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Sampling and Analysis Data Document for:

Lawrence Livermore National Laboratory
Sandia National Laboratories - Livermore

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.

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Volume I

June 1989

DEPARTMENT OF ENERGY

ENVIRONMENTAL SURVEY

ORNL/TM-11174

LAWRENCE LIVERMORE NATIONAL LABORATORY AND SANDIA NATIONAL LABORATORIES - LIVERMORE SAMPLING AND ANALYSIS DATA DOCUMENT

(DRAFT)

June 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
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
BHC	Benzene hexachloride
BOD	Biochemical oxygen demand
Br^-	Bromide
B-WMG	Wide-mouth glass (I-Chem cleaning protocol B)
C	Centigrade
Ca	Calcium
Ca^{+2}	Calcium ions
CAPA	Chemical and Physical Analysis
CAR	Corrective Action Required
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_2	Carbon dioxide
COC	Chain of custody
cpm	Counts per minute
Cr	Chromium
CRQL	Contract required quantitation limit
CRREL	U.S. Army Cold Regions Research and Engineering Laboratory
Cs	Cesium

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
DOD	Department of Defense
DOE	Department of Energy
DOE-ES	Department of Energy Environmental Survey
DOE-HQ	Department of Energy Headquarters
dpm	Disintegrations per minute
DW	Drinking water
EAL	Environmental Analysis Laboratory
ECH	Environmental Compliance and Health Protection Division
EHP	Environmental and Health Protection Division
EICP	Extracted ion current profile
EML	Environmental Measurement Laboratory
EMSL-LV	Environmental Monitoring and Systems Laboratory, Las Vegas
EP	Extraction procedure
EPA	Environmental Protection Agency
EPTC	Extraction procedure toxicity characteristic
EPTOX	Extraction procedure toxicity
ESD	Environmental Sciences Division
ESM	Environmental Survey Manual
Eu	Europium
EVAL	Pesticide evaluation standard mixture
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
H&SO	Health and Safety Officer
H_2SO_4	Sulfuric acid
H_3	Tritium
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
IS	Internal standards
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
LLNL	Lawrence Livermore National Laboratory
LLNL/SNLL	Lawrence Livermore National Laboratory and Sandia National Laboratories - Livermore
LLRA	Low-level Radiochemical Analysis
LLRAG	Low-level Radiochemical Analysis Group
LLW	Low-level waste
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	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
ODS	Octadecylsilane
O&G	Oil and grease
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	Publicly 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
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
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
SS	Suspended soils
SSTD	Semivolatile standard
STD	Standard
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

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
Th	Thorium
TIC	Tentatively identified compounds
TICH	Total identifiable chlorinated hydrocarbons
TICP	Total ion current profile
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
um	micrometer or micron
UST	Underground storage tank
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
Y	Yttrium
Zn	Zinc

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INORGANIC ANALYSIS DATA FLAGS

Concentration Qualifiers

B	Value less than the CRQL 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 results exceed control limits
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
AE	Atomic emission - ICP
AS	Semiautomated spectrophotometric
AV	Automated cold vapor AA
C	Manual spectrophotometric
CV	Manual cold vapor AA
F	Furnace AA
NR	Analyte is not required to be analyzed
P	ICP
T	Titrimetric

ORGANIC ANALYSIS DATA FLAGS

B	Analyte found in associated blank as well as in the sample
D	Compounds identified in an analysis at a secondary dilution factor
E	Concentration exceeds the calibration range of the instrument
J	Estimated value
U	Compound analyzed for but not detected

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 Teams at the Lawrence Livermore National Laboratory and Sandia National Laboratories-Livermore (LLNL/SNLL) Sites. The sampling for these sites was done in August 1987. The majority of the analyses were completed by February 1988.

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 LLNL/SNLL Sampling and Analysis Data Document includes information from the DOE Environmental Survey Sampling and Analysis Plans for the LLNL and SNLL Sites (Refs. 1-1 and 1-2) and field and analytical data. Please refer to the July 1987 and August 1987 DOE Environmental Survey Manuals (Refs. 1-3 and 1-4) 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 LLNL/SNLL environmental setting, please refer to the LLNL and SNLL Preliminary Reports for the DOE Environmental Survey (Refs. 1-5 and 1-6) and the DOE Environmental Survey Sampling and Analysis Plans for both sites.

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 E. 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.

1.1 Site Sampling and Analysis

Oak Ridge National Laboratory was designated by DOE to provide sampling teams for the LLNL/SNLL Sites and was responsible for the performance of the laboratory analytical services. These sites were sampled during the same time frame because the SNLL Site is located across the street from the LLNL Site. The requests for sampling and analysis were developed by the DOE Environmental Survey Team after careful consideration of the needs of the LLNL/SNLL Sites 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 sites.

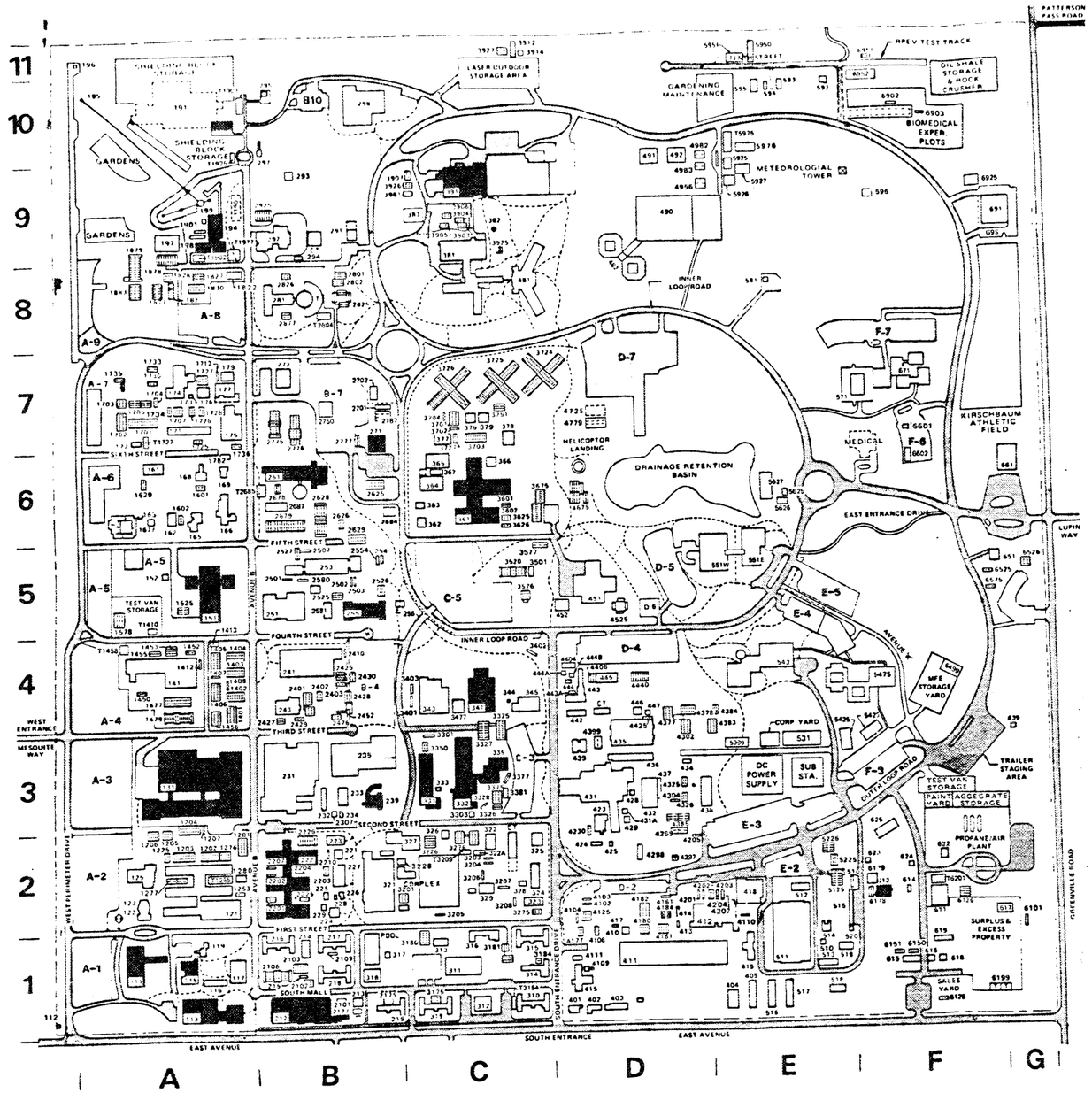
The technical specialists of the Survey Team compared notes, reviewed objectives, and determined which actual or potential environmental problems required sampling and analysis in order to be completely and accurately evaluated. In some cases, a group of sample and analytical requests from different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

The purpose of the LLNL and SNLL Sampling and Analysis Plans was to outline a plan for environmental field sampling and laboratory analysis in support of the DOE Environmental Survey at the LLNL/SNLL Sites (see Figures 1.1a, 1.1b, and 1.1c) located near Livermore, California. The Sampling and Analysis Plans were intended to be guides that incorporated the standard procedures, analytical protocols, field sampling protocols, and other laboratory guidance from the DOE Environmental Survey Manual.

The LLNL/SNLL Sampling and Analysis Teams 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 LLNL/SNLL sampling and analysis personnel.

This LLNL/SNLL 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 will be addressed or considered before the next draft is issued.

Figure 1.1a. Lawrence Livermore National Laboratory Site Map



BUILDING LIST

Bldg No	Building Name	Map Location
111	Exptl Physics	A-1
112	H C Monitor Stat	A-1
113	Theor & Comp	A-1
115	Computer	A-1
116	Comput Progrm	A-1
117	Computer	A-1
119	Fiber Test	A-2
121	Exptl Physics	A-2
122	West Badge Office	A-2
123	Auditorium	A-2
125	West Cafeteria	A-2
131	Engineering	A-4
141	Electr Engr—Records	A-5
151	Nuclear Chem	A-5
152	Emerg Gen House	A-6
161	Laser Isot S D Lab	A-6
162	Laser Research	A-6
163	Test Pn	A-6
165	Special Research	A-6
166	Laser Research	A-6
168	Laser Research	A-6
169	Special Research	A-7
171	Laser Research	A-7
172	Laser Research	A-7
173	Laser Research	A-7
174	Laser Research	A-7
175	Mars Experiment	A-7
176	Laser Research	A-7
177	Laser Research	A-7
179	Laser Research	A-7
182	"O" Group	A-7
190	Physics Nuclear Lab	A-9
191	H.E.A.F.	A-10
194	Electr Pos Accel	A-9
195	Detector House	A-10
196	H.C. Monitor Stat	A-11
197	Physics	A-9
198	Physics	A-9
212	Accelerators	B-1
214	AIS	B-1
215	Vault	B-1
216	Computstrn-DNA	B-1
217	Budget/AIS	B-1
218	Computation	B-1
219	P&O/Physics	B-1
221	Chem Storage	B-2
222	Chemistry	B-2
223	Chemical Engr	B-2
224	High Expl Chem	B-2
225	High Expl Chem	B-2
226	High Expl Chem	B-2
227	High Expl Chem	B-2
228	Storage Magazine	B-2
229	Storage Magazine	B-2
231	Dev & Assembly	B-3
232	Chem H P Labs	B-3
233	Classified Storage	B-3
234	Process Research	B-3
235	WMRDF	B-3
239	Radiography	B-3
241	Refractory Mat'ls	B-4
251	Diagn Chem	B-5
253	Hazards Control	B-5
254	Toxicology	B-5
255	Calibrat & Stands	B-5
256	Communication Exch	B-5
261	Special Projects	B-6
271	Protective Force Div	B-7
272	Laser Electro-Optical	B-7
281	Pool Type React/A/U Chem	B-8
291	LCW Systems	B-9
292	RTNS Facility	B-9
293	RTNS 11	B-9
294	RTNS Storage	B-9
295	Water Pump Hse	B-10
297	Class Waste Disp	B-10
298	Fusion Target Dev	B-10
310	Health Service & Badge Office	C-1
311	Human Resources	C-1
312	South Cafeteria	C-1
313	Emer Communication Ctr	C-1
314	Finance	C-1
315	Finance	C-1
316	Physics	C-1
317	Multipurpose	B-1
318	Energy Vector Res	B-1
319	Physics/Credit Union/Human Res.	C-1
321	Mat'ls Fab Shops	C-2
322	Plating Shop	C-2
323	Fire House	C-2
324	Hazards Control	C-2
325	Utilities Control	C-2
326	Mat'ls Fab Shop	C-2
327	Mech Engr Mat'l Lab	C-2
328	Fire Test Cell	C-2
329	Weld Shop	C-2
331	Gaseous Chem	C-3
332	Metallurgical Chem	C-3
333	Chem Storage	C-3
336	L.I.S.F.	C-3
341	Physics Research	C 4
343	High Pressure	C 4
344	Detonit Res Mag	C 4
345	Detonator Res	C 4
361	Biomedical	C 6
362	Biomedical	C 6
363	Animal House	C 6
364	Animal House	C 6
365	Burned Exp Fac	C 7
366	Health Effects Lab	C 7
367	Bio Medical	C 7
376	Machine Shop	C 7
378	Atmospheric Res	C 7
379	Bio Med Counting Facility	C 7
381	Laser Fusion Lab	C 8
382	Laser-L O S	C 8
383	Laser Mach Shop	C 9
391	High Energy Laser	C 9
401	Steam Plant	D 1
402	Automotive Fleet	D 1
403	Garage	D 1
404	Warehouse	E 1
405	Warehouse	E 1
410	Special Research	D 1
411	Supply & Dist	D 1
412	Biomedical Lab	D 1
413	Marine Biol Lab	D 1
414	Cold Storage	D 1
415	Sec Admin-Orient	D 1
417	Storage	E 2
418	Paint Shop	E 1
419	Decontamination	D 2
423	MFE Power Sup	D 2
424	Electr Substation	D 2
429	ETA Storage	D 3
431	MFE Research	D 2
431A	MFE Storage	D 3
432	MFE Shops	D 2
434	MFE Shop	D 3
435	MFE Research	D 3
438	MFE Capacitor	D 3
438	MFE Shop	D 3
439	MFE Comp Control	D 4
442	MFE Research	D 4
443	Coil Shop	D 4
443A	MFE Storage	D 4
444	Magnet Coil Star	D 4
444A	MFE	D 4
444B	MFE	D 4
445	MFE Magnet Lab	D 4
446	Power Supply	D 4
447	Machine Storage	D 4
451	NMFECC	D 5
452	NMFECC Storage	D 5
481	Laser Fusion Ofc	C 8
482	Special Isotope Sep	D 9
490	Special Isotope Sep	D 9
491	Special Isotope Sep	D 9
492	Special Isotope Sep	D 9
510	FACS/UPS	E 1
511	Craft Shops	E 1
512	Crafts Mt I Assem	E 2
513	Liquid Waste Storage	E 2
514	Waste Disposal	E 1
515	Equipment Stor	E 1
516	Temp Lab & Shop	E 1
517	Indust Electr	E 1
518	Gas Cylind Dock	E 1
519	Mt'l & Equip St	E 1
520	P E Storage	E 1
531	MFE Storage Fac	E 3
543	MFE Office	E 4
551E	Plant Engr	D 5
551W	Tech Info Div	D 5
571	Human Resources	E 7
581	Chemistry	E 8
592	Cow Barn	E-10
593	Sheep Shed	E-10
594	Plant Growth Fac	E-10
595	Greenhouse	E-10
596	Meteorological Sta	F-9
611	Salvage Warehse	F-2
612	Dry Waste	F-2
614	Storage	F-2
615	Tele Operations & Serv	E-1
616	Salvage	F-1
617	Salvage (Tent)	F-1
618	Salvage	F-1
619	Salvage & Reclam	F-1
622	Propane Air Plant	F-2
623	Waste Storage	E-2
624	Waste Storage	E-2
625	Waste Storage/Shp	E-3
651	Visitors Center	F-9
681	Dept Applied Sci	F-8
691	LOD TM Fac	F-9

TRAILER LIST

Bldg No.	Building Name	Map Location
1201	M.E.	A-2
1202	E.E.	A-2
1203	M.E.	A-2
1204	M.E.	A-2
1205	M.E.	A-2
1206	M.E.	A-2
1207	M.E.	A-2
1225	"Y" Div	A-2
1253	T.I.D.	A-2
1255	Library Annex	A-2
1276	E.E.	A-2
1277	Test Program	A-2
1280	Defense Systems	B-1
1301	P.E. Inspector	A-4
1401	Earth Science	A-4
1402	Earth Science	A-4
1403	Earth Science	A-4
1404	Earth Science	A-4
1405	Earth Science	A-4
1406	Earth Science	A-4
1407	T.T.	A-4
1408	Vend Mach	A-4
1410	P.E. Team #3	A-4
1412	Technronics	A-4
1413	"K" Div	B-4
1450	M.E./E.E	A-4
1452	P.E. Team #3	A-4
1453	P.E. Team #3	A-4
1455	E.E.	A-4
1458	Earth Sciences	A-4
1458	Radio Page Tech (Temp)	A-4
1477	E.B.	A-4
1478	Earth Science	A-4
1525	Nuclear Chem	A-5
1578	ME	A-6
1601	"Y" Div	A-6
1602	"Y" Div	A-6
1629	"Y" Div	A-6
1677	N.S.S.P.	A-6
1701	"G" Div	A-7
1702	"G" Div	A-7
1703	"G" Div	A-7
1704	DOE Sec/cour	A-7
1705	"G" Div	A-7
1707	"Y" Div	A-7
1712	"Y" Div	A-7
1725	"Y" Div	A-7
1726	"Y" Div	A-7
1727	"Y" Div	A-7
1730	"G" Div	A-7
1733	"Y" Div	A-7
1734	"Y" Div	A-7
1737	"Y" Div	A-7
1822	"O" Group	A-8
1826	"O" Group	A-8
1827	Energy	A-8
1830	Energy	A-8
1877	"O" Group	A-9
1878	"O" Group	A-9
1879	"O" Group	A-9
1883	"O" Group	A-9
1901	Physics	A-9
1903	H.E.A.F. Project	A-10
1925	H.E.A.F. Project	A-10
1977	"O" Group	A-9
2101	"E" Div	B-1
2102	DPS	B-1
2103	Physics "T"	B-1
2106	Computation	B-1
2109	DPS	B-1
2175	DPS	B-1
2177	I.G.P.P.	B-2
2201	Chemistry	B-2
2202	Chemistry	B-2
2203	Chemistry	B-2
2204	Chemistry	B-2
2207	Chemistry	B-2
2210	Chemistry	B-2
2225	Chemistry	B-2
2226	Chemistry	B-2
2307	Classified Stor.	B-3
2401	Chemistry	B-4
2402	Chemistry	B-4
2403	Chemistry	B-4
2410	Chemistry	B-4
2425	Chemistry	B-4
2427	TID	B-4
2428	Plant Eng.	B-4
2429	Chemistry	B-4
2430	P.E.	B-4
2452	Word Processor	B-4
2478	Word Processor	B-4
2501	Hazards	B-5
2502	Hazards	B-5
2503	Hazards	B-5
2507	Hazards	B-5
2525	"L" Div	B-5
2526	"L" Div	B-5
2527	Hazards	B-5
2554	Hazards	B-5
2580	OP Mod	B-5
2581	"L" Div	B-5
2625	Bus Svcs	B-6
2626	Hazards	B-6
2628	"H" Div	B-6
2629	Hazards	B-6
2678	"Z" Div	B-6
2679	DOE Patents/"H" Div	B-6
2684	Sys Develp Engr	B-6
2685	"Z" Div	B-6
2687	"Z" Div	B-7
2701	Security	B-7
2702	P.E. Inspector	B-7
2750	J.L. Brey	B-7
2775	Q.A. Program	B-7
2776	TID	B-7
2777	Security	B-7
2787	Security	B-7
2801	"Y" Div	B-8
2802	"Y" Div	B-8
2804	"Y" Div	B-8
2825	"Y" Div	B-8
2826	Nuc Chem	B-8
2877	"Y" Div	B-8
2975	RTNS	B-9
3154	Health Services	C-1
3175	LLRA	C-1
3180	MFD	C-1
3181	Physics	C-1
3184	Property Management	C-1
3201	M F D	C-2
3203	M F D	C-2
3204	M F D	C-2
3205	M F D	C-2
3206	M F D	C-2
3208	Hazards	C-2
3209	M F D	C-2
3226	NDE Complex	C-2
3228	MFD	B-2
3275	H.C.	C-2
3276	M.F.D.	C-2
3303	Security	C-3
3325	Weapons Init	C-3
3326	PU Chem	C-3
3327	Physics Weapons	C-3
3328	PU Chem	C-3
3350	Chemistry I.M.D.	C-3
3375	PU Chem	C-2
3377	"Y" Div	C-3
3381	SIS	C-3
3401	P.E. Inspectors	C-4
3477	Tritium Fac	C-4
3520	P.E.	C-5
3576	T.I.D. & Eye Dr.	C-5
3577	Procurement	C-5
3801	Bio-Med	C-6
3802	Bio-Med	C-6
3825	Bio-Med	C-6
3826	Bio-Med	C-6
3875	L.E.F.	C-7
3701	Bio-Med	C-7
3702	Bio-Med T.T.	C-7
3703	Bio-Med	C-7
3704	Bio-Med	C-7
3724	"Y" Div	C-7
3725	"Y" Div	C-7
3726	"Y" Div	C-7
3727	Bio-Med	C-7
3751	"Y" Div	C-7
3903	"Y" Div	C-9
3904	"Y" Div	C-9
3905	"Y" Div	C-9
3906	"Y" Div	C-9
3907	"Y" Div Prgm	C-9
3912	T.T.	C-11
3914	P.E. Storage	C-11
3925	"Y" Div	C 9
3928	"Y" Div	B 9
3927	Plant Engr	C-9
3981	"Y" Div	C-9
4102	Bunk Trlr	D-2
4103	Bunk Trlr	D-2
4104	Plant Engr-T.T.	D-2
4106	Supply & Dist.	D-2
4110	P.E. Team #8	D-1
4111	Security	D-2
4124	P.E.	D-2
4161	Wang	D-1
4177	Supply & Dist	D-1
4180	Supply Proc	D-1
4181	Sub. Serv.	D-1
4182	M F E /ATA/ETA	D-1
4184	M F E /ATA/ETA	D-1
4201	Bio Med	D 2
4202	Bio Med	D 2
4203	Bio Med	D 2
4204	Bio Med	D 2
4205	M F E /ATA	D 2
4207	M F E	D 2
4230	M F E	D 2
4297	M F E	D 2
4298	M F E Storage	D 2
4299	ATA Storage	D 2
4302	D O E	D-3
4304	M F E	D-3
4325	M F E	D-3
4326	M F E	D-3
4377	M F E	D-4
4378	M F E	D-4
4383	DOE-SAN	E-3
4384	P.E. Custodians	E-4
4385	M F E	D-2
4399	M F E (Tent)	D-4
4404	M F E	D-3
4440	M F E	D-4
4475	TMV	D-4
4525	NMFECC	D-5
4675	Central Cafe	D-6
4702	"Y" Div	D-7
4725	Library-Ass	D-7
4779	T.I.S.	D-7
4956	"Y" Div	D-9
4982	P.E. Construction	D-10
4983	P.E. Construction	D-10
5102	P.E. Custodians	E-1
5125	P.E. Operations	E-2
5225	P.E. Inspection	E-2
5226	P.E. Inspection	E-2
5399	MFE Storage	E-3
5425	Beam	F-4
5428	Beam	F-4
5625	Tech Srv	E-9
5628	OMR	E-9
5627	Lab Council	E-9
5925	"Y" Div	E-9
5926	"Y" Div	E-9
5927	"Y" Div	E-9
5950	Berkeley Trlr	F-11
5951	Berkeley Trlr	F-11
5975	Laser	E-10
5978	Lasers	E-9
6101	Store Sales	G-1
6125	Store Sales	F-1
6126	Transp & Reclamation	F-2
6150	Telephone Plan	F-1
6151	Pacific Bell	F-1
6178	Waste Management Hazards	F-2
6179	Toxic Waste	E 2
6199	Reclamation (Tent)	F-1
6201	Motorpool	F-1
6499	MFE Storage (Tent)	F-4
6525	Vis Cntr Aud	G-5
6526	East Gate Badge Ofc	G-5
6575	Vis Cntr Office	G-5
6602	Med Facility	F-10
6902	Bio Med	F-10
6903	Bio Med	F-10
6925	FODTM	F-9
6951	S S E	E-10
6952	S S E	F-11

FALLOUT SHELTERS

Bldg. No.	Spaces
111	834
113	1,205
115	205
131	2,520
151	2,170
194	822
212	192
222	622
239	220
255	500
261	305
271	219
327	213
331	155
332	143
341	123
361	440
391[1]	175
	11,093

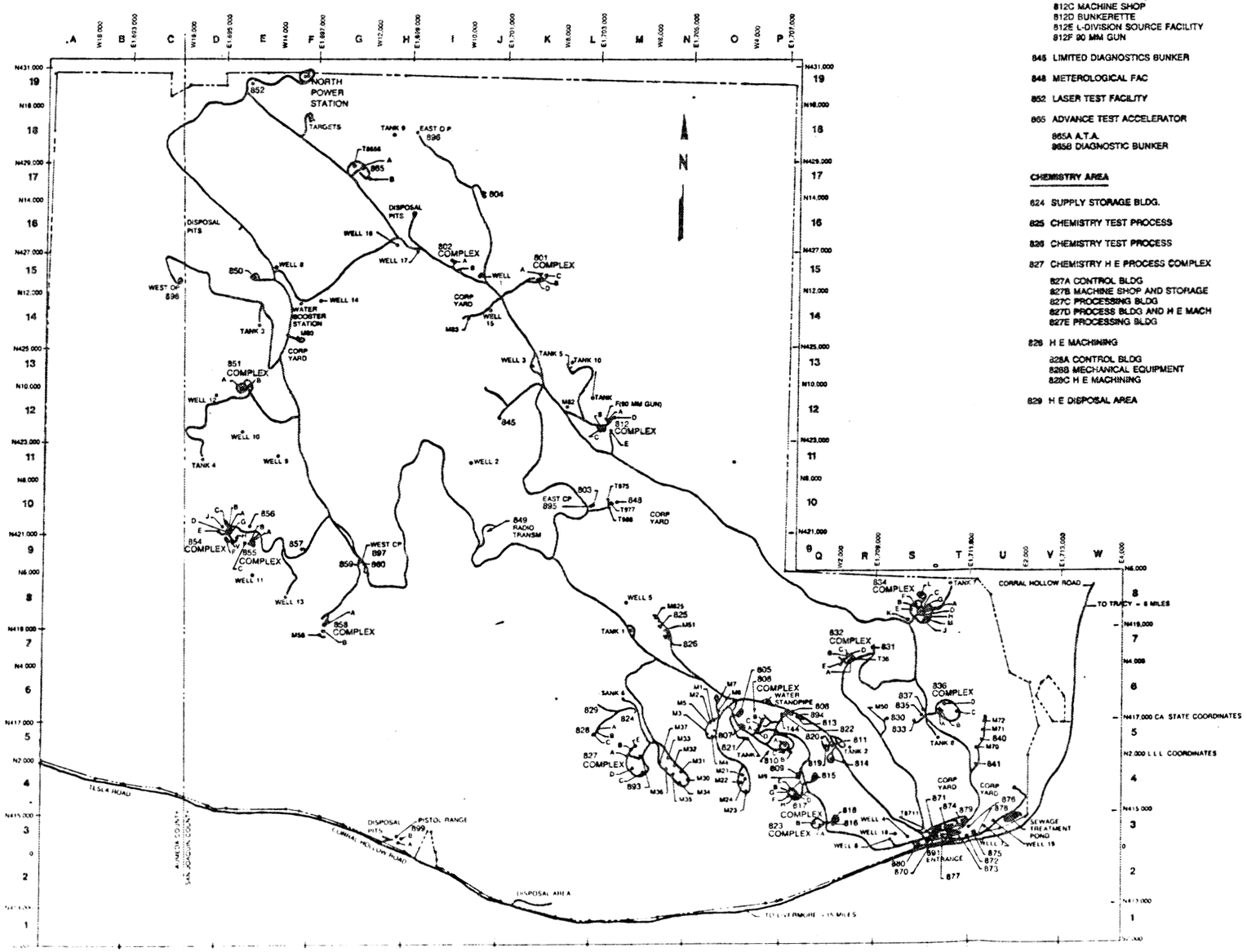
N

0 100 200 300 400

Buildings — Roads — Bicycles Paths — Parking Lots — Trailers — Fallout Shelters — Future facility — Tent

September 1986

Figure 1.1b. Lawrence Livermore National Laboratory Site 300 Map



EAST H E FIRING AREA

801 HYDRODYNAMICS DIAGNOSTICS COMPLEX
- 801A HYDRODYNAMICS DIAGNOSTICS BUNKER
- 801B MACHINE SHOP
- 801C PIT BOX
- 801D ASSEMBLY BAY AND READY ROOM

802 HYDRODYNAMICS DIAGNOSTICS COMPLEX
- 802A HYDRODYNAMICS DIAGNOSTICS BUNKER
- 802B CARPORT

803 STORAGE BLDG

804 LIMITED DIAGNOSTICS BUNKER

812 HYDRODYNAMICS DIAGNOSTICS COMPLEX
- 812A HYDRODYNAMICS DIAGNOSTICS BUNKER
- 812B CHANGE ROOM, PHOTO LAB
- 812C MACHINE SHOP
- 812D BUNKERETTE
- 812E L-DIVISION SOURCE FACILITY
- 812F 90 MM GUN

845 LIMITED DIAGNOSTICS BUNKER

848 METEROLOGICAL FAC

852 LASER TEST FACILITY

865 ADVANCE TEST ACCELERATOR
- 865A A.T.A.
- 865B DIAGNOSTIC BUNKER

CHEMISTRY AREA

824 SUPPLY STORAGE BLDG.

825 CHEMISTRY TEST PROCESS

826 CHEMISTRY TEST PROCESS

827 CHEMISTRY H E PROCESS COMPLEX
- 827A CONTROL BLDG
- 827B MACHINE SHOP AND STORAGE
- 827C PROCESSING BLDG
- 827D PROCESS BLDG AND H E MACH
- 827E PROCESSING BLDG

828 H E MACHINING
- 828A CONTROL BLDG
- 828B MECHANICAL EQUIPMENT
- 828C H E MACHINING

829 H E DISPOSAL AREA

PROCESS AREA

805 H E LENS ASSEMBLY

806 H E MACHINING COMPLEX
- 806A H E MACHINING
- 806B REMOTE MACHINING
- 806C EQUIPMENT STORAGE
- 806D PARTS AND STORAGE

807 H E MACHINING

808 STORAGE

809 RADIOGRAPHY

810 H.E. ASSEMBLY
- 810A ASSEMBLY
- 810B ASSEMBLY
- 810C STORAGE

813 CHANGE ROOM

814 HIGH SPEED CAMERA FACILITY

815 CENTRAL STEAM AND AIR PLANT

817 PRESS AND OVEN COMPLEX
- 817A CONTROL BLDG
- 817B PRESS BLDG
- 817C MAGAZINE
- 817D MECHANICAL EQUIPMENT
- 817E 8 INCH PRESS BLDG
- 817F OVEN BLDG
- 817G MECHANICAL BLDG
- 817H STORAGE BLDG

818 H E SHIPPING AND RECEIVING

821 CHEMISTRY STORAGE

822 STORAGE BLDGS A. B. C. AND D.

823 LINAC RADIOGRAPHY COMPLEX
- 823A LINAC RADIOGRAPHY OFFICE
- 823B LINAC RADIOGRAPHY BLDG.

WEST H E FIRING AREA

849 RADIO TRANSMITTER

850 HYDRODYNAMICS DIAGNOSTICS COMPLEX
- 850A HYDRO BUNKER
- 850B 155 MM GUN

851 HYDRODYNAMICS DIAGNOSTICS COMPLEX
- 851A HYDRODYNAMICS DIAGNOSTICS BUNKER
- 851B MACHINE SHOP

854 DYNAMIC TEST COMPLEX
- 854A CONTROL BLDG
- 854B MECHANICAL EQUIPMENT
- 854C SHOCK TEST
- 854D MECHANICAL EQUIPMENT
- 854E VIBRATION TEST
- 854F SHOCK TEST
- 854G MECHANICAL EQUIPMENT AND SHOP
- 854H VIBRATION TEST
- 854J SHOCK TEST
- 854V VAULT

855 DISASSEMBLY COMPLEX
- 855A CONTROL BLDG
- 855B REMOTE DISASSEMBLY
- 855C MANUAL DISASSEMBLY

856 STORAGE BLDG

857 TEST BLDG

858 DROP TOWER COMPLEX
- 858A TRAILER SHELTER
- 858B DROP TOWER

859 STORAGE BLDG

860 CAMERA STORAGE BLDG

PHYSICAL AND DYNAMIC TEST AREA

830 PHYSICAL TEST

831 TEST CALL—LONG TERM STORAGE

832 PHYSICAL TEST COMPLEX
- 832A CONTROL ROOM
- 832B TEST CELL
- 832C MACHINERY ROOM
- 832D TEST CELL
- 832E CERTIFICATION BLDG

833 PHYSICAL TEST

834 ENVIRONMENTAL TEST COMPLEX
- 834A CONTROL BLDG
- 834B MECHANICAL EQUIPMENT
- 834C MECHANICAL EQUIPMENT
- 834D MECHANICAL EQUIPMENT
- 834E TEST CELL
- 834F TEST CELL
- 834G TEST CELL
- 834H TEST CELL
- 834J TEST CELL
- 834K STORAGE BLDG
- 834L TEST CELL
- 834M SOLAR TEST CELL

835 MACHINE SHOP

836 DYNAMIC TEST COMPLEX
- 836A CONTROL BLDG
- 836B MACHINERY ROOM
- 836C SHAKER
- 837D SHAKER

837 STORAGE BLDG

838 THERMAL STORAGE BLDG

840 EXPLOSIVE STUDY

841 STORAGE BLDG

GENERAL SERVICE AREA

870 POLICE AND FIRE DEPT.

871 ADMINISTRATION BLDG

872 PAINT SHOP

873 C AND M SHOPS AND PLANT ENGR

874 MECHANICAL AND ELECTRONICS ENGR FACIL

875 STORES AND MAINTENANCE SHOP

876 STORAGE BLDG

877 FIRST AID/SECURITY

878 STORAGE BLDG

879 AUTOMOTIVE FLEET

880 CAFETERIA

MISCELLANEOUS

811 STORAGE

819 DECONTAMINATION BLDG

820 CHANGE HOUSE

H E WASTE COLLECTION TANK 8821

PISTOL RANGE-2 MI. WEST OF MAIN GATE

SEWAGE TREATMENT POND, EAST OF 875

CORP YARDS, NORTH OF 875 AND E F A, M F A

WATER STAND PIPE, NORTH OF 805

NORTH POWER STATION-E F A

DISPOSAL PITS, WEST OF PISTOL RANGE AND IN EAST AND WEST FIRING AREAS

DRUM STORAGE FACILITY, NORTH OF 876

POLICE POST

891A MAIN GATE POLICY
891B GSA POST

893 827 COMPLEX POLICE POST

894 PROCESS AREA POLICE POST

895 EAST CONTROL POST

896 EAST OBSERVATION POST

897 WEST CONTROL POST

898 WEST OBSERVATION POST

899A PISTOL RANGE STORAGE BLDG
899B PISTOL RANGE OFFICE

PROCESS AREA MAGAZINES

M1 STORAGE MAGAZINE
M2 STORAGE MAGAZINE
M3 STORAGE MAGAZINE
M4 STORAGE MAGAZINE
M5 H E LIQUID STORAGE
M7 STORAGE MAGAZINE
M8 IN PROCESS MAGAZINE
M9 IN PROCESS MAGAZINE
M21 STORAGE MAGAZINE
M22 STORAGE MAGAZINE
M23 STORAGE MAGAZINE
M24 STORAGE MAGAZINE

NON-FIRING TEST AREA MAGAZINES

M30 STORAGE MAGAZINE
M31 STORAGE MAGAZINE
M32 STORAGE MAGAZINE
M33 STORAGE MAGAZINE
M34 MAGAZETTE
M35 STORAGE MAGAZINE
M36 STORAGE MAGAZINE
M37 MAGAZETTE
M50 STORAGE MAGAZINE
M51 STORAGE MAGAZINE
M70 STORAGE MAGAZINE
M71 STORAGE MAGAZINE
M72 STORAGE MAGAZINE
M825 STORAGE MAGAZINES

FIRING AREA MAGAZINES

M58 READY MAGAZINE
M80 READY MAGAZINE
M82 READY MAGAZINE
M83 READY MAGAZINE

WELLS

W GENERAL SERVICE AREA
W1 EAST FIRING AREA
W2 WEST FIRING AREA
W3 EAST FIRING AREA
W4 GENERAL SERVICE AREA
W5 NORTH OF TANK 1
W6 GENERAL SERVICE AREA
W7 GENERAL SERVICE AREA
W8 WEST FIRING AREA
W9 WEST FIRING AREA
W10 WEST FIRING AREA
W11 WEST FIRING AREA
W12 WEST FIRING AREA
W13 WEST FIRING AREA
W14 WEST FIRING AREA
W15 WEST FIRING AREA
W16 WEST FIRING AREA
W17 WEST FIRING AREA
W18 GENERAL SERVICE AREA
W19 GENERAL SERVICE AREA

WATER TANKS

TANK 1 WEST OF 825
TANK 2 EAST OF 811
TANK 3 SOUTH OF 850
TANK 4 SOUTHWEST OF 851
TANK 5 NORTHWEST OF 812
TANK 6 NORTH OF 827
TANK 7 EAST OF 834
TANK 8 SOUTH OF 833
TANK 9 WEST OF 896
TANK 10 NORTHWEST OF 812

TRAILER (SEMI PERMANENT)

T36 PHYSICAL TEST
T8656 ATA ADMINISTRATION
T8711 PSO CHANGE ROOM
T975 RADAR VAN E C P (WEATHER)
T977 RADAR VAN E C P (WEATHER)
T988 OFFICE E C P (WEATHER)

