plant Engineering. If two cesspools in series served Building 422, samples were to be collected from the second tank only.

The Sampling Team arrived at the site on 18APR88 at 1025. The sky was overcast with light rain showers. The winds were calm and the temperature was 45^{O} to 50^{O}F.

Access to the cesspool was a 6-in. (15-cm) diameter port through a 2-m x 3-m cement cover. The depth was approximately 20 ft (6 m). The liquid in the cesspool was agitated at the beginning of the sampling. A RAD scan of the sample BR308010 collection area was 30 cpm. The TIP reading at the opening of the cesspool was 0.7 ppm. Sample BR308021 was black, sludge-like in consistency, and had a slight sulphur odor. There was a thin, greasy scum layer on the surface in the cesspool. The TIP reading was 0.7 ppm. The RAD scan indicated 40 cpm. The RAD scan for sample BR308032 was 40 cpm. The TIP reading at the cesspool opening was 0.1 ppm. QC rinsate BR308043 was collected at 1255. Horiba readings were taken and recorded for each sample (Field Method: Reference E4.5 for pH and temperature). Decontamination of all equipment was performed between each sampling. Sampling was began at 1100 and completed at 1310.

Request 309: Building 197 Cesspool (Fig. 4.2d). Three grab water samples (Sampling Method: Reference E4.2.3B and E4.2.4) were to be collected from the cesspool for Building 197. Measurements for temperature and pH were to be taken for each sample collected (Field Method: Reference E4.5). However, upon inspection by the Sampling Team on 18APR88, it was discovered to be decommissioned and filled with sand. BNL personnel indicated a sample was taken prior to closure (probably water) for analysis. During a phone conversation between S. Barisas and J. Boros (NWS), an alternative cesspool was suggested (Building 914 cesspool). During the Survey the year before, Building 914 cesspool could not be located. The day the Sampling Team was on-site, heavy equipment was moving earth in the area and BNL personnel did not know where the cesspool was located. Since the cesspool primarily received discharge from a washroom, it was decided to delete Request 309.

Request 310: Building 905 Cesspool (Fig. 4.2e). Three grab water samples (Sampling Method: Reference E4.2.3B and E4.2.4) were to be collected consecutively from the cesspool for Building 905. These samples were to be taken before the collection of sludge samples for Request 315. Two cesspools in series served Building 905, so samples were collected from the second tank.

The Sampling Team arrived at the site on 18APR88 at 1500. The sky was very cloudy with a light rain falling. The temperature was 45° to 50°F, and the winds were calm. The second cesspool, a concrete tank approximately 10 ft in diameter and 12 ft deep, contained mostly liquid. Access to the cesspool was a 6-in. (15-cm) diameter port through a 1-m x 1-m cement cover. The TIP reading was 0.1 ppm inside the tank. Samples BR310014, BR310025, and BR310036 were collected at this location.

Before the first samples were collected, the cesspool was agitated as well as could be reasonably expected. Depth to the liquid was 10 ft, with a water depth of approximately 4 in. There was a slight film on the surface of the water (possibly grease) of sample BR310014. Just before sampling was to begin for BR310036, water began running from the first basin into the sampling basin. The samples were cloudy and very light brown in color. Seven dips of the sampler were required to fill each set of bottles, with all of the volatiles being filled from the first sample collected with the dipper. The samples were collected between 1512 and 1555. Horiba readings were taken and recorded for each sample (Field Method: Reference E4.5 for pH and temperature). A RAD scan showed 40 cpm.

Request 311: Building 479 Cesspool (Fig. 4.2f). One grab sludge sample (Sampling Method: Reference "Method for Sludge/Sediment Sampling in Cesspools," BNL Sampling and Analysis Plan, Appendix E) was to be collected to the depth of the sludge from a selected area of the cesspool for Building 479 after water samples were taken for Request 306. However, the cesspool was filled in so Building 975 cesspool was sampled in its place. Water samples for Request 306 were taken from Building 975 cesspool the previous day.

The Sampling Team arrived on-site on 19APR88. The sky was overcast with high clouds. The temperature was 40°F and winds were calm. QC rinsate BR311026 was collected at 1415 at the loading area behind Building 975. The Team arrived at the sampling location at 1445. The cesspool was approximately 15 ft deep. The TIP measurement at the opening of the cesspool was 0.2 net counts. A RAD scan indicated 40 cpm. Small samples were collected using a stainless steel bucket rather than the TURCO Sampler because the sludge was only about 1 in. thick at the bottom of the cesspool.

The volatile sample for BR311015 was collected after six attempts with the TURCO sampler and two attempts with the bucket. It was soupy and black with a lot of gravel and rock. All remaining parameters were collected using the bucket dipper.

The sample material had a strong odor. Six dips were taken to fill all containers with a small amount of material. Volatile and semivolatile containers were completely filled; other containers were one-third filled.

Request 312: Building 244 Cesspool (Fig. 4.2g). Request 312 for sludge sampling at the Building 244 cesspool is a companion to Request 307 (water samples). This request was deleted for the reasons stated in Request 307.

Request 313: Building 422 Cesspool (Fig. 4.2h). One grab sludge sample (Sampling Method: Reference "Method for Sludge/Sediment Sampling in Cesspools," BNL Sampling and Analysis Plan, Appendix E) was to be collected to the depth of the sludge from a selected area of the cesspool for Building 422 after water samples were taken for Request 308. As the location of this cesspool was not certain, the Sampling Team was to check with BNL Plant Engineering. Access to the cesspool was to be through a 6-in. diameter port, and the depth of water was to be approximately 20 ft (6m).

The Sampling Team arrived on-site at 0950 on 19APR88. The sky was overcast with high clouds. The temperature was approximately $40^{O}F$, and the wind was 1 to 3 mph out of the northwest. A RAD scan of the area showed 50 cpm. The cesspool cover was lifted, and a TIP measurement of 0.0 ppm was taken at the opening.

The collection of sample BR31017 at 1020 produced a thick black sludge with a strong odor. Sample BR313017 was obtained in one dip at approximately 10 ft (bottom of the cesspool). Volatiles and semivolatiles were collected before mixing the sample. The remainder of the sludge was mixed and the other parameters were collected.

Request 314: Building 197 Cesspool (Fig. 4.2i). Request 314 for sludge sampling at Building 197 is a companion to Request 309 (water samples). This request was deleted for the same reasons stated in Request 309.

Request 315: Building 905 Cesspool (Fig. 4.2j). One grab sludge sample (Sampling Method: Reference "Method for Sludge/Sediment Sampling in Cesspools," BNL Sampling and Analysis Plan, Appendix E) was to be collected from a selected area of the cesspool for Building 905. Access to the cesspool was to be through a 6-in. (15-cm) diameter port. The sludge samples were collected to the depth of the sludge on the day after the water samples for Request 310 were collected.

The Sampling Team arrived at the site at 1305 on 19APR88. The sky was overcast with high clouds. The temperature was 40°F and the wind was calm. The top of the sludge was 7 1/2 ft below the access port; the bottom of the cesspool was at 8 ft. The sludge sample was obtained from the first tank because the second tank contained liquid only. The sludge was dark to light brown and very thick. The TIP measurement after the second dip was 1.9 ppm (net difference was 0.4 ppm). A RAD scan of the area showed 30 cpm. Volatiles were collected from the first dip; all remaining samples were collected from the second dip. The sludge had a very strong odor. Sample BR315019 was collected between 1315 and 1335.

4.8.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 2 were as follows:

Request 306: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, oil and grease, cyanide, and tritium. Field measurements for pH and sample temperature were taken.

Request 307: The parameters requested for analysis were volatiles, semivolatiles, ICP-metals, AA-mercury, oil and grease, cyanide, and tritium. Field measurements for pH and sample temperature were also requested. However, this request was deleted.

Request 308: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, oil and grease, cyanide, and tritium. Field measurements for pH and sample temperature were taken.

Request 309: The parameters requested for analysis were volatiles, semivolatiles, ICP-metals, AA-mercury, oil and grease, cyanide, and tritium. Field measurements for pH and sample temperature were also requested. However, this request was deleted.

Request 310: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, oil and grease, cyanide, and tritium. Field measurements for pH and sample temperature were requested.

Request 311: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, hydrocarbons, total uranium, total strontium, and gamma scan (cobalt-60). No field measurements were requested.

Request 312: The parameters requested for analysis were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, hydrocarbons, total uranium, total strontium, gamma scan (cobalt-60), and tritium. No field measurements were requested. This request was deleted.

Request 313: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, hydrocarbons, total uranium, total strontium, and gamma scan (cobalt-60). No field measurements were requested.

Request 314: The parameters requested for analysis were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, hydrocarbons, total uranium, total strontium, and gamma scan (cobalt-60). No field measurements were requested. This request was deleted.

Request 315: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, hydrocarbons, total uranium, total strontium, and gamma scan (cobalt-60). No field measurements were requested.

4.8.3 Field and Analytical Data

Field Data:

Request 306: *The field data are shown in Table 4.3.2. The pH and temperature measurements were made from the water phase of the cesspool from Building 975. The pH values were near neutral ranging from 6.7 to 6.9; the temperature ranged from 6.8^{o} to 7.1^{o}C. In addition, PID readings were taken prior to the first two samplings; in each case, the readings were 0 ppm. Radioactivity readings were 40 cpm.*

Request 308: *The field data are shown in Table 4.3.2. The pH of the three samples were 6.2, 6.4, and 7. The temperature of the water was 9.4^{o} and 9.5^{o}C for the first two samplings and 13^{o}C for the third. The third sampling increased in both pH and temperature. Radioactive scan showed the activity ranging from 30 to 40 cpm.*

Request 310: *The field data are shown in Table 4.3.2. The pH measurements were a constant 7.4 for all three samples. The temperature readings were 7.8^{o}, 7.1^{o}, and 8.8^{o}C. It may be noted that during the last sampling (T = 8.8^{o}C), liquid flowed from Tank 1 to the sampling tank (Tank 2). The radioactive scan showed 40 cpm during the sampling.*

Field Data Evaluation:

Request 306: The pH and temperature readings are reliable since the instrument was calibrated prior to taking the field measurements. No documentation of calibrations was noted regarding the PID and radioactivity readings; however, they were not requested in the plan.

Request 308: The pH and temperature readings are reliable since the instrument was calibrated prior to the field measurements. The radioactive scan should be viewed as a safety precaution in collecting the samples.

Request 310: The temperature and pH readings are reliable since the instrument was calibrated prior to taking the field measurements. The radioactive scan should be regarded as a radiological safety precaution; readings were not required.

Analytical Data:

Request 306:

Anions and cyanide. Analytical results for anions and cyanide are presented in Table 4.3.2. Request 306 contained cyanide below the detection limit of 2 ug/L.

Metals. Analytical results for metals in surface water are presented in Table 4.3.2. Of the 13 metals detected, the following four were below either the IDL or the CRDL: barium, beryllium, mercury, and vanadium. Of the remaining metals detected, copper ranged from 141 to 214 ug/L and zinc from 48 to 130 ug/L. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, and sodium.

Oil and grease. Analytical results for oil and grease are presented in Table 4.3.2. Note that two sample duplicates were analyzed for oil and grease from the cesspool for Building 975 which was substituted for Building 479. For two of the pairs (BR306018 and BR306029), the duplicates are reasonably close; the third sample (BR306030) shows the duplicate analysis to be different (144 and 8 mg/L).

Extractable organics. Analytical results for semivolatile organic compounds are presented in Table 4.3.2. There were 22, 23, and 25 compounds detected in these *three respective surface water samples. Phenol was identified in concentrations ranging from 0.011 to 0.018 mg/L, and 4-methylphenol was identified in concentrations from 0.270 to 0.390 mg/L. Organic sulfur was tentatively identified in estimated concentrations ranging from 0.008 to 0.260 mg/L in these three samples. No concentrations were measured or estimated to be greater than 1 mg/kg.*

Volatile organics. Analytical results for volatile organic compounds are presented in Table 4.3.2. There were three volatiles detected in one of these surface water samples and four volatiles detected in the remaining two samples for this request. Acetone was present in all three samples with measured concentrations of 0.018 mg/L or less. All other concentrations were below quantitation limits and were always estimated to be less than 0.010 mg/L. Methylene chloride and toluene were present in these samples and in the blank.

Radiochemistry. Samples for tritium were not collected.

Request 308:

Anions and cyanide. Analytical results for anions and cyanide are presented in Table 4.3.2. Samples from Request 308 showed cyanide concentrations 70 and 162 ug/L for two samples and cyanide concentrations below the detection level for the third sample.

Metals. Analytical results for metals in surface water are presented in Table 4.3.2. Of the 20 metals detected, 12 were found in all three samples at the following concentrations: antimony ranged from 535 to 1260 ug/L, barium from 1250 to 3260 ug/L, beryllium from 26 to 35 ug/L, cadmium from 1300 to 2820 ug/L, chromium from 18,100 to 50,300 ug/L, copper from 53,000 to 110,000 ug/L, lead from 55,700 to 113,000 ug/L, mercury from 0.44 to 1.8 ug/L, nickel from 24,100 to 46,900 ug/L, selenium from 425 to 537 ug/L, silver from 3340 to 3530 ug/L, and zinc from 191,000 to 357,000 ug/L. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium.

Oil and grease. Analytical results for oil and grease are presented in Table 4.3.2. The oil and grease analysis is from the cesspool of Building 422. The concentrations for the three samples are 8770, 10100, and 10900 mg/L. Field notes record that there was a thin, greasy scum layer on the surface.

Extractable organics. Analytical results for semivolatile organic compounds are presented in Table 4.3.2. There were 27, 28, and 32 volatile organic compounds detected in these three respective samples. Phenol was identified in samples BR308021 and BR308032 in concentrations of 0.074 and 0.066 mg/L, respectively. Some 4-methylphenol was identified in each of the samples in concentrations ranging from 0.094 to 0.830 mg/L. All volatile organic compounds had measured or estimated concentrations of 2.5 mg/kg or less.

Volatile organics. Analytical results for volatile organic compounds are presented in Table 4.3.2. There were 23 compounds detected in one sample, 28 in another, and 32 in the remaining surface water sample for this request. Benzene was identified in all three samples, but the highest measured or estimated concentration was 0.005 mg/L. Carbon disulfide was identified in all three samples, the highest measured or estimated concentration being 0.006 mg/L. Chlorobenzene was measured in all three samples, with the highest concentration being 0.019 mg/L. Chloroform was identified below the quantitation limit in two samples, with the highest estimated concentration being 0.002 mg/L. Methylene chloride was measured in all three samples and identified in the blank. Concentrations ranged from 0.260 to 11 mg/L in the samples. Toluene was measured in all samples and was also present in the blank. Concentrations ranged from 0.510 to 0.580 mg/L. There was some 1,1,1-trichloroethane measured in two samples in concentrations of 0.45 and 0.47 mg/L. Some 1,1,2-trichloroethane was measured in the same samples, but only in concentrations of 0.013 and 0.019 mg/L. Some 1,2-dichloroethane was measured in the same *samples, and detected below the quantitation limit in the other sample. The highest measured (or estimated) concentration was 0.120 mg/L. A compound tentatively identified as a freon was detected in one sample and in the rinsate, with the highest concentration (0.012 mg/L) in the rinsate. Several unknowns were detected in estimated concentrations that were always less than 0.100 mg/L.*

Radiochemistry. Samples for tritium were not collected.

Request 310:

Anions and cyanide. Analytical results for anions and cyanide are presented in Table 4.3.2. Request 310 contained cyanide below the detection limit of 2 ug/L.

Metals. Analytical results for metals in surface water are presented in Table 4.3.2. Of the 16 metals detected, the following six were below either the CRDL or the IDL in all three samples: barium, beryllium, cadmium, mercury, nickel, and vanadium. Of the remaining metals detected, chromium was found in one sample at 13 ug/L, copper ranged from 97 to 169 ug/L, and zinc ranged from 199 to 340 ug/L. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, and sodium.

Oil and grease. Analytical results for oil and grease are presented in Table 4.3.2. Concentrations in the cesspool from Building 905 were 25, 13, and 24 mg/L in the three samples. Field notes report that a slight film was present in sample BR310014 which contained 25 mg/L.

Extractable organics. Analytical results for semivolatile organic compounds are presented in Table 4.3.2. There were 24, 25, and 26 semivolatile organic compounds detected in these three respective surface water samples. Phenol was identified in all three samples in concentrations of 0.031 mg/L or less. Some 2-methylphenol and 4-methylphenol were also identified in these samples with all measured or estimated concentrations being below 0.100 mg/L. Measured or *estimated concentrations of semivolatile organic compounds detected were always less than 1 mg/L.*

Volatile organics. Analytical results for volatile organic compounds are presented in Table 4.3.2. There were five volatile organic compounds detected in one sample and six were detected in the other two surface water samples for this request. Acetone, methylene chloride, and toluene were detected in all samples and also in the blank. Methylene chloride was below detection limits and estimated at 0.002 mg/L in each sample. Toluene was measured in concentrations from 0.036 to 0.046 mg/L in these samples. Those were the highest concentrations of any compound detected except for acetone, which was measured as high as 0.250 mg/L.

Radiochemistry. Samples for tritium were not collected.

Request 311:

Metals. Analytical results for metals in sediment are presented in Table 4.3.2. Of the 17 metals detected, the following seven were below either the CRDL in the one sample collected: barium, beryllium, cobalt, lead, nickel, potassium, and sodium. Of the remaining metals detected, three were found at the following concentrations; chromium at 2.7 mg/kg, copper at 28 mg/kg, and zinc at 11 mg/kg. Uranium was detected at 5 ug/g. Other metals detected were aluminum, calcium, iron, magnesium, manganese, and vanadium.

Petroleum hydrocarbons. Analytical results for petroleum hydrocarbons are presented in Table 4.3.2. The field sampling team experienced difficulty in recovering sludge samples for this request because the sludge was only 1 in. thick. The analysis shows the concentration to be 190 mg/kg; the lowest of the three cesspools sampled.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Analytical results for semivolatile organic compounds are presented in Table 4.3.2. There were 29 volatile organic compounds identified in this sediment sample. None were identified in measurable quantities. Phenol was estimated at 0.030 mg/kg, and 4-methylphenol was estimated at 0.270 mg/kg. Five tentatively identified compounds had estimated concentrations exceeding 1 mg/kg, and one of these (tentatively, diacetone alcohol) had an estimated concentration of over 10 mg/kg.

Volatile organics. There were four volatile compounds detected in this sediment sample. Chloroform was present below the quantitation limit, but was estimated at 0.033 mg/kg. Methylene chloride was present below the quantitation limit, but was estimated at 0.030 mg/kg. Chloroform and methylene chloride were also present in the blank. Toluene was present in the sample, but not in the blank. It was below the quantitation limit in the sample, but was estimated at 0.017 mg/kg.

Radiochemistry. No detectable activity was found in the cesspool for Building 975.

Request 313:

Metals. Analytical results for metals in sediment are presented in Table 4.3.2. Of the 22 metals detected, the following seven were below the CRDL in the one sample collected: beryllium, cobalt, magnesium, potassium, selenium, sodium, and vanadium. Of the remaining metals detected, ten were found at the following concentrations: antimony at 62 mg/kg, barium at 5680 mg/kg, cadmium at 30 mg/kg, chromium at 84 mg/kg, copper at 858 mg/kg, lead at 1180 mg/kg, mercury at 5.7 mg/kg, nickel at 49 mg/kg, silver at 16 mg/kg, and zinc at 10,900 mg/kg. Uranium was detected at 2 ug/g. Other metals detected were aluminum, calcium, iron, and manganese.

Petroleum hydrocarbons. Analytical results for petroleum hydrocarbons are presented in Table 4.3.2. This sample posed no special problems in sampling as in Request 311. The thick black sludge contained 19500 mg/kg of the hydrocarbon.

PCBs and other extractables. Aroclor-1254 was measured at 78 mg/kg in the sediment sample for Request 313.

Extractable organics. Analytical results for semivolatile organic compounds are presented in Table 4.3.2. There were 55 compounds identified in this sediment sample. Phenol had a concentration of 8.6 mg/kg, and 1,4-dichlorobenzene had a concentration of 11 mg/kg. Several other compounds were present in concentrations measured or estimated to be greater than 10 mg/kg, and compounds tentatively identified as alkoxy/hydroxy/alkyls had concentrations estimated at 398 and 1900 mg/kg.

Volatile organics. There were 21 volatile organic compounds detected in this sediment sample. Benzene was below the quantitation limit, but estimated to be 0.120 mg/kg. Carbon disulfide was measured at 2.1 mg/kg. Chlorobenzene was measured at 2 mg/kg. Methylene chloride was beyond the calibration range, but was estimated at 670 mg/kg. Toluene was also beyond the calibration range, but was estimated at 230 mg/kg. Some 1,2-dichloroethane was also identified in concentration beyond the calibration range, but was estimated at 12 mg/kg. There were five TICs detected, with estimated concentrations always less than 0.50 mg/kg. In this sample, there were nine compounds in concentrations beyond the calibration range.

Radiochemistry. Analytical results are presented in Table 4.3.1. The sediment sample taken at Building 422 cesspool contained cesium-137 (79 pCi/kg), total strontium (80 pCi/kg), and potassium-40 (3500 pCi/kg).

Request 315:

<u>Metals</u>. Analytical results for metals in sediment are presented in Table 4.3.2. Of the 21 metals detected, the following seven were below the CRDL in the one sample collected: antimony, beryllium, cobalt, magnesium, potassium, sodium, and vanadium. Of the remaining metals detected, nine were found at the following concentrations: barium at 207 mg/kg, cadmium at 28 mg/kg, chromium at 34 mg/kg, copper at 3300 mg/kg, lead at 546 mg/kg, mercury at 2.9 mg/kg, nickel at 40 mg/kg, silver at 23 mg/kg, and zinc at 2770 mg/kg. Uranium was detected at 15 ug/g. Other metals detected were aluminum, calcium, iron and manganese.

<u>Petroleum hydrocarbons</u>. Analytical results for petroleum hydrocarbons are presented in Table 4.3.2. The sample was taken from the first tank (settling) since the second tank contained only the liquid phase (overflow). The concentration was the highest of the three cesspools sampled at 35000 mg/kg.

<u>PCBs and other extractables</u>. Aroclor-1254 was measured at 4.8 mg/kg in the sediment sample for Request 315.

<u>Extractable organics</u>. Analytical results for semivolatile organic compounds are presented in Table 4.3.2. There were 47 semivolatile organic compounds detected in this sediment sample. Phenol was present in concentration of 5.7 mg/kg. Several compounds were identified in concentrations between 1 and 10 mg/kg. The 4-methylphenol was estimated at 100 mg/kg, but was outside the calibration range of the instrument. A tentatively identified alkoxy/hydroxy/alkyl had an estimated concentration of 6,200 mg/kg. Several other unknowns had estimated concentrations between 10 and 1000 mg/kg.

<u>Volatile organics</u>. There were 11 volatile compounds detected in this sediment sample. Chloroform, methylene chloride, toluene, and xylene were present in the sample and in the blank. The following concentrations were measured:

Chloroform (0.075 mg/kg); Ethylbenzene (2.2 mg/kg); xylene (0.75 mg/kg); 1,1,1-trichloroethane (0.53 mg/kg). Methylene chloride concentration was beyond the calibration range, but was estimated at 10 mg/kg. Concentrations of tetrachloroethene, toluene, and trichloroethene were all beyond calibration range, but were all estimated to be more than 100 mg/kg. A probable freon was tentatively identified in estimated concentration of 0.92 mg/kg

Radiochemistry. Analytical results are presented in Table 4.3.1. The sediment sample taken at Building 905 cesspool contained cesium-137 (65 pCi/kg), total strontium (50 pCi/kg), and potassium-40 (2200 pCi/kg).

Analytical Data Evaluation:

Request 306:

Anions and cyanide. Spike recoveries used in the samples for this request were all out of control. For samples included in SDG No. BR306018, the results are biased low; and the lack of hits may be reflecting the low recovery of 41% of the spike. For samples from SDG No. BR308010, the recoveries may be high. All holding times were met and the instrument calibrated with results in compliance. Results of three sample duplicates were in control (+- 20% RPD).

Metals. Two metals of interest (copper and zinc) were detected above the IDL and the CRDL for this request.

Oil and grease. Holding times were exceeded and method duplicates were not analyzed for SDG No. BR306018, which included analysis for Request 306, 308, and 310. The EPA quality control solution was analyzed with this SDG for calibration.

Extractable organics. Phenol and 4-methylphenol were identified in all samples. No concentrations of any semivolatile organic compound were measured or estimated to be greater than 1 mg/kg.

Volatile organics. Acetone was present in all three samples. All other compounds detected had concentrations that were below quantitation limits and were always estimated to be less than 0.010 mg/L. Methylene chloride and toluene were present in these samples and in the blank.

Request 308:

Anions and cyanide. Spike recoveries used in the samples for this request were all out of control. For samples from SDG No. BR308010, the recoveries may be high; in samples BR308010 and BR308032, spike recoveries were 354 and 305% respectively. The latter two samples were described as being sludge-like and inhomogeneous in nature. All holding times were met and the instrument calibrated with results in compliance. Results of three sample duplicates were in control (+- 20% RPD).

Metals. Twelve metals of interest were detected above the IDL and the CRDL for this request: antimony, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc.

Oil and grease. Holding times were exceeded and method duplicates were not analyzed for SDG No. BR306018, which included analysis for Request 306, 308, and 310. The EPA quality control solution was analyzed with this SDG for calibration.

Extractable organics. Phenol was identified in two samples. Some 4-methylphenol was identified in each of the samples. All volatile organic compounds had measured or estimated concentrations of 2.5 mg/kg or less.

Volatile organics. Benzene, carbon disulfide, and chlorobenzene were identified in all three samples. Chloroform was identified below the quantitation limit in two samples. Methylene chloride and toluene were measured in all three samples and identified in the blank. There was some 1,1,1-trichloroethane measured in two samples, and 1,1,2-trichloroethane was measured in the same samples. Some 1,2-dichloroethane was also measured in those two samples, but detected below the quantitation limit in the other sample. A compound tentatively identified as a freon was detected in one sample and in the rinsate with the highest concentration (0.012 mg/L) in the rinsate. Several unknowns were detected in estimated concentrations that were always less than 0.100 mg/L.

Request 310:

Anions and cyanide. Spike recoveries used in the sample for this request were all out of control. For samples included in SDG No. BR306018, the results are biased low; and the lack of hits may be reflecting the low recovery of 41% of the spike. For samples from SDG No. BR308010, the recoveries may be high; in samples BR308010 and BR308032, spike recoveries were 354 and 305% respectively. The latter two samples were described as being sludge-like and inhomogeneous in nature. All holding times were met and the instrument calibrated with results in compliance. Results of three sample duplicates were in control (+- 20% RPD).

Metals. Three metals of interest (chromium, copper, and zinc) were detected above the IDL and the CRDL for this request.

Oil and grease. Holding times were exceeded and method duplicates were not analyzed for SDG No. BR306018, which included analysis for Request 306, 308, and 310. The EPA quality control solution was analyzed with this SDG for calibration.

Extractable organics. Phenol was identified in all three samples, and 2-methylphenol and 4-methylphenol were also identified in these samples, with all measured or estimated concentrations being below 0.100 mg/L. Measured or estimated concentrations of semivolatile organic compounds detected were always less than 1 mg/L.

Volatile organics. Acetone, methylene chloride, and toluene were detected in all samples and also in the blank. Methylene chloride concentration was below detection limits.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable. One rinsate sample (BR311026) was taken at the Building 975 cesspool.

Request 311:

Metals. Three metals of interest (chromium, copper, and zinc) were detected above the IDL and the CRDL for this request.

Uranium analyses of sludges from the cesspools were in compliance regarding preparation blanks, calibration verification, and spike recovery. The duplicate was in compliance and all holding times were met.

Petroleum hydrocarbons. Due to the small number of samples, calibration verification and spike analysis were not performed; and duplicates were not analyzed. Holding time was exceeded in the three samples.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. No semivolatile organic compounds were identified in measurable quantities. Of the five phthalates identified, four were also present in the blank. Phenol and 4-methylphenol were identified, but estimated concentrations were below 0.3 mg/kg. Five tentatively identified compounds had estimated concentrations exceeding 1 mg/kg, and one of these (tentatively, diacetone alcohol) had an estimated concentration of over 10 mg/kg.

Volatile organics. Chloroform and methylene were present below the quantitation limit and were also present in the blank. Toluene was present, below the quantitation limit in the sample, but was not detected in the blank.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 313:

Metals. Ten metals of interest (antimony, barium, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc) were detected above the IDL and the CRDL for this request.

Uranium analyses of sludges from the cesspools were in compliance regarding preparation blanks, calibration verification, and spike recovery. The duplicate was in compliance and all holding times were met.

Petroleum hydrocarbons. Due to the small number of samples, calibration verification and spike analysis were not performed; and duplicates were not analyzed. Holding time was exceeded in the three samples.

PCBs and other extractables. Aroclor-1254 was present in measurable quantities in the sediment sample for this request. No other pesticides/PCBs were detected.

<u>Extractable organics</u>. Phenol had a concentration of 8.6 mg/kg, and 1,4-dichlorobenzene had a concentration of 11 mg/kg. Several other compounds were present in concentrations measured or estimated to be greater than 10 mg/kg, and compounds tentatively identified as alkoxy/hydroxy/alkyls had concentrations estimated at 398 and 1900 mg/kg. Several compounds detected in the sample were also in the blank.

<u>Volatile organics</u>. Benzene was present below the quantitation limit. Carbon disulfide and chlorobenzene were measured at 2.1 and 2 mg/kg, respectively. Methylene chloride was beyond the calibration range, but was estimated at 670 mg/kg. Toluene was also beyond the calibration range, but was estimated at 230 mg/kg. Some 1,2-dichloroethane was also identified in concentration beyond the calibration range, but was estimated at 12 mg/kg. TICs detected had estimated concentrations always less than 0.50 mg/kg.

<u>Radiochemistry</u>. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 315:

<u>Metals</u>. Nine metals of interest (barium, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc) were detected above the IDL and the CRDL for this request.

Uranium analyses of sludges from the cesspools were in compliance regarding preparation blanks, calibration verification, and spike recovery. The duplicate was in compliance and all holding times were met.

Petroleum hydrocarbons. Due to the small number of samples, calibration verification and spike analysis were not performed; and duplicates were not analyzed. Holding time was exceeded in the three samples.

PCBs and other extractables. Aroclor-1254 was present in measurable quantities in the sediment sample for this request. No other pesticides/PCBs were detected.

Extractable organics. Phenol was present in concentration of 5.7 mg/kg. Several compounds were identified in concentrations between 1 and 10 mg/kg. The 4-methylphenol was estimated at 100 mg/kg, but was outside the calibration range of the instrument. A tentatively identified alkoxy/hydroxy/alkyl had an estimated concentration of 6,200 mg/kg. Several other unknowns had estimated concentrations between 10 and 1000 mg/kg. Five compounds were present in the sample and also in the blank.

Volatile organics. Chloroform, methylene chloride, toluene, and xylene were present in the sample and in the blank. Methylene chloride concentration was beyond the calibration range, but was estimated at 10 mg/kg. Concentrations of tetrachloroethene, toluene, and trichloroethene were all beyond calibration range, but were all estimated to be more than 100 mg/kg. A probable freon was tentatively identified in estimated concentration of 0.92 mg/kg.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.8.4 Limitations and Qualifications:

Data Quality Level:

Request 306: The sampling plan is rated Quality Level I, and field sampling is rated Quality Level II. The overall analytical data is Quality Level II.

Request 307: No data quality level can be assigned since the cesspool was closed after the initial plan was made.

Request 308: The sampling plan is rated Quality Level I, and field sampling is rated Quality Level II. The overall analytical data is Quality Level II.

Request 309: No data quality level can be assigned since the cesspool was closed after the initial plan was made.

Request 310: The sampling plan is rated Quality Level I, and field sampling is rated Quality Level II. The overall analytical data is Quality Level II.

Request 311: The sampling plan and field sampling are rated Quality Level I; the Field Sampling Team did its best to collect the sludge sample, which was only 1 in. thick on the bottom. The overall analytical rating is Quality Level I.

Request 312: No data quality can be assigned since the cesspool was closed.

Request 313: The sampling plan and field sampling are rated Quality Level I. The overall analytical rating is Quality Level I.

Request 314: No data quality can be assigned since the cesspool was closed.

Request 315: The sampling plan and field sampling quality levels are rated Quality Level I. The overall analytical quality rating is Quality Level I.

Field Data:

Request 306: Field sampling was rated Quality Level II because no samples for tritium analysis were taken.

Request 307: No data quality level can be assigned since the cesspool was closed after the initial plan was made.

Request 308: Field sampling was rated Quality Level II because no samples for tritium analysis were taken.

Request 309: No data quality level can be assigned since the cesspool was closed after the initial plan was made.

Request 310: Field sampling was rated Quality Level II because no samples for tritium analysis were taken.

Analytical Data:

Request 306:

Anions and cyanide. Data are Quality Level III. No anions were analyzed. For the cyanide, poor spike recoveries were obtained and no duplicate or laboratory control samples were analyzed.

Metals. Analytical results for sample BR306041 are Quality Level I, except for sodium at Quality Level II, and arsenic, beryllium, and zinc which are Quality Level III. The 10% criteria for the serial dilution result was not met for sodium. Arsenic had poor spike recovery results, beryllium was present in the calibration blank at greater than two times the IDL, and zinc was present in the calibration blank at a level greater than the CRDL. For the remaining samples, results are

Quality Level I with the following exceptions: aluminum and sodium are Quality Level II, and arsenic, beryllium, and zinc are Quality Level III. Results for aluminum exceed the control limits for a calibration verification standard and the interference control standard. The 10% criteria for the serial dilution result was not met for sodium. Arsenic had poor spike recovery results, beryllium was present in the calibration blank at greater than two times the IDL, and zinc was present in the calibration blank at a level greater than the CRDL.

Oil and grease. Data are Quality Level II because no duplicates were analyzed.

Extractable organics. Data are Quality Level II because extraction holding times were exceeded by one to three days.

Volatile organics. Data are Quality Level I.

Radiochemistry. No quality level is assigned because no samples were taken.

Request 308:

Anions and cyanide. Data are Quality Level III. No anions were analyzed. For the cyanide, poor spike recoveries were obtained and no duplicate or laboratory control samples were analyzed.

Metals. Analytical results for sample BR308043 are Quality Level I with the following exceptions: iron is Quality Level II, and arsenic and sodium are Quality Level III. Iron exceeded the control limit for the calibration verification standard. Arsenic is due to poor spike recovery and sodium fell below the control limit for the calibration verification standard. For the remaining samples, results are Quality Level I with the following exceptions: chromium, iron, and lead are Quality Level II, and arsenic and sodium are Quality Level III. Chromium and lead results exceeded the control limits in the interference checks standard. Iron exceeded the control limit for the calibration verification standard. Arsenic is due to poor spike recovery and sodium fell below the control limit for the calibration verification standard.

Oil and grease. Data are Quality Level II because no duplicate samples were analyzed.

Extractable organics. Data are Quality Level II because extraction holding times were exceeded by one day.

Volatile organics. Data are Quality Level I.

Radiochemistry. No quality level is assigned because no samples were taken.

Request 310:

Anions and cyanide. Data are Quality Level III.

Metals. Analytical results for sample BR310014 are Quality Level I with the following exceptions: aluminum and sodium are Quality Level II, and arsenic, beryllium, and zinc are Quality Level III. Results for aluminum exceed the control limits for a calibration verification standard and the interference control standard. The 10% criteria for the serial dilution result was not met for sodium. Arsenic had poor spike recovery results, beryllium was present in the calibration blank at greater than two times the IDL, and zinc was present in the calibration blank at a level greater than the CRDL. For samples BR310025 and BR310036, results are Quality Level I with the following exceptions: aluminum and sodium are Quality Level II, and arsenic is Quality Level III for the same reasons stated above. For sample BR310036, beryllium is also Quality Level III for the same reasons stated above.

Oil and grease. Data are Quality Level II because no duplicate samples were analyzed.

Extractable organics. Data are Quality Level II because extraction holding times were exceeded by one day.

Volatile organics. Data are Quality Level I.

Radiochemistry. No quality level is assigned because no samples were taken.

Request 311:

Metals. Analytical results are Quality Level I with the following exceptions: aluminum and antimony are Quality Level II, and arsenic and beryllium are Quality Level III. Antimony was recovered below the control limit for spike sample analyses and aluminum exceeded the control limits for the calibration verification results and fell below the control limit for the interference check standard. Arsenic had poor spike recovery results and beryllium was recovered above the control limit in laboratory control standard.

The uranium data for the sludge samples analyzed under SDG BR303015 are Quality Level I, which includes Request 311, 313, and 315. Preparation blanks, calibration verification, spike recoveries, and duplicate analysis were all in compliance. Holding times were met.

Petroleum hydrocarbons. Due to the small number of samples, quality control measures were not implemented. The data are Quality Level III for the three samples analyzed.

PCBs and other extractables. No PCBs/Pesticides were detected. The Quality Level was I for all QC results.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 313:

Metals. Analytical results were Quality Level II, except for beryllium at Quality Level III. All elements are Quality Level II because a spiked sample was not analyzed. Beryllium values exceeded the control limit in the solid laboratory control standard.

The uranium data for the sludge samples analyzed under SDG BR303015 are Quality Level I, which includes Request 311, 313, and 315. Preparation blanks, calibration verification, spike recoveries, and duplicate analysis were all in compliance. Holding times were met.

Petroleum hydrocarbons. Due to the small number of samples, quality control measures were not implemented. The data are Quality Level III for the three samples analyzed.

PCBs and other extractables. Data were of Quality Level II primarily due to poor spike recoveries.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 315:

Metals. Analytical results are Quality Level I with the following exceptions: antimony is Quality Level II, and arsenic and beryllium are Quality Level III. Antimony and arsenic spike recovery fell below the control limit. Beryllium exceeded the control limit for the laboratory control standard.

The uranium data for the sludge samples analyzed under SDG BR303015 are Quality Level I, which includes Request 311, 313, and 315. Preparation blanks, calibration verification, spike recoveries, and duplicate analysis were all in compliance. Holding times were met.

Petroleum hydrocarbons. Due to the small number of samples, quality control measures were not implemented. The data are Quality Level III for the three samples analyzed.

PCBs and other extractables. Data were of Quality Level II primarily due to poor spike recoveries.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 2
Request Number: 306

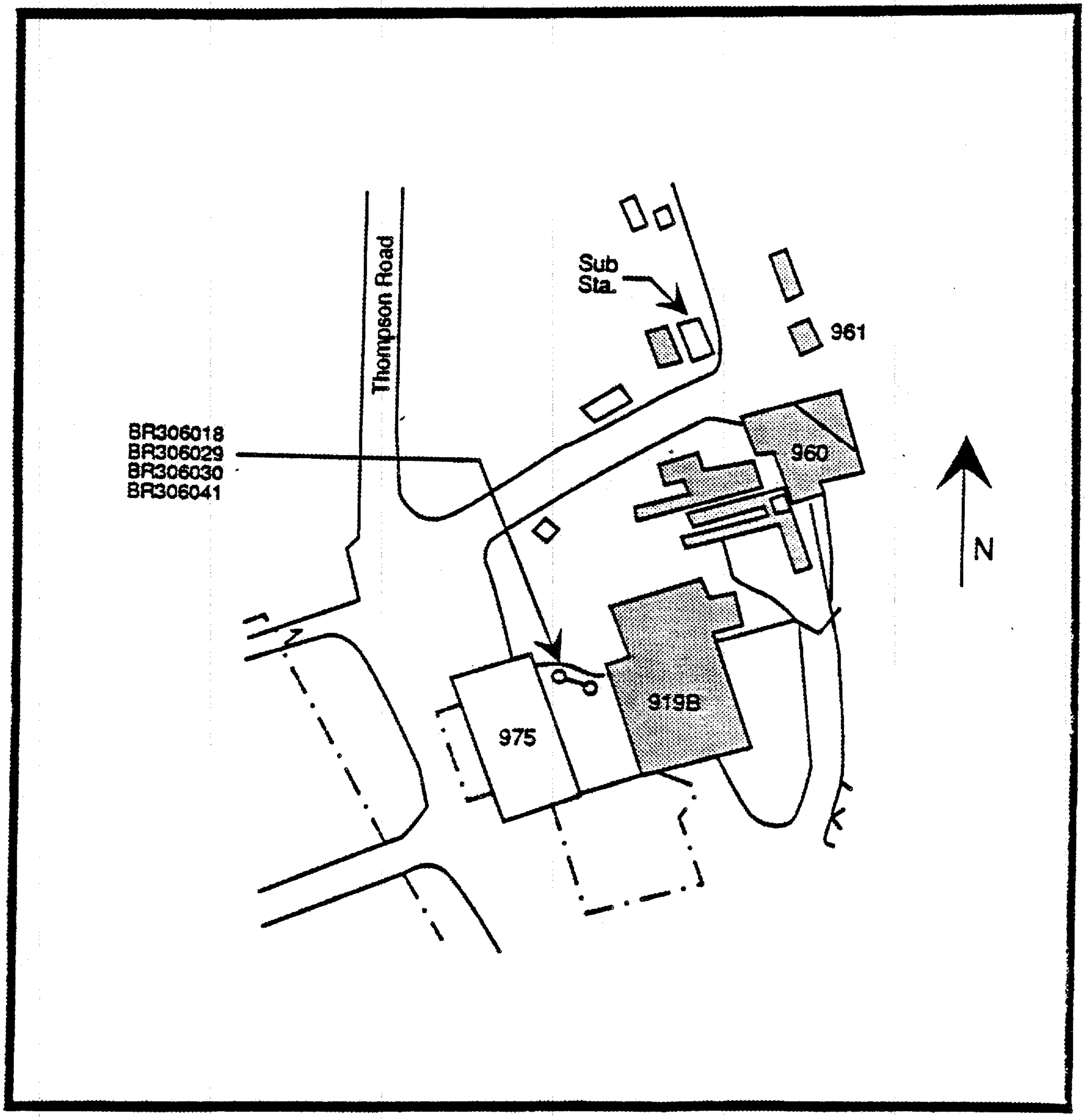

Figure 4.2a. Building 975 Cesspool Replacing Building 479 Cesspool (Request 306)

Environmental Problem: 2
Request Number: 307

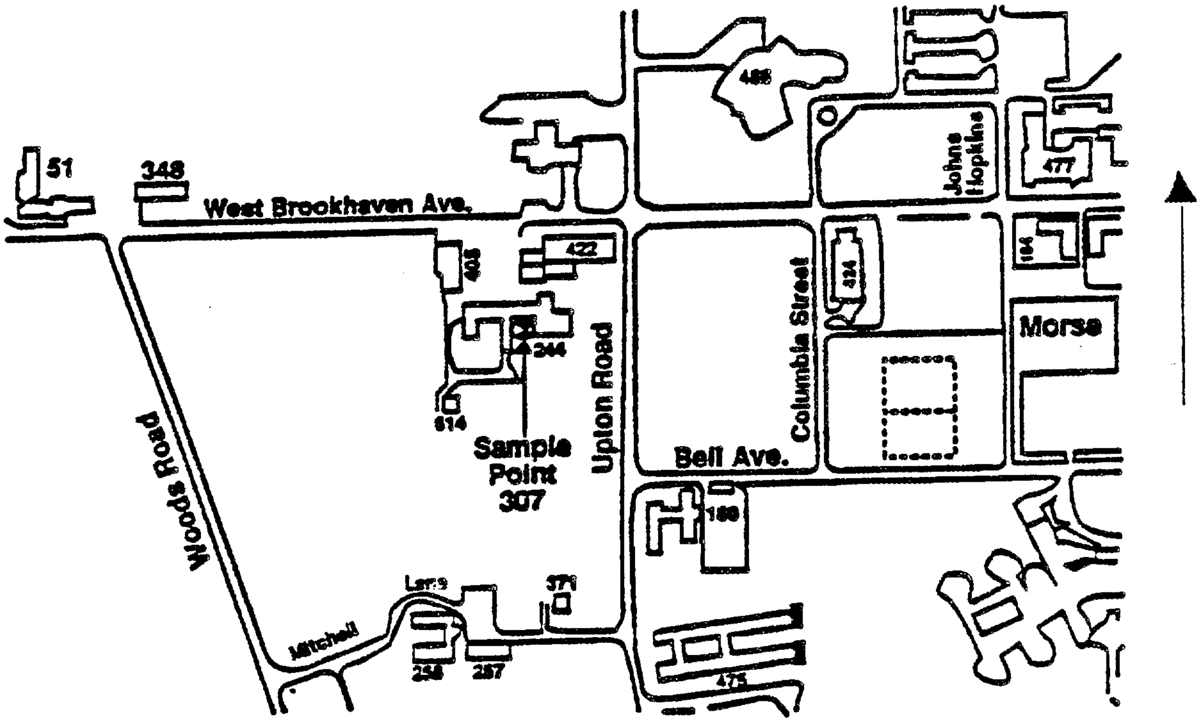

Figure 4.2b. Building 244 Cesspool (Request 307 was deleted)

Environmental Problem: 2
Request Number: 308

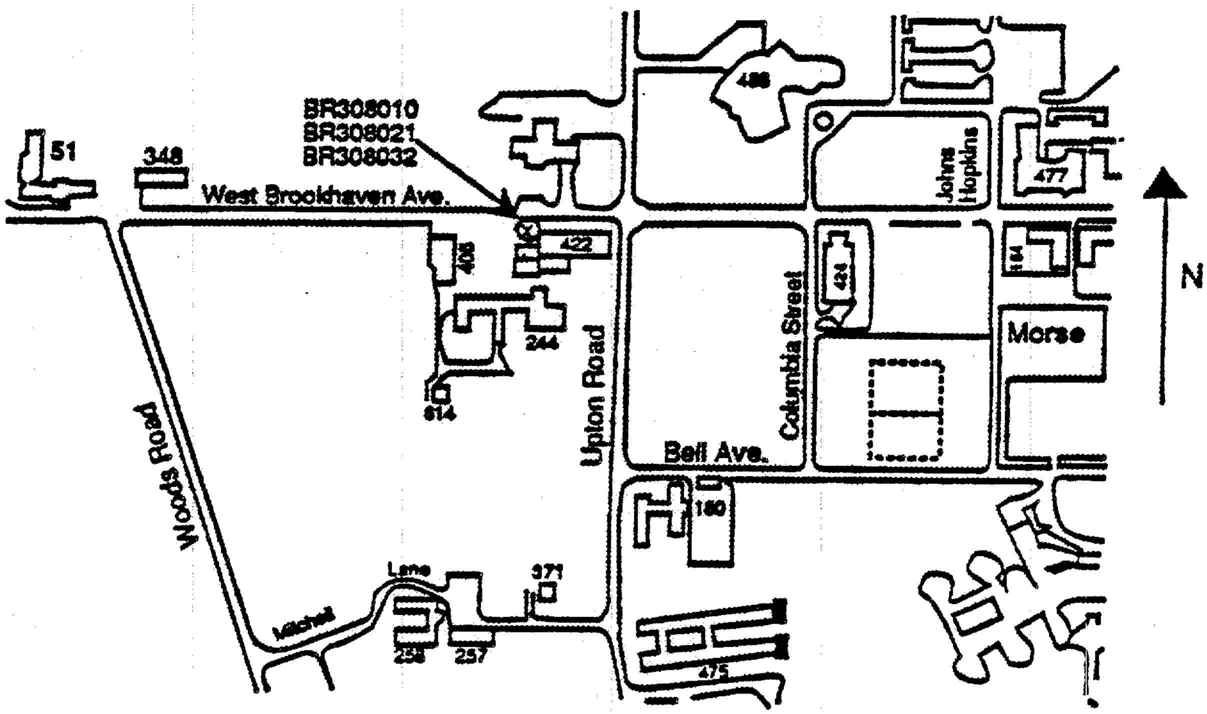

Figure 4.2c. Building 422 Cesspool (Request 308)

Environmental Problem: 2
Request Number: 309

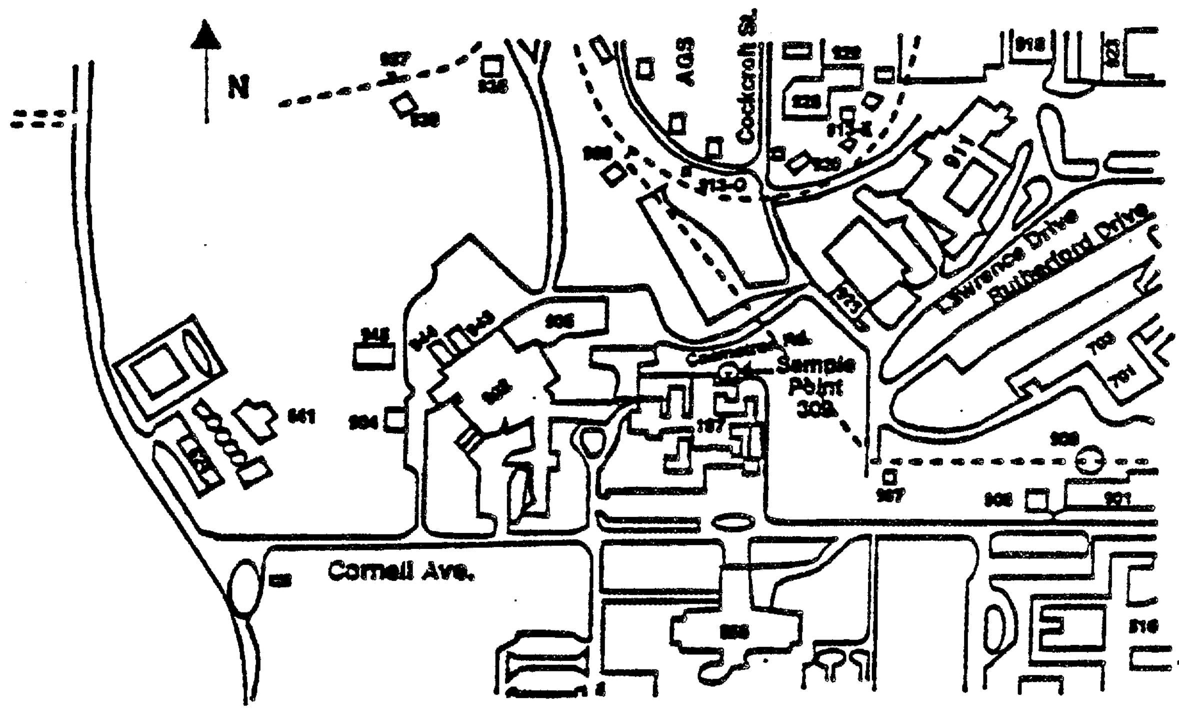

Figure 4.2d. Building 197 Cesspool (Request 309 was deleted)

Environmental Problem: 2
Request Number: 310

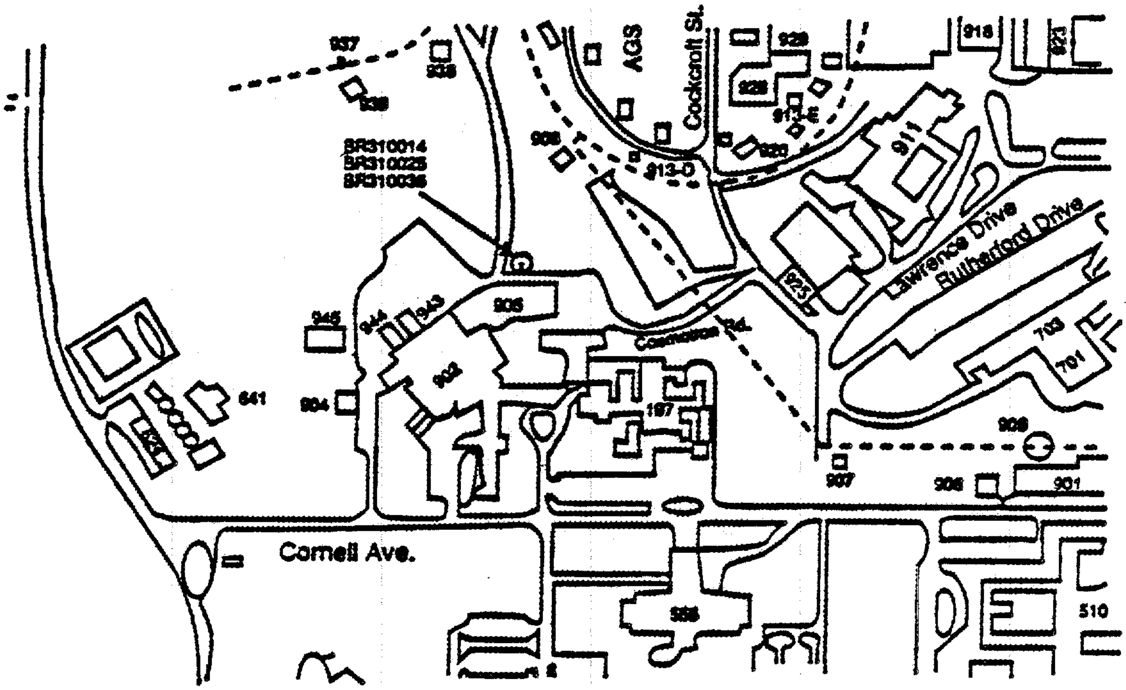

Figure 4.2e. Building 905 Cesspool (Request 310)

Environmental Problem: 2
Request Number: 311

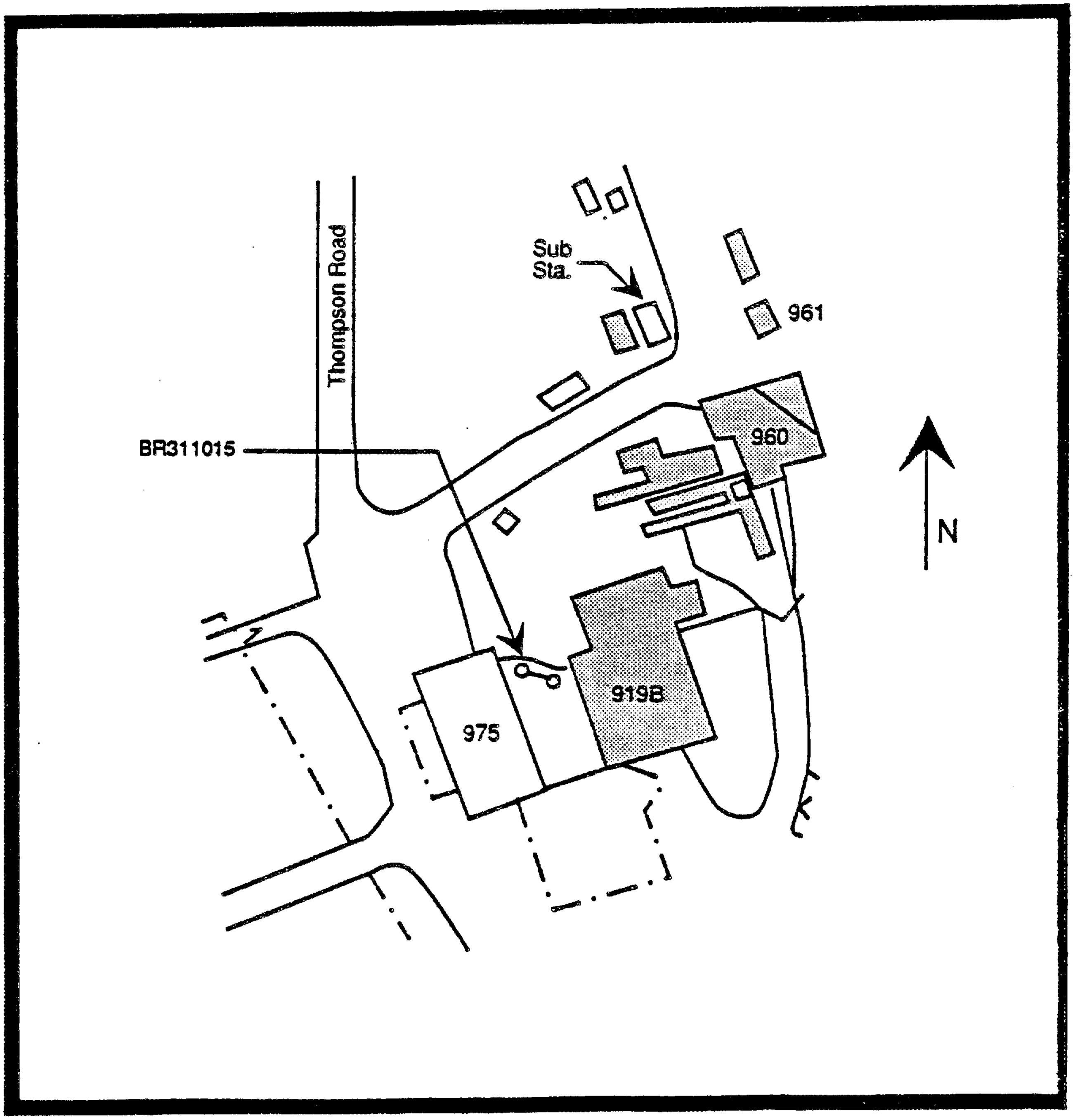

Figure 4.2f. Building 975 Cesspool Replacing Building 479 Cesspool (Request 311)

Environmental Problem: 2
Request Number: 312

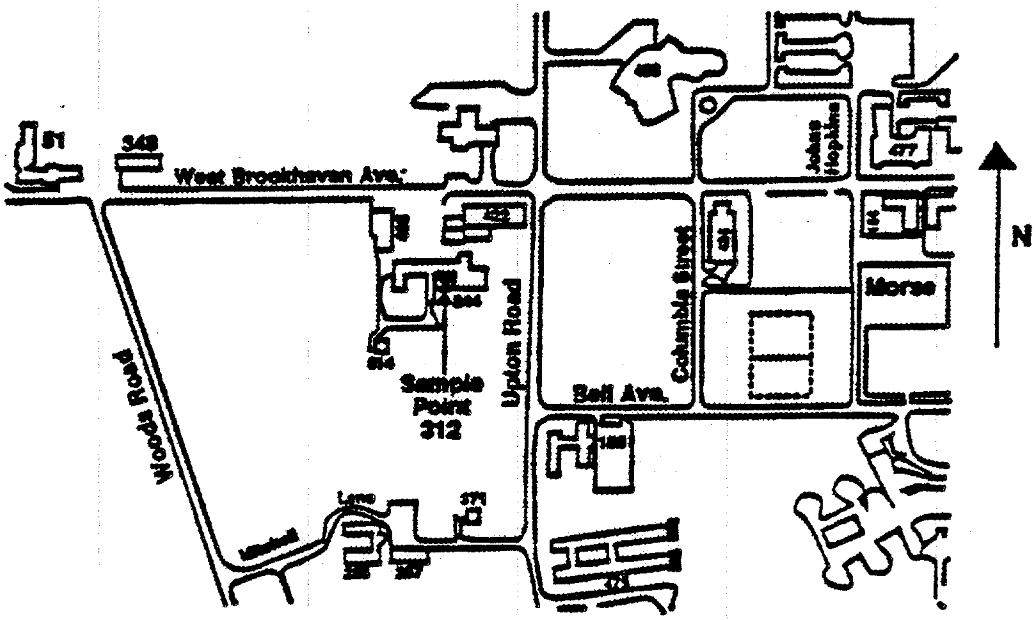

Figure 4.2g. Building 244 Cesspool (Request 312 was deleted)

Environmental Problem: 2
Request Number: 313

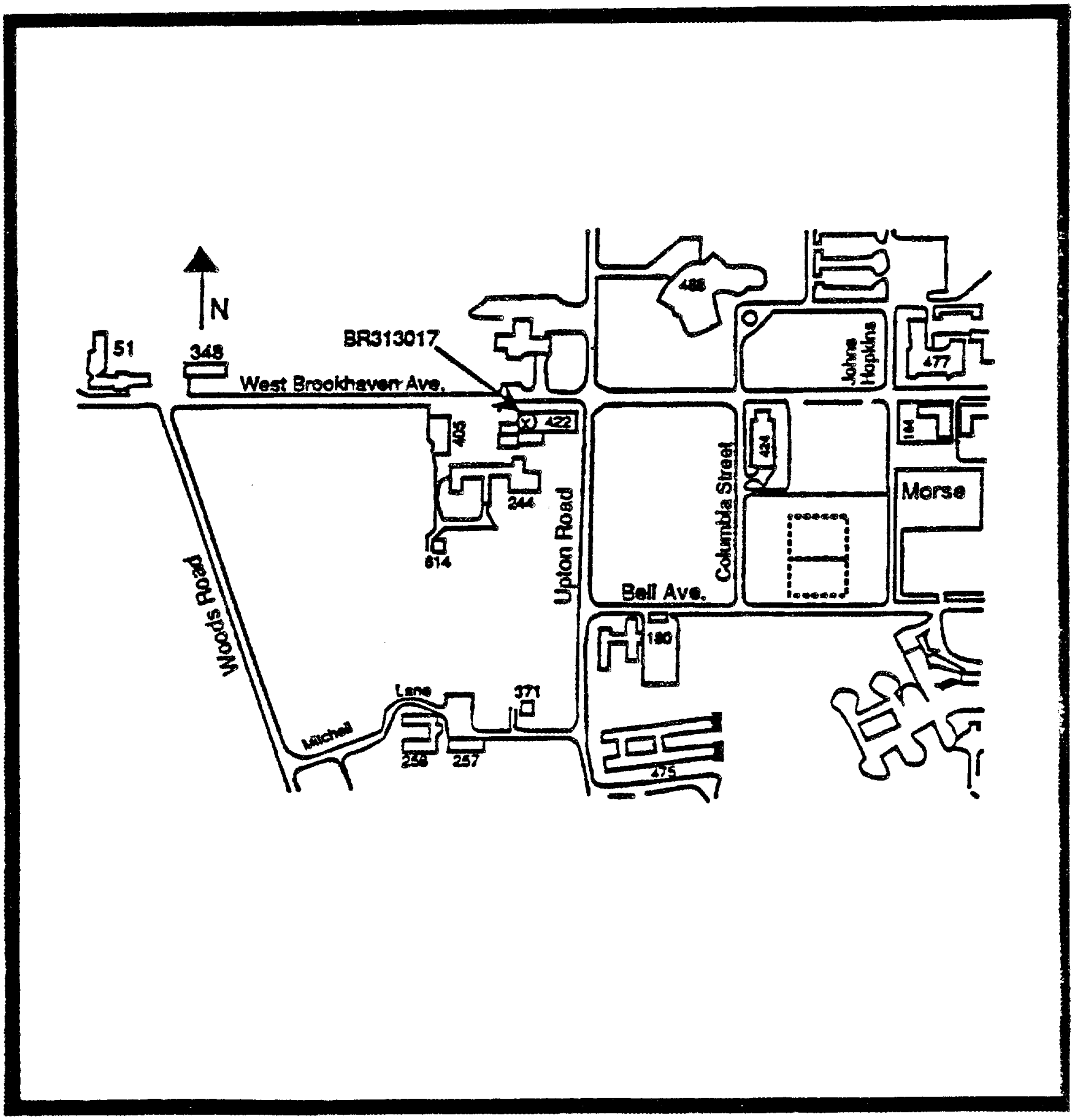

Figure 4.2h. Building 422 Cesspool (Request 313)

Environmental Problem: 2
Request Number: 314

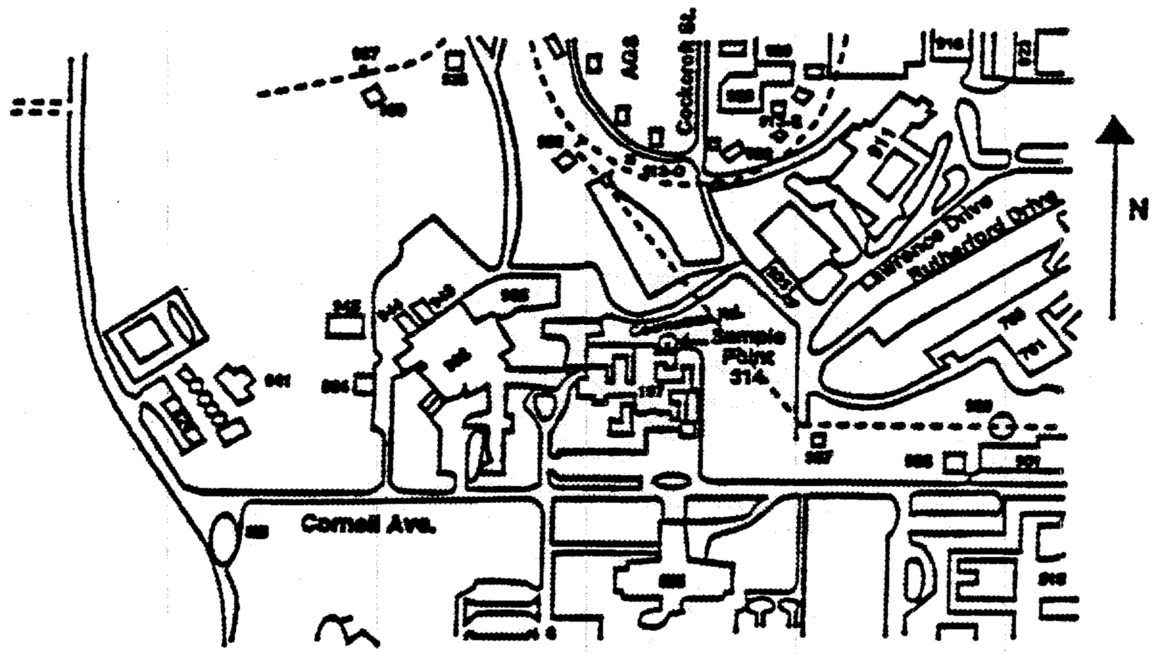

Figure 4.2i. Building 197 Cesspool (Request 314 was deleted)

Environmental Problem: 2
Request Number: 315

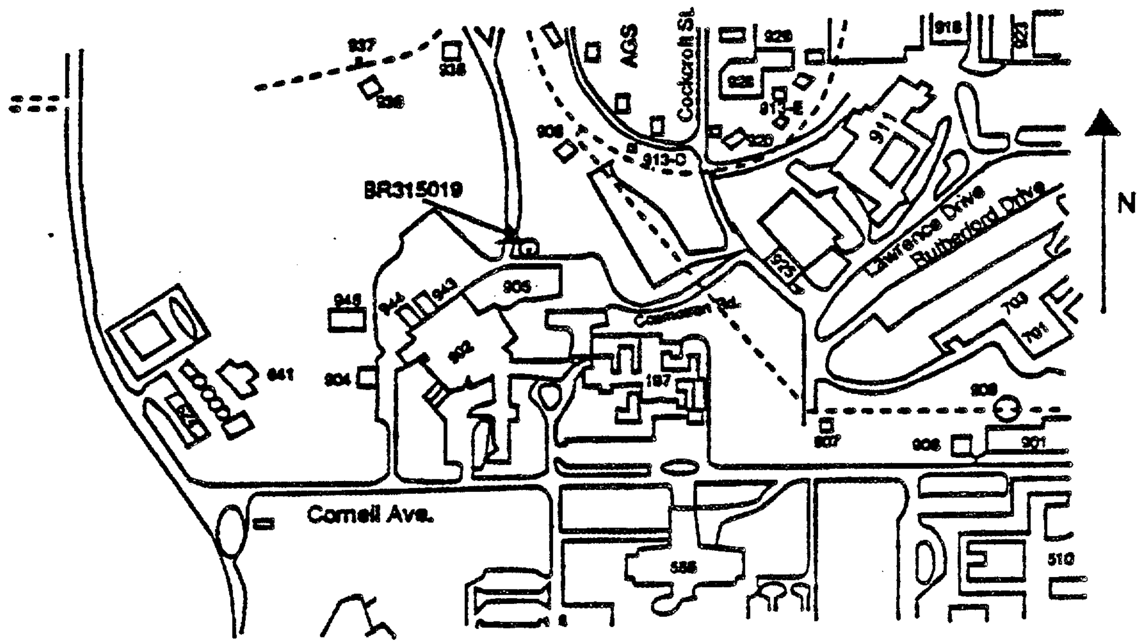

Figure 4.2j. Building 905 Cesspool (Request 315)

TABLE 4.2.2 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 2

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS NUMB HITS	ANIONS NUMB ANAL	METALS NUMB HITS	METALS NUMB ANAL	O&G NUMB HITS	O&G NUMB ANAL	PET HYDRO NUMB HITS	PET HYDRO NUMB ANAL	PES/H/PCB NUMB HITS	PES/H/PCB NUMB ANAL	SEMIVOLS NUMB HITS	SEMIVOLS NUMB ANAL	VOLS NUMB HITS	VOLS NUMB ANAL	RADS NUMB HITS	RADS NUMB ANAL
BR311	B. 479	CESSPOOL	SEDIMENT	1	1	GRAB	0	0	1	1	0	0	1	1	0	1	1	1	1	1	1	1
BR312	B. 244	CESSPOOL	SEDIMENT	1	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BR313	B. 422	CESSPOOL	SEDIMENT	1	1	GRAB	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1
BR314	B. 197	CESSPOOL	SEDIMENT	1	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BR315	B. 905	CESSPOOL	SEDIMENT	1	1	GRAB	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1
		MED TOTAL		5	3		0	0	3	3	0	0	3	3	2	3	3	3	3	3	3	3
BR306	B. 479	CESSPOOL	SUR WATER	1	1	QC FL	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
BR306	B. 479	CESSPOOL	SUR WATER	2	2	GRAB	0	2	2	2	2	2	0	0	0	0	2	2	2	2	0	0
BR306	B. 975	CESSPOOL	SUR WATER	1	1	GRAB	0	1	1	1	1	1	0	0	0	0	1	1	1	1	0	0
BR307	B. 244	CESSPOOL	SUR WATER	3	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BR308	B. 422	CESSPOOL	SUR WATER	3	3	GRAB	2	3	3	3	3	3	0	0	0	0	3	3	3	3	0	0
BR308	B. 422	CESSPOOL	SUR WATER	1	1	QC RN	0	1	1	1	0	1	0	0	0	0	0	0	1	1	0	0
BR309	B. 197	CESSPOOL	SUR WATER	3	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BR310	B. 905	CESSPOOL	SUR WATER	3	3	GRAB	0	3	3	3	3	3	0	0	0	0	3	3	3	3	0	0
BR311	B. 479	CESSPOOL	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	1	0	0	1	1	1	1	1	1
		MED TOTAL		18	12		2	11	12	12	9	11	0	1	0	0	10	10	11	11	1	1
		EP TOTAL		23	15		2	11	15	15	9	11	3	4	2	3	13	13	14	14	4	4

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 306
LOCATION: BUILDING 479 CESSPOOL
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	BR306018	BR306029	BR306030			
FID/PID (PPM)		0	0				
PH (UNITS)		6.7	6.9	6.9			
RADIOACTIVIT (CPM)		40	40	40			
TEMPERATURE (DEG C)		6.8	7.1	6.9			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR306018F / BR306018F / GRAB	BR306018F / BR306018K / GRAB	BR306018G / BR306018G / GRAB	BR306029F / BR306018F / GRAB	BR306029F / BR306018K / GRAB	BR306029G / BR306018G / GRAB
ALUMINUM		226			136 B		
BARIUM		24 B			22 B		
BERYLLIUM		1.7 B			2 B		
CALCIUM		16700			15900		
COPPER		214			141		
IRON		427			251		
MAGNESIUM		5610			5520		
MANGANESE		46			39		
MERCURY				0.06 B			0.07 B
POTASSIUM			20000			22000	
SODIUM		40200 E			41400 E		
VANADIUM		5.6 B			5.6 B		
ZINC		130			56		

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR306030F / BR306018F / GRAB	BR306030F / BR306018K / GRAB	BR306030G / BR306018G / GRAB	BR306041A / BR306018F / FIELD BLANK	BR306041A / BR306018K / FIELD BLANK	BR306041B / BR306018G / FIELD BLANK
ALUMINUM		117 B			60 U		
BARIUM		22 B			2.1 B		
BERYLLIUM		1.9 B			0.91 B		
CALCIUM		15700			200 U		
COPPER		141			10 U		
IRON		255			20 U		
MAGNESIUM		5500			16 B		
MANGANESE		38			5 U		
MERCURY				0.06 B			0.11 B
POTASSIUM			38000			100 U	
SODIUM		40600 E			200 UE		
VANADIUM		4.9 B			4 U		
ZINC		48			11 B		

S&A REQUEST: 306
LOCATION: BUILDING 479 CESSPOOL
MEDIUM: SURFACE WATER

OIL AND GREASE (MG/L)	SAMP NO:	BR306018H	BR306018I	BR306029H	BR306029I	BR306030H	BR306030I
	SDG NO:	BR306018H	BR306018H	BR306018H	BR306018H	BR306018H	BR306018H
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
OIL AND GREASE		14	28	7	8	144	8

OIL AND GREASE (MG/L)	SAMP NO:	BR306041C	BR306041D
	SDG NO:	BR306018H	BR306018H
	TYPE:	FIELD BLANK	FIELD BLANK
OIL AND GREASE		2 U	2 U

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	BR306018E	BR306029E	BR306030E
	SDG NO:	BR306018E	BR306018E	BR306018E
	TYPE:	GRAB	GRAB	GRAB
BENZOIC ACID		50 U	50 U	64
BIS(2-ETHYLHEXYL)PHTHALATE		54	10 U	10 U
DI-N-BUTYLPHTHALATE		3 J	10 U	1 J
DI-N-OCTYLPHTHALATE		3 J	10 U	10 U
PHENOL		18	11	12
4-METHYLPHENOL		390	280	270
* CHOLESTANOL(37.60)		750 J		
* DIOCTYL ADIPATE(31.20)		80 J		
* HYDROCINNAMIC ACID(17.10)			22 J	24 J
* HYDROCINNAMIC ACID(17.20)		27 J		
* PHENYLACETIC ACID(15.80)			110 J	
* PHENYLACETIC ACID(15.90)				150 J
* POSS ALIPHATIC HYDROCAR(28.40)			42 J	
* POSS UNSAT. HYDROCARBON(28.10)			14 J	
* POSS UNSAT. HYDROCARBON(28.20)				16 J
* POSS UNSAT. HYDROCARBON(28.30)				62 J
* POSSIBLE CYANOARYL CPD(16.20)				10 J
* POSSIBLE ERGOSTANOL(38.50)		43 J		
* POSSIBLE ESTER(17.80)			7 J	
* SULFUR(27.10)		8 J	200 J	260 J
* UNKNOWN ACID(20.70)			11 J	
* UNKNOWN ACID(20.80)				14 J
* UNKNOWN ACID(20.90)		23 J		
* UNKNOWN ACID(23.60)			38 J	57 J
* UNKNOWN ACID(23.70)		20 J		
* UNKNOWN ACID(24.50)			7 J	11 J
* UNKNOWN ACID(24.90)			13 J	
* UNKNOWN ACID(25.00)		21 J		

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 306
LOCATION: BUILDING 479 CESSPOOL
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	BR306018E	BR306029E	BR306030E
	SDG NO:	BR306018E	BR306018E	BR306018E
	TYPE:	GRAB	GRAB	GRAB
* UNKNOWN ACID(26.30)			170 J	150 J
* UNKNOWN ACID(26.40)		200 J		
* UNKNOWN ACID(26.50)		180 J		
* UNKNOWN ACID(27.50)		8 J		
* UNKNOWN ACID(28.70)			190 J	
* UNKNOWN ALKYL/HYDROXYL (25.90)			16 J	
* UNKNOWN ALKYL/HYDROXYL (28.40)				68 J
* UNKNOWN ALKYL/HYDROXYL (28.50)		170 J		
* UNKNOWN ALKYL/HYDROXYL (28.60)		150 J		
* UNKNOWN ARYL CPD(16.00)		26 J		
* UNKNOWN CHOLESTEROL CPD(37.50)		77 J		
* UNKNOWN CHOLESTEROL CPD(37.60)				280 J
* UNKNOWN CHOLESTEROL CPD(37.70)			100 J	
* UNKNOWN CHOLESTEROL CPD(37.80)			190 J	140 J
* UNKNOWN CHOLESTEROL CPD(38.00)				62 J
* UNKNOWN ERGOSTANOL CPD(38.90)		42 J		
* UNKNOWN(14.10)			14 J	
* UNKNOWN(17.80)				11 J
* UNKNOWN(19.50)			13 J	12 J
* UNKNOWN(24.70)			5 J	
* UNKNOWN(26.00)				21 J
* UNKNOWN(28.20)			12 J	
* UNKNOWN(28.30)			42 J	
* UNKNOWN(28.80)		130 J		
* UNKNOWN(39.10)		17 J		
* UNKNOWN(39.40)		140 J		
* UNKNOWN(39.80)		42 J		
* UNKNNON ACID(24.90)				20 J
* UNKOWN ACID(28.70)				260 J

VOLATILE ORGANICS (UG/L)	SAMP NO:	BR306018A	BR306029A	BR306030A
	SDG NO:	BRN20017A	BRN20017A	BRN20017A
	TYPE:	GRAB	GRAB	GRAB
ACETONE		16 B	18 B	18 B
METHYLENE CHLORIDE		5 U	2 JB	2 JB
TOLUENE		1 JB	2 JB	2 JB
* THIOBISMETHANE(7.00)		6 J		6 J
* VOA UNKNOWN(7.00)			6 J	

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 CESSPOOLS

DRAFT DO NOT CITE

S&A REQUEST: 308
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO: BR308010	BR308021	BR308032			
PH (UNITS)	6.2	6.4	7			
RADIOACTIVIT (CPM)	30	40	40			
TEMPERATURE (DEG C)	9.4	9.5	13			

ANIONS AND CYANIDE (UG/L)						
SAMP NO:	BR308010I	BR308021I	BR308032I	BR308043I		
SDG NO:	BR308010I	BR308010I	BR308010I	BR308010I		
TYPE:	GRAB	GRAB	GRAB	RINSATE		
CYANIDE, TOTAL	2 U	162	70	2 U		

METALS, INCLUDING CR+6 (UG/L)						
SAMP NO:	BR308010F	BR308010F	BR308010G	BR308021F	BR308021F	BR308021G
SDG NO:	BR303015K	BR308010F	BR308010G	BR303015K	BR308010F	BR308010G
TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		488000			268000	
ANTIMONY		1260			677	
BARIUM		1250			1560	
BERYLLIUM		35			31	
CADMIUM		2820			1840	
CALCIUM		713000			584000	
CHROMIUM		50300			26400	
COBALT		678			482	
COPPER		110000			66400	
IRON		1510000			1030000	
LEAD		113000			100000	
MAGNESIUM		149000			95500	
MANGANESE		8460			6180	
MERCURY			0.44			1.8
NICKEL		46900			27300	
POTASSIUM	41000			30000		
SELENIUM		425			537	
SILVER		3410			3340	
VANADIUM		874			601	
ZINC		357000			302000	

METALS, INCLUDING CR+6 (UG/L)						
SAMP NO:	BR308032F	BR308032F	BR308032G	BR308043F	BR308043F	BR308043G
SDG NO:	BR303015K	BR308010F	BR308010G	BR303015K	BR308010F	BR308010G
TYPE:	GRAB	GRAB	GRAB	RINSATE	RINSATE	RINSATE
ALUMINUM		203000			107 B	
ANTIMONY		535			50 U	

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 308
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR308032F / BR303015K / GRAB	BR308032F / BR308010F / GRAB	BR308032G / BR308010G / GRAB	BR308043F / BR303015K / RINSATE	BR308043F / BR308010F / RINSATE	BR308043G / BR308010G / RINSATE
BARIUM			3260			3.9 B	
BERYLLIUM			26			0.3 U	
CADMIUM			1300			2 U	
CALCIUM			422000			221 B	
CHROMIUM			18100			6 U	
COBALT			337			3 U	
COPPER			53600			10 U	
IRON			754000			26 B	
LEAD			55700			50 U	
MAGNESIUM			72200			34 B	
MANGANESE			4270			5 U	
MERCURY				0.17 B			0.05 B
NICKEL			24100			6 U	
POTASSIUM		39000			100 U		
SELENIUM			360 U			60 U	
SILVER			3530			6 U	
VANADIUM			423			4 U	
ZINC			191000			65	

OIL AND GREASE (MG/L)	SAMP NO: / SDG NO: / TYPE:	BR308010H / BR306018H / GRAB	BR308021H / BR306018H / GRAB	BR308032H / BR306018H / GRAB	BR308043H / BR306018H / RINSATE		
OIL AND GREASE		8770	10100	10900	2 U		