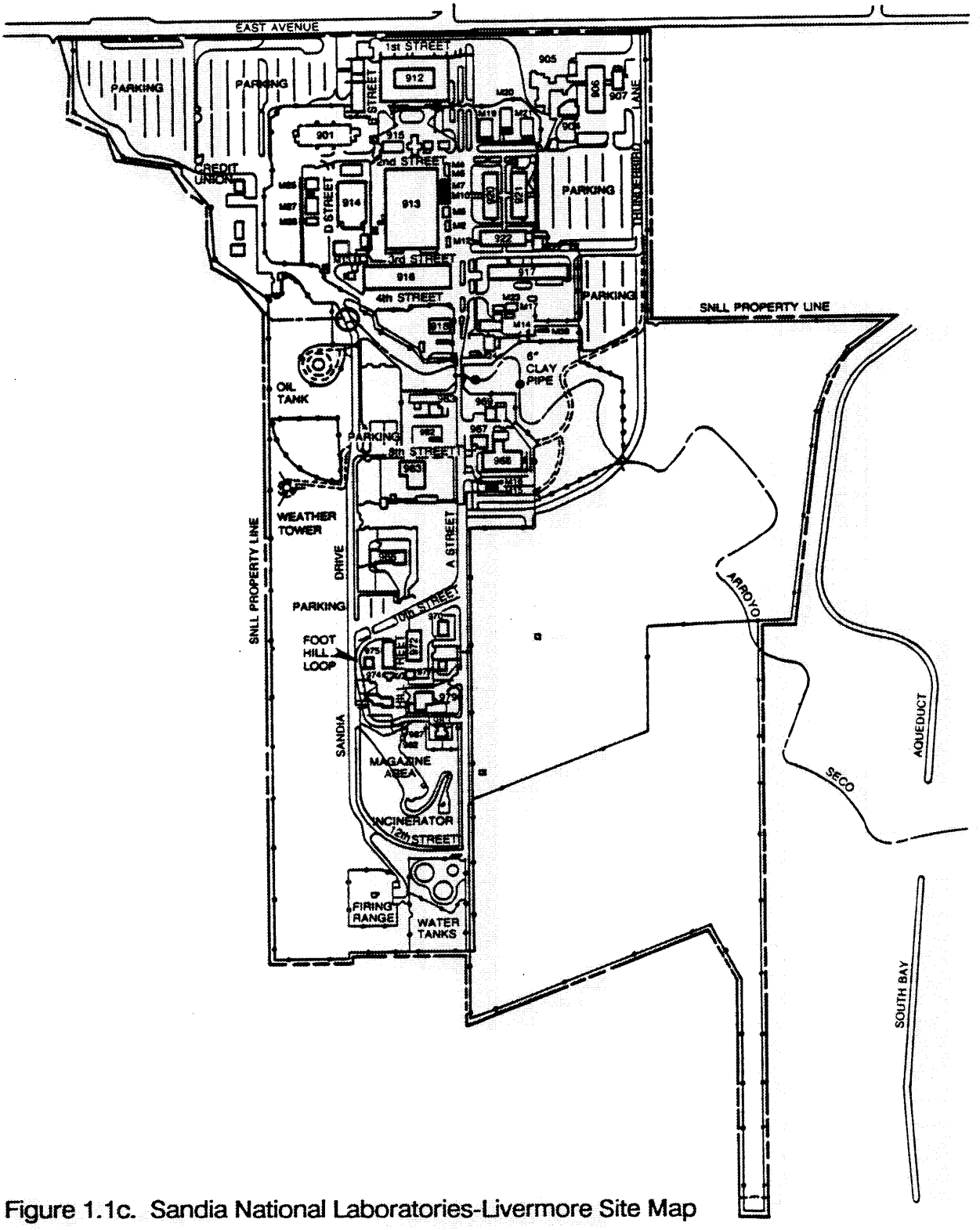
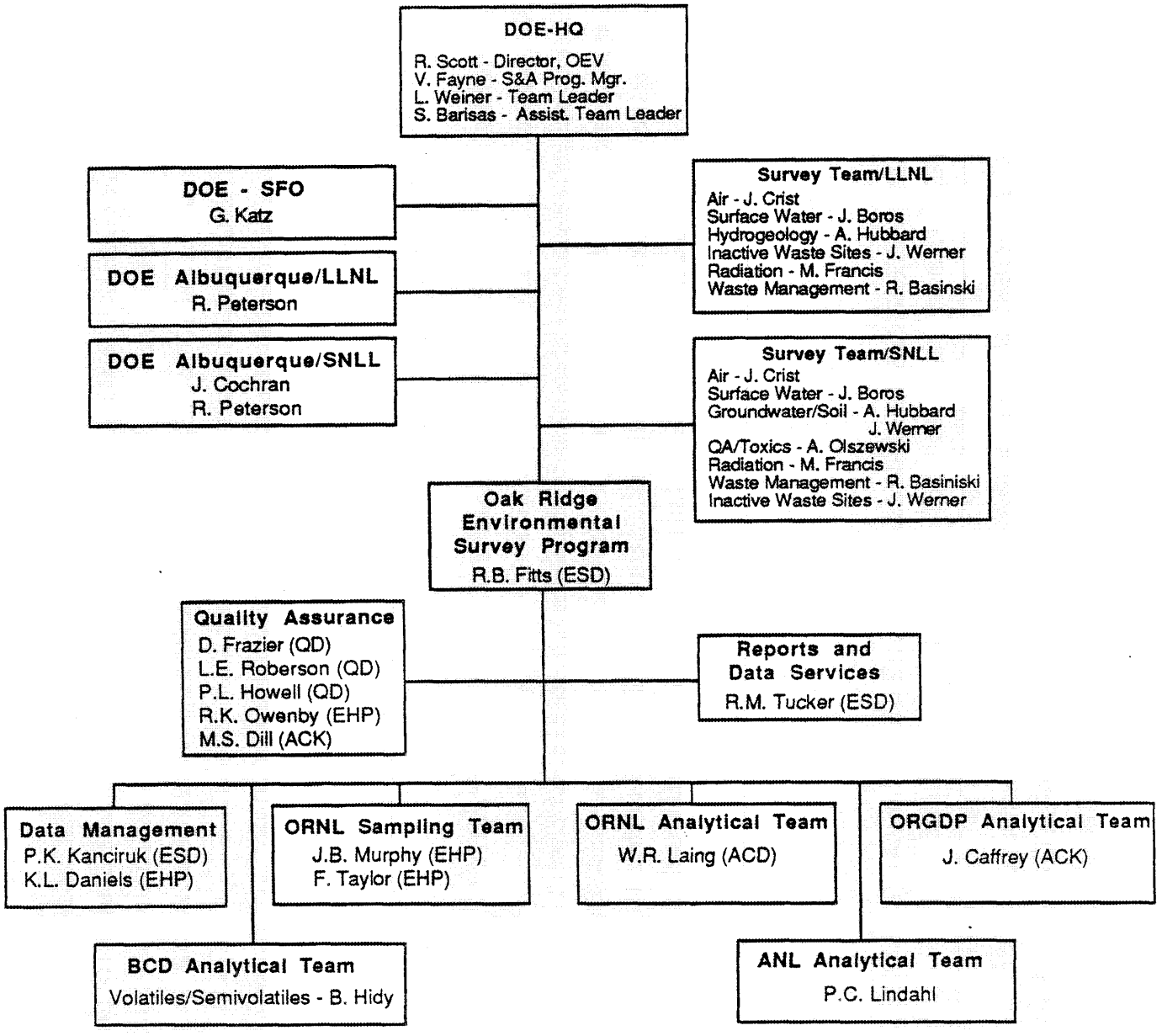


Figure 1.1c. Sandia National Laboratories-Livermore Site Map



Legend:

ACD - Analytical Chemistry Division - ORNL
ACK - Analytical Chemistry Department - ORGDP
ANL - Argonne National Laboratory
BCD - Battelle-Columbus Division
EHP - Environmental and Health Protection Division
ESD - Environmental Sciences Division
QD - Quality Department
SFO - San Francisco Office

Figure 1.2. DOE Leaders, Team Leaders, and Sampling and Analysis Teams for LLNL/SNLL

Insert 2.0 Summary of Sampling and Analysis

TAB here

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 Teams could just as effectively accomplish their objective of modifying the findings 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.

3.0 METHODS

Standard methods and procedures for sampling and analysis provide for uniform results and allow comparisons to be made. Field sampling protocols and analytical methods have been developed and documented in the DOE Environmental Survey Manual (Refs. 1-3 and 1-4). 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 (i.e., 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 Time Composite Sampling

An automated sampler was used to determine mass per unit time concentrations and to identify sporadically discharged contaminants from outfalls or streams. Composite samplers were located near the sample point and set to collect a selected volume at the desired frequency (e.g., 320 mL collected at the same time each hour). The sample was pumped through a tube to a 2 1/2-gal. refrigerated collection jar. Samples were then dispersed from the collection jar to appropriate sample containers (E4.2.2, "Automated Composite Sampler").

3.1.1.3 Volatile Organic Compounds by Vial

Grab samples for volatile organics were collected by submerging a 40-mL vial with a Teflon-coated septum in water. The 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").

3.1.1.4 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").

3.1.1.5 Field Measurements

Horiba or Yellow Springs instruments were used to monitor the water samples for pH, temperature, conductivity, and, in some 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. The reduction-oxidation potential of samples was determined with a standard millivolt meter using an Ag-AgCl-platinum or calomel-platinum electrode system (E4.5, "Field Measurements").

3.1.2 Groundwater Sampling Methods

Groundwater sampling was not performed at LLNL/SNLL Sites.

3.1.3 Solids

The methods used for solid sampling (soils, sludge, and sediments) were 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 distribution, grab samples were collected until a suitable volume was obtained.

3.1.3.1 Surface Soils

The top 3 in. of soil (with stones and vegetation removed) were sampled 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 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 or organic vapor concentrations. A new core was then taken nearby and the core position corresponding to the highest concentration of organic vapor was resampled to obtain an undisturbed sample for volatile organic analysis. Three additional cores from the same sample vicinity 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 sampling boreholes that 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").

3.1.4 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.

3.1.5 Soil Gas Collection

Soil gas samples for the determination of volatile organic compounds were collected by the active method. The active method utilizes a pump for the continuous withdrawal of subsurface gases with syringe sampling and in situ gas chromatography (GC) analysis, or the subsurface gases are pumped through adsorbent tubes and analyzed in the laboratory by GC. The active sampling method is preferred because the zone of sampling is effectively enlarged by the moving air stream, thereby providing a more representative sample from the interstitial spaces. Soil gas sampling at LLNL/SNLL was accomplished by the active method, with the sample tubes returned to ORNL for analysis by GC.

Samples for soil gas analysis were collected using solid sorbent tubes (Carbotrap 300). The Carbotrap 300 tube was designed to trap hydrocarbons, whether present individually or in complex mixtures. The tube contained three distinct adsorbent beds. The back bed trapped vinyl chloride and other light compounds, while the middle bed trapped the C5-C8 compounds, and the front bed (gas inlet) trapped the heaviest compounds. The tube was constructed to allow sampling volumes of up to 10 L without breakthrough. The soil gas stream was pulled through the tube with a personal air monitor pump which had an adjustable sample rate of 0.2 to 4 L per minute.

3.2 Analytical Methods

3.2.1 Organic Analysis Methods

3.2.1.1 Volatile Organics

Volatile organic contaminants in water, soil, or sediment were 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 method, as cited in these two sources, 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 quantitation limits, as specified in the DOE Environmental Survey Manual.

Volatile organics are purged from an aqueous sample or a mixture of soil and distilled water at ambient temperature using an inert gas. 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 1985 National Bureau of Standards (NBS) and Wiley Mass Spectral Libraries 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

Table 3.1. Analytes Determined by CLP Volatiles Analysis Method

	Analyte	CAS Number	Contract Required Quantitation 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	5	5
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 quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.
b. Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.
c. Contract required quantitation limits (CRQL) for volatiles at medium levels in soil/sediment are 100 times the listed CRQL for volatiles at low levels in soil/sediment.

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 CLP protocol requires that the analysis be conducted within 10 days of sample receipt. 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 organics in all samples were extracted by the Organic Analysis Group of ORNL. Part I semivolatile samples were analyzed by the ORNL group; Part II samples were shipped to Battelle and ORGDP for analysis. Semivolatile organic contaminants in water, soil, or sediment samples are determined using the 7/87 CLP Statement of Work and Appendix D of the DOE Environmental Survey Manual for low-level samples. The protocol, as cited in these two sources, 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°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°C. Target compounds are identified on the basis of: (1) relative

Table 3.2. Analytes Determined by CLP Semivolatiles Analysis Method

	Analyte	CAS Number	Contract Required Quantitation 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 Quantitation 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

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

a. Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.
b. Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.
c. Contract required quantitation limits (CRQL) for semivolatiles at medium levels in soil/sediment are 60 times the listed CRQL for semivolatiles at low levels in soil/sediment.

retention times (compound elution times) compared to 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 coextracted 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 CLP protocol requires that aqueous samples must be extracted within five days of sample receipt; soil samples must be extracted within ten days. Samples that have exceeded this holding time can still provide useful information as long as the data is interpreted with caution.

3.2.1.3 Pesticides/PCBs

3.2.1.3.1 Pesticides/PCBs in Water, Soil, and Sediment

Pesticides and polychlorinated biphenyls (PCBs) in water, soil, or sediment are determined using the 7/87 Contract Laboratory Program Statement of Work for low-level samples and Appendix D of 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. Confirmation by GC-MS is seldom done due to insufficient concentration of the pesticides and PCBs in the samples.

The U.S. DOE protocol requires the identification of 27 target compounds at the Contract Required Quantitation Limits (CRQL) 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 CLP protocol requires that aqueous samples be extracted within five days of sample receipt and soil samples extracted within ten 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.

3.2.1.3.2 PCBs in Oils

The PCB content in most oils can be determined at concentrations levels ranging from 90% to less than 1 ug/g by first diluting the oil with hexane. If the sample contains extraneous chloro-species, the hexane dilution is passed through a silica gel-florisil column to clean up the sample prior to analysis. A 1- to 5-uL aliquot is then injected into a gas chromatograph equipped with an electron capture detector. All Aroclors, 1016 to 1260, are resolved reasonably well with the GC-ECD instrumentation. The spectrum of the sample is compared with a standard profile library for identification. The appropriate PCB standard

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

Analyte	CAS Number	Contract Required Quantitation 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 quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

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

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

that matches the PCB found in the sample is quantitatively injected. The peak heights are measured for quantitation.

3.2.1.4 F001 to F005 Solvents

F001 to F005 solvents are those organic compounds specified under EPA Regulations for Identifying Hazardous Waste (40 CFR 261; 45 FR 33119, May 19, 1980) generic to degreasing procedures. To be listed as an F001 to F005 hazardous waste, a total of 10% or more (by volume) of one or more of the compounds listed in Table 3.4 must be present in a spent-solvent waste. As the presence of F001 to F005 compounds can be identified during the analysis of CLP volatile and semivolatile TCL and tentatively identified compounds (TIC), no additional analytical procedure was used to determine the presence of these compounds in SNLL samples. The determination of F001 to F005 in SNLL samples was performed by simply noting the positive hits of these compounds from the CLP volatile and semivolatile organic analysis data. Table 3.4 denotes the compounds that are observed using the CLP volatiles protocol (V), the CLP semivolatile protocol (SV), and those compounds that can be identified using both (B) procedures. (Nitropropane would most probably be identified using the SV procedure.) Results which correspond to reporting requirements for CLP volatile and semivolatile compounds are determined at the ppb level. Consequently, the presence of F001 to F005 was confirmed, but their concentrations were never observed at the gross concentration levels required for listing of any sample as a hazardous waste.

3.2.1.5 High Explosives

There is no EPA standard method for the determination of munitions and munitions by-products in soil. ORNL employs methods similar to those which have been tested at the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire. These methods are applicable for four munitions and two by-products. These include 2,4-dinitrotoluene (2,4-DNT),

Table 3.4. F-List Solvents (F001 to F005)

Compound	CLP Organic Procedure
Tetrachloroethylene (1), (2)	V
Trichloroethylene (1), (2)	V
Methylene chloride (1), (2)	V
Trichloroethane (1), (2)	V
Carbon tetrachloride	V
"chlorinated Fluorocarbons" (#) (1)	B
Chlorobenzene (2)	V
Dichlorobenzene (2)	B
trichloro-1,2,2-trifluoroethane (2)	V
Trichlorofluoromethane (2)	V
Trichloroethane (2)	V
Xylene (3)	V
Acetone (3)	V
Acetate (3)	V
Benzene (3)	V
Ether (3)	V
Methyl Isobutyl Ketone (3)	V
Butyl Alcohol (3)	V
Cyclohexanone (3)	B
Methanol (3)	V
Nitrobenzene (3)	SV
Cresols (4)	SV
Cresylic acid (*) (4)	SV
Toluene (5)	V
Methyl ethyl ketone (5)	V
Carbon Disulfide (5)	V
Isobutanol (5)	V
Pyridine (5)	B
Benzene (5)	V
Ethoxyethanol (5)	V
Nitropropane (5)	SV

V = CLP analytical method for volatile organics.
SV = CLP analytical method for semivolatile organics.
B = Compound identified in both volatile and semivolatile methods.
# = Intrepreted to mean "Freons." Some Freons are listed separately.
* Refers to mixture of phenols from coal tar boiling around 205°C and upward (The Merck Index, 7th Ed, pg 295).

(1) F00l Spent halogenated solvents used in degreasing (toxic).
(2) F002 Spent halogenated solvents (toxic).
(3) F003 Spent nonhalogenated solvents (ignitable).
(4) F004 Spent nonhalogenated solvent (toxic).
(5) F005 Spent nonhalogenated solvent (ignitable and toxic).

octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), 2,6-dinitrotoluene (2,6-DNT) hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), 2,4,6-trinitrotoluene (TNT), and N-methyl-N-2,4,6-tetranitroanaline (Tetryl).

There is no holding time established for munitions and munitions by-products, which may be considered as thermally-unstable semivolatile compounds. However, the EPA/DOD Preanalytical Holding Time Study suggests that the holding time is as critical for soil/water samples that may contain explosives, as it is for similar samples containing semivolatile base/neutral/acid species. In general, initial extraction of a soil sample was performed within 24 hours, and certainly within a week of sample receipt. Water samples do not require extraction and may be analyzed immediately upon receipt. Sample and temporary archival storage employs refrigerators maintained at $4^{o}C$.

Soil samples are ultrasonically extracted with acetonitrile, using 2 to 10 g of soil and 40 mL of acetonitrile. (The soil sample is never oven-dried prior to analysis, but is determined on an "as is" basis.) The extract is centrifuged and an aliquot filtered and diluted (1/1, v/v) with distilled water. Water samples are diluted (1/1, v/v) with acetonitrile. The treated samples are analyzed using an octadecylsilane (C18 or ODS) reversed-phase high performance liquid chromatography (HPLC) column with a mixture of water/acetonitrile/methanol (50/25/25 v/v/v) flowing at 0.8 mL/min. An ultraviolet absorbance detector with a 254 nanometer (nm) fixed filter is employed for quantitating the six analytes. Chromatograms are recorded on both a conventional stripchart recorder and a recording integrator. Experimentally-determined retention times are used for the initial identification of candidate explosive peaks. Peak areas obtained from the recording integrator are used for quantitation.

The identity of the explosives is confirmed by HPLC using a cyano-phase column which exhibits normal-phase behavior and, therefore, inverts the order of elution of most of the analytes. A water/methanol (50/50 v/v) solvent is used to elute the explosives from the cyano column; the monitoring wavelength is the same.

All quantitation was performed using the method of external standards. Four independently-generated standards covering the range of 0.2 to 1.6 ug/mL of each munition or munition by-product are used to generate the working calibration curve. One set of standards is analyzed with each lot of water or soil samples. The quantitation limits for munitions and munitions by-products are typically 0.06 to 0.3 mg/L in water and 0.5 to 2.0 mg/kg in soil, as illustrated in Table 3.5. Blanks and spiked samples are analyzed with each set of samples.

Table 3.5. Standard Reporting Quantitation Limits for Munitions and By-Products

Explosive	Soil Limits, mg/kg	Water Limits, mg/L
2,4-DNT	<1	<0.06
2,6-DNT	<0.5	<0.1
HMX	<2	<0.3
RDX	<2	<0.2
Tetryl	<1	<0.1
TNT	<1	<0.08

HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
Tetryl = N-methyl-N-2,4,6-tetranitroanaline
TNT = 2,4,6-trinitrotoluene
2,4-DNT = 2,4-dinitrotoluene
2,6-DNT = 2,6-dinitrotoluene

3.2.1.6 Total Organic Carbon

The measurement of total organic carbon (TOC) is used in assessing the potential oxygen-demanding load of organic material on a receiving stream. The TOC determination is performed by converting the organic carbon in a sample to carbon dioxide, either catalytically or through wet oxidation procedures. The carbon dioxide (CO_2) formed can be measured directly by infrared detector or

converted to methane (CH_4) and measured by a flame ionization detector. The amount of CO_2 or CH_4 is directly proportional to the concentration of carbonaceous material in the sample.

Because of the various properties of carbon-containing compounds in liquid samples, preliminary treatment of the sample prior to analysis dictates the definition of the carbon as it is measured. The lapse of time between the collection of samples and the start of analysis should be kept to a minimum to reduce the possibility of oxidation or bacterial decomposition of some components in aqueous samples. Also, samples should be kept cool ($4^{o}C$) and protected from sunlight and atmospheric oxygen. In instances where the analysis cannot be performed within 2 hr from the time of sampling, the sample is acidified (pH <2) with hydrochloric or sulfuric acid. The carbonaceous analyzer measures all of the carbon in the sample. Carbonate and bicarbonate carbon are not part of the oxygen demand of a stream; these components must be removed or accounted for in the final calculation.

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. 785 for Inorganic Analysis Multi-media, Multi-concentration and the U.S. DOE Environmental Survey Manual. Table 3.6 summarizes the analytical method and the required quantitation limit for a total of 23 specific metal contaminants. Seventeen of these elements were reported using the inductively coupled plasma (ICP) technique according to the full CLP technical criteria. In addition, three elements (arsenic, selenium, and lead) were also determined by ICP and were reported to quantitation levels which exceeded the CLP requisite limits, but were significantly below the ICP method quantitation limits as listed in the DOE protocol. Graphite furnace atomic absorption (GFAA)

Table 3.6. Elements Determined by Atomic Emission or Absorption Techniques

Element	Contract Required Quantitation Level (ug/L)	DOE Method Quantitation Limit for ICP (ug/L)	Analytical Method
Aluminum	200	200	ICP
Antimony	60	150	ICP
Arsenic	10	250	ICP, GFAA*
Barium	200	200	ICP
Beryllium	5	5	ICP, GFAA#
Cadmium	5	20	ICP
Calcium	5000	5000	ICP
Chromium	10	10	ICP, GFAA*
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, GFAA#
Potassium	5000	5000	FES
Selenium	5	400	ICP, GFAA#
Silver	10	30	ICP, GFAA#
Sodium	5000	5000	ICP
Thallium	10	100	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 for LLNL and SNLL samples were reported for this element.
# Only GFAA results for LLNL samples were reported for this element.

was used to determine and report the concentrations of eight elements (silver, arsenic, beryllium, chromium, lead, nickel, selenium, and thallium) in LLNL samples. The concentrations of arsenic, chromium, lead, and nickel were analyzed by GFAA and reported for SNLL samples.

Mercury was determined by cold vapor flameless atomic absorption (CVFAA), and potassium was determined using flame emission photometry (FES) for samples from both sites.

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. 785 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.

The CLP protocol does not specify digestion procedures for oil samples. The method of sample digestion included the following steps: (a) a 5-mL aliquot of oil is evaporated to dryness, (b) 10 mL of concentrated nitric acid is added and the mixture heated until the reaction looses vigor, (c) 5 mL of concentrated perchloric acid is added and the mixture heated until the appearance of perchloric acid fumes, and (d) the final mixture is diluted to a 25-mL volume with deionized water.

3.2.2.1.2 Potassium

A direct-reading flame photometer was used for the quantitative analysis of potassium in aqueous and solid samples. 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 and 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 10 mg/L.

The preparation procedure for aqueous and solid samples is identical to that used for the ICP analysis of metals.

3.2.2.1.3 Atomic Absorption, Furnace Technique

Graphite furnace atomic absorption was used to determine the concentration of arsenic, beryllium, chromium, lead, nickel, selenium, silver, and thallium in LLNL samples. GFAA is used to determine the concentration of arsenic, chromium, lead, and nickel only in SNLL samples. 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°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 Total Cyanide

Total 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 co-distillation of thiocyanate.) The evolved HCN is absorbed in a scrubber solution containing sodium hydroxide. Cyanide is then determined spectrophotometrically by first converting HCN to 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 spectrophotometric procedure has a quantitation 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-dimethylaminobenzalrhodamine 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 organic wastes is determined gravimetrically after sample extraction with Freon. The oil and grease present in a sample is extracted from an acidified, 1-L aliquot with Freon-113 using a 2-L separatory funnel. The entire specimen container must be extracted to avoid sidewall loss of oils. The Freon 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.

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°C, gasoline, and petroleum fuels through No. 2 fuel oil.

3.2.2.3. Anions

Ion chromatography is a rapid analytical technique for multi-ion analysis in a single solution scan. The method depends on the separation of a group of anions flowing through an anion exchange column, suppression of the eluant conductivity on an acid-form cation exchange column, and final conductimetric detection of the separated anions as they pass through the measurement cell. Identification of the ions present is made by characteristic retention times and is supported by sample spikes. The increase in conductivity caused by each electronegative anion is recorded using a peak integrator or strip chart recorder. Results are compared with those of standard solutions to determine anion concentration. Results are reported for chloride (Cl^-), fluoride (F^-), nitrate (NO_3^-), phosphate (PO_4^{-3}), and sulfate (SO_4^{-2}).

Aqueous samples are allowed to come to ambient temperature before analysis. Holding times for sample analysis are limited to between 48 hrs and 28 days, depending on the anions to be determined.

3.2.2.4 Hexavalent Chromium

Dissolved hexavalent chromium is determined spectrophotometrically by the diphenylcarbazide reaction in acid solution. The method is applicable for measuring chromium (VI) in extraction procedure toxicity (EPTOX) extracts and groundwaters, and domestic and industrial wastes. Interferences include

vanadium, hexavalent molybdenum, and mercurial salts. Because the presence of reducing materials in the specimen is not known, the water specimens are stored at 4°C, with a maximum holding time of 24 hrs. The analysis consists of adding diphenylcarbazide solution to the water or extract solution and adjusting the pH to 2.0. After a 10 min color development period, the absorbance is measured at 540 nm using a spectrophotometer. The absorbance value is converted to concentration by comparison to a hexavalent chromium calibration curve prepared by plotting concentrations of a series of known chromium solutions versus their respective absorbance readings. The spectrophotometric procedure has a limit of 0.010 mg/L.

3.2.2.5 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° to 105°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.

3.2.2.6 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 acidic 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 fluids. 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 3.7 and 3.8 list the regulatory levels for semivolatile and metal analytes determined using CLP analysis protocol.

3.2.2.7 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°C to a constant

Table 3.7. 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 3.8. 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

weight, then pulverized and blended well before sample aliquots are removed. All soil samples are analyzed on a dry weight basis.

3.2.2.7.1 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 counted independently 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.

3.2.2.7.2 Isotopic Uranium in Water

The sample is equilibrated with uranium-232, which is an internal standard. The uranium is then chemically purified by the use of anion exchange resin chromatography and repeated methyl isobutyl ketone (hexone) extractions. The extracted uranium is deposited on a stainless steel disc which is counted on a Nuclear Data MicroVax-based analyzer system using a silicon surface-barrier detector to determine uranium concentration.

Concentrations as low as 4×10^{-5} pCi/mL have been reported when 1-L samples were spiked with 10 dpm of uranium-232 and counted for 1000 min on an alpha pulse height analyzer. The detectors had a 20% efficiency and a 0.005-cpm background over each energy region of interest. A 60% chemical recovery of the uranium was obtained.

3.2.2.7.3 Isotopic Uranium in Soil

A known quantity of uranium-232 tracer, used as an internal standard, is added to a 10-g sample which is then leached with hot nitric acid followed by hot nitric acid-hydrogen peroxide treatment. The leachate is passed through an anion exchange resin to adsorb plutonium and thorium, leaving purified uranium in the effluent solution. The uranium is further purified by repeated extractions with methyl isobutyl ketone (hexone). The final hexone extract is dried on a stainless steel disc which is counted on a Nuclear Data MicroVAX-based analyzer system using a silicon surface-barrier detector to determine the uranium concentration.

Concentrations as low as 0.004 pCi/g have been reported for 10-g soil samples using the counting conditions as described for the determination of isotopic uranium in aqueous samples.

3.2.2.7.4 Total Uranium in Water

The total uranium content in drinking water, surface water, groundwater, and domestic industrial wastes is determined by fluorometric analysis. Uranium is quantitatively extracted from acidified nitrate solutions using trioctylphosphine oxide (TOPO) dissolved in an organic solvent, such as dodecane. Aliquots of the resulting organic extract are pipetted onto pellets of sodium fluoride in small (22 mm) platinum dishes. The pellets are dried at 585°C, fused at 990°C, and annealed at 765°C. The prepared pellets are then placed in a fluorophotometer for measurement of the uranium concentration.

The fluorophotometer was designed and fabricated at ORNL (Model 5198), but is typical of commercial units later available. The analyzer has two ultraviolet light sources for greater sensitivity, optical filters, a multisampler turntable, and a photomultiplier tube for measuring the intensity of the uranium fluorescence light. In routine practice, a set of known uranium standards is prepared on

pellets and exposed to the primary excitation radiation. The characteristic emitted uranium fluorescence is used to adjust the instrument to read directly in nanograms of uranium. The samples are similarly measured; the fluorescence of each is determined and the actual uranium concentration is read in nanograms of uranium. The method has a detection limit of 1 ng.

The procedure works equally well for aqueous and solid specimens. Uranium is directly extracted from 20-mL aliquots of aqueous samples. Fifty-gram portions of solid samples must be acid digested prior to TOPO extraction. The TOPO extract is placed on three identical sodium fluoride pellets to obtain triplicate analyses for both aqueous and solid samples.

3.2.2.7.5 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 is performed on a Tennelec Model LB 4000 computer-controlled system. The lowest reported concentration is 0.5 pCi/L for 250-mL samples.

3.2.2.7.6 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 is performed on a Tennelec Model LB 4000 computer-controlled system. The lowest reported concentration is 0.2 pCi/g for 10-g samples.

3.2.2.7.7 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 in this determination are between 20% and 35%. The gamma spectra are reduced, and reports are 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.

3.2.2.7.8 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 Packard 460C 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 LLNL/SNLL Sites. 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 data for each environmental problem are examined.

Environmental problem data are presented in order of 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 LLNL and SNLL Sampling and Analysis Plans (Refs. 1-1 and 1-2). 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 present samples 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); and the radiological QC section (Appendix E).

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

This section presents descriptions of the structure and contents of the three basic types of data tables that may accompany the discussion of each environmental problem. 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 LLNL/SNLL Sites. 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 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.

TABLE 4.1 LIVERMORE/SANDIA 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	HE ACT ANAL	HE 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
LL001		04/08/87	ARROYO SECO	ARROYO	SEDIMENT	3	3	BKGRN	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL001		04/08/87	ARROYO SECO	ARROYO	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1
LL002		04/08/87	ARROYO SECO	ARROYO	SEDIMENT	3	3	S COM	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL003		06/08/87	TRAILER STG	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL003		06/08/87	TRAILER STG	ARROYO	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1
LL004		05/08/87	RET. BASIN	ARROYO	SEDIMENT	4	4	GRAB	0	0	3	3	0	0	0	0	0	4	4	4	4	4	3	3
LL005		06/08/87	LAS POSITAS	ARROYO	SEDIMENT	3	3	BKGRN	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL006		06/08/87	LAS POSITAS	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL006		06/08/87	LAS POSITAS	ARROYO	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1
LL007		06/08/87	LAS POSITAS	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL008		07/08/87	LAS POSITAS	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	2	3	3	3
LL009		07/08/87	LAS POSITAS	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL010	DELETED		SHIELD BLDG	ARROYO	SEDIMENT	0	3	GRAB	0	0	0	3	0	0	0	0	0	3	0	3	0	3	0	3
LL010	DELETED		SHIELD BLDG	ARROYO	SUR WATER	0	1	QC RN	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	1
LL011		11/08/87	N OF 4TH ST	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL012	DELETED		BLDG. 131	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012	DELETED		BLDG. 151	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012	DELETED		BLDG. 169	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012	DELETED		BLDG. 175	SEWERS	SUR WATER	0	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
LL012	DELETED		BLDG. 175	SEWERS	SUR WATER	0	3	T COM	0	0	0	3	0	0	0	0	0	0	0	3	0	0	0	3
LL012	DELETED		BLDG. 222	SEWERS	SUR WATER	0	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
LL012	DELETED		BLDG. 241	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012	DELETED		BLDG. 298	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012	DELETED		BLDG. 321	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012	DELETED		BLDG. 322	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012	DELETED		BLDG. 331	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012	DELETED		BLDG. 511	SEWERS	SUR WATER	0	1	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
LL012		05/08/87	BLDG. 131	SEWERS	SUR WATER	2	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
LL012		05/08/87	BLDG. 131	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		05/08/87	BLDG. 169	SEWERS	SUR WATER	2	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
LL012		05/08/87	BLDG. 169	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		05/08/87	BLDG. 298	SEWERS	SUR WATER	2	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
LL012		05/08/87	BLDG. 298	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		05/08/87	BLDG. 321	SEWERS	SUR WATER	2	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
LL012		05/08/87	BLDG. 321	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		05/08/87	BLDG. 322	SEWERS	SUR WATER	2	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
LL012		05/08/87	BLDG. 322	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		05/08/87	BLDG. 511	SEWERS	SUR WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		05/08/87	BLDG. 511	SEWERS	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		06/08/87	BLDG. 131	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		06/08/87	BLDG. 131	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		06/08/87	BLDG. 169	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		06/08/87	BLDG. 169	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		06/08/87	BLDG. 298	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0
LL012		06/08/87	BLDG. 298	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1

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TABLE 4.1 LIVERMORE/SANDIA 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	HE ACT ANAL	HE 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
LL012		06/08/87	BLDG. 321	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0
LL012		06/08/87	BLDG. 321	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		06/08/87	BLDG. 322	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		06/08/87	BLDG. 322	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		06/08/87	BLDG. 511	SEWERS	SUR WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		07/08/87	BLDG. 131	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		07/08/87	BLDG. 131	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		07/08/87	BLDG. 169	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		07/08/87	BLDG. 169	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		07/08/87	BLDG. 298	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		07/08/87	BLDG. 298	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		07/08/87	BLDG. 321	SEWERS	SUR WATER	4	4	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	3	3	1	1
LL012		07/08/87	BLDG. 322	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		07/08/87	BLDG. 322	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		10/08/87	BLDG. 151	SEWERS	SUR WATER	2	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
LL012		10/08/87	BLDG. 151	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		10/08/87	BLDG. 222	SEWERS	SUR WATER	4	4	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0
LL012		10/08/87	BLDG. 222	SEWERS	SUR WATER	2	2	T COM	0	0	2	2	0	0	0	0	0	0	2	2	0	0	2	2
LL012		10/08/87	BLDG. 241	SEWERS	SUR WATER	3	3	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	2	2	1	1
LL012		10/08/87	BLDG. 241	SEWERS	SUR WATER	2	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
LL012		10/08/87	BLDG. 331	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		10/08/87	BLDG. 511	SEWERS	SUR WATER	2	2	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0
LL012		10/08/87	BLDG. 511	SEWERS	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		10/08/87	BLDG. 511	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		11/08/87	BLDG. 151	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		11/08/87	BLDG. 151	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		11/08/87	BLDG. 222	SEWERS	SUR WATER	6	6	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	6	6	0	0
LL012		11/08/87	BLDG. 222	SEWERS	SUR WATER	2	2	T COM	0	0	2	2	0	0	0	0	0	0	2	2	0	0	2	2
LL012		11/08/87	BLDG. 241	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		11/08/87	BLDG. 241	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		11/08/87	BLDG. 331	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		11/08/87	BLDG. 331	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	1
LL012		11/08/87	BLDG. 511	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		11/08/87	BLDG. 511	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	1
LL012		12/08/87	BLDG. 151	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		12/08/87	BLDG. 151	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		12/08/87	BLDG. 222	SEWERS	SUR WATER	6	6	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	6	6	0	0
LL012		12/08/87	BLDG. 222	SEWERS	SUR WATER	2	2	T COM	0	0	2	2	0	0	0	0	0	0	2	2	0	0	2	2
LL012		12/08/87	BLDG. 241	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		12/08/87	BLDG. 241	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		12/08/87	BLDG. 331	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		12/08/87	BLDG. 331	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
LL012		12/08/87	BLDG. 511	SEWERS	SUR WATER	3	3	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0
LL012		12/08/87	BLDG. 511	SEWERS	SUR WATER	1	1	T COM	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1

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TABLE 4.1 LIVERMORE/SANDIA 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	HE ACT ANAL	HE 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
LL013	DELETED		BLDG. 612	DITCH	SEDIMENT	0	1	GRAB	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1
LL013		11/08/87	BLDG. 612	DITCH	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
LL014		04/08/87	BLDG. 131	TANK	SEALED CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL015		04/08/87	BLDG. 141	SUMP	SUR WATER	1	1	QC RN	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL015		04/08/87	BLDG. 141	SUMP	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL016		13/08/87	BLDG. 141	SUMP	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL017		13/08/87	BLDG. 141	SUMP	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL018		13/08/87	BLDG. 151	TANK	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL019		13/08/87	BLDG. 151	TANK	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL020		11/08/87	BLDG. 222	TANK	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL021		11/08/87	BLDG. 222	TANK	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL022		04/08/87	BLDG. 231	SUMP	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL022		04/08/87	BLDG. 231	SUMP	SEALED CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL023	DELETED		BLDG. 231	SUMP	SUR WATER	0	1	QC FL	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1
LL023	DELETED		BLDG. 231	SUMP	UNSEAL CO	0	1	GRAB	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1
LL024		11/08/87	BLDG. 298	TANK	UNSEAL CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL025		11/08/87	BLDG. 321	SUMP	SUR WATER	1	1	QC FL	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0
LL025		12/08/87	BLDG. 321	SUMP	UNSEAL CO	1	1	GRAB	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1
LL026		12/08/87	BLDG. 492	SUMP	UNSEAL CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL027 *		12/08/87	BLDG. 514	WASTE	SEDIMENT	9	9	GRAB	0	0	0	9	0	0	0	0	0	0	0	9	0	0	0	0
LL027		12/08/87	BLDG. 514	WASTE	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0
LL028		12/08/87	BLDG. 321	DRUMRACKS	SOIL	4	4	GRAB	0	0	4	4	0	0	0	0	0	0	4	4	4	4	0	0
LL029		07/08/87	875/878	CULVERT	SEDIMENT	3	3	GRAB	0	0	3	3	3	3	0	0	0	0	3	3	3	3	3	3
LL030		07/08/87	N OF 875	CULVERT	SOIL	4	4	GRAB	0	0	4	4	4	4	0	0	0	0	4	4	4	4	4	4
LL031	DELETED		GSA AREA	GSA AREA	SOIL	0	1	GRAB	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	1
LL031	DELETED		GSA AREA	GSA AREA	SUR WATER	0	1	QC RN	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	1
LL031		10/08/87	GSA AREA	GSA AREA	SOIL	15	15	GRAB	0	0	15	15	15	15	0	0	0	0	15	15	15	15	15	15
LL032	DELETED		DRUM RACK	SUMP	SOIL	0	3	GRAB	0	0	0	0	0	3	0	0	0	0	0	3	0	3	0	0
LL032	DELETED		DRUM RACK	SUMP	SEDIMENT	0	9	S COM	0	0	0	0	0	9	0	0	0	0	0	9	0	9	0	0
LL032		10/08/87	DRUM RACK	SUMP	SOIL	3	3	GRAB	0	0	0	0	3	3	0	0	0	0	3	3	3	3	0	0
LL032		10/08/87	DRUM RACK	SUMP	SOIL	6	6	S COM	0	0	0	0	6	6	0	0	0	0	6	6	6	6	0	0
LL032		10/08/87	DRUM RACK	SUMP	SEDIMENT	3	3	S COM	0	0	0	0	3	3	0	0	0	0	3	3	3	3	0	0
LL032		10/08/87	DRUM RACK	SUMP	SUR. WATER	1	1	QC RN	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0
LL033		05/08/87	BLDG. 805	DRAINS	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
LL034		10/08/87	BURN PIT	PITS	SOIL	12	12	GRAB	0	0	12	12	0	0	12	12	0	0	12	12	12	12	12	12
LL034		10/08/87	BURN PIT	PITS	SUR WATER	1	1	QC RN	0	0	1	1	0	0	1	1	0	0	1	1	1	1	1	1
LL035		06/08/87	DIESEL TANKR	TANKS	UNSEAL CO	3	3	S COM	0	0	3	3	0	0	0	0	3	3	0	0	0	0	0	0
LL035		07/08/87	DIESEL TANKR	TANKS	UNSEAL CO	3	3	S COM	0	0	3	3	0	0	0	0	3	3	0	0	0	0	0	0
LL036		04/08/87	GSA AREA	WELLS	SOIL	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL036		05/08/87	GSA AREA	WELLS	SOIL	2	2	GRAB	0	0	2	2	0	0	0	0	0	0	2	2	1	2	2	2
LL036		06/08/87	GSA AREA	WELLS	SOIL	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL036		07/08/87	GSA AREA	WELLS	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	1	0	3	3	3	3	3	3
LL036		07/08/87	GSA AREA	WELLS	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL036		10/08/87	GSA AREA	WELLS	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3

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TABLE 4.1 LIVERMORE/SANDIA 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	HE ACT ANAL	HE 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
LL036		11/08/87	GSA AREA	WELLS	SOIL	3	12	GRAB	0	0	3	12	0	0	0	0	0	0	3	12	3	12	3	12
LL037	DELETED		STP OVERFLOW	POND	SUR WATER	0	1	QC RN	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	1
LL037		06/08/87	STP OVERFLOW	POND	SEDIMENT	3	3	GRAB	0	0	3	3	3	3	0	0	0	0	3	3	3	3	3	3
LL038	DELETED		STP MAIN	POND	SEDIMENT	0	1	GRAB	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1
LL038		07/08/87	STP MAIN	POND	SEDIMENT	4	4	GRAB	0	0	4	4	0	0	0	0	1	0	4	4	4	4	4	4
LL039		05/08/87	865 AREA	DITCH	SEDIMENT	4	4	GRAB	0	0	4	4	0	0	0	0	0	0	4	4	4	4	4	4
LL040		10/08/87	CORRAL H CRK	ARROYO	SEDIMENT	3	3	BKGRN	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
LL041		10/08/87	CORRAL H CRK	DITCH	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
LL042		10/08/87	CORRAL H CRK	CREEK	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
LL043	DELETED		CORRAL H CRK	DITCH	SEDIMENT	0	3	GRAB	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
LL044		05/08/87	FIRING TABLE	DITCHES	SEDIMENT	9	9	GRAB	0	0	9	9	0	0	0	0	0	0	0	0	0	0	9	9
LL044		05/08/87	FIRING TABLE	DITCHES	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
SN001		11/08/87	ARROYO SECO	ARROYOS	SEDIMENT	3	3	BKGRN	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
SN001		11/08/87	ARROYO SECO	ARROYOS	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1
SN002		11/08/87	ARROYO SECO	ARROYOS	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	3	3	3	3	3	3	3
SN003		11/08/87	ARROYO SECO	ARROYOS	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	3	3	3	3	3	3	3
SN004	DELETED		ARROYO SECO	ARROYOS	SEDIMENT	0	1	GRAB	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1
SN004		13/08/87	ARROYO SECO	ARROYOS	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
SN005	DELETED		BLDG. 913	BLDG 913	UNSEAL CO	0	1	GRAB	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1
SN005		10/08/87	BLDG. 913	BLDG 913	UNSEAL CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
SN005		11/08/87	BLDG. 913	BLDG 913	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
SN005		11/08/87	BLDG. 913	BLDG 913	UNSEAL CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
SN005		12/08/87	BLDG. 913	BLDG 913	UNSEAL CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
SN006		10/08/87	SPRAY BOOTH	SPRAY BOOTH	SUR WATER	1	1	QC FL	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
SN006		10/08/87	SPRAY BOOTH	SPRAY BOOTH	SUR WATER	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
SN007		13/08/87	NAVY LANDFIL	INACTIVE SI	SEDIMENT	6	6	GRAB	0	0	6	6	0	0	0	0	0	0	6	6	6	6	6	6
SN008		13/08/87	EXP BURN PIT	INACTIVE SI	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
SN008		13/08/87	EXP BURN PIT	INACTIVE SI	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
SN009		12/08/87	OLD FIRE TRA	INACTIVE SI	SOIL	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	0	0
SN009		13/08/87	OLD FIRE TRA	INACTIVE SI	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	0	0
SN010	DELETED		SANDIA CROSS	INACTIVE SI	SOIL	0	1	GRAB	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
SN010		12/08/87	SANDIA CROSS	INACTIVE SI	SOIL	5	5	GRAB	0	0	5	5	0	0	0	0	0	0	5	5	5	5	0	0
SN011	DELETED		OLD PAINT ST	INACTIVE SI	SOIL	0	3	GRAB	0	0	0	3	0	0	0	0	0	0	0	3	0	3	0	3
SN011		13/08/87	OLD PAINT ST	INACTIVE SI	SOIL	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
					TOTAL	335	393		10	10	224	265	39	54	13	13	41	57	201	254	259	315	203	234

* DATA ANALYSES WILL NOT BE PRESENTED WITHIN THIS DATA DOCUMENT, BUT WILL BE PRESENTED UNDER SEPARATE COVER.

Draft - Do Not Cite

NOTE: Because Environmental Problem numbers are duplicated in LLNL and SNLL, the 4.2 and 4.3 tables will be preceded by either an L for LLNL or an S for SNLL. 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 L4.3.2 is the analytical data summary by medium series table that applies specifically to Environmental Problem 2 of LLNL. Problem-specific tables are located in the appropriate environmental problem section of this chapter. The problem-specific data series tables are:

4.2.1-4.2.n	Sampling and Analysis Data Summary
4.3.1-4.3.n	Analytical Data Summary by Medium for Environmental Problem

The Table 4.2 series 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 in which at least one analyte was detected. The numbers represent the number of samples analyzed and the number of samples with at least one analyte 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 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 is determined by

first having sampling and analytical personnel identify the logical groupings of the data and then having data management determine an easily readable form 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 table 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 appropriate directory for QA/QC tables in Volume II.

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 quantitation 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 Quantitation Limit (CRQL) 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.

Five 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 quantitation limit (CRQL), 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/kg and a sample quantitation limit of 430 ug/kg, the concentration is reported as 300 **J**.

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 all concentration values reported on that Form I are flagged with the **D** flag.

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 unless the analyst determines that the 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. Even though the implementation of establishing the degree of contamination may not be ideally realized, Level II includes a wide range of quality, 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.1-4).

4.4 Background Values

A discussion and presentation of information on background levels of contaminants for environmental media in the LLNL/SNLL Site area, derived directly from LLNL/SNLL 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.

4.6 LLNL Environmental Problem 1: Arroyos

Request Numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.
Requester: J. Boros.
Finding and Basis: Arroyo sediments represent a potential source of contamination due to past practices. LLNL discharged contaminated wastewaters from a number of laboratory operations, including a plating shop, laboratory sinks and hoods, test facilities, utility services, and cooling water blowdown to the storm sewer system as a common past practice. All of this water eventually reached the two arroyos or penetrated the ground. At the time of the Survey, LLNL was releasing no process wastewaters by this route. Groundwater is known to be contaminated, but LLNL has not adequately characterized arroyo sediments as a potential continuing source of pollutants. Off-site migration and groundwater penetration have not been assessed.

4.6.1 Sampling and Analysis Objectives

Statement: Sediment samples were to be collected from Arroyo Seco and Arroyo Las Positas to determine if the contaminants listed in section 4.6.2.2 are present in arroyo sediments above normal levels for that area. Results of the analysis of arroyo sediments can answer questions about the possibility of contaminant migration off-site or downward into aquifers. The first two samples (Arroyo Seco locations) in this group of samples are a continuation of a similar series for Sandia National Laboratories-Livermore (SNLL Environmental Problem 1).

Supporting Information: The recommended sampling points were selected to show possible influences from different areas and process operations at LLNL. Sample Request 1 was the final sample point for assessing impacts from SNLL. Sample Request 5 served as a sample for Arroyo Las Positas as it entered the LLNL Site. Results from LLNL's groundwater monitoring program have confirmed the presence of volatile organics in groundwater under and adjacent to the site.

4.6.2 Sampling and Analytical Design

4.6.2.1 Sampling Design

Request 1: Arroyo Seco at the South Side of East Avenue (Fig. L4.1a). This section of the arroyo was chosen to represent the arroyo before any influence of the LLNL, but downstream of all SNLL influences. Three grab sediment samples were to be collected at selected segments at depths indicated by organic vapor analysis (OVA) field screening at the Arroyo Seco (Sampling Method: Reference Section E5.2.3).

The Sampling Team arrived at the sampling site at 1030 on 04AUG87. The day was sunny, with the temperature about 84°F. The arroyo was approximately 30 ft wide at this point; the sampling area was less than 100 m^2. An attempt was made to select an area within the arroyo where sediment would collect. Beginning approximately 15 ft from a steel grate/underground channel, the area was marked 60 ft down the middle of the channel and divided into a 1 x 60-segment grid. The three segments randomly selected for sampling were at 15 ft (LL001018), 17 ft (LL001029), and 36 ft (LL001030). These samples, collected between 1100 and 1115, were obtained at the depth of the sediment layer (usually 0-3 in.). Soil at the 15-ft and 17-ft locations was rocky; the 36-ft location was mainly dirt. There were no unusual occurrences during sampling. A volatile sample was taken before mixing occurred. PID screening indicated no volatiles at a depth of 0 to 1 ft. (NOTE: The detection limit of the TIP, a PhotoVac PID instrument used for screening, is 0.1 ppm in benzene equivalents using a 10.6 eV detector.) QC rinsate sample LL001041 was collected before the first sample was taken. Bottle A for LL001041 was not submitted for analysis due to a broken cap.

Request 2: Arroyo Seco Downstream from LLNL Drain Pipe (Fig. L4.1b). This sample location represented an area subject to drainage from the office complex at the southwest corner of LLNL. The arroyo was approximately 30 ft wide in

this area; the area sampled was less than 100 m^2. At this location, the area was heterogeneous because the influent from LLNL was coming into the stream; however, there was no need to stratify the sampling because samples were collected above this location (LLNL Request 1). Three grab sediment samples were to be taken from selected segments of the arroyo (Sampling Method: Reference E5.2.3).

The day was sunny, with the temperature about 90°F when the samples were collected on 04AUG87. An area immediately west of the LLNL drain where sediment accumulates was selected for sampling. The area 60 ft downstream from the drain was divided into a 1 x 60-segment grid, and segments 13 (LL002019), 38 (LL002020), and 54 (LL002031) were randomly selected for sampling. Samples were to be collected at a depth of 0 to 5 ft. Wet soil was encountered at sample location LL002019 at the 18-in. depth. There was no water at a depth of 18 in. at sample locations LL002020 and LL002031, but because of sloughing at the bottom of the hole, the 5-ft samples were not attainable. According to Mike Brown of LLNL, the arroyo is full (2 to 3 ft of water) for 2 to 3 months a year. This recharging should allow for detection of any contaminants that might be present at 0- to 3-ft depths. Composite samples were collected at 0 to 4 ft for LL002019, 0 to 3.8 ft for LL002020, and 0 to 3.5 ft for LL002031. These samples were collected between 1410 and 1440. There was no OVA field analyzer reading above the instrument detection level in any of the three holes.

Request 3: East of Outer Loop in Ditch Downstream from the Trailer Staging Area (Fig. L4.1c). This sample location represented an area subject to drainage from stormwater drains in the southeast corner of the site, and from storage and surplus property yards. Three grab sediment samples were to be taken from selected segments in the ditch (Sampling Method: Reference E5.2.3).

The Team began sampling at 0820 on 06AUG87. It was sunny and there was minimal wind. The area to be sampled was less than 100 m^2. An area in the

ditch where sediment would accumulate was selected. Homogeneity with respect to both the ditch and effluents in the ditch was assumed. The section of the ditch approximately 200 m south of the east gate was divided into a 1 x 60-segment grid, and segments 9, 13, and 19 were randomly selected for sampling. The ditch was 30 m long and about 1.5 m wide at this location. It was originally planned to collect samples from 0 to 5 ft in depth, but it was not possible to go deeper than 3 ft with hand digging; therefore, each sample point was to a depth of 3 ft. At each 1-ft depth an aliquot for volatiles and an aliquot for semivolatiles were collected and placed in the cooler. This step was repeated at each 1-ft interval for the sample. The balance of the soil from each 1-ft grab was combined for the sample to be analyzed for ICP-metals, AA-metals, and radionuclides. At sample locations LL003010 and LL003021, the ditch contained numerous small stones in the first 6 in. of soil. Gravel extended to the 1-ft depth at sample location LL003032. At all three locations, road dust from passing automobiles was a possible contaminant. These samples were collected between 0820 and 1054. QC rinsate sample LL003043 was collected at 0741 before collection of the first sample for this request.

Request 4: Inlet to Retention Basin from South Drainage Areas (Fig L4.1d). This sample location would represent an area subject to contaminants in surface water originating from the southcentral portions of the site and would provide data on pollutants delivered to the drainage retention basin. The area was fairly homogeneous with respect to this drain. The lake rarely reaches a level where other drains would influence this area. Three grab sediment samples were to be taken from selected areas of the retention basin (Sampling Method: Reference E5.2.3).

These samples were collected on 05AUG87. The temperature was in the mid-90s, and the day was clear with a slight breeze. Samples were to be collected in the area of the delta, which was less than 100 m^2. The area of interest was a discharge ditch 52 m long that was divided into a 1 x 60-segment grid. Sample point 7 was initially sampled to 1 ft for a volatiles/semivolatiles aliquot. At

that point, the Sampling Team hit a concrete pad and had to move 5 m downstream. It was decided to keep the initial 1-ft aliquot for analysis. This sample was assigned ID number LL004044. A sample log sheet was generated for this sample, and the sample point was given a sampling designation of 04. The sample procedure was changed from random to a systematic random design to ensure that the initial sample was collected near the outfall but upstream of the confluence with a side ditch. The most distant point was sampled first (grid 38), followed by the midpoint (grid 15), and the nearest to the outfall (grid 7), which was relocated. Sample numbers LL004011, LL004022, and LL004033 were collected to a maximum depth of 4 ft rather than 5 ft because it was not possible to go below 4 ft with a posthole digger due to soil moisture. These samples were collected between 1000 and 1216.

Request 5: Arroyo Las Positas at East Boundary, East of Athletic Field (Fig. L4.1e). This sample location served as an indicator of the type of surface runoff entering LLNL from the ranches that lie to the east of the site. Three grab sediment samples were to be taken from selected areas in the arroyo (Sampling Method: Reference E.5.2.3).

The Sampling Team arrived at the sampling location at 1000 on 06AUG87. The temperature was about 90°F. The sky was clear with winds from 0 to 5 mph. The relative humidity was approximately 30%. Three grab sediment samples were to be collected at this location at a depth of 0 to 5 ft, using field PID screening as an indicator of the presence of volatile contaminants. The arroyo was approximately 20 ft wide. The area was homogeneous with respect to both the arroyo and the potential effluent contaminants. The area with the highest sediment deposition was selected for sampling and, beginning upstream, was divided into a 1 x 60-segment grid. The Sampling Team used a posthole digger to obtain the samples. PID readings for sample LL005012 (grid 20) ranged from 0.6 to 1.6 at the 1-ft depth. At 13 in., the PID ranged from 0.2 to 0.5. At the 1.5-ft depth, there was no PID reading, and sampling was stopped at this location. The PID reading at the 1-ft depth for sample LL005023 (grid 27)

ranged from 0.1 to 0.3. For sample LL005034 (grid 28), the PID reading at 1 ft ranged from 0.0 to 0.4. Volatile samples were collected first at all three locations. These samples were collected from 1020 to 1050.

Request 6: Drain Near Tenth Street, Prior to Entry into Arroyo Las Positas (Fig. L4.1f). This sample location represented an area subject to drainage from the Isotope Separations areas and from gardening and maintenance activities in the northeast quadrant of the site. Three grab sediment samples were to be taken from selected areas in the drain basin prior to entry to the arroyo (Sampling Method: Reference E5.2.3).

The Sampling Team arrived at the sampling site at 1330 on 06AUG87. The temperature was about 93°F. The day was clear with winds at 5 to 10 mph. The relative humidity was approximately 30%. The drain emptied into a small basin approximately 7 ft wide by 12 ft long. The purpose of this sampling request was to evaluate the effect of the effluent from the drain and not the arroyo; therefore, it would have been misleading to grid such a small area. Because of the small size of the sample area, a systematic approach was not practical. The most realistic approach was to select three areas where sediment had accumulated and collect samples from these areas. The Sampling Team selected three locations at the mouth of the drain, starting upstream and ending downstream in the lowest part of the drainage. Three grab sediment samples were to be collected at a depth of 0 to 5 ft. Because it was not possible to reach the 5-ft depth with the equipment being used, the holes for samples LL006013 and LL006024 were dug to a depth of 4 ft. Sample LL006035 was dug to a depth of 3.7 ft. Equal portions were collected at each foot for volatile compound analysis. The remaining samples were taken after mixing the sediment taken from the hole. This was repeated at each sample location. These samples were collected between 1400 and 1440. QC rinsate sample LL006046 was collected at 1120, prior to the collection of the first sample.

Request 7: East of Trailer at Building 3914 at Drain, Prior to Entry into Arroyo Las Positas (Fig. L4.1g). This location represented an area subject to drainage from the laser programs outdoor storage area and other parts of the northcentral area of the LLNL site. Three grab sediment samples were to be taken at selected areas of the drain (Sampling Method: Reference E5.2.3).

Samples were collected on 06AUG87 at this location. The day was sunny and hot (mid-90s) with barometric pressure at 767 mm of mercury. The wind was approximately 6.7 meters per second (m/s). The ditch was approximately 100 m long and 3 m deep. The area was rocky, and an attempt was made to find areas where sediment accumulation was obvious. The area was divided into a 1 x 60-segment grid, and three segments were selected for sampling. The bottom of the ditch was moist with a standing pool at the confluence with the arroyo. Green vegetation in the bottom of the ditch indicated frequent hydration. Grab sediment samples were to be collected at a depth of 0 to 5 ft. At the sampling location for sample LL007014 (grid 3), the ditch was wet from recent flow. The sample was dug from 0 to 3 ft, with aliquots taken at 1-ft intervals. Sample LL007025 (grid 37) was dug to a 2-ft maximum because of the compacted soil-gravel base. The ditch where sample LL007036 (grid 57) was collected was moist with vegetative growth in the bottom. This sample was collected at 1-ft intervals and combined to represent the 0 and 3 ft interval. These samples were collected between 1501 and 1543.

Request 8: Arroyo Las Positas Upstream of Drain Entry Near Tenth Street (Fig. L4.1h). This location represented an area subject to drainage from the athletic field and biomedical experimental research plots, but prior to any impacts from the runoffs shown in LLNL Requests 6 and 7. Three grab sediment samples were to be collected at selected areas in the arroyo (Sampling Method: Reference E5.2.3).

Sampling began at approximately 0930 on 07AUG87. The weather was sunny, the barometric pressure was approximately 812 mm of mercury, and wind was from

the southwest at less than 4 m/s. The arroyo was approximately 20 ft wide at the sampling location. The area above the drain entry and upstream for 60 ft was divided into a 1 x 60-segment grid, and three segments were randomly selected for sampling. Areas with accumulated sediment within the grid were selected. The area was assumed to be homogeneous. The arroyo had standing pools of water and was heavily vegetated, suggesting frequent hydration. Three grab sediment samples were to be collected at a depth of 0 to 5 ft. An area of pooled water had an odor of oil or diesel fuel. At the location for sample LL008015 (grid 11), the arroyo was moist with small pools of water and lush vegetation. The sampling hole was moist to a depth of 3 ft. At locations LL008026 (grid 38) and LL008037 (grid 59), the hole was moist and a vegetation cover was removed before digging began. All samples were collected between 1000 and 1047.

Request 9: Drain North of Building 298, Prior to Entry into Arroyo Las Positas (Fig. L4.1i). This location represented an area subject to drainage from parking lots and storage areas at the northcentral part of the site, apart from areas sampled for Request 7. Three grab sediment samples were to be taken from selected areas in the drain (Sampling Method: Reference E5.2.3).

Samples were collected at this location on 07AUG87. The weather was sunny and hot, with a slight westerly breeze (2 mph). The drainage ditch was 1.5 m wide and 1.5 m deep near the arroyo, with an even contour except for erosion near the confluence with the arroyo. The area was considered homogeneous. The ditch from entry to the arroyo, upstream 60 ft, was divided into a 1 x 60-segment grid, and segments 6, 29, and 50 were randomly selected for sampling. The ditch contained debris but no vegetative growth. The soil (sediment) was dry, indicating no recent release of water. The ditch bottom was covered with cast needles from trees to the same depth as the area above each side of the ditch, indicating no recent flow. Though grab sediment samples were to be collected at a depth of 0 to 5 ft, at the locations for samples LL009016, LL009027, and LL009038, the soil was extremely dry and compact, making it

difficult to dig below 1 ft. At location LL009038, the bottom of the ditch was covered with a heavy layer of tree needles. The samples were collected between 1447 and 1512.

Request 10: Ditch at the Northwest Corner of the Site Where Drain Reappears from the Culvert South of the Shielding Block Storage Building (Fig. L4.1j). This location was in a ditch that collected drainage from the extreme northwest corner of the site independently of the arroyo and adjacent to the shielding block storage area. Three grab sediment samples were to be collected to the depth of the sediment at selected areas in the ditch (Sampling Method: Reference E5.2.3). When the Sampling Team arrived at this location, they found that the area had been altered by construction, and the ditch no longer existed. Samples LL010019, LL010020, LL010031, and LL010042 were not collected.

Request 11: Ditch Along West Side of Facility, North of Fourth Street (Fig. L4.1k). The sampling site was approximately 20 m north of the west guard post. This location represented an area subject to drainage from the western portion of the site prior to entry into Arroyo Las Positas. It had been in existence since sometime between 1952 and 1962. Three grab sediment samples were to be collected to the depth of the sediment in the ditch (Sampling Method: Reference E5.2.3).

Samples were collected at this location on 11AUG87. The day was mild and sunny with an approximate temperature of 68°F. There was a slight breeze (4 m/s) from the southwest. Three grab sediment samples were to be collected at a depth of 0 to 5 ft or to the depth of the sediment in the ditch. Because of the discharge from the swimming pool, the ditch appeared wider than 5 ft, but for the purposes of the "Finding and Basis," the suspected contaminants would be found within the 5-ft-wide margin of the ditch. The area, as defined, was very homogeneous. The downstream area was divided into a 1 x 60-segment grid, and segments 20, 43, and 59 were randomly selected for sampling. At the time samples LL011010, LL011021, and LL011032 were collected, the soil (sediment)

was moist, with grass on the surface. In each sampling hole, asphalt bits were found in the top 1 ft of soil, with the first sample location having the most asphalt bits. Each hole was sampled to a depth of 2 ft, and gravel was noted to this depth.

4.6.2.2 Analytical Design

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

Request 1: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) Field measurements for OVAs were taken to determine the presence of volatile contaminants.

Request 2: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 3: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 4: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 5: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) Field measurements for OVAs were taken to determine the presence of volatile contaminants.

Request 6: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 7: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 8: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 9: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 10: The parameters to have been analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was also to be run.) No field measurements were required. (NOTE: No samples were collected because the ditch no longer existed.)

Request 11: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

4.6.3 Field and Analytical Data

Field Data:

Request 1. NA
Request 2. NA
Request 3. NA
Request 4. NA
Request 5. NA
Request 6. NA
Request 7. NA
Request 8. NA
Request 9. NA
Request 10. NA
Request 11. NA

Field Data Evaluation:

Request 1. NA
Request 2. NA
Request 3. NA
Request 4. NA
Request 5. NA
Request 6. NA
Request 7. NA
Request 8. NA

Request 9. NA
Request 10. NA
Request 11. NA

Analytical Data:

Metals.

Request 1. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 19 metals detected, the following four were below the CRQL or the IDL in all three samples: beryllium, cadmium, silver, and sodium. Of the remaining metals, arsenic ranged from 3 to 3.8 mg/kg; barium, 92 to 156 mg/kg; chromium, 36 to 44 mg/kg; lead, 13 to 23 mg/kg; nickel, 33 to 64 mg/kg; and zinc, 51 to 101 mg/kg. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 2. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 19 metals detected, beryllium and sodium were below the CRQL or the IDL in all three samples. Of the remaining metals, arsenic ranged from 2.8 to 4.1 mg/kg; barium, 88 to 209 mg/kg; cadmium was 0.99 mg/kg; chromium, 27 to 53 mg/kg; copper, 17 to 74 mg/kg; lead, 11 to 24 mg/kg; nickel, 28 to 51 mg/kg; silver, 2.5 mg/kg; and zinc, 54 to 135 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 3. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 19 metals detected, beryllium and cadmium were below the CRQL in all three samples. Of the remaining metals detected, arsenic ranged from 1.4 to 3.1 mg/kg; barium, 225 to 253 mg/kg; chromium, 43 to 45 mg/kg; copper, 22 to 24 mg/kg; lead, 8.3 to 9.1 mg/kg; nickel, 71 to 94 mg/kg; silver, 1.5 to 2.6 mg/kg;

and zinc, 49 to 53 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 4. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 18 metals detected, antimony, beryllium, and sodium were below the CRQL or the IDL in all three samples. Of the remaining metals detected, arsenic ranged from 3.9 to 4.6 mg/kg; barium, 230 to 262 mg/kg; chromium, 37 to 42 mg/kg; copper, 22 to 27 mg/kg; lead, 8.8 to 9.2 mg/kg; nickel, 42 to 44 mg/kg; and zinc, 48 to 58 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 5. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 19 metals detected, beryllium and cadmium were below the CRQL or the IDL in all three samples. Of the remaining metals detected, arsenic ranged from 2 to 2.6 mg/kg; barium, 187 to 239 mg/kg; chromium, 20 to 30 mg/kg; copper, 13 to 17 mg/kg; lead, 20 to 42 mg/kg; nickel, 34 to 48 mg/kg, silver was 2 mg/kg; and zinc, 52 to 66 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 6. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 19 metals detected, beryllium and cadmium were below the CRQL in all three samples. Of the remaining metals detected, arsenic ranged from 2.5 to 3.7 mg/kg; barium, 238 to 341 mg/kg; chromium, 21 to 25 mg/kg; copper, 12 to 17 mg/kg; lead, 5.1 to 5.8 mg/kg; nickel, 26 to 38 mg/kg; silver, 1.8 to 2.5 mg/kg; and zinc, 36 to 45 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and zinc. Because RCRA

TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 7. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 19 metals detected, beryllium, cadmium, and sodium were below the CRQL in all three samples. Of the remaining metals detected, arsenic ranged from 3.8 to 4.2 mg/kg; barium, 170 to 265 mg/kg; chromium, 33 to 38 mg/kg; copper, 20 to 26 mg/kg; lead, 7.1 to 8.7 mg/kg; nickel, 40 to 64 mg/kg; silver, 2.8 to 5.3 mg/kg; and zinc, 49 to 57 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and zinc. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 8. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 19 metals detected, beryllium and cadmium were below the CRQL in all three samples. Of the remaining metals detected, arsenic ranged from 2.4 to 2.5 mg/kg; barium, 243 to 303 mg/kg; chromium, 21 to 24 mg/kg; copper, 17 to 74 mg/kg; lead, 5.5 to 5.8 mg/kg; nickel, 21 to 24 mg/kg; silver, 3.7 to 4.4 mg/kg; and zinc, 39 to 47 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 9. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 20 metals detected, antimony, cadmium, and sodium were below the CRQL or the IDL in all three samples. Of the remaining metals detected, arsenic ranged from 3.4 to 4 mg/kg; barium, 199 to 257 mg/kg; beryllium, 0.64 to 0.75 mg/kg; chromium, 35 to 43 mg/kg; copper, 21 to 26 mg/kg; lead, 6.9 to 9.7 mg/kg; nickel, 36 to 48 mg/kg; silver, 1.6 to 2.1 mg/kg; and zinc, 59 to 119 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 10. No metals data were given for this request. No samples were collected because the ditch no longer existed.

Request 11. Analytical data for metals in sediment are presented in Table L4.3.1. Of the 21 metals detected, antimony, beryllium, and sodium were below the CRQL or the IDL in all three samples. Of the remaining metals detected, arsenic ranged from 4.2 to 7.6 mg/kg; barium, 146 to 220 mg/kg; cadmium, 1.1 to 2 mg/kg; chromium, 34 to 47 mg/kg; copper, 30 to 42 mg/kg; lead, 49 to 88 mg/kg; mercury, 0.15 to 2.3 mg/kg; nickel, 34 to 48 mg/kg; silver was 1.6 mg/kg; and zinc, 159 to 445 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Volatile organics. *Analytical results for volatiles are given in Table L4.3.1. Acetone, ethylbenzene, methylene chloride, and toluene were identified in at least one sample for most of the 10 requests for which samples were collected in this environmental problem. Chloroform and benzene were also occasionally present. Additional results for Requests 3, 8, and 9 are discussed below.*

Request 3. In sample LL003032, naphthalene was tentatively identified at 200 ug/kg, in excess of the calibration range of the instrument. Road dust was listed as a possible contaminant at these sampling locations.

Request 8. A trace amount of carbon disulfide was detected and dichlorodiflouromethane was tentatively identified in one of the two samples. The comments of the sampling team included mention of an oily odor. This sampling point was chosen to represent drainage from the athletic field and the biomedical experimental research plots.

Request 9. One of the three samples (LL009038) had concentrations of many volatiles that were high compared with other samples taken for this environmental problem. Sample LL009038 also had a detectable amount of one unknown, and a measured 12 ug of benzene per kilogram of sediment. The Sampling Team had commented that the area sampled received drainage from parking lots.

Extractable organics. *Analytical results for semivolatile organics are presented in Table L4.3.1. From one to 22 compounds were identified in the 20 samples in which at least one semivolatile organic compound was detected. There were measured or estimated amounts of greater than 20 mg of diacetone alcohol (or a compound tentatively identified as diacetone alcohol) per kilogram of sediment in at least two of the three samples for each of Requests 1, 2, and 11. These concentrations were by far the highest for semivolatile organics in Environmental Problem 1, except for the estimated concentrations of 22 and 50 mg of bis(2-ethylhexy)phthalate per kilogram of sediment in two of the three samples for Request 11. In the third sample for Request 11, the measured amount of bis(2-ethylhexy)phthalate was 3.8 mg/kg. Di-N-Butylphthalate was detected in many of the samples, the highest concentrations being 1.1 mg/kg of sediment in sample LL007014 (Request 7). Some of the highest measured or estimated concentrations of semivolatile organics for this environmental problem came from Request 1, which was a request for reference data.*

Other extractables. *Table L4.3.1 presents the results of the analyses for pesticides and PCBs by gas chromatography-electron capture detector (GC-ECD). No pesticides or PCBs were detected in the samples from Requests 1, 4, 6, and 8. Beta-BHC was detected in all of the samples from Requests 3 and 7 and two of the three samples from Request 5 at concentrations ranging from 20 to 80 ug/kg. These samples may also contain low concentrations (<20 ug/kg) of Aldrin, delta-BHC, Dieldrin, and/or DDT. Low concentrations (<20 ug/kg) of Endosulfan II and Endosulfan sulfate were detected in samples LL009016 and LL009027, respectively. All of the samples in Request 11 contained low concentrations (<20*

ug/kg) of one or more of several pesticides. Sample LL011032 was found to contain Methoxychlor at a concentration less than the CRQL (99 ug/kg). Aroclor-1254 was detected in samples LL002031 (approximately 270 ug/kg) and LL011021 (approximately 200 ug/kg). Sample LL002031 also was found to contain approximately 350 ug/kg of Aroclor-1260. Samples for Request 10 were not collected because the ditch no longer existed.

Radiochemistry. *Three sediment samples for Request 1 served as a reference sampling location for LLNL. This location is also the last sampling location for SNLL. Tritium averaged 4266 pCi/kg. Gross alpha averaged 4200 pCi/kg and gross beta averaged 28,333 pCi/kg; levels could not be evaluated in the absence of off-site sediment information.*

Although sediment samples for LLNL Request 2 show about the same degree of contamination as LLNL Request 1, samples for LLNL Requests 3 and 4 are higher, with average tritium concentrations of 146,666 and 156,000 pCi/kg, respectively.

LLNL Request 5 is intended to provide potential reference information on surface runoff entering LLNL from ranches to the east of the site. For LLNL Request 5, tritium contamination averaged 120,000 pCi/kg. Request 6 [three sediment samples from the drain area near Tenth Street (Figure L4.1f)] also showed an average tritium concentration of 120,000 pCi/kg.

Sediment samples taken for LLNL Requests 7, 8, 9, and 11 had lower average concentrations of tritium (ranging from 1666 to 25,000 pCi/kg) than the sediment samples collected for Request 5.

Analytical Data Evaluation:

Metals. The listed metals of interest were detected above the CRQL or the IDL for the following requests:

Request 1. Arsenic, barium, chromium, lead, nickel, and zinc.

Request 2. Arsenic, barium, cadmium, chromium, lead, nickel, silver, and zinc.

Request 3. Arsenic, barium, chromium, copper, lead, nickel, silver, and zinc.

Request 4. Arsenic, barium, chromium, copper, lead, nickel, and zinc.

Request 5. Arsenic, barium, chromium, copper, lead, nickel, silver, and zinc.

Request 6. Arsenic, barium, chromium, copper, lead, nickel, silver, and zinc.

Request 7. Arsenic, barium, chromium, copper, lead, nickel, silver, and zinc.

Request 8. Arsenic, barium, chromium, copper, lead, nickel, silver, and zinc.

Request 9. Arsenic, barium, beryllium, chromium, copper, lead, nickel, silver, and zinc.

Request 10. NA

Request 11. Arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

Volatile organics. Small amounts of local contamination with volatiles were apparent in some of the arroyos.

Extractable organics. Diacetone alcohol was detected at levels around 30 mg/kg in some samples, including a sample taken for reference data; bis(2-ethylhexy)phthalate was estimated in roughly similar concentrations in two of three samples for Request 11, but measured at 3.8 mg/kg in the third sample.

Other extractables. In general, the data collected are of low quality due to problems with poor calibration linearity. Because all of the samples from Requests 1, 2, 6, and 8, as well as sample LL009016, were accidentally spiked with matrix spike solution, no data are available for the matrix spike compounds for these samples. The positive results for beta-BHC in Requests 3, 5, and 7 are to be considered questionable, as should all of the compounds detected in Request 11 samples, due to method blank contamination. Interference by sulfur is suspected in samples LL001018, LL007014, and LL009016.

Radiochemistry. Thirty sediment samples were collected from the Arroyo Seco (12 samples) and Arroyo Los Positas (18 samples) areas. These samples were subjected to gross alpha, gross beta, gamma scan, and tritium analyses. Analytical results are given in Table L4.3.1.

4.6.4 Limitations and Qualifications

Data Quality Level: The sampling plan and sampling are rated Quality Level I. The overall analytical quality is Quality Level II for reasons discussed below.

Field Data: All samples were collected as requested in the plan with the exception of Request 10. This request could not be completed because the ditch to be sampled had been altered by construction and did not exist. The request for two reference sites provided a basis for comparing results from the potentially contaminated sites. Although all requests for LLNL Environmental Problem 1 requested TCLP, none of the total metal concentrations by ICP exceeded the TCLP limits; thus, the TCLP extraction evaluation was not required.

Analytical Data: Due to low concentrations of reported organics, some of the compounds could have been lost by long holding times, especially the volatiles. However, the observation that LLNL Request 1 contained semivolatile organics and the radiological values of Request 5 at some of the highest concentrations

for LLNL samples, make this problem difficult to assess and evaluate. Details on specific analytical data quality levels are given below.

Metals. The duplicate samples were out of control limits with respect to several elements in Request 5. The same was true for the samples in Requests 3, 6, 7, 8, and 9, and true to a lesser extent for Request 11. The spiked, serial dilution, and duplicate samples were out of control limits with respect to copper in several of the samples.

Requests 1, 2, and 4. Data are Quality Level I except antimony, arsenic, and selenium which are Quality Level II in all samples.

Requests 3, 5, 6, 7, and 8. All data are Quality Level II except AA-metals which are Quality Level I.

Request 9. Data are Quality Level I except antimony, chromium, magnesium, manganese, and selenium which are Quality Level II in all samples.

Request 10. No metals data were given for this request because no samples were collected.

Request 11. Data are Quality Level I except manganese, nickel, and selenium which are Quality Level II in all samples.

Volatile organics. Volatiles detected in the samples were also often detected in similar concentrations in trip blanks. Many volatiles were detectable but only in amounts too small to quantify. Many volatiles were not detected in all of the samples for a particular request.

About two-thirds of the entries on the data quality summary sheets were data Quality Level III. Almost 90% of these Quality Level III entries were either because the concentrations were too small to measure or because the compounds

were not clearly identified by mass spectrometry. Also, many compounds were present in the corresponding method blanks. About 30% of the entries on the data quality level summary sheets were Quality Level II, and about 5% were Quality Level I.

Extractable organics. Identifiable compounds were often not detected in all three samples for a particular request. The data are Quality Level II, due mainly to tentative identification by mass spectrometry.

Other extractables. Although it is possible to detect compounds at less than the method quantitation limit, the certainty of the quantitation is decreased. Where a compound was detected at a concentration less than the contract required quantitation limit (CRQL), the method quantitation limit is accompanied by a "J" flag. This format is designed to indicate that the compound may be present in the sample at a level that is too low for the method to accurately measure. To indicate which GC column was used for quantitation, the reported values are accompanied by one or two stars for either the packed or capillary columns, respectively. While quantitation on a capillary column is contrary to CLP protocols, enough information is provided to determine the accuracy of the data.

Contamination of the sample during handling and/or preparation is always a possibility. Method blanks and field blanks were included in the sampling and analysis procedures to determine whether contamination occurred, its source, and its concentration. Where the data for the blanks indicate that contamination occurred, the data for the compound(s) in question in the field samples associated with the blank have been annotated with a "B" flag. Another known interference occurs when sulfur is present in the sample extract. Generally, interference with the identification and quantitation of the early eluting compounds is the result. Because of the large number of samples that arrived at the same time, clean-up of the sample extracts was not performed.

The only means for the detection of pesticides and PCBs by GC-ECD is their retention time. If a change in the operating conditions results in a shift in retention times from that of the standard, positive identifications can be difficult to make. Therefore, the most important data quality indicator is the retention time of the surrogate added to each sample during extraction. Mirex was substituted for the standard surrogate, dibutylchlorendate (DBC). Although this is a potentially significant deviation from the CLP protocols, the results of a direct comparison indicated no significant difference in the behavior of the two. As a result, the advisory limits for DBC were adopted for the recoveries of Mirex. As indicated by the wide CLP acceptance limits for surrogate recoveries, quantitation of the pesticides and PCBs should generally be considered approximate.

Instances occurred where the calibration linearity evaluations specified by the CLP protocols indicated that a calibration problem existed. In response, an additional linearity evaluation procedure was included with the analyses that provided a means for evaluating the data collected. The single working standard called for in the CLP protocols was replaced by a five-point calibration, providing linearity information about all of the compounds instead of a select few. While providing perhaps a more accurate calibration scheme, it also allows the linearity of each compound to be evaluated directly. Where the linearity was not acceptable, qualifications to the data were made.

For many of the samples, matrix spike solution was added by mistake during extraction in place of or in addition to the surrogate spike solution that should have been added. As a result, no information concerning the following compounds can be provided for these samples: gamma-BHC (Lindane), Heptachlor, Aldrin, Dieldrin, Endrin, and 4,4'-DDT. Because 4,4'-DDD is a breakdown product of DDT, no information concerning this compound can be provided. Where no surrogate was added, determination of retention time stability was based upon other information. For the reasons discussed above, the data quality level for Other Extractables is Quality Level III.