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR308010E / BR306018E / GRAB	BR308021E / BR306018E / GRAB	BR308032E / BR306018E / GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE		62	81	90			
BUTYLBENZYLPHTHALATE		1 J	24 U	3 J			
DI-N-BUTYLPHTHALATE		4 J	4 J	4 J			
DI-N-OCTYLPHTHALATE		0.8 J	1 J	2 J			
DIETHYLPHTHALATE		33 U	24 U	0.6 J			
FLUORANTHENE		33 U	24 U	1 J			
N-NITROSODIPHENYLAMINE		33 U	2 J	2 J			
NAPHTHALENE		6 J	14 J	20			
PHENANTHRENE		33 U	1 J	1 J			
PHENOL		13 J	74	66			
PYRENE		33 U	24 U	1 J			

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 — CESSPOOLS — DRAFT DO NOT CITE

S&A REQUEST: 308
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: BR308010E SDG NO: BR306018E TYPE: GRAB	BR308021E BR306018E GRAB	BR308032E BR306018E GRAB
2-METHYLNAPHTHALENE	33 U	24 U	18 J
4-METHYLPHENOL	94	260	830
* ALIPHATIC HYDROCARBON(7.66)	54 J		
* ALIPHATIC HYDROCARBON(7.67)		55 J	
* ALIPHATIC HYDROCARBON(7.69)			31 J
* ALIPHATIC HYDROCARBON(8.33)		33 J	
* ALIPHATIC HYDROCARBON(8.57)		33 J	
* ALIPHATIC HYDROCARBON(9.51)		49 J	
* ALIPHATIC HYDROCARBON(9.52)			37 J
* ALIPHATIC HYDROCARBON(10.80)	89 J	80 J	56 J
* ALIPHATIC HYDROCARBON(10.90)	65 J	33 J	
* ALIPHATIC HYDROCARBON(11.00)	61 J	50 J	35 J
* ALIPHATIC HYDROCARBON(11.40)	55 J	82 J	52 J
* ALIPHATIC HYDROCARBON(11.50)	54 J		
* ALIPHATIC HYDROCARBON(11.70)	56 J	48 J	33 J
* ALIPHATIC HYDROCARBON(12.50)	420 J	1500 J	770 J
* ALIPHATIC HYDROCARBON(13.60)	160 J		
* ALIPHATIC HYDROCARBON(14.50)	200 J		
* ALIPHATIC HYDROCARBON(15.70)	220 J		
* ALIPHATIC HYDROCARBON(16.40)			210 J
* ARYL HYDROCARBON(10.60)			40 J
* CHOLESTANOL(37.60)	270 J	190 J	120 J
* DIMETHYL BENZENE(6.68)		52 J	
* DIMETHYL BENZENE(7.70)			39 J
* METHYL BENZENE(3.82)	110 J		
* METHYL BENZENE(3.83)		36 J	
* METHYL BENZENE(3.85)			25 J
* POSSIBLE AMIDE/AMINE(13.40)			230 J
* SULFUR(27.10)		670 J	
* SULFUR(27.20)			300 J
* UNKNOWN ACID(23.60)	160 J		
* UNKNOWN ACID(26.30)		460 J	
* UNKNOWN ACID(26.40)	1600 J		230 J
* UNKNOWN ACID(26.50)		1700 J	120 J
* UNKNOWN ACID(28.50)	700 J		
* UNKNOWN ACID(28.70)	2500 J		
* UNKNOWN ACID(28.80)		1600 J	130 J
* UNKNOWN CHOLESTEROL CPD(37.80)	57 J		
* UNKNOWN CHOLESTEROL CPD(37.90)		51 J	43 J
* UNKNOWN CHOLESTEROL CPD(39.40)	46 J	32 J	25 J
* UNKNOWN(10.60)		58 J	
* UNKNOWN(27.10)	340 J		

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 CESSPOOLS

DRAFT DO NOT CITE

S&A REQUEST: 308
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR308010B / BRN36015A / GRAB	BR308021B / BRN36015A / GRAB	BR308032B / BRN36015A / GRAB	BR308043A / BRN16011A / RINSATE		
ACETONE		44 B	120 B	94 B	18 B		
BENZENE		1 J	5	4 J	5 U		
CARBON DISULFIDE		3 J	6	6	5 U		
CHLOROBENZENE		6	19	17	5 U		
CHLOROETHANE		16	140	57	10 U		
CHLOROFORM		5 U	2 JB	2 JB	5 U		
CHLOROMETHANE		4 J	29	14	10 U		
ETHYLBENZENE		26	130	98	5 U		
METHYLENE CHLORIDE		260 B	11000 B	10000 B	5 U		
TETRACHLOROETHENE		5 U	7	4 J	5 U		
TOLUENE		550 B	580 B	510 B	3 JB		
TRICHLOROETHENE		0.8 J	590	400	5 U		
VINYL CHLORIDE		11	44	22	10 U		
XYLENE (TOTAL)		110	600	440	5 U		
1,1-DICHLOROETHANE		59	2900	1800	5 U		
1,1-DICHLOROETHENE		2 J	22	14	5 U		
1,1,1-TRICHLOROETHANE		5 U	470	450	5 U		
1,1,2-TRICHLOROETHANE		5 U	19	13	5 U		
1,2-DICHLOROETHANE		4 J	120	80	5 U		
1,2-DICHLOROETHENE		98	520	300	5 U		
1,2-DICHLOROPROPANE		140	380	220	5 U		
2-BUTANONE		18	300	240	10 U		
4-METHYL-2-PENTANONE		32	41	29	10 U		
* FREON 113(12.10)		8 J			12 J		
* PROABABLE 1,3-DIOXOLANE(8.70)			25 J				
* SUBSTITUTED BENZENE(23.10)				17 J			
* SUBSTITUTED BENZENE(34.20)		89 J					
* SUBSTITUTED BENZENE#1(23.30)			92 J				
* SUBSTITUTED BENZENE#2(25.50)			10 J				
* THIOBISMETHANE(7.00)		15 J					
* THIOBISMETHANE(7.10)			68 J	50 J			
* UNKNOWN HYDROCARBON(25.80)				16 J			
* UNKNOWN HYDROCARBON(28.20)		19 J					
* UNKNOWN HYDROCARBON#1(28.20)			4 J				
* UNKNOWN HYDROCARBON#2(29.30)			8 J				
* UNKNOWN HYDROCARBON#3(30.40)			4 J				
* UNKNOWN VOA#1(8.30)			7 J				
* UNKNOWN VOA#1(20.80)				34 J			
* UNKNOWN VOA#2(20.80)			15 J				
* UNKNOWN VOA#2(29.20)				16 J			

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 310
LOCATION: BUILDING 905 CESSPOOL
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO: BR310014	BR310025	BR310036			
CONDUCTIVITY (UMHOS/CM)		7.4				
PH (UNITS)	7.4		7.4			
RADIOACTIVIT (CPM)	40	40	40			
TEMPERATURE (DEG C)	7.8	7.1	8.8			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR310014F SDG NO: BR306018F TYPE: GRAB	BR310014F BR306018K GRAB	BR310014G BR306018G GRAB	BR310025F BR306018F GRAB	BR310025F BR306018K GRAB	BR310025G BR306018G GRAB
ALUMINUM	334			1200		
BARIUM	26 B			27 B		
BERYLLIUM	2.6 B			2.6 B		
CADMIUM	2 U			2 U		
CALCIUM	26200			26200		
CHROMIUM	6 U			13		
COPPER	97			112		
IRON	552			1460		
MAGNESIUM	5410			5540		
MANGANESE	57			67		
MERCURY			0.07 B			0.07 B
NICKEL	6 U			14 B		
POTASSIUM		38000			35000	
SODIUM	49300 E			47800 E		
VANADIUM	5.9 B			6.5 B		
ZINC	199			219		

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR310036F SDG NO: BR306018F TYPE: GRAB	BR310036F BR306018K GRAB	BR310036G BR308010G GRAB			
ALUMINUM	1350					
BARIUM	38 B					
BERYLLIUM	2.7 B					
CADMIUM	2.7 B					
CALCIUM	27500					
CHROMIUM	7.1 B					
COPPER	169					
IRON	1850					
MAGNESIUM	5620					
MANGANESE	71					
MERCURY			0.09 B			
NICKEL	13 B					

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 CESSPOOLS

DRAFT DO NOT CITE

S&A REQUEST: 310
LOCATION: BUILDING 905 CESSPOOL
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR310036F / BR306018F / GRAB	BR310036F / BR306018K / GRAB	BR3100360 / BR308010G / GRAB			
POTASSIUM			34000				
SODIUM		47600 E					
VANADIUM		6.1 B					
ZINC		340					

OIL AND GREASE (MG/L)	SAMP NO: / SDG NO: / TYPE:	BR310014H / BR306018H / GRAB	BR310025H / BR306018H / GRAB	BR310036H / BR306018H / GRAB			
OIL AND GREASE		25	13	24			

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR310014E / BR306018E / GRAB	BR310025E / BR310025E / GRAB	BR310036E / BR310025E / GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE		5 J	3 JB	6 JB			
BUTYLBENZYLPHTHALATE		10 U	1 J	1 J			
DI-N-BUTYLPHTHALATE		10 U	10 U	4 JB			
DI-N-OCTYLPHTHALATE		10 U	0.6 J	10 U			
PHENOL		31	28	13			
2-METHYLPHENOL		2 J	1 J	10 U			
4-METHYLPHENOL		97	100	45			
* ALKYL SUBSTITUTED PHENO(21.40)			300 J				
* ALKYL SUBSTITUTED PHENO(21.50)				160 J			
* ALKYL SUBSTITUTED PHENO(22.30)			21 J	12 J			
* ALKYL SUBSTITUTED PHENO(22.90)			35 J	24 J			
* ALKYL SUBSTITUTED PHENO(23.00)			43 J				
* ALKYL SUBSTITUTED PHENO(23.10)			29 J	29 J			
* ALKYL SUBSTITUTED PHENO(23.20)				23 J			
* ALKYL SUBSTITUTED PHENO(23.50)			29 J	18 J			
* ALKYL SUBSTITUTED PHENO(23.60)			49 J	19 J			
* CAFFEINE(24.70)		20 J					
* CHOLESTANOL(37.50)		80 J					
* CHOLESTEROL(37.90)		75 J					
* DIOCTYL ADIPATE(31.20)				28 J			
* PHENYL HYDROCARBON(21.40)		380 J					
* PHENYL HYDROCARBON(22.20)		26 J					
* PHENYL HYDROCARBON(22.80)		46 J					
* PHENYL HYDROCARBON(23.00)		61 J					
* PHENYL HYDROCARBON(23.10)		45 J					

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 310
LOCATION: BUILDING 905 CESSPOOL
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR310014E / BR306018E / GRAB	BR310025E / BR310025E / GRAB	BR310036E / BR310025E / GRAB
* PHENYL HYDROCARBON(23.50)		36 J		
* POSS PHENYL/HYDROCARBON(25.00)		47 J		
* POSSIBLE EPICHOLESTANOL(37.70)			210 J	
* POSSIBLE EPICHOLESTANOL(37.80)				160 J
* POSSIBLE PHENYL COMPOUN(25.10)			26 J	
* POSSIBLE UNKNOWN ESTER(17.40)			20 J	
* POSSIBLE UNKNOWN ESTER(17.80)			52 J	
* SULFUR(27.10)		240 J		
* UNKNOWN ACID(20.80)		19 J		
* UNKNOWN ACID(26.40)		690 J		
* UNKNOWN ACID(28.80)		600 J		
* UNKNOWN ALKYL/HYDROXYL (28.40)		46 J		
* UNKNOWN ARYL COMPOUND(15.70)			19 J	
* UNKNOWN CARBOXYLIC ACID(23.70)				35 J
* UNKNOWN CARBOXYLIC ACID(26.40)			280 J	70 J
* UNKNOWN CARBOXYLIC ACID(28.70)			180 J	
* UNKNOWN CARBOXYLIC ACID(28.80)				150 J
* UNKNOWN CHOLESTEROL COM(37.90)			140 J	150 J
* UNKNOWN CHOLESTEROL COM(38.00)			250 J	
* UNKNOWN CHOLESTEROL COM(38.10)				200 J
* UNKNOWN(11.80)				14 J
* UNKNOWN(17.30)		57 J		
* UNKNOWN(17.50)				12 J
* UNKNOWN(17.70)		61 J		
* UNKNOWN(17.80)		25 J		31 J
* UNKNOWN(19.60)			17 J	
* UNKNOWN(23.10)			20 J	
* UNKNOWN(23.60)		49 J		
* UNKNOWN(27.10)			89 J	42 J
* UNKNOWN(28.50)				25 J
* UNKNOWN(31.40)		140 J		
* 2-BUTOXYETHANOL PHOSPHA(31.40)			120 J	59 J

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR310014A / BRN20017A / GRAB	BR310025A / BRN20017A / GRAB	BR310036A / BRN20017A / GRAB
ACETONE		190 B	220 B	250 B
CHLOROMETHANE		10 U	3 J	3 J
METHYLENE CHLORIDE		2 JB	2 JB	2 JB
TOLUENE		36 B	36 B	46 B

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 310
LOCATION: BUILDING 905 CESSPOOL
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)				
	SAMP NO:	BR310014A	BR310025A	BR310036A
	SDG NO:	BRN20017A	BRN20017A	BRN20017A
	TYPE:	GRAB	GRAB	GRAB
* DIMETHYLDISULFIDE(16.20)		14 J	24 J	41 J
* THIOBISMETHANE(7.00)		26 J	31 J	30 J

S&A REQUEST: 311
LOCATION: BUILDING 479 CESSPOOL
MEDIUM: SEDIMENT

FIELD MEASUREMENTS	SAMP NO:	BR311015
RADIOACTIVIT (CPM)		50

METALS, INCLUDING CR+6 (MG/KG)				
	SAMP NO:	BR311015C	BR311015C	BR311015D
	SDG NO:	BR311015C	BR311015K	BR311015D
	TYPE:	GRAB	GRAB	GRAB
ALUMINUM		1850		
BARIUM		11 BE		
BERYLLIUM		0.53 B		
CALCIUM		9600		
CHROMIUM		2.7		
COBALT		0.95 B		
COPPER		28		
IRON		3640		
LEAD		8.5 B		
MAGNESIUM		5670		
MANGANESE		24		
MERCURY				0.06
NICKEL		2.1 B		
POTASSIUM			180 B	
SODIUM		65 B		
VANADIUM		14		
ZINC		11		

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 CESSPOOLS

DRAFT DO NOT CITE

S&A REQUEST: 311
LOCATION: BUILDING 479 CESSPOOL
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (UG/G)	SAMP NO: BR311015E SDG NO: BR303015E TYPE: GRAB
URANIUM, TOTAL	5

PETROLEUM HYDROCARBONS (MG/G)	SAMP NO: BR311015F SDG NO: BR311015F TYPE: GRAB
PETROLEUM HYDROCARBONS	0.19

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: BR311015B SDG NO: BR311015B TYPE: GRAB
BIS(2-ETHYLHEXYL)PHTHALATE	200 J
BUTYLBENZYLPHTHALATE	640 B
DI-N-BUTYLPHTHALATE	210 JB
DI-N-OCTYLPHTHALATE	78 JB
DIETHYLPHTHALATE	96 JB
FLUORANTHENE	11 J
INDENO(1,2,3-CD)PYRENE	330 J
PHENOL	30 J
4-METHYLPHENOL	270 J
* ALICYCLIC ALCOHOL/STERO(35.10)	25 J
* ALICYCLIC ALCOHOL/STERO(35.30)	50 J
* ALICYCLIC ALCOHOL/STERO(36.70)	33 J
* ALICYCLIC ALCOHOL/STERO(36.90)	16 J
* ALICYCLIC ALCOHOL/STERO(37.70)	1600 J
* ALICYCLIC ALCOHOL/STERO(38.30)	40 J
* ALICYCLIC ALCOHOL/STERO(38.70)	110 J
* ALICYCLIC ALCOHOL/STERO(39.00)	62 J
* ALICYCLIC ALCOHOL/STERO(39.60)	450 J
* ALICYCLIC ALCOHOL/STERO(39.90)	110 J
* ALICYCLIC ALCOHOL/STERO(40.10)	26 J
* ALKOXY/HYDROXY/ALKYL CP(28.50)	420 J
* DIACETONE ALCOHOL(6.19)	14000 JAB
* POSSIBLE KETONE(6.51)	2100 J
* SULFUR(27.10)	280 J
* UNKNOWN ACID(26.40)	1400 J
* UNKNOWN ACID(28.70)	1400 J
* UNKNOWN(25.40)	89 J
* UNKNOWN(28.40)	250 J

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2
CESSPOOLS

S&A REQUEST: 311
LOCATION: BUILDING 479 CESSPOOL
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	
SAMP NO:	BR311015B
SDG NO:	BR311015B
TYPE:	GRAB
* UNKNOWN(37.40)	34 J

VOLATILE ORGANICS (UG/KG)	
SAMP NO:	BR311015A
SDG NO:	BR311015A
TYPE:	GRAB
CHLOROFORM	33 JB
ETHYLBENZENE	9 JB
METHYLENE CHLORIDE	30 JB
TOLUENE	17 J

RADIOCHEMISTRY (PCI/KGD)	
SAMP NO:	BR311015G
SDG NO:	LLL8304
TYPE:	GRAB
SR-TOT	-35

S&A REQUEST: 311
LOCATION: BUILDING 479 CESSPOOL
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)		
SAMP NO:	BR311026F	BR311026G
SDG NO:	BR308010F	BR308010G
TYPE:	RINSATE	RINSATE
IRON	58 B	
MAGNESIUM	24 B	
MERCURY		0.06 B
ZINC	88	

EXTRACTABLE ORGANICS (UG/L)	
SAMP NO:	BR311026E
SDG NO:	BR306018E
TYPE:	RINSATE
* BUTYLATED HYDROXYTOLUEN(20.00)	18 J

S&A REQUEST: 311
LOCATION: BUILDING 479 CESSPOOL
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: BR311026E SDG NO: BR306018E TYPE: RINSATE					
* METHYL BENZENE(3.82)	3 J					
* UNKNOWN(24.20)	3 J					

VOLATILE ORGANICS (UG/L)	SAMP NO: BR311026A SDG NO: BRN28015A TYPE: RINSATE					
ACETONE	16 B					
TOLUENE	3 JB					

RADIOCHEMISTRY (PCI/L)	SAMP NO: BR311026J SDG NO: LLL8304 TYPE: RINSATE					
SR-TOT	-0.3					

S&A REQUEST: 313
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SEDIMENT

FIELD MEASUREMENTS	SAMP NO: BR313017					
RADIOACTIVIT (CPM)	50					

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: BR313017C SDG NO: BR313017C TYPE: GRAB	BR313017C BR313017K GRAB	BR313017D BR311015D GRAB			
ALUMINUM	2830 E					
ANTIMONY	62					
BARIUM	5680					
BERYLLIUM	2.6 B					
CADMIUM	30					
CALCIUM	39300					
CHROMIUM	84					

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2
CESSPOOLS

DRAFT DO NOT CITE

S&A REQUEST: 313
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)				
	SAMP NO:	BR313017C	BR313017C	BR313017D
	SDG NO:	BR313017C	BR313017K	BR311015D
	TYPE:	GRAB	GRAB	GRAB
COBALT		15 B		
COPPER		858		
IRON		37600 E		
LEAD		1180		
MAGNESIUM		1870 BE		
MANGANESE		481		
MERCURY				5.7
NICKEL		49		
POTASSIUM			630 B	
SELENIUM		72 B		
SILVER		16		
SODIUM		4010 B		
VANADIUM		10 B		
ZINC		10900		

METALS, INCLUDING CR+6 (UG/G)		
	SAMP NO:	BR313017E
	SDG NO:	BR303015E
	TYPE:	GRAB
URANIUM, TOTAL		2

PETROLEUM HYDROCARBONS (MG/KG)		
	SAMP NO:	BR313017F
	SDG NO:	BR313017F
	TYPE:	GRAB
PETROLEUM HYDROCARBONS		19500

PCBS & OTHER EXTRACTABLES (UG/KG)		
	SAMP NO:	BR313017B
	SDG NO:	BR800062B
	TYPE:	GRAB
AROCLOR-1254		78000

EXTRACTABLE ORGANICS (UG/KG)		
	SAMP NO:	BR313017B
	SDG NO:	BR311015B
	TYPE:	GRAB
ACENAPHTHENE		6900

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 313
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: BR313017B SDG NO: BR311015B TYPE: GRAB					
ACENAPHTHYLENE	170 J					
ANTHRACENE	590 J					
BENZO(A)ANTHRACENE	2100					
BENZO(A)PYRENE	750 JB					
BENZO(B)FLUORANTHENE	2100 B					
BENZO(G,H,I)PERYLENE	2000					
BENZO(K)FLUORANTHENE	2300 B					
BENZOIC ACID	9400 J					
BIS(2-CHLOROISOPROPYL)ETHER	1800 J					
BIS(2-ETHYLHEXYL)PHTHALATE	19000 B					
BUTYLBENZYLPHTHALATE	4500 B					
CHRYSENE	3300					
DI-N-BUTYLPHTHALATE	970 JB					
DI-N-OCTYLPHTHALATE	360 JB					
DIBENZOFURAN	4400					
DIETHYLPHTHALATE	780 J					
DIMETHYLPHTHALATE	230 J					
FLUORANTHENE	9100 B					
FLUORENE	5400					
INDENO(1,2,3-CD)PYRENE	1500 J					
N-NITROSO-DI-N-PROPYLAMINE	1700 J					
NAPHTHALENE	4900					
PHENANTHRENE	24000					
PHENOL	8600					
PYRENE	8700 B					
1,4-DICHLOROBENZENE	11000					
2-METHYLNAPHTHALENE	8600					
2-METHYLPHENOL	100 J					
2-NITROANILINE	200 J					
2-NITROPHENOL	380 J					
2,4-DIMETHYLPHENOL	400 J					
4-CHLOROANILINE	180 J					
4-METHYLPHENOL	130000 E					
4-NITROPHENOL	830 J					
* ALICYCLIC ALCOHOL/STERO(37.80)	54000 J					
* ALICYCLIC ALCOHOL/STERO(37.90)	16000 J					
* ALICYCLIC ALCOHOL/STERO(39.40)	26000 J					
* ALICYCLIC ALCOHOL/STERO(39.70)	17000 J					
* ALKOXY/HYDROXY/ALKYL CP(9.79)	4300 J					
* ALKOXY/HYDROXY/ALKYL CP(14.20)	398000 J					
* ALKOXY/HYDROXY/ALKYL CP(30.60)	1900000 J					
* ALKYL HYDROCARBON(7.69)	5400 J					

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 313
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: BR313017B SDG NO: BR311015B TYPE: GRAB					
* ALKYL HYDROCARBON(10.80)	5800 J					
* ALKYL HYDROCARBON(11.60)	3800 J					
* ALKYL HYDROCARBON(14.60)	39000 J					
* ALKYL HYDROCARBON(15.90)	19000 J					
* ALKYL HYDROCARBON(16.40)	22000 J					
* ALKYL HYDROCARBON(19.20)	23000 J					
* DIACETONE ALCOHOL(6.34)	14000 JAB					
* METHYL BENZENE(3.91)	15000 J					
* SULFUR(27.10)	36000 J					
* UNKNOWN(27.90)	13000 J					
* UNKNOWN(31.60)	7700 J					
* UNKNOWN(37.50)	45000 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO: BR313017A SDG NO: BR313017A TYPE: GRAB					
ACETONE	7200 E					
BENZENE	120 J					
CARBON DISULFIDE	2100					
CHLOROBENZENE	2000					
ETHYLBENZENE	3400 B					
METHYLENE CHLORIDE	670000 BE					
TETRACHLOROETHENE	14000 E					
TOLUENE	230000 E					
TRICHLOROETHENE	270000 E					
XYLENE (TOTAL)	2100 B					
1,1-DICHLOROETHANE	190000 E					
1,1-DICHLOROETHENE	8100 E					
1,1,1-TRICHLOROETHANE	330000 E					
1,2-DICHLOROETHANE	12000 E					
1,2-DICHLOROETHENE	980					
1,2-DICHLOROPROPANE	4300					
* PROB. AROMATIC HYDROCAR(18.91)	130 J					
* PROBABLE DICHLOROBENZEN(20.44)	340 J					
* PROBABLE HYDROCARBON #1(19.26)	280 J					
* PROBABLE HYDROCARBON #2(22.08)	350 J					
* UNKNOWN(21.06)	430 J					

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2
CESSPOOLS

S&A REQUEST: 313
LOCATION: BUILDING 422 CESSPOOL
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: BR313017G SDG NO: LLL8305 TYPE: GRAB
CS-137	79
K-40	3500
SR-TOT	80

S&A REQUEST: 315
LOCATION: BUILDING 905 CESSPOOL
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: BR315019C SDG NO: BR311015C TYPE: GRAB	BR315019C BR311015K GRAB	BR315019D BR311015D GRAB
ALUMINUM	6910		
ANTIMONY	36 BN		
BARIUM	207 E		
BERYLLIUM	1.5 B		
CADMIUM	28		
CALCIUM	17100		
CHROMIUM	34		
COBALT	3.3 B		
COPPER	3300		
IRON	27800		
LEAD	546		
MAGNESIUM	2100 B		
MANGANESE	217		
MERCURY			2.9
NICKEL	40		
POTASSIUM		880 B	
SILVER	23		
SODIUM	1000 B		
VANADIUM	11 B		
ZINC	2770		

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 CESSPOOLS

DRAFT DO NOT CITE

S&A REQUEST: 315
LOCATION: BUILDING 905 CESSPOOL
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (UG/G)	SAMP NO: BR315019E SDG NO: BR303015E TYPE: GRAB
URANIUM, TOTAL	15

PETROLEUM HYDROCARBONS (MG/G)	SAMP NO: BR315019F SDG NO: BR311015F TYPE: GRAB
PETROLEUM HYDROCARBONS	35

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO: BR315019B SDG NO: BR800062B TYPE: GRAB
AROCLOR-1254	4800

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: BR315019B SDG NO: BR311015B TYPE: GRAB
ACENAPHTHENE	520 J
ANTHRACENE	810 J
BENZO(A)ANTHRACENE	3800
BENZO(A)PYRENE	2300 B
BENZO(B)FLUORANTHENE	4800 B
BENZO(G,H,I)PERYLENE	1700
BENZO(K)FLUORANTHENE	5200 B
BIS(2-ETHYLHEXYL)PHTHALATE	5300 B
BUTYLBENZYLPHTHALATE	2300 B
CHRYSENE	3900
DI-N-BUTYLPHTHALATE	420 JB
DI-N-OCTYLPHTHALATE	300 JB
DIBENZ(A,H)ANTHRACENE	720 J
DIBENZOFURAN	340 J
DIETHYLPHTHALATE	330 J
FLUORANTHENE	6000 B
FLUORENE	510 J
INDENO(1,2,3-CD)PYRENE	2700
ISOPHORONE	91 J
N-NITROSODIPHENYLAMINE	120 J
NAPHTHALENE	160 J

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 CESSPOOLS

DRAFT DO NOT CITE

S&A REQUEST: 315
LOCATION: BUILDING 905 CESSPOOL
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: BR315019B SDG NO: BR311015B TYPE: GRAB					
PHENANTHRENE	4800					
PHENOL	5700					
PYRENE	8900 B					
2-METHYLNAPHTHALENE	550 J					
4-CHLOROANILINE	770 J					
4-METHYLPHENOL	100000 E					
* ALICYCLIC ALCOHOL/STERO(37.60)	6600 J					
* ALICYCLIC ALCOHOL/STERO(39.80)	1700 J					
* ALKOXY/HYDROXY/ALKYL CP(30.40)	6200000 J					
* ALKYL HYDROCARBON(12.50)	12000 J					
* ALKYL HYDROCARBON(16.40)	23000 J					
* ALKYL HYDROCARBON(18.20)	13000 J					
* ALKYL HYDROCARBON(21.30)	31000 J					
* ALKYL HYDROCARBON(22.80)	9700 J					
* ALKYL HYDROCARBON(24.20)	42000 J					
* ALKYL HYDROCARBON(24.90)	13000 J					
* ALKYL HYDROCARBON(25.50)	9000 J					
* DIACETONE ALCOHOL(6.08)	21000 JAB					
* UNKNOWN ACID(25.30)	13000 J					
* UNKNOWN ACID(25.40)	13000 J					
* UNKNOWN ACID(27.30)	510000 J					
* UNKNOWN ACID(27.90)	12000 J					
* UNKNOWN ACID(29.30)	210000 J					
* UNKNOWN(24.30)	40000 J					
* UNKNOWN(25.00)	22000 J					
* UNKNOWN(31.00)	6600 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO: BR315019A SDG NO: BR313017A TYPE: GRAB					
CHLOROFORM	75 B					
ETHYLBENZENE	2200 B					
METHYLENE CHLORIDE	10000 BE					
TETRACHLOROETHENE	170000 E					
TOLUENE	160000 E					
TRICHLOROETHENE	150000 E					
XYLENE (TOTAL)	750 B					
1,1-DICHLOROETHANE	12000 E					
1,1,1-TRICHLOROETHANE	530					
* PROBABLE FREON(2.83)	920 J					

TABLE 4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
CESSPOOLS

S&A REQUEST: 315
LOCATION: BUILDING 905 CESSPOOL
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO: BR315019A SDG NO: BR313017A TYPE: GRAB					
* UNKNOWN(19.60)	89 J					

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: BR315019G SDG NO: LLL8306 TYPE: GRAB					
CS-137	65					
K-40	2200					
SR-TOT	50					

4.9 Environmental Problem 3: Groundwater Contamination

Request Number: 316.

Requester: J. Werner.

Finding and Basis: The absence of upgradient monitoring may have resulted in undetected migration of off-site contamination onto the BNL site and may add uncertainty to the meaning of on-site data. BNL drinking water wells have been shut down because of organics contamination. These wells were located upgradient of all known on-site hazardous waste areas, but were downgradient of smaller, off-site potential sources. Therefore, the exact source of the contaminations was not identified. There were two potential, but unconfirmed, off-site sources of groundwater contamination. First, an off-site underground storage tank (UST) at a retail gas station located upgradient at the intersection of Raynor Road and Rt. 25 was known to have leaked gasoline into the groundwater. This UST was approximately one mile from the BNL boundary along William Floyd Parkway and 1.5 miles from the nearest on-site well (designated well SG). The extent of this contamination has not been determined. Dissolved product has not been detected at the 13 to 14 wells that were installed near the station. Only floating product has been measured. Because toluene is one of the primary constituents of gasoline, and one of the suspected contaminants at the B-975 Bubble Chamber Area, it was important to have reliable upgradient data.

The second potential off-site source of groundwater contamination was from cesspool degreasers (e.g., solvents such as trichloroethylene [TCE] and trichloroethane [TCA]). State and local environmental agencies believe that the use of these septic tank cleaners has caused wide-spread groundwater contamination on Long Island. The extent of groundwater contamination at BNL from these sources was not known. There were approximately four dozen houses on the west side of the William Floyd Parkway, along the western border of BNL, and approximately two dozen houses located on the northern border of BNL. These houses may have been potential sources.

4.9.1 Sampling and Analysis Objectives

Statement: Water samples were collected and analyzed in an attempt to detect the presence of groundwater contamination at BNL that may have been moving on-site from off-site sources. This sampling effort also provided a basis for comparison with on-site groundwater monitoring results. Installation of these new wells will add piezometeric data to the existing on-site data base to better understand the groundwater flow regime, including variations caused by on-site pumping.

Supporting Information: Three existing upgradient wells (SG, SB, and SC) are inadequete for sampling due to their small diameter, PVC casing, and distance (900 to 2400 ft) from the BNL boundary.

4.9.2 Sampling and Analytical Design

4.9.2.1 Sampling Design

Request 316: New Monitoring Wells Upgradient of BNL (Phase II) (Fig. 4.3a). A well nest consisting of a 25-ft well and a 50-ft well was to be installed on the west side of Upton Road near the north gate to BNL. The shallow well (ID number 561) was to be used to collect groundwater samples in the upper sections of the aquifer near the air/water interface. Samples collected from the deep well (ID number 560) were to be used to determine if a contaminant plume had penetrated to the 40- to 50-ft depth. Exact well depths and screen intervals were to be selected during drilling and were to be based partially on new water level measurements.

The groundwater monitoring wells were to be augered and the cuttings examined to assure placement of the screened interval in a sand lens. The wells were to be constructed of 4-inch diameter 304 stainless steel. The screen was to be

10 ft long and have a 0.010 slot size. Gravel pack was to fill in the annulus around the screen to a depth of 2 ft above the top of the screen. Bentonite pellets were then to be placed on the gravel pack to form a seal 2 ft thick. If insufficient moisture was available to allow the seal to develop, clean water was to be added to the borehole to help develop the seal. The well was to be tremie grouted to the surface and the grout allowed to harden for at least 12 hours before well development. Well development was to be accomplished by bailing or surging. During well development, periodic measurements of pH, temperature, and specific conductance were to be taken. Development was to continue until the readings had stabilized.

The wells were to be installed and constructed in compliance with all RCRA standards as found in Chapter 3 of RCRA Ground-Water Technical Enforcement Guidance Document, 1986. All necessary permits were to be obtained by a licensed drilling contractor. Wells were to be protected by locking caps and protective posts mounted in a concrete pad.

Two samples were to be collected from each well (Sampling Method: Reference E4.4.4.1 and E4.4.4.4). Samples were to be collected consecutively. If both samples could not be collected on the same day, all parameters for the first sample were to be collected on the first day and those for the second sample on the second day. Groundwater sampling was not to be performed until at least 24 hours after well development. Groundwater elevations in the wells were to be measured before sampling to determine the minimum volume to be purged (Field Method: Reference E4.4.3).

The wells were to be purged until measured field parameters had stabilized. At least three to five borehole volumes were expected to be evacuated before the parameters stabilized. A submersible pump was to be used, although Teflon and stainless steel bailers were to be available if the submersible pump proved to be unacceptable.

Measurements of temperature, pH, and specific conductance were to be performed before and after sampling to confirm water stability (Field Method: Reference E4.5). Samples were to be collected in order of susceptibility to volatilization, and level of concern to the DOE Survey Team. The order in which parameters were to be collected was volatiles, semivolatiles, total tritium, and ICP-metal.

Samples were collected from the wells on 25JUN88. The weather was sunny with a slight breeze, and the temperature was in the mid-70s. The wells were purged with a submersible pump until field measurements stabilized. The depth from the top of the casing to the water surface was 31.9 ft in the shallow well and 31.0 ft in the deep well. Samples BR316010 and BR316021 were collected from the deep well at 1554 and 1612, respectively. Samples BR316032 and BR316043 were collected from the shallow well at 1710 and 1728, respectively.

Note: The following deviations from the Sampling and Analysis Plan were noted:

1. Well 561 was intended to be a 25-ft well used to sample the upper sections of the aquifer near the air/water interface. Well 560's intended use was to determine if a contaminated plume had penetrated to the 40- to 50-ft depth. Though the screen area for well 560 is from 39 to 49 ft as intended, the screen area of Well 561 (which was drilled to the depth of 37 ft) is 26.5 to 36.5 ft.

2. The development of Wells 560 and 561 also appears to have served as the purging. Less than 2 hr elapsed between the beginning of development and the beginning of sampling. Paragraph 3.2.3.2.1.2 of the Addendum to the Sampling and Analysis Plan

required a 24-hr wait between development and sampling.

3. Paragraph 3.2.3.2.1.5 of the Addendum to the Sampling and Analysis Plan required measurements of pH, temperature, and specific conductance before and after sampling to confirm water stability. The logbooks show that the last field measurements for Well 560 were taken 2 1/2 hr before sampling and the last measurements for Well 561 were taken 1 1/2 hr before sampling. In both cases, the field measurements were made during well development, and no measurements were taken after sampling.

4. In the cases of both wells, development began almost immediately after grouting, even though the Addendum to the Sampling and Analysis Plan (3.2.3.2.1) required at least a 12-hr wait between the two stages.

4.9.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 3 were as follows:

Request 316: Samples were analyzed for volatiles, semivolatiles, total tritium, and ICP-metals. Samples were measured in the field for pH, specific conductance, and temperature.

4.9.3 Field and Analytical Data

Field Data:

Request 316: *The field measurements are shown in Table 4.3.3 Samples BR316010 and BR316021 are from the deep well; and the samples BR316032 and BR316043 are from the shallow well. The conductivity of the shallow well was 104 umhos/cm; and from the deep well, the conductivity was 137 umhos/cm. The pH was slightly higher in the shallow well at 5.1 as compared with 4.8 in the deeper well. The temperature was lower in the shallow well, measuring 11^{o}C; in the deep well, it was 13^{o}C. The PID readings in all cases registered 0 ppm.*

Field Data Evaluation:

Request 316: The measurements reported were taken prior to sampling the water. Though the Sampling and Analysis Plan required measurement after sampling, none were taken. Calibration data of the instrument prior to measuring pH, temperature, and conductivity were not available.

Analytical Data:

Request 316:

<u>Metals</u>. Analytical results for metals in groundwater are presented in Table 4.3.3. Of the 16 metals detected, only calcium, manganese, and sodium were above either the CRDL or the IDL.

<u>Extractable organics</u>. Analytical results for semivolatile compounds are presented in Table 4.3.3. From one to seven semivolatile organic compounds were identified in these four respective groundwater (pump) samples. No semivolatile organics were identified in measurable concentrations. Di-n-butylphthalate was identified in estimated concentration of 0.003 mg/L in one sample. Two other

phthalates were identified in concentrations of less than 0.100 mg/L in these samples and also in the blank. Concentrations of tentatively identified compounds were always less than 0.100 mg/L.

Volatile organics. Analytical results for volatile organic compounds are presented in Table 4.3.3. From two to five volatile compounds were identfied in these four respective pump samples. Chloroform, methylene chloride and toluene were detected. Measured concentrations of methylene chloride were 0.011 mg/L or less. Chloroform and toluene were below quantitation limits, but were always estimated at less than 0.010 mg/L.

Radiochemistry. Analytical results are presented in Table 4.3.3. Samples from Well 560 contained small amounts of tritium (85 and 147 pCi/L). The two samples from Well 561 were slightly higher at 128 and 152 pCi/L.

Analytical Data Evaluation:

Request 316:

Metals. Three metals (calcium, manganese, and sodium) were detected above either the CRDL or the IDL for this request.

Extractable organics. No semivolatile organics were identified in measurable concentrations. Concentrations of tentatively identified compounds were always less than 0.100 mg/L.

Volatile organics. Chloroform, methylene chloride and toluene were detected in these samples. Measured or estimated concentrations volatile compounds were always less than 0.015 mg/Kg.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample

results were within 10% of their true value, radiological data are considered reliable.

4.9.4 Limitations and Qualifications

Data Quality Level:

Request 316: The sampling plan is rated Quality Level I. The field sampling is rated Quality Level II. The overall analytical rating is Quality Level II.

Field Data:

Request 316: Field measurements were made several hours prior to sampling during well development. Since minimal time was allowed (less than 2 hr) between well development and sampling which called for a 24 hr wait, the data quality for the field data and possibly the laboratory data are suspect.

Analytical Data:

Request 316:

Metals. Data are Quality Level I for all metals with the exception of thallium which is Quality Level II because it exceeded the control limit for the interference control standard.

Extractable organics. Data are of Quality Level I.

Volatile organics. Data are of Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 3
Request Number: 316

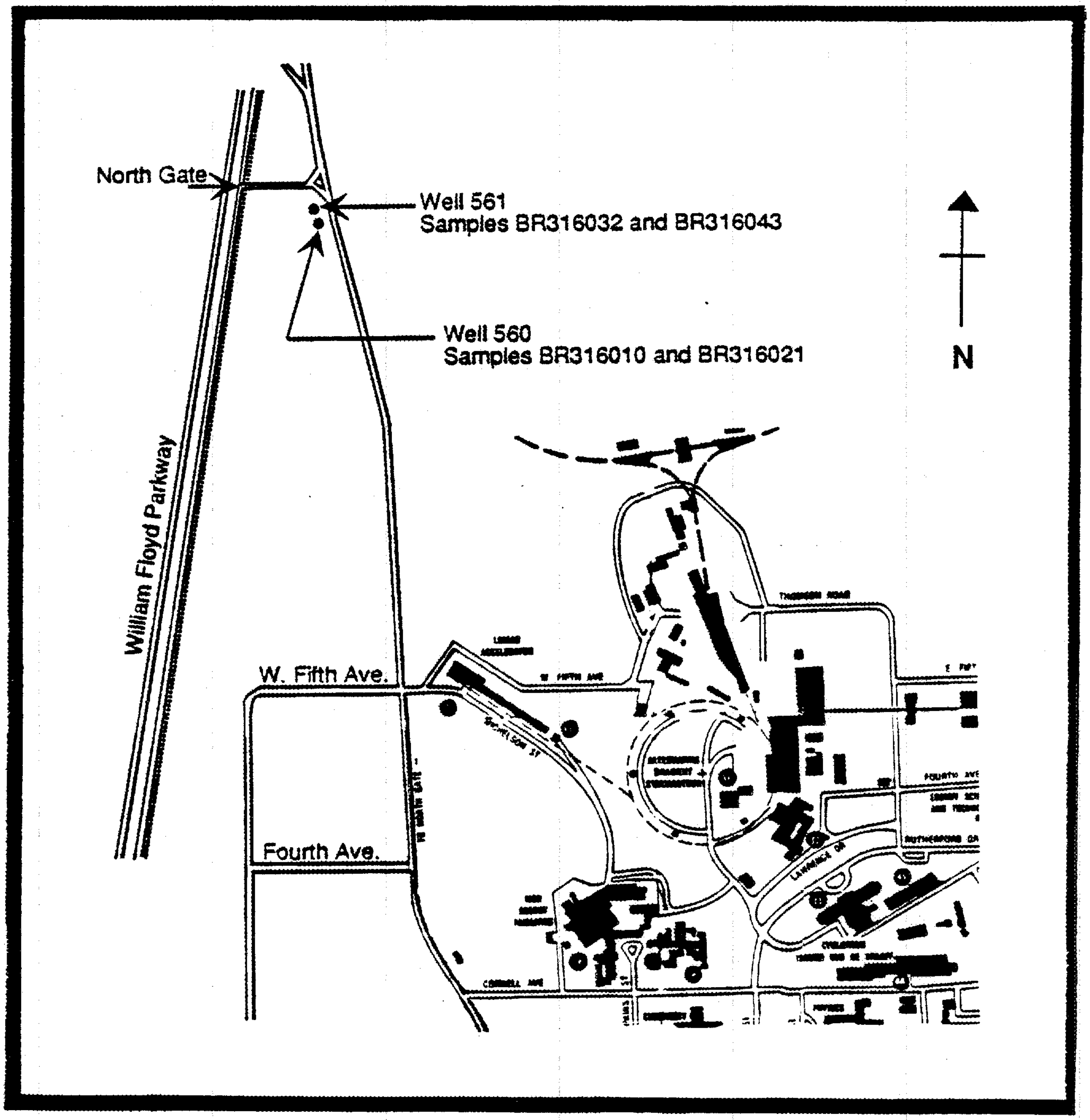

Figure 4.3a. New Monitoring Wells Upgradient of BNL (Request 316)

TABLE 4.2.3 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 3

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS NUMB HITS	ANIONS NUMB ANAL	METALS NUMB HITS	METALS NUMB ANAL	O&G NUMB HITS	O&G NUMB ANAL	PET HYDRO NUMB HITS	PET HYDRO NUMB ANAL	PES/H/PCB NUMB HITS	PES/H/PCB NUMB ANAL	SEMIVOLS NUMB HITS	SEMIVOLS NUMB ANAL	VOLS NUMB HITS	VOLS NUMB ANAL	RADS NUMB HITS	RADS NUMB ANAL
BR316	W UPTON RD	WELL	GRN WATER	4	4	PUMP	0	0	4	4	0	0	0	0	0	0	4	4	4	4	4	4
			MED TOTAL	4	4		0	0	4	4	0	0	0	0	0	0	4	4	4	4	4	4
			EP TOTAL	4	4		0	0	4	4	0	0	0	0	0	0	4	4	4	4	4	4

TABLE 4.3.3 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 3 UPGRADIENT MONITORING WELLS

DRAFT DO NOT CITE

S&A REQUEST: 316
LOCATION: WEST SIDE UPTON RD.
MEDIUM: GROUND WATER

FIELD MEASUREMENTS	SAMP NO: BR316010	BR316021	BR316032	BR316043
CONDUCTIVITY (UMHOS/CM)	137	137	104	104
FID/PID (PPM)	0	0	0	0
PH (UNITS)	4.8	4.8	5.1	5.1
TEMPERATURE (DEG C)	13	13	11	11

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR316010H SDG NO: BR000011A TYPE: PUMP	BR316021H BR000011A PUMP	BR316032H BR000011A PUMP	BR316043H BR000011A PUMP
ALUMINUM	21 U	26 B	21 U	24 B
ANTIMONY	58 U	58 U	68 B	58 U
BARIUM	31 B	32 B	41 B	42 B
CALCIUM	8670	8540	3760 B	3660 B
CHROMIUM	3.6 B	2.6 U	6.7 B	4.7 B
COPPER	24 B	25 B	8.9 B	3.4 B
IRON	22 B	20 B	16 B	9.6 B
MAGNESIUM	2380 B	2390 B	2100 B	2100 B
MANGANESE	156	158	469	469
NICKEL	12 U	15 B	12 U	12 U
POTASSIUM	4990 B	5100	5730	5810
SELENIUM	97 U	97 U	97	97
SILVER	2.2 U	4.2 B	3.7 B	2.2 U
SODIUM	19300	19200	13700	13800
VANADIUM	5.3 B	6.1 B	7.1 B	6.1 B
ZINC	21	18 B	17 B	13 B

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: BR316010F SDG NO: BR000022B TYPE: PUMP	BR316021E BR000022B PUMP	BR316032E BR000022B PUMP	BR316043F BR000022B PUMP
BIS(2-ETHYLHEXYL)PHTHALATE	66 B	37 B	23 B	14 B
BUTYLBENZYLPHTHALATE	11 B	10 U	7 BJ	10 U
DI-N-BUTYLPHTHALATE	3 J	10 U	10 U	10 U
* HEXANEDIOIC ACID DIOCTY(25.62)		19 J		
* HEXANEDIOIC ACID DIOCTY(25.63)	39 J		92 J	
* UNKNOWN(12.38)	11 J			
* UNKNOWN(16.52)	11 J	9 J		
* UNKNOWN(23.30)		12 J		
* UNKNOWN(27.87)		16 J		
* UNKNOWN(27.90)	22 J			

TABLE 4.3.3 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 3 DRAFT DO NOT CITE
UPGRADIENT MONITORING WELLS

S&A REQUEST: 316
LOCATION: WEST SIDE UPTON RD.
MEDIUM: GROUND WATER

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR316010B / BR000022B / PUMP	BR316021B / BR000022B / PUMP	BR316032C / BR000022B / PUMP	BR316043B / BR000022B / PUMP		
ACETONE		10 U	13	10 U	10 U		
BROMODICHLOROMETHANE		5 U	3 J	5 U	5 U		
CHLOROFORM		4 J	4 J	2 J	5 U		
METHYLENE CHLORIDE		5 U	6	11	7		
TOLUENE		3 J	2 J	1 J	1 J		

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR316010I / 013 / PUMP	BR316021I / 013 / PUMP	BR316032I / 013 / PUMP	BR316043I / 013 / PUMP		
H-3		85	147	128	152		

TABLE 4.4.3 SAMPLE LOCATIONS AND SAMPLE VOLUMES
ENVIRONMENTAL PROBLEM 3

WELL ID	SAMPLE NUMBER	DATE	SAMPLING METHOD	VOLUME (L)
560	BR316010	25JUN88	SUBM. PUMP	47.7
560	BR316021	25JUN88	SUBM. PUMP	47.7
561	BR316032	25JUN88	SUBM. PUMP	16.4
561	BR316043	25JUN88	SUBM. PUMP	16.4

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4.10 Environmental Problem 4: BNL Landfill

Request Number: 500 (phase I), 507, and 508 (phase II).

Requester: R. Basinski.

Finding and Basis: Leachate from the current landfill may be a potential source of soil and groundwater contamination. The Survey Team observed that several discrete streams of leachate were discharging from the landfill and pooling outside the fence line.

BNL has disposed of solid wastes in two on-site landfills since the beginning of its operations in 1947. The former landfill was used from 1947 to 1966 by BNL and by the Army during World War II. Limited records existed regarding waste disposal in the facility. Much of the waste disposed of was construction and demolition debris, laboratory debris, unreclaimable decontaminated equipment, contaminated clothing, radioactive animal carcasses, and personnel protective clothing. Once in 5 to 7 years, sludge from the sanitary sewage plant was disposed of in the landfill. The water treatment plant sludge was disposed of on the landfill once or twice each year. It is likely that both hazardous and mixed wastes were disposed of in the landfill.

The present landfill was put into operation in January 1967. Since the beginning, putrescible and nonputrescible trash and building materials were deposited in the landfill. However, since February 1981, putrescible trash has been taken off-site to the Brookhaven Town Landfill. Lightly contaminated radioactive wastes, including paper towels, contaminated clothing, personnel protective devices, mouse litter contaminated with tritium, and carcasses of animals used in experiments were disposed of in the landfill. It is possible that the current landfill has received some of the same materials as those disposed of in the former landfill. The landfill was receiving 6 to 8 tons daily of nonputrescible wastes and building materials at the time of the Environmental Survey.

Disposal of radioactive wastes was stopped in 1978, although at least one load of radioactively contaminated sewage sludge was disposed of in the landfill after 1978. Administrative controls requiring waste segregation at the source were used to keep radioactive wastes from being disposed of at the landfill. A radiation monitor was used to check each truckload of material that was to be disposed of at the landfill. Access to the landfill was restricted by a fence and a locked gate, except during working hours. The landfill was operating in accordance with a permit issued by the New York Department of Environmental Conservation (NYDEC) at the time of the Environmental Survey.

4.10.1 Sampling and Analysis Objectives

Statement: Water and soil samples were to be collected near the BNL Landfill to determine if the contaminants listed in section 4.10.2.2 were present above analytical detection levels in leachate from the landfill (phase I). In addition, four new wells were to be installed near the landfill, and split-spoon and groundwater samples were to be collected for analysis (phase II).

Supporting Information: The NYDEC permit for BNL contains several site-specific requirements. Special conditions prohibited disposal of perishable or radioactive materials and required quarterly monitoring and reporting of analyses of groundwater for metals and excess radioactivity. Special requirements for asbestos disposal included the designation of a specific cell for asbestos disposal, fencing, a 5-ft separation from groundwater, daily cover, record-keeping, and prior notification to NYDEC of asbestos disposal.

Fourteen monitoring wells were in the area, although results for some may have been questionable because BNL audits have shown several wells to be screened at a questionable depth. Chloroform and radioactivity have been detected in the groundwater.

4.10.2 Sampling and Analytical Design

4.10.2.1 Sampling Design

Request 500: BNL Landfill Leachate (Fig. 4.4a). Three grab water samples (Sampling Method: Reference E4.2.1 and E4.2.3A) were to be collected from the area of the leachate pool and plumes of the BNL Landfill. If leachate was present in the southeast section, one grab sample was to be collected from that area. If leachate was not present in all areas, grab surface soil samples were to be collected from each of the stained areas. The plumes and the pooled area were to be considered homogeneous. The Sampling Team was to divide the pool area and the leachate plumes into three regions, then divide each region into a 20-segment grid. (The combined plume areas were to contain 60 segments.) Sampling site selection was to be by systematic random; however, when the Sampling Team arrived on-site, they found this approach inappropriate. By direction of Field Team Leader Fred Taylor, samples were taken from areas of pooled leachate.

Water samples BR500014, BR500025, and BR500036 and soil samples BR500047, BR500058, and BR500069 were collected on 13APR88 between 0851 and 1130. Both water and soil samples were collected at each sampling location. On 16APR88, the Sampling Team returned to the landfill site to collect additional water samples due to the need for extra volume in the laboratory. Water samples BR500070, BR500081, and BR500092 were collected between 1150 and 1200. Field measurements for pH, conductiity, and temperature were taken for each sample (Field Method: Reference E4.5). OVAs were taken using a "TIP" (Field Method: Reference App. D, BNL Sampling and Analysis Plan).

The Sampling Team arrived at sample location BR500014 (water) at about 0845. The sky was overcast, temperature about 45^{O}F, and there was a slight wind from the northwest. The site was located along the north fence line of the landfill, approximately 300 ft west of the dirt road leading into the landfill area. A RAD scan showed 25 cpm. The samples were taken from a hole, approximately 2 to 2 1/2 in. in diameter, that had been dug 2 days prior to sampling. Water was standing within 2 to 3 in. of the top of the hole. The area was very sandy with a red stain. The water was brown and greasy looking and had floating red scum.

Sample location BR500025 (water) was located on the southeast side of the landfill area, about 100 ft north of the southeast corner of the fenced landfill area and about 15 ft from the fence line. A RAD scan showed 35 cpm. There were some maples and pussy willows in the area. Native grasses with roots 2 to 3 in. into the soil were growing on the surface. There was sand below the layer of soil. The samples were taken from a hole that had been dug 2 days prior to sampling. Water was standing within 3 to 4 in. of the top of the hole. The water was reddish brown with some iridescence and floating red scum.

Sampling location BR500036 (water) was on the southwest edge of the landfill area, about 75 ft west of the southeast corner of the landfill and about 3 ft from the fence line. The area sampled was a low-lying area on which leached material and liquid had accumulated. A RAD scan showed 40 cpm. The water was rust colored and had a greasy scum and iridescence on the surface. The road just south of this area also had standing water. There were abundant trees (red maples and pussy willows) outside the fenced area. During collection of this sample, the wind began gusting at 20 to 30 mph from the northeast.

The Sampling Team arrived at sample location BR500047 (soil) at 1000. Soil at the site was heavily stained dark red with what appeared to be iron oxide. Vegetation growth in the area seemed to be inhibited by either the "iron" or by an overabundance of water. The sampling site was approximately 30 ft long and was divided into 20 sections. Section 7 was randomly chosen to be sampled. The topsoil was dark red silt, which abruptly changed to sand at approximately 2 in. The sand was stained orange and was fine to medium in grain size. The water table was 4 in. below the surface. A RAD scan showed 10 to 30 cpm, and the OVA reading was 3.2.

Sample location BR500058 (soil) was also stained dark red, with an iridescent sheen on the surface. The soil profile was the same as for the previous sample, except that the soil layer was only 1 in. thick. There was no dust in the area because the soil was moist.

Sample location BR500069 (soil) was very wet, with a pond of standing water. The soil composition was silty and claylike and was stained with iron oxide and oil. Vegetation was of the type supported by sustained water levels (rushes, etc.). A RAD scan at this point read 30 to 80 cpm. The OVA reading was 6.0 to 7.0.

When the Sampling Team returned to the landfill site on 16APR88 to collect additional water samples, the temperature was about 40^{O}F, with winds gusting 15 to 20 mph.

Sample location BR500070 was along the north fence line of the landfill. The sample was collected from a basin dug in the leachate plume on 11APR88. This sample was collected to provide additional volume for matrix spikes.

Sample BR500081 was collected along the east fence line in a basin dug on 11APR88. The water had a definite foul odor and a metallic sheen.

Sample BR500092 was collected along the south fence line from a permanent pool of water. The pool had bulrush vegetation at the fence line. There was no metallic sheen on the water at this location.

Note: The following deviations from the Sampling and Analysis Plan were noted:

1. The Sampling and Analysis Plan required soil samples to be taken if leachate was not present. Even though leachate was present, the soil samples were collected.

2. Additional water samples (BR500070, BR500081, and BR500092) were taken because of a need for additional volume in the laboratory. No field measurements for pH, conductivity, temperature, and OVAs were taken.

Request 507: (Groundwater) New Monitoring Wells in the Current Landfill Area (Fig. 4.4b). Four wells were to be installed near the BNL current landfill. The wells were to be arranged such that a single 25-ft well (ID number 562) would be installed and sampled upgradient of the landfill. Another single 25-ft well (ID number 563) would be located downgradient of the landfill. A well nest consisting of a 25-ft well (ID number 564) and a 50-ft well (ID number 565) was also to be installed at another downgradient location. The shallow wells would be used to collect groundwater samples in the upper sections of the aquifer near the air/water interface. The deep well would be used to determine if any contaminant plume had penetrated to the 40- to 50-ft depth. Exact well depths and screen intervals were to be selected during drilling and were to be based partially on new water level measurements.

The groundwater monitoring wells were to be augered and the cuttings examined to assure placement of the screened interval in a sand lens. The wells were to be constructed of 4-in. diameter 304 stainless steel. The screen was to be 10 ft long and have a 0.010 slot size. Gravel pack was used to fill in the annulus around the screen to a depth of 2 ft above the top of the screen.

Bentonite pellets were then to be placed on the gravel pack to form a seal 2 ft thick. If insufficient moisture was available to allow the seal to develop, clean water was to be added to the borehole to help develop the seal. The well was to be tremie grouted to the surface and the grout allowed to harden for at least 12 hr before well development. Well development was to be accomplished by bailing or surging. During well development, periodic measurements of pH, temperature, and specific conductance were to be taken. Development was to continue until the readings had stabilized.

The wells were to be installed and constructed in compliance with all RCRA standards as found in Chapter 3 of RCRA Ground-Water Technical Enforcement Guidance Document, 1986. All necessary permits were to be obtained by a licensed drilling contractor. Wells were to be protected by locking caps and protective posts mounted in a concrete pad.

Two samples were to be collected from each well (Sampling Method: Reference E4.4.4.1 and E4.4.4.4). Samples were to be collected consecutively. If both samples could not be collected on the same day, all parameters for the first sample were to be collected on the first day and those for the second sample on the second day. Groundwater sampling was not to be performed until at least 24 hr after well development. Groundwater elevations in the wells were to be measured before sampling to determine the minimum volume to be purged (Field Method: Reference E4.4.3).

The wells were to be purged until measured field parameters had stabilized. At least three to five borehole volumes were expected to be evacuated before the parameters stabilized. A submersible pump was to be used, although Teflon and stainless steel bailers were to be available if the submersible pump proved to be unacceptable.

Measurements of temperature, pH, and specific conductance were to be performed before and after sampling to confirm water stability (Field Method: Reference

E4.5). Samples were to be collected in order of susceptibility to volatilization, and level of concern to the DOE Survey Team. The order in which parameters were to be collected was volatiles, semivolatiles, total tritium, strontium-90, ICP-metals, and plutonium.

Samples for Request 507 were collected on 30JUN88. The weather was partly cloudy with a light breeze, and the temperature was in the low 70s.

Samples BR507011 and BR507022 were collected from the shallow well (ID number 562) upgradient from the landfill near the First Street entrance at 0948. The actual well depth was 34 ft. The depth of the water surface from ground level was 26 ft.

Samples BR507033 and BR507044 were collected from the shallow well (ID number 563) downgradient from the landfill at 1200 and 1220, respectively. The actual well depth was 18 ft. The depth to the water surface from ground level was 12.6 ft.

Samples BR507055 and BR507066 were collected at the shallow well at the downgradient nest at 1528 and 1542, respectively. The actual depth of the well was 21 ft. The depth to the water surface from the ground level was 13.5 ft.

Samples BR507077 and BR507088 were collected from the deep well at the downgradient nest at 1715 and 1720, respectively. The actual well depth was 49 ft. The depth to the water surface from the ground level was 12.8 ft.

Note: The following deviations from the Sampling and Analysis Plan were noted:

1. Well 562 (which was intended to sample the upper sections of the aquifer near the air/water interface) was drilled to the depth of 34 ft. It

was, therefore, sampling water from the 24- to 34-ft depths.

2. At Well 562, the samples were collected approximately 1/2 hr after the development of the well began; for Well 563, 1 hr elapsed between the beginning of well development and the collection of the first sample; for Well 564, approximately 2 hr elapsed between the beginning of development and sampling; and for Well 565, 1 1/4 hr passed between the beginning of development and sampling. Paragraph 3.2.4.3.1.2 of the Addendum to the Sampling and Analysis Plan states that "groundwater sampling will not be performed until at least 24 hr after well development."

3. Paragraph 3.2.5.3.1.5 of the Addendum to the Sampling and Analysis Plan requires measurements of pH, temperature, and specific conductance before and after sampling to confirm water stability. All field measurements recorded in the logbooks were taken during the development of the wells prior to sampling. No measurements were taken after sampling.

4. Samples BR507022 and BR507011 were, according to the logbook, collected at the same time.

Request 508: (Subsurface Soil) New Monitoring Wells in the Current Landfill Area (Fig. 4.4c). Four wells were to be installed near the BNL current landfill. The wells were to be arranged such that a single 25-ft well (ID number 562) would be installed and sampled upgradient of the landfill. Another single 25-ft well (ID number 563) would be located downgradient of the landfill. A well nest consisting of a 25-ft well (ID number 564) and a 50-ft well (ID number 565) was also to be installed at another downgradient location. Split-spoon soil samples were to be collected during drilling at intervals of 2 to 4, 6 to 8, 10 to 12, and 20 to 22 ft for Wells 562 and 563. Well 565 was to have samples taken at 2 to 4, 6 to 8, 10 to 12, 20 to 22, 30 to 32, 40 to 42, and 48 to 50 ft. No soil samples were to be taken from Well 564.

The wells were drilled by R & L Water Well Contractors, using a Speedstar drill rig and hollow-stem auger. The wells were installed and constructed in compliance with all applicable local regulations and facility standards.

Using a split spoon sampler, soil samples were collected at intervals of 2 to 4, 6 to 8, 10 to 12, and 20 to 22 ft at Wells 562, 563 and 564. Samples were collected at 31 to 32 1/2, 41 1/2 to 43, and 48 1/2 to 50 ft at Well 565. Samples above the water level (2 to 4, 6 to 8, and 10 to 12 ft for Wells 562, 563 and 564 and 20 to 22 ft in Well 562) were taken in triplicate. One sample container from each sample set was placed in the sun or heated for 15 min. After that time, the air was tested for OVA with a FID. If levels increased 5 ppm over background, the remaining two volatile samples, along with the rest of the samples for that well, were retained for laboratory analysis. The heated volatile sample was to be given to BNL for proper disposal. If the OVA indicated an absence of organic vapor, lithological information was recorded and all samples were to be discarded. Samples were to be collected in order of their sensitivity to volatilization and interest to the DOE Survey Team. The order of collection was volatiles, semivolatiles, total tritium, ICP-metals, strontium 90, and plutonium. The samples collected below the water level were for lithological determination only.

Only samples from Wells 563 and 564 showed PID levels above 5 ppm. Samples BR508056, (2 to 4 ft), BR508067 (6 to 8 ft) and BR508078 (10 to 12 ft) were analyzed for Well 563. They were collected on 28JUN88 at 1007, 1038, 1058 respectively. Samples BR508089 (2 to 4 ft), BR508090 (6 to 8 ft), and BR508103 (10 to 12 ft) were analyzed for Well 564. They were collected on 28JUN88 at 1622, 1641, and 1658 respectively. All other soil samples for this request were given to BNL for disposal after lithological data were recorded. The data are as follows:

Well 562

Depth (in feet)	Soil Description
0-2	Two layers of asphalt at approximately 5 in. each covered cobbles in loam soil.
2-4	Poorly-sorted, light brown sand of fine to coarse grain, subangular to subrounded and slightly silty; one cobble approximately 2 1/2 to 3 in. in diameter.
6-8	Well-sorted sand of medium to coarse grain, subrounded, with no fines and few pebbles.
10-12	Well-sorted sand of coarse to very coarse grain, subangular to subrounded; the sand coarsened with depth until it became a fine gravel with pebbles in the last 6 in.
20-22	Well-sorted, moist sand of coarse to very coarse grain, subangular to subrounded; the sand coarsened with depth until it became a fine gravel with pebbles in the last 6 in.

Well 563

Depth (in feet)	Soil Description
2-4	Fine-grained sand, brown to gray, mixed with silt and clay.
6-8	Micaceous, tan to light brown, silt mixed with clay and some sand partings.
9	Well-sorted, medium-grained sand mixed with small amounts of silt and clay.
10-12	Micaceous gray silt mixed with some clay and sand for the first foot, with well-sorted, medium to coarse, moist gravel with no fines for the second foot. The gravel had been stained with an orange leachate.
20-22	Medium to coarse sand with pebbles, gravel and no fines.

Well 564

Depth (in feet)	Soil Description
0-2	Sandy loam with tree roots.
2-4	The first foot was 50% moderately-sorted, light brown sand of medium to fine grain mixed with silt and 50% well-sorted, well-rounded pebbles approximately 3/4 to 1 in. in diameter. The second foot was fine-to

	medium-grain sand with gray silt and well-sorted, subangular gravel.
6-8	Fine- to medium-grain sand with gray silt and well-sorted, subangular gravel.
10-12	Fine- to medium-grain sand with gray silt; well-sorted subangular gravel; cobbles; and pebbles.
12 1/2-17	Fine- to medium-grain sand, coarsening downwards to very coarse sand and small gravel with little to no fines.

Well 565

Depth (in feet)	Soil Description
31-32 1/2	Poorly-sorted, subangular to subrounded gray sand of fine to coarse grain with some fines and a few pebbles.
41 1/2-43	Poorly-sorted, subangular to subrounded gray sand of fine to coarse grain, with some fines and a few pebbles.

Note: The following deviations from the Sampling and Analysis Plan were noted:

1. Three soil samples were taken from shallow Well 564 in the nest downgradient from the landfill. The Addendum to the Sampling and Analysis Plan

specifically states that this well will not be sampled.

2. Three soil samples were taken for Well 563. The fourth (20 to 22 ft) was not taken because the well was only drilled to an 18-ft depth.

4.10.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 4 were as follows:

Request 500: Samples were analyzed for volatiles, semivolatiles, pesticides, PCBs, ICP-metals, AA-mercury, tritium, and gamma scan. Water samples were measured for radiation, pH, conductivity, temperature, and OVA. Field measurements for radiation and OVAs were made during collection of soil samples.

Request 507: Samples were analyzed in the laboratory for volatiles, semivolatiles, total tritium, ICP-metals, strontium-90, and plutonium. Field measurements were taken for pH, specific conductance, and temperature.

Request 508: Samples were analyzed in the laboratory for volatiles, semivolatiles, total tritium, ICP-metals, strontium-90, and plutonium. Organic vapor headspace analysis using a flame ionization detector was conducted in the field.

4.10.3 Field and Analytical Data

Field Data:

Request 500: *Field data are given in Table 4.3.4. Request 500, which included both water and soil samples, was honored by a separate team from that of Requests 507 (groundwater) and 508 (soil). Results of measurements for the water samples show that the pHs ranged from 6.8 to 7.3. The conductivity values ranged from 0.82 to 1.7 mS/cm. The temperature of the water varied from 7.8°C to 9°C. No PID readings were registered. The radioactive scans showed 35 to 40 cpm.*

Soil samples were also collected in this request. Field measurements made included a radioactive scan and OVA (PID) readings for two of the three soil samples. These results, which are also noted in the text but not in the tables, were 10 to 30 cpm and 3.2 ppm for sample BR500047 and 30-80 cpm and 6.0 to 7.0 ppm for sample BR500069.

Request 507: *Field measurements for this request include conductivity, pH, and temperature. In addition, PID readings were taken but all readings showed no organic vapors. For the results to be understood, the samples must be viewed in four groups of pairs: one pair of samples from the shallow upgradient Well 562; the next pair of samples from the shallow downgradient Well 563; one pair from the shallow downgradient Well 564; and the final pair from the deep downgradient Well 565. Water in the shallow upgradient Well 562 was at 26 ft; in the remaining samples (including the deep well), water was at the 12 to 13.5 ft depth.*

The upgradient well measured conductivity of 563 umhos/cm, with a water temperature of 13°C and pH of 5.8. In the downgradient wells, the conductivity of the two shallow wells showed conductivities which were lower than the upgradient well (729 and 642 umhos/cm for wells 563 and 564 respectively) and *pHs which were higher (6.2 and 6.6 respectively). The temperature of the water was equal to or slightly lower (13°C and 12°C respectively). In the deep well (565), which was drilled close to well 564, the conductivity was the lowest (237 umhos/cm), with an intermediate pH of 6.3 and a higher temperature of 15°C.*

Request 508: *The field measurements taken during well drilling represent wells which were downgradient from the landfill. Samples BR508056, BR508067, and BR508078 represent Well 563, and samples BR508089, BR508090, and BR508103 represent Well 564. The FID readings for Well 563 range from 70 to 180 ppm; for Well 564 the range is greater (2.4 to 520 ppm). There was no radioactivity associated with Well 563; however, in Well 564, radioactivity was present and the readings were converted to dose rates of 20 urem/hr.*

Field Data Evaluation:

Request 500: The instrument used to measure pH, conductivity, and temperature was calibrated on the day prior to use; hence, the results are reliable. In addition, the PID was calibrated on the day of use with a fixed organic compound; hence, the readings are reliable as the organic vapor properties are similar to the calibrating compound. Radiological instruments were calibrated prior to visiting a site; in general, the results are reliable for beta/gamma radiation. It must be noted that the field data were taken on the first sampling round; three days later, more water samples were collected. However, the field readings were not taken.

Request 507: Although no formal written information was available, contact with the field team leader (M. Abashian) confirmed that the instrument used for the measurement was calibrated prior to use in the field. The results represent sample readings taken either during or soon after well development; the plan stated the readings to be made 24 hours after well development. No readings were made after taking the samples for laboratory analysis as per the plan; hence, it is not known if the water in the wells had stabilized.

Request 508: According to the S&A Plan, samples were to be taken for three of the four wells if FID readings were obtained; otherwise, the samples were to be discarded. Although the plan specified that no samples would be collected from Well 564, the absence of FID readings from the other samples (thus discarded) suggested that samples from Well 564 be retained for analysis. Because no depths were recorded with the FID readings, the relationship of concentrations with depth cannot be established.

Analytical Data:

Request 500 (soil):

Metals. Analytical results for metals in soil are presented in Table 4.3.4. Of the 19 metals detected, four were below either the CRDL or the IDL in all three samples: cadmium, cobalt, silver, and sodium. Of the remaining metals detected, chromium ranged from 4.3 to 20 mg/kg, copper from 6.7 to 28 mg/kg, mercury from 0.07 to 0.31 mg/kg, nickel at 15 mg/kg, zinc from 45 to 180 mg/kg, barium was at 57 mg/kg, beryllium at 1.4 mg/kg, and lead at 49 mg/kg. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, and vanadium.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Analytical data for semivolatile organic compounds are given in Table 4.3.4. Of the three soil samples, 21 compounds were detected in two and 24 compounds were detected in the other. Fluoranthenes and pyrene were identified in concentrations between 0.480 and 0.580 mg/kg in sample BR500069. Other than that, no semivolatile organic compounds were identified in measurable concentrations. All estimated concentrations of positively identified compounds were less than 1 mg/kg, and estimated concentrations of tentatively identified compounds were less than 1 mg/kg except for diacetone alcohol (all *three samples, 1.6 to 1.9 mg/L), dioctyl adipate (all three samples, 1.6 to 1.9 mg/L), and probable aldol-condensation (all three samples, 20 to 30 mg/L).*

Volatile organics. *Analytical data for volatile organic compounds are given in Table 4.3.4. For the soil samples, three volatile compounds were detected in one sample, four in another, and five in the remaining sample. Chloroform was detected in the blank and in all samples in concentrations below the quantitation limit, but always estimated at less than 0.020 mg/kg. There was some 1,1,1-trichloroethane detected in one sample, below the quantitation limit but with estimated concentration of 0.009 mg/kg. Several probable hydrocarbons were tentatively identified with estimated concentrations of 0.31 mg/kg or less.*

Radiochemistry. *Analytical results are presented in Table 4.3.4. One soil sample (BR500069) contained a small amount of cobalt-60 (44 pCi/kg). All three samples contained cobalt-137 (62 to 260 pCi/kg) and naturally occurring potassium-40 (5,100 to 11,000 pCi/kg).*

Request 500 (surface water):

Metals. *Analytical results for metals in surface water are presented in Table 4.3.4. Of the 19 metals detected, five were below either the CRDL or the IDL in all three samples: beryllium, cobalt, lead, mercury, and silver. Of the remaining metals detected, barium ranged from 331 to 346 ug/L, cadmium from 11 to 14 ug/L, zinc from 54 to 668 ug/L, chromium was at 57 ug/L, copper at 74 ug/L, and nickel at 53 ug/L. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, sodium, and vanadium.*

PCBs and other extractables. *This analyte was not detected for this request.*

Extractable organics. *Analytical data for semivolatile organic compounds are given in Table 4.3.4. Of the three surface water samples, there were 26 semivolatile organic compounds detected in two samples and 27 such compounds* *detected in the remaining sample. Benzoic acid and bis(2-ethylhexyl)phthalate were measured in concentrations of 0.390 and 0.630 mg/L, respectively, in sample BR500081; but no other semivolatile organic compound was identified in measured or estimated concentrations exceeding 0.100 mg/L in any of the samples. The 4-methylphenol in BR500081 was measured as 0.100 mg/L, but other measured or estimated concentrations of phenol or phenol compounds were always less than 0.050 mg/L). All tentatively identified compounds had concentrations estimated as 0.140 mg/L or less.*

Volatile organics. There were eight, nine, and 11 volatile compounds detected in the three respective surface water samples for this request. Benzene was detected in one sample (below quantitation limit: estimated concentration was 0.003 mg/L). Methylene chloride was identified in all samples and also in the blank. The highest measured or estimated concentration was 0.006 mg/L. Toluene was present in all samples and also in the blank. The highest concentration was 0.021 mg/L. Some 1,1,1-trichloroethane was detected in sample BR500014, and its concentration was measured at 0.110 mg/L. The highest measured or estimated concentration of any identified compound was 0.140 mg/L (measured acetone in one sample and measured chloroethane in another), and the highest estimated concentration of a TIC was 0.022 mg/L of an unknown ketone.

Radiochemistry. This analyte was not detected for this request.

Request 507 (groundwater):

Metals. Analytical results for metals in groundwater are presented in Table 4.3.4. Of the 19 metals detected, ten were below the either CRDL or the IDL in all eight samples: aluminum, antimony, beryllium, cobalt, copper, lead, nickel, silver, thallium, and vanadium. Of the remaining metals detected, barium ranged from 211 to 333 ug/L, chromium from 11 to 15 ug/L, and from zinc 25 to 60 *ug/L. Other metals detected were calcium, iron, magnesium, manganese, potassium, and sodium.*

Extractable organics. Analytical data for semivolatile organic compounds are given in Table 4.3.4. In each of these eight groundwater samples, the number of semivolatile organic compounds detected ranged from one to 15. Phenol was detected in two of the samples in measured concentrations of 0.011 and 0.037 mg/L. Phthalates were present in several samples and often in associated blanks. No measured or estimated concentration of a positively identified compound exceeded 0.080 mg/L, and no estimated concentration of a tentatively identified compound exceeded 0.300 mg/L.

Volatile organics. There were eight groundwater samples taken for this request. From one to eight volatile compounds were detected in particular samples. Benzene was identified in four samples with a highest measured or estimated concentration of 0.007 mg/L. In the same four samples, chlorobenzene was identified below the quantitation limit, but with a highest estimated concentration of 0.002 mg/L. Chloroform was identified in one sample, below the quantitation limit, but with an estimated concentration of 0.002 mg/L. Methylene chloride was measured in six samples with a highest concentration of 0.011 mg/L. Toluene was identified in all but one sample, with a highest measured or estimated concentration of 0.054 mg/L. None of these compounds were found in the blank. TICs were detected in two of the samples with estimated concentrations of 0.016 mg/L in each case.

Radiochemistry. Analytical results are presented in Table 4.3.4. Both samples of water from Well 562 contained tritium (104 and 218 pCi/L), plutonium-239 (0.015 and 0.008 pCi/L), and strontium-90 (1 and 1.3 pCi/L). Only one sample (BR507022) contained detectable plutonium-238 (0.005 pCi/L).

Both water samples from Well 563 contained tritium (3,150 and 3,260 pCi/L) and strontium-90 (4.44 pCi/L). Plutonium-238 (0.017 pCi/L) and plutonium-239 (0.01 pCi/L) were detected in samples BR507044 and BR507033, respectively.

Both water samples from Well 564 contained tritium (6,240 and 6,740 pCi/L) and strontium-90 (2.9 and 3.9 pCi/L). Plutonium-239 (0.025 pCi/L) was found in sample BR507066.

Both water samples from Well 565 contained tritium (204 and 425 pCi/L), strontium-90 (0.98 and 2.2 pCi/L), and plutonium-238 (0.011 and 0.039 pCi/L).

Request 508 (soil):

Metals. Analytical results for metals in soil are presented in Table 4.3.4. Of the 20 metals detected, nine were below the either CRDL or the IDL in all six samples: arsenic, barium, beryllium, calcium, cobalt, lead, silver, sodium, and thallium. Of the remaining metals detected, chromium ranged from 2.2 to 279 mg/kg, copper from 3.6 to 9.3 mg/kg, and zinc from 4 to 16 mg/kg, antimony was at 55 mg/kg, and nickel at 5 mg/kg. Other metals detected were aluminum, iron, magnesium, manganese, potassium, and vanadium.

Extractable organics. Twelve semivolatiles were detected in sample BR508089. From zero to five semivolatiles were detected in each of the remaining five soil samples for this request. In sample BR508089, pentachlorophenol was identified in concentration of 4 mg/kg, phenol in concenrtation of 2.5 mg/kg, and 1,4-dichlorobenzene in concentration of 1.7 mg/kg. Other phenol compounds were present in concentrations between 2 and 3 mg/kg in the same sample. In the other samples, some glycols were tentatively identified in estimated concentrations of from 0.87 mg/kg to 4.9 mg/kg in sample BR508067. Otherwise, measured or estimated concentrations of semivolatile organic compounds in these samples was always less than 1 mg/kg.

Volatile organics. There were six soil samples taken for this request. From one to five volatile compounds were detected in particular samples. Methylene chloride was detected in all samples with the highest concentration measured at 1.4 mg/kg. Toluene was detected in one sample below the quantitation limit, but with an estimated concentration of 0.002 mg/kg. Some 1,1,1-trichloroethane was detected in five samples with a highest concentration measured at 0.088 mg/kg. No other volatile compounds were detected with measured or estimated concentrations exceeding 0.150 mg/kg.

Radiochemistry. Analytical results are presented in Table 4.3.4. All six soil samples contained strontium-90 (25 to 100 pCi/kg). Five samples contained plutonium-238 (0.033 to 0.45 pCi/kg) and four samples contained plutonium-239, (0.026 to 0.52 pCi/kg). No tritium was found.

Sample BR508114 (rinsate) contained tritium (194 pCi/L), plutonium-238 (0.044 pCi/L), plutonium-239 (0.032 pCi/L), and strontium-90 (1.2 pCi/L).

Analytical Data Evaluation:

Request 500 (soil):

Metals. Seven metals of interest (chromium, copper, mercury, zinc, barium, beryllium, and lead) were detected above either the IDL or the CRDL for this request.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Fluoranthenes and pyrene were identified in concentrations between 0.480 and 0.580 mg/kg in sample BR500069, but no other semivolatile organic compounds were identified in measurable concentrations. All estimated concentrations of positively identified compounds were less than 1 mg/kg, and estimated concentrations of tentatively identified compounds were less than 2 mg/kg, except for the probable aldol-condensation of 20 to 30 mg/L in all three samples.

Volatile organics. Chloroform was detected in the blank and in all of the soil samples. There was some 1,1,1-trichloroethane detected in one of those samples. Several probable hydrocarbons were tentatively identified.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 500 (surface water):

Metals. Six metals of interest (barium, cadmium, chromium, copper, nickel, and zinc) were detected above either the IDL or the CRDL for this request.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. For the surface water samples, benzoic acid and bis(2-ethylhexyl)phthalate were measured in concentrations of 0.390 and 0.630 mg/L, respectively, in sample BR500081, but no other semivolatile organic compound was identified in measured or estimated concentrations exceeding 0.100 mg/L in any of the samples. Measured or estimated concentrations of phenol or phenol compounds were always 0.100 mg/L or less. All tentatively identified compounds had concentrations estimated as 0.140 mg/L or less.

Volatile organics. Benzene methylene chloride, toluene, and 1,1,1-trichloroethane were each detected in at least one of the surface water samples. The highest measured or estimated concentration of any identified compound in the surface water samples was 0.140 mg/L (measured acetone in one sample and measured chloroethane in another), and the highest estimated concentration of a TIC was 0.022 mg/L of an unknown ketone.

Radiochemistry. This analyte was not detected for this request.

Request 507 (groundwater):

Metals. Three metals of interest (barium, chromium, and zinc) were detected above the either IDL or the CRDL for this request.

Extractable organics. Phenol was detected in two of the samples in measured concentrations of 0.011 and 0.037 mg/L. No measured or estimated concentration of a positively identified compound exceeded 0.080 mg/L, and no estimated concentration of a tentatively identified compound exceeded 0.300 mg/L.

Volatile organics. Benzene and chlorobenzene were identified in the same four samples. Chloroform was identified in one sample. Methylene chloride was measured in six samples, and toluene was identified in all but one sample. None of these compounds was found in the blank. TICs were detected in two of the samples.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 508 (soil):

Metals. Five metals of interest (antimony, chromium, copper, nickel, and zinc) were detected above the either IDL or the CRDL for this request.

Extractable organics. In sample BR508089, pentachlorophenol, phenol, and 1,4-dichlorobenzene were identified in concentrations of from 1.7 to 4.0 mg/kg. Other phenol compounds were present in concentrations between 2 and 3 mg/kg in the same sample.

Volatile organics. Methylene chloride was detected in all samples. Toluene was detected in one sample. Some 1,1,1-trichloroethane was detected in five samples.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.10.4 Limitations and Qualifications

Data Quality Level:

Request 500: The sampling plan quality rating is Quality Level II; the field sampling quality rating is Quality Level II. The overall analytical quality rating is Quality Level I.

Request 507: The sampling plan quality rating is Quality Level I. The field sampling quality rating is Quality Level II. The overall analytical quality rating is Quality Level II.

Request 508: The sampling plan quality rating is Quality Level II. The field sampling quality rating is Quality Level II. The overall analytical quality rating is Quality Level II.

Field Data:

Request 500: The sampling plan used gridding for selecting the water samples and a modified "stained" area for soils if leachate is absent. The number of soil samples to be collected was not specified in the plan. The conditions depicted in the map accompanying the S&A plan did not represent the conditions in the field. The field sampling team found the area of the landfill to be quite different and used existing leachate "pools" to obtain samples covering three sides of the fenced landfill site. The water collected for analysis initially was insufficient for analysis, a second sampling was made on the same day but no field measurements were made to enable resolution of any inconsistent laboratory results.

Request 507: The elapsed time between well development and collection of the first samples were on the order of a few hours (2 hr or less), although the plan had called for sampling 24 hr after well development. Furthermore, field measurements were not made after sampling to establish if the well water was stabilized.

Request 508: The plan specifically deleted samples from Well 564. However samples were to be collected from wells only if the OVA readings were positive. Two of the three wells to be sampled showed no OVA readings and thus were discarded; Well 564 samples did contain organic vapors and the sampling team decided to collect samples. The basis for the quality rating II for the sampling team is the lack of documentation in the logbooks on the sampling depth of the readings.

Analytical Data:

Request 500:

Metals. Analytical results for samples BR500014, BR500025, and BR500036 were Quality Level I with the following exceptions: aluminum and calcium were Quality Level II, and arsenic was Quality Level III. Aluminum and calcium results exceeded the control limits for both the calibration verification standard and the laboratory control standard. Arsenic is Quality Level III for all samples because of poor spike recovery results. For samples BR500047 and BR500048, results were Quality Level I with the following exceptions: antimony was Quality Level II, and arsenic and beryllium were Quality Level III. Antimony fell below the control limit for spike recovery. Beryllium exceeded the control limit for the laboratory control standard. For sample BR500069, results were Quality Level I with the following exceptions: antimony, silver, and vanadium were Quality Level II, and arsenic was Quality Level III. Antimony and beryllium evaluations are the same as stated above. The percent recovery values for the interference check standard for silver and vanadium fell below the control limit.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. For Request 500, the soil samples were of Quality Level I and the water samples were of Quality Level II because extraction holding times were exceeded by five days.

Volatile organics. For the soil samples in Request 500, the data are of Quality Level II primarily because holding times were exceeded. For the surface water samples in Request 500, the data are of Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 507:

Metals. Data are Quality Level I for all metals with the exception of thallium which is Quality Level II because it exceeded the control limit for the interference control standard.

Extractable organics. Data are of Quality Level I.

Volatile organics. Data are of Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 508:

Metals. All analytes in all samples were Quality Level I with the exception of thallium and antimony which are Quality Level II. Thallium is Quality Level II because it exceeded the control limit for the interference control standard. Antimony results are Quality Level II because they were recovered below the control limit in the spiked sample in all samples except BR508114, which is Quality Level I.

Extractable organics. Data are of Quality Level II because holding times were exceeded by two days and had poor agreement between duplicate sample results.

Volatile organics. Data are of Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 4
Request Number: 500

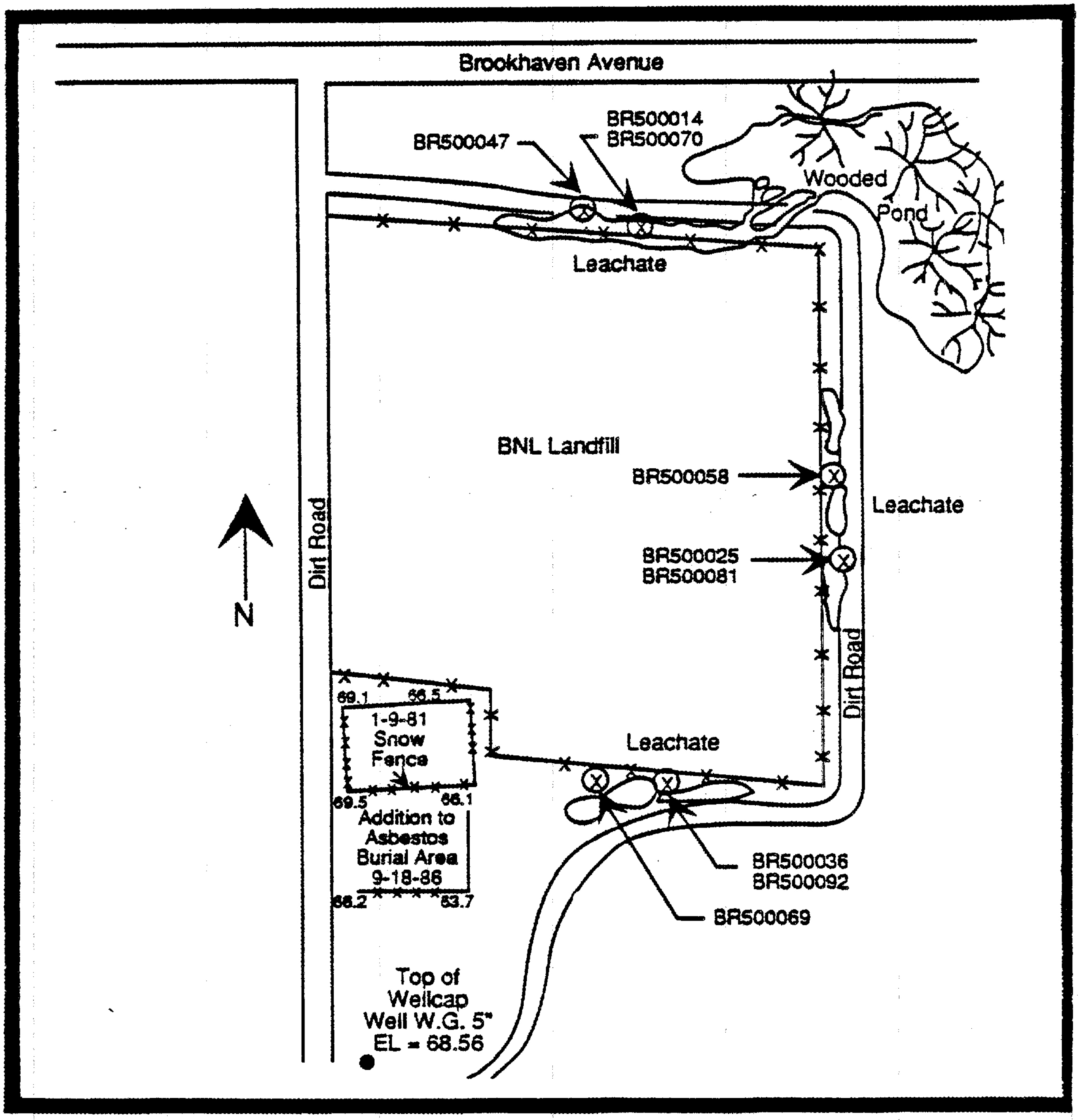

Figure 4.4a. BNL Landfill Leachate (Request 500)

Environmental Problem: 4
Request Number: 507

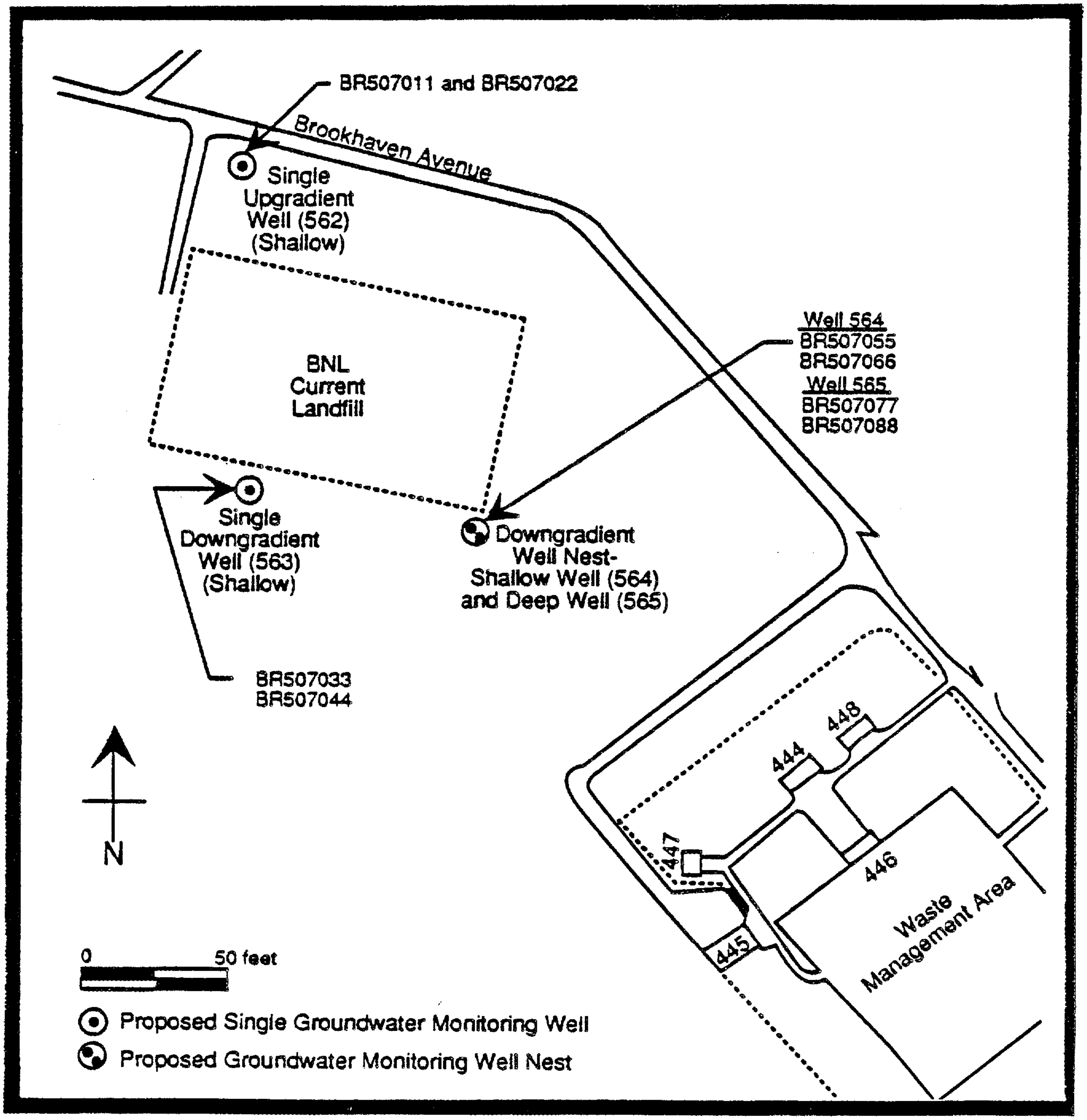

Figure 4.4b. New Monitoring Wells in the Current Landfill Area Groundwater (Request 507)

Environmental Problem: 4
Request Number: 508

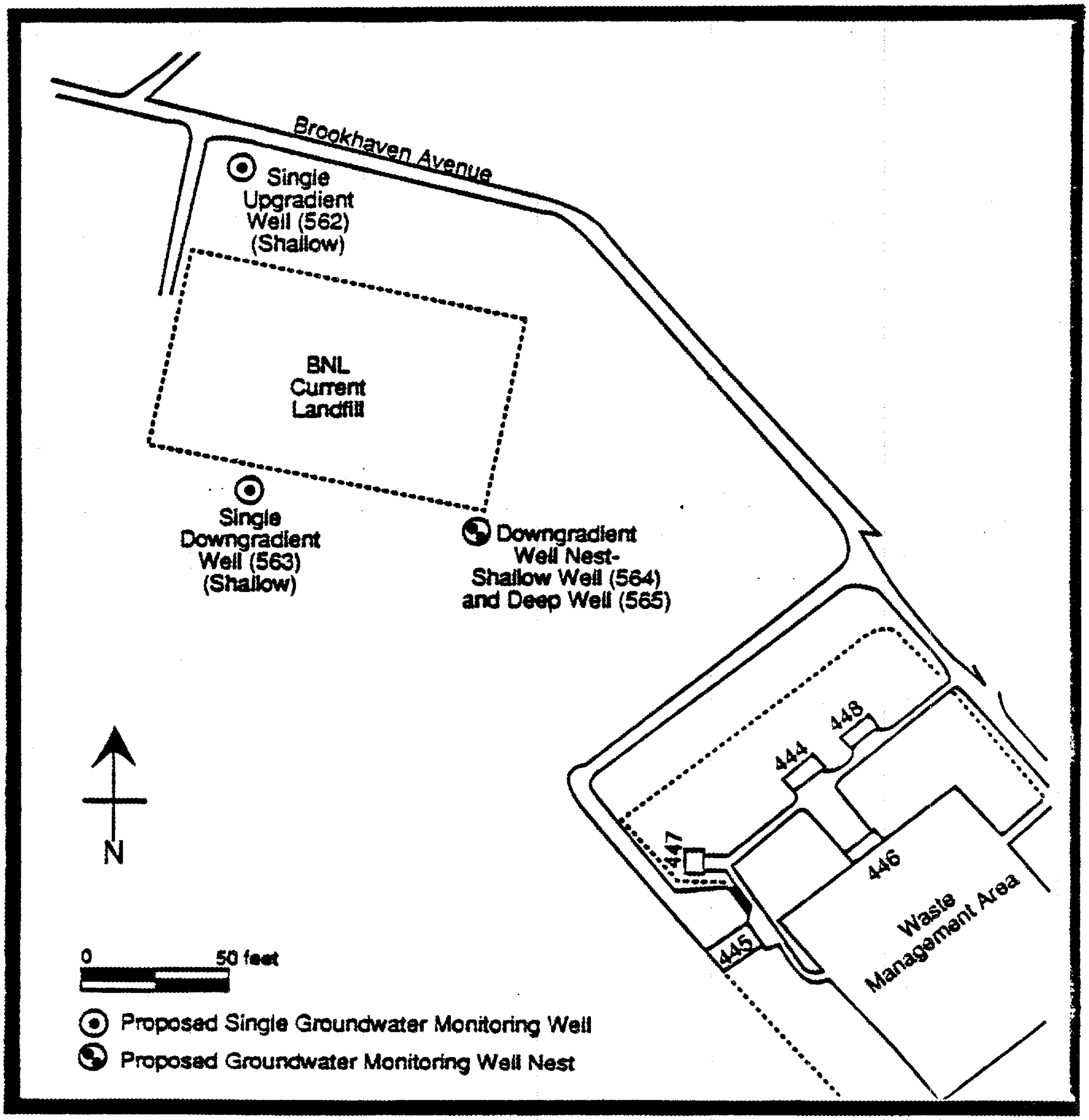

Figure 4.4c. New Monitoring Wells in the Current Landfill Area Subsurface Soil (Request 508)

TABLE 4.2.4 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 4

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS NUMB HITS	ANIONS NUMB ANAL	METALS NUMB HITS	METALS NUMB ANAL	O&G NUMB HITS	O&G NUMB ANAL	PET HYDRO NUMB HITS	PET HYDRO NUMB ANAL	PES/H/PCB NUMB HITS	PES/H/PCB NUMB ANAL	SEMIVOLS NUMB HITS	SEMIVOLS NUMB ANAL	VOLS NUMB HITS	VOLS NUMB ANAL	RADS NUMB HITS	RADS NUMB ANAL
BR500	BNL LANDF	LEACHATE	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	0	3	3	3	3	3	3	3
BR508	U/D CUR LF	WELL AT LND	SOIL	10	6	GRAB	0	0	6	6	0	0	0	0	0	0	4	6	6	6	6	6
		MED TOTAL		13	9		0	0	9	9	0	0	0	0	0	3	7	9	9	9	9	9
BR500	BNL LANDF	LEACHATE	SUR WATER	6	6	GRAB	0	0	3	3	0	0	0	0	0	3	3	3	3	3	0	3
BR508	U/D CUR LF	WELL AT LND	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
		MED TOTAL		7	7		0	0	4	4	0	0	0	0	0	3	4	4	4	4	1	4
BR507	CURR. LNDF	WELL	GRN WATER	8	8	PUMP	0	0	8	8	0	0	0	0	0	0	8	8	8	8	8	8
		MED TOTAL		8	8		0	0	8	8	0	0	0	0	0	0	8	8	8	8	8	8
		EP TOTAL		28	24		0	0	21	21	0	0	0	0	0	6	19	21	21	21	18	21

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 500
LOCATION: BNL LANDFILL LEACHATE
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR500047C BR303015C GRAB	BR500047C BR303015K GRAB	BR500047D BR303015D GRAB	BR500058C BR303015C GRAB	BR500058C BR303015K GRAB	BR500058D BR303015D GRAB
ALUMINUM		3370			3670		
BARIUM		18 B			20 B		
BERYLLIUM		0.52 B			0.36 B		
CADMIUM		0.38 U			0.42 U		
CALCIUM		5330			635 B		
CHROMIUM		4.3			4.9		
COBALT		2.4 B			2.9 B		
COPPER		6.7			8.3		
IRON		11400			10200		
LEAD		10 B			13 B		
MAGNESIUM		1740			574 B		
MANGANESE		223			98		
MERCURY				0.31			0.11
NICKEL		3.7 B			4.2 B		
POTASSIUM			290 B			270 B	
SILVER		1.1 U			1.3 U		
SODIUM		76 B			150 B		
VANADIUM		9 B			9.3 B		
ZINC		178			45		

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR500069C BR303015C GRAB	BR500069C BR303015K GRAB	BR500069D BR303015D GRAB			
ALUMINUM		18600					
BARIUM		57					
BERYLLIUM		1.4					
CADMIUM		0.48 B					
CALCIUM		4930					
CHROMIUM		20					
COBALT		7.3 B					
COPPER		28					
IRON		24200					
LEAD		49					
MAGNESIUM		2800					
MANGANESE		423					
MERCURY				0.07			
NICKEL		15					
POTASSIUM			1400				
SILVER		1.5 B					
SODIUM		272 B					

S&A REQUEST: 500
LOCATION: BNL LANDFILL LEACHATE
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)						
SAMP NO:	BR500069C	BR500069C	BR500069D			
SDG NO:	BR303015C	BR303015K	BR303015D			
TYPE:	GRAB	GRAB	GRAB			
VANADIUM	35					
ZINC	180					

EXTRACTABLE ORGANICS (UG/KG)						
SAMP NO:	BR500047B	BR500058B	BR500069B			
SDG NO:	BR303015B	BR303015B	BR303015B			
TYPE:	GRAB	GRAB	GRAB			
ANTHRACENE	24 J	400 U	470 U			
BENZO(A)ANTHRACENE	120 J	100 J	340 J			
BENZO(A)PYRENE	110 J	87 J	410 J			
BENZO(B)FLUORANTHENE	210 J	120 J	490			
BENZO(G,H,I)PERYLENE	410 U	61 J	470 J			
BENZO(K)FLUORANTHENE	410 U	400 U	530			
BIS(2-ETHYLHEXYL)PHTHALATE	120 J	400 U	330 J			
CHRYSENE	110 J	110 J	380 J			
DI-N-BUTYLPHTHALATE	59 JB	400 U	110 JB			
DI-N-OCTYLPHTHALATE	11 JB	11 JB	30 JB			
DIBENZ(A,H)ANTHRACENE	410 U	400 U	200 J			
DIETHYLPHTHALATE	26 JB	30 JB	45 JB			
FLUORANTHENE	230 J	180 J	580			
INDENO(1,2,3-CD)PYRENE	95 J	71 J	450 J			
PHENANTHRENE	100 J	73 J	170 J			
PYRENE	190 J	170 J	480			
* ALIPHATIC HYDROCARBON(6.71)	350 JB	280 JB				
* ALIPHATIC HYDROCARBON(6.75)			390 JB			
* ALIPHATIC HYDROCARBON(6.91)	450 JB					
* ALIPHATIC HYDROCARBON(6.92)		330 JB				
* ALIPHATIC HYDROCARBON(6.94)			550 JB			
* DIACETONE ALCOHOL(6.08)	1600 JAB	1600 JAB				
* DIACETONE ALCOHOL(6.11)			1900 JAB			
* DIOCTYL ADIPATE(31.20)	1600 JB	1600 JB				
* DIOCTYL ADIPATE(32.20)			1900 JB			
* POSS ALIPHATIC HYDROCAR(5.02)		440 J				
* POSSIBLE KETONE(10.10)			350 J			
* PROB ALDOL-CONDENSATION(3.58)	1100 JA					
* PROB ALDOL-CONDENSATION(3.59)		810 JA				
* PROB ALDOL-CONDENSATION(3.64)			1300 JA			
* PROB ALDOL-CONDENSATION(4.96)		20000 JA				
* PROB ALDOL-CONDENSATION(4.98)	25000 JA					
* PROB ALDOL-CONDENSATION(5.04)			30000 JA			
* PROB ALIPHATIC HYDROCAR(5.02)	380 J					

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 500
LOCATION: BNL LANDFILL LEACHATE
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR500047B	BR500058B	BR500069B
	SDG NO:	BR303015B	BR303015B	BR303015B
	TYPE:	GRAB	GRAB	GRAB
* UNKNOWN CARBOXYLIC ACID(26.20)			75 J	
* UNKNOWN(5.08)				700 J
* UNKNOWN(8.92)			170 J	
* UNKNOWN(8.93)				200 J
* UNKNOWN(10.10)		280 J	310 J	

VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR500047A	BR500058A	BR500069A
	SDG NO:	BR305028A	BR305028A	BR305028A
	TYPE:	GRAB	GRAB	GRAB
CHLOROFORM		16 JB	15 JB	18 JB
1,1,1-TRICHLOROETHANE		9 J	31 U	37 U
* PROBABLE HYDROCARBON #1(26.76)			40 J	
* PROBABLE HYDROCARBON #1(26.77)		29 J		
* PROBABLE HYDROCARBON #1(29.49)				92 J
* PROBABLE HYDROCARBON #2(29.50)			130 J	
* PROBABLE HYDROCARBON #2(29.51)		80 J		
* PROBABLE HYDROCARBON #2(32.35)				190 J
* PROBABLE HYDROCARBON #3(32.36)		220 J		
* PROBABLE HYDROCARBON #3(32.37)			310 J	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR500047E	BR500047F	BR500058E	BR500058F	BR500069E	BR500069F
	SDG NO:	LLL8269	LLL8269	LLL8269	LLL8269	LLL8269	LLL8269
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CO-60			30 U		30 U		44
CS-137			62		74		260
H-3		-1600		-100		-800	
K-40			5100		5200		11000

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 500
LOCATION: BNL LANDFILL LEACHATE
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO: BR500014	BR500025	BR500036			
CONDUCTIVITY (MS/CM)	0.82	1.7	0.96			
FID/PID (PPM)	0	0	0			
PH (UNITS)	7.1	6.8	7.3			
RADIOACTIVIT (CPM)	35	35	40			
TEMPERATURE (DEG C)	9	7.8	8.3			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR500014F SDG NO: BR300012G TYPE: GRAB	BR500014F BR300012K GRAB	BR500014G BR500014G GRAB	BR500025F BR300012G GRAB	BR500025F BR300012K GRAB	BR500025G BR500014G GRAB
ALUMINUM	885			1290		
BARIUM	82 BE			331 E		
BERYLLIUM	2 B			2.5 B		
CADMIUM	4.5 B			14		
CALCIUM	146000			166000		
CHROMIUM	6 U			6 U		
COBALT	14 B			38 B		
COPPER	10 U			10 U		
IRON	69900			221000		
LEAD	50 U			50 U		
MAGNESIUM	15100			35600		
MANGANESE	2930			9760		
MERCURY			0.07 B			0.03 B
NICKEL	6.1 B			24 B		
POTASSIUM		6800			14000	
SILVER	6 U			7.2 B		
SODIUM	5170 E			87000 E		
VANADIUM	14 B			20 B		
ZINC	54			151		

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR500036F SDG NO: BR300012G TYPE: GRAB	BR500036F BR300012K GRAB	BR500036G BR500014G GRAB			
ALUMINUM	58500					
BARIUM	346 E					
BERYLLIUM	4.7 B					
CADMIUM	11					
CALCIUM	187000					
CHROMIUM	57					
COBALT	38 B					
COPPER	74					

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 500
LOCATION: BNL LANDFILL LEACHATE
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR500036F / BR300012G / GRAB	BR500036F / BR300012K / GRAB	BR500036G / BR500014G / GRAB
IRON		163000		
LEAD		127 B		
MAGNESIUM		31200		
MANGANESE		7180		
MERCURY				0.08 B
NICKEL		53		
POTASSIUM			29000	
SILVER		7.3 B		
SODIUM		40200 E		
VANADIUM		111		
ZINC		669		

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR500070A / BR306018E / GRAB	BR500081A / BR306018E / GRAB	BR500092A / BR306018E / GRAB
BENZOIC ACID		40 J	390	20 J
BIS(2-CHLOROETHOXY)METHANE		10 J	10 U	0.5 J
BIS(2-ETHYLHEXYL)PHTHALATE		9 J	630	20
DI-N-BUTYLPHTHALATE		10 U	3 J	10 U
DI-N-OCTYLPHTHALATE		10 U	10 U	0.9 J
DIETHYLPHTHALATE		10 U	0.7 J	10 U
PHENOL		12 U	14	4 J
2-METHYLPHENOL		3 J	0.8	1 J
2,4-DIMETHYLPHENOL		2 J	10 U	10 U
4-METHYLPHENOL		47	100	38
* ARYL HYDROCARBON(18.20)			13 J	
* ARYL HYDROCARBON(20.80)		18 J		
* DIOCTYL ADIPATE(31.10)		24 J		100 J
* ETHYL PHENOL(13.90)			130 J	
* HYDROCINNAMIC ACID(17.10)				7 J
* HYDROCINNAMIC ACID(17.30)		100 J		
* HYDROCINNAMIC ACID(17.40)			110 J	
* METHYL BENZENE(3.84)		18 J		7 J
* PHENYLACETIC ACID(15.60)		10 J		
* PHENYLACETIC ACID(15.80)			74 J	
* POSS. AMIDE/AMINE(13.30)				87 J
* POSS. AMIDE/AMINE(13.40)		17 J		
* POSS. AMIDE/AMINE(13.70)				4 J
* UNKNOWN ACID(12.50)			20 J	
* UNKNOWN ACID(13.00)		79 J		

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 500
LOCATION: BNL LANDFILL LEACHATE
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR500070A / BR306018E / GRAB	BR500081A / BR306018E / GRAB	BR500092A / BR306018E / GRAB
* UNKNOWN ACID(13.10)				7 J
* UNKNOWN ACID(13.40)				3 J
* UNKNOWN ACID(13.60)		16 J		
* UNKNOWN ACID(13.80)		77 J		
* UNKNOWN ACID(14.50)		28 J		
* UNKNOWN ACID(16.00)		8 J		
* UNKNOWN ARYL COMPOUND(17.60)			17 J	
* UNKNOWN ARYL COMPOUND(20.90)			59 J	
* UNKNOWN ARYL CPD(20.80)				17 J
* UNKNOWN ETHER(17.90)			19 J	
* UNKNOWN HYDROXYL CPD(4.96)				7 J
* UNKNOWN HYDROXYL CPD(7.47)		36 J		
* UNKNOWN HYDROXYL CPD(7.72)				19 J
* UNKNOWN KETONE(4.60)		10 J		7 J
* UNKNOWN KETONE(7.40)				21 J
* UNKNOWN KETONE(7.41)		50 J		
* UNKNOWN KETONE(12.10)		40 J		
* UNKNOWN KETONE(13.30)		10 J	18 J	
* UNKNOWN PYRIDINE CPD(18.00)				4 J
* UNKNOWN(4.91)				9 J
* UNKNOWN(5.84)				5 J
* UNKNOWN(8.47)		19 J		
* UNKNOWN(8.82)		69 J		
* UNKNOWN(9.68)				7 J
* UNKNOWN(10.40)			32 J	
* UNKNOWN(10.60)			66 J	
* UNKNOWN(10.70)			18 J	
* UNKNOWN(11.10)		140 J		
* UNKNOWN(11.60)				12 J
* UNKNOWN(11.80)				7 J
* UNKNOWN(12.20)			19 J	
* UNKNOWN(12.40)			23 J	
* UNKNOWN(12.60)		27 J		
* UNKNOWN(13.00)			14 J	
* UNKNOWN(13.70)			100 J	
* UNKNOWN(14.50)				3 J
* UNKNOWN(18.40)				5 J
* UNKNOWN(26.5)			28 J	
* UNKNOWN(31.6)			22 J	
* UNKNOWN(31.7)			26 J	

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 500
LOCATION: BNL LANDFILL LEACHATE
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO: BR500014A SDG NO: BRN11016A TYPE: GRAB	BR500025A BRN11016A GRAB	BR500036A BRN11016A GRAB
ACETONE	17 B	140 B	81 B
BENZENE	5 U	3 J	5 U
CHLOROETHANE	140	15	12
ETHYLBENZENE	5 U	2 J	5 U
METHYLENE CHLORIDE	2 JB	5 B	6 B
TOLUENE	5 B	3 JB	21 B
XYLENE (TOTAL)	3 J	5 U	5
1,1-DICHLOROETHANE	100	5 U	5 U
1,1,1-TRICHLOROETHANE	110	5 U	5 U
1,2-DICHLOROETHENE	0.7 J	5 U	1 J
2-BUTANONE	10 U	67	44
2-HEXANONE	10 U	10 U	47
4-METHYL-2-PENTANONE	10 U	15	13
* TETRAHYDROFURAN(10.50)		13 J	
* UNKNOWN KETONE #1(17.40)			10 J
* UNKNOWN KETONE #2(27.00)			22 J

S&A REQUEST: 507
LOCATION: NEAR BNL CURRENT LDF
MEDIUM: GROUND WATER

FIELD MEASUREMENTS	SAMP NO: BR507011	BR507022	BR507033	BR507044	BR507055	BR507066
CONDUCTIVITY (UMHOS/CM)	563	563	729	729	642	642
FID/PID (PPM)	0	0	0	0	0	0
PH (UNITS)	5.8	5.8	6.2	6.2	6.6	6.6
TEMPERATURE (DEG C)	13	13	13	13	12	12

FIELD MEASUREMENTS	SAMP NO: BR507077	BR507088
CONDUCTIVITY (UMHOS/CM)	237	237
FID/PID (PPM)	0	0
PH (UNITS)	6.3	6.3
TEMPERATURE (DEG C)	15	15

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 507
LOCATION: NEAR BNL CURRENT LDF
MEDIUM: GROUND WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR507011H BR000011A PUMP	BR507022H BR000011A PUMP	BR507033H BR000011A PUMP	BR507044H BR000011A PUMP	BR507055H BR000011A PUMP	BR507066H BR000011A PUMP
ALUMINUM		21 U	40 B	54 B	52 B	42 B	38 B
ANTIMONY		58 U	58 U	65 B	58 U	65 B	58 U
BARIUM		80 B	76 B	319	333	269	277
BERYLLIUM		0.2 B	0.2 U	0.6 B	0.6 B	0.6 B	0.6 B
CALCIUM		7880	8050	59400	59600	77800	77200
CHROMIUM		3.6 B	6.2 B	14	15	12	11
COBALT		14 U	14 U	45 B	38 B	14 U	14 U
COPPER		3.1 B	3.3 B	1.9 U	2.8 B	1.9 U	1.9 U
IRON		822	829	57900	58300	70900	70700
LEAD		50 U	50 U	53 B	50 U	65 B	50 U
MAGNESIUM		2670 B	2650 B	21700	21900	17500	17300
MANGANESE		2670	2650	5070	5100	2740	2720
NICKEL		24 B	27 B	17 B	14 B	19 B	17 B
POTASSIUM		24800	24800	18400	18600	16800	16600
SILVER		2.3 B	3.5 B	22 B	7.2 B	6.5 B	7.4 B
SODIUM		18600	18800	56500	56000	23700	23400
THALLIUM		26 U	26 U	26 U	41 B	26 U	26 U
VANADIUM		7.6 B	8.2 B	32 B	32 B	28 B	27 B
ZINC		18 B	19 B	60	31	33	25

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR507077H BR000011A PUMP	BR507088H BR000011A PUMP
ALUMINUM		44 B	39 B
ANTIMONY		58 U	68 B
BARIUM		184 B	211
BERYLLIUM		0.2 U	0.2 U
CALCIUM		10500	10300
CHROMIUM		6.3 B	6.7 B
COBALT		14 U	14 U
COPPER		3.8 B	1.9 U
IRON		13400	14200
LEAD		50 U	50 U
MAGNESIUM		1650 B	1570 B
MANGANESE		3240	3220
NICKEL		19 B	14 B
POTASSIUM		8130	7980
SILVER		2.8 B	3.2 B
SODIUM		22200	22400
THALLIUM		26 U	35 B

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 507
LOCATION: NEAR BNL CURRENT LDF
MEDIUM: GROUND WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	BR507077H	BR507088H				
	SDG NO:	BR000011A	BR000011A				
	TYPE:	PUMP	PUMP				
VANADIUM		9.9 B	9.4 B				
ZINC		26	42				

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	BR507011E	BR507022E	BR507033E	BR507044E	BR507055E	BR507066E
	SDG NO:	BR000022B	BR000022B	BR000022B	BR000022B	BR000022B	BR000022B
	TYPE:	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP
BENZOIC ACID		52 U	51 U	53 U	22 J	53 U	24 J
BIS(2-ETHYLHEXYL)PHTHALATE		5 J	9 J	80	10	8 J	8 J
BUTYLBENZYLPHTHALATE		7 BJ	6 BJ	7 BJ	6 BJ	8 BJ	7 BJ
PHENOL		10 U	10 U	37	11	11 U	10 U
* CAPROLACTAM(13.45)						8 J	
* CAPROLACTAM(13.48)				16 J			
* CAPROLACTAM(13.53)					9 J		
* HEXANEDIOIC ACID DIOCTY(25.58)				73 J			
* HEXANEDIOIC ACID DIOCTY(25.62)							21 J
* UNKNOWN HYDROCARBON(28.77)						15 J	
* UNKNOWN(7.45)		18 J	13 J				
* UNKNOWN(10.63)				17 J			
* UNKNOWN(10.70)					20 J		
* UNKNOWN(11.85)				9 J			
* UNKNOWN(11.92)					9 J		
* UNKNOWN(13.08)				13 J			
* UNKNOWN(13.13)					12 J		
* UNKNOWN(24.62)				14 J			
* UNKNOWN(25.12)				15 J			
* 1,1'-BIPHENYL(15.40)				200 J			
* 1,1'-BIPHENYL(15.48)					150 J		
* 1,1'-OXYBIS-BENZINE(15.65)				300 J			
* 1,1'-OXYBISBENZENE(15.73)					220 J		
* 2-CHLORETHANOLPHOSPHATE(19.70)				22 J			
* 2-CHLOROETHANOLPHOSPHAT(19.78)					15 J		
* 2-METHLY-PENTANOICACID(8.17)							31 J
* 2-METHYLPENTANOIZ-ACID						15 J	
* 2,2,4-TRIMETHYL-1,3-PEN(11.77)				33 J			
* 2,2,4-TRIMETHYL1,3PENTA(11.83)					19 J		
* 4-METHYL-PENTANOICACID							8 J
* 4-PHENOXYPHEND(19.53)					12 J		
* 4-PHENOXYPHENOL(19.47)				13 J			

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 507
LOCATION: NEAR BNL CURRENT LDF
MEDIUM: GROUND WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: SDG NO: TYPE:	BR507077E BR000022B PUMP	BR507088E BR000022B PUMP				
BENZOIC ACID		56 U	52 U				
BIS(2-ETHYLHEXYL)PHTHALATE		8 J	7 BJ				
BUTYLBENZYLPHTHALATE		11 U	6 BJ				
PHENOL		11 U	10 U				
* CAPROLACTAM(13.45)							
* CAPROLACTAM(13.48)							
* CAPROLACTAM(13.53)							
* HEXANEDIOIC ACID DIOCTY(25.58)							
* HEXANEDIOIC ACID DIOCTY(25.62)							
* UNKNOWN HYDROCARBON(28.77)							
* UNKNOWN(7.45)							
* UNKNOWN(10.63)							
* UNKNOWN(10.70)							
* UNKNOWN(11.85)							
* UNKNOWN(11.92)							
* UNKNOWN(13.08)							
* UNKNOWN(13.13)							
* UNKNOWN(24.62)							
* UNKNOWN(25.12)							
* 1,1'-BIPHENYL(15.40)							
* 1,1'-BIPHENYL(15.48)							
* 1,1'-OXYBIS-BENZINE(15.65)							
* 1,1'-OXYBISBENZENE(15.73)							
* 2-CHLORETHANOLPHOSPHATE(19.70)							
* 2-CHLOROETHANOLPHOSPHAT(19.78)							
* 2-METHLY-PENTANOICACID(8.17)							
* 2-METHYLPENTANOIZ-ACID							
* 2,2,4-TRIMETHYL-1,3-PEN(11.77)							
* 2,2,4-TRIMETHYL1,3PENTA(11.83)							
* 4-METHYL-PENTANOICACID							
* 4-PHENOXYPHEND(19.53)							
* 4-PHENOXYPHENOL(19.47)							

VOLATILE ORGANICS (UG/L)	SAMP NO: SDG NO: TYPE:	BR507011A BR000022B PUMP	BR507022A BR000022B PUMP	BR507033A BR000022B PUMP	BR507044A BR000022B PUMP	BR507055A BR000022B PUMP	BR507066A BR000022B PUMP
BENZENE		5 U	5 U	4 J	5	6	7
CHLOROBENZENE		5 U	5 U	1 J	2 J	1 J	1 J
CHLOROETHANE		10 U	10 U	130	110	54	38
CHLOROFORM		5 U	2 J	5 U	5 U	5 U	5 U

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 507
LOCATION: NEAR BNL CURRENT LDF
MEDIUM: GROUND WATER

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR507011A BR000022B PUMP	BR507022A BR000022B PUMP	BR507033A BR000022B PUMP	BR507044A BR000022B PUMP	BR507055A BR000022B PUMP	BR507066A BR000022B PUMP
ETHYLBENZENE		5 U	5 U	7	9	4 J	3 J
METHYLENE CHLORIDE		11	5 U	8	6	7	12
TOLUENE		5 U	3 J	8	9	12	14
1,1-DICHLOROETHANE		5 U	5 U	17	15	5 U	5 U
* UNKNOWN(9.27)					16 J		
* UNKNOWN(9.30)				16 J			

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR507077A BR000022B PUMP	BR507088A BR000022B PUMP
BENZENE		5 U	5 U
CHLOROBENZENE		5 U	5 U
CHLOROETHANE		10 U	5 J
CHLOROFORM		5 U	5 U
ETHYLBENZENE		5 U	5 U
METHYLENE CHLORIDE		7	5 U
TOLUENE		54	49
1,1-DICHLOROETHANE		5 U	5 U
* UNKNOWN(9.27)			
* UNKNOWN(9.30)			

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR507011I 014 PUMP	BR507011J 013 PUMP	BR507011K 015 PUMP	BR507022I 014 PUMP	BR507022J 013 PUMP	BR507022K 015 PUMP
H-3			218			104	
PU-238				-0.0073			0.0053
PU-239				0.015			0.0079
SR-90		1			1.3		

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR507033I 014 PUMP	BR507033J 013 PUMP	BR507033K 015 PUMP	BR507044I 014 PUMP	BR507044J 013 PUMP	BR507044K 015 PUMP
H-3			3150			3260	
PU-238				0			0.017
PU-239				0.01			-0.0057
SR-90		4			4.4		

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 BNL LANDFILLS

DRAFT DO NOT CITE

S&A REQUEST: 507
LOCATION: NEAR BNL CURRENT LDF
MEDIUM: GROUND WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	BR507055I	BR507055J	BR507055K	BR507066I	BR507066J	BR507066K
	SDG NO:	014	013	015	014	013	015
	TYPE:	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP
H-3			6240			6740	
PU-238				0			-0.035
PU-239				0			0.025
SR-90		2.9			3.9		

RADIOCHEMISTRY (PCI/L)	SAMP NO:	BR507077I	BR507077J	BR507077K	BR507088I	BR507088J	BR507088K
	SDG NO:	014	013	015	014	013	015
	TYPE:	PUMP	PUMP	PUMP	PUMP	PUMP	PUMP
H-3			425			204	
PU-238				0.011			0.039
PU-239				-0.0036			-0.015
SR-90		2.2			0.98		

S&A REQUEST: 508
LOCATION: AT THE WELLS TO BE INSTALLED UPGRADIENT & DOWNGRADIENT OF BNL CURRENT LANDFILL
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:	BR508056	BR508067	BR508078	BR508089	BR508090	BR508103
FID/PID (PPM)		70	140	180	2.4	520	20
RADIOACTIVIT (CPM)		0	0	0			
RADIOACTIVIT (UREM/HR)					20	20	20

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	BR508056D	BR508067D	BR508078D	BR508089D	BR508090D	BR508103D
	SDG NO:	BR508056D	BR508056D	BR508056D	BR508056D	BR508056D	BR508056D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		7630	4080	1750	1680	1020	1130
ANTIMONY		12 UN	5.9 UN	6.8 UN	10 UN	55 N	8.3 UN
ARSENIC		16 U	8.2 U	9.3 U	14 U	16 B	12 U
BARIUM		22 B	20 B	0.2 U	6 B	4.3 B	4.3 B
BERYLLIUM		0.04 U	0.1 B	0.02 U	0.04 U	0.03 U	0.03 U
CALCIUM		308 B	201 B	90 B	56 B	118 B	125 B
CHROMIUM		10	7.9	3.7	279	2.8	2.2
COBALT		2.8 U	3.2 B	2.8 B	2.5 U	2 U	2 U

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 BNL LANDFILLS

DRAFT DO NOT CITE

S&A REQUEST: 508
LOCATION: AT THE WELLS TO BE INSTALLED UPGRADIENT & DOWNGRADIENT OF BNL CURRENT LANDFILL
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR508056D / BR508056D / GRAB	BR508067D / BR508056D / GRAB	BR508078D / BR508056D / GRAB	BR508089D / BR508056D / GRAB	BR508090D / BR508056D / GRAB	BR508103D / BR508056D / GRAB
COPPER		9.3	7.2	3.6	4.2 B	3.4 B	3.1 B
IRON		5920	6850	3840	2400	1520	1680
LEAD		11 B	8.1 B	5.8 U	8.8 U	7.2 U	7.1 U
MAGNESIUM		1290	1110	400 B	279 B	217 B	247 B
MANGANESE		50	107	134	182	28	29
NICKEL		5.8 B	5	2.4 B	3.7 B	2.7 B	1.8 B
POTASSIUM		542 B	526	197 B	152 B	117 B	115 B
SILVER		4.2 B	3 B	1.3 B	1.3 B	1 B	0.9 B
SODIUM		45 B	37 B	24 B	19 B	20 B	20 B
THALLIUM		7.6 B	2.6 U	3 U	4.6 U	3.7 U	3.7 U
VANADIUM		18	14	6.6	5.5 B	4.7 B	4.4 B
ZINC		16	14	6.5	4.9	4	4.2

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR508056C / BR000022B / GRAB	BR508067C / BR000022B / GRAB	BR508078C / BR000022B / GRAB	BR508089C / BR000022B / GRAB	BR508090C / BR000022B / GRAB	BR508103C / BR000022B / GRAB
ACENAPHTHENE		760 U	800 U	780 U	1300	710 U	690 U
BIS(2-ETHYLHEXYL)PHTHALATE		140 J	210 J	170 J	690 U	710 U	690 U
N-NITROSO-DI-N-PROPYLAMINE		760 U	800 U	780 U	470 J	710 U	690 U
PENTACHLOROPHENOL		3700 U	3900 U	3800 U	4000	3500 U	3400 U
PHENOL		760 U	800 U	780 U	2500	710 U	690 U
PYRENE		760 U	800 U	780 U	3300	710 U	690 U
1,2,4-TRICHLOROBENZENE		760 U	800 U	780 U	1500	710 U	690 U
1,4-DICHLOROBENZENE		760 U	800 U	780 U	1700	710 U	690 U
2-CHLOROPHENOL		760 U	800 U	780 U	2200	710 U	690 U
2,4-DINITROTOLUENE		760 U	800 U	780 U	1100	710 U	690 U
4-CHLORO-3-METHYLPHENOL		760 U	800 U	780 U	2700	710 U	690 U
* TRIETHYLENE GLYCOL			6500 J				
* TRIETHYLENE GLYCOL(12.92)			3900 J				
* UNKNOWN GLYCOL(19.98)			4900 J				
* UNKNOWN GLYCOL(22.83)			870 J				
* UNKNOWN(8.28)		380 J					
* UNKNOWN(9.03)		360 J	520 J				
* UNKNOWN(14.08)					3600 J		
* UNKNOWN(16.37)					1300 J		

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 508
LOCATION: AT THE WELLS TO BE INSTALLED UPGRADIENT & DOWNGRADIENT OF BNL CURRENT LANDFILL
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR508056A	BR508067A	BR508078A	BR508089A	BR508090A	BR508103A
	SDG NO:	BR000022B	BR000022B	BR000022B	BR000022B	BR000022B	BR000022B
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		74	1200 U	60	66	23 U	86
METHYLENE CHLORIDE		400	1400	360 B	110	130	82
TOLUENE		4 J	600 U	12 U	11 U	11 U	11 U
1,1,1-TRICHLOROETHANE		88	600 U	85 B	37	48	24
2-BUTANONE		140	1200 U	160	120	110	130

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR508056E	BR508056F	BR508056G	BR508067E	BR508067F	BR508067G
	SDG NO:	014	013	015	014	013	015
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
H-3			-446			-393	
PU-238				0.11			0.45
PU-239				0.026			0.52
SR-90		100			45		

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR508078E	BR508078F	BR508078G	BR508089E	BR508089F	BR508089G
	SDG NO:	014	013	015	014	013	015
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
H-3			-678			-163	
PU-238				-0.029			0.19
PU-239				-0.24			0.35
SR-90		47			25		

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR508090E	BR508090F	BR508090G	BR508103E	BR508103F	BR508103G
	SDG NO:	014	013	015	014	013	015
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
H-3			-509			-285	
PU-238				0.42			0.033
PU-239				0			0.099
SR-90		57			28		

TABLE 4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
BNL LANDFILLS

S&A REQUEST: 508
LOCATION: AT THE WELLS TO BE INSTALLED UPGRADIENT & DOWNGRADIENT OF BNL CURRENT LANDFILL
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR508114F SDG NO: BR000011A TYPE: RINSATE					
CALCIUM	97 B					
COPPER	4.8 B					
IRON	58 B					
MANGANESE	4.2 B					
SODIUM	298 B					
VANADIUM	4.7 B					
ZINC	5.6 B					

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: BR508114E SDG NO: BR000022B TYPE: RINSATE					
BIS(2-ETHYLHEXYL)PHTHALATE	120					
BUTYLBENZYLPHTHALATE	10 B					
* N,N-DIETHYL-3-METHYLBEN(17.80)	46 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO: BR508114A SDG NO: BR000022B TYPE: RINSATE					
CHLOROFORM	16					
METHYLENE CHLORIDE	86					
1,1,1-TRICHLOROETHANE	7					

RADIOCHEMISTRY (PCI/L)	SAMP NO: BR508114G SDG NO: 014 TYPE: RINSATE	BR508114H 013 RINSATE	BR508114I 015 RINSATE			
H-3		194				
PU-238			0.044			
PU-239			0.032			
SR-90	1.2					

TABLE 4.4.4 SAMPLE LOCATIONS AND SAMPLE VOLUMES
ENVIRONMENTAL PROBLEM 4

WELL ID	SAMPLE NUMBER	DATE	SAMPLING METHOD	VOLUME (L)
562	BR507011	30JUN88	SUBM. PUMP	18.2
562	BR507022	30JUN88	SUBM. PUMP	18.2
563	BR507033	30JUN88	SUBM. PUMP	11.0
563	BR507044	30JUN88	SUBM. PUMP	11.0
564	BR507055	30JUN88	SUBM. PUMP	15.5
564	BR507066	30JUN88	SUBM. PUMP	15.5
565	BR507077	30JUN88	SUBM. PUMP	86.7
565	BR507088	30JUN88	SUBM. PUMP	86.7

4.11 Environmental Problem 5: Building 811 Mixed Wastes

Request Numbers: 501, 501a, and 502.

Requester: R. Basinski.

Finding and Basis: Lack of mixed-waste characterization procedures, handling procedures, and disposal facilities may have lead to contamination of environmental media through releases caused by mishandling and/or long-term storage of mixed wastes.

BNL did not generally characterize radioactive wastes in regard to their potential for being mixed wastes. Radioactive wastes have been managed without regard to hazardous characteristics. The largest source of potential mixed waste would have resulted from the evaporative concentration of radioactive waste waters at the Building 811 Radioactive Waste Concentration Facility (RWCF), which produced a slurry that was solidified. At one time this slurry was shipped to Hanford for disposal, but at the time of the Environmental Survey, it was being stored on-site because of questions regarding the mixed-waste status of the slurry. The solidified material has not been tested to determine if it would pass the toxic characteristic leaching procedure (TCLP), which is more rigorous than the EP Tox test. Continuous landfilling of the solidified product may require that it have an unconfined compressive strength of 50 psi. Information was not available on the unconfined compressive strength of the waste. Tanks D-1, D-2, and D-3 at the RWCF used to contain 3700 ft^3 of sludge. The contents of these tanks, which may be mixed waste, have been removed. The sludge was solidified and was being stored at the HWMA during the Environmental Survey.

4.11.1 Sampling and Analysis Objectives

Statement: Samples were collected from the drums stored at the HWMA and in Building 811 to determine if they exceed TCLP standards and to determine the concentration of radiological contaminants in the leachate.

Supporting Information: The radioactive aqueous wastes were evaporated so that a liquid volume reduction of 100/1 was obtained. Therefore, any potential hazardous-waste constituents were concentrated in the resultant slurry. The slurry was solidified in drums and was being stored at the HWMA. Approximately 100,000 gal. of radioactive waste water were being stored for evaporative distillation. It was estimated that approximately 4000 gal. of solidified slurry will result, with no disposal options available if the solidified product is a mixed waste. The Building 811 RWCF had three 100,000-gal. storage tanks in a partially contained asphalt area. During the Survey, tanks D-1 and D-3 were not in use due to leaks. The two tanks contained approximately 3000 ft^3 of sludge contaminated with mixed fission products and transuranics, including plutonium. Tank D-2 was still in use and contained 700 ft^3 of similar sludge and 60,000 gal. of wastewater. The sludge in the tanks resulted primarily from wastewaters received from the Brookhaven Graphite Research Reactor (BGRR). Before replacement of the natural uranium fuel rods at the BGRR with improved enriched uranium fuel elements, the natural uranium fuel elements corroded when placed in the storage canal. The canal water became grossly contaminated with uranium oxide, some plutonium, and considerable fission products. Diatomaceous earth-filter media and ion-exchange resins were used to remove these contaminants. The diatomaceous earth-filter media and back flush from the ion exchange columns were then pumped to the Building 811 tanks for storage. Most of this material settled into a claylike solid on the bottom of the tanks. It was possible that any waste disposal option would require that the waste package be retrievable due to the concentration of plutonium present. BNL had submitted a request for funding to package the wastes in a form suitable for retrievable storage at a DOE repository. The sludge had not been tested for hazardous characteristics, although it is known from sludge analyses that heavy metals, including lead and chromium, are present.

BNL had Chem-Nuclear perform a scoping study on options for handling the tank sludge. Chem-Nuclear's study showed that there are "hot spots" within the sludge as evidenced by surface counts ranging from 100 mR/hr to 1,800 mR/hr. These "hot spots" may have been items such as fuel chips, thermocouple tips, gold plated cobalt pellets, etc. Volume was not known, but BNL personnel believed it to be minimal. Chem-Nuclear, after concluding laboratory tests, recommended a solidification procedure, i.e., 120 ft^3 of wet sludge would be solidified with 50 ft^3 of solidifying agent in 6-ft^3 steel boxes. One foot of water was added on top of the sludge in the tanks to act as a moderator, and the sludge was dredged out to avoid "hot spot" material. Wastewaters were treated within the regular radioactive wastewater treatment system. BNL plans to ship the resulting 36 to 38 steel boxes to Hanford for disposal. However, disposal at Hanford may be precluded if testing shows that the solidified sludge is a mixed waste. Treatment and disposal of the "hot spot" material has not been evaluated. The sludge was removed from the tanks, solidified, and stored in the HWMA.

4.11.2 Sampling and Analytical Design

4.11.2.1 Sampling Design

Request 501: Building 811 Solidified Evaporator Condensate Storage Area in the HWMA (Fig. 4.5a). Four grab solidified evaporator condensate slurry samples were to be collected from drums stored in the HWMA (Sampling Method: Reference E5.3.1. This is not the normal tank sampling method outlined in Appendix E of the DOE Environmental Survey Manual, but may be the best and most appropriate method for obtaining this sample. If condensate slurry is hardened, samples may have to be taken with a hand corer.) The Sampling Team was to look for drums not encased in concrete, select four for sampling, and collect a grab sample from each drum. The drums were to be monitored with an LEL meter during sampling. If all the drums were encased in concrete, the Team was to disregard this request.

The Sampling Team arrived at the HWMA at 0930 on 13APR88. The sky was cloudy and overcast, and winds were gusting to approximately 10 mph. The ambient temperature was approximately 45^{o}F. Drums TR10, TR40, TR71, and TR103 had been isolated for sampling, and the Team asked to have them further separated to reduce personnel exposure. A RAD scan of the area showed 5000 cpm. J. Conner of BNL Health Physics made scans of each drum as follows: TR10 registered 120,000 cpm; TR40 registered 90,000 cpm; TR71 registered 170,000 cpm; and TR103 registered 120,000 cpm.

Samplers were dressed in coveralls, taped gloves, shoe covers, and full-face masks for protection. Sampling was achieved by taping a plastic bag around the drum to contain any residue. The solid material was chipped with a stainless steel chisel and hammer. Sample BR501015 was collected from drum TR10; BR501026 from drum TR40; BR501037 from TR71; and BR501048 from drum TR103. These samples were collected between 1000 and 1050. QC rinsate BR501093 was collected at 1114.

W. Burke was the "clean person" for sampling. BNL HWMA personnel performed a health physics check after decontamination and cleanup. All rinse water was collected.

Request 501a: Building 811 Nonsolidified Evaporator Condensate Slurry (Fig.4.5b). It was believed that nonsolidified slurry may have been present in Building 811. If the slurry was found, the Sampling Team was to RAD scan the area prior to sample collection, then collect four random grab slurry samples from the population (Sampling Method: Reference E5.3.1). If the slurry was not found, they were to disregard this request.

Request 501a was deleted because there was no slurry present and because construction work to install new tanks was in progress. No slurry was to be generated for 30 days or more. S. Barisas, K. Owenby, and F. Taylor visited Building 811 on 13APR88 and verified that no slurry was present.

Request 502: Solidified Sludge from Tanks D-1, D-2, and D-3 (Fig. 4.5c). It was believed that solidified material may have been stored in cylinders in tanks at the HWMA. If the material was found and it was possible to collect samples, the Sampling Team was to collect nine grab solidified sludge samples from three randomly selected cylinders (Sampling Method: Reference E5.3.1).

Request 502 was deleted because the cylinders were welded shut, and there was no access for obtaining samples.

4.11.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 5 were as follows:

Request 501: The parameters analyzed were ICP-metals, TCLP-metals (if indicated by analytical results), and total uranium. The field measurement taken was for radiation.

Request 501a: This request was deleted.

Request 502: This request was deleted.

4.11.3 Field and Analytical Data

Field Data:

Request 501: *Although the S&A Plan did not specify any field data for three requests of this problem, measurement of the radiation is provided for Request 501 in Table 4.3.5. Requests 501a and 502 were not collected because no slurry was found (501a) and because the drums were welded shut without any access to the waste (502). The radiation scan revealed the activity level of the waste to range from 90,000 cpm to 170,000 cpm.*

Field Data Evaluation:

Request 501: The radiation scan was performed by the health physics personnel of Brookhaven National Laboratory and may be assumed to be reliable.

Analytical Data:

Request 501:

Metals. Analytical results for metals in sediment are presented in Table 4.3.5. Of the 20 metals detected, the following four were below the CRDL or the IDL in all four samples: arsenic, cadmium, cobalt, and silver. Of the remaining metals detected, antimony ranged from 14 to 22 mg/kg, barium from 60 to 91 mg/kg, beryllium from 2.9 to 3.2 mg/kg, chromium from 128 to 135 mg/kg, copper from 9.9 to 58 mg/kg, nickel from 37 to 82 mg/kg, and zinc from 27 to 39 mg/kg. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, sodium, and vanadium. None of these results exceeded the RCRA EP Toxicity limits; therefore, TCLP analyses were not performed.

Results of analysis of uranium for Request 501 is given in Table 4.3.5. The concentration ranged from 42 to 169 mg/kg for four samples; these are the highest concentrations found in the Brookhaven samples.

Analytical Data Evaluation:

Request 501:

Metals. Seven metals of interest, antimony, barium, beryllium, chromium, copper, nickel, and zinc, were detected above either the CRDL or IDL for this request.

For uranium analyses preparation blanks, calibration verification data, and spike results were in compliance. All holding times were met; however, 50% of duplicate results were out of compliance.

4.11.4 Limitations and Qualifications

Data Quality Level:

Request 501: The sampling plan is Quality Level II; the field sampling is Quality Level I. The overall analytical quality level is Quality Level II.

Field Data:

Request 501: The sampling plan failed to highlight the need for adequate precautions to be taken in obtaining the samples. Radiation readings should have been part of the required field measurements. The sampling team sought proper advice and took needed precautions to safeguard personnel, as well as taking precautions to prevent any spread of contamination from the drums.

Analytical Data:

Request 501:

Metals. Analytical results are Quality Level II, except arsenic, barium, and calcium which are Quality Level III; and lead and silver in specific samples (see below) which are Quality Level III. The majority of analytes are Quality Level II because CLP preparation procedures are not vigorous enough to completely digest concrete samples. Arsenic and barium had poor recoveries in the spiked samples. Calcium results for duplicate analysis exceeded the RPD control limit.

For samples BR501037 and BR501048, lead was Quality Level III because results for the calibration verification fell below the control limit. Silver in sample BR501037 was also Quality Level III because of poor calibration verification results.

The data for this series of uranium analysis are Quality Level II because only 50% of the duplicate analysis met the compliance requirements.

Environmental Problem: 5
Request Number: 501

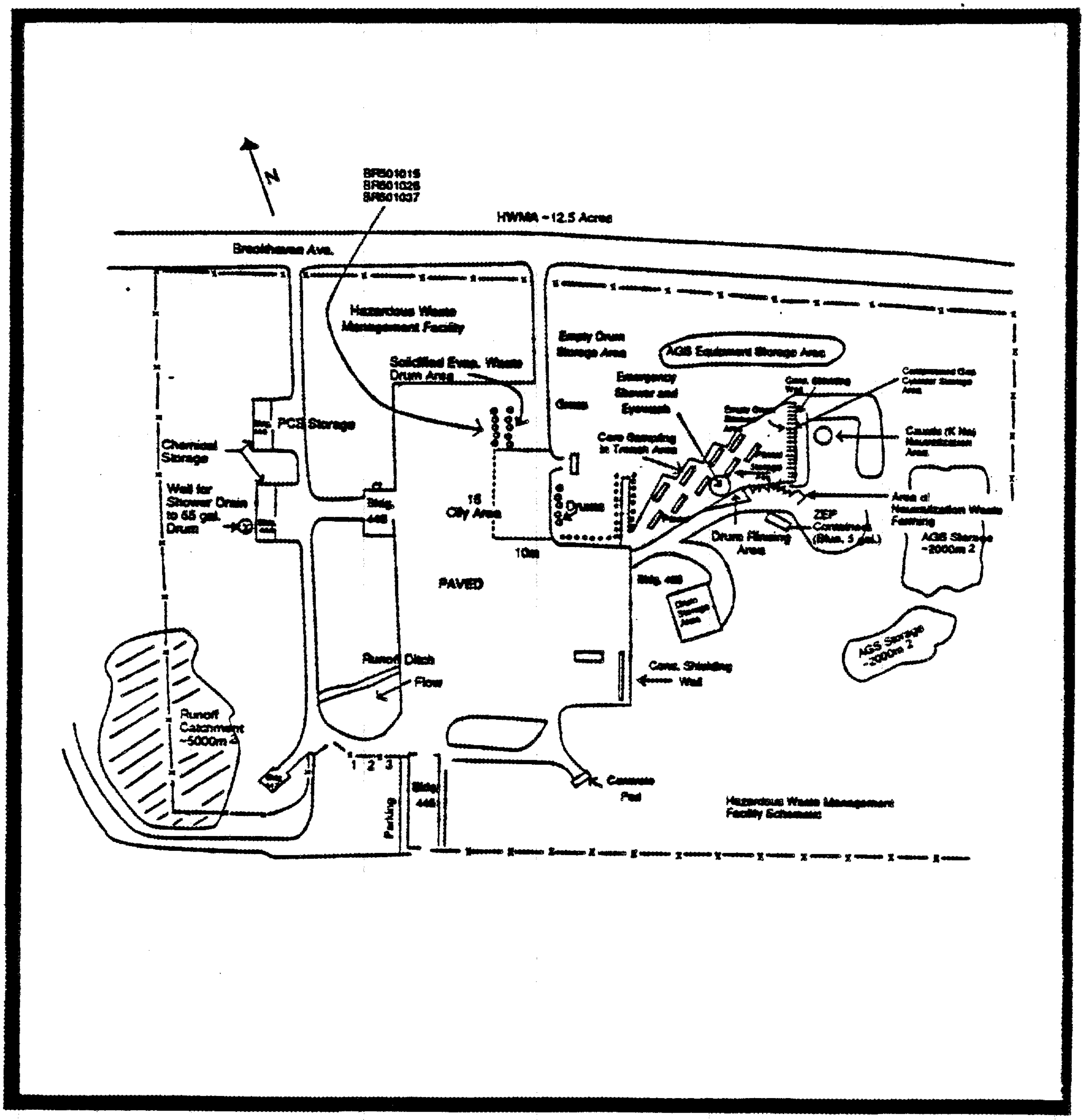

Figure 4.5a. Building 811 Solidified Evaporator Condensate Storage Area in the HWMA (Request 501)

Environmental Problem: 5
Request Number: 501a

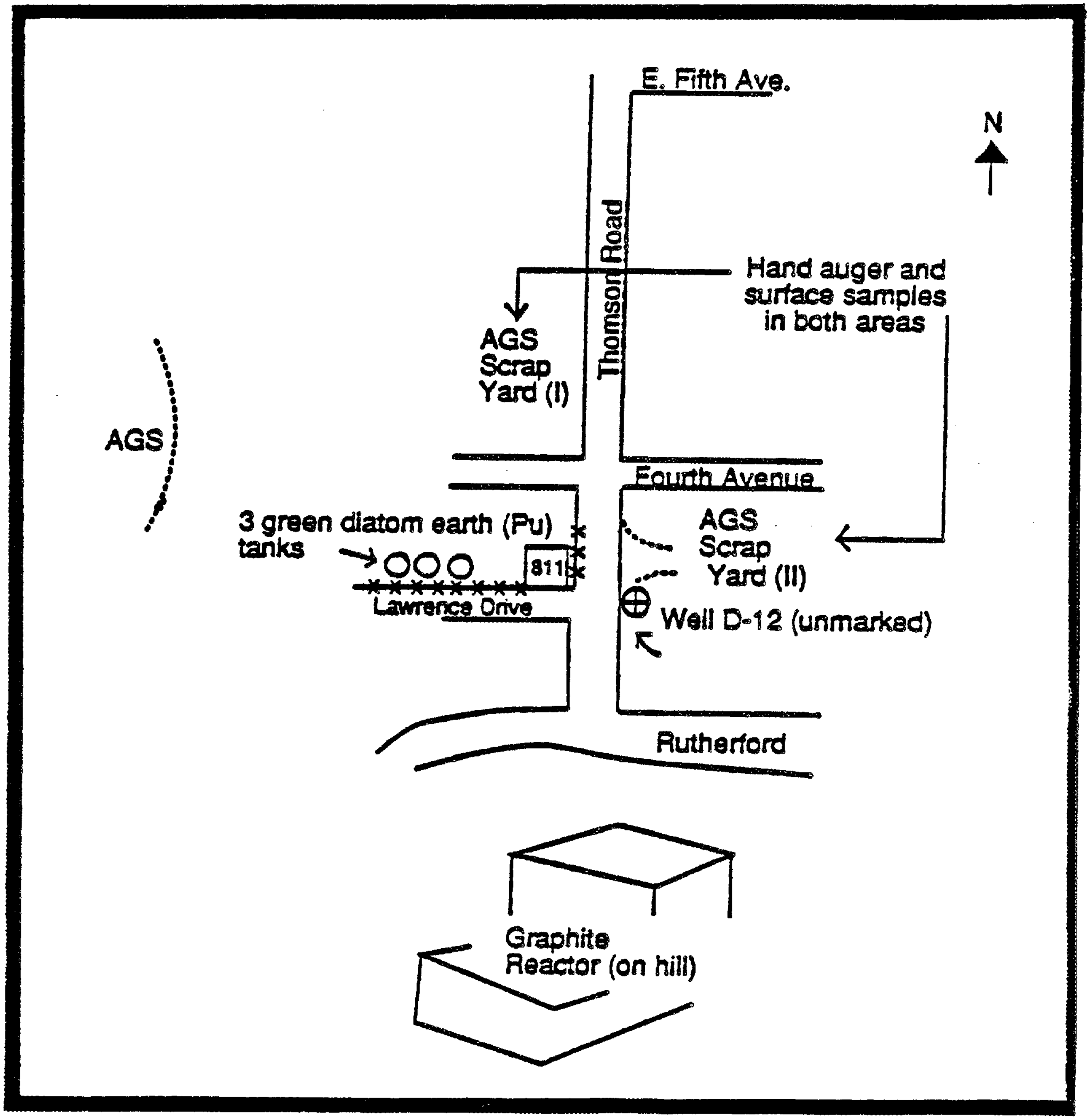

Figure 4.5b. Building 811 Nonsolidified Evaporator Condensate Slurry
(Request 501a was deleted)

Environmental Problem: 5
Request Number: 502

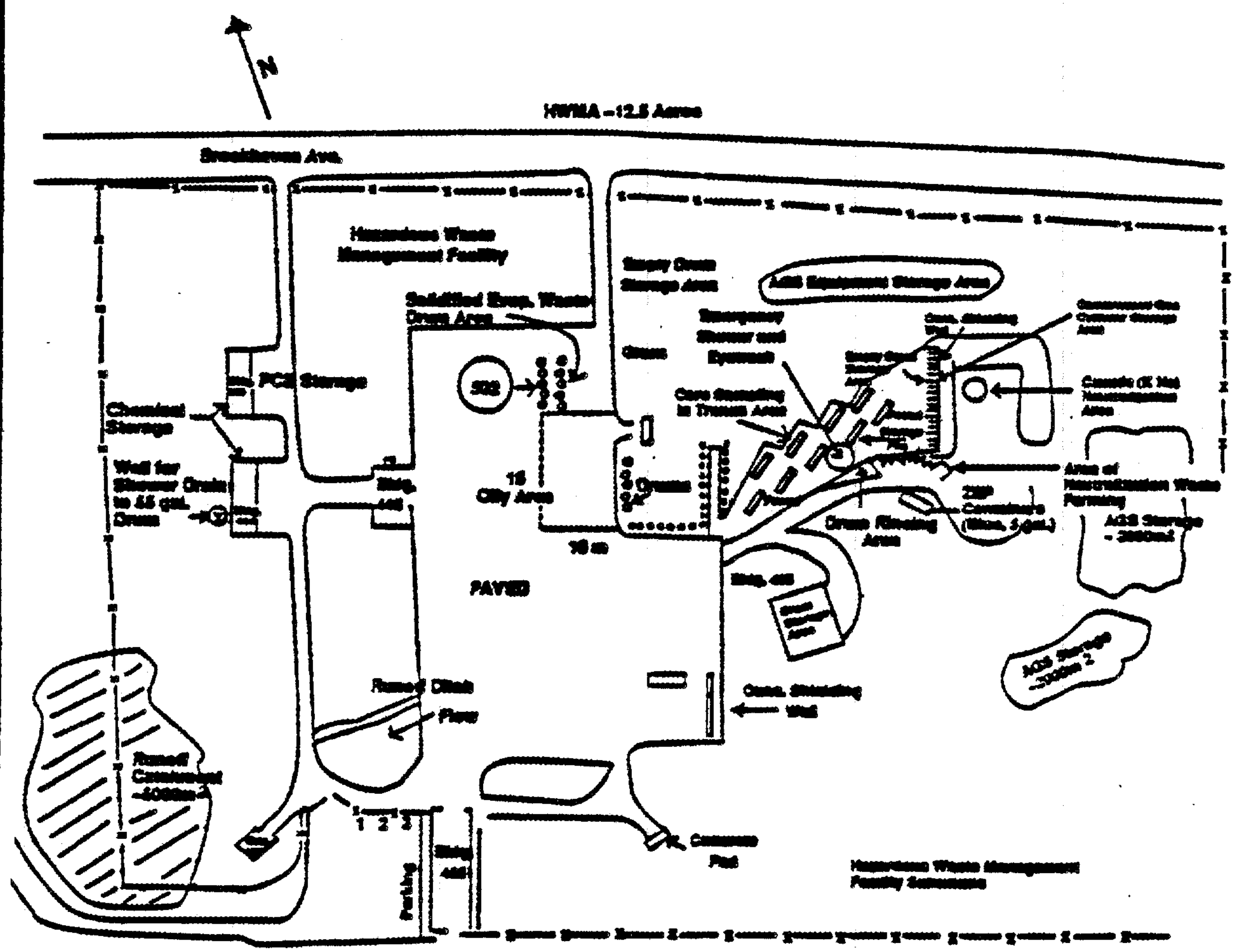

Figure 4.5c. Solidified Sludge from Tanks D-1, D-2, and D-3
(Request 502 was deleted)

TABLE 4.2.5 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 5

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS NUMB HITS	ANIONS NUMB ANAL	METALS NUMB HITS	METALS NUMB ANAL	O&G NUMB HITS	O&G NUMB ANAL	PET HYDRO NUMB HITS	PET HYDRO NUMB ANAL	PES/H/PCB NUMB HITS	PES/H/PCB NUMB ANAL	SEMIVOLS NUMB HITS	SEMIVOLS NUMB ANAL	VOLS NUMB HITS	VOLS NUMB ANAL	RADS NUMB HITS	RADS NUMB ANAL
BR501	B. 811	SLURRY	SEDIMENT	8	4	GRAB	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0
BR502	B. 811	SLUDGE	SEDIMENT	9	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		MED TOTAL		17	4		0	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0
BR501	B. 811	SLURRY	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
		MED TOTAL		1	1		0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
		EP TOTAL		18	5		0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 4.3.5 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 5 BUILDING 811 MIXED WASTES

DRAFT DO NOT CITE

S&A REQUEST: 501
LOCATION: BUILDING 811 SOLIDIFIED EVAPORATOR CONDENSATE STORAGE AREA IN THE HWMA
MEDIUM: SEDIMENT

FIELD MEASUREMENTS	SAMP NO:	BR501015	BR501026	BR501037	BR501048		
RADIOACTIVIT (CPM)		120000	90000	170000	120000		

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR501015A BR308010F GRAB	BR501015A BR501015K GRAB	BR501026A BR308010F GRAB	BR501026A BR501015K GRAB	BR501037A BR308010F GRAB	BR501037A BR501015K GRAB
ALUMINUM		21300		21600		17400	
ANTIMONY		14		12 B		22	
ARSENIC		14 UN		13 UN		19 BN	
BARIUM		91 N		88 N		60 N	
BERYLLIUM		3.2 NE		3.1 NE		2.9 NE	
CADMIUM		0.48 B		0.44 U		0.76 B	
CALCIUM		2.6 *		240000 *		221000 *	
CHROMIUM		135 NE		134 NE		128 NE	
COBALT		7.6 B		7.3 B		8 B	
COPPER		22 *		9.9 *		34 *	
IRON		13900 E		14400 E		13100 E	
MAGNESIUM		29000		29000		19800	
MANGANESE		256 N		262 N		221 N	
NICKEL		48		39		82	
POTASSIUM			8400		7200		8300
SILVER		1.9 B		1.7 B		1.4 U	
SODIUM		64900 *E		33800 *E		74900 *E	
VANADIUM		17		17		24	
ZINC		31		27		39	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR501048A BR308010F GRAB	BR501048A BR501015K GRAB				
ALUMINUM		21500					
ANTIMONY		9.9 B					
ARSENIC		12 UN					
BARIUM		73 N					
BERYLLIUM		2.9 NE					
CADMIUM		0.38 U					
CALCIUM		269000 *					
CHROMIUM		134 NE					
COBALT		8 B					
COPPER		58 *					
IRON		14000 E					
MAGNESIUM		30500					

TABLE 4.3.5 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 5 BUILDING 811 MIXED WASTES

DRAFT DO NOT CITE

S&A REQUEST: 501
LOCATION: BUILDING 811 SOLIDIFIED EVAPORATOR CONDENSATE STORAGE AREA IN THE HWMA
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)			
	SAMP NO:	BR501048A	BR501048A
	SDG NO:	BR308010F	BR501015K
	TYPE:	GRAB	GRAB
MANGANESE		283 N	
NICKEL		37	
POTASSIUM			9900
SILVER		1.6 B	
SODIUM		19900 *E	
VANADIUM		17	
ZINC		31	

METALS, INCLUDING CR+6 (UG/G)					
	SAMP NO:	BR501015B	BR501026B	BR501037B	BR501048B
	SDG NO:	BR501015B	BR501015B	BR501015B	BR501015B
	TYPE:	GRAB	GRAB	GRAB	GRAB
URANIUM, TOTAL		169	42	55	72

S&A REQUEST: 501
LOCATION: BUILDING 811 SOLIDIFIED EVAPORATOR CONDENSATE STORAGE AREA IN THE HWMA
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (MG/L)		
	SAMP NO:	BR501093B
	SDG NO:	BR300012I
	TYPE:	RINSATE
URANIUM, TOTAL		0.004

METALS, INCLUDING CR+6 (UG/L)			
	SAMP NO:	BR501093A	BR501093A
	SDG NO:	BR306018F	BR306018K
	TYPE:	RINSATE	RINSATE
ALUMINUM		1180	
BARIUM		37 B	
BERYLLIUM		1.7 B	
CADMIUM		9.7	
CALCIUM		20100	
CHROMIUM		58	
COBALT		4.1 B	
COPPER		280	

TABLE 4.3.5 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 5 DRAFT DO NOT CITE
BUILDING 811 MIXED WASTES

S&A REQUEST: 501
LOCATION: BUILDING 811 SOLIDIFIED EVAPORATOR CONDENSATE STORAGE AREA IN THE HWMA
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR501093A / BR306018F / RINSATE	BR501093A / BR306018K / RINSATE				
IRON		2490					
LEAD		89 B					
MAGNESIUM		2970 B					
MANGANESE		77					
NICKEL		112					
POTASSIUM			1600 B				
SODIUM		13100 E					
VANADIUM		4.8 B					
ZINC		1020					

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4.12 Environmental Problem 6: HWMA Releases

Request Numbers: 503, 504, and 505.

Requester: R. Basinski.

Finding and Basis: Hazardous and radioactive wastes and constituents may have been released from the HWMA, contaminating the soil and groundwater. Outdoor storage was used for radioactive oils (26 drums), radioactive solidified evaporator sludge (53 drums), and oil-contaminated sands (35 drums) from cleanup of oil spills at the Central Steam Plant (CSP). Spills of oils had occurred, as evidenced by oily stains at the area adjacent to the empty drum storage area. Spills in the acid/base neutralization area had also occurred because of the previous practice of dumping the neutralization supernatant on the ground. Unanalyzed HWMA runoff entered a pond northwest of the facility. Activated Alternating Gradient Synchrotron (AGS) equipment had been stored on the ground for approximately 10 years. The long-term storage of highly radioactive solid wastes in the trenches and holes could result in the release of radioactive constituents to the ground. Gas cylinders and neutralization salts have also been stored for long terms.

The long-term outdoor storage of liquid radioactive wastes and solidified radioactive wastes that may be mixed wastes, in areas without impermeable bases and secondary containment, could have resulted in releases of wastes to the environment. Some of these areas have been in use for 20 to 30 years.

4.12.1 Sampling and Analysis Objectives

Statement: Samples were collected to determine if hazardous and radioactive contaminants listed in section 4.12.2.2 were present above analytical detection levels in soil in the HWMA.

Supporting Information: The HWMA was the central receiving, processing, and storage area for all BNL hazardous, radioactive, and PCB wastes. The HWMA was fenced, with about one-fourth of the area paved with blacktop and the rest natural field grass and weeds. There were five permanent buildings used for waste processing, treatment, and storage and six railway cars used for storage of equipment, such as new drums, vermiculite, cement, and packing materials. In the eastern corner of the facility, there was a bermed area where wastes have been released from gas cylinders by venting with a rifle bullet or explosive charge and by open burning.

Drums containing waste and radioactive waste shipping containers were stored outside in the central portion of the facility on the blacktop area. The shipping containers hold compacted radioactive trash and radioactive equipment that were to be shipped to Hanford for disposal. Radioactive oils (26 drums) and radioactive solidified evaporator slurry from Building 811 (53 drums) were also stored at the time of the Survey. Near the PCB Barn (Building 448), 35 drums of sand contaminated by oil from the oil-spill cleanup at the CSP were stored outdoors. Some of the oils may have contained ignitable hazardous wastes. Nonradioactive waste oil was not stored outdoors during the Survey. However, according to the Report of the Safety Assessment Committee for the Hazardous Waste Management Facility (December 1986), "...at the time of the audit (Safety Assessment) several hundred drums of oil were in storage on the paved area."

The release of oil from containers stored outside in the paved area may have contaminated the adjacent ground. The paved area next to where empty drums were stored was extensively oil stained. During the Survey, runoff from the oil stained area had a visible sheen, indicative of oil contamination. Facility personnel indicated that this condition was not unusual. The Safety Assessment Report previously mentioned also noted that waste solvents were stored outside and "Evidence of spillage and leakage to the macadam blacktop is apparent due to the drum weathering and to leaking drums which have been delivered to the

HWMA." The Safety Assessment Report and Survey Team observation indicated that spills of liquid radioactive and/or hazardous wastes have been a long-term problem at the HWMA.

HWMA personnel have routinely treated small quantities (e.g., gallons) of nonradioactive acids and bases by neutralization, collecting the precipitated salts and releasing the supernatant to the ground, a practice that may have contaminated the ground. The acids and bases were not analyzed for hazardous metallic constituents. Sodium and potassium metal were disposed of by treatment in the neutralization tank, with the caustic solution also released to the pavement.

Radioactive oils, solvents, chromic acid, acids, and bases were neutralized as necessary and solidified. This practice took place outside of Building 446, which was used for receiving, sorting, and storing compatible radioactive waste. Although the neutralization and solidification took place in containers, accidental releases would not be contained since there was no secondary containment. The solidified product, formerly shipped to Hanford, was being stored on-site due to restrictions on sending mixed wastes to Hanford. These wastes have not been tested for unconfined compressive strength and by the TCLP.