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

Environmental Problem: LLNL 1
Request Number: LLNL 1

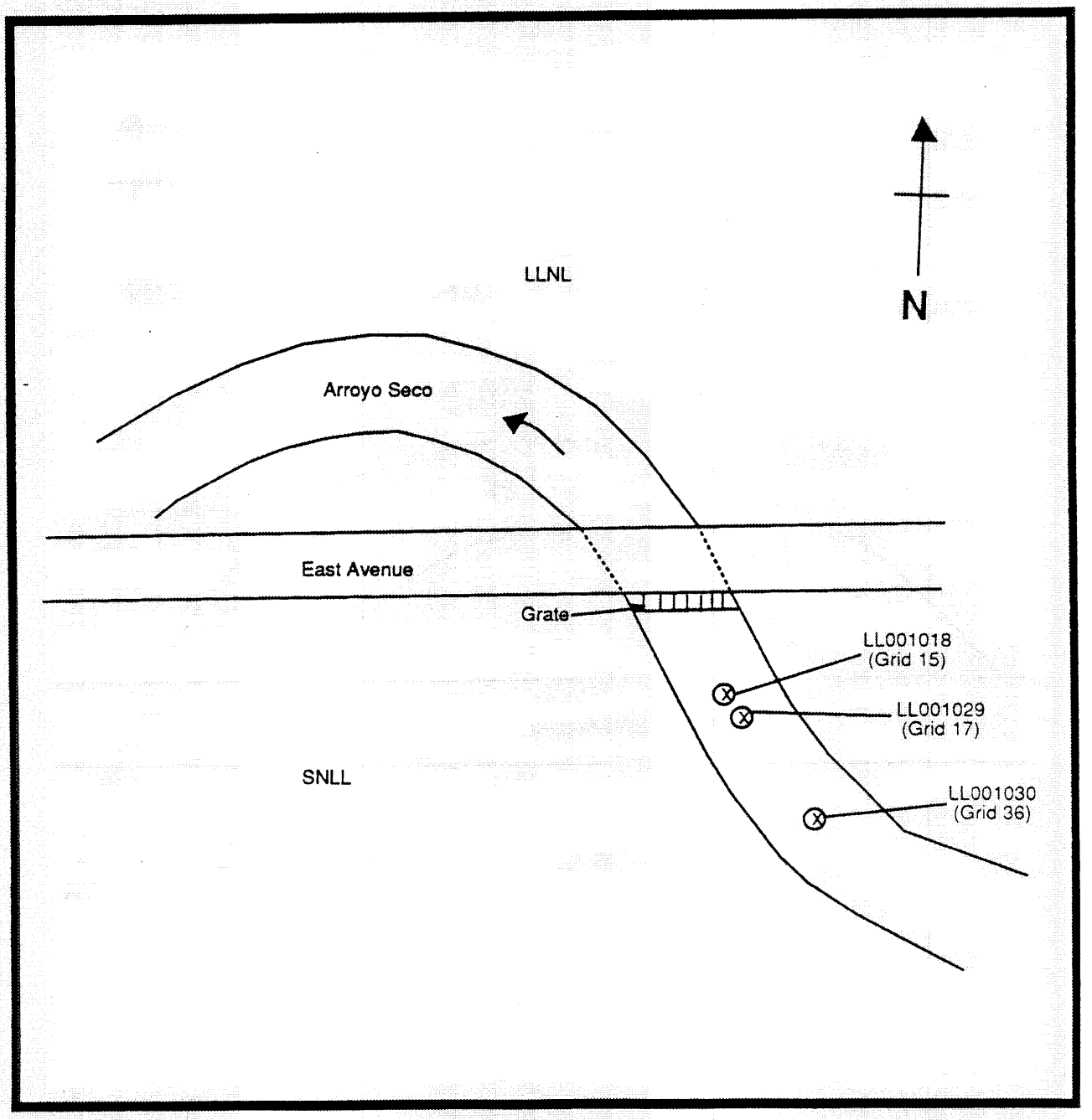

Figure L4.1a. Arroyo Seco at the South Side of East Avenue (LLNL Request 1)

Environmental Problem: LLNL 1
Request Number: LLNL 2

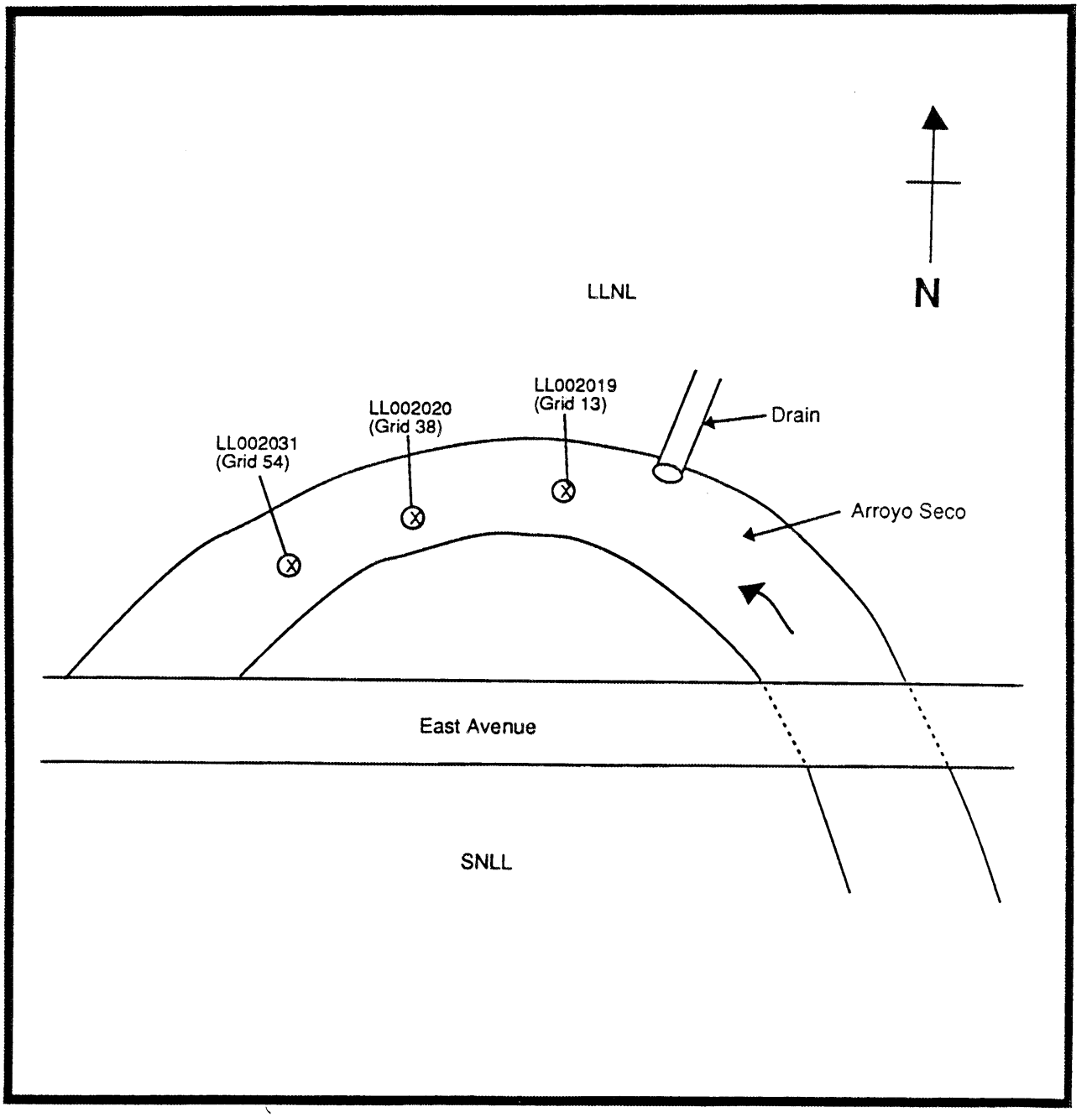

Figure L4.1b. Arroyo Seco Downstream from LLNL Drain Pipe (LLNL Request 2)

Environmental Problem: LLNL 1
Request Number: LLNL 3

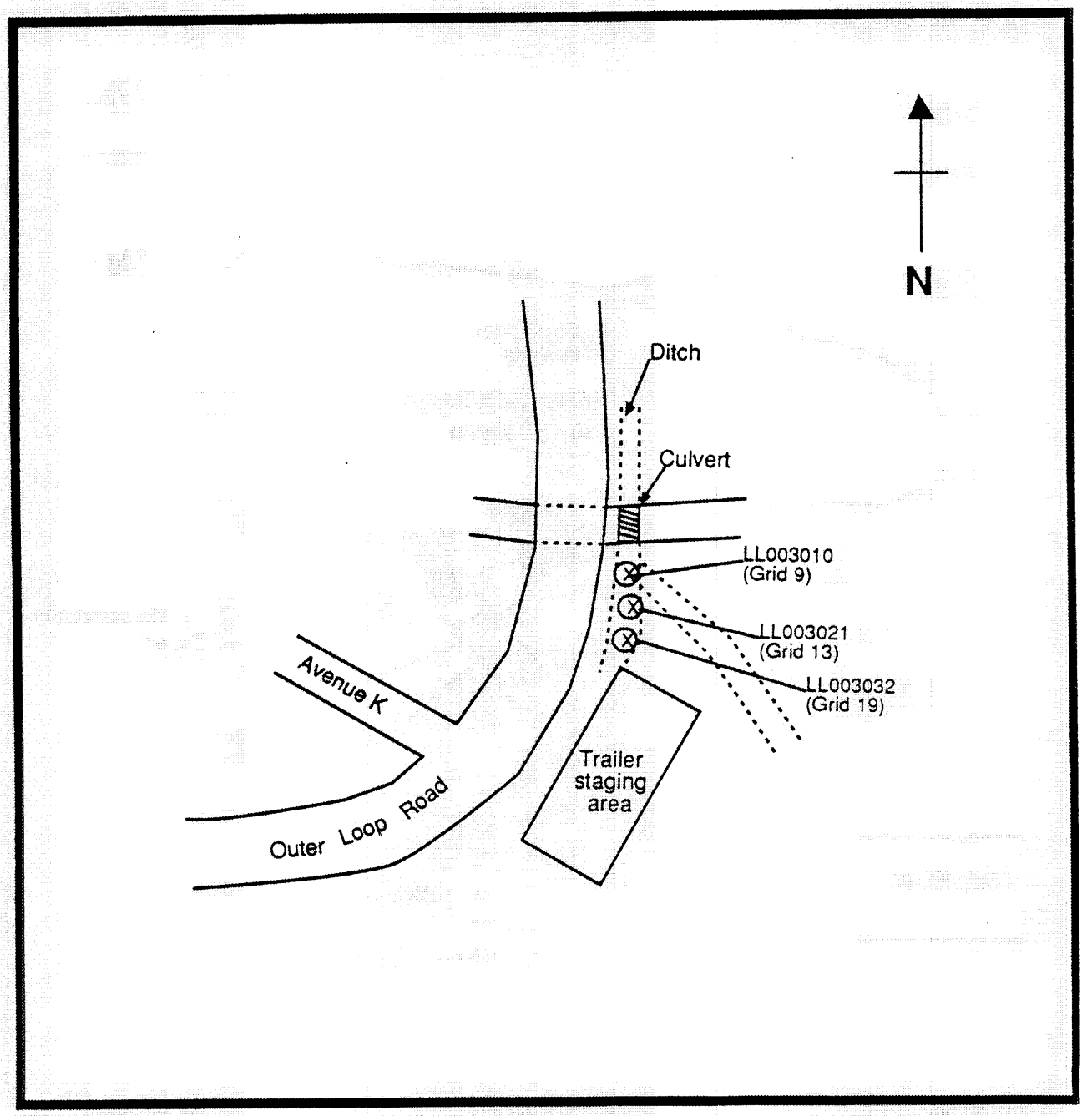

Figure L4.1c. East of Outer Loop in Ditch Downstream from the Trailer Staging Area (LLNL Request 3)

Environmental Problem: LLNL 1
Request Number: LLNL 4

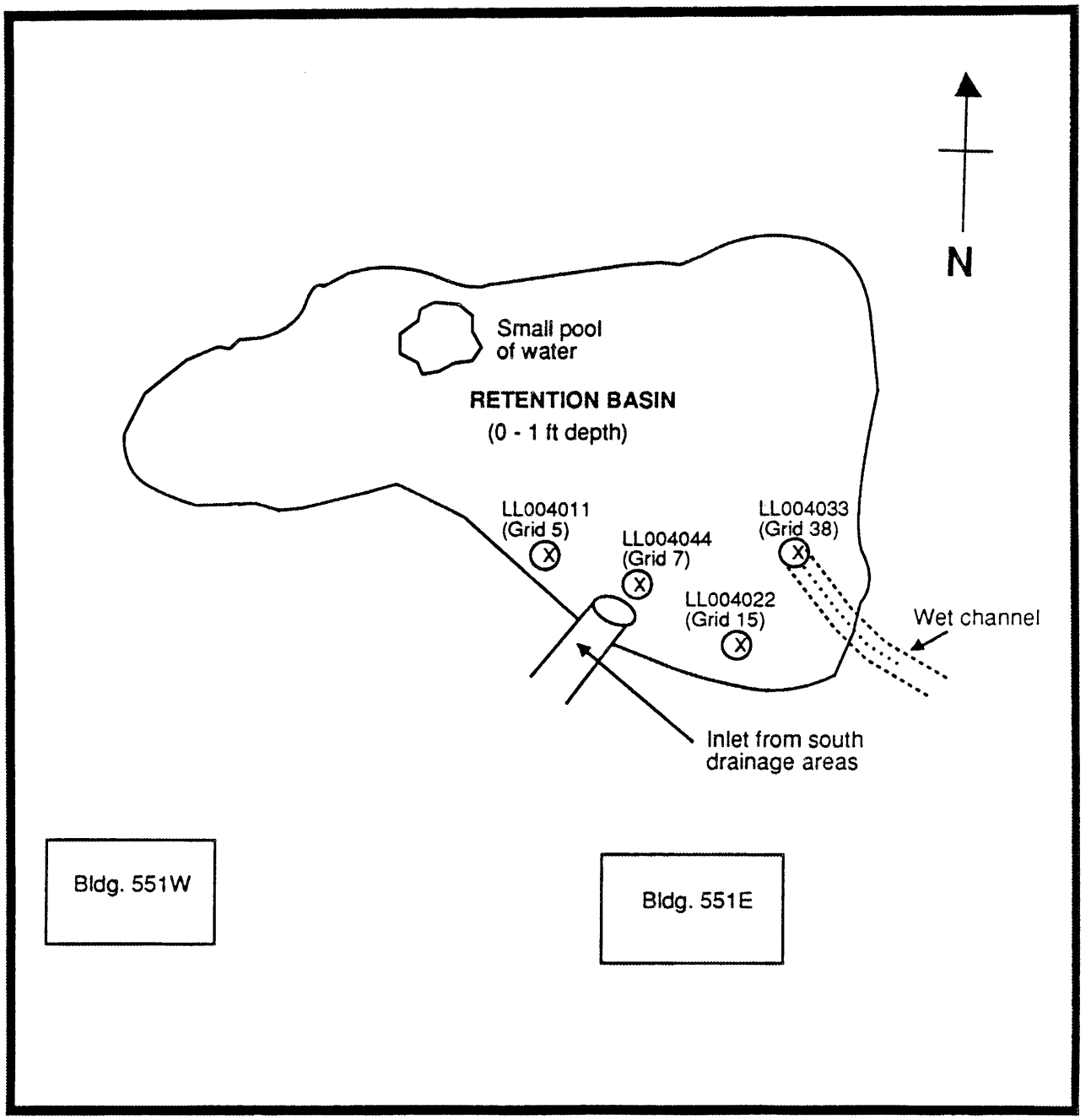

Figure L4.1d. Inlet to Retention Basin from South Drainage Areas
(LLNL Request 4)

Environmental Problem: LLNL 1
Request Number: LLNL 5

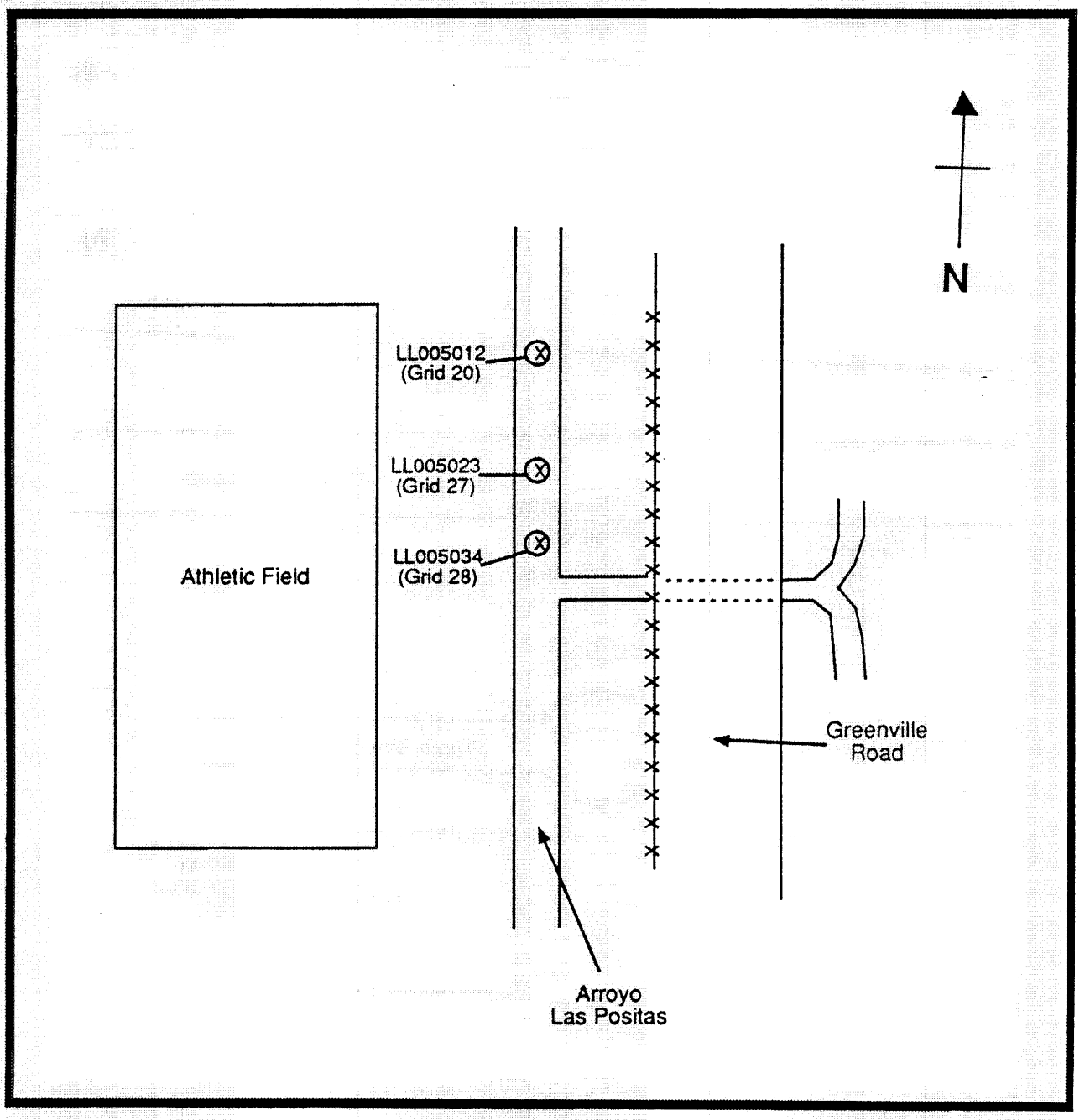

Figure L4.1e. Arroyo Las Positas at East Boundary, East of Athletic Field (LLNL Request 5)

Environmental Problem: LLNL 1
Request Number: LLNL 6

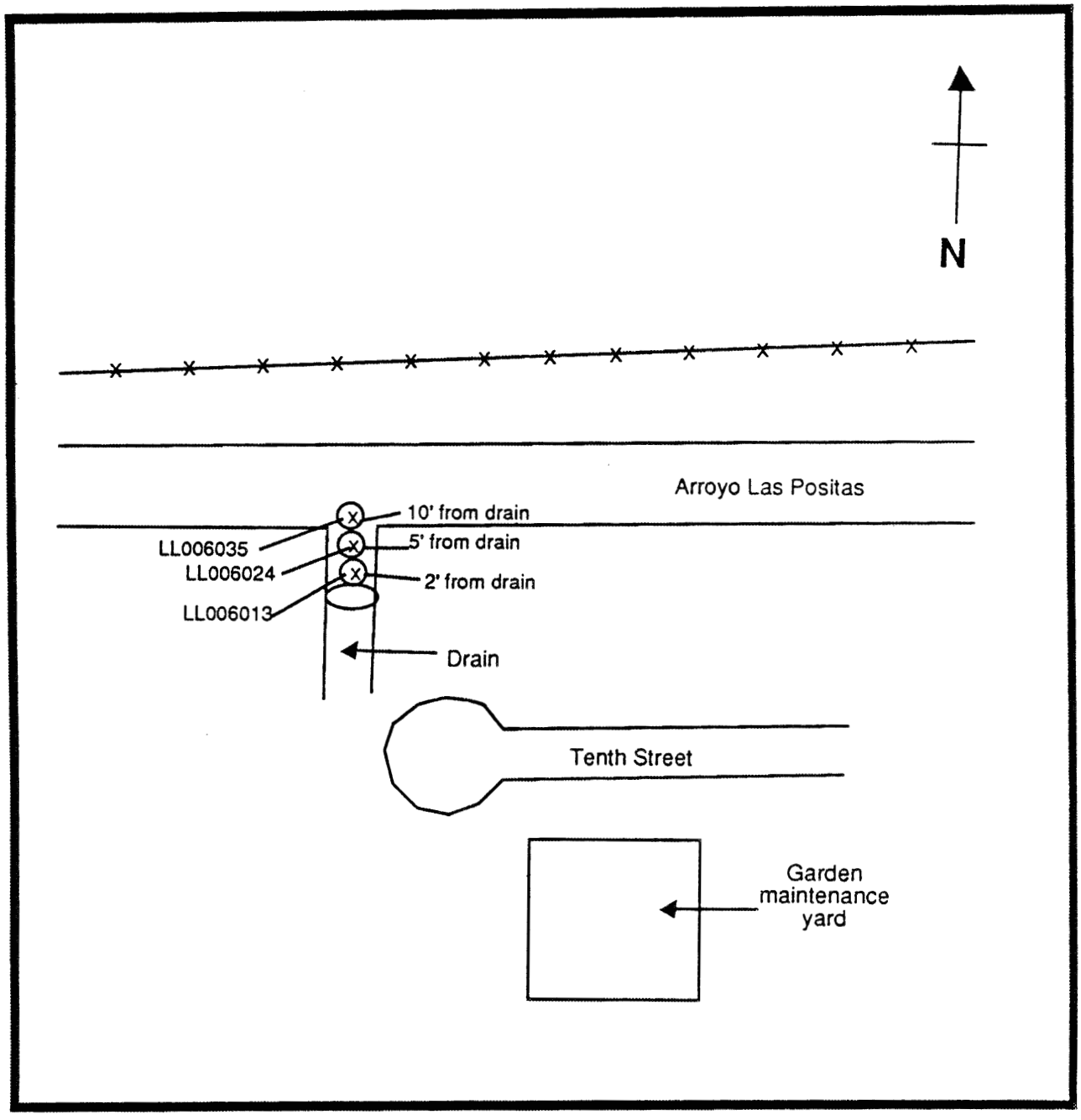

Figure L4.1f. Drain Near Tenth Street, Prior to Entry into Arroyo Las Positas (LLNL Request 6)

Environmental Problem: LLNL 1
Request Number: LLNL 7

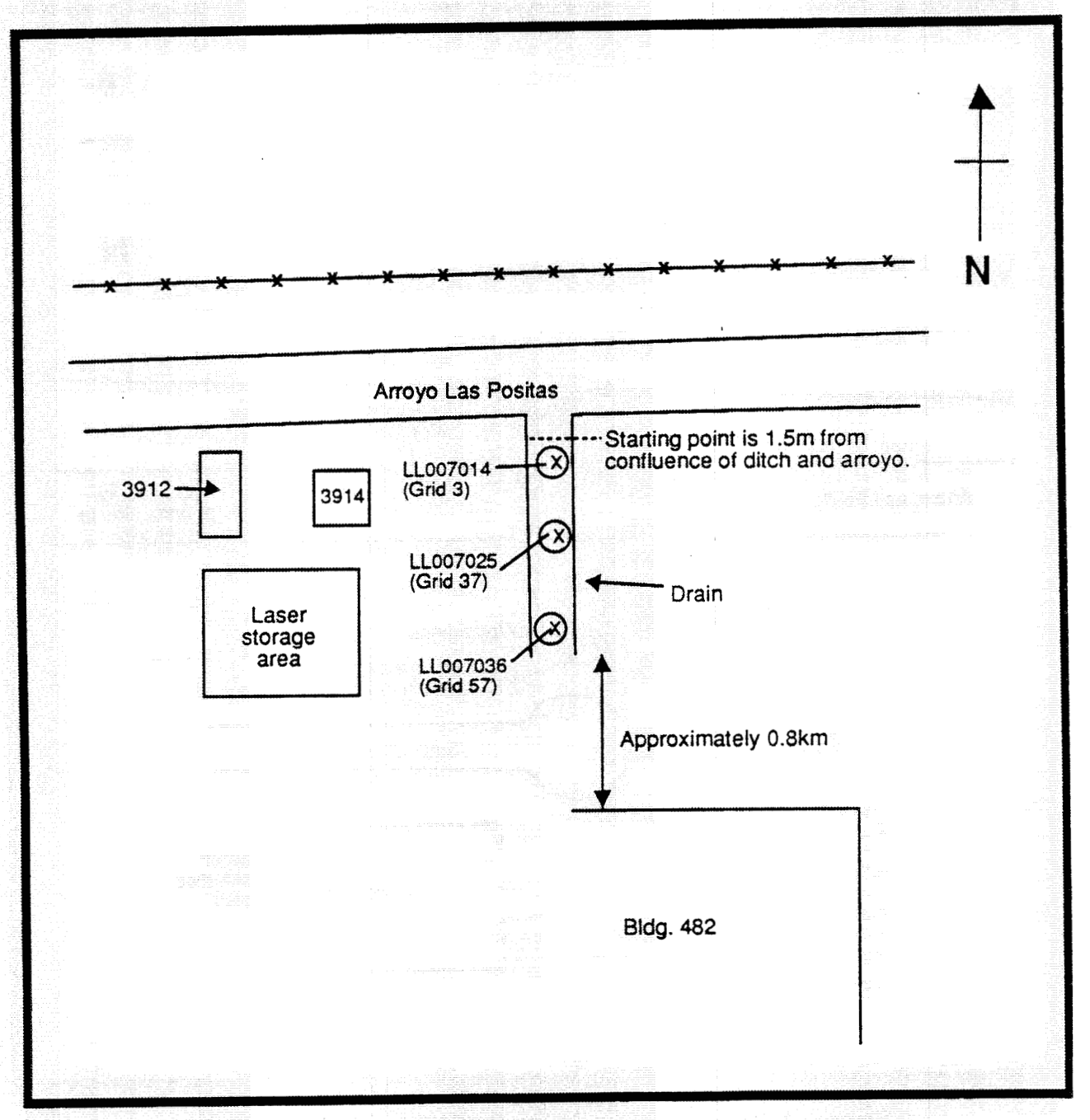

Figure L4.1g. East of Trailer at Building 3914 at Drain Prior to Entry into Arroyo Las Positas (LLNL Request 7)

Environmental Problem: LLNL 1
Request Number: LLNL 8

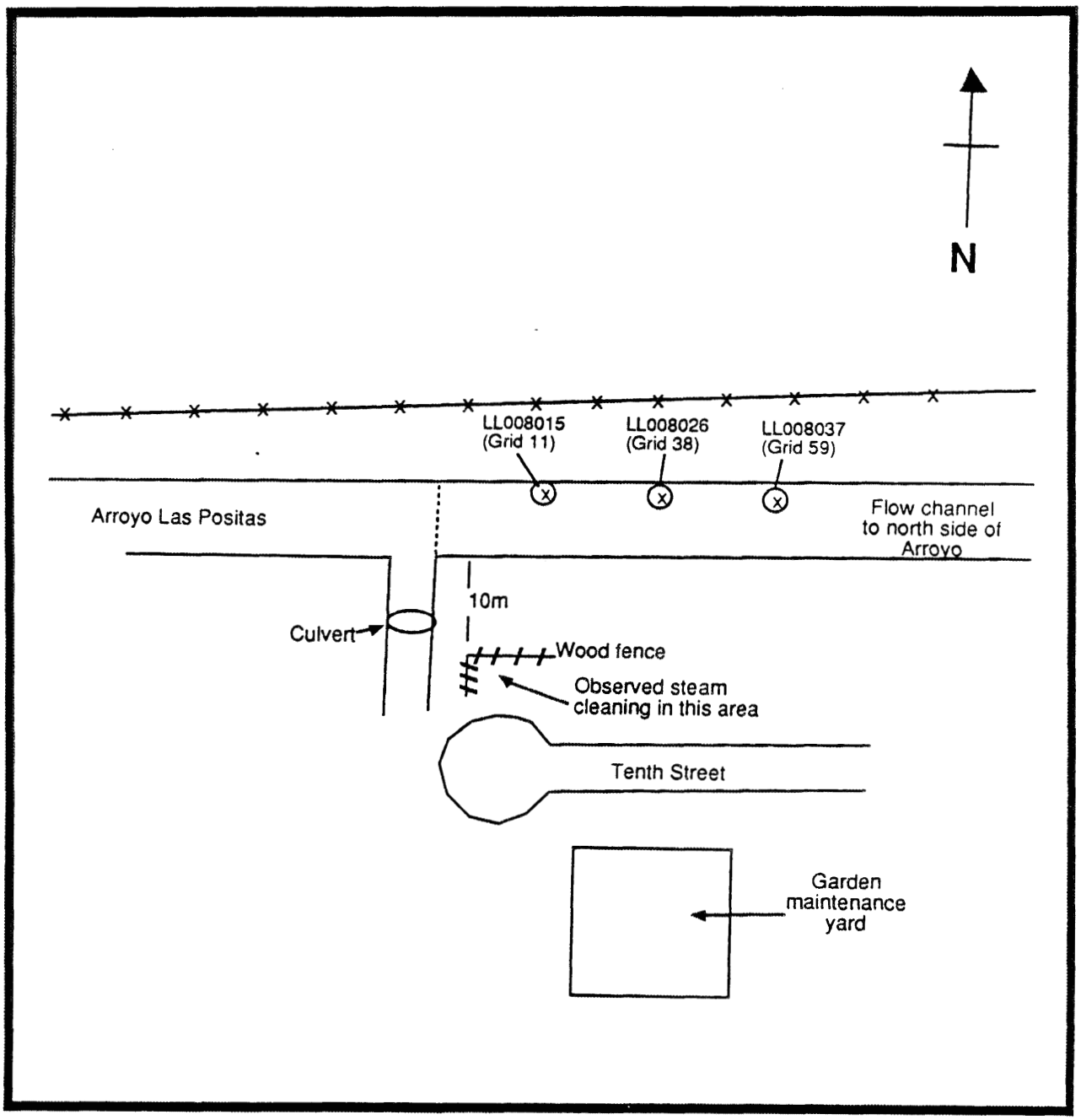

Figure L4.1h. Arroyo Las Positas Upstream of Drain Entry
Near Tenth Street (LLNL Request 8)

Environmental Problem: LLNL 1
Request Number: LLNL 9

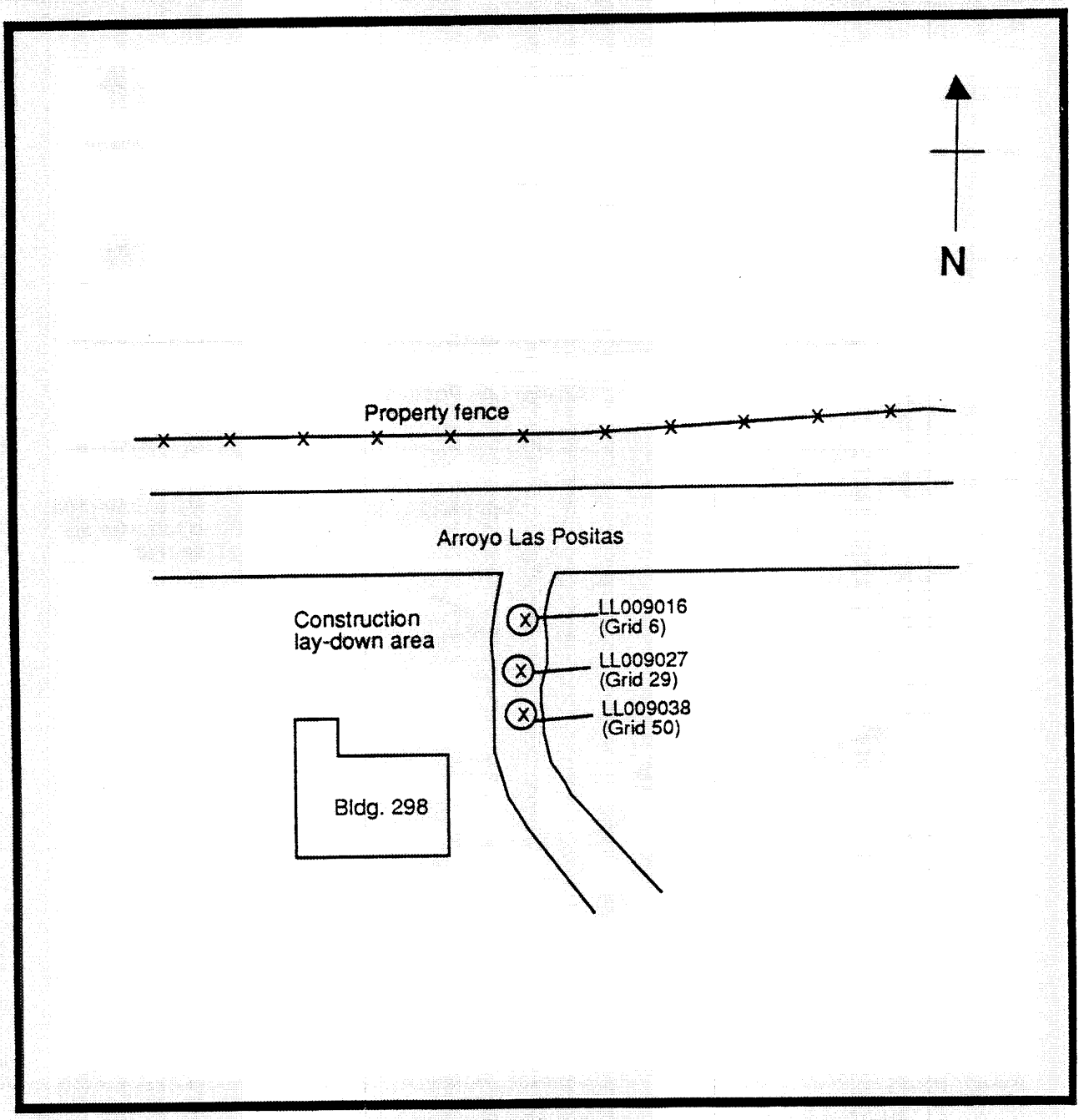

Figure L4.1i. Drain North of Building 298, Prior to Entry into Arroyo Las Positas (LLNL Request 9)

Environmental Problem: LLNL 1
Request Number: LLNL 10

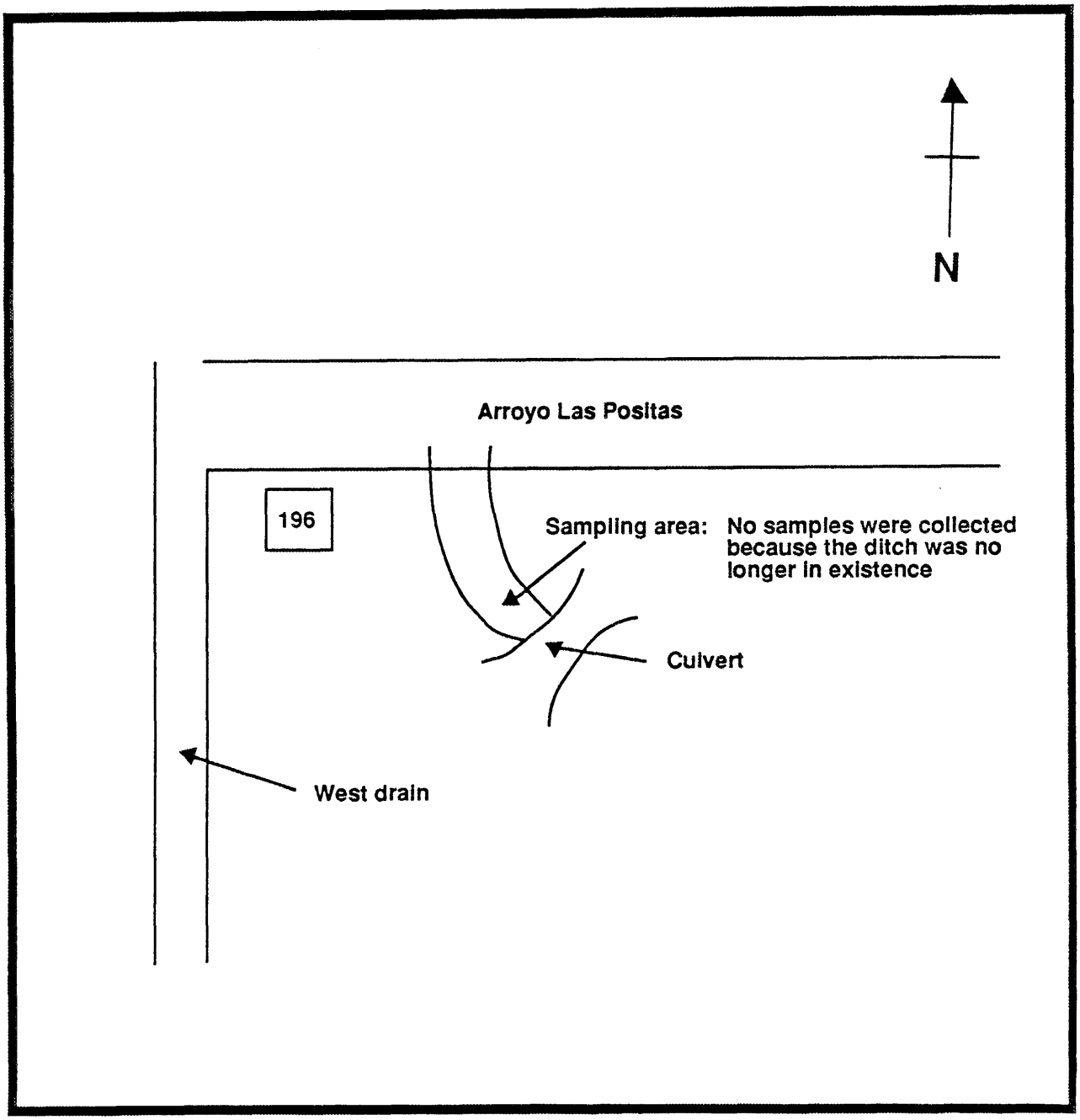

Figure L4.1j. Ditch at the Northwest Corner of the Site Where Drain Reappears from the Culvert South of the Shielding Block Storage Building (LLNL Request 10)