The long-term field storage of activated, but noncharacterized, AGS equipment may have resulted in the release of radioactive constituents to the ground. Activated AGS experimental components stored on the ground have not had the identity of the radionuclide contamination determined by AGS personnel. HWMA personnel said that, when the material was received, present procedures requiring identification of radionuclides in materials shipped to the HWMA did not exist. The equipment, which is stored on the ground, should not contain any surface contamination.

Long-term storage of highly radioactive material in holes and trenches has a potential for release of radioactive constituents to the groundwater. Nine underground trenches (22 ft long, 2 ft wide, and 5 ft deep) and 16 vertical (9 ft deep) and slanted (12 ft long) holes were used to store highly radioactive materials that were too radioactive to package in shipping containers and meet Department of Transportation (DOT) standards, or that would contain a total radioactive content in excess of the amount allowed by Hanford waste acceptance criteria. Although the storage is considered "interim," some of the material has been "stored" for as long as 20 years, and there were no existing plans for final disposition.

The trenches were concrete-lined and covered to prevent runoff from entering the trenches. The holes were either concrete-lined or consisted of large tile pipes. Five holes and six trenches contained radioactive materials at the time of the Environmental Survey. All stored materials were solids. Water leaks into the trenches have occurred when the water table was very high.

4.12.2 Sampling and Analytical Design

4.12.2.1 Sampling Design

Request 503: West of Building 444 (Fig. 4.6a). Four grab soil samples (Sampling Method: Reference E5.2.3) were to be collected from the area west of Building 444. Spills may have occurred in this area for a number of years, and the potential for future spills exists. The area of concern was to be divided into an 80-segment grid and assumed homogeneous. Four segments were to be randomly selected for sampling to a depth of 3 ft.

The Sampling Team arrived at the site at 1005 on 14APR88 after experiencing problems finding the exact location. The sky was overcast, and the temperature was 45^{O}F, with a slight breeze from the north. The Team had to deviate from the location specified by the Sampling and Analysis Plan by moving inside the fenced area west of Building 444, beginning 10 ft west of the drain. S. Barisas showed the Team where to lay out the grid at the new site. The grid locations did not match those assigned in the general field folder; therefore, the locations were changed to match the grids devised by F. Taylor.

The building was located approximately 150 ft east of the fenced area. There was a pond just outside the fence. The area sampled was grass (sod) covered. The area was divided into an 8 x 10 grid. Sample BR503017 (grid 9) was collected at 1010. At 0 to 3 in., the soil was a medium brown loam with roots; at 3 to 5 in., the soil was black with 3- to 10-cm pebbles; at 5 in. to 3 ft, the soil was light to medium brown, fine grained, and slightly moist. Sample BR503028 (grid 21) was collected at 1053. The soil at this location was the same as the first sample, except that black ash with clinkers was encountered at approximately 3 to 12 in. At sample BR503039 (grid 23) the soil varied from brown/black loam at 0 to 3 in.; black ash with 3- to 10-mm pebbles at 3 to 12 in.; light brown, very finely grained, moist sand from approximately 12 to 30 in.; and finely grained, loosely consolidated reddish-brown sand at approximately 30 to 36 in. At sample BR503040 (grid 68) the soil was light to dark brown loam with roots at 0 to 3 in.; at approximately 3 to 30 in., the soil was light to medium brown, loosely consolidated sand with 3- to 15-mm pebbles; and at approximately 30 to 36 in., pliable, moist, partly sandy clay was encountered. QC rinsate BR503051 was collected at 1140.

A RAD scan of the area showed 400 cpm. OVA readings were recorded for each sample.

Request 504: Southwest of Empty Drum Storage Area, West of RAD Waste Pits (Fig. 4.6b). Three grab soil samples (Sampling Method: Reference E5.2.3) were to be collected from the area southwest of the empty drum storage area and west of the RAD waste pits. Spills may have occurred in this area for a number of years, and the potential for future spills exists. The area of concern was to be divided into a 6 x 10 grid and assumed homogeneous. Three segments were to be randomly selected for sampling to a depth of 3 ft.

Samples BR504018, BR504029, and BR504030 were collected at this site on 14APR88. The sky was overcast, and the temperature was approximately 48^{O}F. The area to be sampled was covered with asphalt, which was first broken with a chisel at the sampling points. For sample BR504018, a flight auger was used to auger from 0 to 2 ft for parameters other than volatiles. Volatiles samples were collected from 2 to 3 ft with a split spoon. All other samples were collected with the split spoon only.

RAD scans and OVA readings were done for each sample taken. At sample location BR504018 (grid 46), the PID reading was 15.8 counts, and the RAD scan showed 3000 cpm. At sample location BR504029 (grid 55), the readings were 7.5 for PID and 10,000 cpm for RAD scan. At sample location BR504030 (grid 42), the readings were 34.2 for PID and 9000 for RAD scan. The background OVA reading was 6.5 units, and the RAD scan was 9000 cpm.

Request 505: AGS Equipment Storage Area (Fig. 4.6c). Six grab soil samples (Sampling Method: Reference E5.2.3) were to be collected from the perimeter of the AGS Equipment Storage Area. The perimeter was to be divided into a 120-segment grid, with grab samples taken from 0 to 3 ft from each selected segment. The area was to be considered homogeneous because potential contaminants were not suspected to be of high concentration, and the potential diluting effect of compositing could greatly reduce the chance of detecting an environmental problem. Because the potential for spills and/or runoff still exists, a sample depth of 0 to 3 ft was to be considered sufficient.

A systematic random sampling was done as follows: (1) Approximately 7 ft outside the perimeter of the AGS Equipment Storage Area, an 820-ft L-shaped line was divided into 120 segments, 6.8 ft each. (2) The first sample point was segment 16 (approximately 109 ft down the line). (3) The next five samples were chosen by adding 20 segments (or 136 ft) to the last sample position.

The segments chosen were grids 16, 36, 56, 76, 96, and 116.

Samples for this request were collected on 14APR88. The sky was partly cloudy, temperature was 45^{o} to 50^{o}F, and winds were calm with gusts of 7 to 10 mph from the southeast. The storage area had even, grassy ground cover outside the perimeter, with small bushes and 3- to 6-ft pines.

Sample BR505019 (grid 16) was collected at 1033. RAD scan values at this location were 1200 to 1500 cpm. From the surface to 4 in., the soil was dark brown, grainy, silty sand; from 4 in. to 2 ft, soil was light brown to rust, sandy, and fine grained. At 2 to 2 1/2 ft, soil remained light brown, with more clay material. From 2 1/2 to 3 ft, soil was beige and sandy.

Sample BR505020 (grid 36) was collected 136 ft southwest of the first sample at 1057. A RAD scan at this site showed 1300 cpm. The soil profile was about the same as for the first sample, except that gravel was encountered at 2 to 2 1/2 ft. The aluminum foil ripped slightly while the sample was being composited.

Sample BR505031 (grid 56) was collected at 1128. The soil sample profile was about the same as the previous two samples, except the soil was more compact. A RAD scan of the area read 1000 to 1400 cpm; a scan of the sample read 1100 cpm. The aluminum foil developed small tears while the sample was being composited.

Sample BR505042 (grid 76) had the same soil profile as the previous sample. A RAD scan of the area read 1400 to 2000 cpm; a scan of the sample read 1500 cpm. It was collected at 1152.

The sampling location for sample BR505053 was moved 3 ft to the southwest of the original location at grid 96 because large rocks were encountered. The soil profile was as follows: 0 to 6 in., medium to dark brown, grainy soil; 6 in. to 2 1/2 ft, light brown (rust), fine grainy soil with mixed-medium gravel; 2 1/2 to 3 ft, beige coarse grainy sand. RAD scan levels at this location increased from 2000 to 3500 cpm. (There were fuel rod ends stored nearby.) The sample was taken at 1225.

The soil profile for sample BR505064 (grid 116) was as follows: 0 to 6 in., medium brown sandy soil; 6 in. to 2 ft, light brown (rust), medium to fine grainy soil with gravel; 2 to 3 ft, beige sand. A RAD scan of the area indicated 1200 to 1800 cpm; a RAD scan of the sample read 1300 cpm. The sample was completed at 1247.

The Health Physicist, J. O'Conner, checked all Sampling Team members and sampling equipment, and found all to be free of contamination.

4.12.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 6 were as follows:

Request 503: The parameters to be analyzed were volatiles, semivolatiles, oil and grease, ICP-metals, TOC, and gamma scan. The analysis for TOCs was deleted from the requests by personnel of the survey team (S.Barissa); thus, samples were not collected. Field measurements of OVAs and radiation were taken.

Request 504: The parameters to be analyzed were volatiles, semivolatiles, oil and grease, ICP-metals, TOC, and gamma scan. The analysis for TOCs was deleted from the requests by personnel of the survey team (S.Barissa); thus, samples were not collected. Field measurements of OVAs and radiation were taken.

Request 505: The parameter analyzed was gamma scan. Field measurements for radiation were taken.

4.12.3 Field and Analytical Data

Field Data:

Request 503: *Field data are included in Table 4.3.6. None of the requests specifically requested field measurements; however, the data are included for better characterization of the specific sampling sites. Organic vapor measurements show that none was present in measurable amounts. The rad scan of the area showed 400 cpm.*

Request 504: *Field data are included in Table 4.3.6. None of the requests specifically requested field measurements; however, the data are included for better characterization of the specific sampling sites. Field measurements at this site showed organic vapor to be present. Concentrations ranged from 7.5 to 34 ppm. In addition, there is radiation present at this site; the radiation scan showed between 3000 to 10000 cpm.*

Request 505: *Field data are included in Table 4.3.6. None of the requests specifically requested field measurements; however, the data are included for better characterization of the specific sampling sites. Radiation readings were taken along the AGS equipment storage area. The values obtained are not included in the table, but are recorded in the Sampling Design Section. Values obtained ranged from about 1000 to 3500 cpm.*

Field Data Evaluation:

Request 503: Because the same instruments are used for the PID and radiation scan, data evaluations for the three requests are the same. The rad scan instrument is routinely calibrated and the results are reliable. The PID instrument is tested prior to use and the results are also reliable.

Request 504: Because the same instruments are used for the PID and radiation scan, data evaluations for the three requests are the same. The rad scan instrument is routinely calibrated and the results are reliable. The PID instrument is tested prior to use and the results are also reliable.

Request 505: Because the same instruments are used for the PID and radiation scan, data evaluations for the three requests are the same. The rad scan instrument is routinely calibrated and the results are reliable. The PID instrument is tested prior to use and the results are also reliable.

Analytical Data:

Request 503:

Metals. Analytical results for metals in soil are presented in Table 4.3.6. Of the 17 metals detected, the following seven were below either the CRDL or the IDL in all four samples: beryllium, calcium, cobalt, lead, potasium, selenium, and sodium. Of the remaining metals detected, barium ranged from 55 to 266 mg/kg, chromium from 5.7 to 9.6 mg/kg, copper from 6.9 to 8.6 mg/kg, nickel from 16 to 33 mg/kg, and zinc from 10 to 17 mg/kg. Other metals detected were aluminum, iron, magnesium, manganese, and vanadium.

Oil and grease. Analytical results for oil and grease are presented in Table 4.3.6. Three of the four soil samples showed concentrations of 490, 560, and 430 *mg/kg. The fourth sample, which was the first sampled and which was located at the easternmost location of the grids, showed a concentration of 2130 mg/kg. The rinsate (BR503051) contained 35 mg/L of oil and grease material.*

Extractable organics. Analytical results for semivolatile organic compounds are presented in Table 4.3.6. From 23 to 30 compounds were identified in each of these four respective soil samples. There were four phthalates present in the samples and in the associated blanks. No compounds were identified in measured or estimated concentrations of 1 mg/kg or more. Compounds tentatively identified as diacetone alcohol and probable aldol condensation were present in estimated concentrations ranging from 13 to 28 mg/kg. Two aliphatic hydrocarbons and an unknown ketone were tentatively identified in concentrations ranging from 2.9 to 4.3 mg/kg in sample BR503040. Otherwise all estimated concentrations of tentatively identified compounds were less than 2 mg/kg.

Volatile organics. Analytical results for volatile organic compounds are presented in Table 4.3.6. Four soil samples were taken for this request. Three samples each had six identifiable compounds and one sample had five identifiable compounds. Chloroform and methylene chloride were present in all samples and in the blank. The highest measured concentration for these two compounds was 0.033 mg/kg of chloroform. Other concentrations of these two compounds were below quantitation limits, but estimated at 0.027 mg/kg or less. All compounds detected in the samples were also in the blank, except for acetone and one of the TICs. Highest estimated concentration of the TICs was 0.32 mg/kg.

Radiochemistry. Analytical results are presented in Table 4.3.6. All four soil samples taken west of Building 444 contained cesium-137 (990 to 17,000 pCi/kg) and naturally occurring potassium-40 (6,300 to 7,100 pCi/kg). Two samples (BR503017 and BR503040) contained cobalt-60 (93 and 55 pCi/kg).

Request 504:

Metals. *Analytical results for metals in soil are presented in Table 4.3.6. Of the 16 metals detected, the following three were below either the CRDL or the IDL in all three samples: cobalt, lead, and sodium. Of the remaining metals detected, barium was at 54 mg/kg and beryllium at 1 mg/kg; chromium ranged from 6.3 to 15 mg/kg, copper from 12 to 17 mg/kg, nickel from 6.3 to 8.9 mg/kg, and zinc from 11 to 27 mg/kg. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, and vanadium.*

Oil and grease. *Analytical results for oil and grease are presented in Table 4.3.6. Two of the three samples showed concentrations of 220 and 320 mg/kg; the third showed 13,300 mg/kg. The latter sample also showed the highest PID reading of 34.2 as compared with PID readings of 7.5 and 15.8 ppm.*

Extractable organics. *Analytical results for semivolatile organic compounds are presented in Table 4.3.6. There were 10 compounds detected in two of these samples and 36 compounds detected in the remaining sample (BR504030). Tentatively identified aldol condensation had estimated concentrations of from 14 to 27 mg/kg in each of the three samples. All other measured or estimated concentrations were 1.5 mg/kg or less in two of the samples. Sample BR504030, however, had several compounds detected with measured or estimated concentrations greater than 3 mg/kg. Measured concentrations included acenaphthylene (3.3 mg/kg), dibenzo(A,H)anthracene (5.3 mg/kg), and naphthalene (4.4 mg/kg). Among the positively identified compounds in sample BR504030, those not mentioned above had estimated concentrations because most of the concentrations were outside the calibration range. Several of these estimates exceeded 10 mg/kg and two estimates exceeded 100 mg/kg (Anthracene and pyrene were both estimated at 170 mg/kg). With the exception of probable aldol condensation, all the TICs in this sample had estimated concentrations of less than 7 mg/kg.*

Volatile organics. Analytical results for volatile organic compounds are presented in Table 4.3.6. There were five compounds detected in one sample, six in another, and 14 in the remaining sample. Chloroform was detected in all samples and in one of the blanks. The highest measured or estimated concentration of chloroform was a measured 0.032 mg/kg. Methylene chloride was identified below quantitation limits in all samples and was also present in the blanks. Its highest estimated concentration was 0.023 mg/kg. Estimated concentrations of TICs were 1 mg/kg or less.

Radiochemistry. Analytical results are presented in Table 4.3.6. Only cobalt-137 was detected and it was found in all three samples (1,100 to 1,800 pCi/kg).

Request 505:

Radiochemistry. Analytical results are presented in Table 4.3.6. Five samples contained cobalt-137 (720 to 42,000 pCi/kg), and one sample (BR505031) contained a small amount of manganese-54 (23 pCi/kg). All six samples contained potassium-40 (3,400 to 8,500 pCi/kg).

Analytical Data Evaluation:

Request 503:

Metals. Five metals of interest (barium, chromium, copper, nickel, and zinc) were detected above the CRDL for this request.

Oil and grease. Requests 503 and 504 were analyzed with SDG No. 503017; the holding time was exceeded and no method duplicates were analyzed. No calibration of the method was made.

Extractable organics. No compounds were identified in measured or estimated concentrations of 1 mg/kg or more. Compounds tentatively identified as diacetone alcohol and probable aldol condensation were present in estimated concentrations of less than 30 mg/kg. Two aliphatic hydrocarbons and an unknown ketone were tentatively identified in concentrations ranging from 2.9 to 4.3 mg/kg in sample BR503040. Otherwise all estimated concentrations of tentatively identified compounds were less than 2 mg/kg.

Volatile organics. Chloroform and methylene chloride were present in all samples and in the blank. All compounds detected in the samples were also in the blank, except for acetone and one of the TICs.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 504:

Metals. Six metals of interest (barium, beryllium, chromium, copper, nickel, and zinc) were detected above the CRDL in the samples for this request.

Oil and grease. Requests 503 and 504 were analyzed with SDG No. 503017; the holding time was exceeded and no method duplicates were analyzed. No calibration of the method was made.

Extractable organics. Tentatively identified aldol condensation had estimated concentrations of from 14 to 27 mg/kg in each of the three samples. Sample BR504030 had several compounds detected with measured or estimated concentrations greater than 3 mg/kg. Measured concentrations included acenaphthylene (3.3 mg/kg), dibenzo(A,H)anthracene (5.3 mg/kg), and naphthalene

(4.4 mg/kg). Most of concentrations of positively identified compounds were outside the calibration range. With the exception of probable aldol condensation, all of the TICs in this sample had estimated concentrations of less than 7 mg/kg.

Volatile organics. Chloroform was detected in all samples and in one of the blanks. Methylene chloride was identified below quantitation limits in all samples and was also present in the blanks.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 505:

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.12.4 Limitations and Qualifications

Data Quality Level:

Request 503: The sampling plan for Request 503 is rated Quality Level II. The field sampling is rated Quality Level I. The overall analytical quality rating is Quality Level II.

Request 504: The sampling plan for Request 504 is rated Quality Level I. The field sampling is rated Quality Level I. The overall analytical quality rating is Quality Level I.

Request 505: The sampling plan for Request 505 is rated Quality Level I. The field sampling is rated Quality Level I. The overall analytical quality rating is Quality Level I.

Field Data:

Request 503: The sampling plan for Request 503 identified samples to be taken outside the fenced area. The sampling team found it difficult to locate the sampling site because a pond existed in the area recommended for sampling. The samples were taken inside the fence and closer to the contaminating source.

Request 504: The plan and field sampling requirements were met.

Request 505: The plan and field sampling requirements were met.

Analytical Data:

Request 503:

Metals. Analytical results for samples BR503039 and BR503040 were Quality Level I with the following exceptions: antimony, magnesium, nickel, and vanadium were Quality Level II; and arsenic, beryllium, and silver were Quality Level III. Antimony exceeded the control limit for spike recovery. Magnesium and vanadium fell below the control limit for calibration verification results. Nickel exceeded the control limit for calibration verification results. Arsenic fell below the control limits for spike recovery. Beryllium was found in the calibration blank at less than the CRDL and was recovered above the control limit in the laboratory control standard. Silver results exceeded the control limit in the calibration verification standards. For samples BR503017 and BR503028, results were Quality Level I with the following exceptions: antimony was Quality Level II, and arsenic and beryllium were Quality Level III. For sample BR503028 selenium was also Quality Level III. Antimony, arsenic, and beryllium were downgraded for the same reasons stated above. The selenium value exceeded the control limit in the laboratory control standard.

Oil and grease. The data for this problem are Quality Level III because the holding time was exceeded, no method duplicate was analyzed, and no calibration was made.

Extractable organics. These data are given as Quality Level I, although several compounds had concentrations out of calibration range and were, therefore, estimated in BR504030.

Volatile organics. For Request 503, most of the compounds detected in the samples were also present in the blank. Data are of Quality Level II.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 504:

Metals. Analytical results were Quality Level II except for beryllium at Quality Level III. For samples BR504029 and BR504030, lead was also at Quality Level 'II. All analytes received Quality Level II because a spiked sample was not -ed with the sample set. Beryllium exceeded the control limit in the solid control standard. Lead fell below the control limits for calibration -lts in the two samples mentioned above.

Oil and grease. The data for this problem are Quality Level III because the holding time was exceeded, no method duplicate was analyzed, and no calibration was made.

Extractable organics. These data are given as Quality Level I, although several compounds had concentrations out of calibration range and were, therefore, estimated in BR504030.

Volatile organics. Data are Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 505:

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 6
Request Number: 503

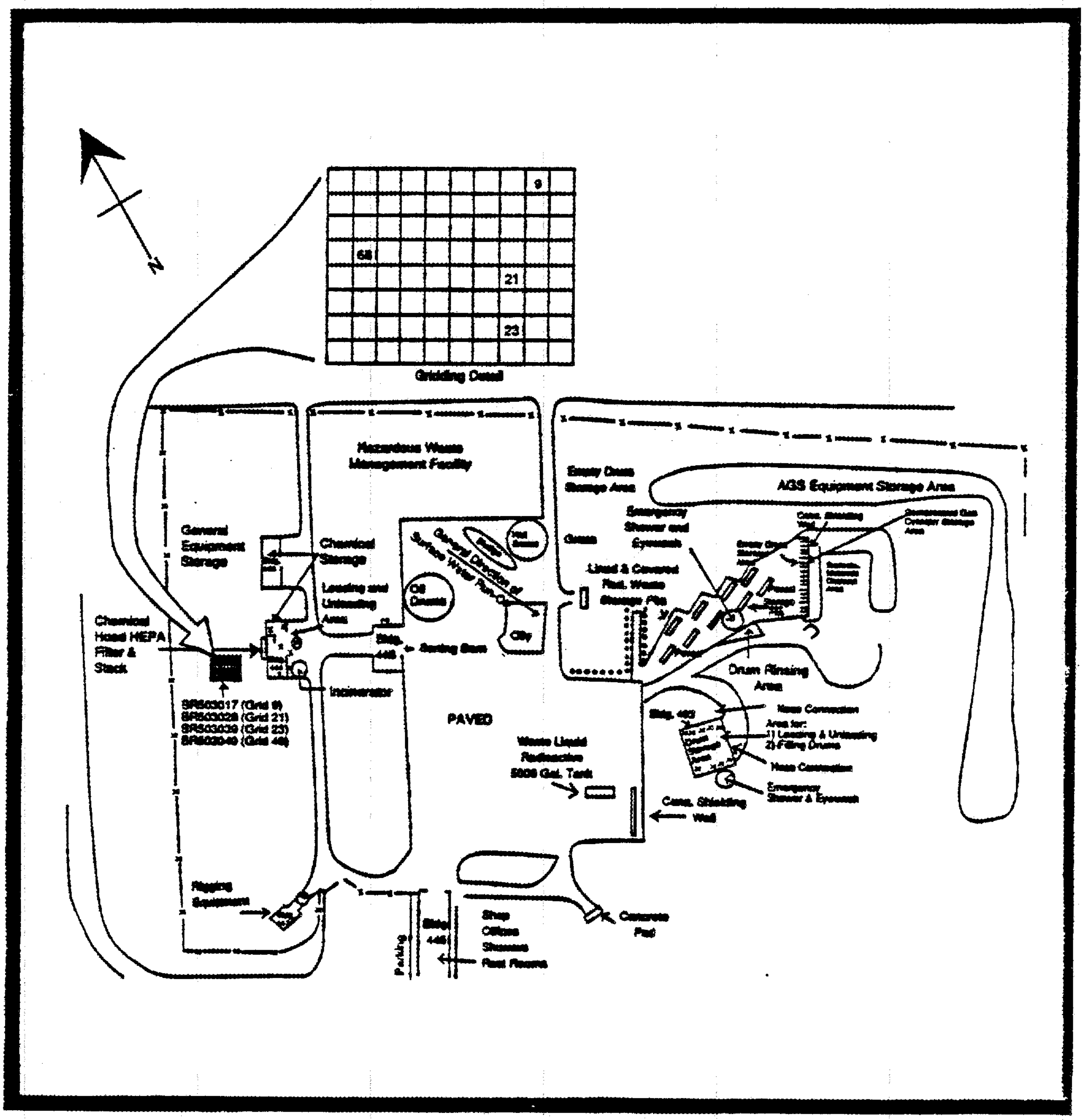

Figure 4.6a. West of Building 444 (Request 503)

Environmental Problem: 6
Request Number: 504

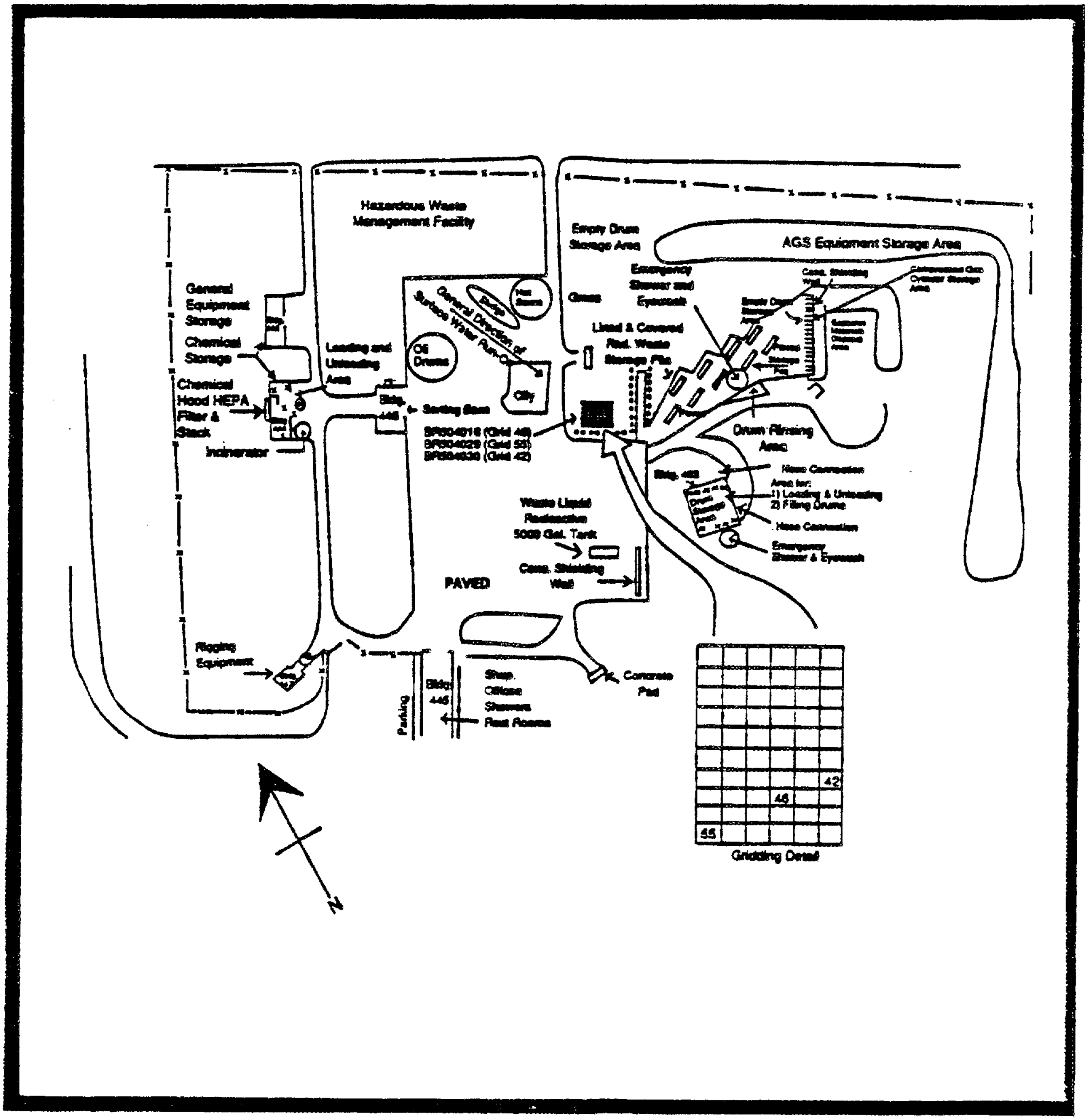

Figure 4.6b. Southwest of Empty Drum Storage Area, West of RAD Waste Pits (Request 504)

Environmental Problem: 6
Request Number: 505

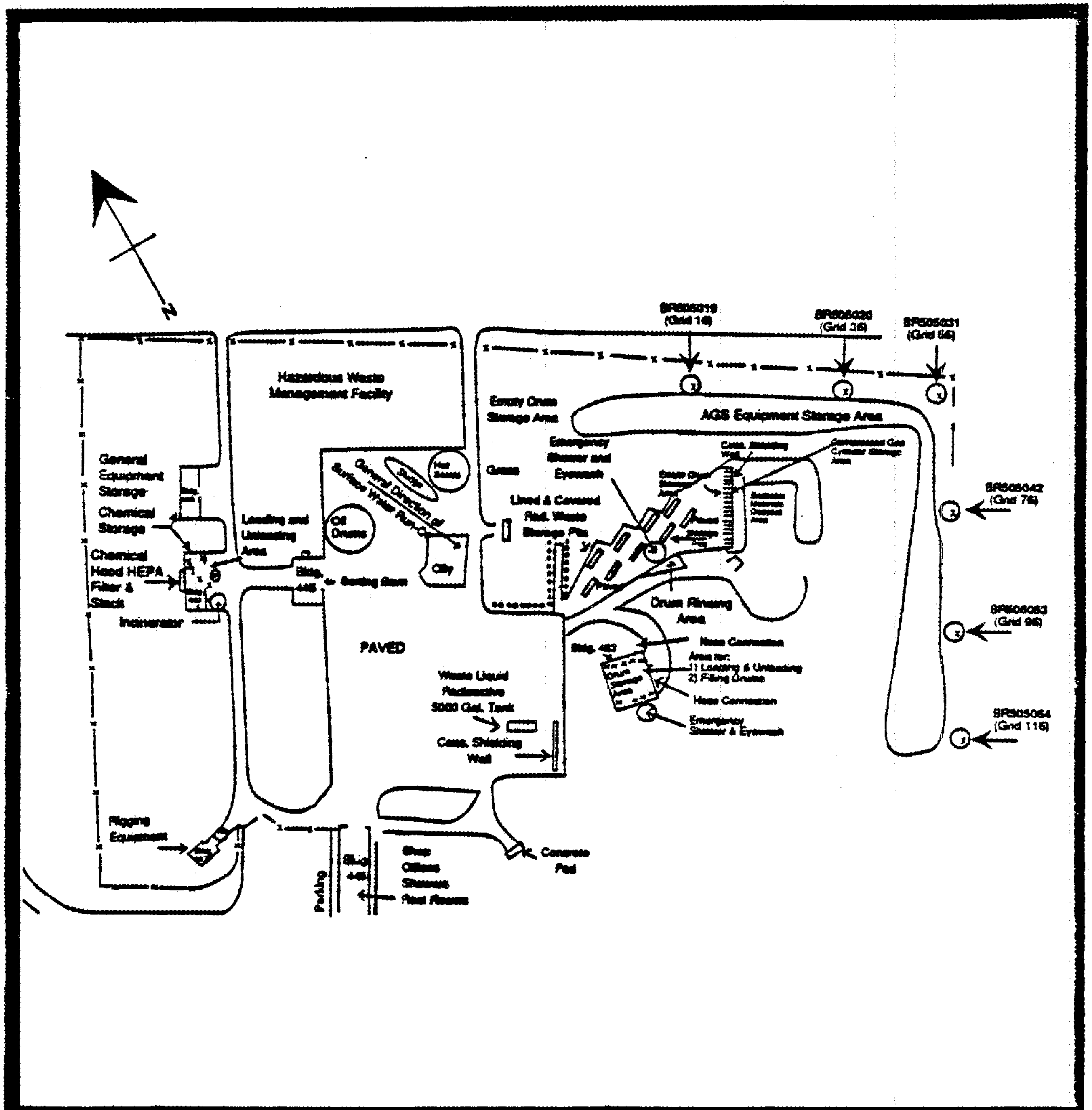

Figure 4.6c. AGS Equipment Storage Area (Request 505)

TABLE 4.2.6 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 6

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS NUMB HITS	ANIONS NUMB ANAL	METALS NUMB HITS	METALS NUMB ANAL	O&G NUMB HITS	O&G NUMB ANAL	PET HYDRO NUMB HITS	PET HYDRO NUMB ANAL	PES/H/PCB NUMB HITS	PES/H/PCB NUMB ANAL	SEMIVOLS NUMB HITS	SEMIVOLS NUMB ANAL	VOLS NUMB HITS	VOLS NUMB ANAL	RADS NUMB HITS	RADS NUMB ANAL
BR503	B. 444	RELEASES	SOIL	4	4	GRAB	0	0	4	4	4	4	0	0	0	0	4	4	4	4	4	4
BR504	B. 444	RELEASES	SOIL	3	3	GRAB	0	0	3	3	3	3	0	0	0	0	3	3	3	3	3	3
BR505	AGS AREA	RELEASES	SOIL	6	6	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
			MED TOTAL	13	13		0	0	7	7	7	7	0	0	0	0	7	7	7	7	13	13
BR503	B. 444	RELEASES	SUR WATER	1	1	QC RN	0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	1
			MED TOTAL	1	1		0	0	1	1	1	1	0	0	0	0	1	1	1	1	0	1
			EP TOTAL	14	14		0	0	8	8	8	8	0	0	0	0	8	8	8	8	13	14

TABLE 4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 — DRAFT DO NOT CITE

HHMA RELEASES

S&A REQUEST: 503
LOCATION: WEST OF BUILDING 444
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO: BR503017	BR503028	BR503039	BR503040		
FID/PID (PPM)	0	0	0	0		
RADIOACTIVIT (CPM)	400					

METALS, INCLUDING CR+6 (MG/KG)	BR503017D	BR503017D	BR503028D	BR503028D	BR503039D	BR503039D
SDG NO:	BR303015C	BR303015K	BR303015C	BR303015K	BR303015C	BR303015K
TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM	7470		9300		6010	
BARIUM	66		55		266	
BERYLLIUM	0.6 B		0.67 B		0.63 B	
CALCIUM	163 B		160 B		229 B	
CHROMIUM	8.3		9.6		6.8	
COBALT	3.2 B		2.5 B		2.3 B	
COPPER	6.9		7.1		8.6	
IRON	10200		7930		7740	
LEAD	9.4 B		9.2 B		12 B	
MAGNESIUM	600 B		1070		511 B	
MANGANESE	30		42		29	
NICKEL	16		20		33	
POTASSIUM		360 B		470 B		370 B
SELENIUM	9.4 U		9.6 B		9.2 U	
SODIUM	107 B		105 B		84 B	
VANADIUM	15		16		14	
ZINC	15		17		10	

METALS, INCLUDING CR+6 (MG/KG)	BR503040D	BR503040D				
SDG NO:	BR303015C	BR303015K				
TYPE:	GRAB	GRAB				
ALUMINUM	5560					
BARIUM	11 B					
BERYLLIUM	0.43 B					
CALCIUM	123 B					
CHROMIUM	5.7					
COBALT	1.6 B					
COPPER	3.7 B					
IRON	4910					
LEAD	7.7 U					
MAGNESIUM	524 B					
MANGANESE	31					
NICKEL	16					
POTASSIUM		380 B				

TABLE 4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6
HWMA RELEASES

S&A REQUEST: 503
LOCATION: WEST OF BUILDING 444
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	BR503040D	BR503040D				
	SDG NO:	BR303015C	BR303015K				
	TYPE:	GRAB	GRAB				
SELENIUM		9.3 U					
SODIUM		72 B					
VANADIUM		10					
ZINC		11					

OIL AND GREASE (MG/KG)	SAMP NO:	BR503017C	BR503028C	BR503039C	BR503040C		
	SDG NO:	BR503017C	BR503017C	BR503017C	BR503017C		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
OIL AND GREASE		2130	490	560	430		

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR503017B	BR503028B	BR503039B	BR503040B		
	SDG NO:	BR503017B	BR503017B	BR503017B	BR503017B		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
ACENAPHTHENE		25 J	370 U	22 J	10 J		
ACENAPHTHYLENE		39 J	370 U	380 U	370 U		
ANTHRACENE		190 J	110 J	26 J	49 J		
BENZO(A)ANTHRACENE		330 J	110 J	77 J	370 U		
BENZO(A)PYRENE		630	130 J	56 J	17 J		
BENZO(B)FLUORANTHENE		340 J	70 J	62 J	370 U		
BENZO(G,H,I)PERYLENE		660	390	250 J	65 J		
BIS(2-ETHYLHEXYL)PHTHALATE		260 JB	370 U	380 U	370 U		
CHRYSENE		320 J	110 J	75 J	39 J		
DI-N-BUTYLPHTHALATE		88 J	61 JB	380 U	370 U		
DI-N-OCTYLPHTHALATE		17 JB	370 U	380 U	370 U		
DIBENZ(A,H)ANTHRACENE		180 J	100 J	51 J	370 U		
DIBENZOFURAN		380 U	8 J	380 U	370 U		
DIETHYLPHTHALATE		180 JB	370 U	380 U	11 JB		
FLUORANTHENE		430	150 J	66 J	72 J		
FLUORENE		55 J	370 U	380 U	370 U		
INDENO(1,2,3-CD)PYRENE		580	360 J	160 J	38 J		
PHENANTHRENE		360 J	190 J	34 J	81 J		
PYRENE		580	230 J	160 J	120 J		
2-METHYLNAPHTHALENE		24 J	15 J	380 U	370 U		
* ALIPHATIC HYDROCARBON(5.91)					260 J		
* ALIPHATIC HYDROCARBON(6.70)				910 J			
* ALIPHATIC HYDROCARBON(6.73)			620 JB				
* ALIPHATIC HYDROCARBON(6.74)		520 JB			3100 JB		
* ALIPHATIC HYDROCARBON(6.86)				240 JB			

TABLE 4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 HWMA RELEASES

DRAFT DO NOT CITE

S&A REQUEST: 503
LOCATION: WEST OF BUILDING 444
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR503017B / BR503017B / GRAB	BR503028B / BR503017B / GRAB	BR503039B / BR503017B / GRAB	BR503040B / BR503017B / GRAB		
* ALIPHATIC HYDROCARBON(6.91)				660 JB			
* ALIPHATIC HYDROCARBON(6.93)					2900 JB		
* ALIPHATIC HYDROCARBON(6.95)		650 JB	810 JB				
* ARYL HYDROCARBON(9.29)				230 J			
* DIACETONE ALCOHOL(6.15)			1500 JAB		23000 JAB		
* DIACETONE ALCOHOL(6.19)		1500 JAB					
* DIACETONE ALCOHOL(6.50)				13000 JAB			
* DIOCTYL ADIPATE(31.20)		1500 JB	1500 JB	1500 JB	1500 JB		
* POSS ALIPHATIC HYDROCAR(6.49)		160 JB			1300 JB		
* POSS ALIPHATIC HYDROCAR(6.50)			220 JB				
* POSS AROMATIC AMINE(28.40)		300 J					
* POSS UNSAT HYDROCARBON(5.03)					170 J		
* PROB ALDOL-CONDENSATION(4.93)					21000 JAB		
* PROB ALDOL-CONDENSATION(5.04)				28000 JAB			
* PROB ALDOL-CONDENSATION(5.13)			17000 JAB				
* PROB ALDOL-CONDENSATION(5.18)		15000 JAB					
* SULFUR(27.10)		750 J		1500 J			
* SULFUR(27.20)			1500 J				
* UNKNOWN ACID(27.00)				69 J	150 J		
* UNKNOWN KETONE(6.56)					4300 J		
* UNKNOWN(3.60)					950 JB		
* UNKNOWN(3.64)			990 JB	1400 JB			
* UNKNOWN(3.65)		960 JB					
* UNKNOWN(5.41)					730 J		
* UNKNOWN(5.82)				170 J			
* UNKNOWN(8.01)					170 J		
* UNKNOWN(8.40)					570 J		
* UNKNOWN(8.41)		190 J	170 J				
* UNKNOWN(8.59)				520 J			
* UNKNOWN(8.89)					410 J		
* UNKNOWN(9.00)				300 J			
* UNKNOWN(24.40)				81 J	160 J		
* UNKNOWN(36.30)		310 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR503017A / BR503017A / GRAB	BR503028A / BR503028A / GRAB	BR503039A / BR503017A / GRAB	BR503040A / BR503017A / GRAB		
ACETONE		120	55 U	130	60 U		
CHLOROFORM		22 JB	33 B	27 JB	24 JB		
ETHYLBENZENE		9 JB	10 JB	9 JB	9 JB		

S&A REQUEST: 503
LOCATION: WEST OF BUILDING 444
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR503017A / BR503017A / GRAB	BR503028A / BR503028A / GRAB	BR503039A / BR503017A / GRAB	BR503040A / BR503017A / GRAB		
METHYLENE CHLORIDE		20 JB	21 JB	24 JB	21 JB		
XYLENE (TOTAL)		6 JB	7 JB	8 JB	8 JB		
* PROBABLE FREON 113(3.03)					220 JB		
* PROBABLE FREON 113(3.04)			320 JB				
* PROBABLE HYDROCARBON(19.22)				29 JB			
* PROBABLE HYDROCARBON(19.24)		27 JB					
* PROBABLE HYDROCARBON(25.95)			38 J				

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR503017E / LLL8280 / GRAB	BR503028E / LLL8280 / GRAB	BR503039E / LLL8280 / GRAB	BR503040E / LLL8280 / GRAB		
CO-60		93	40 U	30 U	55		
CS-137		17000	6100	4400	990		
K-40		7100	8300	6300	6300		

4-260

S&A REQUEST: 503
LOCATION: WEST OF BUILDING 444
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR503051G / BR306018F / RINSATE					
ALUMINUM		72 B					
BARIUM		2.9 B					
BERYLLIUM		0.49 B					
CALCIUM		219 B					
IRON		82 B					
MAGNESIUM		33 B					
NICKEL		18 B					
ZINC		21					

TABLE 4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 HWMA RELEASES

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S&A REQUEST: 503
LOCATION: WEST OF BUILDING 444
MEDIUM: SURFACE WATER

OIL AND GREASE (MG/L)	SAMP NO: BR503051F SDG NO: BR306018H TYPE: RINSATE					
OIL AND GREASE	35					

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: BR503051E SDG NO: BR306018E TYPE: RINSATE					
BIS(2-ETHYLHEXYL)PHTHALATE	300					
DI-N-BUTYLPHTHALATE	10 J					
DIETHYLPHTHALATE	26					
PHENOL	9 J					
* ARYL HYDROCARBON(22.80)	2 J					
* ARYL HYDROCARBON(23.30)	2 J					
* ARYL HYDROCARBON(24.50)	2 J					
* DIACETONE ALCOHOL(6.00)	51 JA					
* POSSIBLE UNSAT HYDROCAR(10.80)	87 J					
* POSSIBLE UNSAT HYDROCAR(19.40)	47 J					
* UNKNOWN ACID(21.00)	46 J					
* UNKNOWN ALKYL/HYDROXYL (29.10)	22 J					
* UNKNOWN ALKYL/HYDROXYL (35.30)	87 J					
* UNKNOWN AMIDE(23.20)	87 J					
* UNKNOWN AMIDE(25.90)	28 J					
* UNKNOWN ETHER(29.90)	51 J					
* UNKNOWN ETHER(37.00)	28 J					
* UNKNOWN HYDROXYL CPD(32.10)	16 J					
* UNKNOWN HYDROXYL CPD(32.80)	23 J					
* UNKNOWN HYDROXYL/ALKYL (26.60)	5 J					
* UNKNOWN(27.20)	2 J					
* UNKNOWN(28.10)	650 J					
* UNKNOWN(30.30)	100 J					
* 1-METHYL-2-PYRROLIDONE(11.00)	33 J					

VOLATILE ORGANICS (UG/L)	SAMP NO: BR503051A SDG NO: BR801041A TYPE: RINSATE					
ACETONE	18 B					
METHYLENE CHLORIDE	1 JB					
TOLUENE	3 JB					

TABLE 4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6
HWMA RELEASES

S&A REQUEST: 504
LOCATION: SOUTHWEST OF EMPTY DRUM STORAGE AREA, WEST OF RAD WASTE PITS
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO: BR504018	BR504029	BR504030			
FID/PID (PPM)	16	7.5	34			
RADIOACTIVIT (CPM)	3000	10000	9000			

METALS, INCLUDING CR+6 (MG/KG)						
SAMP NO:	BR504018D	BR504018D	BR504029D	BR504029D	BR504030D	BR504030D
SDG NO:	BR313017C	BR313017K	BR313017C	BR313017K	BR313017C	BR313017K
TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM	10100 E		5210 E		7990 E	
BARIUM	54		6.9 B		21 B	
BERYLLIUM	1		0.43 B		0.67 B	
CALCIUM	973		167 B		617 B	
CHROMIUM	15		6.3		12	
COBALT	6.7 B		1.4 B		3.6 B	
COPPER	12		2.6 B		17	
IRON	16200 E		6340 E		11400 E	
LEAD	9.8 B		7.6 U		7.4 U	
MAGNESIUM	1550 E		509 BE		1230 E	
MANGANESE	232		25		129	
NICKEL	8.9		3.5 B		6.3	
POTASSIUM		870		260 B		700 B
SODIUM	132 B		46 B		122 B	
VANADIUM	27		11		18	
ZINC	27		11		18	

OIL AND GREASE (MG/KG)						
SAMP NO:	BR504018C	BR504029C	BR504030C			
SDG NO:	BR503017C	BR503017C	BR503017C			
TYPE:	GRAB	GRAB	GRAB			
OIL AND GREASE	220	320	13300			

EXTRACTABLE ORGANICS (UG/KG)						
SAMP NO:	BR504018B	BR504029B	BR504030B			
SDG NO:	BR503017B	BR503017B	BR503017B			
TYPE:	GRAB	GRAB	GRAB			
ACENAPHTHENE	380 U	360 U	19000 E			
ACENAPHTHYLENE	380 U	360 U	3300			
ANTHRACENE	380 U	360 U	170000 E			
BENZO(A)ANTHRACENE	380 U	360 U	62000 E			
BENZO(G,H,I)PERYLENE	380 U	360 U	21000 E			
BENZO(K)FLUORANTHENE	380 U	360 U	47000 E			
BIS(2-ETHYLHEXYL)PHTHALATE	320 JB	360 U	360 U			

S&A REQUEST: 504
LOCATION: SOUTHWEST OF EMPTY DRUM STORAGE AREA, WEST OF RAD WASTE PITS
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR504018B / BR503017B / GRAB	BR504029B / BR503017B / GRAB	BR504030B / BR503017B / GRAB
CHRYSENE		380 U	360 U	50000 E
DI-N-BUTYLPHTHALATE		55 J	46 J	360 U
DI-N-OCTYLPHTHALATE		11 JB	360 U	31 JB
DIBENZ(A,H)ANTHRACENE		380 U	360 U	5300
DIBENZOFURAN		380 U	360 U	18000 E
DIETHYLPHTHALATE		380 U	15 JB	360 U
FLUORANTHENE		380 U	360 U	68000 E
FLUORENE		380 U	360 U	45000 E
INDENO(1,2,3-CD)PYRENE		380 U	360 U	23000 E
NAPHTHALENE		380 U	360 U	4400
PYRENE		380 U	360 U	170000 E
2-METHYLNAPHTHALENE		380 U	360 U	17000 E
* ALIPHATIC HYDROCARBON(6.57)			140 J	
* ALIPHATIC HYDROCARBON(6.75)		410 JB		
* ALIPHATIC HYDROCARBON(6.76)			660 JB	
* ALIPHATIC HYDROCARBON(6.94)		500 JB		
* ALIPHATIC HYDROCARBON(6.95)			770 JB	
* DIACETONE ALCOHOL(6.11)				4000 JAB
* DIACETONE ALCOHOL(6.17)		1500 JAB	1400 JAB	
* DIMETHYL NAPHTHALENE(18.30)				1500 J
* DIMETHYL NAPHTHALENE(18.50)				2100 J
* DIMETHYL NAPHTHALENE(18.80)				800 J
* DIOCTYL ADIPATE(31.20)		1500 JB	1400 JB	1300 JB
* METHYL FLUORENE(22.80)				310 J
* METHYL FLUORENE(22.90)				220 J
* POSS ALIPHATIC HYDROCAR(6.50)		150 JB		
* POSS ALIPHATIC HYDROCAR(6.51)			250 JB	
* POSS. ARYLTHIOLE COMPOU(23.60)				240 J
* PROB ALDOL-CONDENSATION(4.96)				27000 JA
* PROB ALDOL-CONDENSATION(5.02)				4900 JAB
* PROB ALDOL-CONDENSATION(5.13)		14000 JAB		
* PROB ALDOL-CONDENSATION(5.17)			17000 JAB	
* TRIMETHYL NAPHTHALENE(20.20)				620 J
* TRIMETHYL NAPHTHALENE(20.80)				760 J
* UNKNOWN PNA HYDROCARBON(25.50)				530 J
* UNKNOWN PNA HYDROCARBON(25.60)				310 J
* UNKNOWN PNA HYDROCARBON(25.80)				220 J
* UNKNOWN PNA HYDROCARBON(25.90)				330 J
* UNKNOWN PNA HYDROCARBON(27.30)				210 J
* UNKNOWN PNA HYDROCARBON(29.30)				1100 J
* UNKNOWN(3.65)		780 JB		
* UNKNOWN(3.67)			1000 JB	

S&A REQUEST: 504
LOCATION: SOUTHWEST OF EMPTY DRUM STORAGE AREA, WEST OF RAD WASTE PITS
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR504018B / BR503017B / GRAB	BR504029B / BR503017B / GRAB	BR504030B / BR503017B / GRAB			
* UNKNOWN(21.40)				840 J			
* 1-METHYL NAPHTHALENE(16.60)				6100 J			

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR504018A / BR311015A / GRAB	BR504029A / BR503017A / GRAB	BR504030A / BR503017A / GRAB			
ACETONE		140 B	56 U	54 U			
CHLOROFORM		32 B	18 J	21 J			
ETHYLBENZENE		8 JB	8 J	9 J			
METHYLENE CHLORIDE		23 JB	19 JB	18 JB			
STYRENE		2 JB	28 U	27 U			
XYLENE (TOTAL)		6 JB	6 J	7 J			
* METHYL-NAPHTHALENE #1(28.26)				820 J			
* METHYL-NAPHTHALENE #2(28.67)				1000 J			
* NAPHTHALENE(25.50)				320 J			
* PROB AROMATIC HYDROCARB(24.10)				56 J			
* PROB AROMATIC HYDROCARB(24.55)				58 J			
* PROBABLE FREON 113(3.01)				200 JB			
* PROBABLE FREON 113(3.07)			210 JB				
* PROBABLE HYDROCARBON #1(19.22)				24 JB			
* PROBABLE HYDROCARBON #2(22.05)				25 JB			
* SUBSTITUTED NAPHTHALENE(27.13)				41 J			
* SUBSTITUTED NAPHTHALENE(27.38)				27 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR504018E / LLL8281 / GRAB	BR504029E / LLL8281 / GRAB	BR504030E / LLL8281 / GRAB			
CS-137		1800	1100	1300			

TABLE 4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
HWMA RELEASES

S&A REQUEST: 505
LOCATION: AGS EQUIPMENT STORAGE AREA
MEDIUM: SOIL

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR505019A	BR505020A	BR505031A	BR505042A	BR505053A	BR505064A
	SDG NO:	LLL8282	LLL8282	LLL8282	LLL8282	LLL8282	LLL8282
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CS-137		1100	890	42000	850		720
K-40		8500	5500	7500	8400	6500	3400
MN-54				23			

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4.13 Environmental Problem 7: Spray Aeration Treatment System

Request Numbers: 506.

Requester: P. A. Eddy and D. T. Detman.

Finding and Basis: Probable on-site contamination was uncharacterized in the areas near the HWMA groundwater spray aeration discharge nozzles. The spray aeration treatment system was a potential pathway for organic compounds and radionuclide contaminants in the groundwater to be transported and deposited on the surface soils.

There was at the time of the Environmental Survey, an operation to strip volatile organics from the groundwater near the HWMA because drinking water standards for volatile organic compounds were exceeded in the groundwater. The groundwater samples in the area also contained radionuclides (gross alpha and beta, cesium-137, cobalt-60, hydrogen-3, sodium-22, and strontium-90); metals (iron, manganese, sodium, lead, and zinc); chlorides; and sulfates at elevated levels.

4.13.1 Sampling and Analysis Objectives

Statement: Soil samples were collected in the areas where spray aeration water is being discharged to provide data on the nature of soil contamination resulting from the groundwater treatment system.

Supporting Information: The on-site soils were not sampled as part of the environmental monitoring program. Although soil studies performed in 1982 and 1983 revealed cesium-137 and cobalt-60 contamination in areas where waste handling and spills occurred, these areas were not related to the spray aeration system. Groundwater analyses performed as part of the "Groundwater Restoration Project" in 1985 indicated strontium-90, hydrogen-3, and gross beta above drinking water standards. These contaminants were being brought to the surface and introduced to the soil by the spray aeration system.

Historical records revealed that strontium-90 was inadvertently injected into one of the wells in the HWMA. Storage of cobalt-60 in "dry wells" approximately 8 ft deep, for a period in excess of 20 years, may have allowed the cobalt-60 to percolate to the groundwater table at depths of 10 to 20 ft.

Maximum values for the average of the 1985 analyses from each well sampled in the HWMA are as follows:

Radiation Parameter	Max. Value (pCi/L)	NYS Drinking Water Standard
Gross Alpha	2.40	15.00
Gross Beta	69.80	50.00(1)**
H-3	22,800.00	20,000.00
Cs-137	7.90	(2)**
Co-60	1.73	(2)**
Sr-90	34.70	8.00
Organic Compounds	(mg/L)	
Chloroform	0.195	0.10
1,1,1-trichloroethane	1.50	0.05(3)**
Trichloroethylene	0.044	0.01
Tetrachloroethylene	1.80	0.05(3)**
Inorganic Compounds	(mg/L)	
Chlorides	24.90	250.00
Sulfates	42.90	250.00
Iron	4.97	0.30
Lead	0.35	0.025
Zinc	5.41	5.00
Manganese	0.77	0.30
Sodium	55.40	(2)**

**(1) Compliance level
**(2) Not established
**(3) NYS Department of Health (DOH) Guideline

4.13.2 Sampling and Analytical Design

4.13.2.1 Sampling Design

Request 506: HWMA Groundwater Spray Aeration Discharge Area. (Fig. 4.7a) Seven grab soil samples (Sampling Method: Reference E5.2.3) were to be collected at each of the five sites in this area where groundwater was being pumped. The source of the spray water for the aeration discharge was to be considered homogeneous. Samples were to be collected at 0 to 5 ft and at 5 to 10 ft where the spray "cone" intercepts the ground. If the 0- to 5-ft increment contained significant humic materials, the sample was to be collected from the last foot; if the 0- to 5-ft increment was primarily sand, a core was to be taken from 5 to 10 ft, and the sample was to be collected from the last foot.

The Sampling Team arrived at the site on 14APR88 at 1000. The temperature was 50^{O}F and the sky was clear. Sample BR506010 was collected at PW-1. The first attempt to obtain a sample was to 5 ft, with organic material being found in the top 3 ft. Coring was increased to 10 ft, where the soil profile consisted of nothing but sand. It was decided that the only probability of contaminant retention would be in the top 3 ft; therefore, split-spoon coring was implemented. The volatiles sample was extracted from the split-spoon barrel intact, wrapped solidly in aluminum foil to eliminate headspace, and the aluminum foil/soil pack placed in a widemouth glass jar. The remainder of the sample was used for nonvolatile parameters.

Subsequent sampling at location BR506021 (PW-5) revealed sand below the top 6 in. The spray aeration system had not operated since October 1987, and it was not probable that tritium, TCE, or other volatiles would be present in the sand fraction (no exchange sites). Since the major concern was radioactive contaminants from spray, only the RAD parameter was collected.

Samples BR506032 (recharge basin west) and BR506043 (recharge basin east) were collected at the surface (0 to 6 in.), using a spatula, and were checked for RADs only. The recharge basins were receiving water diverted from PW-3 and PW-4; the water was 2 to 6 in. deep.

Core sampling was attempted for sample BR506054 at PW-2, but only the top 1 ft was collected for RADs. Samples BR506065 at PW-3 and BR506076 at PW-4 were also sampled for RADs only. S. Barisas concurred with the decision to sample for RADs only.

4.13.2.2 Analytical Design

Samples for Request 506 were to be analyzed for volatiles, semivolatiles, tritium, strontium-90, and gamma scan (cesium-137). However, the Sampling Team decided, with concurrence from a representative of DOE-HQ, to sample for RADs because of the sandy composition of the soil and because the spray aerator had not been operating for several months. Only one sample (BR506010 at PW-1) was sampled for volatile and nonvolatile parameters.

4.13.3 Field and Analytical Data

Field Data:

Request 506: *Since the primary concern was radionuclides, the field team took radiation scans of the samples collected. The activity level ranged from 100 to 1000 cpm. Only two of the seven samples registered above 100 cpm although BR506076 data was not reported; the highest reading was obtained in sample BR506010.*

Field Data Evaluation:

Request 506: The instrument used to scan the radiation was calibrated prior to being taken from the sampling team's laboratory. These field instruments are reliable in estimating beta/gamma radiation.

Analytical Data:

Request 506:

Extractable organics. Analytical Data for semivolatile organic compounds are presented in Table 4.3.7. There were 25 such compounds detected in this soil sample. No compounds were identified in measurable quantities. There were nine compounds that were present in the blank as well as in the samples. These included the three compounds that were tentatively identified in estimated concentrations of more than 10 mg/Kg. Some aliphatic hydrocarbons and an unknown ketone were tentatively identified in estimated concentrations between 2 and 4 mg/Kg. All but the unknown ketone were also present in the blank. Estimated concentrations of positively identified compounds were always less than 0.010 mg/Kg.

Volatile organics. Analytical results for volatile organic compounds are given in Table 4.3.7. Five volatile compounds were detected in this soil sample. Chloroform and methylene chloride were each measured at 0.031 mg/Kg and were also each detected in the blank. A probable freon was detected as a TIC with an estimated concentration of 0.54 mg/Kg.

Radiochemistry. Analytical results are presented in Table 4.3.7. Cesium-137 was detected in all samples (29 to 290 pCi/Kg) except the two (BR506032 and BR506043) from the recharge basin area. Tritium (200 pCi/Kg) was found in only one sample (BR506010) taken at PW-1. Total strontium (8 to 95 pCi/Kg) was *detected in four samples. Naturally occurring potassium-40 (2,500 to 9,700 pCi/Kg) was found in all seven samples.*

Analytical Data Evaluation:

Request 506:

Extractable organics. No compounds were identified in measurable quantities. Estimated concentrations of positively identified compounds were always less than 0.010 mg/Kg. Several compounds were present in the blank as well as in the samples. These included the compounds tentatively identified in estimated concentrations of more than 10 mg/Kg.

Volatile organics. Chloroform and methylene chloride were each identified in the sample and also in the blank. A probable freon was detected as a TIC.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.13.4 Limitations and Qualifications

Data Quality Level:

Request 506: The sampling plan and field sampling are rated as Quality Level I. The sampling team noted that the area was mostly sand and would not retain volatiles and tritium; therefore, with the concurrence of the DOE representative, the Team obtained samples only for radionuclides with the exception of BR506010, which was submitted for the other laboratory analyses. The overall analytical rating is Quality Level I.

Field Data:

Request 506: Data are of Quality Level I.

Analytical Data:

Extractable organics. These data were given as Quality Level I, although no compounds were identifiable in measurable quantities. Several identified or tentatively identified compounds were also present in the blank.

Volatile organics. All volatile compounds detected were also present in the blank. Data are of Quality Level II.

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 7
Request Number: 506

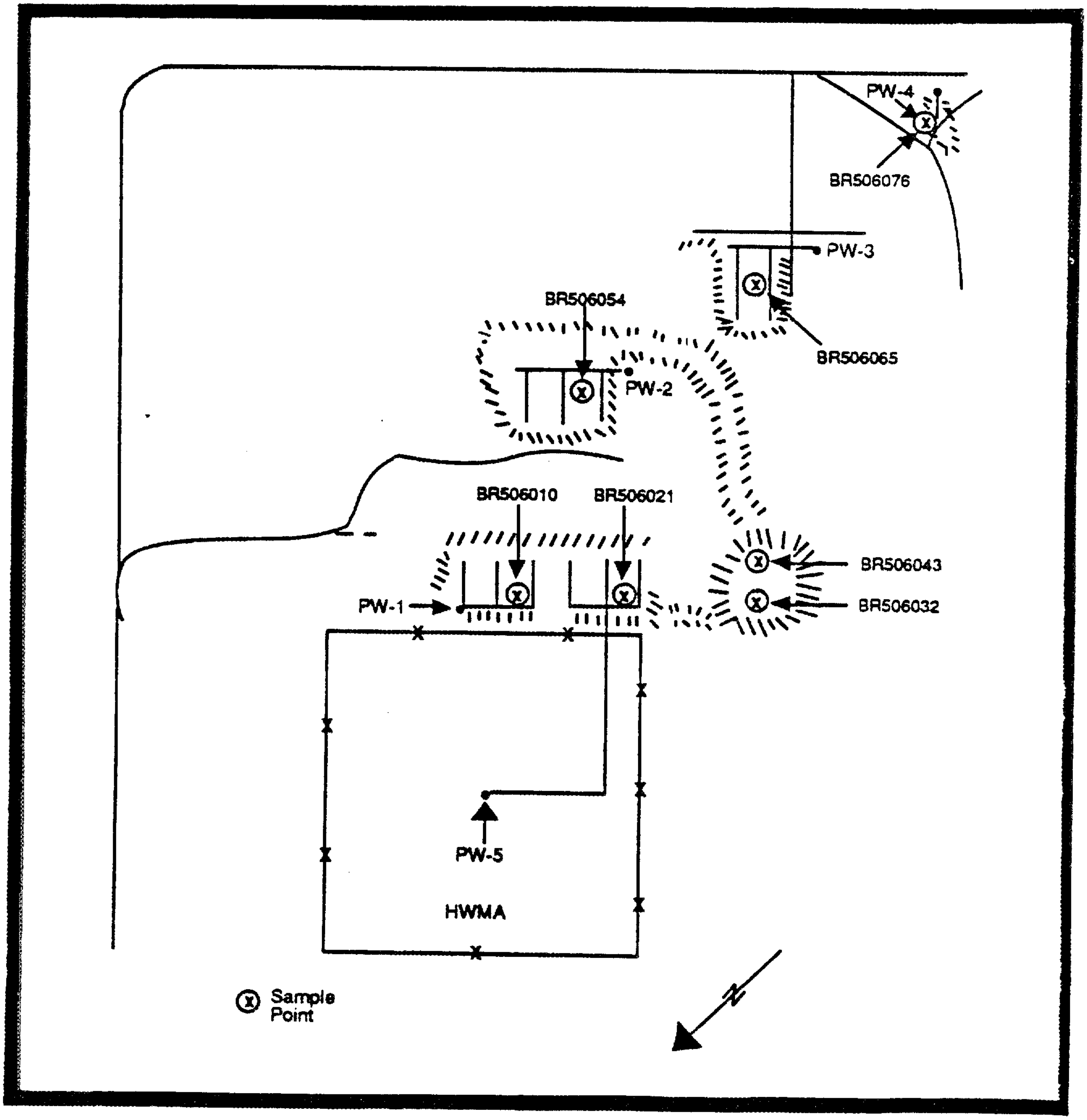

Figure 4.7a. HWMA Groundwater Spray Aeration Discharge Area (Request 506)

TABLE 4.2.7 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 7

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS		METALS		O&G		PET HYDRO		PES/H/PCB		SEMIVOLS		VOLS		RADS	
							NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL
BR506	HNMA SPRAY	AERATION	SOIL	7	7	GRAB	0	0	0	0	0	0	0	0	0	0	1	1	1	1	7	7
		MED TOTAL		7	7		0	0	0	0	0	0	0	0	0	0	1	1	1	1	7	7
		EP TOTAL		7	7		0	0	0	0	0	0	0	0	0	0	1	1	1	1	7	7

TABLE 4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 SPRAY AERATION TREATMENT SYSTEM

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S&A REQUEST: 506
LOCATION: HWMA GROUNDWATER SPRAY AERATION DISCHARGE AREA
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO: BR506010	BR506021	BR506032	BR506043	BR506054	BR506065
RADIOACTIVIT (CPM)	1000	350	100	100	100	100

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: BR506010B SDG NO: BR503017B TYPE: GRAB					
ACENAPHTHENE	10 J					
BENZO(B)FLUORANTHENE	23 J					
BIS(2-ETHYLHEXYL)PHTHALATE	90 JB					
BUTYLBENZYLPHTHALATE	36 J					
DI-N-OCTYLPHTHALATE	13 JB					
FLUORANTHENE	25 J					
PYRENE	32 J					
* ALIPHATIC HYDROCARBON(5.95)	150 J					
* ALIPHATIC HYDROCARBON(6.74)	2600 JB					
* ALIPHATIC HYDROCARBON(6.94)	2300 JB					
* DIACETONE ALCOHOL(6.22)	22000 JAB					
* DIOCTYL ADIPATE(42.60)	170 J					
* POSS ALIPHATIC HYDROCAR(6.50)	1100 JB					
* POSS UNSAT HYDROCARBON(24.10)	410 J					
* PROB ALDOL-CONDENSATION(4.96)	18000 JAB					
* UNKNOWN ACID(24.40)	270 J					
* UNKNOWN ACID(26.90)	310 J					
* UNKNOWN ACID(31.20)	18000 JB					
* UNKNOWN KETONE(6.56)	3800 J					
* UNKNOWN(3.68)	900 JB					
* UNKNOWN(5.46)	340 J					
* UNKNOWN(8.02)	130 J					
* UNKNOWN(8.41)	590 J					
* UNKNOWN(8.88)	570 J					
* UNKNOWN(10.00)	530 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO: BR506010A SDG NO: BR311015A TYPE: GRAB					
CHLOROFORM	31 B					
ETHYLBENZENE	9 JB					
METHYLENE CHLORIDE	31 B					
XYLENE (TOTAL)	7 JB					
* PROBABLE FREON 113(3.03)	540 JB					

TABLE 4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 SPRAY AERATION TREATMENT SYSTEM

DRAFT DO NOT CITE

S&A REQUEST: 506
LOCATION: HWMA GROUNDWATER SPRAY AERATION DISCHARGE AREA
MEDIUM: SOIL

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR506010C	BR506010D	BR506021C	BR506032C	BR506043C	BR506054C
	SDG NO:	LLL8283	LLL8284	LLL8283	LLL8283	LLL8283	LLL8283
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CS-137		29		230	20 U	20 U	93
H-3			200				
K-40		5600		9700	2500	2700	6400
SR-TOT		95		32	8	-27	22

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR506065C	BR506076C
	SDG NO:	LLL8283	LLL8283
	TYPE:	GRAB	GRAB
CS-137		260	290
H-3			
K-40		5700	5400
SR-TOT		0	0

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4.14 Environmental Problem 8: Sewage Treatment Plant Filter Beds

Requests: 800, 801, 802, and 803.

Requester: J. Werner.

Finding and Basis: The sand and sludge disposal associated with the sewage treatment plant may have been a source of groundwater contamination. Historical discharges to the sewage treatment plant have included hazardous substances and radionuclides at higher concentrations than currently observed. These historical releases have percolated through the filter beds and into the groundwater; deposited in the sludge of the Emhoff filter, the clarifier, and the filter beds; and desposited in the sand from the filter beds.

Wastewater previously flowed through the Emhoff filter before being pumped to the filter beds. At the time of the Environmental Survey, wastewater flowed through the clarifier before going to the filter beds. Sludge (toilet waste, metals, etc.) had been collected in the Emhoff filter, the clarifier, and the filter beds. The sludge from the Emhoff filter and the clarifier has been pumped into eight sludge drying beds located north of the clarifier, but west of the filter beds, except on one occasion (according to BNL personnel) when the Emhoff tank sludge was pumped onto the ground west of the sludge drying beds.

The sludge from the filter beds had been disposed of in the former and current landfills (both of which were under scrutiny for a broader pattern of hazardous substance disposal and thus were not included in this sampling and analysis request). This sludge may have been contaminated with radioactive (e.g., tritium and strontium-90), organic (TCA), and inorganic (heavy metals) wastes. This sludge disposal operation was performed every 5 to 7 years, although no records were available to confirm the frequency, volume, or location of disposal. The sand from under the sludge in the sewage treatment plant has been dredged out only twice during the life of the facility, according to BNL personnel, and may have been contaminated in the same manner as the sludge. Again, no records were available to confirm this statement.

4.14.1 Sampling and Analysis Objectives

Statement: Samples were collected to determine if the contaminants listed in section 4.14.2.2 were present above analytical detection levels in the mounds of sand dredged from the sewage treatment plant filter beds, the sludge in the old sludge drying beds, and the sludge and water in the Emhoff tanks.

Supporting Information: The filter-bed sand underneath the sludge in the sewage treatment plant filter beds had been dredged out of the beds at least twice during the operation of the facility. The sand, which may have been contaminated in the same manner as the sludge, was placed in piles alongside the beds on the north and south sides.

The filter beds at the sewage treatment plant were constructed by the Army in 1942 to replace the original 36 to 48 filter beds constructed in 1917 and located in the same area of what was then Camp Upton.

Sludge from the Emhoff tanks and the clarifier was pumped into eight sludge drying beds and may have been a source of groundwater contamination. The sludge drying beds were lined with high-density polyethylene plastic in the early 1980s, but direct percolation could have occurred before then. The beds were used for approximately 20 years before they were lined. There is no information on the volume or constituents of this sludge. Because of data on the constituents of the effluent from the sewage treatment plant, it is reasonable to assume that there are radioactive (tritium and strontium-90), organic (TCA), and inorganic (heavy metals) wastes in the sludge.

Basically, the Emhoff tanks were early primary settling basins for raw sewage coming into the sewage treatment plant. They were used to settle out toilet wastes, metals, etc. The sewage previously had a higher concentration of hazardous constituents than it currently contains, but there is no information on the sludge components because only the post-treatment effluent was sampled. According to the annual Environmental Monitoring Reports (EMRs), the sludge from the sewage treatment plant (presumably, the Emhoff filter and the clarifier) was discharged to the Meadow Marsh Experiment (Upland Recharge Area). The presence of tritium and strontium-90 is based on the annual EMRs. The presence of organics is based on interviews with BNL personnel and their knowledge of practices at BNL. The date of the last use of the Emhoff tank is not known with certainty. According to BNL personnel, it was last used in the early 1970s when the Emhoff tank had to be "reactivated" for the Meadow Marsh Experiment, which lasted from 1972 to 1978. Rainwater can enter the sections of the tank because the tank is open at the top except for a catwalk spanning the sections of the tank. During the spring 1987 Survey, the top of the water in the tank sections was covered with a layer of duckweed (Lemma sp.).

4.14.2 Sampling and Analytical Design

4.14.2.1 Sampling Design

Request 800: Mound Areas on North and South Sides of Filter Beds (Fig. 4.8a). Ten composite grab soil samples (Sampling Method: Reference E5.2.3) were to be collected along the north and south sides of the filter beds in the mounds formed when the beds were dredged. The mounds were to be considered homogeneous based on the operation and dredging of the filter beds. However, because of the time it has taken to form these mounds, potential contaminants may have infiltrated the deeper zones of the mounds. Samples were to be taken from both sides or mounds; however, the soil around the north side of the filter bed had been moved and/or landscaped in the construction of a road and berming around the pistol area. It was determined through discussion between F. Taylor and K. Johnson that samples from the north side of the filter beds would no longer be representative of the request. Therefore, only five samples were taken from the south side of the beds.

The area south of the beds was divided into a 1 x 100 grid. A number between 1 and 20 was randomly selected for the first sampling point. Five samples were collected from each area at approximately 100-ft intervals, beginning with sample point 1 at segment 9 (46 ft). Samples were collected by boring at one 4-ft interval and two 3-ft intervals to a depth of 10 ft. A composite sample was obtained by collecting equal aliquots from each interval.

These samples were collected on 15APR88 between 1110 and 1415. The ambient temperature was about 45^{O}F, with an overcast sky and wind less than 5 mph. The Sampling Team removed the first 1 ft of overburden before beginning to collect sample BR800062 (grid 9). A core tube was extracted at 1030, but had to be sealed because widemouth jars for the volatiles sample had not been brought to the site. Someone was sent to obtain the jars. Samples BR800073 (grid 28), BR800084 (grid 48), BR800095 (grid 68), and BR800108 (grid 88) were subsequently collected. The soil composition was mostly sand with little organic material. QC rinsate BR800119 was also collected at this location. Background RAD reading was 25 to 50 cpm for these samples, and PID reading was 0.0.

Request 801: Emhoff Tank at Sewage Treatment Plant (Fig. 4.8b). Three consecutive grab water samples (Sampling Method: Reference E4.3.1.1) were to be collected from the Emhoff tank, using a glass tube. The sample was to be representative of the vertical column. Care was to be taken not to mix the contents because sediment samples were also to be collected from the tanks.

The Sampling Team arrived at the site at 1150 on 15APR88. The sky was overcast and the temperature was 40^{O}F. The tank area was overgrown with weeds. The water in the tanks was light green and was 90% covered with algae. The water had an odor of ferol. Samples BR801018, BR801029, and BR801030 were collected between 1210 and 1317. Field measurements were taken for pH and temperature (Field Method: Reference E4.5). QC rinsate BR801041 was collected at 1334. Because extra volume was not needed for the semivolatiles rinsate (BR801041F), this was omitted per R. K. Owenby. The RAD reading was 35 cpm at the site.

Request 802: Emhoff Tank at Sewage Treatment Plant (Fig. 4.8c). Three grab sediment samples (Sampling Method: Reference "Method for Sludge/Sediment Sampling in Cesspools," BNL Sampling and Analysis Plan, Appendix E) were to be collected from the Emhoff tank. The sediment was to be considered homogeneous. The tank was to be divided into a 60-segment grid, with three segments randomly selected for sampling to the depth of the sediment. The Sampling Team found, however, that the tank was constructed differently from the information provided by the Survey Team, which made it impossible to collect sediment samples from the main tank area. It was possible to collect sediment samples from the bubble gas chamber on the east side of the tank. Because the sediment's depth was not homogeneous, the samples were collected from the center (BR802020), the south end (BR802031), and the north end (BR802019) in order to sample the entire range of the sediment. Samples were collected to the depth of the sediment.

The Sampling Team arrived at the site at 1430 on 18APR88. The temperature was approximately 45°F, with 5- to 10-mph winds. There was a moderate to heavy rainfall. A RAD scan showed 50 cpm. The depth of the tank in the side chamber was 20 ft, including water and sediment. After several attempts, sample BR802019 was collected at 1644.

The Sampling Team returned to the site on 19APR88 at 1003 to complete sampling the tank. The temperature was approximately 41°F, with a clear sky and gusty winds. A RAD scan showed 50 cpm. The sampler worked as expected. The sediment was approximately 6 ft deep at sample location BR802020. The sediment at sample location BR802031 at the south end of the tank (near the inlet) was approximately 8 ft deep, with 12 ft of water overburden. Samples BR802020 and BR802031 were collected at 1045 and 1145, respectively.

Request 803: Sewage Treatment Plant Sludge Drying Bed Area (Fig. 4.8d). Four grab soil samples (Sampling Method: Reference E5.2.3) were to be collected from selected areas within the sludge drying beds. The application of sludge in the bed was to be assumed random and homogeneous, but since vertical migration with time could occur, a sample to the depth of the sediment was to be collected from each selected segment in the bed.

The Sampling Team arrived at the site at 0855 on 18APR88. The temperature was 45^{o}F, with an overcast sky and gusty winds. A RAD scan of the area read 50 cpm. A transect was laid down the middle of the beds, covering all eight beds. An 1 x 80 grid was then laid along the transect with each grid approximately 1.66 ft long. A number between 1 and 20 (grid 8) was randomly selected and designated point 1. Four samples were collected at 20-segment intervals, beginning with point 1. A stainless steel dipper with extensions was used to reach into the middle of the beds to retrieve samples. Samples BR803010 (grid 8), BR803021 (grid 28), BR803032 (grid 48), and BR803043 (grid 68) were collected between 0909 and 1012. The sludge was 12 to 18 in. deep. The sediment for the first three samples was black, with a mild odor and thick texture (like pudding). Sediment for sample BR803043 was thinner because of standing water (consistency of baby food), but still black in color.

Rain mixed with sleet started at 1000, and the temperature dropped about 5 to 6 degrees.

4.12.2.2 Analytical Design

The parameters to be analyzed and/or measured for Environmental Problem 8 were as follows:

Request 800: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, AA-lead, gamma scan (cesium-137), tritium, and strontium-90. The field measurements taken were for OVAs and RADs.

Request 801: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, gamma scan (cesium-137), tritium, and strontium-90. The field measurements taken included sample pH and temperature.

Request 802: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, total uranium, gamma scan (cobalt-60, cesium-137), tritium, and strontium-90. The only required field measurement was a RAD scan.

Request 803: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, AA-mercury, total uranium, tritium, gamma scan (cobalt-60, cesium-137), and strontium-90. The only required field measurement was a RAD scan.

4.14.3 Field and Analytical Data

Field Data:

Request 800: *Reported results are given in Table 4.3.8. Although no field measurements were requested, the sampling team measured volatile organics and the radiation levels. The volatile organic concentrations using the PID instrument were not detectable (0 ppm). The radiation scan was 25 cpm for two samples and 35 cpm for three samples.*

Request 801: *Reported results are given in Table 4.3.8. The pH and temperature of three water samples are given in Table 4.3.8. The pH was slightly alkaline and ranged from 7.7 to 8.3. The temperature ranged from 8.8^{O}C to 10^{O}C.*

Request 802: *Reported results are given in Table 4.3.8. No field measurements were taken for the sludge samples which were collected in the same site as the water samples of Request 801. A rad sçan showed the air concentration to be 50 cpm.*

Request 803: *Reported results are given in Table 4.3.8. No field measurements were required for samples taken at the sludge drying bed area. A rad scan showed the air concentration of beta/gamma was 50 cpm.*

Field Data Evaluation:

Request 800: The PID instrument was calibrated prior to use; thus, the results are reliable for volatile organics with properties similar to the calibrating gas. The readings of the radiation detector, calibrated at the sampling team laboratory, are reliable.

Request 801: The PID instrument was calibrated prior to use; thus, the results are reliable for volatile organics with properties similar to the calibrating gas. The readings of the radiation detector, calibrated at the sampling team laboratory, are reliable. The instrument to measure pH and temperature was calibrated prior to field measurements; therefore, the results are reliable.

Request 802: The PID instrument was calibrated prior to use; thus, the results are reliable for volatile organics with properties similar to the calibrating gas. The readings of the radiation detector, calibrated at the sampling team laboratory, are reliable.

Request 803: The PID instrument was calibrated prior to use; thus, the results are reliable for volatile organics with properties similar to the calibrating gas. The readings of the radiation detector, calibrated at the sampling team laboratory, are reliable.

Analytical Data:

Request 800:

Metals. Analytical results for metals in soil are presented in Table 4.3.8. Of the 16 metals detected, the following ten were below either the CRDL or the IDL in all five samples: barium, beryllium, calcium, cobalt, copper, magnesium, nickel, potassium, sodium, and vanadium. Of the remaining metals detected, chromium ranged from 3.5 to 4.7 mg/kg, lead from 1.8 to 4.6 mg/kg, and zinc from 7.4 to 11 mg/kg. Other metals detected were aluminum, iron, and manganese.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Analytical Data for semivolatile organic compounds are presented in Table 4.3.8. From eight to 11 compounds were detected in these respective soil samples. Five phthalates and pyrene were positively identified. The only compound detected that was not also present in the blank was bis(2-ethylhexyl)phthalate. No measured or estimated concentrations of positively identified compounds exceeded 0.1 mg/kg. TICs included probable aldol condensation in estimated concentrations ranging from 11 to 16 mg/kg across the five samples. Estimated concentrations of all other TICs were less than 1.5 mg/kg.

Volatile organics. Analytical Data for volatile organic compounds are presented in Table 4.3.8. There were five samples taken for this request. From five to seven compounds were detected in particular samples. Chloroform in concentrations ranging from 0.028 to 0.032 mg/kg was measured in all samples and was also detected in the blank. Methylene chloride in estimated concentrations ranging from 0.019 to 0.021 mg/kg was detected below the quantitation limit in all samples and was also detected in the blank. Toluene in an estimated concentration of 0.002 mg/kg was detected below the quantitation limit in one sample, and was also in the blank. The highest estimated concentration of TICs was 0.320 (for a probable freon) which was also detected in the blank.

Radiochemistry. Analytical results are presented in Table 4.3.8. All five soil samples collected on the south side of the filter beds contained cesium-137 (11 to 96 pCi/kg) and tritium (100 to 700 pCi/kg). Total strontium was detected (51 pCi/kg) in one sample (BR800062).

A simple rinsate sample (BR800119) contained only 3.4 pCi Sr/L.

Request 801:

Metals. Analytical results for metals in water in an unsealed container are presented in Table 4.3.8. Of the 14 metals detected, the following six were below either the CRDL or the IDL in all three samples: barium, beryllium, copper, mercury, nickel, and vanadium. Of the remaining metals detected, zinc ranged from 35 to 78 ug/L. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, and sodium.

PCBs and other extractables. Some 4,4'-DDT was measured in two of four samples from Request 801. Concentrations were both less than 0.001 mg/L.

Extractable organics. Analytical Data for semivolatile organic compounds are presented in Table 4.3.8. The range of compounds detected in these four respective samples was from four to 13. Bis(2-ethylhexyl)phthalate was identified in one sample with an estimated concentration of 0.003 mg/L. No other semivolatile compounds were positively identified. All TICs had estimated concentrations of less than 1 mg/L.

Volatile organics. Analytical Data for volatile organic compounds are presented in Table 4.3.8. Methylene chloride was detected in one sample and also in the blank. Toluene was detected in the remaining two samples and also in the blank. In all cases, concentrations of these compounds in the samples were below quantitation limits. The highest estimated concentration of either of these compounds was 0.001 mg/L (for methylene chloride in sample BR801030). No other volatile compounds were detected in these samples.

Radiochemistry. Analytical results are presented in Table 4.3.8. Of three water samples collected from the Emhoff tank, one contained cesium-137 (2.7 pCi/L in BR801030), one contained tritium (70 pCi/L in BR801029), and all contained total strontium (1 to 2.8 pCi/L). A simple rinsate sample had no detectable activity.

Request 802:

Metals. Analytical results for metals in sediment are presented in Table 4.3.8. Of the 22 metals detected, the following six were below either the CRDL or the IDL in all three samples: antimony, beryllium, cobalt, potassium, selenium, and sodium. Of the remaining metals detected, barium ranged from 1070 to 1810 mg/kg, cadmium from 17 to 42 mg/kg, chromium from 281 to 1450 mg/kg, copper from 419 to 2350 mg/kg, lead from 576 to 1270 mg/kg, mercury from 12 to 352 mg/kg, nickel from 35 to 109 mg/kg, silver from 410 to 990 mg/kg, and zinc from 4810 to 8250 mg/kg. Uranium was detected at 5 to 17 ug/g. Other metals detected were aluminum, calcium, iron, magnesium, manganese, and vanadium.

Uranium analysis was requested for the sludge sample in Request 802. This sample from the south end of the "Bubble Gas Chamber" of the Emhoff tank contained a lower uranium concentration (5 ug/g) than the center and north sludge samples which contained 17 ug/g.

PCBs and other extractables. Aroclor-1254 was measured in concentrations ranging from 2 to 29 mg/kg in the three sediment samples for Request 802.

Extractable organics. Analytical Data for semivolatile organic compounds are presented in Table 4.3.8. There were 56 semivolatile compounds detected in each of two samples and 57 semivolatile compounds detected in the remaining sample. Several compounds were positively identified and measured in concentrations exceeding 10 mg/L. Phenol was detected in all three samples, but always in estimated (below quantitation limits) concentrations of less than 1 mg/kg. In two of the samples, there was some 1,2-dichlorobenzene with measured concentrations of 2.3 and 1.5 mg/kg. In two samples, 2,4-dinitrotoluene was detected with estimated (below quantitation limits) concentrations of less than 0.250 mg/kg. Estimated concentrations of TICs often exceeded 10 mg/kg, and a tentatively identified alkoxy/hydroxy/alkyl concentration was estimated in excess of 1 gm/kg.

Volatile organics. Analytical Data for volatile organic compounds are presented in Table 4.3.8. There were 30 volatile compounds detected in two of these sediment samples, and 19 volatile compounds were detected in the remaining sample. Benzene was present in all three samples; its highest concentration was 0.170 mg/kg in BR802020. Carbon disulfide was present in all three samples; highest concentration was 0.230 mg/kg in BR802020. Chlorobenzene was present in all three sample; its highest concentration was 1.9 mg/kg in BR802019. Chloroform was present in all samples and also in the blanks; its highest sample concentration was 0.160 mg/kg in BR802019. Methylene chloride was present in *all three samples and also in the blanks; its highest measured or estimated sample concentration was 0.120 in BR802019. Toluene was detected below quantitation limits in all three samples; its highest estimated concentration was 0.093 mg/kg in BR802019. Some 1,1,2,2-tetrachloroethane was present in all three samples and also in the blanks; its highest measured or estimated concentration was the measured 0.660 mg/kg in BR802020. TICs included several probable hydrocarbons. Estimated concentrations of TICs were 4.7 mg/kg or less.*

<u>Radiochemistry</u>. Analytical results are presented in Table 4.3.8. Three sediment samples collected from the Emhoff tank all contained tritium (500 to 6,500 pCi/kg), cobalt-60 (110 to 11,000 pCi/kg), cesium-137 (1,500 to 76,000 pCI/kg), total strontium (660 to 39,000 pCi/kg) and potassium-40 (5,500 to 7,100 pCi/kg). One sample (BR802020) contained europium-152 (680 pCi/kg).

Request 803:

<u>Metals</u>. Analytical results for metals in soil are presented in Table 4.3.8. Of the 20 metals detected, the following five were below either the CRDL or the IDL in all four samples: cobalt, magnesium, potassium, selenium, and sodium. Of the remaining metals detected, barium ranged from 787 to 925 mg/kg, beryllium from 3.8 to 5.4 mg/kg, cadmium from 100 to 115 mg/kg, chromium from 478 to 552 mg/kg, copper from 4590 to 5190 mg/kg, lead from 2560 to 3110 mg/kg, mercury from 45 to 66 mg/kg, nickel from 477 to 770 mg/kg, silver from 642 to 704 mg/kg, and zinc from 2410 to 2670 mg/kg. Other metals detected were aluminum, calcium, iron, manganese, and vanadium.

Uranium analysis was requested for the sludge samples in Request 803. These samples were collected from the sludge drying bed. The four samples showed relatively constant concentrations of uranium ranging between 5 to 7 ug/g.

<u>PCBs and other extractables</u>. Aroclor-1254 was measured in concentrations ranging from 5.7 to 24 mg/kg in the four soil samples for Request 803.

<u>Extractable organics</u>. Analytical Data for semivolatile organic compounds are presented in Table 4.3.8. From 33 to 41 semivolatile compounds were identified in each of these four respective soil samples. Several compounds had concentrations either below quantitation limits or above calibration range, so those concentrations were estimated. Nitrobenzene and phenol were detected in different individual samples in concentrations below quantitation limits and estimated at 0.17 and 0.57 mg/kg, respectively. An unknown hydrocarbon was detected in BR803010 with an estimated concentration of 7.6 g/kg, and tentatively identified alkoxy/hydroxy/alkyls were estimated in similar concentrations (6 to 7.5 g/kg) in each of the other three samples. Tentatively identified diacetone alcohol was estimated in concentrations exceeding 100 mg/kg in each of the samples, and several other TICs had estimated concentrations of greater than 10 mg/kg.

<u>Volatile organics</u>. Analytical Data for volatile organic compounds are presented in Table 4.3.8. Five volatile compounds were detected in one of these soil samples (BR803010), and 15, 16, and 17 volatiles were found in the other three respective samples. Carbon disulfide was found in two samples, with the highest measured or estimated concentration being 0.170 mg/kg. Chloroform was present in all samples and also in the blank. It was below quantitation limits in three of the samples (highest estimated concentration was 0.180 mg/kg), and was measured at 0.170 mg/kg in the other sample (BR803032). Methylene chloride was measured in all samples; its highest concentration was 0.490 mg/kg in BR803010. Tetrachloroethene was measured in three of the samples, but was out of the calibration range in the remaining sample (BR803010) and was estimated at 58 mg/kg. Toluene, present in two of the samples, was measured at 4.7 mg/kg in BR803010. Some 1,1,2,2-tetrachloroethane was present below the quantitation limit in BR803021; its estimated concentration was 0.120 mg/kg. It was also

present in the blank. TICs included several probable hydrocarbons. Estimated concentration of TICs was 4.2 mg/kg or less.

Radiochemistry. Analytical results are given in Table 4.3.8. All four soil samples collected in the sludge drying beds contained tritium (400 to 2,200 pCi/kg), manganese-54 (95 to 180 pCi/kg), cobalt-60 (6,200 to 14,000 pCi/kg), zinc-65 (1,300 to 3,200 pCi/kg), total strontium (2,200 to 3,700 pCi/kg), cesium-137 (11,000 to 13,000 pCi/kg) and naturally occurring potassium-40 (2,600 to 3,800 pCi/kg). Two samples (BR803021 and BR803032) contained europium-152 (440-560 pCi/kg), europium-154 (870-1,800 pCi/kg), and europium-155 (320-850 pCi/kg). Sample BR803032 also contained cobalt-58 (120 pCi/kg).

Analytical Data Evaluation:

Request 800:

Metals. Three metals of interest (chromium, lead, and zinc) were detected above the CRDL in the samples for this request.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. The only compound detected that was not also present in the blank was bis(2-ethylhexy)lphthalate. No measured or estimated concentrations of positively identified compounds exceeded 0.1 mg/kg. TICs included probable aldol condensation in estimated concentrations ranging from 11 to 16 mg/kg across the five samples. Estimated concentrations of all other TICs were less than 1.5 mg/kg.

Volatile organics. Chloroform and methylene chloride were detected in all samples and also in the blank. Toluene was detected below the quantitation limit in one sample and also in the blank. The highest estimated concentration of TICs was 0.320, for a probable freon which was also detected in the blank.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 801:

Metals. One metal of interest (zinc) was detected above the CRDL in the samples for this request.

PCBs and other extractables. Some 4,4'-DDT was detected in two samples for Request 801.

Extractable organics. Bis(2-ethylhexyl)phthalate was identified in one sample, with an estimated concentration of 0.003 mg/L. No other semivolatile compounds were positively identified. All TICs had estimated concentrations of less than 1 mg/L.

Volatile organics. Methylene chloride and toluene were detected in the blank and in the samples, though neither compound was detected in all samples. The highest estimated concentration of either of these compounds was 0.001 mg/L, which was for methylene chloride in sample BR801030. All concentrations were below quantitation limits. No other volatile compounds were detected in these samples.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample

results were within 10% of their true value, radiological data are considered reliable.

Request 802:

Metals. Nine metals of interest (barium, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc) were detected above the CRDL in the samples for this request. The quality control of the total uranium samples from Request 802 was excellent; preparation blanks, calibration verification, spike recoveries, and duplicate analysis were all in compliance.

PCBs and other extractables. Aroclor-1254 was measured in concentrations up to 29 mg/kg in the sediment samples for Request 802.

Extractable organics. Each sample contained over 50 detectable semivolatile organic compounds. Several compounds were positively identified and measured in concentrations exceeding 10 mg/L. Phenol and 2,4-dinitrotoluene were detected in these samples with estimated (below quantitation limits) concentrations of less than 1 mg/kg. There was some 1,2-dichlorobenzene in two of the samples with measured concentrations of 2.3 and 1.5 mg/kg. Estimated concentrations of TICs often exceeded 10 mg/kg, and a tentatively identified alkoxy/hydroxy/alkyl concentration was estimated in excess of 1 mg/kg.

Volatile organics. Benzene, carbon disulfide, and chlorobenzene were present in all three samples. Chloroform and methylene chloride were present in all samples and also in the blanks. Toluene was detected below quantitation limits in all three samples. Some 1,1,2,2-tetrachloroethane was present in all three samples and also in the blanks. Estimated concentrations of TICs were 4.7 mg/kg or less.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 803:

Metals. Ten metals of interest (barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc) were detected above the CRDL in the samples for this request. In Request 803 the quality control measures for total uranium samples were all in compliance except duplicates analysis which were 50% in compliance.

PCBs and other extractables. Aroclor-1254 was measured in concentrations up to 24 mg/kg in the soil samples for Request 803.

Extractable organics. Over 30 semivolatile compounds were identified in each of these four respective soil samples. Several compounds had concentrations either below quantitation limits or above calibration range, so those concentrations were estimated. Nitrobenzene and phenol were detected in concentrations below quantitation limits. Semivolatile TICs had estimated concentrations as high as 7.6 g/kg.

Volatile organics. Carbon disulfide was found in two samples. Chloroform was present in all samples and also in the blank. Methylene chloride was measured in all samples. Tetrachloroethene was measured in three of the samples, but was out of the calibration range in the remaining sample (BR803010) and was estimated at 58 mg/kg. Toluene was present in two of the samples. Some 1,1,2,2-tetrachloroethane was present below the quantitation limit in BR803021 and was also present in the blank. Estimated concentration of TICs was 4.2 mg/kg or less.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.14.4 Limitations and Qualifications

Data Quality Level:

Request 800: The sampling plan for Request 800 is rated Quality Level II. The field sampling for Request 800 is rated Quality Level I. The overall analytical quality rating is Quality Level II.

Request 801: The sampling plan for Request 801 is rated Quality Level I. The field sampling for Request 801 is rated Quality Level I. The overall analytical quality rating is Quality Level I.

Request 802: The sampling plan for Request 802 is rated Quality Level I. The field sampling for Request 802 is rated Quality Level I. The overall analytical quality rating is Quality Level I.

Request 803: The sampling plan for Request 803 is rated Quality Level I. The field sampling for Request 803 is rated Quality Level I. The overall analytical quality rating is Quality Level II.

Field Data:

Request 800: The plan for Request 800 called for 10 composites, but the depiction in the accompanying figure shows 6 sites plus a soil boring site without explanation of the latter.

Request 801: Data are Quality Level I.

Request 802: In request 802, the samples were collected from the aeration tank rather than from the Emhoff tank because the construction of the tanks differed from the depiction in the plan which was provided by the survey team.

Request 803: Data are Quality Level I.

Analytical Data:

Request 800:

Metals. Analytical results are Quality Level II, except for beryllium and lead, which are Quality Level III. All analytes in the first five samples are Quality Level II because no spike sample was analyzed with the sample set. Beryllium recovery exceeded the control limit for the solid laboratory control standard. Calibration verification results for lead fell below the control limit. All analytes in sample BR800119 are Quality Level I with the exception of aluminum and sodium which are Quality Level II; and arsenic, beryllium and zinc which are Quality Level III. Aluminum exceeded the control limit for the calibration verification results. Sodium was recovered above the control limit in the laboratory control standard and serial dilution results did not meet the 10% criteria. Poor recovery of arsenic was obtained from the spiked sample. Beryllium for this sample was present at less than the CRDL in the calibration blank. Zinc was observed at greater than the CRDL in the preparation blank.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 801:

Metals. Analytical results are Quality Level I with the following exceptions: sodium is Quality Level II, and arsenic and zinc are Quality Level III. Sodium was recovered above the control limit in the laboratory control standard and serial dilution results did not meet the 10% criteria. Poor recovery of arsenic was obtained from the spiked sample. Zinc was observed at greater than the CRDL in the preparation blank.

PCBs and other extractables. Data are Quality Level I for the liquid samples from the unsealed container.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 802:

Metals. Analytical results are Quality Level I with the following exceptions: antimony is Quality Level II, and arsenic and beryllium are Quality Level III. Antimony was recovered below the control limit from the spiked sample. Poor recovery of arsenic was obtained from the spiked sample. Berylium was recovered above the control limt from the solid laboratory control standard.

The data quality level for total uranium in Request 802 is Quality Level I.

PCBs and other extractables. Data are Quality Level II for the sediment samples due to poor spike recovery results.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 803:

Metals. All analytes were assigned Quality Level II because no spiked sample was analyzed with this sample set. Beryllium in sample BR803043 was recovered above the control limit in the laboratory control standard.

The data quality level for total uranium in Request 803 is Quality Level II. The latter level assignment is mainly due to duplicate analysis showing only 50% compliance.

PCBs and other extractables. Data are Quality Level II for the soil samples due to poor spike recovery results.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 8
Request Number: 800

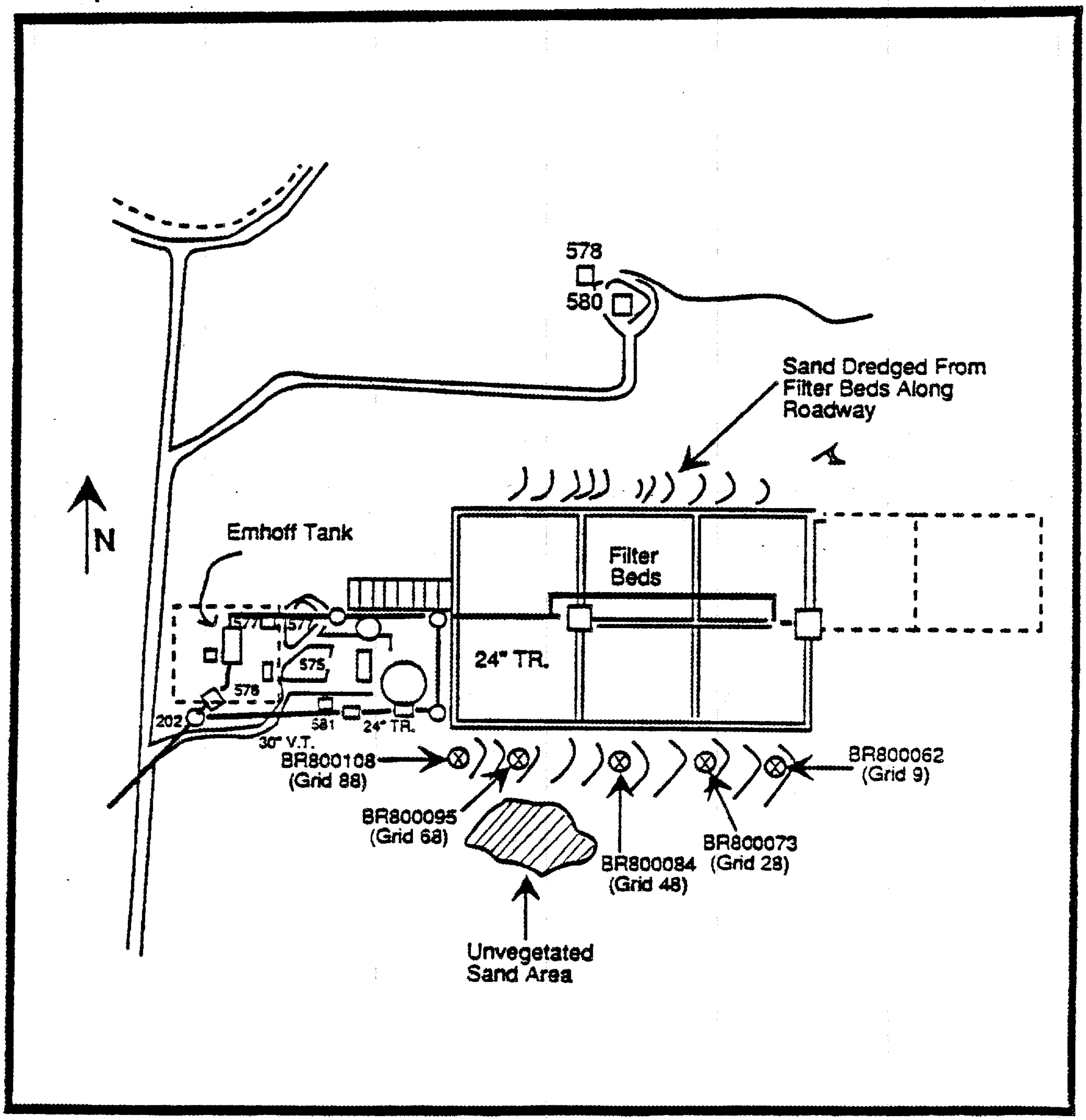

Figure 4.8a. Mound Areas on North and South Sides of Filter Beds
(Request 800)

Environmental Problem: 8
Request Number: 801

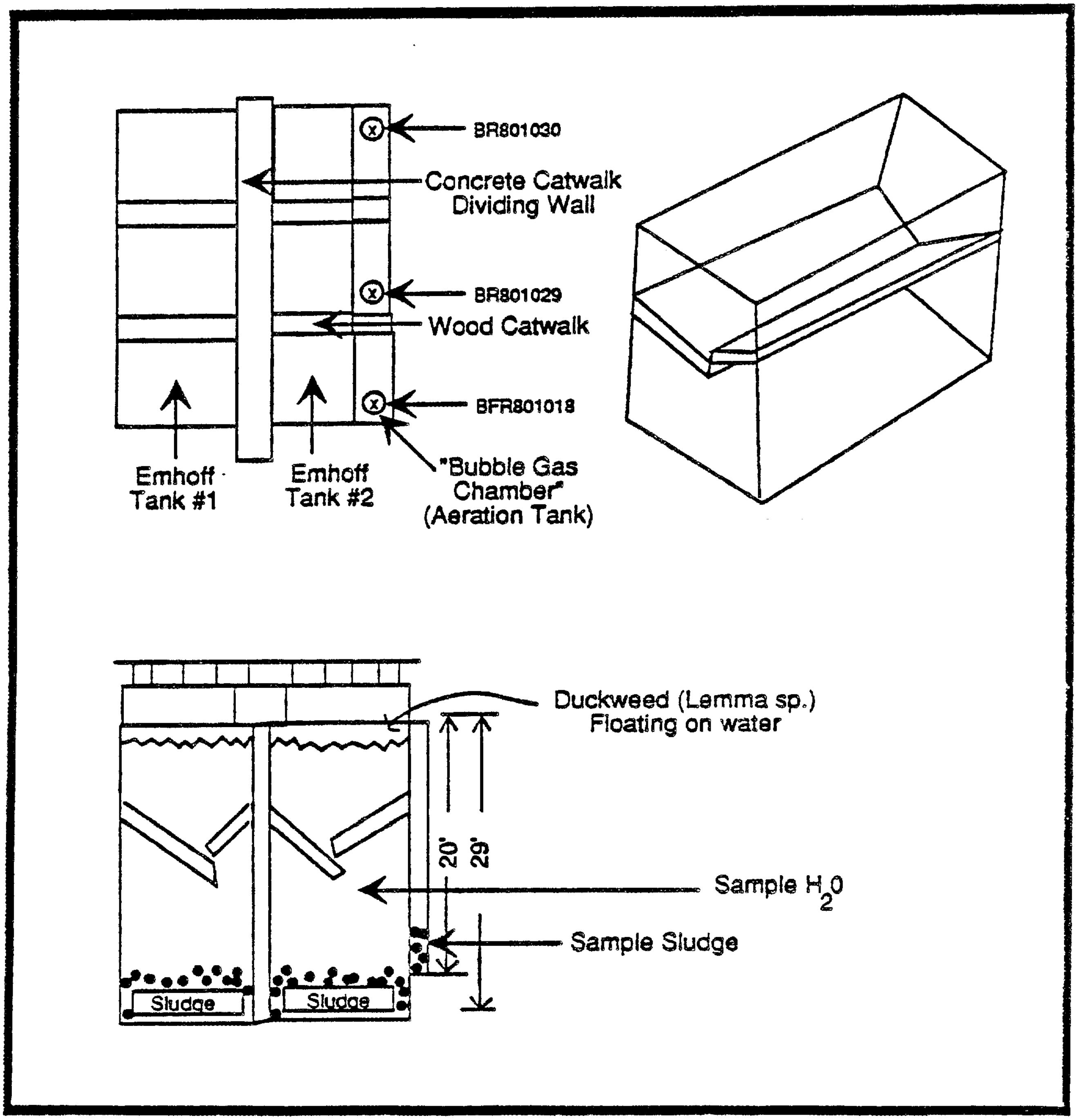

Figure 4.8b. Emhoff Tank at Sewage Treatment Plant (Request 801)

Environmental Problem: 8
Request Number: 802

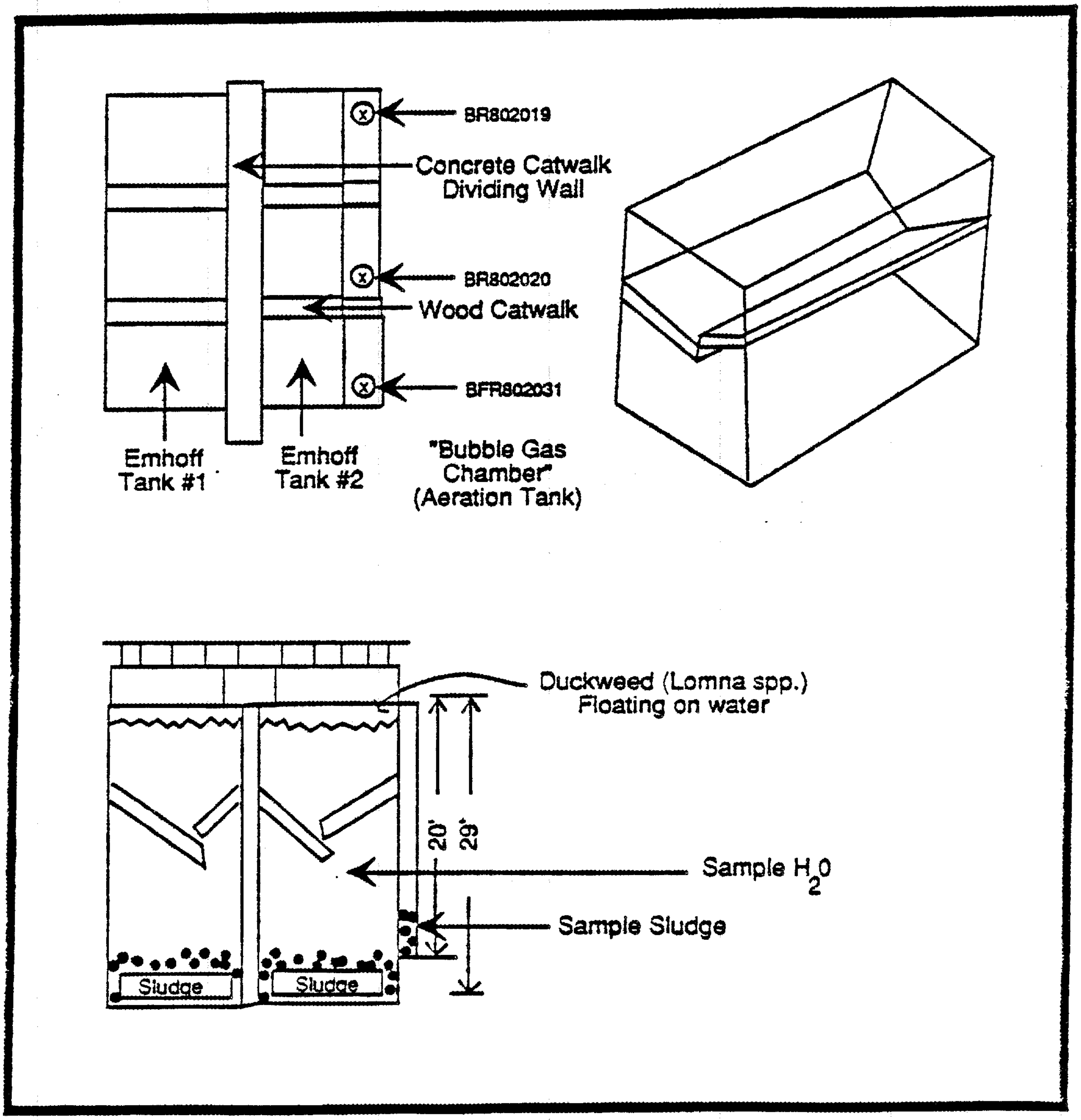

Figure 4.8c. Emhoff Tank at Sewage Treatment Plant (Request 802)

Environmental Problem: 8
Request Number: 803

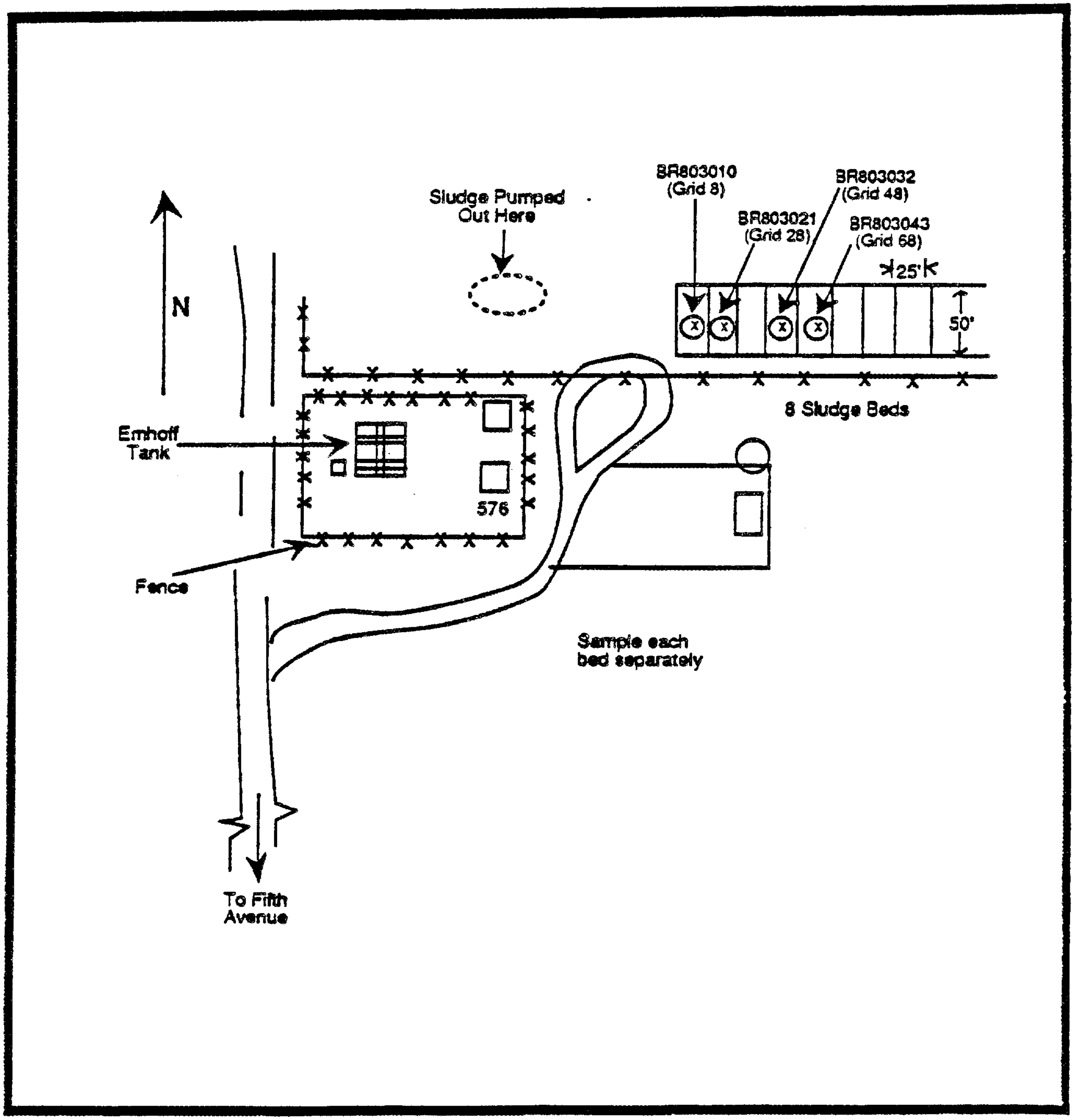

Figure 4.8d. Sewage Treatment Plant Sludge Drying Bed Area (Request 803)

TABLE 4.2.8 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 8

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS		METALS		O&G		PET HYDRO		PES/H/PCB		SEMIVOLS		VOLS		RADS	
							NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL
BR800	STP	DREDGE MATL	SOIL	5	5	GRAB	0	0	5	5	0	0	0	0	0	5	5	5	5	5	5	5
BR803	STP	SLUDGE BEDS	SOIL	4	4	GRAB	0	0	4	4	0	0	0	0	4	4	4	4	4	4	4	4
			MED TOTAL	9	9		0	0	9	9	0	0	0	0	4	9	9	9	9	9	9	9
BR802	STP	TANK	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
			MED TOTAL	3	3		0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
BR800	STP	DREDGE MATL	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	1	0	0	1	1	1	1
BR801	STP	TANK	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1
			MED TOTAL	2	2		0	0	2	2	0	0	0	0	0	2	1	1	2	2	2	2
BR801	STP	TANK	UNSEAL CO	3	3	GRAB	0	0	3	3	0	0	0	0	2	3	3	3	3	3	3	3
			MED TOTAL	3	3		0	0	3	3	0	0	0	0	2	3	3	3	3	3	3	3
			EP TOTAL	17	17		0	0	17	17	0	0	0	0	9	17	16	16	17	17	17	17

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 800
LOCATION: MOUND AREAS ON NORTH AND SOUTH SIDES OF THE FILTER BEDS
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:	BR800062	BR800073	BR800084	BR800095	BR800108	
FID/PID (PPM)		0	0	0	0	0	
RADIOACTIVIT (CPM)		35	35	35	25	25	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR800062C BR313017C GRAB	BR800062C BR313017K GRAB	BR800062D BR800062D GRAB	BR800073C BR313017C GRAB	BR800073C BR313017K GRAB	BR800073D BR800062D GRAB
ALUMINUM		3220 E			3140 E		
BARIUM		7.3 B			5.6 B		
BERYLLIUM		0.24 B			0.22 B		
CALCIUM		62 B			81 B		
CHROMIUM		3.6			3.8		
COBALT		1 B			0.74 B		
COPPER		1.5 U			1.8 B		
IRON		2560 E			2520 E		
LEAD				1.8			2.6
MAGNESIUM		236 BE			271 BE		
MANGANESE		19			16		
NICKEL		2 B			1.9 B		
POTASSIUM			120 B			140 B	
SODIUM		44 B			51 B		
VANADIUM		5.1 B			5 B		
ZINC		9.6			7.4		

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR800084C BR313017C GRAB	BR800084C BR313017K GRAB	BR800084D BR800062D GRAB	BR800095C BR313017C GRAB	BR800095C BR313017K GRAB	BR800095D BR800062D GRAB
ALUMINUM		2580 E			3780 E		
BARIUM		7.8 B			8.1 B		
BERYLLIUM		0.22 B			0.26 B		
CALCIUM		211 B			137 B		
CHROMIUM		4.7			4.6		
COBALT		1.1 B			0.95 B		
COPPER		2.8 B			2.3 B		
IRON		2580 E			3680 E		
LEAD				2.6			4.6
MAGNESIUM		432 BE			331 BE		
MANGANESE		25			30		
NICKEL		2.6 B			2.4 B		
POTASSIUM			230 B			190 B	
SODIUM		56 B			38 B		

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 SEWAGE TREATMENT PLANT AND FILTER BEDS

DRAFT DO NOT CITE

S&A REQUEST: 800
LOCATION: MOUND AREAS ON NORTH AND SOUTH SIDES OF THE FILTER BEDS
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: SDG NO: TYPE:	BR800084C BR313017C GRAB	BR800084C BR313017K GRAB	BR800084D BR800062D GRAB	BR800095C BR313017C GRAB	BR800095C BR313017K GRAB	BR800095D BR800062D GRAB
VANADIUM		5.5 B			6.9 B		
ZINC		14			11		

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: SDG NO: TYPE:	BR800108C BR313017C GRAB	BR800108C BR313017K GRAB	BR800108D BR800062D GRAB			
ALUMINUM		1940 E					
BARIUM		5.2 B					
BERYLLIUM		0.17 B					
CALCIUM		121 B					
CHROMIUM		3.5					
COBALT		0.9 B					
COPPER		2.9 B					
IRON		2430 E					
LEAD				2.4			
MAGNESIUM		314 BE					
MANGANESE		24					
NICKEL		2 B					
POTASSIUM			180 B				
SODIUM		50 B					
VANADIUM		4.9 B					
ZINC		9.7					

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: SDG NO: TYPE:	BR800062B BR311015B GRAB	BR800073B BR311015B GRAB	BR800084B BR311015B GRAB	BR800095B BR311015B GRAB	BR800108B BR311015B GRAB	
BIS(2-ETHYLHEXYL)PHTHALATE		570	110 J	450	270 J	350 U	
BUTYLBENZYLPHTHALATE		48 JB	80 JB	52 JB	100 JB	46 JB	
DI-N-BUTYLPHTHALATE		97 JB	160 JB	87 JB	190 JB	110 JB	
DI-N-OCTYLPHTHALATE		9 JB	10 JB	5 JB	360 U	350 U	
DIETHYLPHTHALATE		70 JB	85 JB	60 JB	84 JB	63 JB	
PYRENE		6 JB	14 JB	9 JB	12 JB	350 U	
* ALKYL HYDROCARBON(6.68)		380 JB			430 JB		
* ALKYL HYDROCARBON(6.70)			400 JB	370 JB			
* ALKYL HYDROCARBON(6.73)						350 JB	
* ALKYL HYDROCARBON(6.88)					520 JB		
* ALKYL HYDROCARBON(6.89)		470 JB					
* ALKYL HYDROCARBON(6.90)			490 JB	450 JB			

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 800
LOCATION: MOUND AREAS ON NORTH AND SOUTH SIDES OF THE FILTER BEDS
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR800062B / BR311015B / GRAB	BR800073B / BR311015B / GRAB	BR800084B / BR311015B / GRAB	BR800095B / BR311015B / GRAB	BR800108B / BR311015B / GRAB
* ALKYL HYDROCARBON(6.92)						440 JB
* DIACETONE ALCOHOL(6.05)					1400 JAB	
* DIACETONE ALCOHOL(6.06)		1400 JAB				
* DIACETONE ALCOHOL(6.11)			1400 JAB	1400 JAB		
* DIACETONE ALCOHOL(6.14)						1400 JAB
* PROB ALDOL-CONDENSATION(4.99)					16000 JAB	
* PROB ALDOL-CONDENSATION(5.00)		16000 JAB				
* PROB ALDOL-CONDENSATION(5.03)						11000 JAB
* PROB ALDOL-CONDENSATION(5.06)			14000 JAB	13000 JAB		
* UNKNOWN(3.56)		860 JB			820 JB	
* UNKNOWN(3.59)			820 JB	770 JB		810 JB

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR800062A / BR503028A / GRAB	BR800073A / BR503028A / GRAB	BR800084A / BR503028A / GRAB	BR800095A / BR503028A / GRAB	BR800108A / BR503028A / GRAB
ACETONE		53 U	53 U	56 U	120	52 U
CHLOROFORM		28 B	30 B	32 B	30 B	30 B
ETHYLBENZENE		9 JB	10 JB	11 JB	10 JB	9 JB
METHYLENE CHLORIDE		21 JB	20 JB	20 JB	19 JB	20 JB
STYRENE		4 JB	26 U	4 JB	27 U	3 JB
TOLUENE		2 J	26 U	28 U	27 U	26 U
XYLENE (TOTAL)		7 JB	7 JB	9 JB	8 JB	7 JB
* PROBABLE FREON 113(3.02)				310 JB		
* PROBABLE FREON 113(3.03)		310 JB				
* PROBABLE FREON 113(3.04)			320 JB			290 JB
* PROBABLE HYDROCARBON(19.23)						22 JB
* PROBABLE HYDROCARBON(25.93)					26 J	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR800062E / LLL8298 / GRAB	BR800062F / LLL8299 / GRAB	BR800073E / LLL8298 / GRAB	BR800073F / LLL8299 / GRAB	BR800084E / LLL8298 / GRAB	BR800084F / LLL8299 / GRAB
CS-137		35		96		38	
H-3			100		600		100
SR-TOT		51		0		-49	

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8
SEWAGE TREATMENT PLANT AND FILTER BEDS

DRAFT DO NOT CITE

S&A REQUEST: 800
LOCATION: MOUND AREAS ON NORTH AND SOUTH SIDES OF THE FILTER BEDS
MEDIUM: SOIL

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR800095E / LLL8298 / GRAB	BR800095F / LLL8299 / GRAB	BR800108E / LLL8298 / GRAB	BR800108F / LLL8299 / GRAB		
CS-137		42		11			
H-3			700		500		
SR-TOT		-97		-68			

S&A REQUEST: 800
LOCATION: MOUND AREAS ON NORTH AND SOUTH SIDES OF THE FILTER BEDS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR800119F / BR306018F / RINSATE					
ALUMINUM		133 B					
BARIUM		28 B					
BERYLLIUM		0.99 B					
IRON		505					
MAGNESIUM		36 B					
MANGANESE		6.1 B					
ZINC		31					

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR800119A / BR801041A / RINSATE					
ACETONE		16 B					
CHLOROFORM		2 JB					
TOLUENE		2 JB					

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR800119I / LLL8298 / RINSATE	BR800119J / LLL8299 / RINSATE				
H-3			-290				
SR-TOT		3.4					

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 SEWAGE TREATMENT PLANT AND FILTER BEDS

DRAFT DO NOT CITE

S&A REQUEST: 801
LOCATION: EMHOFF TANK AT STP
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)							
	SAMP NO:	BR801041G	BR801041H				
	SDG NO:	BR306018F	BR306018G				
	TYPE:	RINSATE	RINSATE				
BARIUM		2.9 B					
BERYLLIUM		0.98 B					
COPPER		19 B					
IRON		44 B					
MERCURY			0.06 B				
ZINC		16 B					

EXTRACTABLE ORGANICS (UG/L)							
	SAMP NO:	BR801041E					
	SDG NO:	BR306018E					
	TYPE:	RINSATE					
* POSSIBLE AMIDE/AMINE(34.80)		8 J					
* UNKNOWN(3.30)		7 J					

VOLATILE ORGANICS (UG/L)							
	SAMP NO:	BR801041A					
	SDG NO:	BR801041A					
	TYPE:	RINSATE					
ACETONE		25 B					
TOLUENE		2 JB					

RADIOCHEMISTRY (PCI/L)							
	SAMP NO:	BR801041J	BR801041K				
	SDG NO:	LLL8301	LLL8301				
	TYPE:	RINSATE	RINSATE				
H-3			-690				
SR-TOT		-0.3					

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 — DRAFT DO NOT CITE

SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 801
LOCATION: EMHOFF TANK AT STP
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO: BR801018	BR801029	BR801030			
PH (UNITS)	8.3	7.7	7.8			
TEMPERATURE (DEG C)	10	9.1	8.8			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR801018G SDG NO: BR306018F TYPE: GRAB	BR801018G BR306018K GRAB	BR801018H BR500014G GRAB	BR801029G BR306018F GRAB	BR801029G BR306018K GRAB	BR801029H BR500014G GRAB
ALUMINUM	270			300		
BARIUM	11 B			11 B		
BERYLLIUM	2.6 B			2.7 B		
CALCIUM	41200			44800		
COPPER	10 U			10 B		
IRON	191			569		
MAGNESIUM	5620			6160		
MANGANESE	41			59		
MERCURY			0.05 B			0.06 B
NICKEL	9 B			6.7 B		
POTASSIUM		17000			17000	
SODIUM	21400 E			22400 E		
VANADIUM	5.7 B			6.6 B		
ZINC	54			78		

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR801030G SDG NO: BR306018F TYPE: GRAB	BR801030G BR306018K GRAB	BR801030H BR500014G GRAB			
ALUMINUM	252					
BARIUM	7.2 B					
BERYLLIUM	2.6 B					
CALCIUM	40500					
COPPER	10 U					
IRON	169					
MAGNESIUM	5510					
MANGANESE	39					
MERCURY			0.07 B			
NICKEL	6.7 B					
POTASSIUM		17000				
SODIUM	21600 E					
VANADIUM	6 B					
ZINC	35					

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 801
LOCATION: EMHOFF TANK AT STP
MEDIUM: UNSEALED CONTAINER

PCBS & OTHER EXTRACTABLES (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR801018F / BR301057B / GRAB	BR801029F / BR301057B / GRAB	BR801030E / BR301057B / GRAB	BR801030F / BR301057B / GRAB		
4,4'-DDT		0.53	0.1 U	0.23	0.1 U		

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR801018E / BR306018E / GRAB	BR801029E / BR306018E / GRAB	BR801030E / BR306018E / GRAB	BR801030F / BR306018E / GRAB		
BIS(2-ETHYLHEXYL)PHTHALATE		10 U	3 J	10 U	10 U		
* ALIPHATIC HYDROCARBON(22.70)		3 J					
* METHYL BENZENE(3.82)			8 J				
* POSS ALIPHATIC HYDROCAR(34.70)		19 J					
* TETRACHLOROETHANE(7.83)				8 J	13 J		
* TETRACHLOROETHANE(7.84)		5 J					
* UNKNOWN ALKYL/HYDROXYL (36.40)		11 J					
* UNKNOWN ALKYL/HYDROXYL (37.60)		10 J					
* UNKNOWN HYDROXYL COMPOU(4.94)					140 J		
* UNKNOWN HYDROXYL COMPOU(5.85)					110 J		
* UNKNOWN(3.28)					6 J		
* UNKNOWN(3.42)			4 J				
* UNKNOWN(3.64)			8 J				
* UNKNOWN(3.67)				5 J			
* UNKNOWN(4.89)			13 J				
* UNKNOWN(4.93)		74 J					
* UNKNOWN(4.95)				150 J			
* UNKNOWN(5.80)			29 J				
* UNKNOWN(5.84)		50 J					
* UNKNOWN(5.86)				150 J			
* UNKNOWN(6.35)			4 J				
* UNKNOWN(8.21)			10 J				
* UNKNOWN(8.52)			11 J				
* UNKNOWN(8.53)				7 J			
* UNKNOWN(23.10)		7 J					
* UNKNOWN(25.90)		3 J					
* UNKNOWN(30.00)		7 J					
* UNKNOWN(31.10)			6 J				
* UNKNOWN(32.80)		11 J					
* UNKNOWN(35.20)			10 J				
* UNKNOWN(35.30)		19 J					
* UNKNOWN(37.00)		8 J					

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 — DRAFT DO NOT CITE

SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 801
LOCATION: EMHOFF TANK AT STP
MEDIUM: UNSEALED CONTAINER

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR801018A / BR801041A / GRAB	BR801029A / BR801041A / GRAB	BR801030A / BR801041A / GRAB			
METHYLENE CHLORIDE		5 U	5 U	1 JB			
TOLUENE		0.5 JB	0.4 JB	5 U			

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR801018I / LLL8285 / GRAB	BR801018J / LLL8285 / GRAB	BR801018K / LLL8286 / GRAB	BR801029I / LLL8285 / GRAB	BR801029J / LLL8285 / GRAB	BR801029K / LLL8286 / GRAB
CS-137		4 U			4 U		
H-3				-240			70
SR-TOT			2.8			1.6	

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR801030I / LLL8285 / GRAB	BR801030J / LLL8285 / GRAB	BR801030K / LLL8286 / GRAB			
CS-137		2.7					
H-3				-120			
SR-TOT			1				

S&A REQUEST: 802
LOCATION: EMHOFF TANK AT STP
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR802019C / BR311015C / GRAB	BR802019C / BR311015K / GRAB	BR802019D / BR802019D / GRAB	BR802020C / BR311015C / GRAB	BR802020C / BR311015K / GRAB	BR802020D / BR802019D / GRAB
ALUMINUM		9650			11200		
ANTIMONY		53 UN			29 BN		
BARIUM		1070 E			1140 E		
BERYLLIUM		3.2 B			2.9 B		
CADMIUM		39			42		
CALCIUM		11800			18700		
CHROMIUM		923			1450		
COBALT		12 B			11 B		
COPPER		2350			1890		

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 802
LOCATION: EMHOFF TANK AT STP
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: SDG NO: TYPE:	BR802019C BR311015C GRAB	BR802019C BR311015K GRAB	BR802019D BR802019D GRAB	BR802020C BR311015C GRAB	BR802020C BR311015K GRAB	BR802020D BR802019D GRAB
IRON		22800			25500		
LEAD		887			1270		
MAGNESIUM		3390 B			4670		
MANGANESE		300			444		
MERCURY				175			352
NICKEL		109			59		
POTASSIUM			1700 B			1200 B	
SELENIUM		72 B			34 U		
SILVER		990			525		
SODIUM		1190 B			784 B		
VANADIUM		34 B			37		
ZINC		4810			8250		

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: SDG NO: TYPE:	BR802031C BR311015C GRAB	BR802031C BR311015K GRAB	BR802031D BR802019D GRAB			
ALUMINUM		10900					
ANTIMONY		25 BN					
BARIUM		1810 E					
BERYLLIUM		2.4 B					
CADMIUM		17					
CALCIUM		39700					
CHROMIUM		287					
COBALT		6.4 B					
COPPER		419					
IRON		17800					
LEAD		576					
MAGNESIUM		12600					
MANGANESE		121					
MERCURY				12			
NICKEL		35					
POTASSIUM			1400 B				
SELENIUM		28 U					
SILVER		410					
SODIUM		673 B					
VANADIUM		27					
ZINC		5240					

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 SEWAGE TREATMENT PLANT AND FILTER BEDS

DRAFT DO NOT CITE

S&A REQUEST: 802
LOCATION: EMHOFF TANK AT STP
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (UG/G)			
SAMP NO:	BR802019E	BR802020E	BR802031E
SDG NO:	BR303015E	BR303015E	BR303015E
TYPE:	GRAB	GRAB	GRAB
URANIUM, TOTAL	17	17	5

PCBS & OTHER EXTRACTABLES (UG/KG)			
SAMP NO:	BR802019B	BR802020B	BR802031B
SDG NO:	BR800062B	BR800062B	BR800062B
TYPE:	GRAB	GRAB	GRAB
AROCLOR-1254	29000	16000	2000

EXTRACTABLE ORGANICS (UG/KG)			
SAMP NO:	BR802019B	BR802020B	BR802031B
SDG NO:	BR311015B	BR311015B	BR311015B
TYPE:	GRAB	GRAB	GRAB
ACENAPHTHENE	11000	8600	15000
ACENAPHTHYLENE	100 J	37 J	81 J
ANTHRACENE	12000	21000	11000 J
BENZO(A)ANTHRACENE	5100	3800	3900
BENZO(A)PYRENE	2700	2000	2000
BENZO(B)FLUORANTHENE	2900	2200	4100
BENZO(G,H,I)PERYLENE	1500 J	1300 J	1300
BENZO(K)FLUORANTHENE	3400	2600	4800
BIS(2-CHLOROETHOXY)METHANE	2000 U	1300 U	19 J
BIS(2-CHLOROISOPROPYL)ETHER	110 J	1300 U	1000 U
BIS(2-ETHYLHEXYL)PHTHALATE	14000	3100	2700
BUTYLBENZYLPHTHALATE	5100 B	1200 JB	2300 B
CHRYSENE	5600	3800	3900
DI-N-BUTYLPHTHALATE	1700 JB	2100 B	1100 B
DI-N-OCTYLPHTHALATE	1100 JB	370 JB	510 JB
DIBENZ(A,H)ANTHRACENE	460 J	320 J	420 J
DIBENZOFURAN	8400	6400	11000
DIETHYLPHTHALATE	830 JB	530 JB	380 JB
DIMETHYLPHTHALATE	170 J	81 J	70 J
FLUORANTHENE	14000	12000	16000
FLUORENE	12000	11000	15000
INDENO(1,2,3-CD)PYRENE	2200	1100 J	1300
ISOPHORONE	74 J	1300 U	83 J
N-NITROSODIPHENYLAMINE	2000 U	1300 U	980 J
NAPHTHALENE	6100	2600	2800
PHENANTHRENE	47000 BE	37000 BE	46000 BE
PHENOL	37 J	27 J	830 J
PYRENE	20000 B	17000 B	17000 BE

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 802
LOCATION: EMHOFF TANK AT STP
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE: BR802019B / BR311015B / GRAB	BR802020B / BR311015B / GRAB	BR802031B / BR311015B / GRAB
1,2,4-TRICHLOROBENZENE	320 J	330 J	1000 U
1,3-DICHLOROBENZENE	650 J	550 J	1000 U
1,4-DICHLOROBENZENE	2300	1500	1000 U
2-CHLORONAPHTHALENE	470 J	360 J	34 J
2-METHYLNAPHTHALENE	4800	5300	8400
2-NITROANILINE	190 J	420 J	280 J
2,4-DIMETHYLPHENOL	2000 U	120 J	1000 U
2,4-DINITROTOLUENE	2000 U	170 J	240 J
2,6-DINITROTOLUENE	200 J	300 J	400 J
4-CHLORO-3-METHYLPHENOL	410 J	310 J	600 J
4-CHLOROANILINE	200 J	190 J	1000 U
4-CHLOROPHENYL-PHENYLETHER	2000 U	280 J	1000 U
4-METHYLPHENOL	140 J	200 J	220 J
4-NITROANILINE	9800 U	6600 U	250 J
4-NITROPHENOL	9800 U	840 J	640 J
* ALICYCLIC ALCOHOL/STERO(35.30)	7800 J		
* ALICYCLIC ALCOHOL/STERO(36.80)	10000 J		
* ALICYCLIC ALCOHOL/STERO(37.60)		44000 J	
* ALICYCLIC ALCOHOL/STERO(37.70)	66000 J		
* ALICYCLIC ALCOHOL/STERO(38.00)		29000 J	
* ALICYCLIC ALCOHOL/STERO(38.10)	35000 J		
* ALICYCLIC ALCOHOL/STERO(39.60)			22000 J
* ALICYCLIC ALCOHOL/STERO(39.90)	16000 J	13000 J	
* ALICYCLIC ALCOHOL/STERO(40.00)			12000 J
* ALICYCLIC ALCOHOL/STERO(38.00)	56000 J		
* ALKOXY/HYDROXY/ALKYL CP(10.90)	5900 J		
* ALKOXY/HYDROXY/ALKYL CP(17.10)			740000 J
* ALKOXY/HYDROXY/ALKYL CP(30.00)	4700000 J	4400000 J	1700000 J
* ALKYL HYDROCARBON(10.80)	11000 J	23000 J	
* ALKYL HYDROCARBON(12.50)			21000 J
* ALKYL HYDROCARBON(13.60)		10000 J	
* ALKYL HYDROCARBON(14.60)			15000 J
* ALKYL HYDROCARBON(14.80)	14000 J	21000 J	14000 J
* ALKYL HYDROCARBON(15.90)	16000 J	22000 J	11000 J
* ALKYL HYDROCARBON(16.40)			11000 J
* ALKYL HYDROCARBON(17.80)			4800 J
* ALKYL HYDROCARBON(19.20)	9900 J	18000 J	
* ALKYL HYDROCARBON(22.10)		12000 J	
* ALKYL HYDROCARBON(22.90)	3400 J	21000 J	2400 J
* ALKYL HYDROCARBON(24.30)	2700 J	18000 J	
* DIACETONE ALCOHOL(6.20)			19000 JAB
* DIACETONE ALCOHOL(6.23)	78000 JAB		

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 802
LOCATION: EMHOFF TANK AT STP
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR802019B	BR802020B	BR802031B
	SDG NO:	BR311015B	BR311015B	BR311015B
	TYPE:	GRAB	GRAB	GRAB
* DIACETONE ALCOHOL*(6.24)			93000 JAB	
* DIMETHYL NAPHTHALENE(18.20)			12000 J	
* DIMETHYLNAPHTHALENE(18.20)				4700 J
* POSSIBLE ALKYL HYDROCAR(18.90)				2800 J
* POSSIBLE KETONE(6.53)		9400 J	9800 J	
* SULFUR(27.20)		8300 J		
* SULFUR(27.30)				3100 J
* UNKNOWN ACID(26.40)		5100 J		
* UNKNOWN(10.90)			8400 J	
* UNKNOWN(26.60)				3600 J
* UNKNOWN(27.00)		3500 J		
* UNKNOWN(27.10)				5900 J
* UNKNOWN(28.00)		3900 J	18000 J	7700 J
* UNKNOWN(31.70)				4600 J
* UNKNOWN(37.70)				68000 J
* UNKNOWN(38.10)			13000 J	
* UNKNOWN(39.60)			15000 J	

VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR802019A	BR802020A	BR802031A
	SDG NO:	BR311015A	BR311015A	BR313017A
	TYPE:	GRAB	GRAB	GRAB
ACETONE		310 U	1800 B	130 U
BENZENE		43 J	170	31 J
CARBON DISULFIDE		71 J	230	29 J
CHLOROBENZENE		1900	710	13 J
CHLOROFORM		160 B	100 B	60 JB
ETHYLBENZENE		760 B	820 B	85 B
METHYLENE CHLORIDE		120 JB	85 JB	97 B
STYRENE		28 JB	100 U	67 U
TOLUENE		93 J	79 J	28 J
XYLENE (TOTAL)		260 B	290 B	41 JB
1,1,2,2-TETRACHLOROETHANE		260 B	660 B	37 JB
* NAPHTHALENE(25.51)		810 J		
* NAPHTHALENE(25.52)				540 J
* PROB AROMATIC HYDROCARB(20.66)			850 J	
* PROB. AROMATIC HYDROCAR(21.00)				900 J
* PROB. SUBSTITUTED BENZE(21.51)			1200 J	
* PROB. SUBSTITUTED BENZE(22.09)			1700 J	
* PROB. SUBSTITUTED CYCLO(18.90)			3200 J	
* PROB. SUBSTITUTED CYCLO(20.26)		390 J		

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 802
LOCATION: EMHOFF TANK AT STP
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR802019A BR311015A GRAB	BR802020A BR311015A GRAB	BR802031A BR313017A GRAB
* PROB. SUBSTITUTED CYCLO(20.27)			2000 J	
* PROB. SUBSTITUTED NAPHT(21.02)			4700 J	
* PROB. SUBSTITUTED NAPHT(22.56)			1800 J	
* PROB. SUBSTITUTED NAPHT(23.09)			3400 J	
* PROB. SUBSTITUTED NAPHT(28.28)				1400 J
* PROB. SUBSTITUTED NAPHT(28.29)		1200 J		
* PROBABLE AROMATIC HYDRO(18.89)		1000 J		
* PROBABLE AROMATIC HYDRO(19.70)			2900 J	
* PROBABLE AROMATIC HYDRO(19.71)		1400 J		
* PROBABLE CYCLOHEXANE #1(24.47)			1200 J	
* PROBABLE CYCLOHEXANE #2(28.33)			1200 J	
* PROBABLE CYCLOHEXANE(24.48)				650 J
* PROBABLE DICHLOROBENZEN(20.39)		1100 J		
* PROBABLE DICHLOROBENZNE(21.22)		1200 J		
* PROBABLE HYDROCARBON #1(17.22)		610 J		
* PROBABLE HYDROCARBON #1(17.24)			1800 J	
* PROBABLE HYDROCARBON #1(19.24)				790 J
* PROBABLE HYDROCARBON #2(17.49)			840 J	
* PROBABLE HYDROCARBON #2(18.10)		1100 J		
* PROBABLE HYDROCARBON #2(22.08)				1700 J
* PROBABLE HYDROCARBON #3(18.12)			3100 J	
* PROBABLE HYDROCARBON #3(19.24)		730 J		
* PROBABLE HYDROCARBON #3(23.07)				620 J
* PROBABLE HYDROCARBON #4(19.23)			1000 J	
* PROBABLE HYDROCARBON #4(19.91)		920 J		
* PROBABLE HYDROCARBON #4(24.72)				1100 J
* PROBABLE HYDROCARBON #5(19.92)			2700 J	
* PROBABLE HYDROCARBON #5(25.06)		870 J		
* PROBABLE HYDROCARBON #5(26.52)				990 J
* PROBABLE HYDROCARBON #6(21.27)			1800 J	
* PROBABLE HYDROCARBON #6(26.51)		960 J		
* PROBABLE HYDROCARBON #6(28.97)				690 J
* PROBABLE HYDROCARBON #7(25.06)			2700 J	
* PROBABLE HYDROCARBON #7(28.96)		660 J		
* PROBABLE HYDROCARBON #8(26.51)			3500 J	
* PROBABLE HYDROCARBON #9(28.96)			1000 J	
* PROBABLE SUBSTITUTED BE(20.98)		2300 J		
* PROBABLE SUBSTITUTED BE(21.47)		1100 J		
* PROBABLE SUBSTITUTED BE(22.08)		980 J		
* PROBABLE SUBSTITUTED BE(22.33)		600 J		
* PROBABLE SUBSTITUTED BE(23.02)		590 J		
* PROBABLE SUBSTITUTED CY(24.47)		460 J		

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 802
LOCATION: EMHOFF TANK AT STP
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR802019F LLL8307 GRAB	BR802019G LLL8307 GRAB	BR802020F LLL8307 GRAB	BR802020G LLL8307 GRAB	BR802031F LLL8307 GRAB	BR802031G LLL8307 GRAB
CO-60		11000		3400		110	
CS-137		58000		76000		1500	
EU-152				680			
H-3			500		2600		6500
K-40		5500		7100		5700	
SR-TOT		39000		39000		660	

S&A REQUEST: 803
LOCATION: STP SLUDGE DRYING BED AREA
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR803010C BR313017C GRAB	BR803010C BR313017K GRAB	BR803010D BR810019D GRAB	BR803021C BR313017C GRAB	BR803021C BR313017K GRAB	BR803021D BR810019D GRAB
ALUMINUM		9310 E			8430 E		
BARIUM		925			841		
BERYLLIUM		4.1			3.8		
CADMIUM		115			101		
CALCIUM		20800			19100		
CHROMIUM		520			478		
COBALT		36 B			34 B		
COPPER		5190			4590		
IRON		28300 E			26100 E		
LEAD		2880			2560		
MAGNESIUM		3530 BE			3160 BE		
MANGANESE		195			177		
MERCURY				55			61
NICKEL		537			477		
POTASSIUM			670 B			650 B	
SELENIUM		65 B			46 B		
SILVER		704			650		
SODIUM		2260 B			2160 B		
VANADIUM		1100			1010		
ZINC		2670			2410		

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 SEWAGE TREATMENT PLANT AND FILTER BEDS

DRAFT DO NOT CITE

S&A REQUEST: 803
LOCATION: STP SLUDGE DRYING BED AREA
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR803032C / BR313017C / GRAB	BR803032C / BR313017K / GRAB	BR803032D / BR810019D / GRAB	BR803043C / BR313017C / GRAB	BR803043C / BR313017K / GRAB	BR803043D / BR810019D / GRAB
ALUMINUM		9260 E			9690 E		
BARIUM		918			787		
BERYLLIUM		4.5			5.4 B		
CADMIUM		110			100		
CALCIUM		22100			15300		
CHROMIUM		529			552		
COBALT		37 B			35 B		
COPPER		5000			4820		
IRON		28000 E			28700 E		
LEAD		2870			3110		
MAGNESIUM		3520 BE			3560 BE		
MANGANESE		185			154		
MERCURY				66			45
NICKEL		550			770		
POTASSIUM			750 B			950 B	
SELENIUM		62 B			98 U		
SILVER		642			662		
SODIUM		2090 B			2310 B		
VANADIUM		1240			1880		
ZINC		2630			2580		

METALS, INCLUDING CR+6 (UG/G)	SAMP NO: / SDG NO: / TYPE:	BR803010E / BR501015B / GRAB	BR803021E / BR501015B / GRAB	BR803032E / BR501015B / GRAB	BR803043E / BR501015B / GRAB
URANIUM, TOTAL		6	5	7	6

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR803010B / BR800062B / GRAB	BR803021B / BR800062B / GRAB	BR803032B / BR800062B / GRAB	BR803043B / BR800062B / GRAB
AROCLOR-1254		24000	12000	12000	5700

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR803010B / BR311015B / GRAB	BR803021B / BR311015B / GRAB	BR803032B / BR311015B / GRAB	BR803043B / BR311015B / GRAB
ACENAPHTHENE		1600 U	260 J	370 J	300 J
ACENAPHTHYLENE		1600 U	1900 U	68 J	88 J

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 803
LOCATION: STP SLUDGE DRYING BED AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR803010B / BR311015B / GRAB	BR803021B / BR311015B / GRAB	BR803032B / BR311015B / GRAB	BR803043B / BR311015B / GRAB
ANTHRACENE		970 J	880 J	910 J	680 J
BENZO(A)ANTHRACENE		1100 J	1100 J	1400 J	3300 U
BENZO(A)PYRENE		960 J	950 J	1200 J	560 J
BENZO(G,H,I)PERYLENE		1600 U	610 J	1900 U	3300 U
BENZOIC ACID		8200 U	9600 U	140 J	1200 J
BIS(2-CHLOROISOPROPYL)ETHER		1600 U	96 J	1900 U	3300 U
BIS(2-ETHYLHEXYL)PHTHALATE		50000 E	43000 E	41000 E	56000 E
BUTYLBENZYLPHTHALATE		4400 B	4200 B	4800 B	4000 B
CHRYSENE		1300 J	1300 J	1500 J	1200 J
DI-N-BUTYLPHTHALATE		1100 JB	1200 JB	950 JB	1200 JB
DI-N-OCTYLPHTHALATE		830 JB	920 JB	980 JB	1900 JB
DIBENZOFURAN		1600 U	310 J	300 J	230 J
DIETHYLPHTHALATE		800 JB	770 JB	690 JB	1600 JB
DIMETHYLPHTHALATE		1600 U	100 J	150 J	200 J
FLUORANTHENE		2600	2600	2600	1700 J
FLUORENE		440 J	400 J	350 J	3300 U
INDENO(1,2,3-CD)PYRENE		1600 U	620 J	440 J	3300 U
ISOPHORONE		1600 U	100 J	1900 U	240 J
N-NITROSODIPHENYLAMINE		1600 U	1900 U	200 J	3300 U
NAPHTHALENE		1600 U	170 J	180 J	3300 U
NITROBENZENE		1600 U	1900 U	1900 U	170 J
PHENANTHRENE		3200 B	3200 B	3400 B	2300 JB
PHENOL		1600 U	1900 U	570 J	3300 U
PYRENE		4000 B	3600 B	4000 B	3100 JB
2-METHYLNAPHTHALENE		680 J	740 J	610 J	610 J
2-NITROANILINE		8200 U	100 J	260 J	390 J
2-NITROPHENOL		1600 U	400 J	210 J	3300 U
2,6-DINITROTOLUENE		1600 U	1900 U	1900 U	670 J
4-CHLORO-3-METHYLPHENOL		1600 U	180 J	170 J	3300 U
4-CHLOROANILINE		1600 U	470 J	120 J	3300 U
4-CHLOROPHENYL-PHENYLETHER		1600 U	1900 U	190 J	3300 U
4-METHYLPHENOL		1600 U	620 J	1900 U	3300 U
* ALICYCLIC ALCOHOL/STERO(37.60)		94000 J	110000 J	64000 J	120000 J
* ALICYCLIC ALCOHOL/STERO(37.90)				82000 J	180000 J
* ALICYCLIC ALCOHOL/STERO(38.00)		93000 J	110000 J		68000 J
* ALICYCLIC ALCOHOL/STERO(38.30)		26000 J	20000 J	22000 J	21000 J
* ALICYCLIC ALCOHOL/STERO(38.90)		14000 J			
* ALICYCLIC ALCOHOL/STERO(39.50)			51000 J		
* ALICYCLIC ALCOHOL/STERO(39.80)					34000 J
* ALICYCLIC ALCOHOL/STERO(39.90)		34000 J	34000 J	29000 J	
* ALICYCLIC ALCOHOL/STERO(40.10)		14000 J			
* ALKOXY/HYDROXY/ALKYL CP(29.90)				7200000 J	

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 SEWAGE TREATMENT PLANT AND FILTER BEDS

DRAFT DO NOT CITE

S&A REQUEST: 803
LOCATION: STP SLUDGE DRYING BED AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR803010B / BR311015B / GRAB	BR803021B / BR311015B / GRAB	BR803032B / BR311015B / GRAB	BR803043B / BR311015B / GRAB
* ALKOXY/HYDROXY/ALKYL CP(30.00)			6000000 J		7500000 J
* ALKYL HYDROCARBON(12.40)			20000 J	14000 J	21000 J
* ALKYL HYDROCARBON(14.50)				16000 J	22000 J
* ALKYL HYDROCARBON(14.80)					17000 J
* ALKYL HYDROCARBON(15.90)			19000 J	14000 J	18000 J
* ALKYL HYDROCARBON(17.70)				17000 J	
* ALKYL HYDROCARBON(19.20)		6700 J	20000 J	18000 J	15000 J
* ALKYL HYDROCARBON(22.00)		5900 J		16000 J	
* ALKYL HYDROCARBON(22.90)		17000 J	21000 J	47000 J	
* ALKYL HYDROCARBON(24.30)		11000 J	11000 J	22000 J	21000 J
* DIACETONE ALCOHOL(6.05)		170000 JAB			
* DIACETONE ALCOHOL(6.12)				140000 JAB	
* DIACETONE ALCOHOL(6.13)			110000 JAB		180000 JAB
* POSSIBLE ARYL HYDROCARB(23.40)				16000 J	
* POSSIBLE KETONE(6.48)				23000 J	
* POSSIBLE KETONE(6.49)					32000 J
* POSSIBLE PHENYL COMPOUN(22.80)					33000 J
* PROBABLE PHENYL COMPOUN(23.60)		6500 J			
* SULFUR(27.10)		7900 J	9600 J	33000 J	41000 J
* UNKNOWN ACID(26.30)				43000 J	20000 J
* UNKNOWN ACID(26.40)		27000 J	18000 J		
* UNKNOWN ACID(26.50)			42000 J		
* UNKNOWN ACID(28.70)		10000 J	23000 J		
* UNKNOWN HYDROCARBON(30.00)		7600000 J			
* UNKNOWN(23.10)			8100 J	19000 J	16000 J
* UNKNOWN(23.40)			8300 J		13000 J
* UNKNOWN(39.40)		15000 J			
* UNKNOWN(39.50)		33000 J			
* 4-NONYLPHENOL(23.00)		10000 J	10000 J	20000 J	17000 J

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR803010A / BR313017A / GRAB	BR803021A / BR313017A / GRAB	BR803032A / BR313017A / GRAB	BR803043A / BR313017A / GRAB
ACETONE		240 U	1200	280 U	2200
CARBON DISULFIDE		120 U	150 U	150	170 J
CHLOROFORM		93 JB	150 JB	170 B	180 JB
CHLOROMETHANE		240 U	300 U	470	490 U
ETHYLBENZENE		120 U	47 JB	140 U	67 JB
METHYLENE CHLORIDE		490 B	220 B	230 B	390 B
TETRACHLOROETHENE		58000 E	2400	560	340

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 SEWAGE TREATMENT PLANT AND FILTER BEDS

DRAFT DO NOT CITE

S&A REQUEST: 803
LOCATION: STP SLUDGE DRYING BED AREA
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR803010A BR313017A GRAB	BR803021A BR313017A GRAB	BR803032A BR313017A GRAB	BR803043A BR313017A GRAB		
TOLUENE		4700	31 J	140 U	240 U		
TRICHLOROETHENE		6000 E	150 U	140 U	240 U		
1,1,2,2-TETRACHLOROETHANE		120 U	120 JB	140 U	240 U		
* PROB. SUBSTITUTED NAPHT(22.46)			1600 J				
* PROB. SUBSTITUTED NAPHT(22.50)			1400 J				
* PROB. SUBSTITUTED NAPHT(23.05)					1300 J		
* PROB. SUBSTITUTED NAPHT(23.06)				1600 J			
* PROB. SUBSTITUTED NAPHT(24.45)				1400 J			
* PROB. SUBSTITUTED NAPHT(24.46)					1900 J		
* PROBABLE CYCLIC-HYDROCA(18.52)				1500 J			
* PROBABLE HYDROCARBON #1(18.09)				1400 J			
* PROBABLE HYDROCARBON #1(19.24)			1500 J		1300 J		
* PROBABLE HYDROCARBON #2(19.23)				1200 J			
* PROBABLE HYDROCARBON #2(19.92)					1800 J		
* PROBABLE HYDROCARBON #2(19.94)			1900 J				
* PROBABLE HYDROCARBON #3(19.95)				2000 J			
* PROBABLE HYDROCARBON #3(20.33)			3000 J		2500 J		
* PROBABLE HYDROCARBON #4(20.34)				4200 J			
* PROBABLE HYDROCARBON #4(20.90)					1600 J		
* PROBABLE HYDROCARBON #4(20.92)			1900 J				
* PROBABLE HYDROCARBON #5(20.91)				2000 J			
* PROBABLE HYDROCARBON #5(22.07)			2500 J		2100 J		
* PROBABLE HYDROCARBON #6(21.50)				1500 J			
* PROBABLE HYDROCARBON #6(24.69)					1600 J		
* PROBABLE HYDROCARBON #6(24.70)			1800 J				
* PROBABLE HYDROCARBON #7(22.06)				1700 J			
* PROBABLE HYDROCARBON #7(25.07)			1300 J				
* PROBABLE HYDROCARBON #7(26.50)					1700 J		
* PROBABLE HYDROCARBON #8(26.52)			1900 J				
* PROBABLE HYDROCARBON #8(28.96)					1400 J		

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR803010F LLL8302 GRAB	BR803010G LLL8302 GRAB	BR803021F LLL8302 GRAB	BR803021G LLL8302 GRAB	BR803032F LLL8302 GRAB	BR803032G LLL8302 GRAB
CO-58						120	
CO-60		8000		14000		9100	
CS-137		13000		12000		13000	
EU-152				440		560	
EU-154				870		1800	
EU-155		220		320		850	

TABLE 4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8 DRAFT DO NOT CITE
SEWAGE TREATMENT PLANT AND FILTER BEDS

S&A REQUEST: 803
LOCATION: STP SLUDGE DRYING BED AREA
MEDIUM: SOIL

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR803010F / LLL8302 / GRAB	BR803010G / LLL8302 / GRAB	BR803021F / LLL8302 / GRAB	BR803021G / LLL8302 / GRAB	BR803032F / LLL8302 / GRAB	BR803032G / LLL8302 / GRAB
H-3			1200		2200		400
K-40		3400		2600			
MN-54		95		180		110	
SR-TOT		2300		2200		3000	
ZN-65		1300		2000		1800	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: / SDG NO: / TYPE:	BR803043F / LLL8302 / GRAB	BR803043G / LLL8302 / GRAB				
CO-58							
CO-60		6200					
CS-137		11000					
EU-152							
EU-154							
EU-155							
H-3			500				
K-40		3800					
MN-54		150					
SR-TOT		3700					
ZN-65		3200					

4.15 Environmental Problem 9: AGS I and II Scrap Yards

Request Numbers: 804 and 805.

Requester: J. Werner.

Finding and Basis: Activated metal in the AGS steel storage yards was rusting and flaking off, thereby potentially contaminating the soil and groundwater. The AGS Department maintained two steel storage yards (AGS I and AGS II). AGS I was used for storage of clean steel; AGS II was used for storage of contaminated steel. However, contaminated steel has accidentally been placed in the clean steel yard.

4.15.1 Sampling and Analysis Objectives

Statement: Soil samples were collected to determine if the contaminants listed in section 4.15.2.2 were present above background levels in soil in the AGS scrap yards.

Supporting Information: The steel stored in the contaminated yard had surface activities of 10 to 100 mR/hr, with excesses of 100 mR/hr. Steel had been stored in the yards for periods of up to 20 years. During this time, exposed surfaces have rusted and, in many cases, flaked off onto the ground. During the Survey, the Survey Team observed that water formed pools in the yard when it rained. The contaminated steel storage yard was not fenced and was freely accessible to all site personnel. The soils in the yards had not been checked for radiation. The D-12 well was located near the AGS scrap yards. The construction of the well was unclear.

4.15.2 Sampling and Analytical Design

4.15.2.1 Sampling Design

Request 804: AGS I and II Scrap Yards (Fig. 4.9a). A total of six soil samples (Sampling Method: Reference E5.1 and E5.2.3) were to be collected from AGS Scrap Yard Areas I and II, three samples from each area. The two areas were to be considered heterogeneous with respect to each other, but individually were considered homogeneous. Each area was to be divided into a 6 x 10 grid, and three segments from each area were to be randomly selected for sampling. Surface samples and composite samples from 6 in. to 3 ft were to be collected and composited at each selected segment. The 3-ft interval was chosen because the potential for contamination is continuous, and, therefore, many suspected contaminants may be present at that depth.

Samples at the AGS II scrap yard were collected on 20APR88. The temperature was approximately 45^{O}F, with wind gusting up to 20 mph, making working conditions uncomfortable. The AGS II scrap yard is east of Thomson Road, approximately 100 ft from Building 811. The grid was laid out in an area previously cleared of scrap metal, but the original surface had not been removed or filled in. A RAD scan indicated a background reading of 50 cpm. The strong wind prevented a positive PID reading because of rapid dilution. Samples BR804044 (grid 39), BR804055 (grid 47), and BR804066 (grid 1) were collected at this location between 1105 and 1124. The soil was light to medium brown sand with small pebbles.

Work began at AGS I scrap yard at 1215 on 20APR88. Weather conditions were the same as they had been earlier in the day during sampling of AGS II. AGS I was previously a laydown yard for metals. The overall area was covered with layers of heavy metal at the time of sampling. A background RAD scan at BR804011 (grid 38) indicated 500 cpm. Samples BR804022 (grid 42) and BR804033 (grid 37) were also collected in this area. A RAD scan at BR804022 and BR804033 indicated 120 and 50 cpm, respectively. Use of the PID (OVA) was not possible because of strong winds. These samples were collected between 1220 and 1235. The soil profile at this sampling location was 12 in. of clay, grading into a sand/pebble mix to 3 ft.

Request 805: Well D-12 Near AGS Scrap Yard II (Fig. 4.9b). Three grab water samples (Sampling Method: Reference E4.4.3 and E4.4.4.4) were to be collected from Well D-12. There was thought to be a potential for groundwater contamination from the deteriorating scrap contaminated with radioactivity stored near Well D-12. Sampling the well could provide an indication of the presence of organic or radioactive contamination of groundwater. The construction of the well was unclear; therefore, the presence of tritium, organic solvents, or strontium-90 would not necessarily pinpoint a plume. J. Nuida, the BNL contact, had all the well completion information and was to provide this information to the Sampling Team.

The groundwater elevation was to be measured before sampling was initiated to determine the volume to be purged. Two or three volumes were to be purged by pumping or bailing. Recharge time was unknown prior to sampling. Temperature, pH, and conductivity were to be measured before and after sample collection to confirm water stability (Field Method: Reference E4.5). Samples were to be collected in the order of susceptibility to volatilization.

The Sampling Team arrived at Well D-12 at 0900 on 20APR88. The well is located approximately 75 ft north of the entrance to the Building 811 driveway on the east side of the road. The weather was partly cloudy with a slight wind from the northeast. Team members found that the well was cased with tubing for Well Wizard pumping, and a bailer could not be used to purge the well. F. Taylor and W. Parsons located a Well Wizard and began pumping the well at 0935. The water was clear immediately after purging began. The water level was 26.5 ft below ground surface. At 0940, the pH was 6.4, temperature was approximately 40°F, dissolved oxygen (DO) was 3.3 ppm, conductivity was .12 ms/cm, and turbidity was 3 ppm. The readings stabilized at 1005 after purging for 30 min at a pumping rate of 3 L/min. Samples BR805012, BR805023, and BR805034 were collected between 1015 and 1021. Because the Well Wizard was used instead of a bailer, QC rinsate BR805045 was not collected.

4.15.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 9 included the following:

Request 804: The parameters analyzed were ICP-metals, total uranium, strontium-90, and gamma scan [cobalt-60, cesium-137, and bismuth-207 (daughter product of lead)]. Field measurements for background radiation were made at each sample site. PID readings were not taken due to high winds.

Request 805: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-lead, tritium, gamma scan, and strontium-90. The field measurements taken were for pH, temperature, dissolved oxygen, specific conductance, turbidity, and radioacivity. Water level was also measured.

4.15.3 Field and Analytical Data

Field Data:

Request 804: *The data are recorded in Table 4.3.9. The results of the radiation scan show that the activity ranged from 50 to 500 cpm. Samples from the contaminated scrap area (AGS II) show a constant reading of 50 cpm (BR804044, BR804055, and BR804066). In the uncontaminated area (AGS I) the readings were 50, 120, and 500 cpm.*

Request 805: *The data are recorded in Table 4.3.9. Conductivity, pH, and temperature were requested as field measurements. The well was cased for pumping with the Well Wizard equipment; thus the well could not be bailed. The pump was started and samples were collected when the readings stabilized after 30 minutes. Thus with exception of the turbidity readings, all measurements are constant. The conductivity was 0.12 uS/cm; the pH was 6.4; and the temperature was 15°C. In addition, the dissolved oxygen (3.3 ppm) and rad scan (200 cpm) remained constant; the turbidity reading was 0 for two samples and 3 ppm for the third.*

Field Data Evaluation:

Request 804: The beta/gamma counter, which provides reliable readings, was calibrated prior to the sampling team's departure for the facility. Used to measure pH, conductivity, and temperature, the instrument was calibrated prior to field use. The dissolved oxygen and turbidity calibrations were performed before the teams left for the facility. The field measurements for Request 804 are reliable.