Environmental Problem: LLNL 1
Request Number: LLNL 11

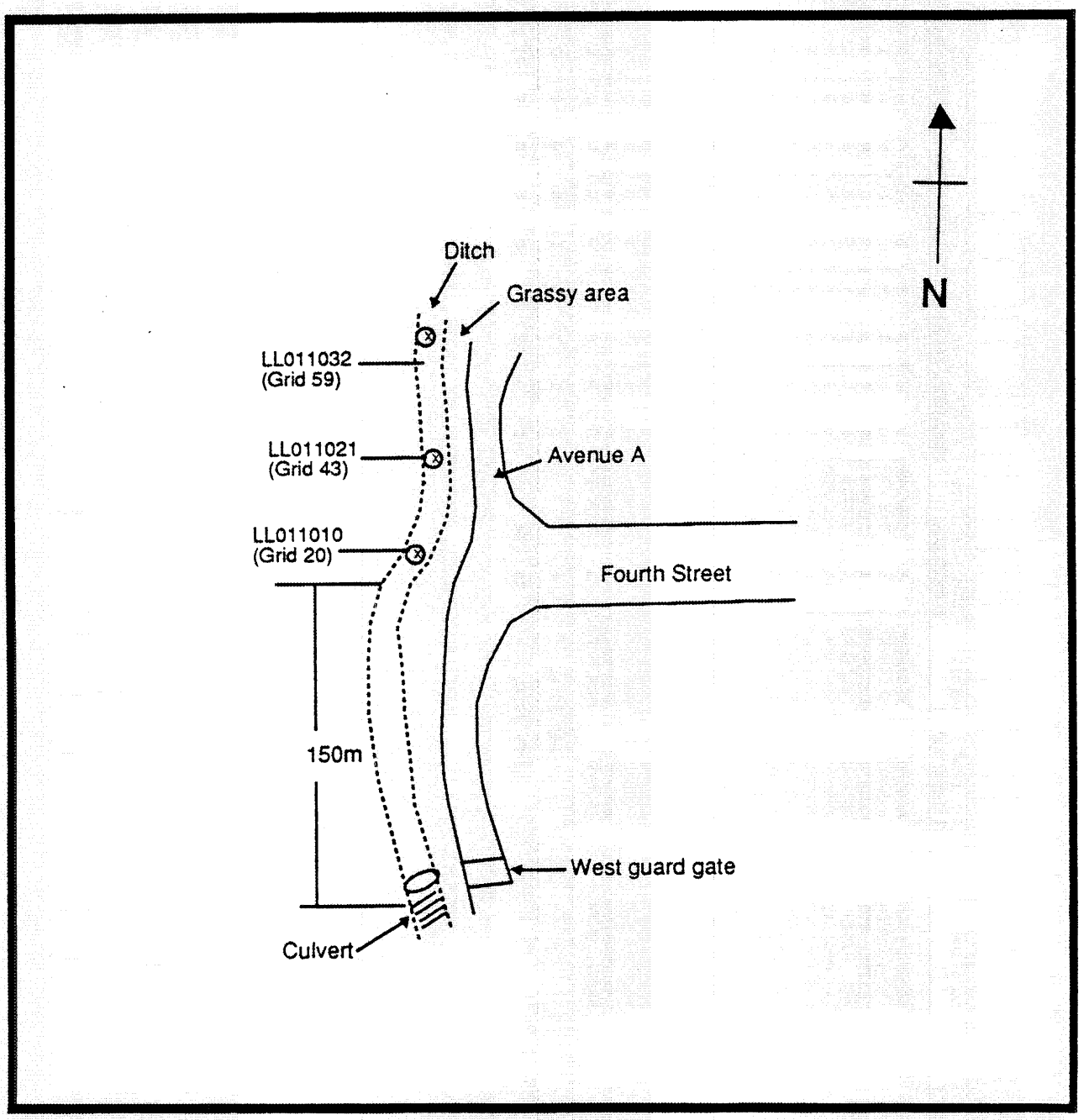

Figure L4.1k. Ditch Along West Side of Facility North of Fourth Street (LLNL Request 11)

TABLE L4.2.1 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	HE NUMB HITS	HE 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
LL001	ARROYO SECO	ARROYO	SEDIMENT	3	3	BKGRN	0	0	3	3	0	0	0	0	0	3	3	3	3	3	3	3
LL002	ARROYO SECO	ARROYO	SEDIMENT	3	3	S COM	0	0	3	3	0	0	0	0	1	3	3	3	3	3	3	3
LL003	TRAILER STG	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	2	3	3	3	3	3
LL004	RET. BASIN	ARROYO	SEDIMENT	4	4	GRAB	0	0	3	3	0	0	0	0	0	0	0	4	4	4	3	3
LL005	LAS POSITAS	ARROYO	SEDIMENT	3	3	BKGRN	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL006	LAS POSITAS	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	0	3	3	3	3	3
LL007	LAS POSITAS	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
LL008	LAS POSITAS	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	0	3	2	2	3	3
LL009	LAS POSITAS	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	2	3	3	3	3	3	3	3
LL010	SHIELD BLDG	ARROYO	SEDIMENT	3	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LL011	N OF 4TH ST	ARROYO	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	3	3	3	3	3	3	3	3
			MED TOTAL	34	31		0	0	30	30	0	0	0	0	21	27	20	31	30	30	30	30
LL001	ARROYO SECO	ARROYO	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL003	TRAILER STG	ARROYO	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL006	LAS POSITAS	ARROYO	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL010	SHIELD BLDG	ARROYO	SUR WATER	1	0	QC RN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			MED TOTAL	4	3		0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
			EP TOTAL	38	34		0	0	33	33	0	0	0	0	21	27	23	34	33	33	33	33

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TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 001
LOCATION: ARROYO SECO AT SOUTH SIDE OF EAST AVENUE
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL001018C	LL001018D	LL001029C	LL001029D	LL001030C	LL001030D
	SDG NO:	LL001018C	LL001018D	LL001018C	LL001018D	LL001018C	LL001018D
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
ALUMINUM		7780		11700		7810	
ARSENIC			3.8 *N		3 *N		3.2 *N
BARIUM		92		156		141	
BERYLLIUM		0.24 B		0.4 B		0.29 B	
CADMIUM		0.59 B		0.71 B		0.68 B	
CALCIUM		2510 E		5030 E		11600 E	
CHROMIUM			44		36		43
COBALT		6.4 B		11		8.6	
COPPER		14		24		15	
IRON		14600		20600		13600	
LEAD			16		23		13
MAGNESIUM		4470		6790		4010	
MANGANESE		301		1250		650	
NICKEL			48		64		33
POTASSIUM		1600		2300		1600	
SILVER		0.9 U		0.91 B		0.85 U	
SODIUM		126 B		209 B		151 B	
VANADIUM		21		32		26	
ZINC		51		101		60	

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL001018B	LL001029B	LL001030B
	SDG NO:	LL001018	LL001018	LL001018
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
BIS(2-ETHYLHEXYL)PHTHALATE		170 J	350	340 U
DI-N-BUTYLPHTHALATE		800	350 U	340 U
DIETHYLPHTHALATE		130 J	350 U	33 J
* ALKYL HYDROCARBON (6.73)				1000 J
* ALKYL HYDROCARBON (6.91)				1700 J
* ALKYL HYDROCARBON (6.92)			32 J	
* ALKYL HYDROCARBON (34.08)		840 J		
* ALKYL HYDROCARBON (34.10)			210 J	
* AROMATIC HYDROCARBON (10.23)				1300 J
* AROMATIC HYDROCARBON (18.31)		700 J		
* AROMATIC HYDROCARBON (18.32)			100 J	
* AROMATIC HYDROCARBON (21.13)		3100 J		
* AROMATIC HYDROCARBON (21.14)				1200 J
* CARBOXYLIC ACID (26.26)				840 J
* CINEOLE (VAN) (10.85)				840 J
* CINEOLE (10.85)			34 J	
* CYCLIC HYDROCARBON (24.15)				440 J

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 001
LOCATION: ARROYO SECO AT SOUTH SIDE OF EAST AVENUE
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL001018B	LL001029B	LL001030B
	SDG NO:	LL001018	LL001018	LL001018
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
* DIACETONE ALCOHOL (6.21)				22000 J
* DIACETONE ALCOHOL (6.22)		33000 J		
* DIACETONE ALCOHOL (6.40)			1400 J	
* PROBABLE CYCLIC ALKENE (8.43)			16 J	
* PROBABLE CYCLIC ALKENE (8.44)				580 J
* PROBABLE CYCLIC ALKENE (18.69)		850 J		
* PROBABLE CYCLIC ALKENE (18.72)				500 J
* PROBABLE CYCLIC ALKENE (18.84)		9200 J	1200 J	
* PROBABLE CYCLIC ALKENE (18.85)				3900 J
* PROBABLE HYDROCARBON (5.87)			11 J	620 J
* PROBABLE HYDROCARBON (6.94)		1300 J		
* PROBABLE HYDROCARBON (8.45)		1100 J		
* PROBABLE HYDROCARBON (10.22)		750 J		
* PROBABLE HYDROCARBON (19.17)		1800 J		
* PROBABLE HYDROCARBON (19.18)			260 J	490 J
* PROBABLE HYDROCARBON (21.26)			150 J	
* PROBABLE HYDROCARBON (37.52)			210 J	
* TETRADECANOIC ACID(9CI)(26.25)			200 J	
* UNKNOWN (5.39)			20 J	
* UNKNOWN (5.42)		1400 J		
* UNKNOWN (5.52)				2200 J
* UNKNOWN (5.70)		2900 J		
* UNKNOWN (5.74)			66 J	
* UNKNOWN (6.65)			25 J	
* UNKNOWN (6.67)		1200 J		
* UNKNOWN (8.10)		1700 J		1200 J
* UNKNOWN (8.11)			36 J	
* UNKNOWN (10.85)		2600 J		
* UNKNOWN (20.74)		720 J		
* UNKNOWN (20.75)			150 J	
* UNKNOWN (21.15)			760 J	
* UNKNOWN (26.76)				490 J
* UNKNOWN (35.15)		750 J		
* UNKNOWN (35.24)		870 J		
* UNKNOWN (35.26)				530 J
* UNKNOWN (41.48)			170 J	
* UNKNOWN ALKOXY COMPOUND(6.63)				860 J
* UNKNOWN ALKOXY COMPOUND(27.75)			220 J	420 J

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 001
LOCATION: ARROYO SECO AT SOUTH SIDE OF EAST AVENUE
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL001018A	LL001029A	LL001030A
	SDG NO:	0810	0810	0811
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
ACETONE		9 JB	16 B	14 B
ETHYLBENZENE		5 U	5 U	1 JB
METHYLENE CHLORIDE		18 B	34 B	13 B
TOLUENE		5 U	2 JB	1 JB
* UNKNOWN(32.07)				12 J
* UNKNOWN(38.76)				14 J

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL001018E	LL001029E	LL001030E
	SDG NO:	LLL7209	LLL7209	LLL7209
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
CS-137		27	35	22
G-ALPH		3500	5900	3200
GROSS-BETA		29000	32000	24000
H-3		4300	5900	2600
K-40		10000	10000	12000

S&A REQUEST: 001
LOCATION: ARROYO SECO AT SOUTH SIDE OF EAST AVENUE
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL001041F	LL001041G
	SDG NO:	LL001041F	LL001041G
	TYPE:	RINSATE	RINSATE
ALUMINUM		317	
BARIUM		5.3 B	
CADMIUM		2.1 B	
CHROMIUM			1.3 B
COPPER		8.6 B	
IRON		1740	
MAGNESIUM		74 B	
MANGANESE		34	
SODIUM		461 B	
ZINC		57	

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 001
LOCATION: ARROYO SECO AT SOUTH SIDE OF EAST AVENUE
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: LL001041E SDG NO: D112 TYPE: RINSATE
BIS(2-ETHYLHEXYL)PHTHALATE	7 J

VOLATILE ORGANICS (UG/L)	SAMP NO: LL001041B SDG NO: 0808 TYPE: RINSATE
ACETONE	5 JB
METHYLENE CHLORIDE	11 B
TOLUENE	1 J

RADIOCHEMISTRY (PCI/L)	SAMP NO: LL001041I SDG NO: LLL7209 TYPE: RINSATE	LL001041J LLL7209 RINSATE
G-ALPH	0	
GROSS-BETA	43	
H-3		210

S&A REQUEST: 002
LOCATION: ARROYO SECO DOWNSTREAM FROM LLNL DRAIN PIPE
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: LL002019C SDG NO: LL001018C TYPE: S. COMPOSITE	LL002019D LL001018D S. COMPOSITE	LL002020C LL001018C S. COMPOSITE	LL002020D LL001018D S. COMPOSITE	LL002031C LL001018C S. COMPOSITE	LL002031D LL001018D S. COMPOSITE
ALUMINUM	9400		8030		10600	
ARSENIC		4.1 *N		1.3 B*N		2.8 *N
BARIUM	209		88		126	
BERYLLIUM	0.33 B		0.25 B		0.4 B	
CADMIUM	0.44 U		0.42 U		0.99	
CALCIUM	9290 E		2110 E		2780 E	
CHROMIUM		27		32		53
COBALT	9		6.2 B		11	
COPPER	19		17		74	
IRON	18100		16200		17200	

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 002
LOCATION: ARROYO SECO DOWNSTREAM FROM LLNL DRAIN PIPE
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL002019C	LL002019D	LL002020C	LL002020D	LL002031C	LL002031D
	SDG NO:	LL001018C	LL001018D	LL001018C	LL001018D	LL001018C	LL001018D
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE
LEAD			11		24		18
MAGNESIUM		4700		4540		5100	
MANGANESE		633		346		370	
NICKEL			28		40		51
POTASSIUM		1700		1400		1900	
SILVER		0.87 U		0.84 U		2.5	
SODIUM		320 B		129 B		225 B	
VANADIUM		29		23		29	
ZINC		64		54		135	

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL002019B	LL002020B	LL002031B			
	SDG NO:	LL101	LL101	LL101			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
AROCLOR-1254		170 U	160 U	270			
AROCLOR-1260		170 U	160 U	350			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL002019B	LL002020B	LL002031B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
BIS(2-ETHYLHEXYL)PHTHALATE		180 J	340 U	360 U			
DI-N-BUTYLPHTHALATE		400	340 U	360 U			
DIETHYLPHTHALATE		33 J	340 U	51 J			
PYRENE		43 J	340 U	360 U			
* ALKYL HYDROCARBON (5.87)		440 J					
* ALKYL HYDROCARBON (5.88)				450 J			
* ALKYL HYDROCARBON (6.71)		910 J					
* ALKYL HYDROCARBON (6.72)				850 J			
* ALKYL HYDROCARBON (6.92)		1300 J					
* ALKYL HYDROCARBON (6.93)				1300 J			
* ALKYL HYDROCARBON (14.49)				1400 J			
* CARBOXYLIC ACID (26.23)				150 J			
* CYCLOHEXASILOXANE, DODE(16.95)				780 J			
* CYCLOPENTASILOXANE, DEC(13.70)				130 J			
* DIACETONE ALCOHOL (6.34)				29000 J			
* DIACETONE ALCOHOL (6.36)			1400 J				
* DIACETONE ALCOHOL (6.38)		30000 J					
* PROBABLE CYCLIC ALKENE (18.80)				180 J			
* UNKNOWN (5.51)				930 J			

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 ARROYOS

DRAFT DO NOT CITE

S&A REQUEST: 002
LOCATION: ARROYO SECO DOWNSTREAM FROM LLNL DRAIN PIPE
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL002019B	LL002020B	LL002031B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
* UNKNOWN (5.52)		820 J					
* UNKNOWN (5.74)		2100 J		2100 J			
* UNKNOWN (8.09)				1000 J			
* UNKNOWN (8.10)		900 J					
* UNKNOWN (11.32)		340 J					
* UNKNOWN (19.82)				770 J			
* UNKNOWN (22.38)				540 J			
* UNKNOWN (24.59)				340 J			
* UNKNOWN (26.57)				280 J			
* UNKNOWN ALKOXY COMPOUND 6.66)		580 J					
* UNKNOWN ALKOXY COMPOUND (6.65)				670 J			
* UNKNOWN ALKOXY COMPOUND(28.36)		160 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL002019A	LL002020A	LL002031A			
	SDG NO:	0811	0811	0812			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
ACETONE		13 B	12 B	14 B			
ETHYLBENZENE		1 JB	1 JB	5 U			
METHYLENE CHLORIDE		23 B	13 B	28 B			
TOLUENE		0.8 JB	0.8 JB	5 U			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL002019E	LL002020E	LL002031E			
	SDG NO:	LLL7209	LLL7209	LLL7209			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
CS-137		59	27	92			
G-ALPH		0	7800	4300			
GROSS-BETA		25000	33000	24000			
H-3		1900	6200	10000			
K-40		9900	9900	13000			

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 003
LOCATION: EAST OF OUTER LOOP IN DITCH DOWNSTREAM FROM THE TRAILER STAGING AREA
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL003010C	LL003010D	LL003021C	LL003021D	LL003032C	LL003032D
	SDG NO:	LL003010C	LL001018D	LL003010C	LL001018D	LL003010C	LL001018D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		18800 *E		22100 *E		25400 *E	
ARSENIC			1.4 B*N		3.1 *N		2.8 *N
BARIUM		225 *		253 *		230 *	
BERYLLIUM		0.58 B		0.69 B		0.73 B	
CADMIUM		0.65 B		0.73 B		0.69 B	
CALCIUM		3970 *E		5830 *E		5190 *E	
CHROMIUM			44		43		45
COBALT		14		12		13	
COPPER		23 N*E		22 N*E		24 N*E	
IRON		24100 *		27500 *		27600 *	
LEAD			8.9		8.3		9.1
MAGNESIUM		6260 *		6780 *		7430 *	
MANGANESE		730 *E		610 *E		658 *E	
NICKEL			78		94		71
POTASSIUM		2600		2700		3200	
SILVER		1.5		2.6		1.9	
SODIUM		585 B		1160		1040	
VANADIUM		48 *		55 *		57 *	
ZINC		50 N*		49 N*		53 N*	

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL003010B	LL003021B	LL003032B
	SDG NO:	LL101	LL101	LL101
	TYPE:	GRAB	GRAB	GRAB
ALDRIN		8.6 J	8.7 J	8.6 J
BETA-BHC		25 B	80 B	21 B
DELTA-BHC		8.6 J	8.7 J	8.6 U

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL003010B	LL003021B	LL003032B
	SDG NO:	LL122987	LL122987	LL122887
	TYPE:	GRAB	GRAB	GRAB
DI-N-BUTYLPHTHALATE		490 U	390	470 U
* UNKNOWN (6.30)				210 J

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 003
LOCATION: EAST OF OUTER LOOP IN DITCH DOWNSTREAM FROM THE TRAILER STAGING AREA
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL003010A	LL003021A	LL003032A			
	SDG NO:	0821	0821	0826			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		12 B	10 JB	13 B			
CHLOROFORM		5 JB	9 B	5 U			
ETHYLBENZENE		2 JB	2 JB	5 U			
METHYLENE CHLORIDE		4 JB	3 JB	3 JB			
TOLUENE		1 JB	1 JB	5 U			
* NAPHTHALENE(52)				200 JE			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL003010E	LL003021E	LL003032E			
	SDG NO:	LLL7225	LLL7225	LLL7225			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		7800	5700	10000			
GROSS-BETA		19000	17000	18000			
H-3		110000	210000	120000			
K-40		8000	9100	12000			

S&A REQUEST: 003
LOCATION: EAST OF OUTER LOOP IN DITCH DOWNSTREAM FROM THE TRAILER STAGING AREA
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL003043F	LL003043G				
	SDG NO:	LL003043F	LL001041G				
	TYPE:	RINSATE	RINSATE				
ALUMINUM		629					
BARIUM		11 B					
CADMIUM		2.6 B					
CALCIUM		207 B					
COPPER		11 B					
IRON		528					
MAGNESIUM		160 B					
MANGANESE		15 B					
NICKEL			2.7 B				
POTASSIUM		200 B					
SODIUM		597 B					
ZINC		27 E					

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 ARROYOS

DRAFT DO NOT CITE

S&A REQUEST: 003
LOCATION: EAST OF OUTER LOOP IN DITCH DOWNSTREAM FROM THE TRAILER STAGING AREA
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL003043E					
	SDG NO:	D108					
	TYPE:	RINSATE					
BIS(2-ETHYLHEXYL)PHTHALATE		2 J					
DI-N-BUTYLPHTHALATE		0.8 J					
* UNKNOWN (21.77)		2 J					
* UNKNOWN (33.82)		10 J					

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL003043A					
	SDG NO:	0812					
	TYPE:	RINSATE					
ACETONE		10 B					
ETHYLBENZENE		1 JB					
METHYLENE CHLORIDE		13 B					
TOLUENE		2 JB					

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL003043H	LL003043I				
	SDG NO:	LLL7225	LLL7225				
	TYPE:	RINSATE	RINSATE				
G-ALPH		0					
GROSS-BETA		51					
H-3			0				

S&A REQUEST: 004
LOCATION: INLET TO RETENTION BASIN FROM SOUTH DRAINAGE AREAS
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL004011C	LL004011D	LL004022C	LL004022D	LL004033C	LL004033D
	SDG NO:	LL001018C	LL001018D	LL001018C	LL001018D	LL001018C	LL001018D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		13800		17400		14800	
ANTIMONY		5.1 BN		5.9 BN		4.6 UN	
ARSENIC			3.9 *N		4.6 *N		4.2 *N
BARIUM		230		262		233	
BERYLLIUM		0.5 B		0.63 B		0.54 B	
CALCIUM		4290 E		10700 E		3330 E	

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 004
LOCATION: INLET TO RETENTION BASIN FROM SOUTH DRAINAGE AREAS
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL004011C	LL004011D	LL004022C	LL004022D	LL004033C	LL004033D
	SDG NO:	LL001018C	LL001018D	LL001018C	LL001018D	LL001018C	LL001018D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
CHROMIUM			37		42		42
COBALT		11		13		12	
COPPER		22		27		25	
IRON		21300		24800		23500	
LEAD			8.8		9.2		9
MAGNESIUM		5860		7110		6080	
MANGANESE		494		556		571	
NICKEL			42		43		44
POTASSIUM		2100		3000		2700	
SODIUM		364 B		398 B		436 B	
VANADIUM		41		46		42	
ZINC		48		58		51	

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL004011A	LL004022A	LL004033A	LL004044A		
	SDG NO:	0812	0812	0812	0812		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
ACETONE		19 B	18 B	17 B	15 B		
ETHYLBENZENE		1 JB	5 U	2 JB	5 U		
METHYLENE CHLORIDE		20 B	18 B	19 B	23 B		
TOLUENE		0.9 JB	0.9 JB	1 JB	5 U		

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL004011E	LL004022E	LL004033E			
	SDG NO:	LLL7208	LLL7208	LLL7208			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		8400	6800	9700			
GROSS-BETA		25000	30000	26C00			
H-3		170000	160000	140000			
K-40		14000	12000	11000			

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 005
LOCATION: ARROYO LAS POSITAS AT BOUNDARY EAST OF ATHLETIC FIELD
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL005012C	LL005012D	LL005023C	LL005023D	LL005034C	LL005034D
	SDG NO:	LL003010C	LL005012D	LL003010C	LL005012D	LL003010C	LL005012D
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
ALUMINUM		12600 *E		15600 *E		16600 *E	
ARSENIC			2		2.6		2.6
BARIUM		187 *		239 *		237 *	
BERYLLIUM		0.4 B		0.52 B		0.54 B	
CADMIUM		0.36 B		0.68 B		0.47 B	
CALCIUM		5050 *E		5960 *E		5540 *E	
CHROMIUM			20 *		30 *		30 *
COBALT		8.9		10		9.7	
COPPER		13 N*E		17 N*E		16 N*E	
IRON		14400 *		17400 *		17800 *	
LEAD			20 N		42 N		32 N
MAGNESIUM		4040 *		4790 *		4760 *	
MANGANESE		509 *E		570 *E		549 *E	
NICKEL			34		43		48
POTASSIUM		2400		2400		5900	
SILVER		1.1 B		2		1.4 B	
SODIUM		1070		1210		1360	
VANADIUM		33 *		38 *		38 *	
ZINC		52 N*		66 N*		63 N*	

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL005012B	LL005023B	LL005034B
	SDG NO:	LL101	LL101	LL101
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
ALDRIN		8.3 U	8.6 J	8.5 J
BETA-BHC		8.3 J	22 B	23 B
DIELDRIN		17 J	17 U	17 U
4,4'-DDT		17 J	17 U	17 U

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL005012B	LL005023B	LL005034B
	SDG NO:	LL122287	LL122187	LL122887
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
BIS(2-ETHYLHEXYL)PHTHALATE		350 U	360 U	40 J
BUTYLBENZYLPHTHALATE		350 U	360 U	69 J
DI-N-BUTYLPHTHALATE		620	710	610
PENTACHLOROPHENOL		1700 U	1800 U	52 J
PYRENE		350 U	360 U	35 J
2-METHYLPHENOL		350 U	360 U	45 J
* UNKNOWN (6.20)		180 J		

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 005
LOCATION: ARROYO LAS POSITAS AT BOUNDARY EAST OF ATHLETIC FIELD
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL005012B	LL005023B	LL005034B			
	SDG NO:	LL122287	LL122187	LL122887			
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND			
* UNKNOWN (7.50)			200 J				
* UNKNOWN (8.30)		210 J					
* UNKNOWN (14.10)			430 J				
* UNKNOWN (15.60)			340 J				
* UNKNOWN (20.30)			440 J				
* UNKNOWN (21.20)			870 J				
* UNKNOWN (22.10)			400 J				
* UNKNOWN (23.00)			190 J				
* UNKNOWN (25.30)			220 J				
* UNKNOWN (25.40)			170 J				
* UNKNOWN (25.50)		170 J					
* UNKNOWN (27.50)			330 J				
* UNKNOWN (28.00)		280 J					
* UNKNOWN (31.00)		230 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL005012A	LL005023A	LL005034A			
	SDG NO:	0827	0826	0816			
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND			
ACETONE		16 B	3 JB	11 U			
BENZENE		5 U	5 U	0.8 J			
CHLOROFORM		5 U	5 U	2 J			
METHYLENE CHLORIDE		3 J	8 B	12			
TOLUENE		2 J	2 JB	3 JB			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL005012E	LL005023E	LL005034E			
	SDG NO:	LLL7226	LLL7226	LLL7226			
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND			
CS-137		68	89	49			
G-ALPH		6800	9200	7800			
GROSS-BETA		22000	20000	12000			
H-3		130000	110000	120000			
K-40		11000	12000	12000			

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 006
LOCATION: DRAIN NEAR TENTH STREET PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL006013C	LL006013D	LL006024C	LL006024D	LL006035C	LL006035D
	SDG NO:	LL003010C	LL005012D	LL003010C	LL005012D	LL003010C	LL005012D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		15500 *E		20800 *E		15200 *E	
ARSENIC			2.9		3.7		2.5
BARIUM		261 *		341 *		238 *	
BERYLLIUM		0.56 B		0.67 B		0.58 B	
CADMIUM		0.47 B		0.57 B		0.49 B	
CALCIUM		3500 *E		4200 *E		6830 *E	
CHROMIUM			22 *		25 *		21 *
COBALT		8.1		9.5		9.7	
COPPER		12 N*E		17 N*E		14 N*E	
IRON		18200 *		22900 *		18500 *	
LEAD			5.1 N		5.8 N		5.8 N
MAGNESIUM		3790 *		4720 *		4010 *	
MANGANESE		600 *E		629 *E		488 *E	
NICKEL			28		38		26
POTASSIUM		2500		3200		2500	
SILVER		2		1.8		2.5	
SODIUM		961		1250		1030	
VANADIUM		38 *		51 *		38 *	
ZINC		36 N*		45 N*		39 N*	

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL006013B	LL006024B	LL006035B			
	SDG NO:	LL202	LL202	LL202			
	TYPE:	GRAB	GRAB	GRAB			
4,4'-DDD		18 J	18 J	18 J			

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL006013A	LL006024A	LL006035A			
	SDG NO:	0816	0814	0814			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		17 B	22 B	18 B			
ETHYLBENZENE		2 JB	2 JB	2 JB			
METHYLENE CHLORIDE		6	5 J	6			
TOLUENE		1 JB	1 JB	1 JB			

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 006
LOCATION: DRAIN NEAR TENTH STREET PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL006013E	LL006024E	LL006035E
	SDG NO:	LLL7228	LLL7228	LLL7228
	TYPE:	GRAB	GRAB	GRAB
G-ALPH		11000	5700	6200
GROSS-BETA		25000	25000	26000
H-3		120000	120000	120000
K-40		16000	16000	14000

S&A REQUEST: 006
LOCATION: DRAIN NEAR TENTH STREET PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL006046F	LL006046G
	SDG NO:	LL003043F	LL001041G
	TYPE:	RINSATE	RINSATE
ALUMINUM		98 B	
BARIUM		3.1 B	
CHROMIUM			1.1 B
IRON		173	
MAGNESIUM		12 B	
NICKEL			3.9 B
POTASSIUM		100	
SODIUM		292 B	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL006046E
	SDG NO:	D108
	TYPE:	RINSATE
BIS(2-ETHYLHEXYL)PHTHALATE		2 J

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL006046A
	SDG NO:	0812
	TYPE:	RINSATE
ACETONE		16 B
ETHYLBENZENE		1 JB
METHYLENE CHLORIDE		13 B
TOLUENE		2 JB

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 006
LOCATION: DRAIN NEAR TENTH STREET PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SURFACE WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL006046H	LL006046I
	SDG NO:	LLL7228	LLL7228
	TYPE:	RINSATE	RINSATE
G-ALPH		14	
GROSS-BETA		0	
H-3			140

S&A REQUEST: 007
LOCATION: EAST OF TRAILER AT BUILDING 3914 AT DRAIN PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL007014C	LL007014D	LL007025C	LL007025D	LL007036C	LL007036D
	SDG NO:	LL003010C	LL005012D	LL003010C	LL005012D	LL003010C	LL005012D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		15800 *E		16700 *E		14000 *E	
ARSENIC			4		4.2		3.8
BARIUM		265 *		170 *		185 *	
BERYLLIUM		0.59 B		0.62 B		0.51 B	
CADMIUM		0.29 B		0.46 B		0.6 B	
CALCIUM		10300 *E		4780 *E		6550 *E	
CHROMIUM			38 *		33 *		36 *
COBALT		13		13		11	
COPPER		25 N*E		26 N*E		20 N*E	
IRON		24200 *		25300 *		22200 *	
LEAD			8.2 N		8.7 N		7.1 N
MAGNESIUM		6740 *		6690 *		5580 *	
MANGANESE		594 *E		556 *E		538 *E	
NICKEL			64		64		40
POTASSIUM		3100		2700		2500	
SILVER		2.8		4		5.3	
SODIUM		640 B		578 B		396 B	
VANADIUM		42 *		47 *		41 *	
ZINC		53 N*		57 N*		49 N*	

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL007014B	LL007025B	LL007036B
	SDG NO:	LL101	LL101	LL101
	TYPE:	GRAB	GRAB	GRAB
ALDRIN		8.7 U	8.6 J	8.6 J

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 ARROYOS

DRAFT DO NOT CITE

S&A REQUEST: 007
LOCATION: EAST OF TRAILER AT BUILDING 3914 AT DRAIN PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SEDIMENT

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL007014B	LL007025B	LL007036B			
	SDG NO:	LL101	LL101	LL101			
	TYPE:	GRAB	GRAB	GRAB			
BETA-BHC		37 B	23 B	28 B			
DELTA-BHC		8.7 U	8.6 J	8.6 J			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL007014B	LL007025B	LL007036B			
	SDG NO:	LL122287	LL122287	LL122987			
	TYPE:	GRAB	GRAB	GRAB			
DI-N-BUTYLPHTHALATE		1100	610	530			
* UNKNOWN (6.20)			200 J				
* UNKNOWN (6.30)		150 J					
* UNKNOWN (7.20)		1500 J					
* UNKNOWN (20.20)				300 J			
* UNKNOWN (20.40)		140 J					
* UNKNOWN (21.10)				200 J			
* UNKNOWN (23.10)			190 J				
* UNKNOWN (23.30)			660 J				
* UNKNOWN (25.30)				310 J			
* UNKNOWN (25.50)			160 J				

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL007014A	LL007025A	LL007036A			
	SDG NO:	0821	0827	0827			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		11 JB	37 B	31 B			
ETHYLBENZENE		2 JB	6 U	6 U			
METHYLENE CHLORIDE		6 B	6 U	6 U			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL007014E	LL007025E	LL007036E			
	SDG NO:	LLL7244	LLL7244	LLL7244			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		10000	12000	4600			
GROSS-BETA		26000	24000	27000			
H-3		3800	3500	3000			
K-40		12000	12000	11000			

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 008
LOCATION: ARROYO LAS POSITAS UPSTREAM OF DRAIN ENTRY NEAR TENTH STREET
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL008015C	LL008015D	LL008026C	LL008026D	LL008037C	LL008037D
	SDG NO:	LL003010C	LL005012D	LL003010C	LL005012D	LL003010C	LL005012D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		14800 *E		14500 *E		16400 *E	
ARSENIC			2.4		2.4		2.5
BARIUM		254 *		243 *		303 *	
BERYLLIUM		0.52 B		0.51 B		0.6 B	
CADMIUM		0.4 B		0.31 B		0.54 B	
CALCIUM		4120 *E		8070 *E		7560 *E	
CHROMIUM			21 *		23 *		24 *
COBALT		8.3		8.9		10	
COPPER		17 N*E		21 N*E		74 N*E	
IRON		16600 *		16300 *		19600 *	
LEAD			5.5 N		5.8 N		5.7 N
MAGNESIUM		3320 *		3400 *		4140 *	
MANGANESE		342 *E		432 *E		496 *E	
NICKEL			21		21		24
POTASSIUM		2500		2400		2900	
SILVER		3.7		3.7		4.4	
SODIUM		716 B		590 B		821	
VANADIUM		36 *		37 *		42 *	
ZINC		39 N*		41 N*		47 N*	

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL008015B	LL008026B	LL008037B
	SDG NO:	LL202	LL202	LL202
	TYPE:	GRAB	GRAB	GRAB
4,4'-DDD		18 J	18 J	18 J

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL008026A	LL008037A
	SDG NO:	0814	0814
	TYPE:	GRAB	GRAB
ACETONE		18 B	44 B
CARBON DISULFIDE		6 U	2 J
ETHYLBENZENE		6 U	4 JB
METHYLENE CHLORIDE		6	6 U
TOLUENE		1 JB	2 JB
* METHANE, DICHLORODIFLUO(3.81)			59 J

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 008
LOCATION: ARROYO LAS POSITAS UPSTREAM OF DRAIN ENTRY NEAR TENTH STREET
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL008015E	LL008026E	LL008037E			
	SDG NO:	LLL7243	LLL7243	LLL7243			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		11000	1100	14000			
GROSS-BETA		18000	30000	25000			
H-3		1000	68000	6000			
K-40		14000	14000	15000			

S&A REQUEST: 009
LOCATION: DRAIN NORTH OF BUILDING 298 PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL009016C	LL009016D	LL009027C	LL009027D	LL009038C	LL009038D
	SDG NO:	LL009016C	LL009016D	LL009016C	LL009016D	LL009016C	LL009016D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		17800 *		23100 *		19100 *	
ANTIMONY		4.3 UN		4.2 BN		4.8 BN	
ARSENIC			3.4		4		3.4
BARIUM		199 *		257 *		220 *	
BERYLLIUM		0.57 B		0.75		0.64	
CADMIUM		0.28 U		0.41 B		0.24 U	
CALCIUM		3360 *		4110 *		3320 *	
CHROMIUM			35		43		43
COBALT		11		13		11	
COPPER		21 E		26 E		21 E	
IRON		23400 *		28900 *		24500 *	
LEAD			6.9		9.7		8
MAGNESIUM		4800 *E		6050 *E		5060 *E	
MANGANESE		580 *E		734 *E		529 *E	
NICKEL			36 *		48 *		41 *
POTASSIUM		2700		2900		2500	
SILVER		1.6		2.1		1.6	
SODIUM		189 B		222 B		212 B	
VANADIUM		45		50		45	
ZINC		60 *		119 *		59 *	

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 009
LOCATION: DRAIN NORTH OF BUILDING 298 PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SEDIMENT

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO: LL009016B SDG NO: LL202 TYPE: GRAB	LL009027B LL202 GRAB	LL009038B LL202 GRAB			
DIELDRIN	U	18 J	18 U			
ENDOSULFAN II	18 J	18 U	18 U			
ENDOSULFAN SULFATE	18 U	18 J	18 U			
4,4'-DDD	18 J	18 U	18 U			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: LL009016B SDG NO: LL011288 TYPE: GRAB	LL009027B LL011288 GRAB	LL009038B LL011288 GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE	99 J	320 J	99 J			
BUTYLBENZYLPHTHALATE	360 U	110 J	360 U			
DI-N-BUTYLPHTHALATE	170 J	81 J	76 J			
* UNKNOWN (6.20)	160 J					
* UNKNOWN (15.40)	140 J					
* UNKNOWN (20.20)	180 J					
* UNKNOWN (21.20)	240 J					
* UNKNOWN (22.00)		240 J	240 J			
* UNKNOWN (22.10)	380 J					
* UNKNOWN (23.00)	290 J					
* UNKNOWN (23.40)	330 J	430 J	360 J			
* UNKNOWN (25.20)	270 J	550 J	460 J			
* UNKNOWN (26.20)		170 J				
* UNKNOWN (27.20)			2000 J			
* UNKNOWN (27.30)		1800 J				
* UNKNOWN (28.50)		280 J				
* UNKNOWN (30.10)			2700 J			

VOLATILE ORGANICS (UG/KG)	SAMP NO: LL009016A SDG NO: 0828 TYPE: GRAB	LL009027A 0828 GRAB	LL009038A 0828 GRAB			
ACETONE	36 B	24 B	86 B			
BENZENE	6 U	1 J	12			
CHLOROFORM	6 U	6 U	6			
ETHYLBENZENE	6 U	6 U	3 JB			
METHYLENE CHLORIDE	6 U	6	55			
TOLUENE	2 JB	4 JB	30 B			
XYLENE (TOTAL)	6 U	6 U	4 J			
* ACETIC ACID, METHYL EST(9.6)		11 J	28 J			
* UNKNOWN(11.12)			22 J			

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 009
LOCATION: DRAIN NORTH OF BUILDING 298 PRIOR TO ENTRY INTO ARROYO LAS POSITAS
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL009016E	LL009027E	LL009038E			
	SDG NO:	LLL7246	LLL7246	LLL7246			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		8100	4600	2300			
GROSS-BETA		26000	24000	24000			
H-3		0	5000	0			
K-40		12000	13000	13000			

S&A REQUEST: 011
LOCATION: DITCH ALONG WEST SIDE OF FACILITY NORTH OF FOURTH STREET
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL011010C	LL011010D	LL011021C	LL011021D	LL011032C	LL011032D
	SDG NO:	LL011010C	LL005012D	LL011010C	LL005012D	LL011010C	LL005012D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		17400 *		12100 *		12000 *	
ANTIMONY		5 BN		4.5 UN		5.7 BN	
ARSENIC			5.1		7.6		4.2
BARIUM		220		171		146	
BERYLLIUM		0.57 B		0.4 B		0.4 B	
CADMIUM		1.1		1.7		2	
CALCIUM		4320 *		4260 *		3920 *	
CHROMIUM			46 *		47 *		34 *
COBALT		8.7		9.3		7.8	
COPPER		30		31		42	
IRON		25700 *		23500 *		21900 *	
LEAD			49 N		88 N		62 N
MAGNESIUM		6160		5110		5830	
MANGANESE		572 *		645 *		654 *	
MERCURY			0.15		2.3		0.65
NICKEL			36		48		34
POTASSIUM		3800		3300		3100	
SILVER		1.6		1.4 B		1.6	
SODIUM		205 B		234 B		177 B	
VANADIUM		37		29		33	
ZINC		159		355		445	

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 ARROYOS

DRAFT DO NOT CITE

S&A REQUEST: 011
LOCATION: DITCH ALONG WEST SIDE OF FACILITY NORTH OF FOURTH STREET
MEDIUM: SEDIMENT

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL011010B	LL011021B	LL011032B			
	SDG NO:	LL202	LL202	LL202			
	TYPE:	GRAB	GRAB	GRAB			
ALDRIN		9.6 U	9.6 U	9.9 J			
AROCLOR-1254		190 U	200	200 U			
BETA-BHC		9.6 U	9.6 B	11			
DELTA-BHC		9.6 U	9.9 U	1 J			
DIELDRIN		19 U	19 J	20 J			
ENDRIN		19 U	19 J	20 J			
HEPTACHLOR		9.6 J	9.6 U	9.9 J			
HEPTACHLOR EPOXIDE		9.6 U	9.6 J	9.9 J			
METHOXYCHLOR		96 U	96 U	99 J			
4,4'-DDT		19 J	19 U	20 J			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL011010B	LL011021B	LL011032B			
	SDG NO:	LL001018	LL001018B	LL001018B			
	TYPE:	GRAB	GRAB	GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE		22000 E	50000 E	3800			
DI-N-BUTYLPHTHALATE		400 U	68 J	420 U			
DI-N-OCTYLPHTHALATE		23 J	39 J	420 U			
DIETHYLPHTHALATE		400 U	64 J	420 U			
* DIACETONE ALCOHOL (6.23)				17000 J			
* DIACETONE ALCOHOL (6.26)			23000 J				
* DIACETONE ALCOHOL (6.43)		29000 J					
* PHTHALATE ESTER (32.19)			85 J				
* PHTHALATE ESTER (32.43)			11 J				
* PHTHALATE ESTER (32.53)			11 J				
* POSSIBLE KETONE (6.64)		890 J					
* PROBABLE ALIPHATIC HYDR (6.79)		260 J					
* PROBABLE ALIPHATIC HYDR (6.99)		410 J					
* PROBABLE HYDROCARBON (6.70)			280 J				
* PROBABLE HYDROCARBON (6.91)			510 J				
* PROBABLE HYDROCARBON (18.77)			180 J				
* PROBABLE HYDROCARBON (28.68)			18 J				
* PROBABLE HYDROCARBON (28.70)				410 J			
* PROBABLE SILOXANE (36.62)			12 J				
* PROBABLE SILOXANE (37.70)			15 J				
* PROBABLE SILOXANE (38.90)			13 J				
* PROBABLE SILOXANE (40.36)			10 J				
* PROBABLE SILOXANE (42.17)			10 J				
* PROBABLE SILOXANE (44.48)			9 J				
* UNKNOWN (5.45)			1500 J				
* UNKNOWN (5.55)				1600 J			

TABLE L4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYOS

S&A REQUEST: 011
LOCATION: DITCH ALONG WEST SIDE OF FACILITY NORTH OF FOURTH STREET
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL011010B	LL011021B	LL011032B
	SDG NO:	LL001018	LL001018B	LL001018B
	TYPE:	GRAB	GRAB	GRAB
* UNKNOWN (5.64)		1800 J		
* UNKNOWN (5.92)				120 J
* UNKNOWN (6.57)			800 J	
* UNKNOWN (6.60)				1100 J
* UNKNOWN (6.85)				3100 J
* UNKNOWN (8.07)			190 J	
* UNKNOWN (8.08)				360 J
* UNKNOWN (8.15)		240 J		
* UNKNOWN (8.97)				290 J
* UNKNOWN (9.04)		200 J		
* UNKNOWN SILOXANE (5.77)				310 J
* UNKNOWN SILOXANE (13.67)				89 J

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL011010A	LL011021A	LL011032A
	SDG NO:	0829	0829	0829
	TYPE:	GRAB	GRAB	GRAB
ACETONE		26 B	20 B	24 B
METHYLENE CHLORIDE		24	13	24

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL011010E	LL011021E	LL011032E
	SDG NO:	LLL7283	LLL7283	LLL7283
	TYPE:	GRAB	GRAB	GRAB
CS-137		35	73	38
G-ALPH		14000	5400	12000
GROSS-BETA		24000	14000	25000
H-3		15000	21000	16000
K-40		10000	8200	10000

4.7 LLNL Environmental Problem 2: Building Sanitary Effluents

Request Number: 12.
Requester: R. Basinski.
Finding and Basis: Lack of characterization of sanitary discharges from buildings where hazardous wastes are handled represented the potential for undetected release of hazardous wastes or constituents to the sanitary system.