Request 805: The beta/gamma counter, which provides reliable readings, was calibrated prior to the sampling team's departure for the facility. Used to measure pH, conductivity, and temperature, the instrument was calibrated prior to field use. The dissolved oxygen and turbidity calibrations were performed before the teams left for the facility. The field measurements for Request 805 are reliable.

Analytical Data:

Request 804:

<u>Metals</u>. Analytical results for metals in soil are presented in Table 4.3.9. Of the 18 metals detected, the following four were below either the CRDL or the IDL in all six samples: cobalt, lead, silver, and sodium. Of the remaining metals detected, barium ranged from 11 to 28 mg/kg, beryllium from 0.83 to 1.0 mg/kg, chromium from 6.2 to 11 mg/kg, copper from 4.2 to 12 mg/kg, nickel from 5.7 to 11 mg/kg, and zinc from 12 to 36 mg/kg. Uranium was detected at 1 to 3 ug/g. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, and vanadium.

In Request 804 for total uranium, two separate areas were delineated in the scrap yard--AGS I and AGS II. Results of AGS I, which is the storage area for clean steel pieces, show concentrations of 1 ug/g with one sample being at or below the detection level of 1 ug/g. In AGS II, the concentrations were 2, 3, and 1 ug/g for the three samples taken from the contaminated steel storage area.

<u>Radiochemistry</u>. Analytical results are given in Table 4.3.9. All three soil samples from AGS I contained cesium-137 (22 to 100 pCi/kg) and potassium-40 (5,700 to 8,700 pCi/kg). Total strontium was detected in two samples (BR804022, 54 pCi/kg and BR804033, 70 pCi/kg). A small amount of cobalt-60 (24pCi/kg) was found in sample BR804011.

Samples from the AGS II storage yard all contained cesium-137 (40 to 90 pCi/kg) and naturally occurring potassium-40 (4,300 to 7,400 pCi/kg). Two samples contained total strontium (BR804044, 80 pCi/kg; and BR804066, 130 pCi/kg).

Request 805:

Metals. Analytical results for metals in groundwater are presented in Table 4.3.9. Of the ten metals detected, only calcium and sodium were above either the CRDL or the IDL.

Extractable organics. Analytical results for semivolatile organics are given in Table 4.3.9. Data for Request 804 did not include semivolatile organics. Data for request 805 included three groundwater samples. No semivolatile compounds were positively identified in these samples. Two samples had one TIC detected, and the remaining sample had three TICs detected. No particular TIC semivolatile compound was detected in more than one sample, and all concentrations were estimated below 0.010 mg/L.

Volatile organics. Four volatile compounds were detected in two of these ground water samples, and five volatiles were detected in the remaining sample. Chloroform was detected below the quantitation limit in all three samples; its estimated concentrations was 0.002 mg/L in all cases. It was also present in the blank. The same is true for toluene, except the highest estimated concentration of that compound was 0.0008 mg/L. Some 1,1,1-trichloroethane was measured in each of the three samples with the highest concentration being 0.060 mg/L. A compound tentatively identified as a freon was detected in two samples; its highest concentration was 0.019 mg/L.

Radiochemistry. The three water samples from Well D-12 contained only total strontium (0.5 to 1.3 pCi/L).

Analytical Data Evaluation:

Request 804:

Metals. Six metals of interest (barium, beryllium, chromium, copper, nickel, and zinc) were detected above either the CRDL or the IDL in the samples for this request.

The quality control of total uranium sampling for Request 804 was excellent; preparation blanks, calibration verification, spike recoveries, and duplicate results were all in compliance. Hold time was met for all samples.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 805:

Metals. Only calcium and sodium were detected above either the CRDL or the IDL in the samples for this request.

Extractable organics. No semivolatile compounds were positively identified in these samples. No particular TIC was detected in more than one sample and all concentrations were estimated below 0.010 mg/L.

Volatile organics. Chloroform and toluene were detected below the quantitation limits in all three samples, and both compounds were also present in the blank. Some 1,1,1-trichloroethane was measured in each of the three samples. A compound tentatively identified as a freon was detected in two samples.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.15.4 Limitations and Qualifications

Data Quality Level:

Request 804: The sampling plan and field sampling for Request 804 are rated Quality Level I. The overall analytical quality rating is Quality Level I.

Request 805: The sampling plan and field sampling for Request 805 are rated Quality Level I. The overall analytical quality rating is Quality Level I.

Field Data:

Request 804: The field data for Request 804 are rated Quality Level I.

Request 805: The field data for Request 805 are rated Quality Level I.

Analytical Data:

Request 804:

Metals. Analytical results are Quality Level I with the following exceptions: antimony is Quality Level II, and arsenic and beryllium are Quality Level III. Antimony and arsenic were recovered below the control limit from the spiked sample. Beryllium exceeded the control limits for the solid laboratory control standard.

Uranium is Quality Level I due to excellent quality control results.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 805:

Metals. Analytical results are Quality Level I with the following exceptions: aluminum and sodium are Quality Level II, and arsenic, beryllium, and zinc are Quality Level III. Aluminum results exceeded the control limit for calibration verification. Sodium was recovered above the control limit for the laboratory control standard and serial dilution results did not meet the 10% criteria. Arsenic was recovered from the spiked sample below the control limit. Beryllium was observed below the CRDL in the calibration blank. Zinc was observed at greater than the CRDL in the preparation blank.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 9
Request Number: 804

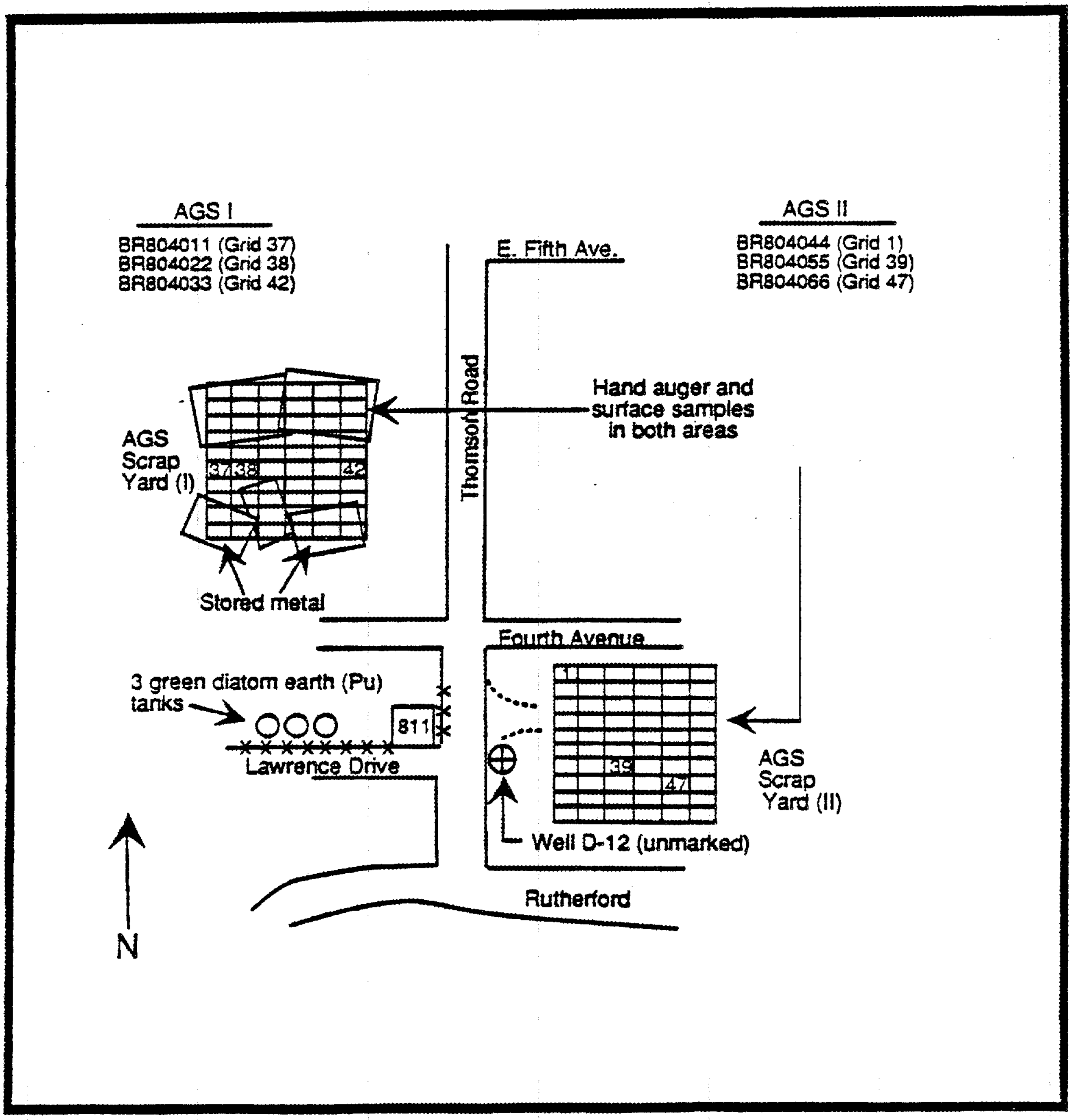

Figure 4.9a. AGS I and II Scrap Yards (Request 804)

Environmental Problem: 9
Request Number: 805

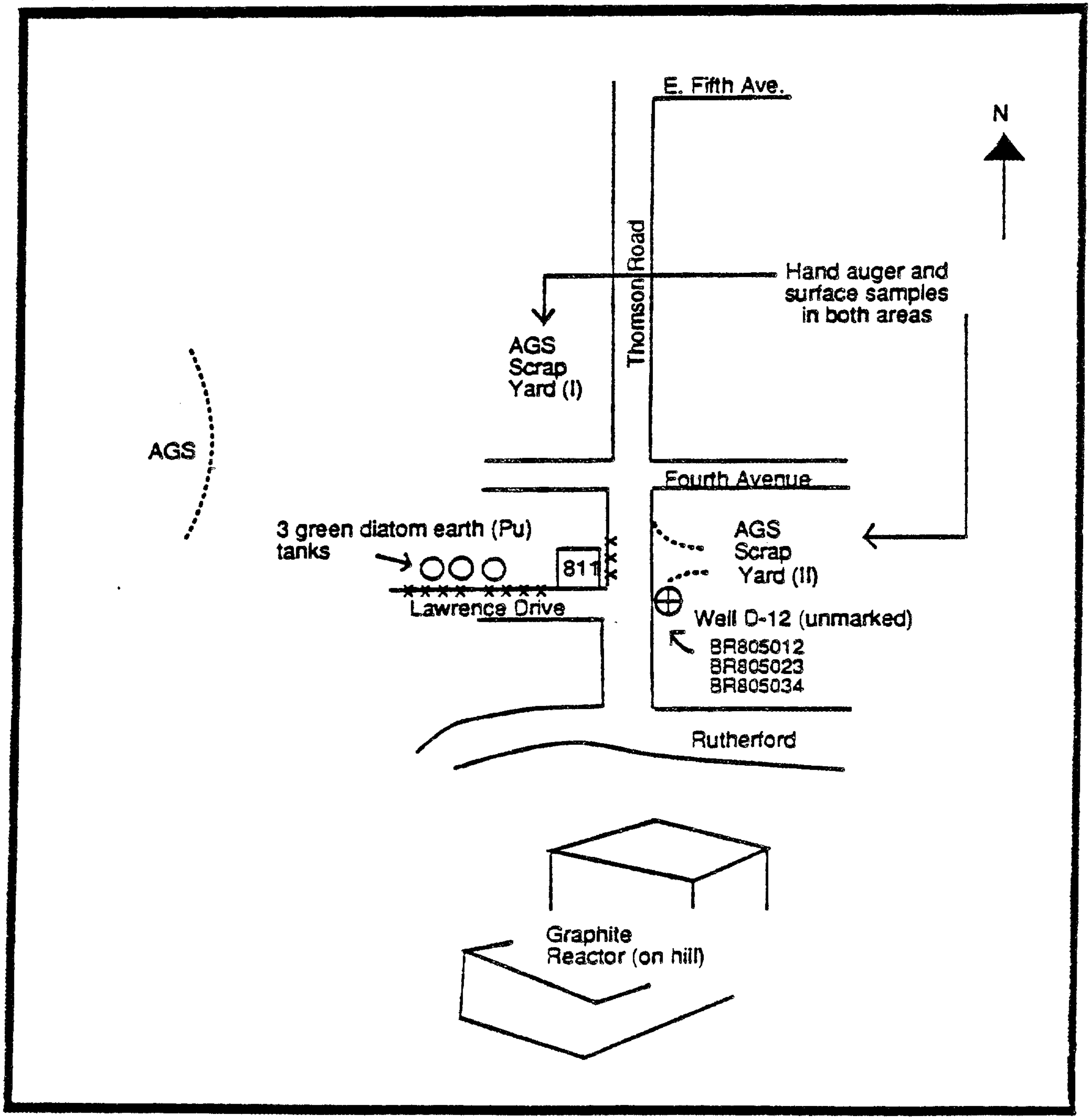

Figure 4.9b. Well D-12 Near AGS Scrap Yard (Request 805)

TABLE 4.2.9 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 9

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS		METALS		O&G		PET HYDRO		PES/H/PCB		SEMIVOLS		VOLS		RADS	
							NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL	NUMB HITS	NUMB ANAL
BR804	AGS I&II	SCARPYARD	SOIL	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
BR804	AGS I&II	SCRAPYARD	SOIL	5	5	GRAB	0	0	5	5	0	0	0	0	0	0	0	0	0	0	5	5
		MED TOTAL		6	6		0	0	6	6	0	0	0	0	0	0	0	0	0	0	6	6
BR805	AGS SCRAP.	WELL	GRN WATER	4	4	WELWZ	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
		MED TOTAL		4	4		0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
		EP TOTAL		10	10		0	0	9	9	0	0	0	0	0	0	3	3	3	3	9	9

TABLE 4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 AGS I & II SCRAPYARDS

DRAFT DO NOT CITE

S&A REQUEST: 804
LOCATION: AGS I AND II SCRAP YARDS
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:	BR804011	BR804022	BR804033	BR804044	BR804055	BR804066
RADIOACTIVIT (CPM)		500	120	50	50	50	50

METALS, INCLUDING CR+6 (MG/KG)							
	SAMP NO:	BR804011A	BR804011A	BR804022A	BR804022A	BR804033A	BR804033A
	SDG NO:	BR311015C	BR311015K	BR311015C	BR311015K	BR311015C	BR311015K
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		5140		8620		7620	
BARIUM		11 BE		17 BE		17 BE	
BERYLLIUM		0.92		1		0.83	
CALCIUM		37100		51700		8120	
CHROMIUM		6.2		8.6		9.6	
COBALT		2.3 B		3.2 B		4.2 B	
COPPER		4.2		5.4		12	
IRON		5860		8960		11400	
LEAD		6.6 U		6.6 U		14 B	
MAGNESIUM		20900		28700		4810	
MANGANESE		131		114		145	
NICKEL		5.7		7		11	
POTASSIUM			500 B		770		550 B
SILVER		0.81 B		0.8 U		0.8 U	
SODIUM		137 B		201 B		399 B	
VANADIUM		9.3		14		25	
ZINC		12		25		18	

METALS, INCLUDING CR+6 (MG/KG)							
	SAMP NO:	BR804044A	BR804044A	BR804055A	BR804055A	BR804066A	BR804066A
	SDG NO:	BR311015C	BR311015K	BR311015C	BR311015K	BR311015C	BR311015K
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		8290		11200		8110	
BARIUM		27 E		28 E		24 BE	
BERYLLIUM		0.93		1		0.87	
CALCIUM		16400		18400		8010	
CHROMIUM		11		11		9.2	
COBALT		3.9 B		3 B		3.5 B	
COPPER		6.2		6.9		5	
IRON		9720		11600		10000	
LEAD		8.5 B		12 B		15 B	
MAGNESIUM		1600		1810		1650	
MANGANESE		145		112		121	
NICKEL		9.1		7		5.9	
POTASSIUM			610 B		720		560 B
SILVER		0.81 U		0.82 U		0.8 U	

TABLE 4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 AGS I & II SCRAPYARDS — DRAFT DO NOT CITE

S&A REQUEST: 804
LOCATION: AGS I AND II SCRAP YARDS
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	BR804044A	BR804044A	BR804055A	BR804055A	BR804066A	BR804066A
	SDG NO:	BR311015C	BR311015K	BR311015C	BR311015K	BR311015C	BR311015K
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
SODIUM		103 B		123 B		83 B	
VANADIUM		17		21		17	
ZINC		17		36		16	

METALS, INCLUDING CR+6 (UG/G)	SAMP NO:	BR804011B	BR804022B	BR804033B	BR804044B	BR804055B	BR804066B
	SDG NO:	BR303015E	BR303015E	BR303015E	BR303015E	BR303015E	BR303015E
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
URANIUM, TOTAL		1 U	1	1	2	3	1

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR804011C	BR804022C	BR804033C	BR804044C	BR804055C	BR804066C
	SDG NO:	LLL8311	LLL8311	LLL8311	LLL8311	LLL8311	LLL8311
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CO-60		24	30 U	30 U	30 U	30 U	30 U
CS-137		22	52	100	40	44	90
K-40		5700	8700	6600	6900	7400	4300
SR-TOT		-20	54	70	80	-5	130

S&A REQUEST: 805
LOCATION: NEAR AGS SCRAPYARD
MEDIUM: GROUND WATER

FIELD MEASUREMENTS	SAMP NO:	BR805012	BR805023	BR805034			
CONDUCTIVITY (MS/CM)		0.12	0.12	0.12			
DO (PPM)		3.3	3.3	3.3			
PH (UNITS)		6.4	6.4	6.4			
RADIOACTIVIT (CPM)		200	200	200			
TEMPERATURE (DEG C)		15	15	15			
TURBIDITY (PPM)		3	0	0			

TABLE 4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
AGS I & II SCRAPYARDS

S&A REQUEST: 805
LOCATION: NEAR AGS SCRAPYARD
MEDIUM: GROUND WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR805012F / BR306018F / WELL WHIZ	BR805012F / BR306018K / WELL WHIZ	BR805023F / BR306018F / WELL WHIZ	BR805023F / BR306018K / WELL WHIZ	BR805034F / BR306018F / WELL WHIZ	BR805034F / BR306018K / WELL WHIZ
ALUMINUM		68 B		78 B		86 B	
BARIUM		23 B		22 B		24 B	
BERYLLIUM		0.76 B		0.71 B		0.94 B	
CALCIUM		9920		9930		9340	
IRON		22 B		20 U		20 U	
MAGNESIUM		3720 B		3720 B		3730 B	
POTASSIUM			1600 B		1500 B		1600 B
SODIUM		11600 E		11300 E		12300 E	
VANADIUM		4 U		4 U		5 B	
ZINC		11 B		7.2 B		10 B	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR805012E / BR306018E / WELL WHIZ	BR805023E / BR306018E / WELL WHIZ	BR805034E / BR306018E / WELL WHIZ
* ALIPHATIC HYDROCARBON(24.10)			4 J	
* POSSIBLE UNSAT HYDROCAR(24.10)		10 J		
* UNKNOWN(3.23)			4 J	
* UNKNOWN(4.88)			2 J	
* UNKNOWN(24.10)				3 J

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR805012A / BRN28015A / WELL WHIZ	BR805023A / BRN16011A / WELL WHIZ	BR805034A / BRN16011A / WELL WHIZ
ACETONE		10 U	5 JB	10 U
CHLOROFORM		2 JB	2 JB	2 JB
TOLUENE		0.4 JB	0.5 JB	0.8 JB
1,1-DICHLOROETHANE		32	30	31
1,1-DICHLOROETHENE		3 J	3 J	4 J
1,1,1-TRICHLOROETHANE		60	55	56
* FREON 113(12.20)			18 J	19 J

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR805012I / LLL8312 / WELL WHIZ	BR805012J / LLL8312 / WELL WHIZ	BR805023I / LLL8312 / WELL WHIZ	BR805023J / LLL8312 / WELL WHIZ	BR805034I / LLL8312 / WELL WHIZ	BR805034J / LLL8312 / WELL WHIZ
H-3			-370		-450		-200
SR-TOT		0.5		1.3		0.8	

TABLE 4.4.9 SAMPLE LOCATIONS AND SAMPLE VOLUMES
ENVIRONMENTAL PROBLEM 9

WELL ID	SAMPLE NUMBER	DATE	SAMPLING METHOD	VOLUME (L)
D12	BR805012	20APR88	WELL WIZ.	112.0
D12	BR805023	20APR88	WELL WIZ.	112.0
D12	BR805034	20APR88	WELL WIZ.	112.0
D12	BR805045	20APR88	WELL WIZ.	112.0

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4.16 Environmental Problem 10: Bubble Area

Request Numbers: 806, 807, 809, and 810.

Requester: J. Werner / D. Detman.

Finding and Basis: Spills and leaks of hazardous substances onto the ground and asphalt in the bubble area may have caused groundwater and surface water contamination in addition to the visually apparent soil contamination. The substances spilled or leaked include toluene-containing scintillation fluid and an apparent variety of other hazardous substances.

4.16.1 Sampling and Analysis Objectives

Statement:

Requests 806 and 807 (Phase I). Soil samples were to be collected from selected stained areas in the Bubble Area, and water samples were to be collected from Well SG in the Bubble Area to determine if the contaminants listed in section 4.16.2.2 (Requests 806 & 807) were present above analytical detection levels in groundwater in the 975 building area.

Requests 809 and 810 (Phase II). Water and soil samples were to be collected to determine if the contaminants listed in section 4.16.2.2 (Requests 809 and 810) were present above analytical detection levels in soils and groundwater from the B-975 Bubble-chamber Area. Because of the presence of low-density immiscible contaminants such as toulene, and the potential for high-density contaminants such as TCE, both shallow and deep wells were installed. The wells were located in pairs, one shallow (25 ft) and one deep (50 ft). Well pairs were located both upgradient and downgradient of the storage disposal area. Split-spoon soil samples were taken for lithologic purposes at the 2 to 4 ft, 6 to 8 ft, 10 to 12 ft, and 20 to 22 ft intervals in the deep wells. If any of these subsurface samples had an PID headspace reading greater than 5 ppm above instrument background levels, all samples from that well were retained for laboratory analysis. Split-spoon samples for lithologic logging purposes only were taken at 10-ft intervals below the 20- to 22-ft interval to a total depth of 50 ft. The deepest sample interval was 48 to 50 ft.

Supporting Information: The Survey Team observed several labeled tanks and drums in the Bubble Area. BNL personnel said that the labels may be questionable. Since the Survey, the tanks and drums have been removed; however, it is not known whether soil sampling or soil removal was performed. No groundwater monitoring has been conducted in this area. Nearby supply wells have shown trichloroethylene contamination. These wells are not suitable for monitoring purposes because of the long screening and uncertain depth below the water table. BNL hydrogeologists believe that groundwater flows north to south, but the gradient is uncertain. If the north to south flow is correct, the contaminated supply wells are upgradient from known waste sites (i.e., landfills, HWMA). Results from Well SG might also help determine the extent of groundwater contamination. It may serve as an existing upgradient well, depending on the results of soil sampling in the Bubble Area. Data from the new wells will help determine the extent of contamination in the area. Water-level measurements taken from the two new shallow wells were used in conjunction with water level data taken from Well SG to determine the groundwater flow direction and gradient in the immediate area.

4.16.2 Sampling and Analytical Design

4.16.2.1 Sampling Design

Request 806: Well SG in Bubble Area (Soil)(Fig. 4.10a). Approximately 14 grab surface soil samples (Sampling Method: Reference E5.1) were to be collected from selected stained areas within the Bubble Area Waste Site. From details supplied by the requester, numerous distinct areas were noted. The exact number of samples was to be determined after on-site observation. After selecting the areas to be sampled, each area was to be divided into either a 6 x 10 or 8 x 10 grid. Three or four segments were then to be randomly selected for sampling from each area. Surface samples were to be collected if the soil had not been disturbed. If soil had been removed and replaced with fill, the Sampling Team was to core to 1 ft below the fill and collect the samples.

Samples for this request were collected on 20APR88. The temperature was approximately 35^{o}F, with a clear sky and winds 5 to 10 mph from the west.

The Bubble Area north of Building 975 was divided into four distinct sampling areas, designated areas A, B, C, and D. Samples BR806013 (grid 7), BR806024 (grid 10), and BR806035 (grid 26) were collected from Area A between 0856 and 0910. Area A supports grasses and various types of weeds. The soil for sample BR806013 was moist with a large amount of humus material in the top 3 in. Soil contained approximately 40% gray clay, with the rest being composed of brown sand and silt. Sample BR806024 was composed of sand, silt, and gravel in equal amounts, with the soil being dark brown to black. A frozen layer was encountered at 2 in. Sample BR806035 was similar in composition to the previous sample.

Samples BR806046 (grid 35), BR806057 (grid 48), and BR806068 (grid 55) were collected from Area B between 0920 and 0929. These samples contained a higher percentage of gravel than the previous samples. The soil for samples BR806046 and BR806057 was brown and contained no gray clay in the top 2 in. Clay was more predominate in the bottom 1 in. Sample BR806068 was composed of 30% gravel but contained no gray shale. The other 70% of the sample was dark brown sand and silt. The gravels in the sample were poorly sorted.

Samples BR806079 (grid 5), BR806080 (grid 37), BR806091 (grid 55), and BR806104 (grid 70) were collected from Area C between 0941 and 0955. Little or no gravel was contained in sample BR806079. Gray shale was encountered at 4 in. Sample

BR806080 contained brown silt in the top 1/2 in.; the bottom 2 1/2 in. was composed of a broken gray shale. Sample BR806091 was composed of 1 in. of brown top soil, with the bottom 2 in. being gray crushed shale with a gray clay matrix. The first inch of topsoil for sample BR806104 was removed and residue of decomposed metal was encountered. Gray crushed slate was then found in the bottom 1 in.

Samples BR806115 (grid 23), BR806126 (grid 25), BR806137 (grid 49), and BR806148 (grid 73) were collected from Area D between 1006 and 1024. Sample BR806115 had a black layer of 2 1/2 in., with gray shale at 2 1/2 to 3 in. Surface soil at sample location BR806126 had moss growing in it. The soil profile below the surface was similar to BR806115. Sample BR806137 was composed of moist dark brown sand for the top 2 in.; the bottom 1 in. was light brown silt. Sample BR806148 consisted of brown sand and silt for the top 2 in., with gray shale underlying it. QC rinsate BR806159 was collected at 1026 from the trowels and pans used for sampling.

Request 807: Well SG in Bubble Area (Water)(Fig. 4.10b). Three grab water samples (Sampling Method: Reference E4.4.3 and E4.4.4.4) were to be collected from Well SG. The groundwater elevation was to be measured to determine the volume to be purged before sampling began. Two or three volumes were to be purged by pumping or bailing. If the well was bailed, a Teflon or stainless steel bailer was to be used. Recharge time was not known prior to sampling. Temperature, pH, and specific conductivity were to be measured in the field before and after sample collection to confirm water stability (Field Method: Reference E4.5). Samples were collected in the order of susceptibility to volatilization.

The Sampling Team arrived at the site at 0915 on 21APR88. The sky was overcast, with winds out of the northwest at 1 to 5 mph. The temperature was 45^{o}F. A RAD scan of the area was 75 cpm.

The well was located on the west edge of the wooded section at the north entrance to the Accelerator Development Department. Dense grasses and brush covered the area. The casing ended approximately 2 ft above the ground surface and was very weathered and rusty.

The volume of the well was calculated to be 16.3 gal. The depth of the well was 36.95 ft, and the depth to the top of the water was 21 ft. The first purge of the well began at 0935. The water was rust colored with no odor. Temperature, pH, and conductivity were measured with the first, 11th, and 19th bails of water. The well depth was checked after the 25th bail, and the water surface was at 21 ft, indicating that the well was recharging at the rate of bailing. The water was slightly more rust colored than it was at the start of bailing. Temperature, pH, and conductivity measurements were taken from the 26th, 34th, 43rd, 50th, and 58th bails. The water appeared to be clearing a little at this point. The depth to the water surface was checked again after the 66th bail and was still 21 ft. Water depth and pH were checked again after the 100th bail; the depth was still 21 ft. Sample collection began at 1040. The volatiles samples for BR807014, BR807025, and BR807036 were collected from the first three bails, respectively. Collection of volatiles samples was completed at 1048. The remaining samples were collected, beginning with the fourth bail. Sample BR807014 was collected between 1050 and 1055, consisting of the fourth through eighth bails. Sample BR807025 was collected from 1057 to 1102, consisting of bails nine through 13. The water had a light rust color and was cloudy. By this time, the sky had cleared, the wind had stopped, and the temperature had risen to 55°F. Sample BR807036 was collected between 1106 and 1108, using bails 14 through 21. Field preservative blank BR807047 was collected at 1116.

Request 809: Four New Wells Near the B-975 Bubble-chamber Area (Water) (Fig.4.10c). Two well nests (each containing a deep well of approximately 50 ft and a shallow well of approximately 25 ft) were installed near the B-975 Bubble-chamber Area. The shallow (25 ft) well in each nest was to be used to collect groundwater samples in the upper sections of the aquifer near the air/water interface. The deep (50 ft) well in each nest was to be used to collect samples to determine if the contaminant plume had reached the 40- to 50-ft depth. The wells were to be augered to a 10-in. diameter. A 4-in. diameter 304 stainless steel casing was used. A screen area 10 ft long with a 0.010 slot size was to extend from the well bottom to the bottom of the casing. A gravel pack was to fill the annulus to the depth of 2 ft above the top of the screen. Bentonite pellets were to be used above the gravel pack to form a 2-ft seal. If insufficient moisture was available to allow the seal to develop, clean water was to be added to the borehole to help develop the seal. The well was to be tremie grouted to the surface and the grout allowed to harden for at least 12 hours before well development. Well development was to be accomplished by bailing or surging. During well development, periodic measurements of pH, temperature, and specific conductance were to be taken (Field Method: Reference E4.5). Development was to continue until the readings had stabilized.

The wells were to be installed and constructed in compliance with all RCRA standards as found in Chapter 3 of RCRA Ground-Water Technical Enforcement Guidance Document, 1986. All necessary permits were to be obtained by a licensed drilling contractor. Wells were to be protected by locking caps and protective posts mounted in a concrete pad.

Two samples were to be collected from each well (Sampling Method: Reference E4.4.4.1 and E4.4.4.4). Samples were to be collected consecutively. If both samples could not be collected on the same day, all parameters for the first sample were to be collected on the first day and those for the second sample on the second day. Groundwater sampling was not to be performed until at least 24 hr after well development. Groundwater elevation was to be measured before sampling to determine the minimum volume to be purged (Field Method: Reference E4.4.3).

The well was to be purged until measured field parameters had stabilized. Three to five borehole volumes were expected to be evacuated before the parameters stabilized. A submersible pump was to be used, although Teflon and stainless steel bailers were to be available if the submersible pump proved to be unacceptable.

Measurements of temperature, pH, and specific conductance were to be performed before and after sampling to confirm water stability (Field Method: Reference E4.5). Samples were to be collected in order of susceptibility to volatilization, and the level of concern to the DOE Survey Team. The order in which parameters were to be collected was volatiles, semivolatiles, total tritium, strontium-90, and ICP-metals.

The upgradient nest was located northwest of the B-975 Bubble-chamber Area and consisted of Well 559 (29 ft) and Well 558 (50 ft). The downgradient nest was located southeast of the B-975 Bubble-chamber Area and consisted of Well 557 (50 ft) and Well 556 (27 ft).

The downgradient, shallow well (556) was installed between 1105 and 1730 on 21JUN88. The well was developed between 1620 and 1630 on 24JUN88. Stability was achieved after pumping 100 gal. of water from the well. Field measurements were recorded at 65, 80, and 100 gal. The well was purged immediately after development. Purge volume was 50 gal. Samples BR809050 and BR809061 were collected between 1736 and 1752. The sky was sunny with a light breeze, and temperatures were in the upper 70^{o}F range.

The downgradient, deep well (557) was installed between 0930 and 1715 on 20JUN88. The well was developed between 1715 and 1725 on 24JUN88. Stability was achieved after pumping 200 gal. of water from the well. Field measurements were recorded at 100, 125, 150, and 200 gal. The well was purged immediately after development. Purge volume was 50 gal. Samples BR809072 and BR809083 were collected between 1812 and 1826. The sky was sunny with a light breeze, and temperatures were in the upper 70°F range.

The upgradient, shallow well (559) was installed between 1530 and 2008 on 16JUN88. On the same day, an attempt to install a well was made in the same area between 1120 and 1500. This well had to be abandoned due to a cave-in during grouting. Well 559 was developed between 1200 and 1215 on 23JUN88. Stability was achieved after pumping 275 gal. of water from the well. Field measurements were recorded at 225, 250, and 275 gal. The well was purged immediately after development. Purge volume was 275 gal. Samples BR809116 and BR809129 were collected between 1233 and 1258. Weather conditions during sampling were not noted in the logbooks.

The upgradient, deep well (558) was installed between 0900 and 1800 on 18JUN88. Well 558 was developed between 1400 and 1415 on 23JUN88. Stability was achieved after pumping 250 gal. of water from the well. Field measurements were recorded at 175, 200, 225, and 250 gal. The well was purged immediately after development. Purge volume was 250 gal. Samples BR809130 and BR809049 were collected between 1502 and 1516. Weather conditions during sampling were not noted in the logbooks.

Note: The following deviations and/or discrepancies from the Addendum to the Sampling and Analysis Plan were noted for Request 809.

1. Less than 1 1/2 hr elapsed between the end of development and the beginning of sampling. Paragraph 3.2.10.4.1.2 of the Addendum to the

Sampling and Analysis Plan required a 24-hr wait between development and sampling.

2. Paragraph 3.2.10.4.1.5 of the Addendum to the Sampling and Analysis Plan required measurements of pH, temperature, and specific conductance before and after sampling to confirm water stability. The logbooks show records of these field measurements only during well development (ranging from 18 min to 1 hr 6 min before sampling). No measurements were taken after sampling.

3. On Well 557, the project logbook states that the well was sand packed to 35 ft, while the well construction summary shows a gravel pack and the Addendum to the Sampling and Analysis Plan requires a gravel pack.

4. While grouting Well 557, the crew ran out of grout 10 ft before reaching the surface. When they returned the next day, approximately 5 ft of what appeared to be mud, had entered the hole. No references to removing the mud or completing the grouting exist in the logbooks.

Request 810: Four New Well Near the B-975 Bubble-chamber Area (Soil)(Fig. 4.10d). During the installation of Wells 557 and 558 (see Request 809), subsurface soil samples were to be collected both above and below the water level. The samples were to be used to provide information on soil lithology and the presence of contaminants in the soil column. They were also to be used as indicators of potential groundwater contamination. Field screening was to be conducted using a flame ionization detector (FID) for organic vapor headspace analysis (OVA).

Using a split-spoon sampler, soil samples were to be collected at intervals of 2 to 4, 6 to 8, 10 to 12, 20 to 22, 30 to 32, 40 to 42, and 48 to 50 ft. Samples above the water table were to be collected in triplicate. One sample container was to be placed in the sun or heated for 15 to 20 min. After that time, the air from the container was to be tested for OVA with a FID. If levels increased above 5 ppm over background, the remaining two volatile samples, along with the rest of the samples for that well, were to be retained for laboratory analysis. The heated volatile sample was to be given to BNL for proper disposal. If the FID indicated an absence of organic vapor, all samples were to be discarded. Samples were to be collected in order of their sensitivity to volatilization and interest to the DOE Survey Team. The order for collection was volatiles, semivolatiles, total tritium, ICP-metals, and strontium-90. The samples collected from below the water level were to be for lithologic determination only. No samples collected from either well showed OVA levels above the 5 ppm. Therefore, lithological data were recorded and all soil samples given to BNL for disposal. The data are as follows:

Well 557

Depth (in feet)	Soil Description
0-2	Light tan to dark brown clay with medium to coarse, moderately-sorted, subrounded to rounded sand with a small quantity of gravel and pebbles.
2-4	A bed of well-sorted 1- to 2-in. diameter gravel, pebbles, and cobbles with very little sand or clay.

6-8	Brown silt (90%) with very thin stringers of sand approximately every 2 to 4 in.
10-12	The top 4 in. were well-rounded pebbles and cobbles; the middle 13 in. well-sorted, tan to white sand of medium to coarse grain, subangular to rounded with very little fines; and the last 3 in. well-sorted gravel of 1/8 in. or less diameter.
20-22	Well-sorted gravel and pebbles (up to 1 in. in diameter) with very coarse sand. No fines.
30-32	Well-sorted gravel and pebbles (up to 1 in. in diameter) with very coarse sand. No fines.
40-42	Well-sorted gravel and pebbles (up to 1 in. in diameter) with very coarse sand. No fines.
48-50	Well-sorted gravel and pebbles (up to 1 in. in diameter) with very coarse sand. No fines.

Well 558

Depth (in feet)	Soil Description
2-4	Poorly-sorted sands and gravels with some well-rounded, very quartzose cobbles.

6-8	Coarse to very coarse, rounded to well rounded, light tan, well-sorted quartz sand with very little fines and some gravel.
10-12	Coarse to very coarse, rounded to well-rounded, light tan, well-sorted quartz sand with very little fines and some gravel.
20-22	Coarse to very coarse, subrounded to well-rounded, light tan, well-sorted quartz sand with very little fines and more gravel than the last two samples.
30-32	Forty percent well-rounded 1 in. diameter gravel in a medium coarse sand matrix.
40-42	Tan to very light brown, medium to coarse sand with gravel and cobbles. (This sample had a higher sand to gravel ratio than the 30- to 32-ft sample.)
48-50	Tan to very light brown, medium to coarse sand with gravel and cobbles. (This sample had a higher sand to gravel ratio than the 30- to 32-ft sample.)

4.16.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 10 included the following:

Request 806: The parameters analyzed were volatiles, semivolatiles, ICP-metals, strontium-90, and gamma scan (cesium-137 and cobalt-60). Field measurements for radiation were taken at each sample site.

Request 807: The parameters analyzed were volatiles, semivolatiles, PCBs, ICP-metals, tritium, gamma scan, and total strontium. Field measurements were taken for pH, specific conductance, temperature, dissolved oxygen, radioactivity, and turbidity. Water level was also measured.

Request 809: The parameters analyzed were volatiles, semivolatiles, total tritium, ICP-metals, and strontium-90. The field measurements taken were pH, specific conductance, and temperature.

Request 810: The parameters analyzed were to be volatiles, semivolatiles, total tritium, ICP-metals, and strontium-90. Organic vapor headspace analysis (OVA) using a flame ionization detector (FID) was done as a field measurement.

4.16.3 Field and Analytical Data

Field Data:

Request 806: *The data are given in Table 4.3.10. Although not required, a radiation scan was made at each soil site. The results show that the readings ranged from 20 cpm to 40 cpm. Four separate areas were sampled and were labelled "A", "B", "C", and "D". Correspondence samples were BR806013, BR806024, and BR806035 for "A"; BR806046, BR806057, and BR806068 for "B";*

BR806079, BR806080, BR806091, and BR806104 for "C"; and BR806115, BR806126, BR806137, and BR806148 for "D". Samples were taken sequentially in time from 0856 to 1024 from area "A" to "D"; note that the rinsate sample (BR806159) was taken at 1026 which had a reading of 20 cpm.

Request 807: *The data are given in Table 4.3.10. The conductivity, pH, and temperature measurements are shown in Table 4.3.10. The three measurements are the same for the three water samples: the conductivity is 0.1 mS/cm; the pH is 8.1; and the water temperature is 14°C. Although requested, no FID readings were taken. Other measurements taken included dissolved oxygen (2.2 ppm), rad scan (75 cpm), and turbidity (73 ppm).*

Request 809: *The data are given in Table 4.3.10. Field measurements for the wells are given in Table 4.3.10. Data were recorded for only three of the four wells. Well 556 showed conductivity at 189 umhos/cm; pH at 5.4; and temperature at 12°C. Well 557 showed conductivity at 121 umhos/cm; ph at 4.9; and temperature at 12°C. Only one measurement was recorded for Well 558; the conductivity was 97 umhos/cm; pH was 5.6; and the temperature was 11°C. No measurements were recorded for Well 559.*

Request 810: *The data are given in Table 4.3.10. FID readings were taken and no volatile organics were detected; therefore, no samples were collected.*

Field Data Evaluation:

Request 806: The instrument used to take the activity readings was calibrated prior to the sampling team's departure to the facility. The readings are reliable for portable field instruments. The conductivity, pH, and temperature probes are calibrated prior to taking field measurements; the probes for dissolved oxygen and turbidity are calibrated at the laboratory prior to the sampling team's departure to the facility. Readings for these measurements are reliable.

Request 807: The instrument used to take the activity readings was calibrated prior to the sampling team's departure to the facility. The readings are reliable for portable field instruments. The conductivity, pH, and temperature probes are calibrated prior to taking field measurements; the probes for dissolved oxygen and turbidity are calibrated at the laboratory prior to the sampling team's departure to the facility. Readings for these measurements are reliable.

Request 809: The instrument used to measure conductivity, pH, and temperature and the FID instrument were calibrated prior to field use as normal operating procedure for the team. The data are reliable.

Request 810: The instrument used to measure conductivity, pH, and temperature and the FID instrument were calibrated prior to field use as normal operating procedure for the team. The data are reliable.

Analytical Data:

Request 806:

Metals. Analytical results for metals in soil are presented in Table 4.3.10. Of the nineteen metals detected, arsenic and cobalt were below either the CRDL or the IDL in all fourteen samples. Of the remaining metals barium ranged from 40 to 114 mg/kg, beryllium from 0.96 to 3.3 mg/kg, cadmium from 0.75 to 33 mg/kg, chromium from 4.4 to 105 mg/kg, copper from 8 to 408 mg/kg, lead from 12 to 200 mg/kg, nickel from 5.7 to 195 mg/kg, silver from 1.4 to 1.9 mg/kg, and zinc from 26 to 1020 mg/kg. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, sodium, and vanadium.

Extractable organics. Analytical data for semivolatile organic compounds are presented in Table 4.3.10. In the 14 soil samples for this request, the number of *compounds detected in any individual sample ranged from 15 to 30. Benzo(G,H) perylene, dibenzo(A,H)anthracene, and indeno(1,2,3-CD)pyrene were identified in measurable quantities in sample BR806148. No other compounds were identified in measureable quantities. With the exception of two phthalates that were both present in the blanks, no estimated concentration of any identifiable compound exceeded 1 mg/kg. The following TICs had estimated concentrations of greater than 10 mg/kg: Diacetone alcohol, unknown alkene ethers, and an unknown in BR806104. The unknown alkene ethers frequently had estimated concentrations as high as 100 mg/kg and 1 gm/kg. The unknown in BR806104 had an estimated concentration of 1.4 gm/kg.*

Volatile organics. *Analytical data for volatile organic compounds are presented in Table 4.3.10. There were 20 volatile compounds detected in sample BR806115; from two to nine volatiles were detected in the other 13 respective soil samples taken for this request. Carbon tetrachloride was detected below the quantitation limit in sample BR806104 (estimated concentration was 0.018 mg/kg), but was not detected in any other sample. Chloroform was detected in all samples and also in the blanks. It was below the quantitation limit in several samples, but the highest measured or estimated concentration was a measured 0.032 mg/kg, which actually occurred in two samples, BR806115 and BR806126. Methylene chloride was detected in all but one sample and was also detected in the blanks. It was measured at 0.230 mg/kg in BR806046, but all other measured or estimated concentrations were below 0.030 mg/kg. Toluene was detected below the quantitation limit in two samples (highest estimated concentration was 0.017 mg/kg). Some 1,1,1-trichloroethane was present in BR806046 (concentration measured at 0.230 mg/kg), and some 1,1,2,2-tetrachloroethane was detected below the quantitation limit (estimated concentration was 0.004 mg/kg) in BR806115. Acetone was identified in four samples and also in the blank with sample concentrations being measured at 0.120 mg/kg or less. Except as noted above, measured or estimated concentrations of all positively identified compounds in these samples were always less than 0.100 mg/kg. Several TICs,* *including seven probable aromatic hydrocarbons, were detected in sample BR806115. No estimated concentration of any TIC in these samples was as great as 1 mg/kg.*

Radiochemistry. Analytical results are given in Table 4.3.10. Three soil samples from Area A contained cesium-137 (210 to 390 pCi/kg) and potassium-40 (10,000 to 12,000 pCi/kg). One sample (BR806013) contained total strontium (9 pCi/kg). Three samples from Area B contained cesium-137 (110 to 150 pCi/kg) and potassium-40 (5,900 to 11,000 pCi/kg). Two samples contained total strontium (BR806046, 92 pci/kg and BR806057, 15 pCi/kg). Four samples from Area C contained cesium-137 (61 to 190 pCi/kg) and potassium-40 (5,400 to 11,000 pCi/kg). Total strontium was found in two samples (BR806080, 49 pCi/kg and BR806091, 12 pCi/kg). Four samples collected from Area D contained cesium-137 (62 to 230 pCi/kg) and potassium-40 (4,200 to 9,800 pCi/kg). One sample contained total strontium (BR806115, 49 pCi/kg). One rinsate sample was collected and it contained only total strontium (3.1 pCi/kg).

Request 807:

Metals. Analytical results for metals in groundwater are presented in Table 4.3.10. Of the fifteen metals detected the following nine were below either the CRDL or the IDL in all three samples: barium, beryllium, chromium, cobalt, copper, magnesium, nickel, potassium, and vanadium. Of the remaining metals detected, zinc ranged from 1130 to 1240 ug/L. Other metals detected were aluminum, calcium, iron, manganese, and sodium.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Analytical data for semivolatile organic compounds are presented in Table 4.3.10. Three volatile compounds were detected in two of these samples and two in the remaining sample. No identifiable compounds were *detected. Tentatively identified compounds were identified in estimated concentrations of 0.014 mg/L or less.*

Volatile organics. Analytical data for volatile organic compounds are presented in Table 4.3.10. There were two, three, and four volatile compounds detected in the three respective bailer samples taken for this request. No volatile compound was positively identified in measurable quantities. Chloroform was present in all samples in concentrations below the quantitation limit and was also present in the blank. Concentration estimates never exceeded 0.003 mg/L. Toluene was detected below the quantitation limit and estimated at less than 0.001 mg/L in BR807036. Some 1,1,1-trichloroethane was detected in two samples, in concentrations below the quantitation limit, but was estimated at 0.002 mg/L. One compound, tentatively identified as a freon, occurred in two samples in estimated concentrations of less than 0.10 mg/L.

Radiochemistry. Analytical results are given in Table 4.3.10. Only one water sample (BR807014) of the three taken from Well SG contained tritium (30 pCi/L). Two samples contained small amount of total strontium (BR807014, 2.2 and BR807036, 3.2 pCi/L). A field blank (BR807047 contained no tritium or strontium.

Request 809:

Metals. Analytical results for metals in groundwater are presented in Table 4.3.10. Of the 15 metals detected, the following seven were below either the CRDL or the IDL in all eight samples: aluminum, barium, beryllium, copper, nickel, silver, and vanadium. Of the remaining metals detected, chromium was 14 ug/L in two samples, and zinc ranged from 26 to 62 ug/L. Other metals detected were calcium, iron, magnesium, manganese, potassium, and sodium.

Extractable organics. Analytical data for semivolatile organic compounds are presented in Table 4.3.10. From one to seven semivolatile compounds were *identified in particular samples of the total of eight ground water samples for this request. There were two phthalates identified in the samples and in the blank. Concentrations in samples were always 0.15 mg/L or less. No other semivolatile compounds were positively identified. Estimated concentrations of unknowns were also always less than 1 mg/L.*

Volatile organics. Analytical data for volatile organic compounds are presented in Table 4.3.10. There were eight pump samples for this request. Two of the samples had one volatile compound identified. One sample had two volatiles identified. Four samples had three identifiable volatiles, and one sample contained four identifiable volatiles. Chloroform was measured in half the samples with a maximum concentration of 0.011 mg/L. Methylene chloride appeared in one sample at 0.007 mg/L. Toluene occurred in all samples. The highest concentration was a measured 0.010 mg/L. Some 1,1,1-trichloroethane was identified in two samples with concentrations of 0.005 mg/L in one sample and an estimated (below quantitation limit) 0.004 mg/L in the other.

Radiochemistry. Analytical results are given in Table 4.3.10. Both water samples from Well 556 contained tritium (181 and 217 pCi/L) and strontium-90 (1.7 and 1.8 pCi/L). For Well 557, samples contained tritium (97 and 155 pCi/L) and strontium-90 (1.2 and 1.5 pCi/L). Well 558 samples contained tritium (165 and 215 pCi/L) and strontium-90 (1.4 and 1.7 pCi/L). Well 559 samples contained strontium-90 (2.4 and 2.6 pCi/L) but only sample BR809129 contained tritium (56 pCi/L).

Request 810: *No samples were analyzed for this request.*

Analytical Data Evaluation:

Request 806:

Metals. Eight metals of interest, barium, beryllium, cadmium, copper, lead, nickel, silver and zinc, were detected above the CRDL for this request.

Extractable organics. With the exception of two phthalates that were both present in the blanks, no estimated concentration of any identifiable compound exceeded 1 mg/kg. No other compounds were identified in measureable quantities except for Benzo(g,h) perylene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d)pyrene in sample BR806148. Unknown alkene ethers frequently had estimated concentrations as high as 100 mg/kg and 1 gm/kg. An unknown in BR806104 had an estimated concentration of 1.4 gm/kg.

Volatile organics. Carbon tetrachloride was detected below the quantitation limit in sample BR806104. Chloroform was detected in all samples and also in the blanks. It was below the quantitation limit in several samples. Methylene chloride was detected in all but one sample and was also detected in the blanks. Toluene was detected below the quantitation limit in two samples. Some 1,1,1-trichloroethane was present in BR806046, and some 1,1,2,2-tetrachloroethane was detected below the quantitation limit in BR806115. Acetone was identified in four samples and also in the blank. Except as noted under Analytical Data, above, measured or estimated concentrations of all positively identified compounds in these samples were always less than 0.100 mg/kg. Several TICs, including seven probable aromatic hydrocarbons, were detected in sample BR806115. No estimated concentration of any TIC in these samples was as great as 1 mg/kg.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample

results were within 10% of their true value, radiological data are considered reliable.

Request 807:

Metals. One metal of interest, zinc, was detected above the CRDL for this request.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. No identifiable compounds were detected for Request 807. Tentatively identified compounds were identified in estimated concentrations of 0.014 mg/L or less.

Volatile organics. No positively identified volatile compound was present in measurable quantities. Chloroform was present in all samples and also in the blank. Toluene was detected in one sample. Some 1,1,1-trichloroethane was detected in two samples. One compound, tentatively identified as a freon, occurred in two samples.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 809:

Metals. Two metals of interest, chromium and zinc, were detected above the CRDL for this request.

Extractable organics. There were two phthalates identified in the samples and in the blank. Concentrations in samples were always 0.15 mg/L or less. No other semivolatile compounds were positively identified. Estimated concentrations of unknowns were also always less than 1 mg/L.

Volatile organics. Chloroform was measured in half the samples. Methylene chloride appeared in one sample. Toluene occurred in all samples. Some 1,1,1-trichloroethane was identified in two samples. All measured or estimated concentrations of volatile organic compounds were 0.011 mg/L or less.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

Request 810: No samples were analyzed for this request.

4.16.4 Limitations and Qualifications

Data Quality Level:

Request 806: The sampling plan for Request 806 is rated Quality Level I. The field sampling for Request 806 is rated Quality Level I. The overall analytical rating is Quality Level I.

Request 807: The sampling plan for Request 807 is rated Quality Level I. The field sampling for Request 807 is rated Quality Level I. The overall analytical rating is Quality Level I.

Request 809: The sampling plan for Request 809 is rated Quality Level I. The field sampling for Request 809 is rated Quality Level II. The overall analytical rating is Quality Level I.

Request 810: The sampling plan for Request 810 is rated Quality Level I. The field sampling for Request 810 is rated Quality Level II. An overall analytical rating is not applicable since no analysis was performed.

Field Data:

Request 806:

Request 807: Although the field sampling team did not take FID readings for Request 807, the care and conscientious sampling for the laboratory analysis more than made up for the minor oversight.

Request 809: In request 809, the documentation is lacking and the sampling plan was not followed. However, although the 24 hour waiting after well development was not followed, purging of the well was performed and the samples were taken after purge volumes of 50 to 250 gallons.

Request 810: Although samples were not collected in Request 810, lithologic description was provided for Wells 557 and 558.

Analytical Data:

Request 806:

Metals. Analytical results for the first 14 samples were Quality Level I, except for antimony, chromium, and nickel at Level II, and arsenic and beryllium at

Level III. Recovery of antimony, chromium, nickel and arsenic from the spiked sample fell below the control limit. Beryllium was recovered from the laboratory control standard above the control limit. Sample BR806159 results were Quality Level I with the exception of aluminum which was Quality Level II; and arsenic and zinc which were Quality Level III. Aluminum calibration verification results exceeded the control limit. Arsenic was recovered below the control limit from the spiked sample. Zinc was present above the CRDL in the preparation blank.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 807:

Metals. Analytical results were Quality Level I, except for aluminum and sodium at Level II, and arsenic and beryllium at Level III. Aluminum calibration verification results exceeded the control limit. Sodium was recovered from the laboratory control sample above the control limit and the serial dilution result did not meet the 10% criteria. Arsenic was recovered from the spiked sample below the control limit. Beryllium was present below the CRDL in the calibration blank.

PCBs and other extractables. This analyte was not detected for this request.

Extractable organics. Data are Quality Level I.

Volatile organics. Data are Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 809:

Metals. Analytical results were Quality Level I, except for iron and sodium at Level II, and arsenic at Level III. Iron was observed above the control limit and sodium was observed below the control limit in the calibration verification results. Arsenic was recovered from the spiked sample below the control limit.

Extractable organics. Data are Quality Level II because extraction holding times were exceeded by two days.

Volatile organics. Data are Quality Level I.

Radiochemistry. Radiological results were assigned a Quality Level I.

Request 810: No samples were analyzed for this request.

Environmental Problem: 10
Request Number: 806

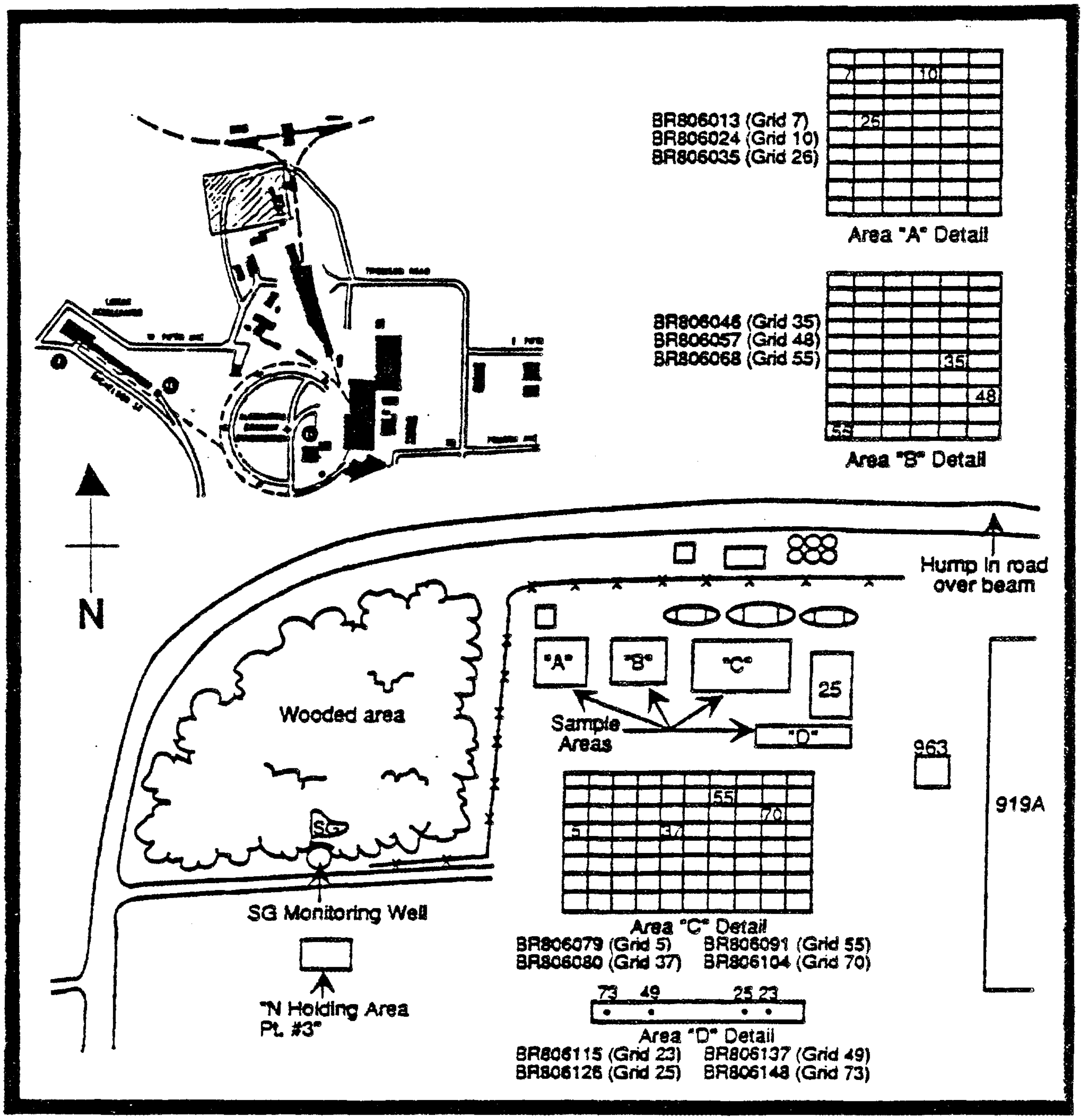

Figure 4.10a. Well SG in the Bubble Area (Request 806)

Environmental Problem: 10
Request Number: 807

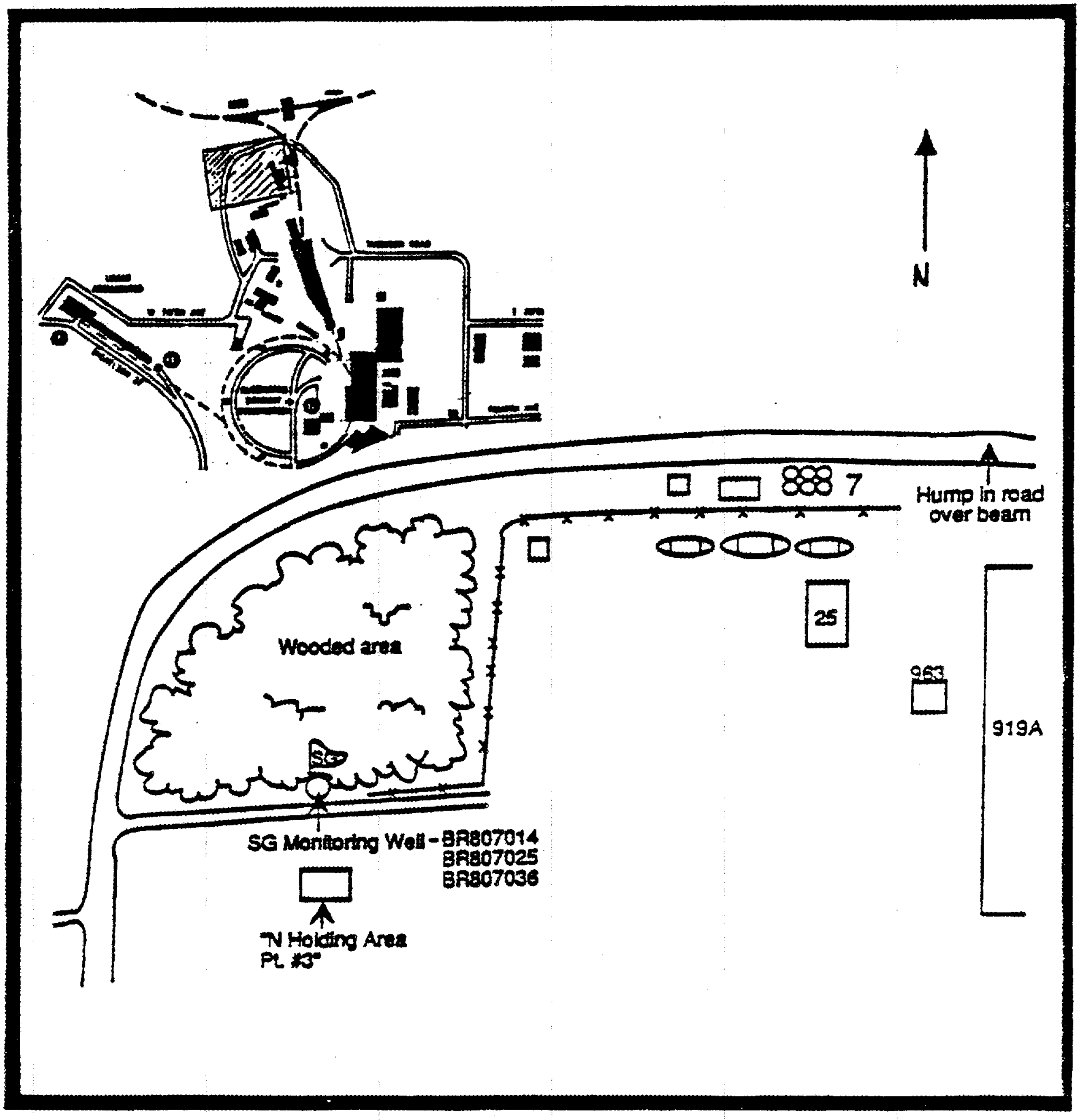

Figure 4.10b. Well SG in the Bubble Area (Request 807)

Environmental Problem: 10
Request Number: 809

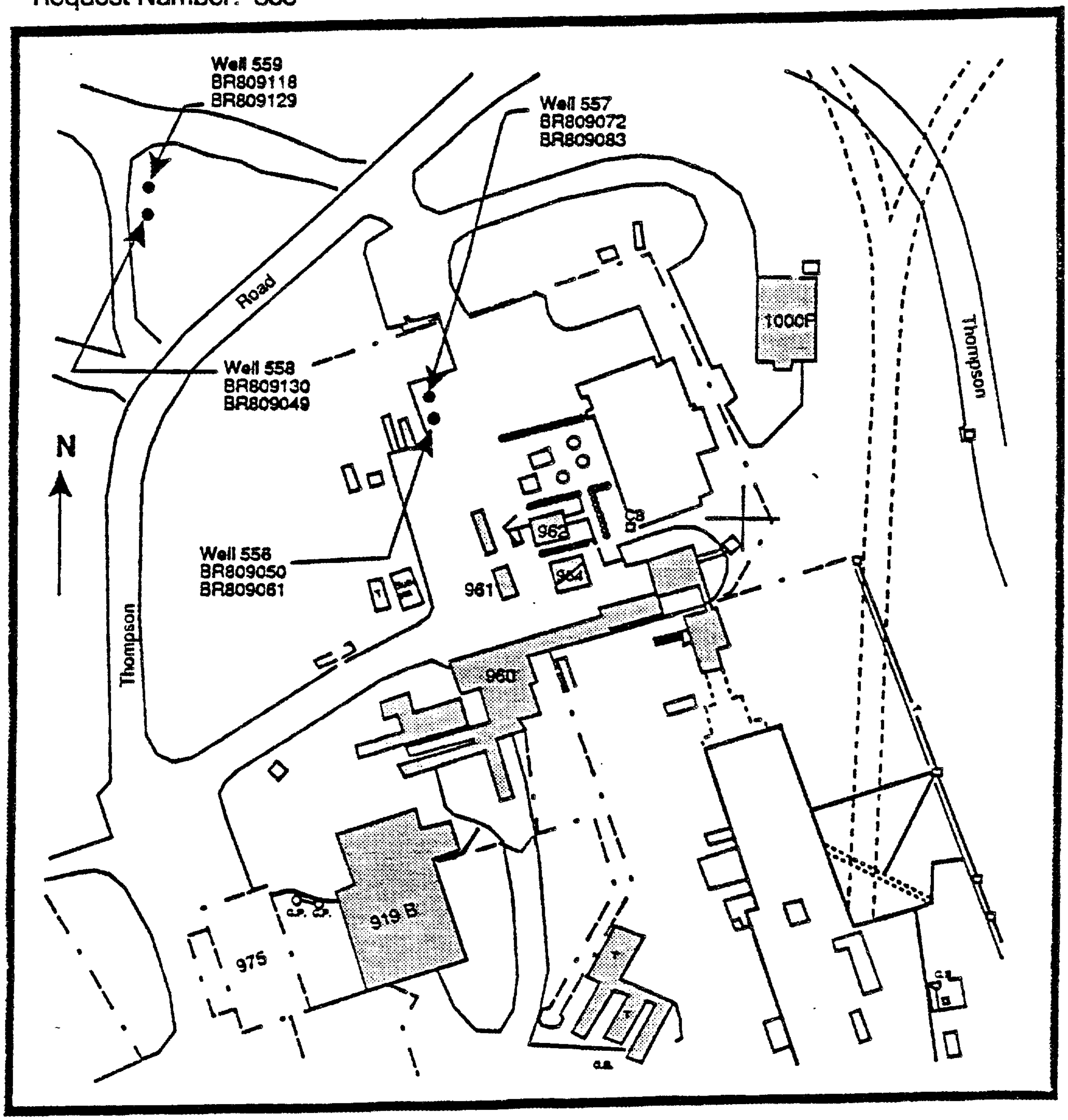

Figure 4.10c. Four New Wells Near the B-975 Bubble-chamber Area Water (Request 809)

Environmental Problem: 10
Request Number: 810

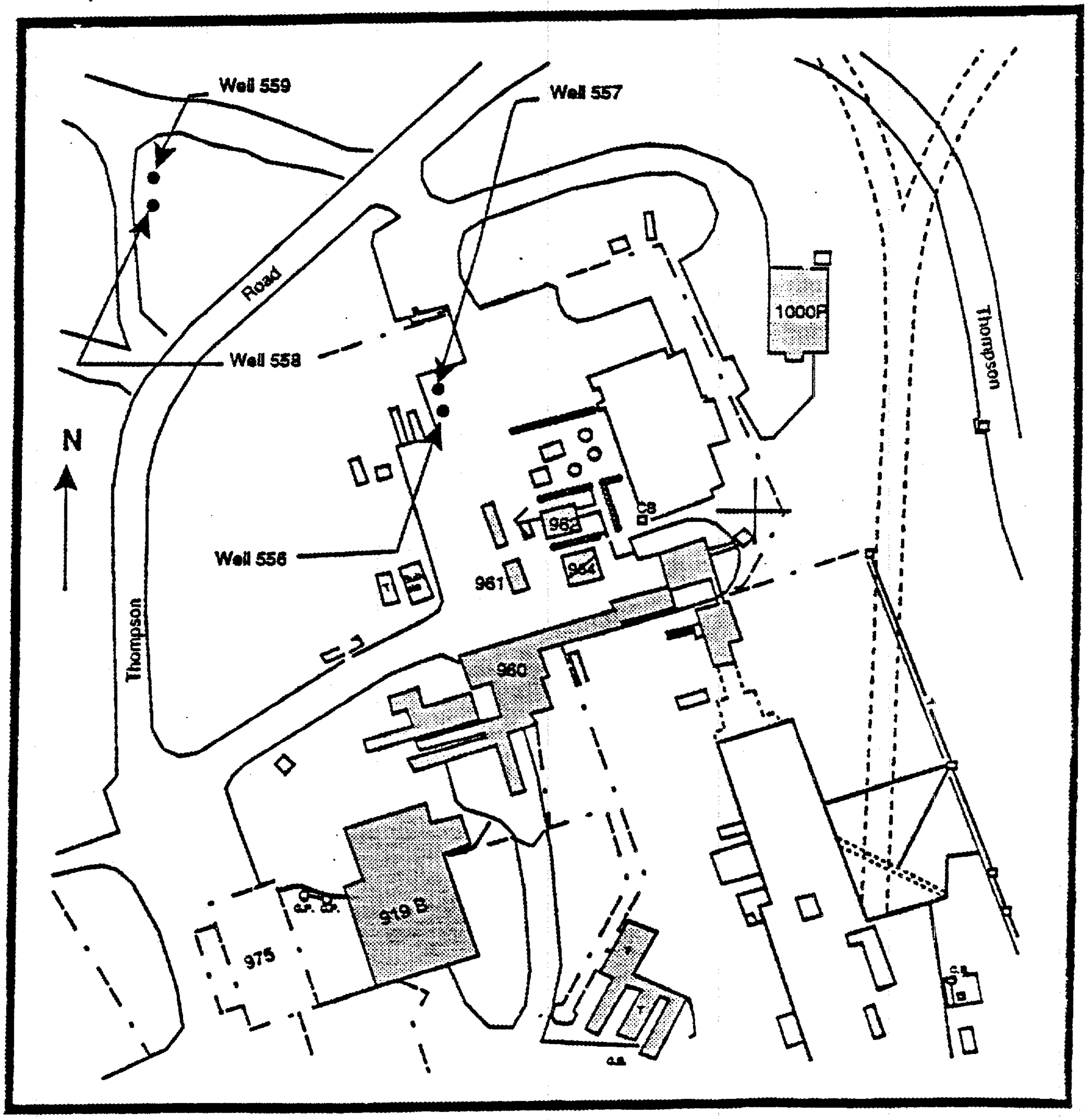

Figure 4.10d. Four New Wells Near the B-975 Bubble-chamber Area - Soil. (No samples were analyzed because none registered over 5 ppm when measured for OVAs.) (Request 810)

TABLE 4.2.10 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 10

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS NUMB HITS	ANIONS NUMB ANAL	METALS NUMB HITS	METALS NUMB ANAL	O&G NUMB HITS	O&G NUMB ANAL	PET HYDRO NUMB HITS	PET HYDRO NUMB ANAL	PES/H/PCB NUMB HITS	PES/H/PCB NUMB ANAL	SEMIVOLS NUMB HITS	SEMIVOLS NUMB ANAL	VOLS NUMB HITS	VOLS NUMB ANAL	RADS NUMB HITS	RADS NUMB ANAL
BR809	B-975	WELL	WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
BR809	B-975	WELL	WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
		MED TOTAL		2	2		0	0	2	2	0	0	0	0	0	0	1	1	1	1	2	2
BR806	B. 975	BUBBLE ARE	SOIL	14	14	GRAB	0	0	14	14	0	0	0	0	0	0	14	14	14	14	14	14
BR810	B. 975	WELLS	SOIL	5	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		MED TOTAL		19	14		0	0	14	14	0	0	0	0	0	0	14	14	14	14	14	14
BR806	B. 975	BUBBLE ARE	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
		MED TOTAL		1	1		0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
BR807	B-975	WELL	GRN WATER	3	3	BAILR	0	0	3	3	0	0	0	0	0	3	3	3	3	3	3	3
BR807	B-975	WELL	GRN WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
BR809	B-975	WELL	GRN WATER	8	8	PUMP	0	0	8	8	0	0	0	0	0	0	8	8	8	8	8	8
		MED TOTAL		12	12		0	0	12	12	0	0	0	0	0	3	11	11	11	11	12	12
		EP TOTAL		34	29		0	0	29	29	0	0	0	0	0	3	27	27	27	27	29	29

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 — DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:					
	BR806013	BR806024	BR806035	BR806046	BR806057	BR806068
RADIOACTIVIT (CPM)	40	40	40	30	40	30

FIELD MEASUREMENTS	SAMP NO:					
	BR806079	BR806080	BR806091	BR806104	BR806115	BR806126
RADIOACTIVIT (CPM)	30	30	30	20	20	20

FIELD MEASUREMENTS	SAMP NO:					
	BR806137	BR806148				
RADIOACTIVIT (CPM)	20	20				

METALS, INCLUDING CR+6 (MG/KG)						
SAMP NO:	BR806013C	BR806013C	BR806024C	BR806024C	BR806035C	BR806035C
SDG NO:	BR806013C	BR806013K	BR806013C	BR806013K	BR806013C	BR806013K
TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM	19500		9500		7240	
ARSENIC	11 UN		8.9 UN		9 UN	
BARIUM	46		25 B		22 B	
BERYLLIUM	1.8 E		1.5 E		1.9 E	
CADMIUM	3.7		2.2		33	
CALCIUM	89100 *		125000 *		128000 *	
CHROMIUM	27 NE		11 NE		8.6 NE	
COBALT	6.9 BE		4 BE		3.3 BE	
COPPER	24		15		118	
IRON	23600 E		12900 E		9880 E	
LEAD	92 N		50 N		55 N	
MAGNESIUM	47800		69100		70900	
MANGANESE	304		183		180	
NICKEL	16 N*E		9.5 N*E		9.2 N*E	
POTASSIUM		1400		960		1000
SILVER	1.8 B		1.6		1.5 B	
SODIUM	401 B		425 B		520 B	
VANADIUM	38 E		19 E		16 E	
ZINC	270 E		96 E		122 E	

METALS, INCLUDING CR+6 (MG/KG)						
SAMP NO:	BR806046C	BR806046C	BR806057C	BR806057C	BR806068C	BR806068C
SDG NO:	BR806013C	BR806013K	BR806013C	BR806013K	BR806013C	BR806013K
TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM	7260		4180		9230	
ARSENIC	8.5 UN		9.3 BN		8.2 UN	

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA   DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: BR806046C SDG NO: BR806013C TYPE: GRAB	BR806046C BR806013K GRAB	BR806057C BR806013C GRAB	BR806057C BR806013K GRAB	BR806068C BR806013C GRAB	BR806068C BR806013K GRAB
BARIUM	23 B		16 B		21 B	
BERYLLIUM	1.3 E		1.4 E		0.98 E	
CADMIUM	1.2		0.54 B		1.8	
CALCIUM	96600 *		150000 *		23300 *	
CHROMIUM	12 NE		6.3 NE		11 NE	
COBALT	3.9 BE		2.5 BE		3 BE	
COPPER	23		12		13	
IRON	9990 E		7670 E		10300 E	
LEAD	22 BN		12 BN		22 BN	
MAGNESIUM	51800		82400		13600	
MANGANESE	163		159		109	
NICKEL	10 N*E		6.7 N*E		7.9 N*E	
POTASSIUM		700 B		940		540 B
SILVER	1.9		1.5		0.82 U	
SODIUM	398 B		561 B		138 B	
VANADIUM	18 E		12 E		21 E	
ZINC	86 E		46 E		55 E	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: BR806079C SDG NO: BR806013C TYPE: GRAB	BR806079C BR806013K GRAB	BR806080C BR806013C GRAB	BR806080C BR806013K GRAB	BR806091C BR806013C GRAB	BR806091C BR806013K GRAB
ALUMINUM	7670		1910		2530	
ARSENIC	8.3 UN		11 BN		8 UN	
BARIUM	18 B		9.8 B		12 B	
BERYLLIUM	0.96 E		1.4 E		1.2 E	
CADMIUM	0.53 B		0.36 B		0.39 B	
CALCIUM	29300 *		177000 *		131000 *	
CHROMIUM	8.6 NE		4.4 NE		11 NE	
COBALT	2.4 BE		2 BE		2.6 BE	
COPPER	8		8.8		16	
IRON	9120 E		5570 E		16600 E	
LEAD	20 BN		23 BN		6.7 UN	
MAGNESIUM	16500		93700		72000	
MANGANESE	86		130		174	
NICKEL	7.3 N*E		5.7 N*E		13 N*E	
POTASSIUM		520 B		990		940
SILVER	0.83 U		1.7		1.4	
SODIUM	147 B		582 B		442 B	
VANADIUM	20 E		6.4 BE		8.3 E	
ZINC	36 E		31 E		26 E	

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806104C / BR806013C / GRAB	BR806104C / BR806013K / GRAB	BR806115C / BR806013C / GRAB	BR806115C / BR806013K / GRAB	BR806126C / BR806013C / GRAB	BR806126C / BR806013K / GRAB
ALUMINUM		8320		5010		3730	
ARSENIC		8.6 UN		8.3 UN		8.3 UN	
BARIUM		40		40		21 B	
BERYLLIUM		1.6 E		1.8 E		1.4 E	
CADMIUM		1.1		0.75		0.53 B	
CALCIUM		80100 *		99400 *		141000 *	
CHROMIUM		33 NE		44 NE		23 NE	
COBALT		20 E		21 E		9.5 E	
COPPER		115		129		53	
IRON		23800 E		14900 E		9540 E	
LEAD		121 N		66 N		21 BN	
MAGNESIUM		45000		55900		77100	
MANGANESE		168		170		160	
NICKEL		64 N*E		60 N*E		25 N*E	
POTASSIUM			850		1000		970
SILVER		1.5		1.4		1.4 B	
SODIUM		391 B		784		686 B	
VANADIUM		19 E		25 E		17 E	
ZINC		396 E		427 E		165 E	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806137C / BR806013C / GRAB	BR806137C / BR806013K / GRAB	BR806148C / BR806013C / GRAB	BR806148C / BR806013K / GRAB		
ALUMINUM		9650		7920			
ARSENIC		8.3 UN		9.1 UN			
BARIUM		56		114			
BERYLLIUM		1.8 E		3.3 E			
CADMIUM		1.2		1.3			
CALCIUM		56600 *		40800 *			
CHROMIUM		73 NE		105 NE			
COBALT		31 E		65 E			
COPPER		200		408			
IRON		18000 E		28000 E			
LEAD		154 N		200 N			
MAGNESIUM		31400		22300			
MANGANESE		204		273			
NICKEL		118 N*E		195 N*E			
POTASSIUM			810		930		
SILVER		1.8		1.5			
SODIUM		611 B		1340			

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA — DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	BR806137C	BR806137C	BR806148C	BR806148C		
	SDG NO:	BR806013C	BR806013K	BR806013C	BR806013K		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
VANADIUM		32 E		54 E			
ZINC		608 E		1020 E			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR806013B	BR806024B	BR806035B	BR806046B	BR806057B	BR806068B
	SDG NO:	BR806013B	BR806013B	BR806013B	BR806013B	BR806013B	BR806013B
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)ANTHRACENE		440 U	390 U	440 U	73 J	350 U	370 U
BENZO(A)PYRENE		440 U	390 U	440 U	210 JB	350 U	370 U
BENZO(B)FLUORANTHENE		440 U	390 U	440 U	170 JB	350 U	370 U
BENZO(G,H,I)PERYLENE		440 U	390 U	440 U	220 J	350 U	370 U
BENZO(K)FLUORANTHENE		440 U	390 U	440 U	130 J	350 U	370 U
BIS(2-ETHYLHEXYL)PHTHALATE		140 JB	1000 B	210 JB	84000 BE	1100 B	360 JB
BUTYLBENZYLPHTHALATE		100 JB	390 U	440 U	170 JB	350 U	370 U
CHRYSENE		440 U	390 U	440 U	110 J	350 U	370 U
DI-N-BUTYLPHTHALATE		67 JB	65 JB	62 JB	230 JB	350 U	64 JB
DI-N-OCTYLPHTHALATE		72 JB	390 U	440 U	2000 B	65 JB	37 JB
DIBENZ(A,H)ANTHRACENE		440 U	390 U	440 U	250 J	350 U	370 U
DIETHYLPHTHALATE		20 J	390 U	440 U	82 J	350 U	370 U
FLUORANTHENE		56 JB	80 JB	52 JB	440 U	350 U	32 JB
INDENO(1,2,3-CD)PYRENE		48 J	390 U	440 U	330 J	350 U	370 U
PHENANTHRENE		35 J	390 U	440 U	43 J	350 U	370 U
PYRENE		74 JB	110 JB	52 JB	82 JB	350 U	28 JB
* ALDOL-CONDENSATION PROD(4.72)							
* ALDOL-CONDENSATION PROD(4.74)							
* ALDOL-CONDENSATION PROD(4.79)			150 JA				
* ALDOL-CONDENSATION PROD(4.84)		1100 JA					
* ALDOL-CONDENSATION PROD(4.86)							
* ALDOL-CONDENSATION PROD(4.90)							
* ALDOL-CONDENSATION PROD(4.94)							
* ALICYCLIC ALCOHOL/STERO(35.30)		1300 JB					
* ALICYCLIC ALCOHOL/STERO(36.80)		940 JB					
* ALICYCLIC ALCOHOL/STERO(37.00)		520 JB					
* ALICYCLIC ALCOHOL/STERO(37.70)		1800 JB					
* ALICYCLIC ALCOHOL/STERO(37.90)		4300 JB					
* ALICYCLIC ALCOHOL/STERO(39.90)		620 JB					
* ALICYCLIC HYDROCARBON(9.48)							
* ALKYL HYDROCARBON (6.86)							
* ALKYL HYDROCARBON(4.94)						280 J	
* ALKYL HYDROCARBON(5.01)							140 J
* ALKYL HYDROCARBON(5.79)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806013B / BR806013B / GRAB	BR806024B / BR806013B / GRAB	BR806035B / BR806013B / GRAB	BR806046B / BR806013B / GRAB	BR806057B / BR806013B / GRAB	BR806068B / BR806013B / GRAB
* ALKYL HYDROCARBON(5.83)							
* ALKYL HYDROCARBON(5.90)							150 J
* ALKYL HYDROCARBON(5.92)							
* ALKYL HYDROCARBON(6.39)							
* ALKYL HYDROCARBON(6.42)						700 J	
* ALKYL HYDROCARBON(6.45)							
* ALKYL HYDROCARBON(6.46)							
* ALKYL HYDROCARBON(6.47)				1900 J			
* ALKYL HYDROCARBON(6.48)							900 J
* ALKYL HYDROCARBON(6.50)							
* ALKYL HYDROCARBON(6.51)					620 J		
* ALKYL HYDROCARBON(6.61)				750 JB			
* ALKYL HYDROCARBON(6.62)							200 JB
* ALKYL HYDROCARBON(6.64)			460 JB				
* ALKYL HYDROCARBON(6.65)							
* ALKYL HYDROCARBON(6.66)							
* ALKYL HYDROCARBON(6.67)						1300 J	
* ALKYL HYDROCARBON(6.68)		1800 JB					
* ALKYL HYDROCARBON(6.70)				2500 JB			
* ALKYL HYDROCARBON(6.71)							1900 JB
* ALKYL HYDROCARBON(6.72)							
* ALKYL HYDROCARBON(6.73)							
* ALKYL HYDROCARBON(6.75)					1500 JB		
* ALKYL HYDROCARBON(6.81)							
* ALKYL HYDROCARBON(6.85)			360 J				
* ALKYL HYDROCARBON(6.87)		1400 JB				1100 J	420 JB
* ALKYL HYDROCARBON(6.88)							
* ALKYL HYDROCARBON(6.90)							
* ALKYL HYDROCARBON(6.91)				2400 JB			
* ALKYL HYDROCARBON(6.92)							1400 JB
* ALKYL HYDROCARBON(6.94)					1300 JB		
* ALKYL HYDROCARBON(22.00)							
* ALKYL HYDROCARBON(22.70)							
* ALKYL HYDROCARBON(22.80)							
* ALKYL HYDROCARBON(22.90)							
* ALKYL HYDROCARBON(23.40)							
* ALKYL HYDROCARBON(24.20)							
* ALKYL HYDROCARBON(24.30)							
* ALKYL HYDROCARBON(24.60)							
* ALKYL HYDROCARBON(24.70)							
* ALKYL HYDROCARBON(25.40)							
* ALKYL HYDROCARBON(25.50)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806013B / BR806013B / GRAB	BR806024B / BR806013B / GRAB	BR806035B / BR806013B / GRAB	BR806046B / BR806013B / GRAB	BR806057B / BR806013B / GRAB	BR806068B / BR806013B / GRAB
* ALKYL HYDROCARBON(26.00)							
* ALKYL HYDROCARBON(26.70)							
* CHLORINATED HYDROCARBON(7.84)							
* DIACETONE ALCOHOL (6.01)			9500 JAB				
* DIACETONE ALCOHOL (6.09)							
* DIACETONE ALCOHOL (6.12)						20000 JAB	
* DIACETONE ALCOHOL (6.18)							
* DIACETONE ALCOHOL (6.22)							
* DIACETONE ALCOHOL (6.37)		28000 JAB					
* DIACETONE ALCOHOL (6.55)							
* DIACETONE ALCOHOL(6.16)							
* DIACETONE ALCOHOL(6.20)							
* DIACETONE ALCOHOL(6.21)							25000 JAB
* DIACETONE ALCOHOL(6.22)				34000 JAB			
* DIACETONE ALCOHOL(6.28)					21000 JAB		
* DIOCTYL ADIPATE *(31.20)				1800 J			
* DIOCTYL ADIPATE(31.10)						1400 JB	
* DIOCTYL ADIPATE(31.20)		1800 JB	1900 JB		1800 JB		
* HEXAMETHYLCYCLOTRISILOX(5.72)		1100 J					
* HEXAMETHYLCYCLOTRISILOX(5.74)				320 J			
* HEXAMETHYLCYCLOTRISILOX(5.75)							
* HEXAMETHYLCYCLOTRISILOX(5.76)							160 J
* HYDROXY AROMATIC HYDROC(18.40)							
* HYDROXY AROMATIC HYDROC(19.00)							
* HYDROXY AROMATIC HYDROC(37.30)							
* PHENYL HYDROCARBON(20.00)			380 J				
* UNKNOWN *(30.50)							
* UNKNOWN ALKENE/ETHER/AL(4.86)							
* UNKNOWN ALKENE/ETHER/AL(4.90)							
* UNKNOWN ALKENE/ETHER/AL(18.50)			150 J				
* UNKNOWN ALKENE/ETHER/AL(22.10)							
* UNKNOWN ALKENE/ETHER/AL(24.00)							
* UNKNOWN ALKENE/ETHER/AL(25.3)							
* UNKNOWN ALKENE/ETHER/AL(25.30)					9 J		
* UNKNOWN ALKENE/ETHER/AL(25.40)						390 J	
* UNKNOWN ALKENE/ETHER/AL(26.00)							
* UNKNOWN ALKENE/ETHER/AL(30.10)							
* UNKNOWN ALKENE/ETHER/AL(30.60)							
* UNKNOWN ALKENE/ETHER/AL(30.8)							
* UNKNOWN ALKENE/ETHER/AL(32.4)							
* UNKNOWN ALKENE/ETHER/AL(34.90)							
* UNKNOWN ALKENE/ETHER/AL(35.7)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806013B / BR806013B / GRAB	BR806024B / BR806013B / GRAB	BR806035B / BR806013B / GRAB	BR806046B / BR806013B / GRAB	BR806057B / BR806013B / GRAB	BR806068B / BR806013B / GRAB
* UNKNOWN ALKENE/ETHER/AL(36.30)							
* UNKNOWN ALKENE/ETHER/AL(36.50)		140000 J	3400000 J				
* UNKNOWN ALKENE/ETHER/AL(37.0)				430000 J			
* UNKNOWN ALKENE/ETHER/AL(37.3)							56000 J
* UNKNOWN KETONE(5.35)						600 J	
* UNKNOWN KETONE(6.45)			1500 J				
* UNKNOWN KETONE(6.48)							
* UNKNOWN KETONE(6.50)						2900 JB	
* UNKNOWN KETONE(6.51)		5200 JB					
* UNKNOWN KETONE(6.52)							
* UNKNOWN KETONE(6.54)				5700 JB			4000 JB
* UNKNOWN KETONE(6.55)							
* UNKNOWN KETONE(6.59)					3400 JB		
* UNKNOWN KETONE(8.12)		370 J					
* UNKNOWN KETONE(8.25)							
* UNKNOWN KETONE(9.06)							
* UNKNOWN KETONE(18.20)			150 J				
* UNKNOWN PHTHALATE ESTER(24.90)							
* UNKNOWN PHTHALATE ESTER(25.00)							
* UNKNOWN PHTHALATE ESTER(26.10)						130 J	
* UNKNOWN PHTHALATE ESTER(31.10)							
* UNKNOWN PHTHALATE ESTER(32.60)							
* UNKNOWN PHTHALATE ESTER(32.70)							
* UNKNOWN PHTHALATE ESTER(33.00)							
* UNKNOWN PHTHALATE ESTER(33.70)							
* UNKNOWN PHTHALATE ESTER(33.80)							
* UNKNOWN PHTHALATE ESTER(35.50)							
* UNKNOWN PHTHALATE ESTER(35.60)							
* UNKNOWN PHTHALATE ESTER(36.10)					95 J		
* UNKNOWN PHTHALATE ESTER(36.20)							
* UNKNOWN PHTHALATE ESTER(37.70)					40 J	23 J	
* UNKNOWN PHTHALATE ESTER(37.80)							
* UNKNOWN PHTHALATE ESTER(39.60)							
* UNKNOWN(3.71)				250 J			
* UNKNOWN(5.31)							
* UNKNOWN(5.33)							
* UNKNOWN(5.40)							
* UNKNOWN(5.41)				1200 JB			
* UNKNOWN(5.42)							600 JB
* UNKNOWN(5.44)							
* UNKNOWN(5.45)							
* UNKNOWN(5.47)					600 JB		

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806013B BR806013B GRAB	BR806024B BR806013B GRAB	BR806035B BR806013B GRAB	BR806046B BR806013B GRAB	BR806057B BR806013B GRAB	BR806068B BR806013B GRAB
* UNKNOWN(5.67)		490 J					
* UNKNOWN(5.88)							
* UNKNOWN(5.95)							
* UNKNOWN(6.39)			160 J				
* UNKNOWN(6.61)							
* UNKNOWN(8.00)							
* UNKNOWN(8.01)						230 J	
* UNKNOWN(8.04)				410 J			
* UNKNOWN(8.05)							270 J
* UNKNOWN(8.06)					210 J		
* UNKNOWN(8.07)							
* UNKNOWN(8.34)							
* UNKNOWN(8.35)						620 J	
* UNKNOWN(8.36)			170 J				
* UNKNOWN(8.38)				980 J			
* UNKNOWN(8.39)							870 J
* UNKNOWN(8.40)					610 J		
* UNKNOWN(8.57)							
* UNKNOWN(8.88)						250 J	
* UNKNOWN(8.89)			250 J	360 J			
* UNKNOWN(8.90)							
* UNKNOWN(8.91)					250 J		380 J
* UNKNOWN(8.96)		810 J					
* UNKNOWN(9.04)							
* UNKNOWN(9.06)			160 J				
* UNKNOWN(9.59)				250 J			
* UNKNOWN(11.60)			120 J				
* UNKNOWN(18.70)			120 J				
* UNKNOWN(19.20)			150 J				
* UNKNOWN(20.50)							
* UNKNOWN(22.40)			260 J				
* UNKNOWN(25.60)							
* UNKNOWN(26.10)		250 J	890 J				
* UNKNOWN(31.90)						34 J	
* UNKNOWN(35.00)							
* UNKNOWN(35.20)							28 J
* UNKNOWN(35.30)							
* UNKNOWN(35.40)							
* UNKNOWN(36.00)							
* UNKNOWN(36.60)							94 J
* UNKNOWN(36.90)							33 J
* UNKNOWN(37.00)						24 J	

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR806013B	BR806024B	BR806035B	BR806046B	BR806057B	BR806068B
	SDG NO:	BR806013B	BR806013B	BR806013B	BR806013B	BR806013B	BR806013B
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
* UNKNOWN(37.60)							
* UNKNOWN(38.00)							
* UNKNOWN(38.10)							
* UNKNOWN(40.00)							
* UNKNOWN(41.30)							
* UNKNOWN(41.60)		300 J					
* UNKNOWN(42.50)							
* UNKOWN KETONE(6.54)							

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR806079B	BR806080B	BR806091B	BR806104B	BR806115B	BR806126B
	SDG NO:	BR806013B	BR806013B	BR806013B	BR806013B	BR806013B	BR806013B
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BENZO(A)ANTHRACENE		370 U	360 U	350 U	370 U	370 U	360 U
BENZO(A)PYRENE		370 U	360 U	350 U	370 U	370 U	360 U
BENZO(B)FLUORANTHENE		370 U	360 U	350 U	370 U	370 U	360 U
BENZO(G,H,I)PERYLENE		370 U	360 U	350 U	370 U	370 U	360 U
BENZO(K)FLUORANTHENE		67 J	360 U	350 U	370 U	370 U	360 U
BIS(2-ETHYLHEXYL)PHTHALATE		460 B	290 JB	460 B	840 B	990 B	380 B
BUTYLBENZYLPHTHALATE		370 U	360 U	350 U	370 U	72 JB	52 JB
CHRYSENE		370 U	360 U	350 U	370 U	370 U	360 U
DI-N-BUTYLPHTHALATE		57 JB	63 JB	350 U	180 JB	300 JB	310 JB
DI-N-OCTYLPHTHALATE		17 JB	360 U	350 U	370 U	370 U	37 JB
DIBENZ(A,H)ANTHRACENE		370 U	360 U	350 U	370 U	370 U	360 U
DIETHYLPHTHALATE		370 U	360 U	350 U	370 U	24 J	360 U
FLUORANTHENE		69 JB	360 U	350 U	370 U	91 JB	82 JB
INDENO(1,2,3-CD)PYRENE		370 U	360 U	350 U	370 U	370 U	360 U
PHENANTHRENE		370 U	360 U	350 U	36 J	40 J	43 J
PYRENE		65 JB	360 U	350 U	76 JB	85 JB	68 JB
* ALDOL-CONDENSATION PROD(4.72)					610 JA		
* ALDOL-CONDENSATION PROD(4.74)				660 JA			
* ALDOL-CONDENSATION PROD(4.79)							
* ALDOL-CONDENSATION PROD(4.84)							
* ALDOL-CONDENSATION PROD(4.86)		140 JA					
* ALDOL-CONDENSATION PROD(4.90)							140 JA
* ALDOL-CONDENSATION PROD(4.94)							
* ALICYCLIC ALCOHOL/STERO(35.30)							
* ALICYCLIC ALCOHOL/STERO(36.80)							
* ALICYCLIC ALCOHOL/STERO(37.00)							
* ALICYCLIC ALCOHOL/STERO(37.70)							
* ALICYCLIC ALCOHOL/STERO(37.90)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: SDG NO: TYPE:	BR806079B BR806013B GRAB	BR806080B BR806013B GRAB	BR806091B BR806013B GRAB	BR806104B BR806013B GRAB	BR806115B BR806013B GRAB	BR806126B BR806013B GRAB
* ALICYCLIC ALCOHOL/STERO(39.90)							
* ALICYCLIC HYDROCARBON(9.48)							
* ALKYL HYDROCARBON (6.86)				2200 J			
* ALKYL HYDROCARBON(4.94)							
* ALKYL HYDROCARBON(5.01)							
* ALKYL HYDROCARBON(5.79)					280 J		
* ALKYL HYDROCARBON(5.83)				280 J			
* ALKYL HYDROCARBON(5.90)							
* ALKYL HYDROCARBON(5.92)							
* ALKYL HYDROCARBON(6.39)					1400 J		
* ALKYL HYDROCARBON(6.42)				1400 J			
* ALKYL HYDROCARBON(6.45)							
* ALKYL HYDROCARBON(6.46)			390 J				1200 J
* ALKYL HYDROCARBON(6.47)							
* ALKYL HYDROCARBON(6.48)							
* ALKYL HYDROCARBON(6.50)							
* ALKYL HYDROCARBON(6.51)							
* ALKYL HYDROCARBON(6.61)							
* ALKYL HYDROCARBON(6.62)							
* ALKYL HYDROCARBON(6.64)							
* ALKYL HYDROCARBON(6.65)					3300 JB		
* ALKYL HYDROCARBON(6.66)				2800 JB			
* ALKYL HYDROCARBON(6.67)		1400 JB					
* ALKYL HYDROCARBON(6.68)							
* ALKYL HYDROCARBON(6.70)			890 JB				
* ALKYL HYDROCARBON(6.71)							1900 JB
* ALKYL HYDROCARBON(6.72)						1700 JB	
* ALKYL HYDROCARBON(6.73)							
* ALKYL HYDROCARBON(6.75)							
* ALKYL HYDROCARBON(6.81)			95 JB				
* ALKYL HYDROCARBON(6.85)					3000 J		
* ALKYL HYDROCARBON(6.87)							
* ALKYL HYDROCARBON(6.88)		1500 JB					
* ALKYL HYDROCARBON(6.90)			810 JB				1900 JB
* ALKYL HYDROCARBON(6.91)							
* ALKYL HYDROCARBON(6.92)							
* ALKYL HYDROCARBON(6.94)							
* ALKYL HYDROCARBON(22.00)						2300 J	
* ALKYL HYDROCARBON(22.70)						2200 J	
* ALKYL HYDROCARBON(22.80)						6400 J	
* ALKYL HYDROCARBON(22.90)						1400 J	
* ALKYL HYDROCARBON(23.40)						2600 J	

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806079B / BR806013B / GRAB	BR806080B / BR806013B / GRAB	BR806091B / BR806013B / GRAB	BR806104B / BR806013B / GRAB	BR806115B / BR806013B / GRAB	BR806126B / BR806013B / GRAB
* ALKYL HYDROCARBON(24.20)						1900 J	
* ALKYL HYDROCARBON(24.30)						7900 J	
* ALKYL HYDROCARBON(24.60)						1400 J	
* ALKYL HYDROCARBON(24.70)						1900 J	
* ALKYL HYDROCARBON(25.40)						3000 J	
* ALKYL HYDROCARBON(25.50)						2600 J	
* ALKYL HYDROCARBON(26.00)						1700 J	
* ALKYL HYDROCARBON(26.70)						1500 J	
* CHLORINATED HYDROCARBON(7.84)					130 J		
* DIACETONE ALCOHOL (6.01)							
* DIACETONE ALCOHOL (6.09)					23000 JAB		
* DIACETONE ALCOHOL (6.12)							
* DIACETONE ALCOHOL (6.18)							21000 JAB
* DIACETONE ALCOHOL (6.22)							
* DIACETONE ALCOHOL (6.37)							
* DIACETONE ALCOHOL (6.55)		39000 JAB					
* DIACETONE ALCOHOL(6.16)				26000 JAB			
* DIACETONE ALCOHOL(6.20)						23000 JAB	
* DIACETONE ALCOHOL(6.21)			15000 JAB				
* DIACETONE ALCOHOL(6.22)							
* DIACETONE ALCOHOL(6.28)							
* DIOCTYL ADIPATE *(31.20)							
* DIOCTYL ADIPATE(31.10)		1500 JB					800 JB
* DIOCTYL ADIPATE(31.20)				1400 JB			
* HEXAMETHYLCYCLOTRISILOX(5.72)							
* HEXAMETHYLCYCLOTRISILOX(5.74)							
* HEXAMETHYLCYCLOTRISILOX(5.75)							240 J
* HEXAMETHYLCYCLOTRISILOX(5.76)							
* HYDROXY AROMATIC HYDROC(18.40)				120 J	180 J		
* HYDROXY AROMATIC HYDROC(19.00)				120 J	240 J		
* HYDROXY AROMATIC HYDROC(37.30)							
* PHENYL HYDROCARBON(20.00)							
* UNKNOWN *(30.50)					1400000 J		
* UNKNOWN ALKENE/ETHER/AL(4.86)					170 J		
* UNKNOWN ALKENE/ETHER/AL(4.90)				190 J			
* UNKNOWN ALKENE/ETHER/AL(18.50)							
* UNKNOWN ALKENE/ETHER/AL(22.10)				210 J			
* UNKNOWN ALKENE/ETHER/AL(24.00)							
* UNKNOWN ALKENE/ETHER/AL(25.3)						180000 J	
* UNKNOWN ALKENE/ETHER/AL(25.30)							
* UNKNOWN ALKENE/ETHER/AL(25.40)							
* UNKNOWN ALKENE/ETHER/AL(26.00)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806079B / BR806013B / GRAB	BR806080B / BR806013B / GRAB	BR806091B / BR806013B / GRAB	BR806104B / BR806013B / GRAB	BR806115B / BR806013B / GRAB	BR806126B / BR806013B / GRAB
* UNKNOWN ALKENE/ETHER/AL(30.10)							
* UNKNOWN ALKENE/ETHER/AL(30.60)				1100000 J			
* UNKNOWN ALKENE/ETHER/AL(30.8)						410000 J	
* UNKNOWN ALKENE/ETHER/AL(32.4)							
* UNKNOWN ALKENE/ETHER/AL(34.90)							97000 J
* UNKNOWN ALKENE/ETHER/AL(35.7)			110000 J				
* UNKNOWN ALKENE/ETHER/AL(36.30)		46000 J					
* UNKNOWN ALKENE/ETHER/AL(36.50)							
* UNKNOWN ALKENE/ETHER/AL(37.0)							
* UNKNOWN ALKENE/ETHER/AL(37.3)							
* UNKNOWN KETONE(5.35)							
* UNKNOWN KETONE(6.45)					5100 J		
* UNKNOWN KETONE(6.48)				4600 J			
* UNKNOWN KETONE(6.50)							
* UNKNOWN KETONE(6.51)							
* UNKNOWN KETONE(6.52)							
* UNKNOWN KETONE(6.54)						3900 JB	4200 JB
* UNKNOWN KETONE(6.55)							
* UNKNOWN KETONE(6.59)							
* UNKNOWN KETONE(8.12)							
* UNKNOWN KETONE(8.25)		340 J					
* UNKNOWN KETONE(9.06)				300 J			
* UNKNOWN KETONE(18.20)							
* UNKNOWN PHTHALATE ESTER(24.90)		200 J					440 J
* UNKNOWN PHTHALATE ESTER(25.00)						2100 J	
* UNKNOWN PHTHALATE ESTER(26.10)							
* UNKNOWN PHTHALATE ESTER(31.10)			1400 J				
* UNKNOWN PHTHALATE ESTER(32.60)							
* UNKNOWN PHTHALATE ESTER(32.70)							
* UNKNOWN PHTHALATE ESTER(33.00)							
* UNKNOWN PHTHALATE ESTER(33.70)							
* UNKNOWN PHTHALATE ESTER(33.80)							
* UNKNOWN PHTHALATE ESTER(35.50)							
* UNKNOWN PHTHALATE ESTER(35.60)							
* UNKNOWN PHTHALATE ESTER(36.10)							
* UNKNOWN PHTHALATE ESTER(36.20)							
* UNKNOWN PHTHALATE ESTER(37.70)							
* UNKNOWN PHTHALATE ESTER(37.80)							
* UNKNOWN PHTHALATE ESTER(39.60)							
* UNKNOWN(3.71)							
* UNKNOWN(5.31)					840 J		
* UNKNOWN(5.33)				890 J			

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806079B / BR806013B / GRAB	BR806080B / BR806013B / GRAB	BR806091B / BR806013B / GRAB	BR806104B / BR806013B / GRAB	BR806115B / BR806013B / GRAB	BR806126B / BR806013B / GRAB
* UNKNOWN(5.40)			480 JB				
* UNKNOWN(5.41)							
* UNKNOWN(5.42)							
* UNKNOWN(5.44)							
* UNKNOWN(5.45)							280 JB
* UNKNOWN(5.47)							
* UNKNOWN(5.67)							
* UNKNOWN(5.88)		130 J					
* UNKNOWN(5.95)		380 J					
* UNKNOWN(6.39)							
* UNKNOWN(6.61)							350 J
* UNKNOWN(8.00)					250 J		
* UNKNOWN(8.01)							
* UNKNOWN(8.04)							
* UNKNOWN(8.05)			150 J				
* UNKNOWN(8.06)							
* UNKNOWN(8.07)							270 J
* UNKNOWN(8.34)					850 J		
* UNKNOWN(8.35)							
* UNKNOWN(8.36)				970 J			
* UNKNOWN(8.38)							
* UNKNOWN(8.39)			490 J				
* UNKNOWN(8.40)							810 J
* UNKNOWN(8.57)		930 J					
* UNKNOWN(8.88)				290 J	250 J		
* UNKNOWN(8.89)							
* UNKNOWN(8.90)			200 J				650 J
* UNKNOWN(8.91)							
* UNKNOWN(8.96)							
* UNKNOWN(9.04)		270 J					
* UNKNOWN(9.06)							
* UNKNOWN(9.59)							
* UNKNOWN(11.60)							
* UNKNOWN(18.70)							
* UNKNOWN(19.20)							
* UNKNOWN(20.50)					170 J		
* UNKNOWN(22.40)							
* UNKNOWN(25.60)						1400 J	
* UNKNOWN(26.10)							
* UNKNOWN(31.90)							
* UNKNOWN(35.00)			85 J				
* UNKNOWN(35.20)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806079B / BR806013B / GRAB	BR806080B / BR806013B / GRAB	BR806091B / BR806013B / GRAB	BR806104B / BR806013B / GRAB	BR806115B / BR806013B / GRAB	BR806126B / BR806013B / GRAB
* UNKNOWN(35.30)					1500 J		
* UNKNOWN(35.40)		45 J					
* UNKNOWN(36.00)		20 J					
* UNKNOWN(36.60)							
* UNKNOWN(36.90)							
* UNKNOWN(37.00)							
* UNKNOWN(37.60)		59 J					
* UNKNOWN(38.00)							
* UNKNOWN(38.10)					1100 J		
* UNKNOWN(40.00)		30 J					
* UNKNOWN(41.30)		28 J					
* UNKNOWN(41.60)							
* UNKNOWN(42.50)		32 J					
* UNKOWN KETONE(6.54)			2100 JB				

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806137B / BR806013B / GRAB	BR806148B / BR806013B / GRAB				
BENZO(A)ANTHRACENE		420 U	390 U				
BENZO(A)PYRENE		420 U	380 JB				
BENZO(B)FLUORANTHENE		420 U	290 JB				
BENZO(G,H,I)PERYLENE		420 U	510				
BENZO(K)FLUORANTHENE		420 U	270 J				
BIS(2-ETHYLHEXYL)PHTHALATE		12000 BE	1000 B				
BUTYLBENZYLPHTHALATE		330 JB	93 JB				
CHRYSENE		99 J	390 U				
DI-N-BUTYLPHTHALATE		330 JB	320 JB				
DI-N-OCTYLPHTHALATE		32000 BE	71 JB				
DIBENZ(A,H)ANTHRACENE		420 U	480				
DIETHYLPHTHALATE		35 J	390 U				
FLUORANTHENE		130 JB	110 JB				
INDENO(1,2,3-CD)PYRENE		420 U	480				
PHENANTHRENE		69 J	390 U				
PYRENE		110 JB	100 JB				
* ALDOL-CONDENSATION PROD(4.72)							
* ALDOL-CONDENSATION PROD(4.74)							
* ALDOL-CONDENSATION PROD(4.79)							
* ALDOL-CONDENSATION PROD(4.84)							
* ALDOL-CONDENSATION PROD(4.86)							
* ALDOL-CONDENSATION PROD(4.90)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	
	BR806137B	BR806148B
	BR806013B	BR806013B
	GRAB	GRAB
* ALDOL-CONDENSATION PROD(4.94)		110 JA
* ALICYCLIC ALCOHOL/STERO(35.30)		
* ALICYCLIC ALCOHOL/STERO(36.80)		
* ALICYCLIC ALCOHOL/STERO(37.00)		
* ALICYCLIC ALCOHOL/STERO(37.70)		
* ALICYCLIC ALCOHOL/STERO(37.90)		
* ALICYCLIC ALCOHOL/STERO(39.90)		
* ALICYCLIC HYDROCARBON(9.48)		91 J
* ALKYL HYDROCARBON (6.86)		
* ALKYL HYDROCARBON(4.94)		
* ALKYL HYDROCARBON(5.01)		
* ALKYL HYDROCARBON(5.79)		
* ALKYL HYDROCARBON(5.83)		
* ALKYL HYDROCARBON(5.90)		
* ALKYL HYDROCARBON(5.92)		99 J
* ALKYL HYDROCARBON(6.39)		
* ALKYL HYDROCARBON(6.42)		
* ALKYL HYDROCARBON(6.45)	1500 J	
* ALKYL HYDROCARBON(6.46)		
* ALKYL HYDROCARBON(6.47)		
* ALKYL HYDROCARBON(6.48)		
* ALKYL HYDROCARBON(6.50)		850 J
* ALKYL HYDROCARBON(6.51)		
* ALKYL HYDROCARBON(6.61)		
* ALKYL HYDROCARBON(6.62)		
* ALKYL HYDROCARBON(6.64)		
* ALKYL HYDROCARBON(6.65)		
* ALKYL HYDROCARBON(6.66)		
* ALKYL HYDROCARBON(6.67)		
* ALKYL HYDROCARBON(6.68)		
* ALKYL HYDROCARBON(6.70)	2900 JB	
* ALKYL HYDROCARBON(6.71)		
* ALKYL HYDROCARBON(6.72)		
* ALKYL HYDROCARBON(6.73)		1600 JB
* ALKYL HYDROCARBON(6.75)		
* ALKYL HYDROCARBON(6.81)		
* ALKYL HYDROCARBON(6.85)		
* ALKYL HYDROCARBON(6.87)		
* ALKYL HYDROCARBON(6.88)		
* ALKYL HYDROCARBON(6.90)	2400 JB	
* ALKYL HYDROCARBON(6.91)		
* ALKYL HYDROCARBON(6.92)		1300 JB

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806137B / BR806013B / GRAB	BR806148B / BR806013B / GRAB				
* ALKYL HYDROCARBON(6.94)							
* ALKYL HYDROCARBON(22.00)							
* ALKYL HYDROCARBON(22.70)							
* ALKYL HYDROCARBON(22.80)							
* ALKYL HYDROCARBON(22.90)							
* ALKYL HYDROCARBON(23.40)							
* ALKYL HYDROCARBON(24.20)							
* ALKYL HYDROCARBON(24.30)							
* ALKYL HYDROCARBON(24.60)							
* ALKYL HYDROCARBON(24.70)							
* ALKYL HYDROCARBON(25.40)							
* ALKYL HYDROCARBON(25.50)							
* ALKYL HYDROCARBON(26.00)							
* ALKYL HYDROCARBON(26.70)							
* CHLORINATED HYDROCARBON(7.84)							
* DIACETONE ALCOHOL (6.01)							
* DIACETONE ALCOHOL (6.09)							
* DIACETONE ALCOHOL (6.12)							
* DIACETONE ALCOHOL (6.18)							
* DIACETONE ALCOHOL (6.22)			15000 JAB				
* DIACETONE ALCOHOL (6.37)							
* DIACETONE ALCOHOL (6.55)							
* DIACETONE ALCOHOL(6.16)							
* DIACETONE ALCOHOL(6.20)		29000 JAB					
* DIACETONE ALCOHOL(6.21)							
* DIACETONE ALCOHOL(6.22)							
* DIACETONE ALCOHOL(6.28)							
* DIOCTYL ADIPATE *(31.20)							
* DIOCTYL ADIPATE(31.10)			1600 JB				
* DIOCTYL ADIPATE(31.20)							
* HEXAMETHYLCYCLOTRISILOX(5.72)							
* HEXAMETHYLCYCLOTRISILOX(5.74)							
* HEXAMETHYLCYCLOTRISILOX(5.75)							
* HEXAMETHYLCYCLOTRISILOX(5.76)							
* HYDROXY AROMATIC HYDROC(18.40)							
* HYDROXY AROMATIC HYDROC(19.00)							
* HYDROXY AROMATIC HYDROC(37.30)		1100 J					
* PHENYL HYDROCARBON(20.00)							
* UNKNOWN *(30.50)							
* UNKNOWN ALKENE/ETHER/AL(4.86)							
* UNKNOWN ALKENE/ETHER/AL(4.90)							
* UNKNOWN ALKENE/ETHER/AL(18.50)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA — DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG) — SAMP NO: / SDG NO: / TYPE:	BR806137B / BR806013B / GRAB	BR806148B / BR806013B / GRAB
* UNKNOWN ALKENE/ETHER/AL(22.10)		
* UNKNOWN ALKENE/ETHER/AL(24.00)		290 J
* UNKNOWN ALKENE/ETHER/AL(25.3)		
* UNKNOWN ALKENE/ETHER/AL(25.30)		
* UNKNOWN ALKENE/ETHER/AL(25.40)		
* UNKNOWN ALKENE/ETHER/AL(26.00)		290 J
* UNKNOWN ALKENE/ETHER/AL(30.10)		260000 J
* UNKNOWN ALKENE/ETHER/AL(30.60)		
* UNKNOWN ALKENE/ETHER/AL(30.8)		
* UNKNOWN ALKENE/ETHER/AL(32.4)	600000 J	
* UNKNOWN ALKENE/ETHER/AL(34.90)		
* UNKNOWN ALKENE/ETHER/AL(35.7)		
* UNKNOWN ALKENE/ETHER/AL(36.30)		
* UNKNOWN ALKENE/ETHER/AL(36.50)		
* UNKNOWN ALKENE/ETHER/AL(37.0)		
* UNKNOWN ALKENE/ETHER/AL(37.3)		
* UNKNOWN KETONE(5.35)		
* UNKNOWN KETONE(6.45)		
* UNKNOWN KETONE(6.48)		
* UNKNOWN KETONE(6.50)		
* UNKNOWN KETONE(6.51)		
* UNKNOWN KETONE(6.52)	5600 JB	
* UNKNOWN KETONE(6.54)		
* UNKNOWN KETONE(6.55)		3100 JB
* UNKNOWN KETONE(6.59)		
* UNKNOWN KETONE(8.12)		
* UNKNOWN KETONE(8.25)		
* UNKNOWN KETONE(9.06)		
* UNKNOWN KETONE(18.20)		
* UNKNOWN PHTHALATE ESTER(24.90)		500 J
* UNKNOWN PHTHALATE ESTER(25.00)		
* UNKNOWN PHTHALATE ESTER(26.10)		
* UNKNOWN PHTHALATE ESTER(31.10)		
* UNKNOWN PHTHALATE ESTER(32.60)	5700 J	
* UNKNOWN PHTHALATE ESTER(32.70)	2100 J	
* UNKNOWN PHTHALATE ESTER(33.00)	7000 J	
* UNKNOWN PHTHALATE ESTER(33.70)	4500 J	
* UNKNOWN PHTHALATE ESTER(33.80)	2100 J	
* UNKNOWN PHTHALATE ESTER(35.50)	3200 J	
* UNKNOWN PHTHALATE ESTER(35.60)	2700 J	
* UNKNOWN PHTHALATE ESTER(36.10)	1800 J	
* UNKNOWN PHTHALATE ESTER(36.20)	4500 J	

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: BR806137B SDG NO: BR806013B TYPE: GRAB	BR806148B BR806013B GRAB				
* UNKNOWN PHTHALATE ESTER(37.70)						
* UNKNOWN PHTHALATE ESTER(37.80)	2400 J					
* UNKNOWN PHTHALATE ESTER(39.60)	780 J					
* UNKNOWN(3.71)						
* UNKNOWN(5.31)						
* UNKNOWN(5.33)						
* UNKNOWN(5.40)						
* UNKNOWN(5.41)						
* UNKNOWN(5.42)						
* UNKNOWN(5.44)		570 JB				
* UNKNOWN(5.45)						
* UNKNOWN(5.47)						
* UNKNOWN(5.67)						
* UNKNOWN(5.88)						
* UNKNOWN(5.95)						
* UNKNOWN(6.39)						
* UNKNOWN(6.61)						
* UNKNOWN(8.00)						
* UNKNOWN(8.01)						
* UNKNOWN(8.04)						
* UNKNOWN(8.05)						
* UNKNOWN(8.06)		96 J				
* UNKNOWN(8.07)						
* UNKNOWN(8.34)						
* UNKNOWN(8.35)						
* UNKNOWN(8.36)						
* UNKNOWN(8.38)						
* UNKNOWN(8.39)	1100 J	500 J				
* UNKNOWN(8.40)						
* UNKNOWN(8.57)						
* UNKNOWN(8.88)						
* UNKNOWN(8.89)						
* UNKNOWN(8.90)						
* UNKNOWN(8.91)		250 J				
* UNKNOWN(8.96)						
* UNKNOWN(9.04)						
* UNKNOWN(9.06)						
* UNKNOWN(9.59)						
* UNKNOWN(11.60)						
* UNKNOWN(18.70)						
* UNKNOWN(19.20)						
* UNKNOWN(20.50)						

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR806137B	BR806148B
	SDG NO:	BR806013B	BR806013B
	TYPE:	GRAB	GRAB
* UNKNOWN(22.40)			
* UNKNOWN(25.60)			
* UNKNOWN(26.10)			
* UNKNOWN(31.90)			280 J
* UNKNOWN(35.00)			
* UNKNOWN(35.20)			
* UNKNOWN(35.30)			
* UNKNOWN(35.40)			
* UNKNOWN(36.00)			
* UNKNOWN(36.60)			
* UNKNOWN(36.90)			
* UNKNOWN(37.00)			
* UNKNOWN(37.60)			
* UNKNOWN(38.00)		980 J	
* UNKNOWN(38.10)			
* UNKNOWN(40.00)			
* UNKNOWN(41.30)			
* UNKNOWN(41.60)			
* UNKNOWN(42.50)			
* UNKOWN KETONE(6.54)			

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VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR806013A	BR806024A	BR806035A	BR806046A	BR806057A	BR806068A
	SDG NO:	BR806013A	BR806013A	BR806013A	BR806013A	BR806013A	BR806013A
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		57 U	63 U	56 U	59 U	110 B	55 U
CARBON TETRACHLORIDE		29 U	31 U	28 U	30 U	27 U	27 U
CHLOROFORM		27 JB	27 JB	26 JB	27 JB	22 JB	21 JB
ETHYLBENZENE		7 JB	31 U	6 JB	9 JB	11 JB	11 JB
METHYLENE CHLORIDE		18 JB	21 JB	28 U	230 B	24 JB	23 JB
STYRENE		29 U	31 U	28 U	30 U	27 U	27 U
TETRACHLOROETHENE		29 U	31 U	28 U	30 U	27 U	27 U
TOLUENE		29 U	31 U	28 U	17 J	27 U	27 U
TRICHLOROETHENE		29 U	31 U	28 U	110	27 U	27 U
XYLENE (TOTAL)		29 U	31 U	28 U	30 U	8 JB	9 JB
1,1-DICHLOROETHANE		29 U	31 U	28 U	36	27 U	27 U
1,1,1-TRICHLOROETHANE		29 U	31 U	28 U	230	27 U	27 U
1,1,2,2-TETRACHLOROETHANE		29 U	31 U	28 U	30 U	27 U	27 U
2-BUTANONE		57 U	63 U	56 U	59 U	53 J	55 U
* PROBABLE AROMATIC HYDRO(17.73)							
* PROBABLE AROMATIC HYDRO(18.69)							

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR806013A	BR806024A	BR806035A	BR806046A	BR806057A	BR806068A
	SDG NO:	BR806013A	BR806013A	BR806013A	BR806013A	BR806013A	BR806013A
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
* PROBABLE AROMATIC HYDRO(18.94)							
* PROBABLE AROMATIC HYDRO(19.14)							
* PROBABLE AROMATIC HYDRO(19.51)							
* PROBABLE AROMATIC HYDRO(19.92)							
* PROBABLE AROMATIC HYDRO(20.84)							
* PROBABLE CYCLOHEXANE(17.44)							
* PROBABLE DIETHYLBENZENE(21.45)							
* PROBABLE FREON 113(3.03)							
* PROBABLE HYDROCARBON #1(18.34)							
* PROBABLE HYDROCARBON #1(19.19)						26 JB	
* PROBABLE HYDROCARBON #2(29.32)						40 J	
* PROBABLE HYDROCARBON(19.22)							33 JB
* PROBABLE HYDROCARBON(19.27)							
* PROBABLE SILANE(23.53)							
* PROBABLE SUBSTITUTED BE(21.69)							
* PROBABLE SUBSTITUTED BE(22.51)							

VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR806079A	BR806080A	BR806091A	BR806104A	BR806104A	BR806115A
	SDG NO:	BR311015A	BR806013A	BR806013A	BR311015A	BR313017A	BR311015A
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		68 B	54 U	55 U	56 U	50 U	120 B
CARBON TETRACHLORIDE		27 U	27 U	27 U	18 J	48	28 U
CHLOROFORM		29 B	24 JB	22 JB	30 B	22 JB	32 B
ETHYLBENZENE		9 JB	11 JB	10 JB	10 JB	8 JB	14 JB
METHYLENE CHLORIDE		25 JB	27 JB	27 JB	29 B	1300 BE	28 JB
STYRENE		27 U	27 U	27 U	4 JB	25 U	4 JB
TETRACHLOROETHENE		7 J	27 U	34	16 J	12 J	4 J
TOLUENE		27 U	27 U	27 U	28 U	62	28 U
TRICHLOROETHENE		27 U	27 U	27 U	28 U	350	28 U
XYLENE (TOTAL)		6 JB	7 JB	7 JB	5 JB	4 JB	11 JB
1,1-DICHLOROETHANE		27 U	27 U	27 U	28 U	100	28 U
1,1,1-TRICHLOROETHANE		27 U	27 U	27 U	28 U	370	28 U
1,1,2,2-TETRACHLOROETHANE		27 U	27 U	27 U	28 U	25 U	4 JB
2-BUTANONE		55 U	54 U	55 U	56 U	50 U	57 U
* PROBABLE AROMATIC HYDRO(17.73)							34 J
* PROBABLE AROMATIC HYDRO(18.69)							86 J
* PROBABLE AROMATIC HYDRO(18.94)							370 J
* PROBABLE AROMATIC HYDRO(19.14)							340 J
* PROBABLE AROMATIC HYDRO(19.51)							200 J
* PROBABLE AROMATIC HYDRO(19.92)							810 J

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806079A / BR311015A / GRAB	BR806080A / BR806013A / GRAB	BR806091A / BR806013A / GRAB	BR806104A / BR311015A / GRAB	BR806104A / BR313017A / GRAB	BR806115A / BR311015A / GRAB
* PROBABLE AROMATIC HYDRO(20.84)							200 J
* PROBABLE CYCLOHEXANE(17.44)							30 J
* PROBABLE DIETHYLBENZENE(21.45)							110 J
* PROBABLE FREON 113(3.03)							
* PROBABLE HYDROCARBON #1(18.34)							42 J
* PROBABLE HYDROCARBON #1(19.19)							
* PROBABLE HYDROCARBON #2(29.32)							
* PROBABLE HYDROCARBON(19.22)							
* PROBABLE HYDROCARBON(19.27)							
* PROBABLE SILANE(23.53)							
* PROBABLE SUBSTITUTED BE(21.69)							52 J
* PROBABLE SUBSTITUTED BE(22.51)							89 J

VOLATILE ORGANICS (UG/KG)	SAMP NO: / SDG NO: / TYPE:	BR806126A / BR311015A / GRAB	BR806137A / BR806013A / GRAB	BR806148A / BR806013A / GRAB			
ACETONE		95 B	54 U	62 U			
CARBON TETRACHLORIDE		28 U	27 U	31 U			
CHLOROFORM		32 B	24 JB	27 JB			
ETHYLBENZENE		10 JB	9 JB	8 JB			
METHYLENE CHLORIDE		26 JB	16 JB	21 JB			
STYRENE		28 U	27 U	31 U			
TETRACHLOROETHENE		11 J	27 U	58			
TOLUENE		28 U	27 U	3 J			
TRICHLOROETHENE		28 U	9 J	7 J			
XYLENE (TOTAL)		4 JB	27 U	6 JB			
1,1-DICHLOROETHANE		28 U	27 U	31 U			
1,1,1-TRICHLOROETHANE		28 U	27 U	31 U			
1,1,2,2-TETRACHLOROETHANE		28 U	27 U	31 U			
2-BUTANONE		56 U	54 U	62 U			
* PROBABLE AROMATIC HYDRO(17.73)							
* PROBABLE AROMATIC HYDRO(18.69)							
* PROBABLE AROMATIC HYDRO(18.94)							
* PROBABLE AROMATIC HYDRO(19.14)							
* PROBABLE AROMATIC HYDRO(19.51)							
* PROBABLE AROMATIC HYDRO(19.92)							
* PROBABLE AROMATIC HYDRO(20.84)							
* PROBABLE CYCLOHEXANE(17.44)							
* PROBABLE DIETHYLBENZENE(21.45)							
* PROBABLE FREON 113(3.03)				390 J			

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR806126A	BR806137A	BR806148A			
	SDG NO:	BR311015A	BR806013A	BR806013A			
	TYPE:	GRAB	GRAB	GRAB			
* PROBABLE HYDROCARBON #1(18.34)							
* PROBABLE HYDROCARBON #1(19.19)							
* PROBABLE HYDROCARBON #2(29.32)							
* PROBABLE HYDROCARBON(19.22)							
* PROBABLE HYDROCARBON(19.27)		27 J					
* PROBABLE SILANE(23.53)				35 JB			
* PROBABLE SUBSTITUTED BE(21.69)							
* PROBABLE SUBSTITUTED BE(22.51)							

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR806013D	BR806024D	BR806035D	BR806046D	BR806057D	BR806068D
	SDG NO:	LLL8313	LLL8313	LLL8313	LLL8313	LLL8313	LLL8313
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CS-137		390	230	210	150	140	110
K-40		12000	11000	10000	9800	11000	5900
SR-TOT		9	-49	-40	92	15	-65

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR806079D	BR806080D	BR806091D	BR806104D	BR806115D	BR806126D
	SDG NO:	LLL8313	LLL8313	LLL8313	LLL8313	LLL8313	LLL8313
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CS-137		190	80	61	180	83	62
K-40		5400	11000	9700	8800	8100	9100
SR-TOT		0	49	12	0	49	-30

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR806137D	BR806148D				
	SDG NO:	LLL8313	LLL8313				
	TYPE:	GRAB	GRAB				
CS-137		91	230				
K-40		4200	9800				
SR-TOT		-19	0				

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO: BR806159					
RADIOACTIVIT (CPM)	20					

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: BR806159F SDG NO: BR306018F TYPE: RINSATE	BR806159F BR306018K RINSATE				
ALUMINUM	278					
BARIUM	5.2 B					
CALCIUM	3220 B					
COPPER	46					
IRON	337					
LEAD	67 B					
MAGNESIUM	1590 B					
MANGANESE	7.8 B					
POTASSIUM		120 B				
ZINC	77					

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: BR806159E SDG NO: BR306018E TYPE: RINSATE					
* UNKNOWN(3.28)	5 J					
* UNKNOWN(19.40)	2 J					
* UNKNOWN(22.80)	6 J					
* UNKNOWN(24.10)	2 J					
* UNKNOWN(26.30)	4 J					
* UNKNOWN(26.40)	3 J					
* UNKNOWN(29.50)	10 J					
* UNKNOWN(32.30)	9 J					
* UNKNOWN(34.80)	31 J					
* UNKNOWN(37.00)	16 J					

VOLATILE ORGANICS (UG/L)	SAMP NO: BR806159A SDG NO: BRN36015A TYPE: RINSATE					
METHYLENE CHLORIDE	2 JB					
TOLUENE	2 JB					
* FREON 113(12.10)	8 J					

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

S&A REQUEST: 806
LOCATION: BUBBLE AREA
MEDIUM: SURFACE WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR806159G / LLL8313 / RINSATE					
SR-TOT		3.1					

S&A REQUEST: 807
LOCATION: B975 BUBBLE AREA
MEDIUM: GROUND WATER

FIELD MEASUREMENTS	SAMP NO:	BR807014	BR807025	BR807036			
CONDUCTIVITY (MS/CM)		0.1	0.1	0.1			
DO (PPM)		2.2	2.2	2.2			
PH (UNITS)		8.1	8.1	8.1			
RADIOACTIVIT (CPM)		75	75	75			
TEMPERATURE (DEG C)		14	14	14			
TURBIDITY (PPM)		73	73	73			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR807014K / BR306018F / BAILER	BR807014K / BR306018K / BAILER	BR807025K / BR306018F / BAILER	BR807025K / BR306018K / BAILER	BR807036K / BR306018F / BAILER	BR807036K / BR306018K / BAILER
ALUMINUM		1900		1350		1340	
BARIUM		42 B		41 B		41 B	
BERYLLIUM		1.4 B		1.2 B		1.2 B	
CALCIUM		9800		10000		10000	
CHROMIUM		6.3 B		8 B		8.1 B	
COBALT		4.4 B		3.4 B		4.3 B	
COPPER		13 B		13 B		13 B	
IRON		44200		44400		56900	
MAGNESIUM		4810 B		4840 B		4840 B	
MANGANESE		713		915		980	
NICKEL		17 B		17 B		23 B	
POTASSIUM			1300 B		1300 B		1200 B
SODIUM		17800 E		16800 E		17100 E	
VANADIUM		12 B		9.3 B		9.6 B	
ZINC		1130		1140		1240	

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 — DRAFT DO NOT CITE

BUBBLE AREA

S&A REQUEST: 807
LOCATION: B975 BUBBLE AREA
MEDIUM: GROUND WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR807047A / BR306018F / FIELD BLANK	BR807047A / BR306018K / FIELD BLANK
ALUMINUM		60 U	
BARIUM		15 B	
BERYLLIUM		0.59 B	
CALCIUM		200 U	
CHROMIUM		6 U	
COBALT		3 U	
COPPER		10 U	
IRON		37 B	
MAGNESIUM		10 U	
MANGANESE		5 U	
NICKEL		6 U	
POTASSIUM			100 U
SODIUM		200 UE	
VANADIUM		4 U	
ZINC		11 B	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR807014E / BR306018E / BAILER	BR807025E / BR306018E / BAILER	BR807036E / BR306018E / BAILER
* SULFUR(27.00)		8 J	14 J	12 J
* UNKNOWN(14.00)				2 J
* UNKNOWN(19.40)			2 J	
* UNKNOWN(24.10)		3 J	3 J	2 J

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR807014A / BRN36015A / BAILER	BR807025A / BRN36015A / BAILER	BR807036A / BRN36015A / BAILER
ACETONE		10 U	5 B	10 U
CHLOROFORM		3 JB	2 JB	3 JB
TOLUENE		5 U	5 U	0.5 JB
1,1,1-TRICHLOROETHANE		2 J	2 J	5 U
* FREON 113(12.10)			9 J	7 J

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 807
LOCATION: B975 BUBBLE AREA
MEDIUM: GROUND WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	BR807014L	BR807014M	BR807025L	BR807025M	BR807036L	BR807036M
	SDG NO:	LLL8314	LLL8314	LLL8314	LLL8314	LLL8314	LLL8314
	TYPE:	BAILER	BAILER	BAILER	BAILER	BAILER	BAILER
H-3			30		-470		-710
SR-TOT		2.2		-1.7		3.2	

RADIOCHEMISTRY (PCI/L)	SAMP NO:	BR807047B
	SDG NO:	LLL8314
	TYPE:	FIELD BLANK
H-3		
SR-TOT		-2.1

S&A REQUEST: 809
LOCATION: B975 BUBBLE AREA
MEDIUM: WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	BR809094A	BR809107H
	SDG NO:	BR000011A	BR000011A
	TYPE:	RINSATE	FIELD BLANK
BERYLLIUM		0.3 B	0.2 U
CALCIUM		35 B	115 B
COPPER		6.7 B	2.5 B
IRON		20 B	6.8 B
MANGANESE		1.9 B	2 B
SILVER		3.1 B	2.2 U
SODIUM		175 B	265 B
VANADIUM		4.1 B	4.4 B
ZINC		2.4 B	4.6 B

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	BR809107F
	SDG NO:	BR000022B
	TYPE:	FIELD BLANK
BIS(2-ETHYLHEXYL)PHTHALATE		19 B
BUTYLBENZYLPHTHALATE		10
* HEXANEDIOIC ACID DIOCTY(25.65)		34 J

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 809
LOCATION: B975 BUBBLE AREA
MEDIUM: WATER

VOLATILE ORGANICS (UG/L)	SAMP NO: BR809107B SDG NO: BR000022B TYPE: FIELD BLANK
CHLOROFORM	27
METHYLENE CHLORIDE	7
TOLUENE	3 J

RADIOCHEMISTRY (PCI/L)	SAMP NO: BR809094B SDG NO: 014 TYPE: RINSATE	BR809094C 013 RINSATE	BR809094D 015 RINSATE	BR809107I 014 FIELD BLANK	BR809107J 013 FIELD BLANK	BR809107K 015 FIELD BLANK
H-3		106			249	
PU-238			0.0014			0.014
PU-239			0.029			0.023
SR-90	0.82			1.3		

S&A REQUEST: 809
LOCATION: B975 BUBBLE AREA
MEDIUM: GROUND WATER

FIELD MEASUREMENTS	SAMP NO: BR809049	BR809050	BR809061	BR809072	BR809083	BR809118
CONDUCTIVITY (UMHOS/CM)	97	189	189	121	121	241
FID/PID (PPM)	0	0	0	0	0	0
PH (UNITS)	5.6	5.4	5.4	4.9	4.9	5.4
TEMPERATURE (DEG C)	11	12	12	12	12	11

FIELD MEASUREMENTS	SAMP NO: BR809129	BR809130
CONDUCTIVITY (UMHOS/CM)	2.4	102
FID/PID (PPM)	0	0
PH (UNITS)	5.4	5.6
TEMPERATURE (DEG C)	11	11

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
BUBBLE AREA

S&A REQUEST: 809
LOCATION: B975 BUBBLE AREA
MEDIUM: GROUND WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR809049H BR809016H PUMP	BR809050H BR809016H PUMP	BR809061H BR809016H PUMP	BR809072H BR809016H PUMP	BR809083H BR809016H PUMP	BR809118H BR809016H PUMP
ALUMINUM		21 U	21 U	30 B	25 B	30 B	40 B
BARIUM		42 B	24 B	22 B	46 B	49 B	67 B
BERYLLIUM		0.2 U	0.2 U	0.2 B	0.2 U	0.2 U	0.2 U
CALCIUM		13300	20800	21800	10700	10600	8570
CHROMIUM		7.6 B	2.6 U	3.2 B	2.6 U	2.6 U	14
COPPER		22 B	2.3 B	8.8 B	16 B	21 B	6 B
IRON		31 B*	141 *	152 *	16 B*	32 B*	33 B*
MAGNESIUM		2760 B	7040	7340	2580 B	2600 B	3520 B
MANGANESE		552	606	618	171	174	528
NICKEL		21 B	24 B	33 B	30 B	29 B	12 U
POTASSIUM		8490	1090 B	1140 B	1530 B	1660 B	10600
SILVER		2.7 B	2.2 U	2.9 B	2.2 U	3.7 B	4.8 B
SODIUM		15600	10300	10900	14800	14700	25800
VANADIUM		6.8 B	8.7 B	9.3 B	5.8 B	7.1 B	6.8 B
ZINC		32	16 B	26	33	62	54

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR809129H BR809016H PUMP	BR809130H BR809016H PUMP
ALUMINUM		40 B	28 B
BARIUM		70 B	43 B
BERYLLIUM		0.2 B	0.2 U
CALCIUM		8880	13500
CHROMIUM		14	6.3 B
COPPER		5.4 B	24 B
IRON		32 B*	37 B*
MAGNESIUM		3640 B	2760 B
MANGANESE		549	546
NICKEL		14 B	21 B
POTASSIUM		11000	8540
SILVER		2.7 B	2.2 U
SODIUM		26500	16300
VANADIUM		7 B	6.9 B
ZINC		28	48

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 809
LOCATION: B975 BUBBLE AREA
MEDIUM: GROUND WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR809049G / BR000022B / PUMP	BR809050E / BR000022B / PUMP	BR809061F / BR000022B / PUMP	BR809072F / BR000022B / PUMP	BR809083F / BR000022B / PUMP	BR809118F / BR000022B / PUMP
BIS(2-ETHYLHEXYL)PHTHALATE		52 B	9 BJ	9 BJ	29 B	20 B	20 B
BUTYLBENZYLPHTHALATE		15 B	6 BJ	10 U	10 U	11 U	12 B
* HEXANEDIOIC ACID DIOCTY(25.62)							32 J
* HEXANEDIOIC ACID DIOCTY(25.63)			18 J		31 J		
* HEXANEDIOIC ACID DIOCTY(25.65)						14 J	
* UNKNOWN(16.30)		98 J					
* UNKNOWN(16.52)		20 J			8 J		
* UNKNOWN(16.55)							
* UNKNOWN(23.32)		19 J					
* UNKNOWN(23.33)					25 J	23 J	
* UNKNOWN(27.88)		27 J					
* UNKNOWN(27.90)					25 J		
* UNKNOWN(27.92)						32 J	
* UNKNOWN(35.53)						19 J	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR809129G / BR000022B / PUMP	BR809130G / BR000022B / PUMP				
BIS(2-ETHYLHEXYL)PHTHALATE		150 B	46 B				
BUTYLBENZYLPHTHALATE		11 B	8 BJ				
* HEXANEDIOIC ACID DIOCTY(25.62)							
* HEXANEDIOIC ACID DIOCTY(25.63)		790 J	140 J				
* HEXANEDIOIC ACID DIOCTY(25.65)							
* UNKNOWN(16.30)			85 J				
* UNKNOWN(16.52)							
* UNKNOWN(16.55)			14 J				
* UNKNOWN(23.32)							
* UNKNOWN(23.33)			16 J				
* UNKNOWN(27.88)							
* UNKNOWN(27.90)			20 J				
* UNKNOWN(27.92)							
* UNKNOWN(35.53)							

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR809049B / BR000022B / PUMP	BR809050B / BR000022B / PUMP	BR809061B / BR000022B / PUMP	BR809072B / BR000022B / PUMP	BR809083B / BR000022B / PUMP	BR809118B / BR000022B / PUMP
BROMODICHLOROMETHANE		5	5 U	5 U	4 J	5	5 U
CHLOROFORM		9	5 U	5 U	7	8	5 U

TABLE 4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 BUBBLE AREA

DRAFT DO NOT CITE

S&A REQUEST: 809
LOCATION: B975 BUBBLE AREA
MEDIUM: GROUND WATER

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR809049B / BR000022B / PUMP	BR809050B / BR000022B / PUMP	BR809061B / BR000022B / PUMP	BR809072B / BR000022B / PUMP	BR809083B / BR000022B / PUMP	BR809118B / BR000022B / PUMP
DIBROMOCHLOROMETHANE		5 U	5 U	5 U	5 U	5 U	5 U
METHYLENE CHLORIDE		5 U	7	5 U	5 U	5 U	5 U
TOLUENE		4 J	4 J	5	8	10	7
1,1,1-TRICHLOROETHANE		5 U	4 J	5	5 U	5 U	5 U

VOLATILE ORGANICS (UG/L)	SAMP NO: / SDG NO: / TYPE:	BR809129B / BR000022B / PUMP	BR809130B / BR000022B / PUMP
BROMODICHLOROMETHANE		5 U	6
CHLOROFORM		5 U	11
DIBROMOCHLOROMETHANE		5 U	3 J
METHYLENE CHLORIDE		5 U	5 U
TOLUENE		8	5
1,1,1-TRICHLOROETHANE		5 U	5 U

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR809049I / 014 / PUMP	BR809049J / 013 / PUMP	BR809050I / 014 / PUMP	BR809050J / 013 / PUMP	BR809061I / 014 / PUMP	BR809061J / 013 / PUMP
H-3			215		181		217
SR-90		1.7		1.7		1.8	

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR809072I / 014 / PUMP	BR809072J / 013 / PUMP	BR809083I / 014 / PUMP	BR809083J / 013 / PUMP	BR809118I / 014 / PUMP	BR809118J / 013 / PUMP
H-3			97		155		-73
SR-90		1.2		1.5		2.4	

RADIOCHEMISTRY (PCI/L)	SAMP NO: / SDG NO: / TYPE:	BR809129I / 014 / PUMP	BR809129J / 013 / PUMP	BR809130I / 014 / PUMP	BR809130J / 013 / PUMP
H-3			56		165
SR-90		2.6		1.4	

TABLE 4.4.10 SAMPLE LOCATIONS AND SAMPLE VOLUMES
ENVIRONMENTAL PROBLEM 10

WELL ID	SAMPLE NUMBER	DATE	SAMPLING METHOD	VOLUME (L)
SG	BR807014	21APR88	BAILER	61.7
SG	BR807025	21APR88	BAILER	61.7
SG	BR807036	21APR88	BAILER	61.7
SG	BR807047	21APR88	BAILER	61.7
559	BR809118	16JUN88	SUBM. PUMP	17.4
559	BR809129	16JUN88	SUBM. PUMP	17.4
558	BR809130	23JUN88	SUBM. PUMP	68.1
558	BR809049	23JUN88	SUBM. PUMP	68.1
556	BR809050	24JUN88	SUBM. PUMP	14.3
556	BR809061	24JUN88	SUBM. PUMP	14.3
557	BR809072	24JUN88	SUBM. PUMP	71.9
557	BR809083	24JUN88	SUBM. PUMP	71.9
	BR809094	25JUN88	BAILER	0.0
	BR809107	25JUN88	BAILER	0.0

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4.17 Environmental Problem 11: Leaching Pits

Request Number: 808.

Requester: J. Werner.

Finding and Basis: A leaching pit from Building 481 Sewer Lift Pump House may have been a source of groundwater contamination. There was no information other than available blueprints to confirm or deny that this pit existed, although this pit would logically be necessary for the sewer system in this area to function. Solvents and acids were known to have been used and to have spilled into the storm sewer lines near Building 208. In November 1985, a drum of TCA was spilled into sewer 165K.

4.17.1 Sampling and Analysis Objectives

Statement: An effort was to be made to locate the leach pit and collect soil samples to determine the presence and type of contaminants in the pit.

Supporting Information: During the investigation of cesspools and septic tank activities, a blueprint was found in Plant Engineering, showing the presence of a leach pit near Pump Station 481. No BNL personnel were familiar with the leach pit, and one BNL employee believed that it was never built. Miscellaneous solvents (TCA, TCE, etc.) are presently used in Buildings 208 and 209 and nearby buildings. Other solvents may have been used in the past. Pump Station 481 (shown as a rectangle in Figure 4.11a) is actually an underground dry well.

4.17.2 Sampling and Analytical Design

4.17.2.1 Sampling Design

Request 808: Building 481 Leach Pit (Fig. 4.11a). Three grab soil samples (Sampling Method: Reference E5.2.3) were to be collected in the area of the leach pit if the pit could be located. The Sampling Team was to open the dry well and determine the status of the pumps and the vaults. They were instructed to have an LEL meter and SCBA nearby when the dry well was opened. They were also to open manhole 165 northwest of Building 210 to determine if the flow through the forced main from sewer 165K exists. When the pit area was located, the area was to be divided into a 60-segment grid, and three segments were to be randomly selected for sampling. A hole was to be augered to the depth of the pit as indicated by the blueprints. If the first hole successfully found the pit, three samples were to be collected from this hole. If the pit was not located on the first try, segments 2 and 3 were to be augered, in order, with the objective of locating the pit. If the pit was not located by any of the three holes, no more attempts were to be made. Depending on the size of the pit in the prints, the sampling point could be biased in order to attempt to "hit" the middle of the pit. Samples were to be collected to the depth of the sediment/soil.

The Sampling Team arrived at the Building 481 leach pit at 0900. An LEL meter and SCBA were available but not needed. The presence of methane was not indicated, and oxygen was normal.

The plan was changed from augering to use of a sludge extractor because BNL Utilities had excavated the overburden to the "pit," and the "pit" was actually a tank. The pit cover had been removed by BNL personnel before the Sampling Team arrived. The sludge extractor described in the BNL Sampling and Analysis Plan was used successfully. Since the pit was circular, the grid was not utilized. The sample locations are noted in Figure 4.11a. The pit was located 3 ft below asphalt and sand. The sludge was 10 ft below the cover, and the sediment/sludge was 1 ft deep. The pit receives material from Building 208, which is a welding shop. The first sample, BR808015 was collected 0915. It was black, with an odor of creosote and the texture of oil or muck. Sample BR808026 was collected at 0925, and sample BR808037 was collected 0935.

4.17.2.2 Analytical Design

The parameters analyzed and/or measured for Environmental Problem 11 were as follows:

Request 808: The parameters analyzed included volatiles, semivolatiles, PCBs, ICP-metals, AA-lead, gamma scan, tritium, and strontium-90. Field measurements for radiation, FID/PID, and LEL were taken and recorded.

4.17.3 Field and Analytical Data

Field Data:

Request 808: *Although no field measurements were requested, OVA and rad scans were taken and recorded. The FID/PID readings ranged from 14 to 18 ppm. The rad scan ranged from 50 to 70 cpm.*

Field Data Evaluation:

Request 808: The instrument used for OVA was calibrated prior to field use; the rad scan instrument was calibrated at the laboratory of the sampling team prior to departure to the facility. Readings are reliable.

Analytical Data:

Request 808:

Metals. Analytical results for metals in soil are presented in Table 4.3.11. Of the 20 metals detected, the following three were below either the CRDL or the IDL in all three samples: potassium, selenium, and sodium. Of the remaining *metals detected, antimony ranged from 44 to 50 mg/kg, barium from 329 to 1480 mg/kg, beryllium from 2.6 to 6.6 mg/kg, cadmium from 28 to 392 mg/kg, chromium from 240 to 465 mg/kg, cobalt from 37 to 95 mg/kg, copper from 4540 to 5210 mg/kg, lead from 208 to 411 mg/kg, nickel from 266 to 849 mg/kg, silver from 16 to 38 mg/kg, and zinc from 2820 to 6480 mg/kg. Other metals detected were aluminum, calcium, iron, magnesium, manganese, and vanadium.*

PCBs and other extractables. Aroclor-1254 was measured at 2.4 mg/kg in sample BR808015. No other compounds in this catagory were detected for this request.

Extractable organics. Analytical data for semivolatile compounds are presented in Table 4.3.11. There were 29 semivolatile compounds detected in one of these soil samples, 31 in another, and 45 in the remaining sample. Phthalates were present in the samples and often also in the blanks. Bis(2-ethylhexyl)phthalate was measured in concentrations between 13 and 42 mg/kg and butylbenzylphthalate was measured as high as 4.1 mg/kg in BR808015. All other positively identified compounds were present in concentrations below quantitation limits, although they were always estimated at 3.8 mg/kg or less. The TICs that had estimated concentrations of greater than 10 mg/kg included aldol condensation products, alicyclic alcohols, an alkoxy/hydroxy/alkyl (6.9 g/kg in BR808015), alkyl hydrocarbons (up to 180 mg/kg in BR808037), aryl hydrocarbons (up to 180 mg/kg in BR808037), diacetone alcohol (up to 780 mg/kg in BR808037), a phenyl hydrocarbon (in two samples, highest estimated concentration was 110 mg/kg in BR808026), organic sulfur (37 mg/kg in BR808015), an unknown acid (74,000 mg/kg in BR808026), unknown alkene ethers (as high as 20 g/kg in BR808026), and other unknowns (as high as 340 mg/kg in BR808026).

Volatile organics. Analytical data for volatile compounds are presented in Table 4.3.11. Two of these soil samples each had 29 identifiable volatile compounds, and there were 15 volatiles detected in the remaining sample. Chlorobenzene was detected in one sample below the quantitation limit (estimated concentration *was 0.079 mg/kg). Chloroform was present in all samples and in one of the blanks. The highest measured or estimated concentration was a measured 0.180 mg/kg (in two samples). Methylene chloride was present in all samples and both blanks. The highest measured or estimated concentration was a measured 0.200 mg/kg in sample BR808037. Toluene was measured in all samples with the highest concentration being 0.850 mg/kg in sample BR808026. Acetone was present in all samples and also in one of the blanks in concentrations ranging from 1.2 to 2.2 mg/kg. Xylene occurred in one sample and 2-hexanone occurred in the two other samples in measured concentrations of 1.1 mg/kg for the Xylene and 1.6 and 3.4 mg/kg for the 2-hexanone. Some 4-methyl-2-pentanone occurred in sample BR808015 and also in the corresponding blank. Concentration was measured at 2.3 mg/kg. With the above exceptions, no positively identified volatile organic compound was measured or estimated in concentrations of 1 mg/kg or more. TICs included probable aromatic hydrocarbons in estimated concentrations of greater than 10 mg/kg in samples BR808026 and BR808037.*

Radiochemistry. Two of the samples showed no detectable tritium but the third sample contained 1100 pCi/kg. Strontium-90 concentrations ranged from 160 to 200 pCi/kg. The gamma scan results showed potassium-40 to be dominant; cobalt-60 averaged 1250 pCi/kg; and cesium-137 averaged 133pCi/kg.

Analytical Data Evaluation:

Request 808:

Metals. Eleven metals of interest (antimony, barium, beryllium, cadmium, chromium, cobalt, copper, lead, nickel, silver, and zinc) were detected above the CRDL in the requests for this sample.

PCBs and other extractables. With the exception of aroclor-1254 in sample BR808015, no compounds in this catagory were found.

Extractable organics. Other than phthalates, which were present in these samples and also often in the associated blanks, all positively identified compounds were present in concentrations below quantitation limits. The TICs often had estimated concentrations well in excess of 10 mg/kg, commonly in excess of 100 mg/kg, and as high as 20 g/kg in one instance.

Volatile organics. Chlorobenzene was detected in one sample below the quantitation limit. Chloroform was present in all samples and in one of the blanks. Methylene chloride was present in all samples and both blanks. Toluene was measured in all samples. With the exceptions noted in the Analytical Data section above, no positively identified volatile organic compound was measured or estimated in concentrations of 1 mg/kg or more. TICs included probable aromatic hydrocarbons in estimated concentrations of greater than 10 mg/kg, in samples BR808026 and BR808037.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Because control sample results were within 10% of their true value, radiological data are considered reliable.

4.17.4 Limitations and Qualifications

Data Quality Level:

Request 808: The sampling plan and field sampling are both rated Quality Level I. The overall analytical quality rating is Quality Level II.

Field Data:

Request 808: The field data were rated Quality Level I.

Analytical Data:

Request 808:

Metals. Analytical results for samples BR808015 and BR808037 were Quality Level I with the following exceptions: antimony and beryllium were Quality Level II, and arsenic and selenium were Quality Level III. For sample BR808026, analytical results were the same except beryllium was Quality Level III. Recovery of antimony and arsenic from the spiked sample fell below the control limit. Beryllium and selenium were observed above the control limit for the solid laboratory control standard.

PCBs and other extractables. Data are Quality Level III because extraction holding times were exceeded by 2 to 3 days and due to poor spike recovery results.

Extractable organics. Data are Quality Level I for sample BR808015 and are Quality Level II for samples BR808026 and BR808037.

Volatile organics. Data are Quality Level II because holding times were exceeded.

Radiochemistry. Radiological results were assigned a Quality Level I.

Environmental Problem: 11
Request Number: 808

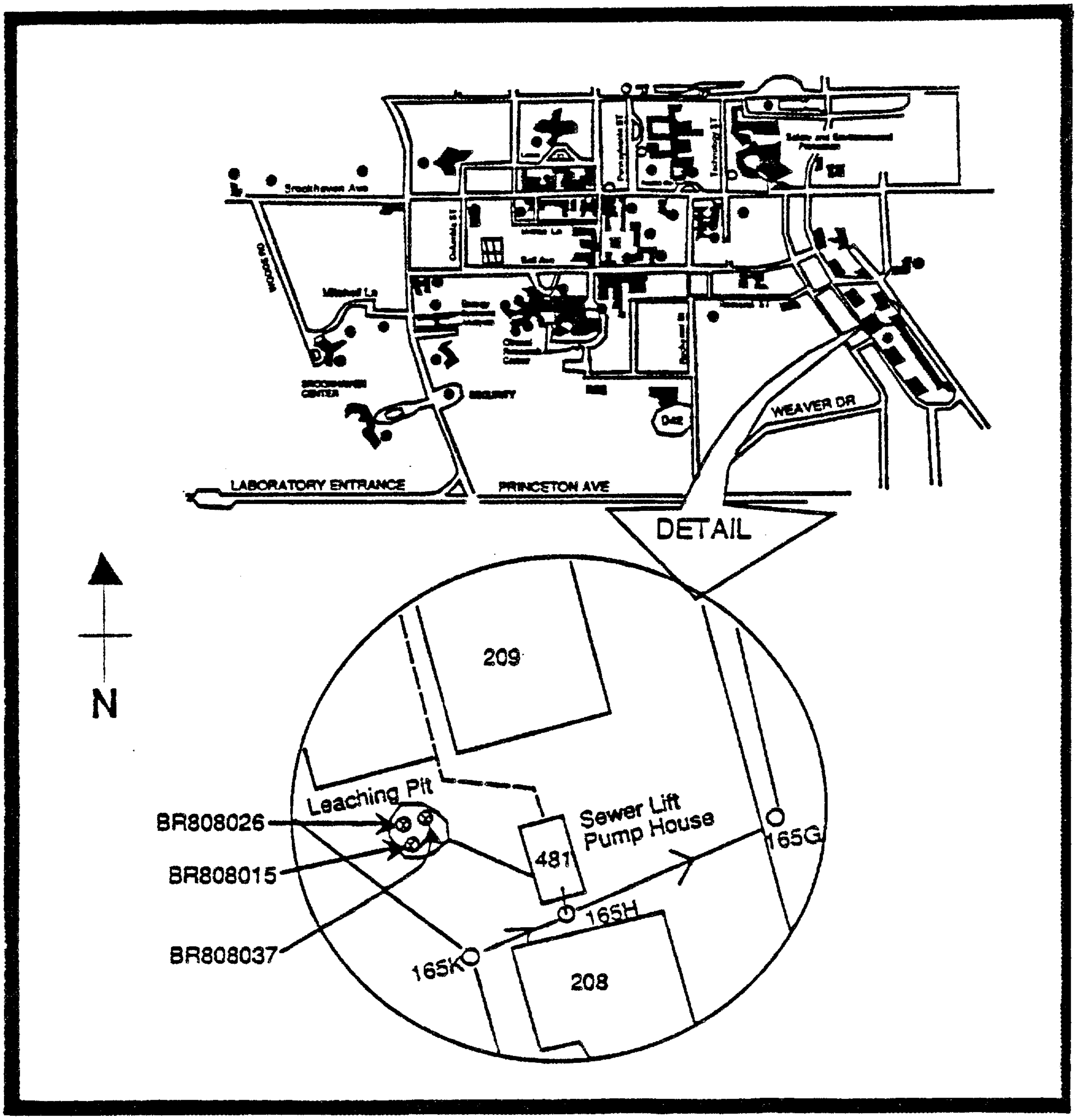

Figure 4.11a. Building 481 Leach Pit (Request 808)

TABLE 4.2.11 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 11

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	ANIONS NUMB HITS	ANIONS NUMB ANAL	METALS NUMB HITS	METALS NUMB ANAL	O&G NUMB HITS	O&G NUMB ANAL	PET HYDRO NUMB HITS	PET HYDRO NUMB ANAL	PES/H/PCB NUMB HITS	PES/H/PCB NUMB ANAL	SEMIVOLS NUMB HITS	SEMIVOLS NUMB ANAL	VOLS NUMB HITS	VOLS NUMB ANAL	RADS NUMB HITS	RADS NUMB ANAL
BR808	B. 481	LEACH PIT	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	1	3	3	3	3	3	3	3
			MED TOTAL	3	3		0	0	3	3	0	0	0	0	1	3	3	3	3	3	3	3
			EP TOTAL	3	3		0	0	3	3	0	0	0	0	1	3	3	3	3	3	3	3
			TOTAL	191	161		2	11	138	138	20	22	3	4	17	55	118	120	122	125	130	135

TABLE 4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 LEACHING PITS

DRAFT DO NOT CITE

S&A REQUEST: 808
LOCATION: BUILDING 481 LEACH PIT
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:	BR808015	BR808026	BR808037			
FID/PID (PPM)		18	14	14			
MOISTURE (%)		0					
RADIOACTIVIT (CPM)		70	50	50			

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR808015C BR311015C GRAB	BR808015C BR311015K GRAB	BR808015D BR800062D GRAB	BR808026C BR311015C GRAB	BR808026C BR311015K GRAB	BR808026D BR800062D GRAB
ALUMINUM		8410			4860		
ANTIMONY		44 N			50 N		
BARIUM		329 E			1480 E		
BERYLLIUM		2.6			1.3 B		
CADMIUM		72			392		
CALCIUM		4160			5250		
CHROMIUM		240			465		
COBALT		85			95		
COPPER		4540			5210		
IRON		18600			29100		
LEAD				208			254
MAGNESIUM		2200			1990 B		
MANGANESE		103			69		
NICKEL		266			849		
POTASSIUM			600 B			410 B	
SELENIUM		34 B			38 B		
SILVER		16			38		
SODIUM		267 B			343 B		
VANADIUM		852			250		
ZINC		2820			6480		

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: / SDG NO: / TYPE:	BR808037C BR311015C GRAB	BR808037C BR311015K GRAB	BR808037D BR800062D GRAB			
ALUMINUM		9300					
ANTIMONY		27 UN					
BARIUM		422 E					
BERYLLIUM		6.6					
CADMIUM		28					
CALCIUM		3300					
CHROMIUM		336					
COBALT		37					
COPPER		4800					

TABLE 4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 DRAFT DO NOT CITE
LEACHING PITS

S&A REQUEST: 808
LOCATION: BUILDING 481 LEACH PIT
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	BR808037C	BR808037C	BR808037D			
	SDG NO:	BR311015C	BR311015K	BR800062D			
	TYPE:	GRAB	GRAB	GRAB			
IRON		26300					
LEAD				411			
MAGNESIUM		2540 B					
MANGANESE		53					
NICKEL		320					
POTASSIUM			520 B				
SELENIUM		40 B					
SILVER		34					
SODIUM		394 B					
VANADIUM		2540					
ZINC		2390					

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	BR808015B	BR808026B	BR808037B			
	SDG NO:	BR800062B	BR800062B	BR800062B			
	TYPE:	GRAB	GRAB	GRAB			
AROCLOR-1254		2400	1600 U	1600 U			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR808015B	BR808026B	BR808037B			
	SDG NO:	BR311015B	BR808026B	BR808026B			
	TYPE:	GRAB	GRAB	GRAB			
ACENAPHTHENE		570 J	16000 U	15000 U			
ACENAPHTHYLENE		100 J	16000 U	15000 U			
ANTHRACENE		180 J	16000 U	790 J			
BENZO(A)PYRENE		460 J	16000 U	15000 U			
BIS(2-ETHYLHEXYL)PHTHALATE		13000	42000 B	25000 B			
BUTYLBENZYLPHTHALATE		4100 B	3300 JB	2700 JB			
DI-N-BUTYLPHTHALATE		730 JB	740 JB	580 JB			
DI-N-OCTYLPHTHALATE		680 JB	1700 JB	15000 U			
DIBENZOFURAN		680 J	16000 U	15000 U			
DIETHYLPHTHALATE		450 JB	16000 U	190 J			
DIMETHYLPHTHALATE		80 J	16000 U	15000 U			
FLUORANTHENE		600 J	1700 JB	1800 JB			
FLUORENE		570 J	16000 U	1100 J			
INDENO(1,2,3-CD)PYRENE		2100 U	2900 JB	1000 JB			
ISOPHORONE		300 J	16000 U	15000 U			
NAPHTHALENE		1000 J	16000 U	15000 U			
PHENANTHRENE		2000 JB	3000 J	3800 J			
PYRENE		1400 JB	3300 JB	2700 JB			

TABLE 4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 LEACHING PITS

DRAFT DO NOT CITE

S&A REQUEST: 808
LOCATION: BUILDING 481 LEACH PIT
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: SDG NO: TYPE:	BR808015B BR311015B GRAB	BR808026B BR808026B GRAB	BR808037B BR808026B GRAB
2-METHYLNAPHTHALENE		1800 J	1800 J	2900 J
2-METHYLPHENOL		100 J	16000 U	15000 U
2-NITROPHENOL		170 J	16000 U	15000 U
2,4-DINITROTOLUENE		310 J	16000 U	15000 U
4-CHLOROANILINE		390 J	16000 U	15000 U
4-CHLOROPHENYL-PHENYLETHER		570 J	16000 U	15000 U
4-METHYLPHENOL		750 J	16000 U	15000 U
4-NITROPHENOL		410 J	78000 U	77000 U
* ALDOL-CONDENSATION PROD(4.83)				340000 JA
* ALDOL-CONDENSATION PROD(4.85)			370000 JA	
* ALICYCLIC ALCOHOL/STERO(37.60)			63000 J	
* ALICYCLIC ALCOHOL/STERO(37.70)				62000 J
* ALICYCLIC ALCOHOL/STERO(37.80)		8300 J		
* ALICYCLIC ALCOHOL/STERO(37.90)			26000 J	
* ALICYCLIC ALCOHOL/STERO(38.00)				25000 J
* ALICYCLIC ALCOHOL/STERO(38.10)			24000 J	27000 J
* ALICYCLIC ALCOHOL/STERO(39.70)			9100 J	
* ALKOXY/HYDROXY/ALKYL CP(30.00)		6900000 J		
* ALKYL HYDROCARBON(8.55)			41000 J	
* ALKYL HYDROCARBON(8.57)				67000 J
* ALKYL HYDROCARBON(9.29)				96000 J
* ALKYL HYDROCARBON(9.51)				71000 J
* ALKYL HYDROCARBON(10.70)			140000 J	
* ALKYL HYDROCARBON(10.80)		830 J		180000 J
* ALKYL HYDROCARBON(10.90)			55000 J	94000 J
* ALKYL HYDROCARBON(11.00)		570 J		
* ALKYL HYDROCARBON(11.10)			39000 J	
* ALKYL HYDROCARBON(11.40)		680 J	46000 J	
* ALKYL HYDROCARBON(11.70)		520 J		
* ALKYL HYDROCARBON(12.50)			110000 J	
* ALKYL HYDROCARBON(14.50)			85000 J	
* ALKYL HYDROCARBON(14.80)		9100 J	67000 J	49000 J
* ALKYL HYDROCARBON(15.90)		10000 J		
* ALKYL HYDROCARBON(17.70)		9700 J		
* ALKYL HYDROCARBON(22.90)				62000 J
* ARYL HYDROCARBON(8.18)		510 J		
* ARYL HYDROCARBON(8.94)		1300 J		
* ARYL HYDROCARBON(9.16)				160000 J
* ARYL HYDROCARBON(9.25)		7500 J		
* ARYL HYDROCARBON(9.33)				140000 J
* ARYL HYDROCARBON(9.40)		3400 J		
* ARYL HYDROCARBON(9.64)		2600 J		

TABLE 4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 LEACHING PITS

DRAFT DO NOT CITE

S&A REQUEST: 808
LOCATION: BUILDING 481 LEACH PIT
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	BR808015B	BR808026B	BR808037B			
	SDG NO:	BR311015B	BR808026B	BR808026B			
	TYPE:	GRAB	GRAB	GRAB			
* ARYL HYDROCARBON(9.90)			37000 J				
* ARYL HYDROCARBON(9.92)				180000 J			
* ARYL HYDROCARBON(10.60)		3100 J		140000 J			
* ARYL HYDROCARBON(10.90)		940 J					
* DIACETONE ALCOHOL(6.10)		1800 JAB					
* DIACETONE ALCOHOL(6.15)			500000 JAB	780000 JAB			
* PHENYL HYDROCARBON(20.00)		8200 J					
* PHENYL HYDROCARBON(22.90)		15000 J	110000 J				
* SULFUR(27.20)		37000 J					
* UNKNOWN ACID(26.40)			74000 J				
* UNKNOWN ALKENE/ETHER/AL(30.0)			2E+07 J				
* UNKNOWN ALKENE/ETHER/AL(30.5)				1E+07 J			
* UNKNOWN(27.20)				260000 J			
* UNKNOWN(27.30)			340000 J				
* UNKNOWN(39.60)				21000 J			
* UNKNOWN(40.20)				13000 J			
* 4-NONYLPHENOL(23.00)			79000 J				

VOLATILE ORGANICS (UG/KG)	SAMP NO:	BR808015A	BR808026A	BR808037A			
	SDG NO:	BR311015A	BR503017A	BR311015A			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		1200 B	2000	2200 B			
BROMODICHLOROMETHANE		170 U	160 U	21 J			
CHLOROBENZENE		79 J	160 U	160 U			
CHLOROFORM		180 B	130 J	180 B			
ETHYLBENZENE		660 B	160 U	880 B			
METHYLENE CHLORIDE		160 JB	120 JB	200 B			
TOLUENE		200	850	360			
XYLENE (TOTAL)		670 B	1100	960 B			
2-BUTANONE		350 U	320 U	310 J			
2-HEXANONE		3400	320 U	1600			
4-METHYL-2-PENTANONE		2300 B	320 U	320 U			
* PROB AROMATIC HYDROCARB(18.47)			6700 J				
* PROB AROMATIC HYDROCARB(18.78)			22000 J				
* PROB AROMATIC HYDROCARB(18.96)		1600 J					
* PROB AROMATIC HYDROCARB(18.98)			15000 J				
* PROB AROMATIC HYDROCARB(19.33)			13000 J				
* PROB AROMATIC HYDROCARB(19.78)		2200 J					
* PROB AROMATIC HYDROCARB(19.80)			28000 J				
* PROB AROMATIC HYDROCARB(20.67)			7400 J				

TABLE 4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 DRAFT DO NOT CITE
LEACHING PITS

S&A REQUEST: 808
LOCATION: BUILDING 481 LEACH PIT
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO: BR808015A SDG NO: BR311015A TYPE: GRAB	BR808026A BR503017A GRAB	BR808037A BR311015A GRAB
* PROB AROMATIC HYDROCARB(21.00)		4300 J	
* PROB AROMATIC HYDROCARB(21.30)		4400 J	
* PROBABLE AROMATIC HYDRO(17.53)			2700 J
* PROBABLE AROMATIC HYDRO(18.49)			7000 J
* PROBABLE AROMATIC HYDRO(18.81)			24000 J
* PROBABLE AROMATIC HYDRO(19.00)			16000 J
* PROBABLE AROMATIC HYDRO(19.36)			11000 J
* PROBABLE AROMATIC HYDRO(19.83)			33000 J
* PROBABLE AROMATIC HYDRO(20.69)			8400 J
* PROBABLE CYCLOHEXANE #1(20.34)			1800 J
* PROBABLE CYCLOHEXANE #1(20.35)	1300 J		
* PROBABLE CYCLOHEXANE #2(21.82)	790 J		
* PROBABLE CYCLOHEXANE #2(28.37)			1700 J
* PROBABLE CYCLOHEXANE #3(28.40)	1100 J		
* PROBABLE DIETHYLBENZENE(21.32)			4200 J
* PROBABLE HYDROCARBON #(18.17)		4500 J	
* PROBABLE HYDROCARBON #(22.10)		5500 J	
* PROBABLE HYDROCARBON #1(15.81)			1200 J
* PROBABLE HYDROCARBON #1(16.22)	1700 J		
* PROBABLE HYDROCARBON #1(22.18)	8500 J		
* PROBABLE HYDROCARBON #1(24.77)	1800 J		
* PROBABLE HYDROCARBON #1(26.57)	1300 J		
* PROBABLE HYDROCARBON #1(27.22)	1400 J		
* PROBABLE HYDROCARBON #1(29.03)	1600 J		
* PROBABLE HYDROCARBON #1(29.52)	1100 J		
* PROBABLE HYDROCARBON #2(17.28)			2800 J
* PROBABLE HYDROCARBON #2(17.29)	1400 J		
* PROBABLE HYDROCARBON #3(17.53)	930 J		
* PROBABLE HYDROCARBON #3(18.18)			4800 J
* PROBABLE HYDROCARBON #3(25.09)			1800 J
* PROBABLE HYDROCARBON #4(18.19)	3500 J		
* PROBABLE HYDROCARBON #4(18.47)	1600 J		
* PROBABLE HYDROCARBON #4(26.54)			2500 J
* PROBABLE HYDROCARBON #5(29.00)			2600 J
* PROBABLE HYDROCARBON #6(19.35)	8600 J		
* PROBABLE HYDROCARBON #7(20.00)	1500 J		
* PROBABLE HYDROCARBON #8(21.16)	3000 J		
* PROBABLE HYDROCARBON #9(21.35)	1300 J		
* PROBABLE SUBSTITUTED BE(21.04)			4300 J
* PROBABLE SUBSTITUTED BE(21.53)			2600 J
* PROBABLE SUBSTITUTED BE(22.12)			4100 J
* PROBABLE SUBSTITUTED BE(22.36)			3000 J

TABLE 4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 LEACHING PITS

DRAFT DO NOT CITE

S&A REQUEST: 808
LOCATION: BUILDING 481 LEACH PIT
MEDIUM: SOIL

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	BR808015E	BR808015F	BR808026E	BR808026F	BR808037E	BR808037F
	SDG NO:	LLL8315	LLL8315	LLL8315	LLL8315	LLL8315	LLL8315
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CO-60		1300		950		1500	
CS-137		130		140		130	
H-3			-100		0		1100
K-40		3200		2000 U		3000	
SR-TOT		190		160		200	

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5.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

This section covers quality assurance and quality control requirements addressed by QA/QC plans for the BNL Site. Section 5.1 reviews the QA/QC plan for the BNL Site and provides a summary of the quality control samples generated and collected in the field. An analysis of results, a summary of laboratory QA/QC procedures for stable and radioactive contaminants, and a discussion of audits conducted by the EPA and others are also provided. (Please refer to specific environmental problems in Chapter 4.0 for data limitations.) Section 5.2 addresses stable chemistry, laboratory radiological chemistry, and field radiological chemistry, as well as audits conducted by the EPA and others.