4.7.1 Sampling and Analysis Objectives

Statement: Samples were to be collected to determine if hazardous constituents listed in Sect. 4.7.2.2 were present at or above method detection levels in the sanitary effluent from process buildings and labs where hazardous wastes are generated.

Supporting Information: LLNL has policies and procedures that call for hazardous wastes collected in the labs to be taken to designated waste accumulation areas. Also, sinks that receive waste waters are plumbed to retention tanks. However, there had been no previous testing of building sanitary effluents to determine that procedures were being followed and whether or not hazardous waste or constituents were being discharged through the sanitary system.

4.7.2 Sampling and Analytical Design

4.7.2.1 Sampling Design

Request 12: Sanitary System Effluents from Buildings 241, 151, 511, 175, 169, 298, 331, 321, 322, 131, and 222 (Fig. 4.12). Three composite water samples were to be collected (Sampling Method: Reference E4.2.2) from the sanitary discharges from each of these 11 buildings over three different days for a total of 33 composite samples. It was assumed that the potential release of

contaminants would be on a sporadic basis; therefore, the flow from the buildings (as far as contaminant release was concerned) would be heterogeneous. Because the purpose of the request was not to identify a "normal" sanitary discharge but contaminants that might be directed to the sanitary line, a time-proportional composite sample instead of a flow-proportional composite was suggested. There were two reasons for using this sampling method: (1) a flow-proportional sample would be heavily biased toward the early morning (0800 to 1000) flows, which would not necessarily reflect the discharge throughout the day of "other" constituents, and (2) a time-proportional sample would give a better reflection of the daily pattern of discharges from suspected process buildings and laboratories and would not be diluted by the normally heavy early-morning flows to the sanitary system. Automatic samplers were to be placed at the sanitary discharge point from the buildings selected for sampling. A time-proportional sample was to be collected from 0900 to 1600 each day for three days. Grab water samples (Sampling Method: Reference E4.2.3B) were to be collected each day at 0900, 1200, and 1600 for volatile analysis.

There were five deviations from the LLNL Sampling and Analysis Plan for Request 12:

First, the plan called for sanitary discharges to be sampled for Buildings 169 and 175, but the nearest sampling point to Building 169 was also the nearest sampling point to Building 175. Therefore, the samples from this point are simply listed as being from Building 169, and none are listed for Building 175.

Second, two sample points (manholes 31B and 42B) were needed to adequately sample effluents from Building 222. Therefore, twice as many samples were collected from Building 222 as were required in the Sampling and Analysis Plan.

Third, the plan called for three grab samples and one composite sample to be taken on each of 3 days at each sampling location. Five locations were sampled on August 5, 6, and 7, and the six remaining locations were sampled on August

10, 11, and 12, 1987. On the first day of sampling for each set of sampling points, only two grab samples were collected at each site due to lack of time and the need to sample during normal work hours. On the second and third days of sampling each set of points, three grab samples were taken at each point as stated in the original plan.

Fourth, on the first day of sampling (05AUG87), two of the sample compositors were started late in the day (sample LL012077 at 1420 for Building 169 and sample LL012191 at 1510 for Building 298). The plan had called for time-proportional samples that reflected the daily pattern of discharges, but on the first day of sampling, these compositors had to be started at a time too late in the day to achieve this objective. Adequate representations of conditions over whole days were obtained for all succeeding measurements.

Fifth, on 10AUG87 the flow was too low at Building 241 to collect a composite sample. Instead, samples were collected as grab samples at 1705.

NOTE: Several of the sample IDs for Request 12 were added to the sampling plan at the last minute. The revised plan was not available to the data management staff in time to include them in the Field Team notebooks. Therefore, pages one and two for these additions had to be filled out by hand on-site.

Also, because the Survey program ID codes allow up to 99 sample IDs per request, and because Request 12 exceeded this value, new sample IDs for Request 12 were coded LL912XXX.

The Sampling Team arrived at Building 321, manhole 98, at 1007 on 05AUG87. The sky was clear, the temperature was 87°F, and the winds were at 5 to 10 mph. QC rinsate LL012679 was collected at 1016. Grab water sample LL012555

was collected at 1029. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012226 was started at 1040. The sampler was set to collect 200 mL of liquid every 6 min for approximately 5 1/4 hr. The second grab sample (LL012748) was not collected. The Sampling Team returned at 1540. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1553, and grab sample LL012737 was collected at 1554. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 322, manhole 74C, at 1108 on 05AUG87. The sky was clear, the temperature was 87°F, and the winds were at 5 to 10 mph. Grab water sample LL012588 was collected at 1123. Field measurements for pH, temperature, and specific conductance were taken. Collection of media for composite sample LL012259 was started at 1128. The sampler was set to collect 200 mL of liquid every 6 min for approximately 5 hr. The second grab sample (LL012760) was not collected. The Sampling Team returned at 1628. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1630, and grab sample LL012759 was collected at 1633. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 131, manhole 66A, at 1145 on 05AUG87. The sky was clear, the temperature was 87°F, and the winds were at 5 to 10 mph. Grab water sample LL012340 was collected at 1156. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012011 was started at 1158. The sampler was set to collect 200 mL of liquid every 6 min for approximately 5 hr. The second grab sample (LL012726) was not collected. The Sampling Team returned at 1700. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1700, and grab sample LL012715 was collected at 1706. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 169, manhole 55A, at 1402 on 05AUG87. The sky was clear, the temperature was 92°F, and the winds were at 5 to 10 mph. QC field blank LL012691 was taken at 1344. Grab water sample LL012408 was collected at 1414. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012077 was started at 1420. The sampler was set to collect 400 mL of liquid every 6 min for approximately 3 3/4 hr. The second grab sample (LL012782) was not collected. The Sampling Team returned at 1750. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1750, and grab sample LL012771 was collected at 1805. Field measurements for pH, temperature, and specific conductance were taken. Samples LL012102 and LL012431 for Building 175, manhole 55A were voided because the sampling point was already tested for Building 169.

The Sampling Team arrived at Building 298, manhole 87B, at 1445 on 05AUG87. The sky was clear, the temperature was 92°F, and the winds were at 5 to 10 mph. Grab water sample LL012522 was collected at 1458. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012191 was started at 1510. The sampler was set to collect 450 mL of liquid every 6 min for approximately 3 1/4 hr. The second grab sample (LL012806) was not collected. The Sampling Team returned at 1825. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1825, and grab sample LL012793 was collected at 1829. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 321, manhole 98, at 0820 on 06AUG87. The sky was clear, the temperature was 85°F, and the winds were at 5 to 10 mph. QC field blank LL012704 was collected at 0825. Grab water sample LL012566 was collected at 0920. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012237 was started at 0931. The sampler was set to collect 150 mL of liquid every 6 min for approximately 6 1/4 hr. The second grab sample (LL012828) was collected at

1354. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1542. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1543, and grab sample LL012862 was collected at 1543. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 322, manhole 74C, at 1030 on 06AUG87. The sky was clear, the temperature was 85°F, and the winds were at 5 to 10 mph. Grab water sample LL012599 was collected at 1038. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012260 was started at 1040. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL012839) was collected at 1414. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1542. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1607, and grab sample LL012873 was collected at 1609. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 131, manhole 66A, at 1053 on 06AUG87. The sky was clear, the temperature was 85°F, and the winds were at 5 to 10 mph. Grab water sample LL012351 was collected at 1059. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012022 was started at 1100. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL012817) was collected at 1426. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1632. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1633, and grab sample LL012884 was

collected at 1637. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 169, manhole 55A, at 1115 on 06AUG87. The sky was clear, the temperature was 90°F, and the winds were at 5 to 10 mph. Grab water sample LL012419 was collected at 1117. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012088 was started at 1120. The sampler was set to collect 150 mL of liquid every 6 min for approximately 6 hr. The second grab sample (LL012840) was collected at 1503. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at approximately 1700. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1716, and grab sample LL012895 was collected at 1727. Field measurements for pH, temperature, and specific conductance were taken. Samples LL012113 and LL012442 for Building 175 (manhole 55A) were voided because the sample point was the same as for Building 169.

The Sampling Team arrived at Building 298, manhole 87B, at 1140 on 06AUG87. The sky was clear, the temperature was 90°F, and the winds were at 5 to 10 mph. Grab water sample LL012533 was collected at 1143. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012204 was started at 1151. The sampler was set to collect 150 mL of liquid every 6 min for approximately 6 1/4 hr. The second grab sample (LL012851) was collected at 1450. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at approximately 1745. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1800, and grab sample LL012908 was collected at 1804. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 321, manhole 98, at 0930 on 07AUG87. The sky was clear, the temperature was 80°F, and the winds were at 5 to 10 mph. Grab water sample LL012577 was collected at 0957. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012248 was started at 1010. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL012919) was collected at 1412. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1547. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1548, and grab sample LL012920 was collected at 1556. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 322, manhole 74C, at 1025 on 07AUG87. The sky was clear, the temperature was 80°F, and the winds were at 5 to 10 mph. Grab water sample LL012602 was collected at 1032. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012271 was started at 1046. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL012931) was collected at 1424. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1612. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1613, and grab sample LL012942 was collected at 1614. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 131, manhole 66A, at 1106 on 07AUG87. The sky was clear, the temperature was between 80° and 85°F, and the winds were at 5 to 10 mph. Grab water sample LL012362 was collected at 1112.

Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012033 was started at 1126. The sampler was set to collect 130 mL of liquid every 6 min for approximately 5 1/4 hr. The second grab sample (LL012953) was collected at 1441. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1633. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1635, and grab sample LL012964 was collected at 1636. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 298, manhole 87B, at 1151 on 07AUG87. The sky was clear, the temperature was 85°F, and the winds were at 5 to 10 mph. Grab water sample LL012544 was collected at 1157. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012215 was started at 1206. The sampler was set to collect 175 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL012997) was collected at 1517. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1738. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1740, and grab sample LL912010 was collected at 1743. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 169, manhole 55A, at 1227 on 07AUG87. The sky was clear, the temperature was 85°F, and the winds were at 5 to 10 mph. Grab water sample LL012420 was collected at 1234. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012099 was started at 1240. The sampler was set to collect 150 mL of liquid every 6 min for approximately 4 3/4 hr. The second grab sample (LL012975) was collected at 1500. Field measurements for pH, temperature, and specific

conductance were taken. The Sampling Team returned at 1720. The sky was clear, the temperature was 94°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1721, and grab sample LL012986 was collected at 1723. Field measurements for pH, temperature, and specific conductance were taken. Samples LL012453 and LL012124 for Building 175 (manhole 55A) were voided because the sample point was the same as for Building 169.

QC rinsate LL012680 was collected at 1040 on 10AUG87 at Building 511.

The Sampling Team arrived at Building 331, manhole 228C, at 1049 on 10AUG87. The sky was clear, the temperature was 86°F, and the winds were at 10 to 15 mph. Grab water sample LL012613 was collected at 1059. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012282 was started at 1105. The sampler was set to collect 150 mL of liquid every 6 min for approximately 4 1/2 hr. The second grab sample (LL912123) was not collected. The Sampling Team returned at 1530. The sky was clear, the temperature was 91°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1533, and grab sample LL912134 was collected at 1533. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 222, manhole 42B, at 1120 on 10AUG87. The sky was clear, the temperature was 86°F, and the winds were at 10 to 15 mph. Grab water sample LL912076 was collected at 1125. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL912021 was started at 1130. The sampler was set to collect 150 mL of liquid every 6 min for approximately 4 1/2 hr. The second grab sample (LL912087) was not collected. The Sampling Team returned at 1550. The custody seals were checked and found to be intact and undamaged. The composite sampler was

turned off at 1557, and grab sample LL912098 was collected at 1559. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 222, manhole 31B, at 1140 on 10AUG87. The sky was clear, the temperature was 86°F, and the winds were at 10 to 15 mph. Grab water sample LL012464 was collected at 1144. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012135 was started at 1149. The sampler was set to collect 125 mL of liquid every 6 min for approximately 4 1/2 hr. The second grab sample (LL912054) was not collected. The Sampling Team returned at 1620. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1620, and grab sample LL912065 was collected at 1626. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 241, manhole 38B, at 1219 on 10AUG87. The sky was clear, the temperature was 86°F, and the winds were at 10 to 15 mph. Grab water sample LL012497 was collected at 1226. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012168 was started at 1230. Flow was extremely low, and the sampler was not functioning properly due to the low volume. The second grab sample (LL912101) was not collected. The Sampling Team returned at 1649. The sky was clear, the temperature was 90°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1650, and grab sample LL912112 was collected at 1653. Due to extremely low flow in the effluent line, composite sample LL012168 was unusable. Sample LL012168 was collected as a grab sample between 1654 and 1705. Semivolatiles (bottle A) were not collected. Therefore, bottles B through E were relabeled A through D. Field measurements for pH, temperature, and specific conductance were taken for both grab samples.

The Sampling Team arrived at Building 151, manhole 95B, at 1240 on 10AUG87. The sky was clear, the temperature was 86°F, and the winds were at 10 to 15

mph. Grab water sample LL012373 was collected at 1246. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012044 was started at 1250. The sampler was set to collect 200 mL of liquid every 6 min for approximately 4 1/2 hr. The second grab sample (LL912145) was not collected. The Sampling Team returned at 1714. The sky was clear, the temperature was 90°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1719, and grab sample LL912156 was collected at 1721. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 511, manhole 13E, at 1349 on 10AUG87. The sky was clear, the temperature was 86°F, and the winds were at 10 to 15 mph. Grab water sample LL012646 was collected at 1353. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012317 was started at 1356. The sampler was set to collect 300 mL of liquid every 6 min for approximately 4 hr. The second grab sample (LL912167) was not collected. The Sampling Team returned at 1745. The sky was clear, the temperature was 90°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1750, and grab sample LL912178 was collected at 1755. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 331, manhole 228C, at 0945 on 11AUG87. The sky was clear, the temperature was 82°F, and the winds were at 10 to 15 mph. Grab water sample LL012624 was collected at 0951. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012293 was started at 0955. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/4 hr. The second grab sample (LL912258) was collected at 1249. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1504. The sky was clear, the temperature was 88°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The

composite sampler was turned off at 1513, and grab sample LL912269 was collected at 1505. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 222, manhole 42B, at 1007 on 11AUG87. The sky was clear, the temperature was 82°F, and the winds were at 10 to 15 mph. Grab water sample LL912203 was collected at 1008. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL912032 was started at 1020. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/4 hr. The second grab sample (LL912214) was collected at 1259. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1530. The sky was clear, the temperature was 88°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1530, and grab sample LL912225 was collected at 1533. Field measurements for pH, temperature, and specific conductance were taken. The samples were milky in appearance.

The Sampling Team arrived at Building 222, manhole 31B, at 1020 on 11AUG87. The sky was clear, the temperature was 82°F, and the winds were at 10 to 15 mph. Grab water sample LL012475 was collected at 1023. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012146 was started at 1028. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL912189) was collected at 1306. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1546. The sky was clear, the temperature was 88°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1549, and grab sample LL912190 was collected at 1550. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 241, manhole 38B, at 1031 on 11AUG87. The sky was clear, the temperature was 82°F, and the winds were at 10 to 15 mph. Grab water sample LL012511 was collected at 1033. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012179 was started at 1040. The sampler was set to collect 200 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL912236) was collected at 1317. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1601. The sky was clear, the temperature was 88°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1604, and grab sample LL912247 was collected at 1606. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 151, manhole 95B, at 1050 on 11AUG87. The sky was clear, the temperature was 82°F, and the winds were at 10 to 15 mph. Grab water sample LL012384 was collected at 1052. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012055 was started at 1055. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL912270) was collected at 1328. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1619. The sky was clear, the temperature was 88°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1619, and grab sample LL912281 was collected at 1621. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 511, manhole 13E, at 1107 on 11AUG87. The sky was clear, the temperature was 82°F, and the winds were at 10 to 15 mph. Grab water sample LL012657 was collected at 1110. Field measurements for pH, temperature, and specific conductance were taken. Composite sample

LL012328 was started at 1115. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/4 hr. The second grab sample (LL912292) was collected at 1336. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1629. The sky was clear, the temperature was 88°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1632, and grab sample LL912305 was collected at 1635. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 331, manhole 228C, at 0930 on 12AUG87. The sky was overcast, the temperature was 70°F, and the winds were at 10 to 15 mph. Grab water sample LL012635 was collected at 0932. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012306 was started at 0935. The sampler was set to collect 130 mL of liquid every 6 min for approximately 5 1/4 hr. The second grab sample (LL912394) was collected at 1302. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1448. The sky was clear, the temperature was 84°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1450, and grab sample LL912407 was collected at 1456. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 222, manhole 42B, at 0947 on 12AUG87. The sky was overcast, the temperature was 70°F, and the winds were at 10 to 15 mph. Grab water sample LL012349 was collected at 0950. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL912043 was started at 0955. The sampler was set to collect 125 mL of liquid every 6 min for approximately 5 1/4 hr. The second grab sample (LL912350) was collected at 1253. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1512. The sky was

clear, the temperature was 84°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1516, and grab sample LL912361 was collected at 1518. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 222, manhole 31B, at 1012 on 12AUG87. The sky was overcast, the temperature was 70°F, and the winds were at 10 to 15 mph. Grab water sample LL012486 was collected at 1015. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012157 was started at 1020. The sampler was set to collect 200 mL of liquid every 6 min for approximately 5 1/4 hr. The second grab sample (LL912327) was collected at 1309. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1533. The sky was clear, the temperature was 84°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1537, and grab sample LL912338 was collected at 1536. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 241, manhole 38B, at 1025 on 12AUG87. The sky was clearing, the temperature was 76°F, and the winds were at 10 to 15 mph. Grab water sample LL012500 was collected at 1028. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012180 was started at 1035. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL912372) was collected at 1324. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1552. The sky was clear, the temperature was 84°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1601, and grab sample LL912383 was

collected at 1556. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 151, manhole 95B, at 1047 on 12AUG87. The sky was clearing, the temperature was 76°F, and the winds were at 10 to 15 mph. Grab water sample LL012395 was collected at 1050. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012066 was started at 1055. The sampler was set to collect 200 mL of liquid every 6 min for approximately 5 1/2 hr. The second grab sample (LL912418) was collected at 1333. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1624. The sky was clear, the temperature was 84°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1632, and grab sample LL912429 was collected at 1630. Field measurements for pH, temperature, and specific conductance were taken.

The Sampling Team arrived at Building 511, manhole 13E, at 1109 on 12AUG87. The sky was clearing, the temperature was 76°F, and the winds were at 10 to 15 mph. Grab water sample LL012668 was collected at 1112. Field measurements for pH, temperature, and specific conductance were taken. Composite sample LL012339 was started at 1115. The sampler was set to collect 150 mL of liquid every 6 min for approximately 5 3/4 hr. The second grab sample (LL912316) was collected at 1349. Field measurements for pH, temperature, and specific conductance were taken. The Sampling Team returned at 1649. The sky was clear, the temperature was 84°F, and the wind was at 10 to 15 mph. The custody seals were checked and found to be intact and undamaged. The composite sampler was turned off at 1655, and grab sample LL912430 was collected at 1652. Field measurements for pH, temperature, and specific conductance were taken.

4.7.2.2 Analytical Design

The parameters analyzed and/or measured for LLNL Environmental Problem 2 were volatiles, semivolatiles, ICP-metals, AA-mercury, TCLP-metals, TCLP-semivolatiles, gross alpha, gross beta, and gamma scan. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was to be run.) Field measurements were taken for sample temperature, pH, and specific conductance.

4.7.3 Field and Analytical Data

Field Data: *Effluent temperatures generally ranged between 20° and 30°C although temperatures from 30.1^{o} to 32.7^{o}C were recorded 10 times at various sites during the late afternoon (always after 1530).*

The effluent was always near neutral or basic, with pH values ranging from 6.9 to 9.7. Effluent from Building 169 had the highest value (9.7) at 1234 on 07AUG87 and a value of 9.0 at 1117 on 06AUG87. Effluent from Building 298 also had several pH values above 8.5, the highest of these being 9.4 at 1517 on 07AUG87. Buildings 131, 298, and 331 all provided at least five measured pH values above 8.5 during the sampling period. There did not appear to be any preferred time of day for high pH values.

Considering that the pH readings of the composited samples are more representative of stream conditions, the effluent from Building 322 consistently showed the lowest pH for any given day. The values are 6.9 on 05AUG87, 7.4 on 06AUG87, and 7.3 on 07AUG87.

Conductivity ranged from 0.02 mS/cm at 1424 on 07AUG87 for Building 322 (which often provided low conductivity values) to a high value of 0.68 mS/cm for Building 241 to 1226 on 10AUG87. Most of the conductivity values were between 0.1 and 0.4 mS/cm. The conductivity values of the composited samples

were also the lowest for effluents from Building 322, as were the pH values noted above.

Field Data Evaluation: Although effluents from 11 buildings were initially designated for sampling, the effluents from Buildings 169 and 175 merged and were both present in manhole 55A. Therefore, the results of analysis for Building 169 represent the two sources. In addition, because effluents from Building 222 were discharged by two separate systems, samples were taken at two separate manholes (42B and 31B).

The sampling plan called for one composite and three grab samples per day for three days. However, only eight grab samples for each site were taken due to time constraints, for a total of 11 samples for each site. Although sample number LL012077 should have been a composite sample, the extremely low flow did not permit taking a composite, thus it is a grab sample.

Analytical Data:

Metals.

Building 131. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 17 metals detected, the following 5 were below the CRQL or the IDL in all three samples: barium, cadmium, magnesium, nickel, and vanadium. Of the remaining metals, chromium ranged from 29 to 93 ug/L; copper, 104 to 837 ug/L; lead, 9.6 to 77 ug/L; mercury, 0.31 to 7.9 ug/L; silver, 18 to 72 ug/L; and zinc, 135 to 185 ug/L. Other metals detected were aluminum, copper, iron, manganese, potassium, and sodium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 151. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 16 metals detected, the following 6 were below the CRQL or the IDL in all three samples: barium, cadmium, chromium, magnesium, mercury, and

nickel. Of the remaining metals, copper ranged from 47 to 177 ug/L; lead, 5.8 to 28 ug/L; silver, 10 to 29 ug/L; and zinc, 64 to 132 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, and sodium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 169. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 17 metals detected, the following 4 were below the CRQL or the IDL in all three samples: barium, cadmium, magnesium, and vanadium. Of the remaining metals, chromium was 15 ug/L; copper ranged from 33 to 66 ug/L; lead, 6.1 to 10 ug/L; mercury, 0.49 to 1 ug/L; nickel was 46 ug/L; silver, 26 to 125 ug/L; and zinc, 179 to 385 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, and sodium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 222. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 18 metals detected, the following 4 were below the CRQL or the IDL in all six samples: barium, beryllium, cadmium, and magnesium. Of the remaining metals, antimony was 78 ug/L in one sample; chromium ranged from 18 to 388 ug/L; copper, 31 to 66 ug/L; lead, 5.5 to 26 ug/L; mercury, 0.22 to 85 ug/L; nickel, 47 to 92 ug/L; silver, 18 to 189 ug/L; and zinc, 57 to 131 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, and sodium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 241. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 15 metals detected, the following 6 were below the CRQL or the IDL in all three samples: aluminum, barium, cadmium, magnesium, mercury, and nickel. Of the remaining metals, copper ranged from 27 to 38 ug/L, lead was 9.6 ug/L in one sample, silver was 34 ug/L, and zinc ranged from 30 to 101 ug/L. Other metals detected were calcium, iron, manganese, potassium, and

sodium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 298. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 17 metals detected, the following 5 were below the CRQL or the IDL in all three samples: barium, beryllium, cadmium, magnesium, and nickel. Of the remaining metals, chromium ranged from 11 to 30 ug/L; copper, 42 to 70 ug/L; lead, 8.4 to 11 ug/L; mercury, 0.21 to 1.1 ug/L; silver, 98 to 339 ug/L; and zinc, 134 to 190 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, and sodium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 321. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 16 metals detected, the following 6 were below the CRQL or the IDL in all three samples: barium, cadmium, chromium, magnesium, nickel, and vanadium. Of the remaining metals, copper ranged from 58 to 124 ug/L; lead, 22 to 29 ug/L; mercury was 0.27 ug/L; and zinc ranged 84 to 133 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, and sodium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 322. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 16 metals detected, the following 9 were below the CRQL or the IDL in all three samples: aluminum, barium, cadmium, calcium, magnesium, manganese, mercury, selenium, and sodium. Of the remaining metals, chromium ranged from 10 to 162 ug/L; copper, 45 to 187 ug/L; lead was 7.1 ug/L; nickel ranged from 65 to 124 ug/L; and zinc, 26 to 42 ug/L. Other metals detected were iron and potassium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 331. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 17 metals detected, the following 5 were below the CRQL or the

IDL in all three samples: arsenic, barium, cadmium, magnesium, and nickel. Of the remaining metals, chromium ranged from 25 to 32 ug/L; copper, 272 to 1900 ug/L; lead, 5.6 to 12 ug/L; mercury was 0.25 ug/L; silver was 36 ug/L; and zinc ranged from 123 to 278 ug/L. Other metals detected were aluminum, calcium, iron, and manganese. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Building 511. Analytical data for metals in surface water are presented in Table L4.3.2. Of the 16 metals detected, the following 5 were below the CRQL or the IDL in all three samples: arsenic, barium, magnesium, mercury, and nickel. Of the remaining metals, cadmium ranged from 5.3 to 33 ug/L; chromium was 12 ug/L; copper ranged from 36 to 61 ug/L; lead, 12 to 88 ug/L; and zinc, 72 to 195 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, and sodium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Volatile organics. *Analytical results for volatiles are presented in Table L4.3.2. Acetone, chloroform, ethanol, ethylbenzene, methylene chloride, toluene, xylene, cyclohexanes, 2-propanol, dimethyl disulfide, and carbon disulfide were detected in small amounts in many of the samples for this environmental problem. Results for each building (or sampling point) are discussed below.*

Building 131. An average of six volatiles were detected in each of the eight samples. Values for acetone exceeded the range of instrument calibration in samples LL012340 and LL012351, and the value for methylene chloride exceeded the range of instrument calibration in sample LL012964. In sample LL012362, 1,1,1-trichloroethane was higher than in the other samples. Benzene was estimated at 1 ug/L in one of the samples, but was undetected in the other seven. Small amounts of four unknown volatiles were occasionally detected in these samples.

Building 151. An average of five volatiles were detected in each of the eight samples. Acetone concentration exceeded the instrument calibration in two samples (LL012156 and LL012281). Sample LL012281 had 3100 ug of acetone per liter.

Building 169. An average of five volatiles were detected in each of the eight samples. Methylene chloride measured from this sampling point was 130 ug/L in sample LL012975, but this was the most anomalously high concentration of any volatile for this sampling point.

Building 222. There were two sampling points associated with this building, providing a total of 16 samples. There were four volatiles detected in eight of the samples, three volatiles detected in four samples, and five volatiles detected in two samples. One of the remaining samples had six detectable volatiles and the other had eight. Three samples had detectable amounts of 2-propanol (tentatively identified) and greater than 300 ug/L of acetone, and two out of the three samples had greater than 3500 ug/L of acetone. One other sample (LL912225) contained 260 ug/L of acetone and 8 ug/L of benzene. Three additional samples had acetone concentrations of at least 100 ug/L.

Building 241. Three volatiles were detected in two samples, and four volatiles were detected in five samples. In the remaining sample, eight volatiles were detected, including a small amount of 2-propanol (tentatively identified) and 370 ug/L of acetone. Another sample contained 570 ug/L of acetone. Both acetone values were beyond the calibration range of the instrument.

Building 298. An average of five volatiles were detected in each of the seven samples. A small amount of carbon disulfide was detected in one sample.

Building 321. An average of five volatiles were detected in the seven samples. Acetone concentration (210 ug/L) in sample LL012577 was out of the calibration range of the instrument.

Building 322. An average of three volatiles were detected in each of the eight samples. Acetone concentration (790 ug/L) was out of calibration range in sample LL012588.

Building 331. An average of five volatiles were detected in each of the eight samples. Acetone concentration (460 ug/L) was out of calibration range in sample LL912407.

Building 511. Sixteen volatiles were detected in sample LL012657, and from three to six volatiles were detected in each of the other six samples. Sample LL012657 contained six detectable unknowns, and cyclohexanes and trichlorotrifluoroethane were tentatively identified. Concentrations of some of these compounds were estimated at greater than 100 ug/L.

Extractable organics. *Analytical results for semivolatile organic compounds are presented in Table L4.3.2. From 20 to 25 compounds were detected in 24 of the 31 samples for which there were data available. Only two of the seven remaining samples had fewer than ten identifiable semivolatile organic compounds, and those samples were both from the measuring point corresponding to Building 322. The highest concentrations of semivolatile organic compounds included the following:*

Benzoic acid had estimated concentrations of 2.4 and 1.7 mg/L in samples coming from Buildings 169 and 241, respectively. The highest measured values of benzoic acid were 0.260 and 0.240 mg/L in the effluent from Buildings 511 and 222, respectively.

Bis(2-ethylhexyl)phthalate was measured at a concentration of 0.340 mg/L of effluent coming from Building 298.

A few unknown compounds were detected in estimated concentrations between 1.5 and 1.9 mg/L, but the vast majority were estimated in concentrations of less than 1 mg/L.

Building 131. Samples averaged 14.3 and 88.6 pCi/L of gross alpha and gross beta, respectively.

Building 151. Samples averaged 17.3 and 43.3 pCi/L of gross alpha and gross beta, respectively.

Building 169. Samples averaged 4.7 and 387 pCi/L of gross alpha and gross beta, respectively. In addition, cesium-137 and europium-152, -154, -155 were identified in samples LL012077 and LL012088.

Building 222. Samples averaged 29 and 62 pCi/L of gross alpha and gross beta, respectively, at manhole 31B. Values for manhole 42B averaged 19.3 and 91.7 pCi/L.

Building 241. Samples averaged 4.3 and 41.3 pCi/L of gross alpha and gross beta, respectively.

Building 298. Samples averaged 6 and 154 pCi/L of gross alpha and gross beta, respectively. In addition, sample LL012191 contained cerium-141, -144, niobium-95, and zirconium-95.

Building 321. Samples averaged 24.3 and 48.3 pCi/L of gross alpha and gross beta, respectively.

Building 322. Samples averaged 7.3 and 22.7 pCi/L of gross alpha and gross beta, respectively.

Building 331. Samples averaged 2.3 and 58.7 pCi/L of gross alpha and gross beta, respectively.

Building 511. Samples averaged 12.8 and 25.7 pCi/L of gross alpha and gross beta, respectively.

Analytical Data Evaluation:

Metals. The listed metals of interest were detected above the CRQL or the IDL at the following locations:

Building 131. Chromium, copper, lead, mercury, silver, and zinc.

Building 151. Copper, lead, silver, and zinc.

Building 169. Chromium, copper, lead, mercury, nickel, silver, and zinc.

Building 222. Antimony, chromium, copper, lead, mercury, nickel, silver, and zinc.

Building 241. Copper, lead, silver, and zinc.

Building 298. Chromium, copper, lead, mercury, silver, and zinc.

Building 321. Copper, lead, mercury, and zinc.

Building 322. Chromium, copper, lead, nickel, and zinc.

Building 331. Chromium, copper, lead, mercury, silver, and zinc.

Building 511. Cadmium, chromium, copper, and zinc.

Volatile organics. Acetone concentrations exceeded instrument calibration ranges at seven of the ten sampling points. Methylene chloride was highest in samples taken from the 100 Area. Samples from the 300 Area appeared the least contaminated with volatiles.

Extractable organics. No particularly significant concentrations of semivolatile organic compounds were apparent in these samples.

Radiochemistry. Three samples each of sanitary discharges from 11 buildings were collected. Gross alpha, gross beta, and gamma scans were performed on these samples. Analytical results are given in Table L4.3.2.

4.7.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level II because the plan did not allow sufficient time for taking the requested number of samples during normal working hours. The field sampling is rated Quality Level I because documentation explained the missing samples and the change in the sample types due to unexpected conditions of flow. The overall analytical rating is Quality Level II.

Field Data: With the exception of four samples, which were not taken due to the late hour of the day, the remaining uncollected samples represent a common effluent line or filled-in sump, thus reducing the number collected.

Analytical Data: Because none of the metals exceeded the TCLP limits as evidenced by the ICP analysis, no TCLP analyses were conducted. In the case of the semivolatiles, the identification and quantification of some of the compounds were not sufficiently accurate to establish whether TCLP should have been conducted. Of the identified compounds, none were in the list of compounds to be tested. Details on analytical quality are given below.

Metals. The serial dilution was outside control limits with respect to zinc in many of the samples analyzed. The spiked sample was outside control limits with respect to arsenic for the one sample in which arsenic was detected at the manhole near Building 331.

Data are Quality Level I, except zinc, which is Quality Level III in the following samples: LL012022, LL012044, LL012066, LL012099, LL012135, LL012157, LL012168, LL012180, LL012204, LL012215, LL012237, LL012224, LL012260, LL012271, LL012282, LL012306, LL012317, LL012339, LL912021, LL912043.

Volatile organics. Many volatiles were detected in trip blanks at the same levels as in some of the samples. Because several values were too low to be measured accurately, estimates are given. Compounds were often only tentatively identified.

Approximately 55% of the data were of Quality Level II. Data of Quality Level III occurred when compounds were detected below the respective quantitation limit. Data of Quality Level I occurred in about 15% of the cases in the data quality summary.

Extractable organics. Many of the concentrations are estimated values. Some compounds were detected in one or two, but not all, of the samples from a particular sampling point. As is often the case for semivolatile organic compounds, many compounds were detected that were only tentatively identified. Bis(2-ethylhexyl)phthalate was detected in the field blank. With the exception of one analyte in one sample, the data are all of Quality Level II due mainly to tentative identification by mass spectrometry.

Radiochemistry. Radiological instrumentation was calibrated daily. Instrument backgrounds and efficiencies were also determined. Control sample results were within 10% of the true value.