Table 5.1 provides a cross-reference for correlating and locating QA/QC information in this BNL Sampling and Analysis Data Document, the BNL Sampling and Analysis Plans, and the DOE Environmental Survey Manual (8/87).

5.1 Field QA/QC

The BNL Sampling and Analysis Plans were reviewed by EMSL-LV and approved by DOE. Items 5, 8, 11, and 12 from the QA/QC plan (see Table 5.1) are addressed in the paragraphs that follow.

Item 5. QA Objectives for Completeness. The goal for completeness of field measurements was 100%, although 90% was acceptable. The objective for sampling completeness for effluent and groundwater samples was 95%.

Table 5.2 summarizes the sampling completeness for the BNL effort. The effort was 100^{+}% after correcting for deletions. Ground and surface water efforts were 100% which exceeds the 95% objective for completeness.

Item 8. Calibration Procedures and Frequency. An important factor in the collection of accurate field data is instrument calibration. The guidance provided

Table 5.1. Quality Assurance/Quality Control Project Plan Locator

	Essential Elements**	Data Document	BNL S&A Plan and BCD Addendum***	Survey Manual*
1.	TITLE PAGE WITH APPROVAL SIGNATURES	COVER PAGE	COVER PAGE	COVER PAGE
2.	TABLE OF CONTENTS	iii		APPEND F
3.	PROJECT DESCRIPTION	1.0	1.2.1	
4.	PROJECT ORGANIZATION AND RESPONSIBILITIES	1.1	6.2	Sect. 2
5.	QA OBJECTIVES FOR MEASUREMENT DATA (Precision, accuracy, completeness, representativeness, and comparability)	5.1	6.3	APPEND F
6.	SAMPLING PROCEDURES	3.1	4.0	APPEND E
7.	SAMPLING CUSTODY	3.0	5.8, 5.11	APPEND I
8.	CALIBRATION PROCEDURES AND FREQUENCY	5.1	6.6.4	APPEND E
9.	ANALYTICAL PROCEDURES	3.2	6.6.5	APPEND D
10.	DATA REDUCTION, VALIDATION, AND REPORTING	4.0	6.6.6	APPEND H
11.	INTERNAL QC CHECKS AND FREQUENCY	5.1	6.10	APPEND F
12.	PERFORMANCE AND SYSTEM AUDITS AND FREQUENCY	5.1 and APPEND C	6.11, 6.15	APPEND F
13.	PREVENTIVE MAINTENANCE PROCEDURE AND SCHEDULE		6.6.4	
14.	ROUTINE PROCEDURES FOR DATA ASSESSMENT (Precision, accuracy, and completeness of measurement parameters involved)	5.2 APEND D	6.6.6	APPEND H
15.	CORRECTIVE ACTION	5.1	6.12	APPEND F
16.	QUALITY ASSURANCE REPORTS TO MANAGEMENT	5.0	6.14	APPEND F

* Please refer to the August 1987 DOE Environmental Survey Manual.

** Reference EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Plans" (EPA 1983).

*** Please refer to Appendix F of this data document for a copy of Battelle's addendum to ORNL's BNL Sampling and Analysis Plan.

Table 5.2. Field Sampling Completeness for the BNL Site
Number of Samples[(a)]

Media Type	Planned	Collected[(c)]	Deleted[(d)]	Not Collected
Ground Water	29	29	0	0
Surface Water[(b)]	30	33	6	0
Soils	60	55	5	0
Sub-surface Soil	29	32[(e)]	0	0
Sediment	12	12	0	0
Sludge	25[(f)]	10	15	0
Total	185	171	26	0

(a) Does not include any blank or rinsate samples for QC purposes.
(b) Includes effluent in tanks, sumps and pools, if applicable.
(c) Twelve additional samples obtained. Refer to text for explanations.
(d) Refer to Environmental Problem 2 (Requests 307, 309, 312, and 314) and Environmental Problem 8 (Request 800) texts for explanations of deletions.
(e) Nine samples submitted for analysis.
(f) Environmental Problem 11 (Request 808) specified soil samples. Changed to sludge owing to existing conditions.

in Table 6.1 of the BNL Sampling and Analysis Plans was followed; dates, standards, and problems were recorded in the field logbooks. In some cases, there were instrument stabilization problems, and where data are suspect, it is noted in the tables or text associated with each environmental problem (see Chapter 4.0).

Item 11. Internal Quality Control Checks. The BNL QA/QC plan called for the collection of trip blanks for volatile organic samples and rinsate samples to check on equipment decontamination. The frequency of use for each of these types of QC samples is shown in Table 5.3. However, the guidance in the final version of the DOE Environmental Survey Manual was changed. Table 5.4 lists the field QC samples collected at BNL.

Item 12. Performance and System Audits. An EPA audit team conducted an on-site inspection to evaluate the sampling effort at the BNL Site to document the extent to which procedures identified in the BNL Sampling and Analysis Plans were being followed with respect to implementing specified field tests, field calibration, chain-of-custody, record keeping, quality assurance, sample handling, sample shipment, and sample collection techniques. The field sampling effort and sample management facility were the focus of the inspection. EPA sent no official report to document any deficiencies found. In cases where multiple bottles were indicated for a given analysis, only a single bottle was analyzed.

Therefore the EPA audit of field sampling activities will not be found in Appendix C of this document.

5.2 Analytical QA/QC

Analytical QA/QC is divided into four major sections: analytical chemistry (5.2.1), radiological quality assurance (5.2.2), data management QA/QC (5.2.3), and the analytical QC summary (Appendix D).

Table 5.3. Field QC Samples Planned for the BNL Site

		Solids	Water	Air
Field Preservation Blanks[a]	Organics	NA	NA	NA
	Metals	NA	1/20	NA
	Rads	NA	1/20	NA
Rinsate Samples[a]	Organics	1/20	1/20	1/20
	Metals	1/20	1/20	1/20
	RAds	1/20	1/20	1/20
Trip Blanks[a]	Organics	NR	1/20	1/20
	Metals	NR	NR	NR
	Rads	NR	NR	NR

NA = Not available, not applicable, or not recommended.
NR = Not required.
1/20 = One QC sample for 1 to 20 samples, 2 for 20 to 40, 3 for 40 to 60, etc.

(a) All QC samples are checked with hand held instruments to detect any radioactive contamination.

TABLE 5.4 BROOKHAVEN SITE ENVIRONMENTAL SURVEY FIELD QC SAMPLES

SAMPLE NUMBER	SAMPLE TYPE	TYPE LOCATION	MEDIUM	NUMBER ANALYSES REQUESTED	ANIONS	EXOTC	HAZ WAS	HE	METALS	O&G	PCBS& OTHER EXTRA	PET HYDRO	RADS	SEMI-VOLS	SOIL GAS	VOLS
BRN09012A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN09012B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN11016A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN11016B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN13016A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN16011A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN16011B	TRIP BLANK	TRIP BLANK	WATER	2	0	0	0	0	0	0	0	0	0	0	0	2
BRN17012A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN20017A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN21018A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN22019A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN22019B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN28015A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN28015B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN28015C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN33012A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN33012B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN33012C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN34013A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN35014A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN36015A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN36015B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN37016A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN37016B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BRN37016C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR301046A	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR301046B	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR301046C	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR301046D	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR301046E	QC RINSATE	POND	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0
BR301046F	QC RINSATE	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR301046G	QC RINSATE	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR301046H	QC RINSATE	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR301046I	QC RINSATE	POND	SURF WATER	1	0	1	0	0	0	0	0	0	0	0	0	0
BR301046J	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR301046K	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR302047A	FIELD BLNK	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR302047B	FIELD BLNK	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR302047C	FIELD BLNK	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR302047D	FIELD BLNK	POND	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR304049A	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR304049B	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR304049C	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR304049D	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR304049E	QC RINSATE	POND	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0
BR304049F	QC RINSATE	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR304049G	QC RINSATE	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR304049H	QC RINSATE	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR304049I	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR304049J	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR304049K	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR306041A	FIELD BLNK	CESSPOOL	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR306041B	FIELD BLNK	CESSPOOL	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0

TABLE 5.4 BROOKHAVEN SITE ENVIRONMENTAL SURVEY FIELD QC SAMPLES

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SAMPLE NUMBER	SAMPLE TYPE	TYPE LOCATION	MEDIUM	NUMBER ANALYSES REQUESTED	ANIONS	EXOTC	HAZ WAS	HE	METALS	O&G	PCBS& OTHER EXTRA	PET HYDRO	RADS	SEMI-VOLS	SOIL GAS	VOLS
BR306041C	FIELD BLNK	CESSPOOL	SURF WATER	1	0	0	0	0	0	1	0	0	0	0	0	0
BR306041D	FIELD BLNK	CESSPOOL	SURF WATER	1	0	0	0	0	0	1	0	0	0	0	0	0
BR306041E	FIELD BLNK	CESSPOOL	SURF WATER	1	1	0	0	0	0	0	0	0	0	0	0	0
BR306041F	FIELD BLNK	CESSPOOL	SURF WATER	1	1	0	0	0	0	0	0	0	0	0	0	0
BR308043A	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR308043B	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR308043C	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR308043D	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR308043E	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
BR308043F	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR308043G	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR308043H	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	1	0	0	0	0	0	0
BR308043I	QC RINSATE	CESSPOOL	SURF WATER	1	1	0	0	0	0	0	0	0	0	0	0	0
BR311026A	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR311026B	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR311026C	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR311026D	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR311026E	QC RINSATE	CESSPOOL	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0
BR311026F	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR311026G	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR311026H	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR311026I	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	1	0	0	0	0
BR311026J	QC RINSATE	CESSPOOL	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR316054A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR316054B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR316065A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR316065B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR501093A	QC RINSATE	SLURRY	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR501093B	QC RINSATE	SLURRY	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR503051A	QC RINSATE	RELEASES	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR503051B	QC RINSATE	RELEASES	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR503051C	QC RINSATE	RELEASES	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR503051D	QC RINSATE	RELEASES	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR503051E	QC RINSATE	RELEASES	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
BR503051F	QC RINSATE	RELEASES	SURF WATER	1	0	0	0	0	0	1	0	0	0	0	0	0
BR503051G	QC RINSATE	RELEASES	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR503051H	QC RINSATE	RELEASES	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR507099A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR507099B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR507102A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR507102B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR507113A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR507113B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR507124A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR507124B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR508114A	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR508114B	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR508114C	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR508114D	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR508114E	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
BR508114F	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR508114G	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR508114H	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0

TABLE 5.4 BROOKHAVEN SITE ENVIRONMENTAL SURVEY FIELD QC SAMPLES

SAMPLE NUMBER	SAMPLE TYPE	TYPE LOCATION	MEDIUM	NUMBER ANALYSES REQUESTED	ANIONS	EXOTC	HAZ WAS	HE	METALS	O&G	PCBS& OTHER EXTRA	PET HYDRO	RADS	SEMI-VOLS	SOIL GAS	VOLS
BR508114I	QC RINSATE	WELL AT LN	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR508125A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR508125B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR800119A	QC RINSATE	DREDGE MAT	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR800119B	QC RINSATE	DREDGE MAT	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR800119C	QC RINSATE	DREDGE MAT	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR800119D	QC RINSATE	DREDGE MAT	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR800119E	QC RINSATE	DREDGE MAT	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0
BR800119F	QC RINSATE	DREDGE MAT	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR800119G	QC RINSATE	DREDGE MAT	SURF WATER	1	0	1	0	0	0	0	0	0	0	0	0	0
BR800119H	QC RINSATE	DREDGE MAT	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR800119I	QC RINSATE	DREDGE MAT	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR800119J	QC RINSATE	DREDGE MAT	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR801041A	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR801041B	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR801041C	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR801041D	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR801041E	QC RINSATE	TANK	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0
BR801041F	QC RINSATE	TANK	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0
BR801041G	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR801041H	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR801041I	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR801041J	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR801041K	QC RINSATE	TANK	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR806159A	QC RINSATE	BUBBLE ARE	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR806159B	QC RINSATE	BUBBLE ARE	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR806159C	QC RINSATE	BUBBLE ARE	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR806159D	QC RINSATE	BUBBLE ARE	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR806159E	QC RINSATE	BUBBLE ARE	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
BR806159F	QC RINSATE	BUBBLE ARE	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR806159G	QC RINSATE	BUBBLE ARE	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR807047A	FIELD BLNK	WELL	GRND WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR807047B	FIELD BLNK	WELL	GRND WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR809094A	QC RINSATE	WELL	WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR809094B	QC RINSATE	WELL	WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR809094C	QC RINSATE	WELL	WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR809094D	QC RINSATE	WELL	WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR809107A	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809107B	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809107C	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809107D	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809107E	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
BR809107F	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
BR809107G	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
BR809107H	FIELD BLNK	WELL	WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
BR809107I	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR809107J	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR809107K	FIELD BLNK	WELL	WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
BR809141A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809141B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809152A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809152B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809163A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809163B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809174A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809174B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809185A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
BR809185B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1

Design and implementation of analytical QA plans for the DOE Environmental Survey have been based on the fundamental principle of "data of known quality." Although a Survey program such as this can effectively use data of varying quality levels, it is important that data users be provided with a data quality assessment for any given sample set. In this way, the Survey Team can interpret the analytical data from a programmatic perspective, while considering the analytical limitations imposed on the data. Data quality assessments require that all phases of laboratory support be designed to address the fundamental principles of precision, representativeness, accuracy, comparability, and completeness. The analytical QA program plan has accomplished this through the use of standard procedures, quality control practices, data reporting requirements, and data quality evaluations. A brief summary of some of the major analytical QA components follows.

Sampling and analysis support to the DOE Environmental Survey is a very large scale effort, requiring the contributions of a number of laboratories. From an analytical perspective, data comparability is ensured by adopting a program-wide set of standard analytical procedures, quality control practices, and reporting requirements. These procedures, which are documented in Appendix D of the DOE Environmental Survey Manual, are based on a number of well-documented, EPA-approved methods. In cases where a standard EPA method has not been developed for a given analyte, procedures that have been fully tested and documented were selected. All analytical procedures used for the laboratory analysis of BNL samples are described in Chapter 3.0 and cited in Chapter 6.0 of this report. The majority of the nonradiological determinations for this program use the EPA Contract Laboratory Program protocols. Radiological determinations use a series of procedures which have been developed and/or tested within the DOE national laboratory system. In this way, all of the participating laboratories are required to meet standard performance criteria regarding the precision and accuracy of their analyses. A summary of data quality objectives as described in the defined EPA method is presented in Table 5.5.

Table 5.5. Data Quality Objective

Analyte(s)	Method	Precision	Accuracy
Volatile organics	7/87 CLP S.O.W.	As specified in protocol	As specified in protocol
Semivolatile organics	7/87 CLP S.O.W.	As specified in protocol	As specified in protocol
Pesticides/PCBs	10/86 CLP S.O.W.	As specified in protocol	As specified in protocol
Petroleum Hydrocarbons	EPA 418.1	Not available	Not available
Inorganic Metals	7/87 CLP S.O.W.	As specified in protocol	As specified in protocol
Potassium	*	Not available	Not available
Mercury	EPA 245.1	4 ug/L	10% for conc. > ug/L
Cyanide (water)	EPA 335.2	± .031 mg/L CN @ 0.28 mg/L CN	- 15% bias @ 0.28 mg/L CN
Total Dissolved Solids	EPA 160.1	Not available	Not available

*Non-EPA methods are cited in Chaper 6.0 of this Data Document.

Table 5.5. Data Quality Objective (Continued)

Analyte(s)	Method	Precision	Accuracy
Oil and Grease	EPA 413.1	± 0.9 mg/L @ 12.6 mg/L	+ 7% bias @ 12.6 mg/L
Percent Solids	EPA 160.3	Not available	Not Available
Gross alpha & beta in water	Survey Manual	20% @ 95% confidence level	15%
Isotopic uranium by mass spectometry	*	Not available	Not available
Total uranium in water	Survey Manual	+ 0.5 ug/L @ 95% confidence level	5%
Total uranium in soil	Survey Manual	± 4.4% @ 95% confidence level	Not available
Plutonium Isotopes	Survey Manual	20%	Not availabe
Gamma Emitting Nuclides	Survey Manual	as low as 1%	± 6%
Total strontium	Survey Manual	12% @ 95% confidence level	-5% bias (wastewater); +25% bias (soil)
Tritium	EPA 906.0	30%	30%

*Non-EPA methods are cited in Chaper 6.0 of this Data Document.

All participating laboratories have developed a series of Standard Operating Procedures (SOPs) which establish policies and practices for all phases of laboratory operations. The SOPs provide the basis for day-to-day operation of the laboratory, and serve as the foundation for a technical systems audit.

At a minimum, quality control practices adopted by the individual laboratories must include items mandated by the analytical protocols. In the case of inorganic determinations, these include the use of preparation blanks, calibration blanks, laboratory duplicate samples, laboratory control samples, matrix spikes, analytical spikes, interference check samples, and calibration verification solutions. For organic determinations, these include rigorous tuning criteria, matrix spike samples, matrix spike duplicate samples, method blanks, internal standards, and surrogates. In addition to these requirements, which are imposed by the analytical protocols, the laboratory is required to monitor method performance over time.

Data reporting procedures for the DOE Environmental Survey program were established with the objective of providing a technically defensible, legally admissible data set. Deliverables include CLP reporting forms for organics and inorganics, and reporting forms which provide appropriate levels of QC data for non-CLP analyte parameters. Data comparability is provided by the adoption of a program-wide set of defined deliverables. ORNL will be responsible for a comprehensive case file purge for the BNL Site. These case files include all of the raw data and documentation associated with a site in an auditable structure.

Evaluations of the quality of an analytical support effort to the DOE Environmental Survey were made externally to provide an independent assessment of performance and technical systems. These external assessments of analytical performance include participation in EPA round robins. Organic and inorganic laboratories received regular sets of performance evaluation samples from the EPA during the time BNL samples were being analyzed. These include quarterly blinds (CLP analytes) from EMSL-LV, water pollution series samples (classical analytes) from EMSL-Cincinnati, and quarterly round-robin samples (radiological determinations) from EMSL-LV. A summary of performance results pertinent to the BNL sampling and analysis time period appears in the "Results of Inorganic and Organic Performance Evaluation Studies" in Appendix C. A related, but distinctly different, function is served by the technical systems audits performed by EPA (and NEIC). In this case, on-site evaluation of the laboratory operation is performed during and following the sampling and analysis period. These audits are a qualitative evaluation of the overall laboratory operation, including facilities, equipment, documentation, data validation, and quality control procedures.

5.2.1 Analytical Chemistry QA

Analytical support to the BNL sampling and analysis effort was provided by three laboratories within ORNL in addition to Argonne National Laboratory - East (ANL-E), Argonne, IL; Battelle-Columbus Division (BCD), Columbus, OH; Battelle Pacific Northwest Laboratory (PNL), Richland, WA; and the Analytical Chemistry Department at the Oak Ridge Gaseous Diffusion Plant (ORGDP), Oak Ridge, TN. A portion of radiometric analyses was performed at PNL under the coordination of BCD. Detailed data quality assessments are presented for the samples associated with a given environmental problem/location in Chapter 4.0.

A data quality assessment/data usability determination for ICP-metal analyses performed at ORNL and ANL-E was made using a procedure similar to one that was developed by US EPA for use in EPA contract compliance determinations. The procedure which was developed at ORNL is entitled "Data Quality Evaluation--Preliminary Operating Procedure ICP (Including K)"; a copy of which appears in Appendix D. The preliminary protocol is designed to allow the determination of the utility or quality level for DOE Site Survey ICP and potassium analyses. The format for this procedure also provides a summary of all QC problem areas. The following QC areas are reviewed:

1. Calibration Verification
2. Preparation Blank
3. Calibration Blank
4. Spike Recovery
5. Serial Dilution
6. Interference Check Standard
7. Laboratory Control Standard
8. Duplicate Analyses
9. Holding Time

Each element in a given sample delivery group (SDG) is assigned a Quality Level of I, II, or III according to compliance with CLP limits in the above QC areas.

Data quality assessment/data usability determination for all other analytical methods was made using a modification of a checklist developed by the Idaho National Engineering Laboratory and documented in the Hanford Site Sampling and Analysis Data Document, Volume 1, April 1988. The checklist used to evaluate the quality of BNL results is entitled "Analysis Quality Level Evaluation" and can be found in Appendix D. The checklist addresses the same QC areas as the previously described assessments, but in a less rigorous manner. The checklist was used to verify that the components essential to sampling, analysis, and quality control were integrated into the environmental problem evaluation. In general, data were evaluated on an SDG basis. The exception to this is when an analyte did not conform to the majority of analytes in a given analytical method. Data quality of this analyte was assessed separately and entered in the exception portion of the checklist.

To perform the evaluation, the pertinent information was attached to the checklist and referenced, or simply included in the allowed space. The level of quality for a given determination was assessed according to compliance of sample results to six performance criteria specified in the checklist. These performance criteria include determination of compliance to CLP requirements in the following categories:

1. Holding Time
2. Duplicates
3. Blanks
4. Laboratory Control Standards
5. Calibration Verification
6. Spike Recovery

Data in compliance with all six performance criteria were assigned of Quality Level I. Data Quality Level II was assigned to SDGs in which the numerical average of noncompliance results for the six performance criteria was less than or equal to 20% of the required limits. Quality Level III was assigned to any data in which the average deviation from compliance was greater than 20%. Data quality results associated with the overall BNL data set are located in Volume II of this data document.

In subsequent discussion, overall data quality for the BNL data set is presented in two formats:

1. Accomplishment of data quality objectives
2. Data quality by type of analysis.

5.2.1.1 Accomplishment of Data Quality Objectives

Objectives for the overall data quality for the BNL data set were established in five data quality categories. The categories are completeness, representativeness, comparability, precision, and accuracy. Evaluations of the program's accomplishments within each category follow.

5.2.1.1.1 Completeness

The characteristic of completeness measures the amount of data obtained compared to the amount expected or planned. The program objective was to obtain data for 90% of all samples planned for collection and not deleted. Analytical data were generated for 98% of all samples planned for collection. By general types of analysis, the percentage of samples for which analytical data were obtained for the BNL Site is as follows:

- Volatile organic compounds (VOA), 95%
- Semivolatile organic compounds (SV) , 98%
- Pesticides and polychlorinated biphenyls (pesticides/PCB), 93%
- Petroleum hydrocarbons, 100%
- Inorganic metals, 100%
- Cyanide, 100%
- Oil and grease, 100%
- Total dissolved solids, 100%
- Total uranium, 100%
- Radiological parameters, 100%

Total organic carbon analyses (TOC) were dropped from the BNL Sampling and Analysis Plan per instruction from DOE Sampling Team personnel. Therefore, samples were not collected for this determination.

Program objectives for completeness were satisfied for all analytical methods. Instances where analytical data were not obtained were mainly the result of the following problems:

- The sample was not collected
- The sample was collected but analysis was not performed because either the holding time was already exceeded or sufficient volume was not available for analysis.

5.2.1.1.2 Representativeness

Sampling and measurements were carefully conducted so that results are as representative as possible of the media (e.g., air, soil, and water) and conditions being measured. Sampling protocols were selected and developed where necessary to meet those objectives. Sample handling protocols (e.g., splitting into aliquots, field and travel blanks, preservation, storage, and transportation) were selected to evaluate and protect the representativeness of collected samples.

Recording procedures were utilized to document adherence to proper protocols for sampling, identifying samples, and maintaining sample integrity. Brookhaven coolers containing samples to be analyzed by ANL-E, BCD, ORGDP, or ORNL were shipped by Federal Express and delivered to each respective laboratory's receiving department where the air bills were removed and retained. Coolers were then delivered to the Chemistry Section sample receiving room of each laboratory where they were opened and inventoried in a secure area. Two sets of forms filled out by the sampling team were received with each sample cooler: The "DOE Environmental Survey Chain of Custody for Inorganics/Organics" (COC), and the "Request for Analytical Services, Department of Environmental Management". Receiving information which includes cooler receipt dates and times, cooler and sample conditions, chain-of-custody status, and discrepancies were documented. Internal sample ID labels were attached to all samples. Folders were created to permanently file the packing lists, chains-of-custody records, log-in sheets, and sample tags. An internal chain-of-custody record was used when transferring samples outside of the custody of the respective sample log-in room. Samples designated for specific chemical analyses were delivered on the same or following day to the appropriate analyses groups where they were retained under appropriate storage conditions. The DOE Site Survey Field Sampling Team was notified by phone of any discrepancies in sample identification.

The only instance of a discrepancy in documentation noted by the ORNL Sample Receiving Room was an incorrect cooler number listing on the Request for Analytical Services form which accompanied cooler 018. Receiving personnel corrected this error following discussion with Field Sampling Team personnel. ORNL Sample Receiving personnel also noted leakage from five samples of cooler 007 (three of which were submitted for mercury analysis, one for ICP metals and total strontium, and another for strontium-90), eleven samples of cooler 012 (three of which were submitted for mercury analysis, two for ICP metals and total strontium, three for tritium, one for a gamma scan, and one for strontium-90), and one sample from cooler 025 (submitted for mercury analysis). No irregularities in sample identification were noted in case narratives supplied by the individual analysis groups at ANL-E, BCD, PNL, or ORGDP.

Field and travel blank results indicate contamination of target analytes during sampling or sample transportation was minor. For all analytes, field and transportation contamination occurred in less than 11.4% of the individual batches of samples collected and shipped to the laboratories. The levels of contamination that did infrequently occur were low and did not require rejection of analytical data.

Analytical program objectives for representativeness were established for each analysis type. The quality control requirements monitored to evaluate representativeness were analyte specific holding times. Table 5.6 shows the actual adherence to required extraction and analysis holding times and program objectives as percentages of samples analyzed. Holding times are calculated from the date of sample collection for all regular samples. Holding time requirements are those listed in Test Methods for Evaluating Solid Waste, USEPA SW-846 3rd ed., November 1986. Values appearing within the parentheses denote the actual number of samples in compliance compared to the total number of samples analyzed.

Table 5.6. Adherence to Holding Time Requirements

Analysis Type	Analyses Within Holding Time Requirements (%) Extraction Time Analyses	Extraction Time Objective	Analysis Time Analyses	Analysis Time Objective
Volatiles	NA		62 (89 of 144)	90
Semivolatiles	82 (99 of 121)	85	NA	
Pesticide/PCB	96 (53 of 55)	85	NA	
Petroleum Hydrocarbons	NA		0 (0 of 4)	90
Inorganic Metals+	100 (212 of 212)	98	NA	
Cyanide	100 (11 of 11)	75	NA	
Oil & Grease	NA		50 (11 of 22)	90
Total Dissolved Solids	NA		100 (9 of 9)	90
Total Uranium	NA		100 (46 of 46)	90
Rads	NA		94 (127 of 135)	90

\+ = Calculation based on total results of ICP, GFAA, and CVAA analytes.
NA = Not applicable.

The objective for adherence to the CLP requirement was not met for extraction holding times of the semivolatile organics; these holding times were exceeded by one to five days. The objective was also not met for the analysis holding times of samples designated for volatile organic compound, petroleum hydrocarbon, and oil and grease determinations. Exceeding the holding times for these analyses may have allowed degradation or transformation of the target analytes. The usual result of non-compliance to holding times is that the measured and reported concentrations may underestimate the true value of the analyte.

5.2.1.1.3 Comparability

The characteristic of comparability reflects both internal consistency of measurements and expression of results in units consistent with other organizations reporting similar data. Generating comparable data requires utilizing methodologies which produce comparable results (e.g., metals data obtained by total dissolution of soil is not comparable to data obtained by incomplete dissolution of soil such as the normally used acid leaching methods) and conducting analyses with calibrated analytical instruments within the proper calibration ranges. To ensure comparability of analytical results, all program laboratories utilized only analytical methods specified in the experimental plan. A documented analytical procedure was selected for those determinations not specified in the environmental plan. Additionally, appropriate standard units were utilized for each measurement system, which yielded internally and externally comparable results assuming other comparability criteria were met.

To monitor the ability of the laboratories to generate comparable data, quarterly blind (QB) performance samples from EPA (EMSL-LV) were analyzed for CLP analytes during the BNL analytical program. Similarly, EPA quarterly round robin samples were used to assess comparability for radiological samples. The analytical program objective for comparability was to generate acceptable results for the CLP QB samples. This objective was satisfactorily accomplished for the inorganic and non-target list parameters analyzed. ORNL received scores of

94.1%, 96.3%, and 89.5% for the inorganic QB2-, QB3-, and QB4 FY 88 evaluations. ANL-E scored 99%, 95.8%, and 94.8% for inorganic QB3- and QB4 of FY 88 and QB1 of FY 89, respectively. The objective was not met for one of three organic evaluations by BCD. BCD scored 47.3%, 95.6%, and 93.8% for QB2-, QB3-, and QB4- of FY 88, respectively, and did not participate in the QB1 FY 89 evaluation. The objective was also not met for one of three organic evaluations by ORGDP; ORGDP received a score of 68.8 for QB3 FY 88. ORGDP received acceptable scores of 93.6% and 95.6% for organic QB2- and QB4 FY 88. Only volatile organics and pesticides/PCBs were analyzed by ORGDP for QB4 FY 88; data for semivolatile organics was not submitted. Remedial action was taken by the laboratories to correct problems encountered with the analysis of inorganic and organic samples. A table summarizing these performance scores, copies of the respective EPA QB evaluation reports, and the remedial action responses from each laboratory are provided in Appendix C.

5.2.1.1.4 Precision

Precision, the ability to replicate an analytical value, was evaluated through duplicate analysis of 5% to 10% of the samples analyzed. The program objectives for the precision of analytical measurements were to satisfy CLP precision control limits for 80% of all aqueous analyses and 70% of all soil analyses. The reported data meet CLP precision criteria [relative percentage difference (RPD)] for 97% of all aqueous measurements and for 92% of all soil measurements. The adherence to precision requirements are summarized for each analysis method according to sample matrix in Table 5.7. The values appearing within the parentheses denote the actual number of analytes in compliance with CLP requirements in comparison to the total number of analytes measured. The data quality objective was not met for the analysis of volatile organics in water and semivolatile organics in soils by BCD; only 70% of the aqueous analytes for the volatiles and 9% of the soil analytes in the single semivolatile duplicate were within the control limit. The data quality objective was also not met for the analysis of total uranium in water and soil samples; the one aqueous

Table 5.7 Adherence to Precision Requirements

	Analyses Within CLP Precision Requirements (%)			
	Water Samples		Soil Samples	
Analysis Type	Analyses	Objective	Analyses	Objective
Volatiles				
BCD	70 (7 of 10)	80	100 (10 of 10)	70
ORGDP	100 (35 of 35)	80	97 (34 of 35)	70
Semivolatiles				
BCD	100 (22 of 22)	80	9 (1 of 11)	70
ORGPD	97 (32 of 33)	80	93 (41 of 44)	70
Pesticide/PCB	94 (17 of 18)	80	100 (12 of 12)	70
Inorganic Metals+				
ORNL	100 (89 of 89)	80	95 (105 of 110)	70
ANL-E	100 (43 of 43)	80	100 (22 of 22)	70
Cyanide	100 (3 of 3)	80	NS	
Oil & Grease	**	80	**	70
Total Dissolved Solids	**	80	NA	
Total Uranium	0 (0 of 1)	80	60 (3 of 5)	70
Rads				
ORNL	88 (7 of 8)	80	94 (16 of 17)	70
ORGDP	**	80	#	70
PNL	100 (2 of 2)	80	100 (2 of 2)	70

\+ = Calculation based on total results of ICP, GFAA, and CVAA analytes.
\# = One method duplicate was analyzed. However, there was insufficient uranium available for isotopic determination.
** = Not analyzed.
NA = Not applicable.
NS = No sample of this matrix type submitted for analysis.

Note: All calculations are based on the number of analytes in compliance for a given analytical method.

determination and 60% of the soil measurements were not within the ±20% control limit. The RPD between the uranium measurement of the water duplicate and the original sample was 29%. This noncompliance is most likely a reflection of the greater imprecision that is expected at the detection limit level. RPDs of 27% and 33% were obtained in two out of six duplicates analyzed for uranium in solid samples.

Method duplicates for petroleum hydrocarbon analyses were not performed. This information is not incorporated into Table 5.7 because an objective for precision for this determination was not established by the Survey. Also, the ICP precision results for some solidified condensate samples which were prepared at ORNL using a non-CLP dissolution procedure are not included in this table; precision criteria were met for 86% of these measurements.

5.2.1.1.5 Accuracy

Accuracy, the ability to obtain a true value, is optimized and evaluated for an analytical system through specific quality control (QC) procedures and measurements. The exact QC procedures and measurements required to ensure acceptable accuracy depend on the method, but all chemical methods generally require instrument calibration, method blank analysis, check standard or laboratory control sample analysis (i.e., analysis of a sample of a known analyte concentration), and matrix spike. Organic analyses usually incorporate additional QC procedures to optimize accuracy; the additional procedures referred to are internal standards and surrogate compounds added to every sample. Analytical determinations based on CLP protocol incorporated the required QC samples to assess the accuracy of analytical results. Similar QC samples were also included into all non-CLP procedures; QC results were calculated but no determination of compliance was made because no CLP requirements are available for these methods.

Evaluation of tuning criteria for volatiles and semivolatiles was performed by using the CLP Form V (GC-MS Tuning and Mass Calibration Form) for both the volatile and semivolatile fractions. Instrument tuning criteria were met for 100% of volatile and semivolatile organic data.

The remaining results for accuracy of QC measurements associated with the BNL data are summarized in the categories of calibration (Table 5.8), blanks (Table 5.9), control samples (Table 5.10) and matrix spikes (Table 5.11). Also listed in the summaries for comparison are program objectives, where objectives are established. The results of the QC samples analyzed by ICP at ORNL for some solidified condensate samples (i.e., concrete) are not incorporated into these tables. Rather, they are discussed in the following text.

Entries for percentage compliance for initial and continuing calibration results are summarized in Table 5.8. Percentage compliance for pesticide/PCB analysis is based on results tabulated from Form 8D and E [Check for Linearity and Retention Time Shift of dibutylchloreneate (DBC), respectively] and Form 9 (Standards Summary). Radiometric continuing calibrations were assumed to be in compliance if results fell within $\pm$10% of that observed for the initial calibration of the instrument. Insufficient information was available to determine the percentage of acceptable calibrations for radiological analyses performed by ORGDP and PNL. All other calibration data met program objectives.

Although not incorporated into this table, 98% of the analyte blank results for the solidified condensate samples analyzed by ICP were in compliance. All blank measurements satisfied the program objectives and imply relatively contamination free analyses.

Laboratory control sample analyses were not conducted for most types of analyses. Such analyses were performed for inorganic metals and radiochemical analytes. Results for laboratory control samples were considered to be in control for radiometric analysis if results were within $\pm$20% of the true value.

Table 5.8 Adherence to Calibration Requirements

Analysis Type	Analyses With Acceptable Calibrations (%) Water Samples Analyses	Water Samples Objective	Soil Samples Analyses	Soil Samples Objective
Volatiles				
BCD	100 (40 of 40)	90	100 (40 of 40)	90
ORGDP	100 (140 of 140)	90	100 (140 of 140)	90
Semivolatiles				
BCD	99 (237 of 238)	90	99 (337 of 340)	90
ORGPD	100 (119 of 119)*	90	100 (119 of 119)*	90
Pesticides/PCB	99 (289 of 290)	90	94 (524 of 556)	90
Inorganic Metals+				
ORNL	94 (396 of 423)	90	94 (432 of 460)	90
ANL-E	99 (176 of 178)	90	100 (66 of 66)	90
Cyanide	100 (5 of 5)	90	NS	
Total Uranium	100 (4 of 4)	90	100 (6 of 6)	90
Rads				
ORNL	100 (24 of 24)*	90	100 (24 of 24)*	90
ORGDP	NI	90	NI	90
PNL	NI	90	NI	90

\+ = Calculations based on total of ICP, GFAA, and CVAA analytes.
* = Instrument calibration used for both water and soil samples.
NI = No information available.
NS = No samples of this matrix type submitted for analysis.

Note: All calculations are based on the number of analytes in compliance for a given analytical method.

Table 5.9. Adherence to Method Blank Requirements

	Analyses With Method Blanks Below CRDL (%)			
	Water Samples		Soil Samples	
Analysis Type	Analyses	Objective	Analyses	Objective
Volatiles				
BCD	100 (136 of 136)	95	98 (166 of 170)	95
ORGDP	97 (232 of 238)	95	98 (266 of 272)	95
Semivolatiles				
BCD	98 (128 of 130)*	95	100 (65 of 65)*	95
ORGPD	99 (259 of 260)	95	99 (321 of 325)	95
Pesticides/PCB	100 (54 of 54)	95	100 (81 of 81)	95
Inorganic Metals+				
ORNL	99 (135 of 136)	95	100 (178 of 178)	95
ANL-E	100 (44 of 44)	95	100 (22 of 22)	95
Cyanide	***	95	NS	
Total Dissolved Solids	**	95	NA	
Total Uranium	100 (3 of 3)	95	100 (4 of 4)	95
Rads				
ORNL	100 (6 of 6)	95	100 (5 of 5)	95
ORGDP	#,*	95	#,*	95
PNL	100 (4 of 4)*	95	100 (4 of 4)*	95

\+ = Calculations based on total of ICP, GFAA, and CVAA analytes.
\# = One method blank was analyzed. However, there was insufficient uranium available for isotopic determination.
* = Water blanks were used for both water and soil SDGs.
** = Not analyzed.
*** = Blanks were used to correct sample data. A total of three water blanks were prepared.
NA = Not applicable.
NS = No samples of this matrix submitted for analysis.

Note: All calculations are based on the number of analytes in compliance for a given analytical method.

Table 5.10. Adherence to Control Sample Requirements

	Analyses With Acceptable Control Sample Analyses (%)			
	Water Samples		Soil Samples	
Analysis Type	Analyses	Objective	Analyses	Objective
Volatiles	NA		NA	
Semivolatiles	NA		NA	
Pesticide/PCB	NA		NA	
Inorganic Metals+				
ORNL	96 (65 of 68)	80	92 (82 of 89)	70
ANL-E	100 (44 of 44)	80	86 (19 of 22)	70
Cyanide	**	80	NS	
Rads				
ORNL	100 (12 of 12)	80	100 (20 of 20)	70
ORGDP	100 (4 of 4)*	80	100 (4 of 4)*	70
PNL	100 (18 of 18)*	80	100 (18 of 18)*	70

\+ = Calculations based on total of ICP, GFAA, and CVAA analytes.
* = Control samples analyzed with both water and soil samples.
** = Not analyzed.
NA = Not applicable.
NS = No samples of this matrix submitted for analysis.

Note: All calculations are based on the number of analytes in compliance for a given analytical method.

Table 5.11 Adherence to Matrix Spike Requirements

	Analyses With Acceptable Matrix Spike Analyses (%)					
	Water Samples			Soil Samples		
Analysis Type	Analyses		Objective	Analyses		Objective
Volatiles (TC)						
ORGDP	100	(70 of 70)	80	97	(68 of 70)	70
BCD	95	(19 of 20)	80	100	(20 of 20)	70
Volatiles (IS)						
ORGDP	100	(228 of 228)	90	86	(204 of 237)	80
BCD	100	(9 of 9)	90	100	(9 of 9)	80
Volatiles (SC)						
ORGDP	100	(228 of 228)	90	97	(230 of 237)	80
BCD	100	(9 of 9)	90	89	(8 of 9)	80
Semivolatiles (TC)						
BCD	80	(35 of 44)	80	45	(10 of 22)	70
ORGPD	85	(75 of 88)	80	86	(76 of 88)	70
Semivolatiles (IS)						
BCD	100	(24 of 24)	90	100	(6 of 6)	80
ORGPD	100	(42 of 42)	90	38	(27 of 72)	80
Semivolatiles (SC)						
BCD	92	(154 of 168)	90	62	(30 of 48)	80
ORGPD	93	(269 of 288)	90	93	(380 of 408)	80
Pesticide/PCB (TC)	100	(36 of 36)	80	46	(11 of 24)	70
Pesticide/PCB (SC)	97	(29 of 30)	90	80	(32 of 40)	80
Inorganic Metals+						
ORNL	95	(69 of 73)	80	77	(50 of 65)	70
ANL-E	100	(36 of 36)	80	94	(15 of 16)	70
Cyanide	0	(0 of 3)	80		NS	
Total Uranium	100	(1 of 1)	80	100	(2 of 2)	70
Rads						
ORNL	100	(12 of 12)	80	100	(20 of 20)	70
ORGDP		**	80		**	70
PNL		**	80		**	70

\+ = Calculations based on total of ICP, GFAA, and CVAA analytes.
** = Not analyzed.
NA = Matrix spikes not analyzed for this matrix.
NS = No samples of this matrix submitted for analysis.
IS = Calculations based on the results of internal standard compound recovery.
SC = Calculations based on the results of surrogate compound recovery.
TC = Calculations based on the results of target compound recovery.

Note: All calculations are based on the number of analytes in compliance for a given analytical method.

Results from both inorganic metal and radiometric analyses indicate excellent accuracy for these procedures. Eighty-six percent of the analytes in the ICP laboratory control sample that was prepared with the solidified condensate samples were in compliance.

The performance of matrix spike organic samples was based on the recovery of target compounds (TC), internal standard compounds (IC), and surrogate compounds. The performance objective for matrix spike samples was not realized for the TC and SC semivolatile spikes for soils analyzed by BCD and for the IS semivolatile soil spikes analyzed by ORGDP. The 46% recovery of target compounds in the analysis of two soil spikes for pesticides/PCBs also did not meet the performance objective. A reason for the poor spike recoveries could not be determined by the analyst.

The performance of all matrix spike inorganic samples except cyanide and ICP solidified condensate samples met the objective. None of the three samples spiked with cyanide were in control. A matrix interference was most likely the cause of the high cyanide spike recoveries observed in two sludge-like samples. Only 60% of the ICP analyte spike results for the solidified condensate samples were in compliance.

Although not incorporated into the results listed in Table 5.11, CLP compliance for ICP serial dilutions for water and soil preparations respectively were 100% and 82% for ANL-E, and 96% and 86% for ORNL.

5.2.1.2 Data Quality by Type of Analysis

General observations and facts that should be considered when interpreting data from the BNL Site are provided in this section. Also included is a summary of QA/QC protocol used for non-CLP methods. The discussions are presented by general type of analysis in the following order: volatiles, semivolatiles, pesticides/PCBs, petroleum hydrocarbons, inorganic metals, cyanide, oil and grease, total dissolved solids, total uranium, percent solids, and radiochemical analytes.

5.2.1.2.1 Volatile Organic Compounds

ORGDP analyzed volatile organic compounds in samples for Environmental Problems 0, 1, 2, 4, 6, 7, 8, 9, 10, and 11. BCD analyzed volatiles in samples associated with Problems 3, 4 (Requests 507 and 508), and 10 (Request 809). A summary of the more common analysis problems encountered by each laboratory and deviations from protocol follows.

Volatile Organic Compound Analysis by BCD. Thirty-two samples were analyzed for volatile organic compounds by BCD. These samples consisted of soil, water, and QC samples. Holding time requirements were met for all samples that were analyzed. To save time, several trip blanks were not analyzed so that holding times for the regular samples could be met. These blanks include the following: BR316065 (Problem 3); BR507102, BR507113, and BR507124 (Problem 4); BR809163 and BR809174 (Problem 10); and BR508125 (Problem 99).

With the exception of some low-level soils, volatile organic compound analyses were performed following Revision 7/87 of the EPA CLP protocol. A reduced sample size of 2 to 4 grams, rather than 5 grams, was used in the extraction procedure for low-level soils in order to obtain more acceptable recoveries for surrogates and improved internal standard areas.

A number of analytes and tentatively identified compounds (TICs) are often introduced to the samples rather than originating from the samples themselves. No TICs or TCLs above the CLP limit were found in any of the blanks prepared with the water samples. However, four soil blank analytes were detected at levels above the CRDL. These analytes have been flagged on the CLP forms.

A VOCOL™ (Supelco, Inc.), 60 m long by 0.75 mm ID with 1.5 um film glass capillary was employed for the analysis of these organic compounds. The target compound 1,1,2,2-tetrachloroethane and the surrogate compound 4-bromofluorobenzene (BFB) coelute during the analysis of the Initial Calibration Standards for samples on the VOCOL™ column. Because 1,1,2,2-tetrachloroethane has a fragment ion at m/z 95, which is the primary quantitation ion for BFB, the average relative response factor (RRF) for BFB for the initial calibration was artificially high. This caused the surrogate recovery value of BFB in the method blanks to be less than the 86% minimum criteria. The ion at m/z 174 was therefore selected as the primary quantitation ion for BFB. Using the quantitation ion at m/z 174, an RRF was established for BFB which gave acceptable surrogate recoveries for BFB for all standards, blanks and samples.

Quantitation of TIC compounds by BCD was based on peak height because their coelution with target compounds made area measurements unreliable.

Volatile Organic Compound Analysis by ORGDP. Noncompliance to CLP limits was observed in a number of surrogate and internal standard recoveries. Several analytes were detected in the blanks. The majority of method blanks contained acetone above the CRDL; however, the concentrations were not greater than the CLP limit. In many cases methylene chloride, chloroform, toluene, xylene, and ethyl benzene were present below the CRDL. All field rinsates contained toluene at approximately 12 ug/L. Because these results were below CLP limits, they should have no impact on the sample data. These analytes are flagged on the CLP reporting forms.

Holding times were not met for all samples due to instrument failure. Several samples were reanalyzed because the accompanying QC measurements did not meet specifications. Reanalysis also resulted in noncompliance to the holding time requirement. These noncompliances may result in an underestimation of analyte concentration.

5.2.1.2.2 Semivolatile Organic Compounds

Semivolatile organic compound analyses were performed by BCD and ORGDP. The majority of semivolatile organic compound analyses were done by ORGDP.

The time between sampling and extraction is the most critical with respect to losses. Once samples are extracted, it is less likely that losses will occur. Where samples were not extracted within the holding time, false negatives and/or quantitation biases low are possible. However, where the holding time was exceeded by only a few days, minor losses are expected. Very few samples fall into this category as most of the samples were extracted before their holding times expired. Therefore, the interval between extraction and analysis was 80 to 90 days for all of the samples. False negatives, quantitation biased low due to losses, or quantitation biased high due to evaporation of the extraction solvent were possible results of this delay. Within limits, surrogate recoveries can be used to assess whether these errors have occurred and to what extent.

A summary of the more common analysis problems encountered by each laboratory and deviations from protocol follows.

Semivolatile Organic Compound Analysis by BCD. Twenty-eight samples (6 soil samples and 22 water samples) were submitted to BCD for semivolatile organic compound analysis. These samples consisted of soil, water, and QC samples associated with Environmental Problems 3 (Request 316), 4 (Requests 507 and 508), and 10 (Request 809). Holding time requirements were met for all but four soil samples of Environmental Problem 4.

Semivolatile organic compound analyses are prone to a unique set of contamination problems. Phthalates are a very common contaminant in semivolatile analyses. These compounds are used as plasticizers and are easily extracted with organic solvents and often introduced to samples or their associated extracts at numerous points in the sample analysis process. No compounds above the CLP limit were found in any of the blanks prepared with the soil samples. However, two water blank analytes were detected at levels above the CRDL. These analytes have been flagged on the CLP forms.

Quantitation of TIC compounds by BCD was based on peak height because their coelution with target compounds made area measurements unreliable.

Nonconformance to CLP protocol was cited in several instances. Two water samples, BR809130G and BR809049G, of Environmental Problem 10 received twice the required amount of surrogate. No corrective action for this deviation was mentioned in the case narrative. Soil sample BR508089C of Environmental Problem 4 was accidentally spiked with MS/MSD compounds. This sample is reported as a regular sample with TICs. True soil method blanks were not used. Rather, laboratory soil blanks consisted of the organic and inorganic reagents used in the extraction procedure. Noncompliance to CLP limits are identified on the forms.

Semivolatile Organic Compound Analysis by ORGDP. ORGDP analyzed sediment, sludge, soil, water and QC samples for Environmental Problems 0, 1, 2, 4, 6, 7, 8, 9, 10, and 11. Noncompliance to CLP limits was observed in a relatively small number of QC samples. Matrix interferences are attributed to having caused some of these deviations. A failure to recover 2,4-dinitrophenol in the continuing calibration did not affect any samples, as this compound was undetected in all samples in the affected SDG. These noncompliance situations are noted on the CLP reporting forms. Because of time constraints, matrix problems could not be corrected and GC-MS contamination problems made reanalysis unfeasible.

Holding times were met for the majority of samples. However, twelve samples from Environmental Problems 2, 4, 6, 8, 9, and 10 exceeded the seven-day holding time by one to seven days.

An inadequate volume was provided for twelve regular water samples and three QC rinsates of Environmental Problems 1 (Request 301 and 302), 4 (Request 305), and 10 (Request 809) which were designated for semivolatile organic compound analysis and PCB/pesticide analysis. Only PCB/pesticide analysis was performed on this first set of samples. Sampling Team personnel resampled the sites to obtain more samples for SVO analysis. The well that was associated with Environmental Problem 10 was an exception to this resampling effort. In this case, no further samples were collected; only semivolatile analysis was performed on the original samples. Nine additional regular samples and one rinsate were collected for semivolatile analysis. Since resampling occurred over a period of one to five days from the time the first samples were gathered, new identification numbers were assigned to these nine samples. No new field data was taken during this re-collection period. Some of the resampled waters were used as QC samples for PCB/pesticide determinations performed on samples collected during the first sampling effort. Semivolatile and PCB/pesticide data may therefore not necessarily represent the same results as those from the same sample collection. Also, the result for the PCB/pesticide matrix spike may not represent the matrix effect of the first set of samples.

5.2.1.2.3 Pesticides and Polychlorinated Biphenyls

Pesticides and polychlorinated biphenyls (PCBs) in water and soil samples were determined using Revision 10/86 of the Contract Laboratory Program Statement of Work. One water and two soil SDGs were analyzed. Noncompliances to CLP limits are noted on the CLP forms. Time constraints did not permit reanalysis of samples.

The time between sampling and extraction is the most critical with respect to losses. Once samples are extracted, it is less likely that losses will occur. Where samples were not extracted within the holding time, false negatives and/or quantitation biases low are possible. However, where the holding time was exceeded by only a few days, minor losses are expected. Very few samples fall into this category as most of the samples were extracted before their holding times expired. Therefore, the interval between extraction and analysis was 80 to 90 days for all of the samples. False negatives, quantitation biased low due to losses, or quantitation biased high due to evaporation of the extraction solvent were possible results of this delay. Within limits, surrogate recoveries can be used to assess whether these errors have occurred and to what extent.

The QC results for the water samples were very good; there were few noncompliances to CLP limits. An interfering peak prevented the quantitation of dibutyl chlorendate (DBC) in water sample BR807014F.

As previously described, an insufficient volume of sample was initially received for the preparation of a matrix spike and matrix spike duplicate sample for the water SDG. The additional samples which were received to correct this problem were labeled with DOE sample numbers different from the identification number assigned to the parent sample. Because of this resampling complication, each Form 3E contains three BR sample numbers instead of the normal one. Due to differences in sampling times, matrix results may reflect a difference in sample composition, rather than an indication of matrix interferences within a single sample.

Five soil samples from the South Primary Pond for Environmental Problem 1 had detectable amounts of some target compounds; Aroclor 1260, 4,4'-DDE, 4,4'-DDT, and 4,4'-DDD were identified. It was difficult to confirm the presence of 4,4'-DDT and 4,4'DDD in samples BR303015B and BR303026B which contained Aroclor 1260 because these compounds have similar retention times. Also, there were several peaks which could not be identified from the chromatograms. Overall, the QC for this SDG was good.

5.2.1.2.4 Petroleum Hydrocarbons

A non-CLP method was used for the analysis of petroleum hydrocarbons. Two SDGs which consisted of three sludge samples and a QC water rinsate were analyzed. An extraction blank was prepared and analyzed for each matrix of an analysis run; its value was subtracted from the gross sample measurement to provide a net sample result. There was no detectable amount of hydrocarbon found in the blank for the water sample. There were 0.9 and 1.31 mg of hydrocarbon measured in the sludge method blanks. Samples exceeded the 14-day holding time limit by 19 to 21 days. No additional QC information was reported.

5.2.1.2.5 Inorganic Metals

Inorganic metal determinations were done at ORNL and ANL-E. In general, inorganic analyses were performed according to DOE Environmental Survey protocol; however, some deviations from the stated protocol did occur. A brief discussion of the more common deviations and protocol violations and their impact follows.

ICP Analyses at ORNL. The CLP protocol provides for the analysis of only soil and water samples. To meet the needs of the DOE Site Survey Program, as much as possible of the CLP protocol was followed in the analysis of other sample types. In one case, four samples which were described as solidified condensates (Problem Number 5, Building 811) were not prepared according to CLP procedure. These samples appeared to consist mainly of concrete. A stronger acid digestion procedure was considered more appropriate and was therefore used. As expected, the analysis of a laboratory control sample which was prepared using this procedure showed elemental concentrations higher than those normally obtained by the less rigorous CLP soil preparation method. Of these deviations, only the beryllium and selenium values are considered false positives. In another case, three water samples (Problem Number 2, Building 422) which were black and contained solid material were prepared using the CLP water method. Each preparation was diluted prior to analysis to avoid interference from an oily film which formed on the surface.

Difficulty was encountered in maintaining the calibration for the aluminum primary channel within the ten percent CLP limit. A $\pm$21% recovery limit for this channel was considered acceptable.

The ICP spiking level for arsenic was less than twice its detection limit. This low level accounts for the poor sample spike recoveries observed. Matrix effects and losses which occurred during sample preparation are also suspected causes for the poor recoveries. Consequently, most of the arsenic data cannot be used. The spike recoveries for several other elements often did not fall within the CLP control limits. However, in these instances the results are considered acceptable estimates.

The analysis results of a solid laboratory control sample, which was prepared with each group of BNL soil samples, indicate the possibility of false positive measurements for beryllium. Detectable amount of beryllium were also observed in all BNL soils. Therefore, the beryllium data for BNL soils should be considered estimates. A positive bias for selenium was also observed in the laboratory controls prepared with three groups of soil samples. The results for the following soil samples which showed detectable amounts of selenium were affected and should be considered qualitative: BR304038C, BR305017C, and BR305028C of Environmental Problem 1 taken from the Primary and Wooded Pond areas near the HWMA; BR313017C of Environmental Problem 2 taken from the cesspool northwest of Building 422; BR503028D of Environmental Problem 6 taken outside the fence and west of Building 444 in the HWMA; samples for Problem 8 which include BR802019C from the Emhoff tank at the sewage treatment plant, and BR803010C, BR803021C, and BR803032C from the sewage treatment plant; and BR808015C, BR808026C, and BR808037C of Environmental Problem 11 taken between Buildings 208 and 209.

Two method blanks were always prepared with each group of samples. In one case, zinc was detected in a blank at a level slightly above the contract required detection limit. A group of sixteen water samples associated with this blank was affected. These waters were sampled from Building 444, 479, 905, and 975, from the sewage treatment plant, and the AGS scrap yard areas (Environmental Problems 2, 6, 8, 9, 10). These samples were not redigested and reanalyzed since the second preparation blank was in compliance. The zinc results for these samples may possibly be elevated and therefore should be interpreted with caution.

The interference check samples which followed the analysis runs of two sample groups were not in compliance. The analyses were not redone. Chromium and lead in several water samples taken from Building 379, Building 422, BNL landfill, and the Boundary Road area (Environmental Problem 2, 4, and 10), and in solids taken from Building 444, Building 811, Building 975, the sewage treatment plant, and the Boundary Road (Environmental Problem 5, 6, 8, and 10) were affected. Silver and vanadium in some solids from Building 444, BNL landfill, and the Wooded and Primary Ponds (Environmental Problem 1, 4, and 6) were also affected. Detection limit elevation and negative bias should be taken into account when evaluating the data.

ICP Analyses by ANL-E. A total of 29 samples were received by ANL-E for ICP analysis. These samples consisted of 6 soils and 23 waters from Environmental Problems 3 (Request 316), 4 (Request 507 and 508), and 10 (Request 809). The reported values are from the analysis of QC samples, pump samples taken from landfill and the West Upton Road and Building 975 sites, and landfill grab samples. No sample receiving information denoting ID and shipping discrepancies was given in the case narrative.

All metal determinations except potassium and sodium were made with a JY-48 polychromator. A JY-38 monochromator ICP system was used for potassium and sodium measurements. Positive thallium results should be interpreted with caution; the existence of an unidentified and uncorrected interference introduced the possibility of false-positive or biased-high results for thallium.

The arsenic recovery for three calibration verification solutions deviated $^{+}2\%$ from the control limit. A reanalysis was not performed because arsenic was not detected in any of the samples. This deviation should have no impact on the sample data.

Poor spike recovery (i.e., 50% recovery relative to the 75% acceptance limit) was exhibited for antimony in soil sample BR508056DS associated with Environmental Problem 4, Current landfill. The antimony results for samples belonging to this SDG may therefore be biased low, and should be interpreted with care. Antimony results have been flagged according to protocol.

One iron result was out of compliance for water duplicate BR809016HD which was analyzed with several samples from the Boundary Road and Building 975 of Environmental Problem 10. The method duplicate appeared to have been contaminated. Supporting data suggests, however, that this contamination was most likely an isolated incident. The iron results reported for samples belonging to this SDG are considered reliable.

GFAA and CVAA Analyses by ORNL All but one sample, BR308010G of Environmental Problem 2, were prepared according to CLP protocol. This sludge-like sample which was submitted as a water sample for CVAA analysis did not contain a sufficient amount of liquid. It was therefore necessary to use volumes different from those specified in the CLP preparation procedure. All other QC requirements were met.

Potassium by ORNL A flame photometric procedure was used to determine the concentration of potassium in BNL samples. The CLP schemes for sample preparation and analysis, and the QA/QC protocol specified for the ICP method were followed. One noncompliance situation arose. A higher concentration of potassium was measured in the laboratory control sample which was prepared with some solidified condensate samples from Building 811 for Environmental Problem 5. An increased concentration of potassium was expected since these samples were prepared using a more rigorous acid digestion procedure. Samples associated with this control were not redigested as all other quality control results were in compliance.

5.2.1.2.6 Total Cyanide

Analysis of cyanide was not performed using a CLP procedure. The quality control solutions EPA WP1182-Conc. 5 and 7 were analyzed with the Survey samples. The results were within a control limit of $\pm$15% of the true value. The gross absorbance of a preparation blank was subtracted from that of each sample to provide a net absorbance. Cyanide concentration was then determined based on the net absorbance of the sample. All sample duplicates were in control. Sample inhomogeneity and matrix interferences are suspected to have caused the inadequate spike recoveries.

5.2.1.2.7 Oil and Grease

The analysis of oil and grease in water samples was performed according to DOE Environmental Survey protocol. Sludge-like samples were analyzed following an EPA method for solid waste. Although not required, oil and grease quality control samples were analyzed with each SDG to verify proper method performance. These control results were found acceptable. They ranged from 79% to 89% of their true values. Survey protocol does not require any calibration or preparation blank analysis. An extraction solvent blank was analyzed with each sample group, and the blank result subtracted from the gross weight of residue collected. Although required by Survey protocol, no method duplicates were analyzed. Analysis holding times were exceeded by five days for ten samples from Building 444 and the Boundary Road area for Environmental Problem 6. All other holding times were met.

5.2.1.2.8 Total Dissolved Solids

Analysis for total dissolved solids (or filterable residues) was performed according to DOE Environmental Survey protocol. Calibration verification solutions and laboratory spiked samples were not required; therefore, none were analyzed. Sample duplicates and laboratory and preparation blanks were recommended. However, they were not analyzed. All samples were analyzed within the required holding time.

5.2.1.2.9 Total Uranium

The total uranium concentration in soil and water samples was determined for three SDGs using modified versions of DOE Environmental Survey Method EC-191. Three method duplicates out of six were not within a control limit of 20%. These RPDs did not exceed +33%. All other QC requirements were met.

5.2.1.2.10 Percent Solids by ORNL

ORNL maintained the accuracy of the percent solids determination by checking daily the temperature of the drying oven with a thermometer located at the top of the oven. The temperature exceeded the 103^{O}-$105^{O}C$ range on sixteen days. The greatest deviation was -2.0^{O}C. The Mettler balance was calibrated approximately two months prior to the analysis of BNL samples. The calibration of the electronic balance was checked daily using Class S metric weights at the 1-, 5-, 10-, and 100- levels. The measured mass did not vary by more than +0.5 mg from the known value at the 1-, 5-, and 10-g levels. The measured value at the 100-g level did not vary by more than +3.6 mg from the known value. A single measurement of percent solids was made for each sample. Duplicate determinations were done at a frequency of approximately 20%. No further information is available to describe the QC check performed by other laboratories for the percent solids determination.

5.2.2 Radiological Quality Assurance

The majority of samples requiring radiological analysis were analyzed by the Low-Level Radiochemical Analysis Group (LLRAG) at ORNL. All holding times were met except for eight strontium-90 determinations; the request for these analyses came at a later time than the original request date. The basic purpose of the Quality Assurance (QA) program for the Low-Level Radiochemical Analysis Group (LLRAG) is to ensure that the data produced are of sufficient quality, accuracy, and completeness so that valid interpretations can be made. This purpose is accomplished by assuring that (a) proper sample procedures are followed; (b) the instruments yield accurate and reproducible results; and (c) adequate information is available concerning each sample. All aspects of the work carried out by the LLRAG are thoroughly documented.

The basic QA program for LLRAG has many aspects. Only the Quality Control (QC) aspects of the QA program that concern accuracy and reproducibility of measurements, however, are summarized in this data report. These aspects include results of routine standards (both primary and secondary), blanks for background measurements), and analysis of interlaboratory comparison standards.

Approximately 5% of the total number of samples analyzed for the study were control samples. A control sample could be any of the following:

Spike	-	A sample aliquot with a known amount of analyte added.
In-house	-	An in-house sample with a known concentration of analyte.
EMSL	-	A control sample from the EPA laboratory (EMSL) in Las Vegas.
EML	-	A control sample from the EML laboratory in New York.

Appendix E, Table E.1 shows the laboratory performance of these samples, identifying the sample type, the type of control, the nuclide measured, the result obtained, and the known value or expected result. The "R" value in the table is the ratio of the result obtained and the expected result expressed as a percent and indicates the level of performance. For the DOE Survey, an R value between 80 and 120 is considered acceptable.

5.2.2.1 Gross Alpha-Beta Measurements at LLRAG

In order to ensure the accuracy of the results obtained by gross alpha-beta measurements, a beta standard traceable to NBS was counted daily when the LB-4000 instrument was in use, and blanks (i.e., backgrounds) for both alpha and beta were also obtained daily. In addition to these routine checks, prior to initiation of the measurements of Brookhaven samples, the instrument underwent a full calibration; this included the determination of plateaus.

Averages of the daily calibration checks, done with a beta standard (RNS2-40B) consisting of Sr-90 and Y-90, are presented in Appendix Table E.2. No alpha efficiencies for the LB-4000 are available for inclusion in this report; the beta efficiency alone is used to check the calibration of the instrument (the instrument counts both alpha and beta simultaneously). These results are presented in Table E.3. The mean beta efficiency of the LB-4000 was 35.3% with a standard deviation of 2.2% and a range of 30.44% to 41.16%. All beta efficiency measurement checks indicated a result within the acceptable range of $\pm$4% for each of the 12 detectors on the LB-4000. Since all beta efficiency checks indicated results within the acceptable range, the instruments can be considered to have been accurately calibrated and sufficiently constant during the period of the measurements of the Brookhaven samples.

The results of the alpha and beta background (i.e., blank) measurements are also included in Appendix Table E.3. Examination of these tables indicates that the backgrounds were relatively constant throughout the measurement period of

Brookhaven samples. The alpha background of the LB-4000 had a mean of 0.03 cpm, a standard deviation of 0.01 cpm, and a range of 0.01 to 0.18 cpm. The beta background of the LB-4000 had a mean of 0.96 cpm, a standard deviation of 0.06 cpm, and a range of 0.62 to 2.13 cpm. Both the alpha and the beta backgrounds of the instrument, therefore, were of low enough levels that they did not adversely affect the measurements. The method blanks did not contain any contamination above the drinking water limit.

5.2.2.2 Gamma Spectral Measurements at LLRAG

In order to ensure the accuracy and reproducibility of results obtained by gamma spectral measurements (gamma scans), a secondary standard consisting of Cs-137 and Co-60 was counted daily; a mixed-radionuclide standard traceable to NBS was counted routinely; and backgrounds (i.e., blanks) were counted routinely. The gamma standards are used to check that the energy calibration and efficiency of the instrument remains constant. The mixed-radionuclide standard is used as an additional verification of proper instrument operation and a check of the energy and efficiency calibration. Method blanks did not contain any contamination above the drinking water limit.

LLRAG utilizes six gamma-ray detectors which are attached to a common computer (a MicroVAX) for data collection and analysis. Detector #6 was out of service during the analysis of the Brookhaven samples, leaving only five operational detectors. Appendix Table E.4 presents the results of the daily checks with the gamma standards for each of the five detectors. The count rates, centroids, and peak widths for the Cs-137 661 keV and Co-60 1332 keV peaks are used in the QC check. Unfortunately, only the peak width data was available for inclusion in this report. Examination of the data in this table indicates that the peak widths were very constant during the Brookhaven measurements. Results from the EML Intracomparison Program samples that were analyzed during this time period were all within acceptable limits. Therefore, it can be concluded that the gamma detectors were operating properly during the analysis period of the Brookhaven samples.

Appendix Table E.5 presents a summary of the measured intensities of all the gamma rays observed in the background (i.e., blanks) for the five gamma-ray detectors. The data indicate that the background was low and relatively constant.

5.2.2.3 Liquid Scintillation Measurements at LLRAG

Tritium samples were counted using a Packard 460C Tri-Carb liquid scintillation counter. A Packard tritium standard was counted daily to ensure the accuracy and reproducibility of the results obtained by the system. Backgrounds (i.e., blanks) were also counted daily. Efficiency data and the results for the standard and background counts obtained during the time that the Brookhaven samples were counted are given in Appendix Table E.6. The average value of the standard measurements was 92595 +/- 381 cpm. (All standard measurements were compared to an initial calibration value of 255200 dpm that was obtained on November 11, 1979.) The background for the 460C was 12.6 cpm, with a standard deviation of 1.0 cpm and a range of 11.2 - 14.4 cpm. The average efficiency of the 460C was 58.6%, with a standard deviation of 0.1% and a range of 58.5% - 58.8%. All the data indicate that the 460C was accurately calibrated, sufficiently constant, and had a low enough background so that no degradation of sample results occurred during the period of the Brookhaven sample measurements.

5.2.2.4 Interlaboratory Comparisons by LLRAG

During the period of the Brookhaven measurements, LLRAG participated in the EML Intracomparison Program for the following isotopes:

Soil:	K-40	Water:	H-3
(pCi/g)	Sr-90	(pCi/ml)	Mn-54
	Cs-137		Co-57
	Pu-239		Co-60
	Am-241		Sr-90
	U(pCi)		Cs-134
			Cs-137
			Pu-239
			Am-241
			U(pCi)

The results, presented in Table E.7, measured by LLRAG did not exceed the warning limits, indicating that sufficiently accurate results were being obtained by LLRAG procedures and instruments.

5.2.2.5 Radiometric Analyses by PNL

A total of 71 analytes were received by PNL for radiological analysis. These samples consisted of 18 soils and 53 waters for Request 316 of Environmental Problem 3, Requests 507 and 508 of Environmental Problem 4, and Request 809 of Environmental Problem 10. Results were reported for 29 samples which correspond with the number of samples collected for the survey. The reported values are from the analysis of QC samples, pump samples taken from landfill and the West Upton Road and Building 975 sites, and landfill grab samples. All analyses were performed according to DOE Environmental Survey protocol. No sample receiving or analysis problems were cited in the case narratives. Soil samples were weighed as received. A summary of PNL QC and radiological results follows. A complete listing of PNL radiological control sample results is also included in Table E.1 of Appendix E.

Twenty-nine samples were analyzed on July 8 through July 13, 1988 for tritium content. Table E.8 summarizes the tritium counting efficiency and instrument background (determined using a water blank) for July 8 and 12, 1988. The average instrument counting efficiency and background count were 33.3 $\pm$ 0.56% and 14.18 $\pm$ 0.25 cpm, respectively. The count rates of a control sample and a method blank were also determined on July 8, 11, 12, and 13, 1988 to verify instrument stability. The average background count for the method blank was 14.22 $\pm$ 0.29 cpm. The percent difference (%D) between the measured and known value of the tritium control sample (where the known value was the count rate of the initial calibration made on July 8, 1988 to which all other measured values were compared) ranged from -1.1%. to -0.2%.

The concentration of strontium-90 was determined for twenty-five samples on July 18, 19, and 22, 1988 using Lobeta-1, -2, -3, and -4 instrumentation. Instrument counting efficiencies and counting backgrounds which were measured on July 15, 18, 21, and 27, 1988 are presented in Tables E.9 and E.10. The average efficiency was 55.1%, 54.9%, 55.2%, and 55.0%, and the average background was 0.49$\pm$0.02 cpm, 0.48$\pm$0.05 cpm, 0.52$\pm$0.03 cpm, and 0.49$\pm$0.02 cpm for Lobeta-1, -2, -3, and -4, respectively. The percent difference values for the control standard ranged from -0.7%. to -0.08%.

Seventeen samples were analyzed for plutonium-238 and plutonium-239. Measurements were made on August 12, 18, 25, and September 13, 1988 using instrument PNL-C1, and on August 18, 1988 using PNL-C3, -C4, -C9, -C10, -C11, and -C12. An isotopic plutonium standard was analyzed on August 30, 1988 using PNL-C9, -C10, -C11, and -C12, and on September 6 using PNL-C1, -C2, and -C3 to confirm the efficiency and the system energy calibration of the instrumentation. The percent difference for total plutonium in the laboratory control standards ranged from 0.1% to 0.3%. Percent efficiency data pertinent to plutonium is presented in Table E.11.

5.2.2.6 Radiometric Analyses by ORGDP

Ten samples were analyzed for isotopic uranium by ORGDP. These samples consisted of nine sediments and one QC water rinsate from Environmental Problem 1. Uranium-234, uranium-235, and uranium-238 values are reported from the analysis of grab samples taken from the southeast corner (Request 303) and north corner (Request 304) of the primary pond near the fenced Hazardous Waste Management Area (HWMA), and from the northeast corner (Request 305) of the wooded pond across the driveway from the HWMA.

Sediments were weighed as received. NBS standards were used for calibration and laboratory control purposes. An internal laboratory control sample was also analyzed with the samples. All NBS control results were satisfactory. An acceptable range of values for the internal laboratory control solution was not fully established at the time of analysis. The uranium-235 measured value, however, is within the range that was reported for acceptable compliance. The internal precisions for the laboratory control results ranged from 0.013 %RSD to 0.070 %RSD (percent relative standard deviation). Uranium isotope ratios could not be determined for three sediment samples, a sediment method duplicate and a method blank because a sufficient quantity of uranium could not be isolated to satisfy the sample-loading requirements of the mass spectrometer employed. A complete listing of ORGDP radiological control sample results also appears in Table E.1 of Appendix E.

5.2.2.7 Conclusions

The results of the QC checks presented by LLRAG indicate that the performance of the alpha-beta instrument and the gamma-ray spectrometers was adequate to ensure accuracy and reproducibility of the results obtained using them. In addition, the background seen by each instrument/detector was sufficiently low and sufficiently constant to ensure accurate removal of background effects.

Results summarized for the PNL analyses reflect the good accuracy that can be attributed to the analytical results, as based on the calibration checks. ORGDP's accurate and precise isotopic uranium lab control results are also indicative of good quality sample data. No documentation has been received to describe the performance of either laboratory in interlaboratory cross-check comparisons.

5.2.3 Data Management QA/QC

All analytical data entered into the Data Management System (DMS) goes through a series of verification and validation (V&V) routines to ensure that the data are of the highest quality possible. These V&V routines are designed to capture two potential types of data errors: transcription and consistency.

Data transcription problems (i.e., data entry errors) can be eliminated through the use of electronic data transfer techniques. For BNL data, all ICP data and most organic data were electronically transferred from the instruments to the data base. The remaining, manually-entered data were initially reviewed for legibility, entered, and then 100% visually checked for accuracy. All transcription errors are corrected at the time of discovery and are not documented.

Data consistency problems consist of miscoded information, missing data, incomplete data, and conflicting sample identification codes. After the information has been entered into the data base and all transcription problems corrected, the data are then printed and returned to the field team supervisor or analytical chemist for review. During this review, any missing or incomplete data are corrected and sent back for addition to the data base. Miscoded information is corrected and documented. Conflicting sample identification codes are reviewed and resolved by data management personnel working with field and analytical staff.

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