Environmental Problem: LLNL 2
Request Number: LLNL 12

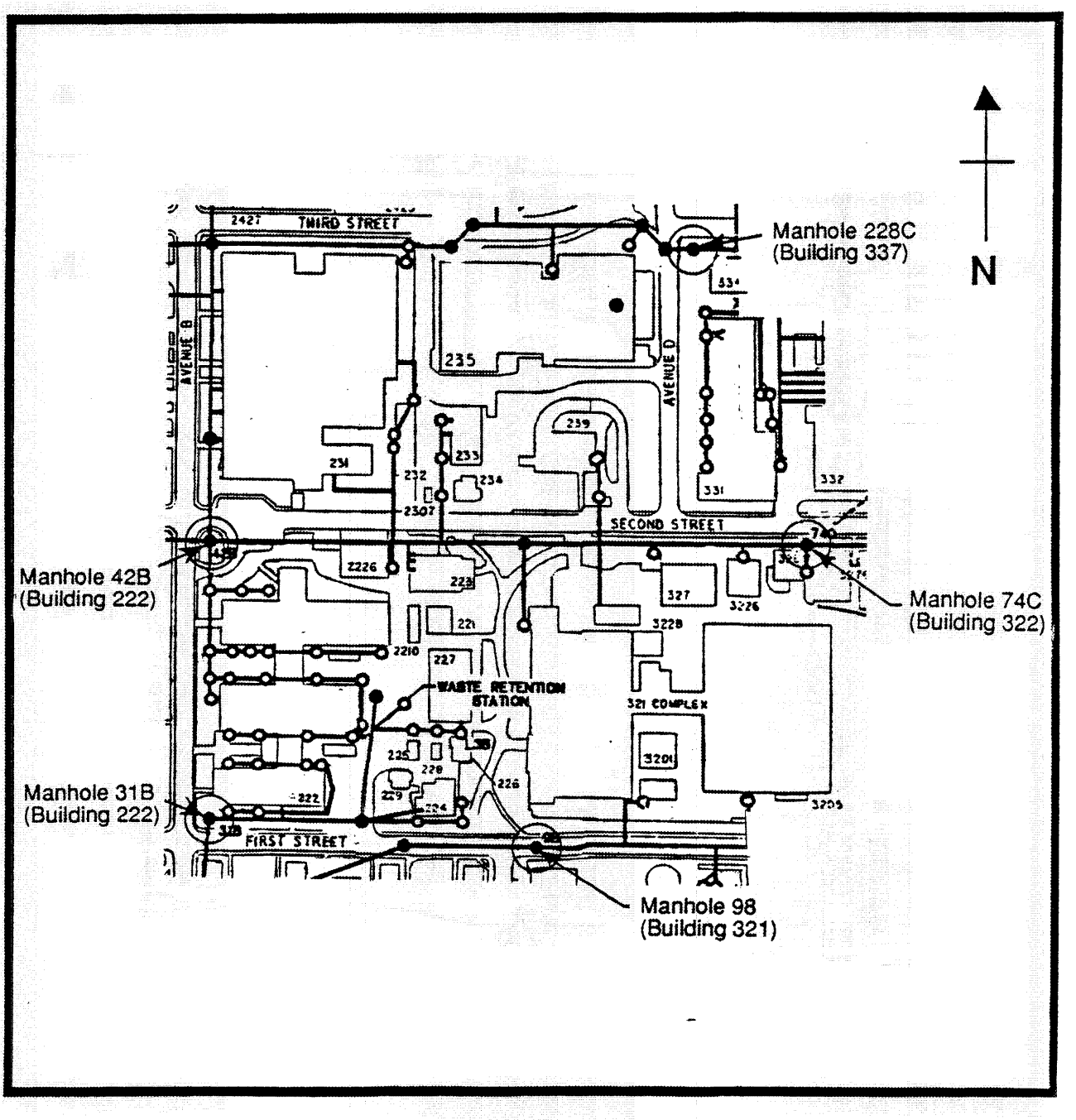

Figure L4.2a. Sanitary System Effluents from Buildings 222, 321, 322, and 331 (LLNL Request 12)

Environmental Problem: LLNL 2
Request Number: LLNL 12

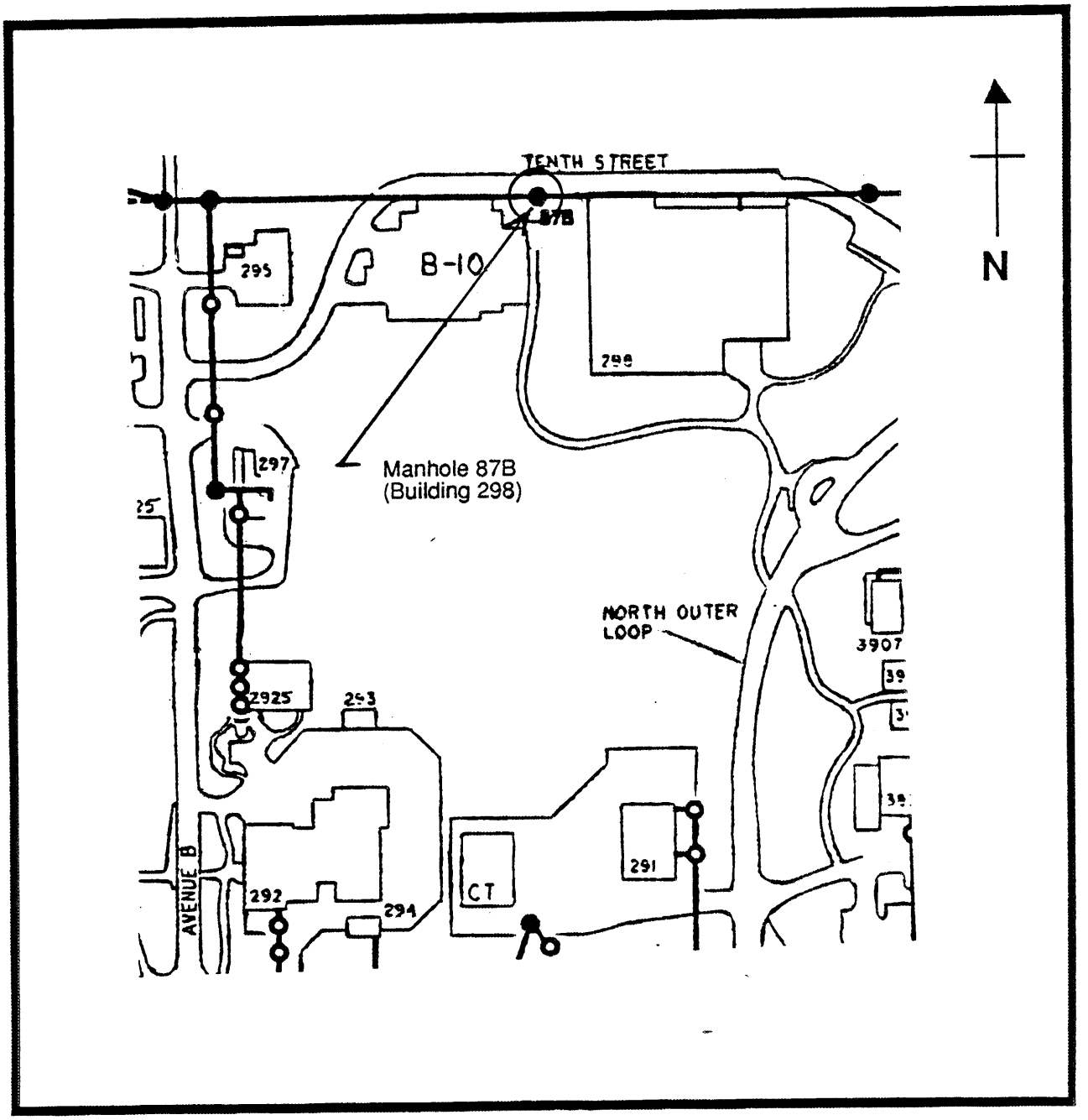

Figure L4.2b. Sanitary System Effluents from Building 298 (LLNL Request 12)

Environmental Problem: LLNL 2
Request Number: LLNL 12

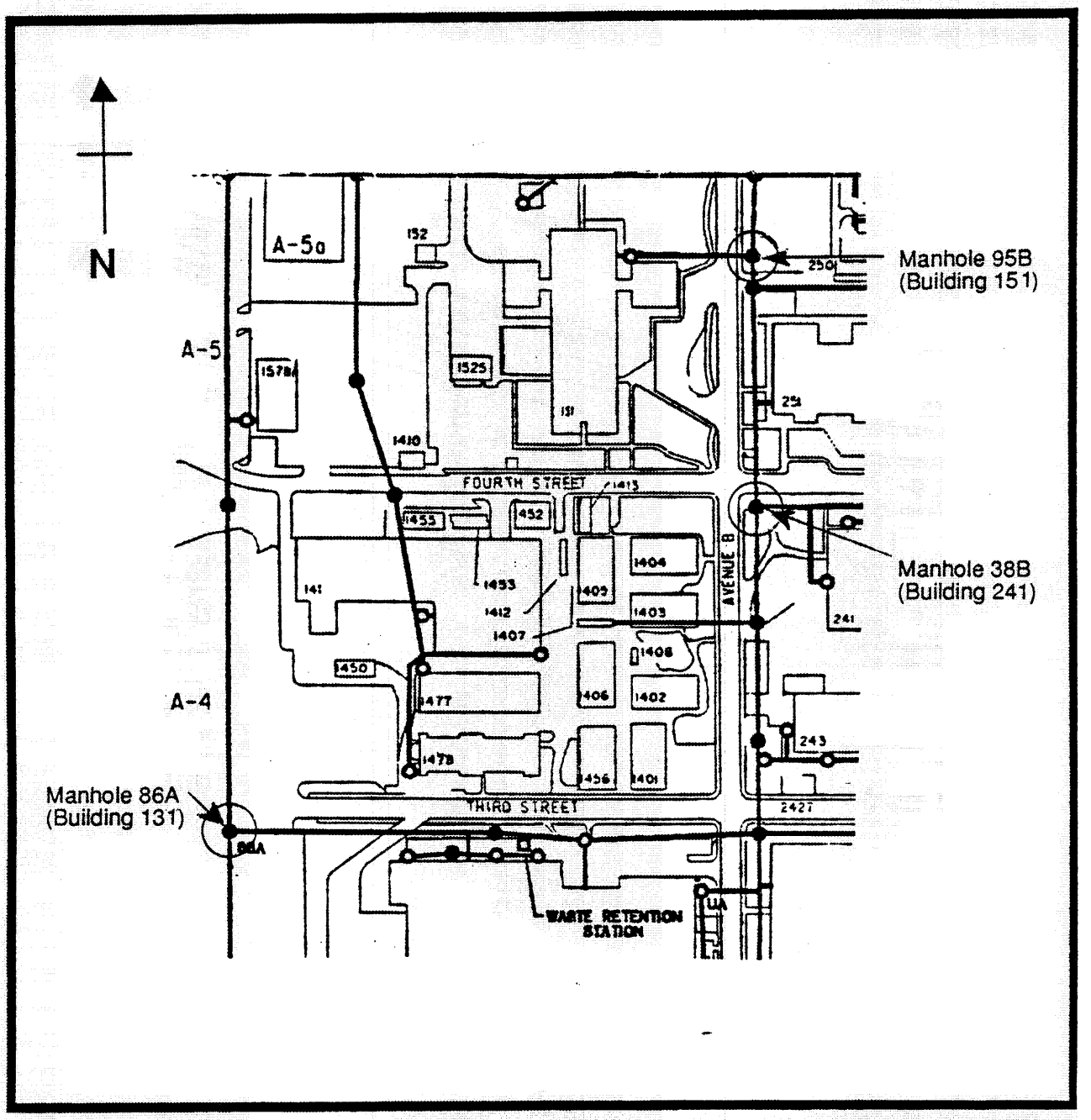

Figure L4.2c. Sanitary System Effluents from Buildings 131, 151, and 241 (LLNL Request 12)

Environmental Problem: LLNL 2
Request Number: LLNL 12

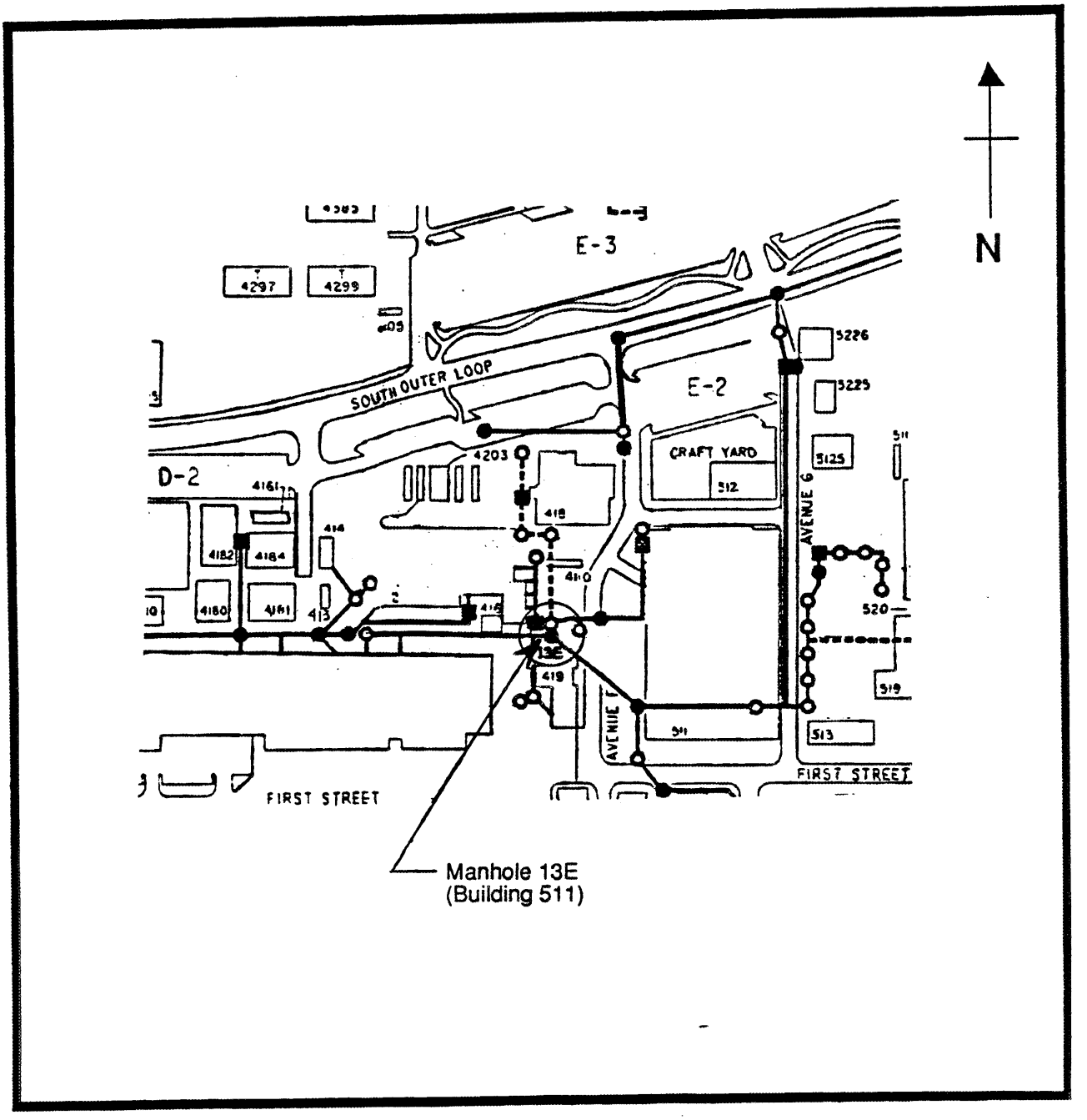

Figure L4.2d. Sanitary System Effluents from Building 511 (LLNL Request 12)

Environmental Problem: LLNL 2
Request Number: LLNL 12

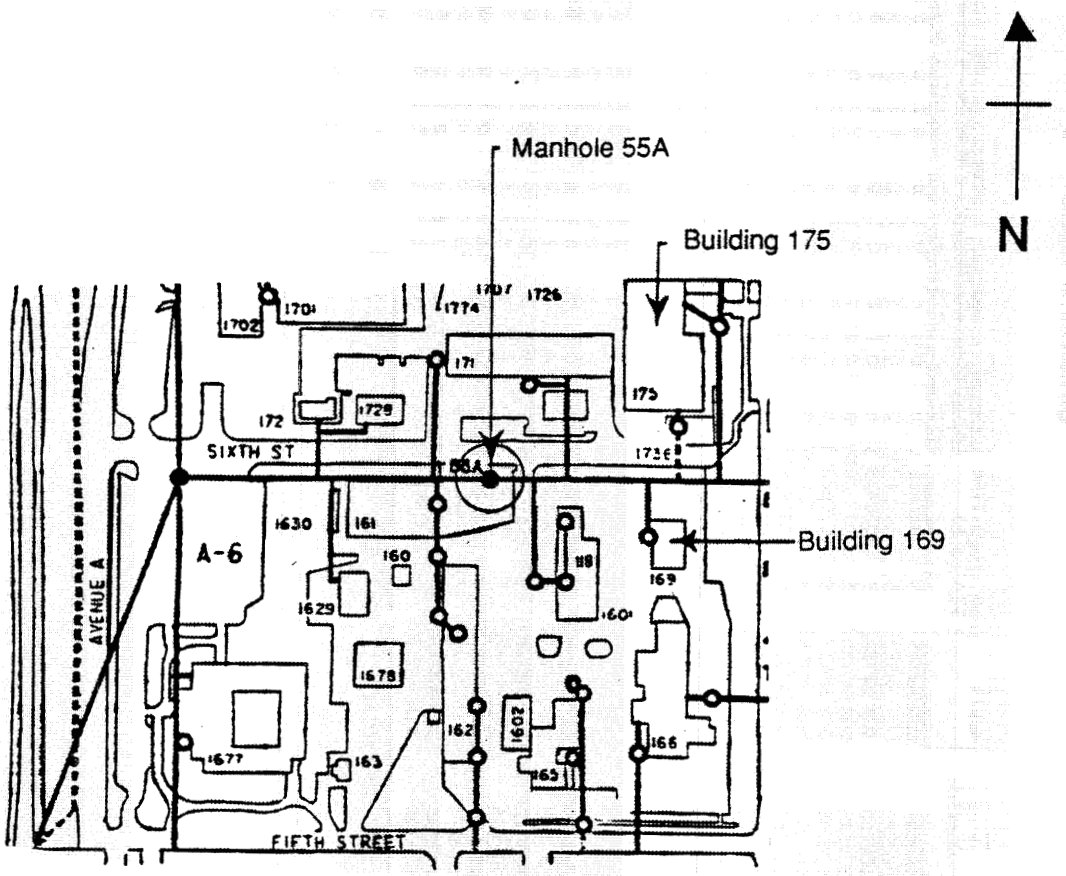

Figure L4.2e. Sanitary System Effluents from Buildings 169 and 175 (LLNL Request 12)

TABLE L4.2.2 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	HE NUMB HITS	HE 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
LL012	BLDG. 131	SEWERS	SUR WATER	9	8	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	8	8	0	0
LL012	BLDG. 131	SEWERS	SUR WATER	3	3	T COM	0	0	3	3	0	0	0	0	0	0	3	3	0	0	3	3
LL012	BLDG. 151	SEWERS	SUR WATER	9	8	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	8	8	0	0
LL012	BLDG. 151	SEWERS	SUR WATER	3	3	T COM	0	0	3	3	0	0	0	0	0	0	3	3	0	0	3	3
LL012	BLDG. 169	SEWERS	SUR WATER	9	8	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	8	8	0	0
LL012	BLDG. 169	SEWERS	SUR WATER	3	3	T COM	0	0	3	3	0	0	0	0	0	0	3	3	0	0	3	3
LL012	BLDG. 175	SEWERS	SUR WATER	3	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LL012	BLDG. 175	SEWERS	SUR WATER	3	0	T COM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LL012	BLDG. 222	SEWERS	SUR WATER	18	16	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	16	16	0	0
LL012	BLDG. 222	SEWERS	SUR WATER	6	6	T COM	0	0	6	6	0	0	0	0	0	0	6	6	0	0	6	6
LL012	BLDG. 241	SEWERS	SUR WATER	10	9	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	8	8	1	1
LL012	BLDG. 241	SEWERS	SUR WATER	2	2	T COM	0	0	2	2	0	0	0	0	0	0	2	2	0	0	2	2
LL012	BLDG. 298	SEWERS	SUR WATER	9	8	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	7	7	0	0
LL012	BLDG. 298	SEWERS	SUR WATER	3	3	T COM	0	0	3	3	0	0	0	0	0	0	3	3	0	0	3	3
LL012	BLDG. 321	SEWERS	SUR WATER	10	9	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	7	7	1	1
LL012	BLDG. 321	SEWERS	SUR WATER	2	2	T COM	0	0	2	2	0	0	0	0	0	0	2	2	0	0	2	2
LL012	BLDG. 322	SEWERS	SUR WATER	9	8	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	8	8	0	0
LL012	BLDG. 322	SEWERS	SUR WATER	3	3	T COM	0	0	3	3	0	0	0	0	0	0	3	3	0	0	3	3
LL012	BLDG. 331	SEWERS	SUR WATER	9	8	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	8	8	0	0
LL012	BLDG. 331	SEWERS	SUR WATER	3	3	T COM	0	0	3	3	0	0	0	0	0	0	2	2	0	0	3	3
LL012	BLDG. 511	SEWERS	SUR WATER	2	2	QC FL	0	0	2	2	0	0	0	0	0	0	1	2	0	0	2	2
LL012	BLDG. 511	SEWERS	SUR WATER	9	8	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	8	8	0	0
LL012	BLDG. 511	SEWERS	SUR WATER	2	2	QC RN	0	0	2	2	0	0	0	0	0	0	2	2	0	0	2	2
LL012	BLDG. 511	SEWERS	SUR WATER	3	3	T COM	0	0	3	3	0	0	0	0	0	0	2	2	0	0	3	3
		MED TOTAL		142	125		0	0	37	37	0	0	0	0	0	0	34	35	86	86	37	37
		EP TOTAL		142	125		0	0	37	37	0	0	0	0	0	0	34	35	86	86	37	37

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TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 131 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012011	LL012022	LL012033	LL012340	LL012351	LL012362
CONDUCTIVITY (MS/CM)		0.38	0.52	0.25	0.3	0.4	0.34
PH (UNITS)		7.4	8.1	8.4	7.9	8.7	8.9
TEMPERATURE (DEG C)		30	28	26	28	28	24

FIELD MEASUREMENTS	SAMP NO:	LL012715	LL012817	LL012884	LL012953	LL012964	
CONDUCTIVITY (MS/CM)		0.27	0.25	0.25	0.28	0.27	
PH (UNITS)		7.5	7.5	8.2	8.4	8.2	
TEMPERATURE (DEG C)		26	29	29	27	27	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012011C	LL012011D	LL012022B	LL012022C	LL012033B	LL012033C
	SDG NO:	LL001041F	LL012011D	LL003043F	LL012022C	LL003043F	LL012011D
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		348		528		237	
BARIUM		26 B		39 B		16 B	
CADMIUM		2.3 B		2.2 B		3.7 B	
CALCIUM		11300		8580		7390	
CHROMIUM		29		67		93	
COPPER		104		837		329	
IRON		630		765		542	
LEAD			13		9.6		77
MAGNESIUM		1860 B		1330 B		1300 B	
MANGANESE		35		28		21	
MERCURY			0.31		7.9		0.33
NICKEL		19 B		28 B		25 B	
POTASSIUM		24000		20000		26000	
SILVER		34		72		18	
SODIUM		32700		56700		23200	
VANADIUM		5 B		4 U		4 U	
ZINC		165		185 E		135 E	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012011A	LL012022A	LL012033A
	SDG NO:	D112	D111	D106
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
BENZOIC ACID		740 E	950 E	560 E
BIS(2-ETHYLHEXYL)PHTHALATE		50	39 B	52 B
DI-N-BUTYLPHTHALATE		11 U	10 U	3 JB
4-METHYLPHENOL		11 U	28	13
* BENZENE ACETIC ACID (17.89)			45 J	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 131 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: SDG NO: TYPE:	LL012011A D112 T. COMPOSITE	LL012022A D111 T. COMPOSITE	LL012033A D106 T. COMPOSITE			
* BENZENE PROPANOIC ACID (19.24)			9 J				
* CAFFEINE (27.13)				39 J			
* CAFFEINE (27.15)		77 J					
* CAFFEINE (27.17)			49 J				
* UNKNOWN (12.04)				19 J			
* UNKNOWN (12.19)			19 J				
* UNKNOWN (17.64)		13 J					
* UNKNOWN (17.85)				76 J			
* UNKNOWN (19.18)				14 J			
* UNKNOWN (19.76)				24 J			
* UNKNOWN (19.86)			17 J				
* UNKNOWN (20.06)			19 J				
* UNKNOWN (22.32)			7 J				
* UNKNOWN (22.99)				110 J			
* UNKNOWN (25.69)		17 J					
* UNKNOWN (25.91)				110 J			
* UNKNOWN (27.21)				18 J			
* UNKNOWN (28.31)		110 J					
* UNKNOWN (28.32)				74 J			
* UNKNOWN (28.50)				35 J			
* UNKNOWN (28.75)				530 J			
* UNKNOWN (29.79)				26 J			
* UNKNOWN (30.79)		1600 J					
* UNKNOWN (30.85)		1600 J					
* UNKNOWN (30.93)				910 JB			
* UNKNOWN (31.23)				620 J			
* UNKNOWN (31.28)				11 JB			
* UNKNOWN (31.29)		170 J					
* UNKNOWN (31.75)		23 J					
* UNKNOWN (31.76)				22 J			
* UNKNOWN (33.05)				8 J			
* UNKNOWN (33.66)		16 J					
* UNKNOWN (41.31)			18 J				
* UNKNOWN (41.43)		15 J					
* UNKNOWN (41.69)			80 J				
* UNKNOWN (42.54)				12 J			
* UNKNOWN ACID (19.67)		57 J					
* UNKNOWN ACID (19.80)			21 J				
* UNKNOWN ACID (22.91)		90 J					
* UNKNOWN ACID (22.98)			39 J				
* UNKNOWN ACID (25.87)		120 J					
* UNKNOWN ACID (25.91)			61 J				

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 131 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012011A	LL012022A	LL012033A			
	SDG NO:	D112	D111	D106			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
* UNKNOWN ACID (27.23)			16 J				
* UNKNOWN ACID (28.61)		790 J					
* UNKNOWN ACID (28.78)			680 J				
* UNKNOWN ACID (28.82)			13 J				
* UNKNOWN ACID (29.82)			10 J				
* UNKNOWN ACID (31.07)		620 J					
* UNKNOWN ACID (31.24)			670 J				
* UNKNOWN ACID (31.28)			15 J				
* UNKNOWN HYDROCARBON (28.35)			44 J				
* UNKNOWN HYDROCARBON (30.95)			1200 J				
* 9,10-ANTHRACENEDIONE (28.89)		27 J					

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012340A	LL012351A	LL012362A	LL012715A	LL012817A	LL012884A
	SDG NO:	0809	0911	0913	0809	0911	0911
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		610 BE	220 BE	18 B	36 B	20 B	15 B
BENZENE		1 J	5 U	5 U	5 U	5 U	5 U
CARBON DISULFIDE		5 U	4 J	5 U	5 U	5 U	5 U
CARBON TETRACHLORIDE		5 U	5 U	11	5 U	5 U	5 U
CHLOROFORM		15	11	11	12	15	14
ETHYLBENZENE		2 JB	5 U	1 J	1 JB	5 U	5 U
METHYLENE CHLORIDE		12 B	3 JB	2 J	12 B	14 B	2 JB
TOLUENE		2 JB	2 JB	1 J	2 JB	5 U	5 U
TRICHLOROETHENE		5 U	5 U	4 J	5 U	5 U	5 U
1,1,1-TRICHLOROETHANE		5 U	5 U	79	1 J	2 J	5 U
* DISULFIDE, DIMETHYL(16.95)							
* DISULFIDE, DIMETHYL(16.96)			22 J				
* ETHANOL(5.42)							
* ETHANOL(5.52)			43 J				
* ETHANOL(5.61)						63 J	
* ETHANOL(5.65)							
* PENTANE(14.01)							
* UNKNOWN(17.01)						14 J	
* UNKNOWN(19.57)							
* UNKNOWN(27.41)							
* UNKNOWN(3.2)							

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 131 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012953A	LL012964A				
	SDG NO:	0912	G911				
	TYPE:	GRAB	GRAB				
ACETONE		3 JB	11 B				
BENZENE		5 U	5 U				
CARBON DISULFIDE		5 U	5 U				
CARBON TETRACHLORIDE		5 U	5 U				
CHLOROFORM		15	10				
ETHYLBENZENE		5 U	5 U				
METHYLENE CHLORIDE		3 J	220 BE				
TOLUENE		1 J	2 J				
TRICHLOROETHENE		5 U	5 U				
1,1,1-TRICHLOROETHANE		5 U	2 J				
* DISULFIDE, DIMETHYL(16.95)		13 J					
* DISULFIDE, DIMETHYL(16.96)							
* ETHANOL(5.42)		15 J					
* ETHANOL(5.52)							
* ETHANOL(5.61)							
* ETHANOL(5.65)			91 J				
* PENTANE(14.01)		17 J					
* UNKNOWN(17.01)							
* UNKNOWN(19.57)		3 J					
* UNKNOWN(27.41)		11 J					
* UNKNOWN(3.2)		10 J					

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012011E	LL012022D	LL012033D			
	SDG NO:	LLL7216	LLL7245	LLL7296			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
CS-137		3 U	3 U	10			
G-ALPH		32	0	11			
GROSS-BETA		95	51	120			

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 151 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012044	LL012055	LL012066	LL012373	LL012384	LL012395
CONDUCTIVITY (MS/CM)		0.16	0.32	0.41	0.5	0.26	0.39
PH (UNITS)		8.2	8.6	8.5	8.7	8.1	8.9
TEMPERATURE (DEG C)		24	32	29	25	22	24

FIELD MEASUREMENTS	SAMP NO:	LL912156	LL912270	LL912281	LL912418	LL912429	
CONDUCTIVITY (MS/CM)		0.13	0.3	0.36	0.32	0.43	
PH (UNITS)		8.1	8	8.6	8.8	8.5	
TEMPERATURE (DEG C)		25	24	29	27	23	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012044C	LL012044D	LL012055B	LL012055C	LL012066B	LL012066C
	SDG NO:	LL003043F	LL012022C	LL003043F	LL012022C	LL012066B	LL001041G
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		268		163 B		181 B	
BARIUM		15 B		9.9 B		24 B	
CADMIUM		3 B		2 U		2 B	
CALCIUM		8850		9370		8680	
CHROMIUM		6.5 B		6 U		6 U	
COPPER		177		47		106	
IRON		1040		317		382	
LEAD			28		5.8		13
MAGNESIUM		1690 B		1400 B		1910 B	
MANGANESE		32		18		21	
MERCURY			0.05 B		0.05 B		0.06 B
NICKEL		10 B		6 U		7.6 B	
POTASSIUM		23000		23000		29000	
SILVER		10		29		6 U	
SODIUM		16200		23100		25300	
ZINC		132 E		64 E		97	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012044A	LL012055A	LL012066A			
	SDG NO:	D106	C827	D106			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
BENZOIC ACID		320 E	63	810 E			
BIS(2-ETHYLHEXYL)PHTHALATE		60 B	7 JB	33 B			
4-METHYLPHENOL		13 U	13	16			
* CAFFEINE (26.79)			7 J				
* CAFFEINE (27.15)		96 J					
* CAFFEINE (27.16)				48 J			

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 151 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012044A	LL012055A	LL012066A
	SDG NO:	D106	C827	D106
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
* UNKNOWN (9.05)			4 J	
* UNKNOWN (11.62)			9 J	
* UNKNOWN (11.77)			4 J	
* UNKNOWN (12.47)			5 J	
* UNKNOWN (12.64)			15 J	
* UNKNOWN (13.00)		81 J		
* UNKNOWN (14.62)			5 J	
* UNKNOWN (15.06)		12 J		
* UNKNOWN (15.92)			8 J	
* UNKNOWN (17.35)			32 J	
* UNKNOWN (17.89)		130 J		
* UNKNOWN (18.03)				180 J
* UNKNOWN (18.09)				17 J
* UNKNOWN (18.13)			2 J	
* UNKNOWN (18.81)			20 J	
* UNKNOWN (19.17)			3 J	
* UNKNOWN (19.20)		22 J		
* UNKNOWN (19.32)				45 J
* UNKNOWN (22.54)			9 J	
* UNKNOWN (22.90)		21 J		
* UNKNOWN (22.98)				56 J
* UNKNOWN (23.88)				20 J
* UNKNOWN (25.11)				21 J
* UNKNOWN (25.49)			6 J	
* UNKNOWN (25.58)		12 J		
* UNKNOWN (25.87)		55 J		
* UNKNOWN (25.91)				85 J
* UNKNOWN (27.24)				26 J
* UNKNOWN (27.71)		12 J		
* UNKNOWN (28.20)			8 J	
* UNKNOWN (28.33)				55 J
* UNKNOWN (28.34)		91 J		
* UNKNOWN (28.68)		560 J		
* UNKNOWN (28.74)		12 J		
* UNKNOWN (28.80)				840 J
* UNKNOWN (29.79)		13 J		
* UNKNOWN (29.82)				28 J
* UNKNOWN (30.44)				51 J
* UNKNOWN (30.79)		420 J		
* UNKNOWN (30.88)		320 J		
* UNKNOWN (30.95)				920 J
* UNKNOWN (31.14)		1400 J		

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 151 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012044A	LL012055A	LL012066A			
	SDG NO:	D106	C827	D106			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
* UNKNOWN (31.28)				1900 J			
* UNKNOWN (33.66)		220 J					
* UNKNOWN (33.84)				100 J			
* UNKNOWN (40.49)			77 J				
* UNKNOWN (40.96)			72 J				
* UNKNOWN (41.27)		24 J					
* UNKNOWN (41.29)				100 J			
* UNKNOWN (41.76)				46 J			
* UNKNOWN (41.89)		29 J					

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012373A	LL012384A	LL012395A	LL912156A	LL912270A	LL912281A
	SDG NO:	G912	0913	G913	0817	0819	0819
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		17 B	17 B	14 B	490 BE	9 JB	3100 BE
CHLOROFORM		9	21	9	8	18	13
ETHYLBENZENE		5 U	2 J	5 U	1 JB	5 U	2 JB
METHYLENE CHLORIDE		3 JB	2 J	2 JB	2 J	2 JB	2 JB
TOLUENE		5 U	1 J	5 U	1 JB	2 JB	2 JB
XYLENE (TOTAL)		5 U	5 U	5 U	5 U	5 U	8
* DISULFIDE, DIMETHYL(17.02)							3
* ETHANOL(5.33)					9 J		
* METHYLETHYLCYCLOHEXANE(47.89)							23
* 2-PROPANOL(8.79)							38

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL912418A	LL912429A
	SDG NO:	0824	0822
	TYPE:	GRAB	GRAB
ACETONE		10 B	19 B
CHLOROFORM		12	11
ETHYLBENZENE		5 U	1 JB
METHYLENE CHLORIDE		2 JB	2 JB
TOLUENE		1 J	2 JB
XYLENE (TOTAL)		5 U	5 U
* DISULFIDE, DIMETHYL(17.02)			
* ETHANOL(5.33)			
* METHYLETHYLCYCLOHEXANE(47.89)			
* 2-PROPANOL(8.79)			

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 151 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012044E	LL012055D	LL012066D			
	SDG NO:	LLL7267	LLL7264	LLL7292			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
G-ALPH		20	0	32			
GROSS-BETA		17	54	59			

S&A REQUEST: 012
LOCATION: BUILDING 169 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012077	LL012088	LL012099	LL012408	LL012419	LL012420
CONDUCTIVITY (MS/CM)		0.46	0.26	0.34	0.25	0.28	0.34
PH (UNITS)		7.4	8	7.9	8.3	9	9.7
TEMPERATURE (DEG C)		33	29	27	28	30	28

FIELD MEASUREMENTS	SAMP NO:	LL012771	LL012840	LL012895	LL012975	LL012986	
CONDUCTIVITY (MS/CM)		0.43	0.18	0.24	0.22	0.46	
PH (UNITS)		8.2	7.7	7.7	7.9	8.1	
TEMPERATURE (DEG C)		33	26	27	27	28	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012077C	LL012077D	LL012088B	LL012088C	LL012099B	LL012099C
	SDG NO:	LL001041F	LL012011D	LL003043F	LL012022C	LL003043F	LL012011D
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		226		180 B		174 B	
BARIUM		18 B		6.9 B		14 B	
CADMIUM		2.4 B		2.4 B		3.4 B	
CALCIUM		10400		7000		8050	
CHROMIUM		15		6 U		6 U	
COPPER		52		33		66	
IRON		1530		350		404	
LEAD			6.8		10		6.1
MAGNESIUM		2820 B		1110 B		1610 B	
MANGANESE		33		18		19	
MERCURY			0.49		0.06 B		1
NICKEL		9 B		46		16 B	
POTASSIUM		29000		27000		23000	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 169 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012077C	LL012077D	LL012088B	LL012088C	LL012099B	LL012099C
	SDG NO:	LL001041F	LL012011D	LL003043F	LL012022C	LL003043F	LL012011D
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
SILVER		53		26		125	
SODIUM		40800		16800		31100	
VANADIUM		5.8 B		4 U		4 U	
ZINC		179		385 E		287 E	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012077A	LL012088A	LL012099A			
	SDG NO:	D112	D111	D106			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
BENZOIC ACID		2400 E	750 E	63 U			
BIS(2-ETHYLHEXYL)PHTHALATE		25	51 B	140 B			
DI-N-BUTYLPHTHALATE		11 U	94	2 JB			
DIETHYLPHTHALATE		7 J	10 U	2 J			
4-METHYLPHENOL		11 U	39	13 U			
* BENZENE ACETIC ACID (17.62)		21 J					
* BENZENEPROPANOIC ACID (19.27)			10 J				
* CAFFEINE (27.14)		120 J					
* CAFFEINE (27.17)				52 J			
* CAFFEINE (27.20)			32 J				
* CHLORO-,PHENYLMETHYLPHE 27.96)			58 J				
* PHTHALIC ANHYDRIDE (18.78)			66 J				
* UNKNOWN (9.62)				130 J			
* UNKNOWN (9.84)				38 J			
* UNKNOWN (12.32)				180 J			
* UNKNOWN (12.36)			90 J				
* UNKNOWN (14.79)				84 J			
* UNKNOWN (16.61)				48 J			
* UNKNOWN (17.82)				110 J			
* UNKNOWN (17.94)			70 J				
* UNKNOWN (22.28)		17 J					
* UNKNOWN (22.30)			180 J				
* UNKNOWN (22.93)				23 J			
* UNKNOWN (25.09)				17 J			
* UNKNOWN (25.88)				40 J			
* UNKNOWN (26.88)			8 J				
* UNKNOWN (27.89)				20 J			
* UNKNOWN (28.36)				100 J			
* UNKNOWN (28.50)			10 J				
* UNKNOWN (28.52)				47 JB			
* UNKNOWN (28.72)				280 J			
* UNKNOWN (30.39)		10 J					

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 169 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012077A	LL012088A	LL012099A			
	SDG NO:	D112	D111	D106			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
* UNKNOWN (30.82)				310 J			
* UNKNOWN (30.83)			210 J				
* UNKNOWN (30.90)				280 J			
* UNKNOWN (30.91)			240 J				
* UNKNOWN (31.17)				1200 J			
* UNKNOWN (31.63)			46 J				
* UNKNOWN (33.82)		29 J					
* UNKNOWN (33.86)				570 J			
* UNKNOWN (33.92)			1500 J				
* UNKNOWN (41.63)			80 J				
* UNKNOWN (41.98)				100 J			
* UNKNOWN (42.85)		20 J					
* UNKNOWN ACID (22.88)		28 J					
* UNKNOWN ACID (22.93)			15 J				
* UNKNOWN ACID (25.88)			18 J				
* UNKNOWN ACID (28.34)			15 J				
* UNKNOWN ACID (28.54)		110 J					
* UNKNOWN ACID (28.71)			42 J				
* UNKNOWN ACID (31.18)			990 J				
* UNKNOWN PHTHALATE (26.78)			81 J				
* 9,10-ANTHRACENEDIONE (28.89)		19 J					

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012408A	LL012419A	LL012420A	LL012771A	LL012840A	LL012895A
	SDG NO:	0809	G911	G912	0809	0911	0815
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		7 JB	87 B	17 B	12 B	22 B	75 B
CHLOROFORM		21	19	21	5	21	11
ETHYLBENZENE		1 JB	5 U	5 U	1 JB	2 JB	1 JB
METHYLENE CHLORIDE		28 B	2 JB	2 JB	19 B	3 JB	44
TOLUENE		0.9 JB	5 U	5 U	1 JB	1 JB	1 JB
XYLENE (TOTAL)		5 U	5 U	5 U	5 U	2 J	5 U
1,2-DICHLOROETHENE		5 U	5 U	5 U	2 J	5 U	5 U
* UNKNOWN(16.96)							
* UNKNOWN(17.2)							
* UNKNOWN(37.3)							
* UNKNOWN(4.1)					290 J		
* UNKNOWN(4.81)					11 J		
* UNKNOWN(5.38)							

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 169 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012975A	LL012986A				
	SDG NO:	0913	0912				
	TYPE:	GRAB	GRAB				
ACETONE		9 JB	12 B				
CHLOROFORM		25	9				
ETHYLBENZENE		5 U	5 U				
METHYLENE CHLORIDE		130	6				
TOLUENE		1 J	1 J				
XYLENE (TOTAL)		5 U	5 U				
1,2-DICHLOROETHENE		5 U	5 U				
* UNKNOWN(16.96)			1 J				
* UNKNOWN(17.2)			2 J				
* UNKNOWN(37.3)		66 J					
* UNKNOWN(4.1)		6 J					
* UNKNOWN(4.81)							
* UNKNOWN(5.38)							

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012077E	LL012088D	LL012099D			
	SDG NO:	LLL7216	LLL7245	LLL7296			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
CS-137		110	18	4.9 U			
EU-152		680	216				
EU-154		210	81				
EU-155		73	32				
G-ALPH		14	0	0			
GROSS-BETA		840	200	120			

S&A REQUEST: 012
LOCATION: BUILDING 222 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012135	LL012146	LL012157	LL012464	LL012475	LL012486
CONDUCTIVITY (MS/CM)		0.28	0.18	0.11	0.21	0.15	0.18
PH (UNITS)		8.4	8.2	8.7	7.9	8.7	8.5
TEMPERATURE (DEG C)		27	27	28	22	21	21

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 222 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL912021	LL912032	LL912043	LL912065	LL912076	LL912098
CONDUCTIVITY (MS/CM)		0.12	0.19	0.21	0.18	0.11	0.13
PH (UNITS)		8.3	8.1	8.5	8.3	8.4	8.3
TEMPERATURE (DEG C)		26	28	28	27	24	24

FIELD MEASUREMENTS	SAMP NO:	LL912189	LL912190	LL912203	LL912214	LL912225	LL912327
CONDUCTIVITY (MS/CM)		0.11	0.13	0.25	0.19	0.21	0.16
PH (UNITS)		8	8.5	8.7	7.8	7.9	8
TEMPERATURE (DEG C)		23	25	22	24	25	24

FIELD MEASUREMENTS	SAMP NO:	LL912338	LL912349	LL912350	LL912361		
CONDUCTIVITY (MS/CM)		0.06	0.15	0.13	0.23		
PH (UNITS)		9.1	7.5	7.4	8.7		
TEMPERATURE (DEG C)		27	20	26	27		

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012135C	LL012135D	LL012146B	LL012146C	LL012157B	LL012157C
	SDG NO:	LL003043F	LL012011D	LL003043F	LL012022C	LL012066B	LL001041G
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		219		142 B		209	
ANTIMONY		30 U		30 U		30 U	
BARIUM		26 B		13 B		15 B	
BERYLLIUM		0.3 U		0.3 U		0.83 B	
CADMIUM		4.4 B		2 U		2 U	
CALCIUM		8740		7640		7650	
CHROMIUM		18		6 U		6 U	
COPPER		61		31		31	
IRON		1090		230		458	
LEAD			26		5.5		4.9 B
MAGNESIUM		1330 B		1000 B		1140 B	
MANGANESE		26		15 B		20	
MERCURY			0.51		0.22		0.16 B
NICKEL		17 B		6.5 B		8.4 B	
POTASSIUM		11000		12000		9400	
SILVER		6 U		6 U		6 U	
SODIUM		14600		14000		6500	
ZINC		131 E		97 E		97	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 222 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL912021B	LL912021C	LL912032B	LL912032C	LL912043B	LL912043C
	SDG NO:	LL003043F	LL012011D	LL003043F	LL012022C	LL012066B	LL015014H
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		197 B		1350		248	
ANTIMONY		30 U		78		30 U	
BARIUM		14 B		156 B		16 B	
BERYLLIUM		0.3 U		0.3 U		0.3 U	
CADMIUM		2 U		2 U		2 U	
CALCIUM		6450		6460		6030	
CHROMIUM		388		6.6 B		6 U	
COPPER		63		41		66	
IRON		250		294		235	
LEAD			10		3.5 B	30 U	
MAGNESIUM		632 B		880 B		864 B	
MANGANESE		13 B		20		15 B	
MERCURY			0.05 B		85		2.1
NICKEL		47		92		39 B	
POTASSIUM		11000		14000		13000	
SILVER		18		77		189	
SODIUM		9410		11800		7810	
ZINC		79 E		63 E		57	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012135A	LL012146A	LL012157A	LL912021A	LL912032A	LL912043A
	SDG NO:	D106	C827	D106	D105	C827	D108
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
BENZOIC ACID		730 E	78	240 E	65 U	13 J	50 J
BIS(2-ETHYLHEXYL)PHTHALATE		150 B	57 B	45 B	58 B	27 B	16 B
BUTYLBENZYLPHTHALATE		13 U	10 U	13 U	2 JB	10 U	13 U
DIETHYLPHTHALATE		2 J	10 U	13 U	1 J	10 U	13 U
4-METHYLPHENOL		17	25	7 J	13 U	2 J	13 U
* BENZENE PROPANOIC ACID (19.21)						6 J	5 J
* CAFFEINE (26.80)					6 J		
* CAFFEINE (27.10)				10 J			
* CAFFEINE (27.12)							
* CAFFEINE (27.13)		17 J					16 J
* CAFFEINE (27.16)							3 J
* ETHYL BENZOIC ACID (18.73)							10 J
* SULFUR, S8 (29.80)						5 J	
* UNKNOWN (8.05)						3 J	
* UNKNOWN (8.27)							
* UNKNOWN (8.64)		17 J				3 J	
* UNKNOWN (9.05)							
* UNKNOWN (9.18)			4 J				

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 222 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012135A	LL012146A	LL012157A	LL912021A	LL912032A	LL912043A
	SDG NO:	D106	C827	D106	D105	C827	D108
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
* UNKNOWN (9.84)		17 J					
* UNKNOWN (12.47)			3 J				
* UNKNOWN (12.63)			53 J				
* UNKNOWN (13.02)				64 J			
* UNKNOWN (13.05)		180 J					
* UNKNOWN (13.17)		130 J					
* UNKNOWN (14.53)						2 J	
* UNKNOWN (14.64)			5 J				
* UNKNOWN (15.09)				9 J			
* UNKNOWN (15.17)		12 J					
* UNKNOWN (15.70)			30 J				
* UNKNOWN (17.01)							3 J
* UNKNOWN (17.21)			6 J				
* UNKNOWN (17.24)						18 J	
* UNKNOWN (17.39)		61 J					
* UNKNOWN (17.47)			2 J				
* UNKNOWN (17.76)							30 J
* UNKNOWN (17.79)				63 J			
* UNKNOWN (17.83)		52 J					
* UNKNOWN (17.87)				28 J			
* UNKNOWN (17.99)			2 J			4 J	
* UNKNOWN (18.25)			4 J				
* UNKNOWN (18.74)						2 J	
* UNKNOWN (19.13)						95 J	
* UNKNOWN (19.18)				11 J			
* UNKNOWN (19.24)		13 J					
* UNKNOWN (19.49)						74 J	
* UNKNOWN (22.86)					5 J		
* UNKNOWN (22.89)				20 J			
* UNKNOWN (22.92)		20 J					
* UNKNOWN (23.16)						4 J	
* UNKNOWN (23.87)				13 J			
* UNKNOWN (25.04)					5 J		
* UNKNOWN (25.21)							4 J
* UNKNOWN (25.80)					11 J		
* UNKNOWN (25.85)		33 J					
* UNKNOWN (25.86)				31 J			
* UNKNOWN (27.16)					3 J		
* UNKNOWN (27.19)		13 J					
* UNKNOWN (27.20)				12 J			
* UNKNOWN (27.50)							4 J
* UNKNOWN (27.80)			6 J				

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 222 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012135A	LL012146A	LL012157A	LL912021A	LL912032A	LL912043A
	SDG NO:	D106	C827	D106	D105	C827	D108
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
* UNKNOWN (27.96)			5 J				
* UNKNOWN (28.06)					7 J		
* UNKNOWN (28.19)			7 J				
* UNKNOWN (28.29)		30 J					
* UNKNOWN (28.30)					27 J		
* UNKNOWN (28.32)				43 J			13 J
* UNKNOWN (28.58)					120 J		
* UNKNOWN (28.65)		340 J					
* UNKNOWN (28.69)				370 J			
* UNKNOWN (29.47)			5 J				
* UNKNOWN (30.03)				11 J			
* UNKNOWN (30.09)		30 J					
* UNKNOWN (30.26)			180 J				
* UNKNOWN (30.55)					20 J		
* UNKNOWN (30.73)					37 J		
* UNKNOWN (30.78)				220 J			
* UNKNOWN (30.80)					60 J		
* UNKNOWN (30.86)		290 J					
* UNKNOWN (30.88)				200 J			
* UNKNOWN (30.90)							160 J
* UNKNOWN (30.98)						12 J	
* UNKNOWN (31.04)					270 J		
* UNKNOWN (31.15)		1000 J		930 J			
* UNKNOWN (31.77)							6 J
* UNKNOWN (33.80)					8 J		
* UNKNOWN (33.83)							5 J
* UNKNOWN (34.66)					9 J		
* UNKNOWN (37.56)					4 J		
* UNKNOWN (37.80)					67 J		
* UNKNOWN (38.04)					29 J		
* UNKNOWN (39.72)					15 J		
* UNKNOWN (40.47)			220 J				
* UNKNOWN (40.52)						28 J	
* UNKNOWN (40.95)			170 J				
* UNKNOWN (40.97)						44 J	
* UNKNOWN (41.27)					31 J		
* UNKNOWN (41.28)		100 J		310 J			
* UNKNOWN (41.33)							35 J
* UNKNOWN (41.71)				220 J			
* UNKNOWN (42.01)							53 J
* UNKNOWN (43.19)			30 J				
* UNKNOWN (43.82)			19 J				

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 222 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012135A	LL012146A	LL012157A	LL912021A	LL912032A	LL912043A
	SDG NO:	D106	C827	D106	D105	C827	D108
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
* UNKNOWN ACID (22.92)							11 J
* UNKNOWN ACID (25.87)							16 J
* UNKNOWN ACID (27.22)							6 J
* UNKNOWN ACID (28.68)							230 J
* UNKNOWN ACID (31.14)							460 J
* UNKNOWN ACID (31.19)							27 J
* UNKNOWN HYDROCARBON (25.04)		14 J					

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012464A	LL012475A	LL012486A	LL912065A	LL912076A	LL912098A
	SDG NO:	G912	0913	G913	0817	0817	0817
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		35 B	2 JB	100 B	150 B	9 JB	11 B
BENZENE		5 U	5 U	5 U	5 U	5 U	5 U
CHLOROFORM		10	22	3 J	8	19	15
ETHYLBENZENE		5 U	5 U	5 U	5 U	1 JB	1 JB
METHYLENE CHLORIDE		3 JB	2 J	3 JB	3 J	5 U	5 U
TOLUENE		5 U	5 U	5 U	1 JB	1 JB	1 JB
XYLENE (TOTAL)		5 U	5 U	5 U	5 U	5 U	5 U
* ETHANOL(5.43)							
* UNKNOWN(4.1)							
* 2-PROPANOL(8.79)							

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL912189A	LL912190A	LL912203A	LL912214A	LL912225A	LL912327A
	SDG NO:	0818	0818	0818	0818	0818	0823
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		41 B	500 BE	21 B	15 B	260 BE	3700 BE
BENZENE		5 U	5 U	5 U	5 U	8	5 U
CHLOROFORM		25	6	20	22	15	11
ETHYLBENZENE		1 JB	1 JB	1 JB	1 JB	1 JB	2 JB
METHYLENE CHLORIDE		5 U	5 U	5 U	5 U	5 U	5 J
TOLUENE		1 JB	1 JB	1 JB	5 U	2 JB	1 JB
XYLENE (TOTAL)		5 U	5 U	5 U	5 U	5 U	2 J
* ETHANOL(5.43)							
* UNKNOWN(4.1)							7 J
* 2-PROPANOL(8.79)							24 J

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 222 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL912338A	LL912349A	LL912350A	LL912361A		
	SDG NO:	0823	0823	0825	0823		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
ACETONE		3800 BE	330 BE	9 JB	12 B		
BENZENE		5 U	5 U	5 U	5 U		
CHLOROFORM		12	16	16	21		
ETHYLBENZENE		1 JB	1 JB	2 JB	1 JB		
METHYLENE CHLORIDE		5 U	5 U	3 J	5 U		
TOLUENE		1 JB	1 JB	1 JB	2 JB		
XYLENE (TOTAL)		5 U	5 U	5 U	5 U		
* ETHANOL(5.43)		52 J					
* UNKNOWN(4.1)							
* 2-PROPANOL(8.79)		21 J	16 J				

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012135E	LL012146D	LL012157D	LL912021D	LL912032D	LL912043D
	SDG NO:	LLL7267	LLL7264	LLL7292	LLL7267	LLL7264	LLL7292
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
CS-137		3 U	3 U	3.8 U	10	3.8	4 U
EU-152					32		
G-ALPH		0	20	38	7	51	0
GROSS-BETA		76	10	100	100	65	110

S&A REQUEST: 012
LOCATION: BUILDING 241 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012168	LL012179	LL012180	LL012497	LL012500	LL012511
CONDUCTIVITY (MS/CM)		0.21	0.22	0.42	0.68	0.43	0.17
PH (UNITS)		8.1	8.3	8.8	8.7	8.4	8.6
TEMPERATURE (DEG C)		25	28	31	23	21	22

FIELD MEASUREMENTS	SAMP NO:	LL912112	LL912236	LL912247	LL912372	LL912383	
CONDUCTIVITY (MS/CM)		0.21	0.26	0.26	0.29	0.27	
PH (UNITS)		8.1	8.3	7.9	8.4	8.3	
TEMPERATURE (DEG C)		25	26	29	25	26	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 241 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012168B	LL012168C	LL012179B	LL012179C	LL012180B	LL012180C
	SDG NO:	LL003043F	LL012022C	LL003043F	LL012022C	LL012066B	LL001041G
	TYPE:	GRAB	GRAB	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		135 B		189 B		149 B	
BARIUM		9.2 B		12 B		13 B	
CADMIUM		2.7 B		2.7 B		2 U	
CALCIUM		6790		9890		9010	
COPPER		27		36		38	
IRON		1060		352		512	
LEAD			9.6		4.1 B		2.8 B
MAGNESIUM		855 B		1460 B		1870 B	
MANGANESE		18		21		22	
MERCURY			0.12 B		0.05 B		0.14 B
NICKEL		7.2 B		7 B		6.2 B	
POTASSIUM		14000		14000		29000	
SILVER		6 U		34		6 U	
SODIUM		10400		20100		24200	
ZINC		30 E		72 E		101	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012168A	LL012179A	LL012180A			
	SDG NO:	D105	C827	D106			
	TYPE:	GRAB	T. COMPOSITE	T. COMPOSITE			
BENZOIC ACID		33 J	139	1700 E			
BIS(2-ETHYLHEXYL)PHTHALATE		13 U	25	23 B			
DI-N-BUTYLPHTHALATE		13 U	10 U	3 J			
PHENOL		13 U	3 J	13 U			
4-METHYLPHENOL		13 U	40	88			
* CAFFEINE (27.21)				77 J			
* CAFFEINE (27.41)		5 J					
* UNKNOWN (9.03)			4 J				
* UNKNOWN (11.79)			5 J				
* UNKNOWN (12.49)			8 J				
* UNKNOWN (12.67)			100 J				
* UNKNOWN (13.11)				320 J			
* UNKNOWN (14.10)			2 J				
* UNKNOWN (14.68)			8 J				
* UNKNOWN (16.07)			13 J				
* UNKNOWN (16.99)		19 J					
* UNKNOWN (17.37)			37 J				
* UNKNOWN (17.80)		150 J					
* UNKNOWN (17.99)			3 J				
* UNKNOWN (18.17)				200 J			
* UNKNOWN (18.83)			28 J				

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 241 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: LL012168A SDG NO: D105 TYPE: GRAB	LL012179A C827 T. COMPOSITE	LL012180A D106 T. COMPOSITE
* UNKNOWN (19.09)	5 J		
* UNKNOWN (19.39)			24 J
* UNKNOWN (22.55)		13 J	
* UNKNOWN (22.84)	5 JB		
* UNKNOWN (22.92)	3 J		
* UNKNOWN (22.99)			59 J
* UNKNOWN (23.60)	4 J		
* UNKNOWN (25.04)	3 J		
* UNKNOWN (25.33)			39 J
* UNKNOWN (25.35)	5 J		
* UNKNOWN (25.55)		15 J	
* UNKNOWN (25.67)			26 J
* UNKNOWN (25.79)	8 JB		
* UNKNOWN (25.92)			61 J
* UNKNOWN (26.41)	5 J		
* UNKNOWN (27.09)	7 J		
* UNKNOWN (28.20)		21 J	
* UNKNOWN (28.32)	72 J		
* UNKNOWN (28.35)			57 J
* UNKNOWN (28.51)			78 J
* UNKNOWN (28.54)	47 J		
* UNKNOWN (28.68)	54 J		
* UNKNOWN (28.71)			250 J
* UNKNOWN (29.28)			23 J
* UNKNOWN (30.69)		24 J	
* UNKNOWN (30.76)	56 J		
* UNKNOWN (30.79)			350 J
* UNKNOWN (30.93)			270 J
* UNKNOWN (30.98)	63 JB		
* UNKNOWN (31.18)			1100 J
* UNKNOWN (33.84)			64 J
* UNKNOWN (40.47)		150 J	
* UNKNOWN (40.96)		160 J	
* UNKNOWN (41.08)			100 J
* UNKNOWN (41.57)			70 J
* UNKNOWN (43.22)		24 J	
* UNKNOWN (43.82)		22 J	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 241 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012497A	LL012500A	LL012511A	LL912112A	LL912236A	LL912247A
	SDG NO:	0912	G913	0913	0818	0818	0819
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		25 B	18 B	4 JB	10 U	570 BE	370 BE
CHLOROFORM		13	11	30	12	25	18
ETHYLBENZENE		5 U	5 U	2 J	1 JB	2 JB	2 JB
METHYLENE CHLORIDE		2 J	2 JB	2 J	5 U	5 U	2 JB
TOLUENE		1 J	5 U	5 U	1 JB	4 JB	1 JB
XYLENE (TOTAL)		5 U	5 U	5 U	5 U	5 U	2 J
* DISULFIDE, DIMETHYL(17.01)							6 J
* 2-PROPANOL(8.79)							13 J

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL912372A	LL912383A
	SDG NO:	0823	0822
	TYPE:	GRAB	GRAB
ACETONE		22 B	13 B
CHLOROFORM		15	16
ETHYLBENZENE		1 JB	5 U
METHYLENE CHLORIDE		5 U	2 JB
TOLUENE		0.9 JB	1 JB
XYLENE (TOTAL)		5 U	5 U
* DISULFIDE, DIMETHYL(17.01)			
* 2-PROPANOL(8.79)			

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012168D	LL012179D	LL012180D
	SDG NO:	LLL7267	LLL7264	LLL7292
	TYPE:	GRAB	T. COMPOSITE	T. COMPOSITE
G-ALPH		0	13	0
GROSS-BETA		49	10	65

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 298 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012191	LL012204	LL012215	LL012522	LL012533	LL012544
CONDUCTIVITY (MS/CM)		0.38	0.47	0.48	0.4	0.34	0.44
PH (UNITS)		8.3	8.5	8.5	8.3	8.6	8.8
TEMPERATURE (DEG C)		33	30	29	27	28	24

FIELD MEASUREMENTS	SAMP NO:	LL012793	LL012851	LL012908	LL012997	LL912010	
CONDUCTIVITY (MS/CM)		0.22	0.35	0.5	0.42	0.18	
PH (UNITS)		8.2	8.8	8.7	9.4	8.4	
TEMPERATURE (DEG C)		33	27	27	28	25	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012191C	LL012191D	LL012204B	LL012204C	LL012215B	LL012215C
	SDG NO:	LL001041F	LL012011D	LL003043F	LL012022C	LL003043F	LL012011D
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		529		300		266	
BARIUM		45 B		27 B		42 B	
BERYLLIUM		1.3 B		0.3 U		3.5 B	
CADMIUM		2.7 B		3 B		3.6 B	
CALCIUM		9660		8890		8470	
CHROMIUM		30		6 U		11	
COPPER		70		42		49	
IRON		1660		608		1060	
LEAD			9.6		11		8.4
MAGNESIUM		1550 B		1530 B		1620 B	
MANGANESE		42		29		29	
MERCURY			0.83		1.1		0.21
NICKEL		9.7 B		8.3 B		11 B	
POTASSIUM		22000		24000		22000	
SILVER		339		98		144	
SODIUM		22000		24400		36500	
ZINC		148		134 E		190 E	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012191A	LL012204A	LL012215A			
	SDG NO:	D113	D111	D105			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
BENZOIC ACID		520 E	320 E	65 U			
BENZYL ALCOHOL		11 U	57	13 U			
BIS(2-ETHYLHEXYL)PHTHALATE		340	97 B	56 B			
DI-N-BUTYLPHTHALATE		3 J	10 U	10 JB			
DI-N-OCTYLPHTHALATE		8 J	10 U	13 U			

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 298 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012191A	LL012204A	LL012215A
	SDG NO:	D113	D111	D105
	TYPE:	I. COMPOSITE	I. COMPOSITE	I. COMPOSITE
DIETHYLPHTHALATE		3 J	10 U	2 J
4-METHYLPHENOL		13	13	13 U
* ANTHRACENEDIONE (28.87)		10 J		
* BENZENE ACETIC ACID (17.72)			18 J	
* CAFFEINE (27.14)		45 J		
* CAFFEINE (27.18)				110 J
* CAFFEINE (27.21)			100 J	
* INDOLE-2,3-DIONE (25.05)				11 J
* PHTHALIC ANHYDRIDE (18.69)				8 J
* UNKNOWN (12.59)			21 J	
* UNKNOWN (12.98)		150 J		52 J
* UNKNOWN (13.04)			37 J	
* UNKNOWN (15.00)		10 J		
* UNKNOWN (16.77)		50 J		
* UNKNOWN (17.68)		38 J		
* UNKNOWN (17.84)			24 J	
* UNKNOWN (18.08)		9 J		
* UNKNOWN (18.79)			15 J	
* UNKNOWN (19.11)				19 J
* UNKNOWN (19.82)				9 J
* UNKNOWN (20.23)		23 J		
* UNKNOWN (22.32)			19 J	
* UNKNOWN (22.91)				22 J
* UNKNOWN (23.46)			37 J	
* UNKNOWN (27.46)			36 J	
* UNKNOWN (28.29)		17 J		
* UNKNOWN (28.35)				120 J
* UNKNOWN (28.38)			64 J	
* UNKNOWN (28.53)		23 J		
* UNKNOWN (30.09)			24 J	
* UNKNOWN (30.74)		16 J		
* UNKNOWN (30.81)				520 J
* UNKNOWN (30.84)		34 J		
* UNKNOWN (30.91)				390 J
* UNKNOWN (31.03)			1100 J	
* UNKNOWN (31.04)		190 J		
* UNKNOWN (31.73)				14 J
* UNKNOWN (32.40)			22 J	
* UNKNOWN (33.70)		1400 J		
* UNKNOWN (33.82)				250 J
* UNKNOWN (41.26)				17 J
* UNKNOWN (41.32)			80 J	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 298 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012191A	LL012204A	LL012215A			
	SDG NO:	D113	D111	D105			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
* UNKNOWN (41.85)			40 J				
* UNKNOWN ACID (19.81)			27 J				
* UNKNOWN ACID (22.92)		38 J					
* UNKNOWN ACID (23.12)			180 J				
* UNKNOWN ACID (25.85)		27 J					
* UNKNOWN ACID (25.86)				38 J			
* UNKNOWN ACID (25.98)			120 J				
* UNKNOWN ACID (28.69)				210 J			
* UNKNOWN ACID (28.85)			1000 J				
* UNKNOWN ACID (29.78)				9 J			
* UNKNOWN ACID (31.14)				820 J			
* UNKNOWN ACID (31.30)				26 J			
* UNKNOWN ACID (31.32)			700 J				
* UNKNOWN HYDROCARBON (24.96)		11 J					
* UNKNOWN HYDROCARBON (25.06)		6 J					
* UNKNOWN HYDROCARBON (26.39)		11 J					
* 9,10-ANTHRACENEDIME (28.84)				17 J			

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012522A	LL012544A	LL012793A	LL012851A	LL012908A	LL012997A
	SDG NO:	0808	0913	0808	0815	0815	0912
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		21 B	22 B	11 B	41 B	22 B	11 B
CARBON DISULFIDE		5 U	1 J	5 U	5 U	5 U	5 U
CHLOROFORM		12	12	8	17	10	20
ETHYLBENZENE		1 JB	1 J	5 U	2 JB	1 JB	5 U
METHYLENE CHLORIDE		11 B	3 J	11 B	5 U	5 U	2 JB
TOLUENE		2 J	1 J	0.7 J	0.9 JB	1 JB	5 U
* DISULFIDE, DIMETHYL(16.96)					18 J		
* DISULFIDE, DIMETHYL(17)			20 J				
* ETHANOL(5.38)		10 J					
* ETHANOL(5.61)							10 J
* UNKNOWN HYDROCARBON(47.93)			5 J				
* UNKNOWN(3.2)			14 J				
* UNKNOWN(5.33)					35 J		

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 298 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL912010A
	SDG NO:	G912
	TYPE:	GRAB
ACETONE		46 B
CARBON DISULFIDE		5 U
CHLOROFORM		11
ETHYLBENZENE		5 U
METHYLENE CHLORIDE		4 JB
TOLUENE		5 U
* DISULFIDE, DIMETHYL(16.96)		
* DISULFIDE, DIMETHYL(17)		
* ETHANOL(5.38)		
* ETHANOL(5.61)		
* UNKNOWN HYDROCARBON(47.93)		
* UNKNOWN(3.2)		
* UNKNOWN(5.33)		

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012191E	LL012204D	LL012215D
	SDG NO:	LLL7216	LLL7245	LLL7296
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
CE-141		32		
CE-144		62		
G-ALPH		0	19	0
GROSS-BETA		380	51	32
NB-95		140		
ZR-95		68		

S&A REQUEST: 012
LOCATION: BUILDING 321 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012226	LL012237	LL012248	LL012555	LL012566	LL012577
CONDUCTIVITY (MS/CM)		0.46	0.48	0.33	0.58	0.29	0.22
PH (UNITS)		8.1	8.6	8.2	7.9	8.6	7.9
TEMPERATURE (DEG C)		30	32	30	26	29	23

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 321 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012737	LL012828	LL012862	LL012919	LL012920	
CONDUCTIVITY (MS/CM)		0.23	0.48	0.38	0.27	0.43	
PH (UNITS)		7.6	8.7	8.5	7.9	8	
TEMPERATURE (DEG C)		27	29	28	27	29	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012226C	LL012226D	LL012237B	LL012237C	LL012248B	LL012248C
	SDG NO:	LL001041F	LL012011D	LL003043F	LL012022C	LL003043F	LL012011D
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	GRAB	GRAB
ALUMINUM		220		269		231	
BARIUM		23 B		25 B		18 B	
CADMIUM		2 B		3.4 B		2 U	
CALCIUM		9110		9440		8470	
CHROMIUM		7.2 B		6 U		6 U	
COPPER		58		123		124	
IRON		405		863		471	
LEAD			22		27		29
MAGNESIUM		1810 B		1530 B		1520 B	
MANGANESE		24		32		20	
MERCURY			0.27		0.06 B		0.07 B
NICKEL		6 U		21 B		7.2 B	
POTASSIUM		25000		18000		18000	
SODIUM		27200		27700		22700	
VANADIUM		4.9 B		4 U		4 U	
ZINC		84		124 E		133 E	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012226A	LL012237A	LL012248A
	SDG NO:	D112	D111	D105
	TYPE:	T. COMPOSITE	T. COMPOSITE	GRAB
BENZOIC ACID		440 E	50 U	65 U
BIS(2-ETHYLHEXYL)PHTHALATE		17	59 B	30 B
DI-N-BUTYLPHTHALATE		3 J	10 U	20 B
DIETHYLPHTHALATE		5 J	10 U	2 J
PHENOL		4 J	10 U	13 U
4-METHYLPHENOL		12	10 U	13 U
* BENZENEPROPANOIC ACID (19.25)		13 J		
* CAFFEINE (27.14)				75 J
* CAFFEINE (27.19)			57 J	
* CAFFEINE (27.20)		73 J		
* UNKNOWN (12.96)				50 J
* UNKNOWN (13.11)		380 J		
* UNKNOWN (15.14)		11 J		

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 321 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012226A	LL012237A	LL012248A
	SDG NO:	D112	D111	D105
	TYPE:	T. COMPOSITE	T. COMPOSITE	GRAB
* UNKNOWN (17.92)		120 J		
* UNKNOWN (19.82)				4 J
* UNKNOWN (20.17)		9 J		
* UNKNOWN (23.47)			41 J	
* UNKNOWN (23.71)				4 J
* UNKNOWN (24.54)		8 J		
* UNKNOWN (25.12)				5 J
* UNKNOWN (25.20)			26 J	
* UNKNOWN (25.22)		17 J		
* UNKNOWN (25.80)				10 J
* UNKNOWN (26.30)				5 J
* UNKNOWN (26.37)			17 J	
* UNKNOWN (26.95)			35 J	
* UNKNOWN (27.43)			66 J	
* UNKNOWN (28.29)				39 J
* UNKNOWN (28.36)		45 J	44 J	
* UNKNOWN (28.49)				9 J
* UNKNOWN (28.54)		80 J		
* UNKNOWN (30.10)			25 J	
* UNKNOWN (30.67)				24 J
* UNKNOWN (30.73)				21 J
* UNKNOWN (30.80)		190 J		
* UNKNOWN (30.82)			230 J	
* UNKNOWN (30.90)		150 J		
* UNKNOWN (30.91)				29 J
* UNKNOWN (30.93)			150 J	
* UNKNOWN (31.01)				100 J
* UNKNOWN (31.87)			38 J	
* UNKNOWN (32.13)				10 J
* UNKNOWN (32.41)			39 J	
* UNKNOWN (33.32)			45 J	
* UNKNOWN (33.81)				200 J
* UNKNOWN (34.13)			75 J	
* UNKNOWN (36.21)			32 J	
* UNKNOWN (41.27)				10 J
* UNKNOWN (41.32)			80 J	
* UNKNOWN (41.81)			48 J	
* UNKNOWN (43.80)				13 J
* UNKNOWN ACID (23.02)		92 J		
* UNKNOWN ACID (25.90)			27 J	
* UNKNOWN ACID (25.92)		84 J		
* UNKNOWN ACID (28.70)		88 J		

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 321 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012226A	LL012237A	LL012248A			
	SDG NO:	D112	D111	D105			
	TYPE:	T. COMPOSITE	T. COMPOSITE	GRAB			
* UNKNOWN ACID (28.72)			330 J				
* UNKNOWN ACID (29.92)		8 J					
* UNKNOWN ACID (31.13)		660 J					
* UNKNOWN ACID (31.19)			1000 J				
* 9,10-ANTHRACENEDIONE (28.83)				6 J			
* 9,10-ANTHRACENEDIONE (28.90)		17 J					

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012555A	LL012577A	LL012737A	LL012828A	LL012862A	LL012919A
	SDG NO:	0809	0912	0809	0815	0815	0912
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		37 B	210 BE	26 B	17 B	13 B	31 B
CHLOROFORM		18	15	18	17	14	18
ETHYLBENZENE		2 JB	5 U	5 U	1 JB	1 JB	1 JB
METHYLENE CHLORIDE		12 B	3 J	12 B	5 U	5 U	3 J
TOLUENE		2 JB	1 J	1 JB	1 JB	1 JB	1 J
XYLENE (TOTAL)		5 U	5 U	5 U	5 U	5 U	3 J
* DISULFIDE, DIMETHYL(16.94)							
* DISULFIDE, DIMETHYL(16.95)			4 J				3 J
* DISULFIDE, DIMETHYL(16.97)					6 J		
* METHYLETHYLCYCLOHEXANE(37.32)					6 J		
* UNKNOWN(5.33)					14 J		
* UNKNOWN(9.65)							3 J

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012920A
	SDG NO:	G912
	TYPE:	GRAB
ACETONE		14 B
CHLOROFORM		19
ETHYLBENZENE		5 U
METHYLENE CHLORIDE		3 JB
TOLUENE		5 U
XYLENE (TOTAL)		5 U
* DISULFIDE, DIMETHYL(16.94)		8 J
* DISULFIDE, DIMETHYL(16.95)		
* DISULFIDE, DIMETHYL(16.97)		
* METHYLETHYLCYCLOHEXANE(37.32)		
* UNKNOWN(5.33)		
* UNKNOWN(9.65)		

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 321 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012226E	LL012237D	LL012248D			
	SDG NO:	LLL7216	LLL7245	LLL7296			
	TYPE:	T. COMPOSITE	T. COMPOSITE	GRAB			
G-ALPH		54	19	0			
GROSS-BETA		70	43	32			

S&A REQUEST: 012
LOCATION: BUILDING 322 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012259	LL012260	LL012271	LL012588	LL012599	LL012602
CONDUCTIVITY (MS/CM)		0.05	0.06	0.04	0.05	0.08	0.06
PH (UNITS)		6.9	7.4	7.3	7.2	8.3	7.9
TEMPERATURE (DEG C)		28	29	27	24	24	23

FIELD MEASUREMENTS	SAMP NO:	LL012759	LL012839	LL012873	LL012931	LL012942	
CONDUCTIVITY (MS/CM)		0.24	0.06	0.39	0.02	0.04	
PH (UNITS)		7.2	8.1	7.5	8.2	7.7	
TEMPERATURE (DEG C)		24	23	28	25	28	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012259C	LL012259D	LL012260B	LL012260C	LL012271B	LL012271C
	SDG NO:	LL001041F	LL012011D	LL003043F	LL012022C	LL003043F	LL012011D
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		152 B		107 B		69 B	
BARIUM		6.5 B		5 B		4.9 B	
CADMIUM		3.1 B		2 U		2 U	
CALCIUM		4190 B		4250 B		2950 B	
CHROMIUM		6.6 B		10		162	
COPPER		114		187		45	
IRON		91 B		174		280	
LEAD			2.4 B		2.4 B		7.1
MAGNESIUM		323 B		347 B		221 B	
MANGANESE		8.1 B		9.8 B		6.6 B	
MERCURY			0.03 B		0.03 B		0.02 B
NICKEL		65		124		76	
POTASSIUM		29000		4000 B		1800 B	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 322 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012259C	LL012259D	LL012260B	LL012260C	LL012271B	LL012271C
	SDG NO:	LL001041F	LL012011D	LL003043F	LL012022C	LL003043F	LL012011D
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
SELENIUM		40 UN		50 UN		77 BN	
SODIUM		3270 B		3660 B		2090 B	
ZINC		30		42 E		26 E	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012259A	LL012260A	LL012271A			
	SDG NO:	D112	D111	D105			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
BIS(2-ETHYLHEXYL)PHTHALATE		17	27 B	21 B			
* CAFFEINE (27.09)				5 J			
* CAFFEINE (27.13)			15 J				
* UNKNOWN (12.98)				73 J			
* UNKNOWN (13.06)			6 J				
* UNKNOWN (24.50)				5 J			
* UNKNOWN (27.96)			2 J				
* UNKNOWN (28.26)				8 J			
* UNKNOWN (28.30)			8 J				
* UNKNOWN (28.51)				28 J			
* UNKNOWN (30.77)				14 J			
* UNKNOWN (30.83)			9 J				
* UNKNOWN (30.93)			6 J				
* UNKNOWN (30.99)				31 J			
* UNKNOWN (33.22)			4 J				
* UNKNOWN (41.30)			13 J				
* UNKNOWN ACID (22.88)			2 J				
* UNKNOWN ACID (25.82)			4 J				
* UNKNOWN ACID (28.56)			27 J				
* UNKNOWN ACID (31.01)			35 J				

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012588A	LL012599A	LL012602A	LL012759A	LL012839A	LL012873A
	SDG NO:	O809	O815	O912	O808	G911	G911
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		790 BE	10 U	10 U	46 B	5 JB	16 B
CHLOROFORM		21	19	15	7	19	16
ETHYLBENZENE		5 U	1 JB	5 U	5 U	5 U	5 U
METHYLENE CHLORIDE		12 B	5 U	2 J	10 B	2 JB	2 JB
TOLUENE		0.8 JB	0.8 JB	5 U	0.7 J	5 U	5 U
* ETHANOL(5.65)							10 J

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 322 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012931A	LL012942A				
	SDG NO:	G912	0912				
	TYPE:	GRAB	GRAB				
ACETONE		3 JB	10 U				
CHLOROFORM		18	11				
ETHYLBENZENE		5 U	1 JB				
METHYLENE CHLORIDE		2 JB	2 J				
TOLUENE		5 U	5 U				
* ETHANOL(5.65)							

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012259E	LL012260D	LL012271D			
	SDG NO:	LLL7216	LLL7245	LLL7296			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
G-ALPH		14	8	0			
GROSS-BETA		22	14	32			

S&A REQUEST: 012
LOCATION: BUILDING 331 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012282	LL012293	LL012306	LL012613	LL012624	LL012635
CONDUCTIVITY (MS/CM)		0.34	0.27	0.22	0.32	0.3	0.28
PH (UNITS)		8.2	8.4	8.6	8.2	8.8	8.1
TEMPERATURE (DEG C)		28	27	28	22	21	20

FIELD MEASUREMENTS	SAMP NO:	LL912134	LL912258	LL912269	LL912394	LL912407	
CONDUCTIVITY (MS/CM)		0.3	0.31	0.41	0.23	0.19	
PH (UNITS)		8.3	8.9	8.8	8.3	8.7	
TEMPERATURE (DEG C)		27	25	27	28	29	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012282C	LL012282D	LL012293B	LL012293C	LL012306B	LL012306C
	SDG NO:	LL003043F	LL012022C	LL003043F	LL001041G	LL012066B	LL001041G
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		278		173 B		187 B	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 331 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012282C	LL012282D	LL012293B	LL012293C	LL012306B	LL012306C
	SDG NO:	LL003043F	LL012022C	LL003043F	LL001041G	LL012066B	LL001041G
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ARSENIC		30 UN		33 BN		30 U	
BARIUM		25 B		14 B		14 B	
CADMIUM		4 B		3.4 B		2.7 B	
CALCIUM		11800		9660		7520	
CHROMIUM		32		25		6 U	
COPPER		1900		626		272	
IRON		926		360		376	
LEAD			8.7		5.6		12
MAGNESIUM		2160 B		1780 B		1260 B	
MANGANESE		27		18		18	
MERCURY			0.25		0.11 B		0.15 B
NICKEL		9.4 B		6 U		6.3 B	
POTASSIUM		14000		15000		16000	
SILVER		6.1 B		36		6 U	
SODIUM		26000		33000		15900	
ZINC		278 E		158 E		123	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012282A	LL012306A
	SDG NO:	D106	D107
	TYPE:	T. COMPOSITE	T. COMPOSITE
BENZOIC ACID		85	74
BIS(2-ETHYLHEXYL)PHTHALATE		28 B	39 B
BUTYLBENZYLPHTHALATE		13 U	3 J
4-METHYLPHENOL		13 U	11 J
* CAFFEINE (27.10)		19 J	
* CAFFEINE (27.16)			30 J
* UNKNOWN (17.56)		23 J	
* UNKNOWN (17.90)			18 J
* UNKNOWN (19.08)		8 J	
* UNKNOWN (19.23)			12 J
* UNKNOWN (22.85)		10 JB	
* UNKNOWN (22.99)			64 J
* UNKNOWN (25.12)			18 J
* UNKNOWN (25.82)		23 J	
* UNKNOWN (25.94)			85 J
* UNKNOWN (27.17)		8 J	
* UNKNOWN (27.24)			21 J
* UNKNOWN (28.27)		19 J	
* UNKNOWN (28.37)			67 J
* UNKNOWN (28.59)		240 J	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 331 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012282A	LL012306A
	SDG NO:	D106	D107
	TYPE:	T. COMPOSITE	T. COMPOSITE
* UNKNOWN (28.65)		9 J	
* UNKNOWN (28.78)			720 J
* UNKNOWN (29.82)			19 J
* UNKNOWN (30.59)			29 J
* UNKNOWN (30.73)		92 J	
* UNKNOWN (30.83)		97 J	
* UNKNOWN (30.88)			350 J
* UNKNOWN (30.98)			470 J
* UNKNOWN (31.07)		650 J	
* UNKNOWN (31.25)			1600 J
* UNKNOWN (37.84)			35 J
* UNKNOWN (38.08)			24 J
* UNKNOWN (41.27)		45 J	
* UNKNOWN (41.33)			100 J
* UNKNOWN (41.75)			36 J
* UNKNOWN HYDROCARBON (21.87)		6 J	
* UNKNOWN HYDROCARBON (23.44)		9 J	
* UNKNOWN HYDROCARBON (24.94)		10 J	
* UNKNOWN HYDROCARBON (25.04)		6 J	
* UNKNOWN HYDROCARBON (26.36)		9 J	
* UNKNOWN HYDROCARBON (26.52)		7 J	

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012613A	LL012624A	LL012635A	LL912134A	LL912258A	LL912269A
	SDG NO:	G912	0913	G913	0817	0819	0819
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		4 JB	6 JB	9 JB	8 JB	21 B	23 B
BENZENE		5 U	5 U	5 U	5 U	5 U	2 J
CHLOROFORM		22	19	17	18	17	19
ETHYLBENZENE		5 U	5 U	5 U	1 JB	2 JB	2 JB
METHYLENE CHLORIDE		2 JB	2 J	3 JB	5 U	2 JB	2 JB
TOLUENE		5 U	5 U	5 U	0.9 JB	1 JB	1 JB
1,1,1-TRICHLOROETHANE		5 U	5 U	5 U	5 U	5 U	5 U
* DISULFIDE, DIMETHYL(16.98)				4 J			
* DISULFIDE, DIMETHYL(17)			4 J				
* ETHANOL(5.38)							14 J
* UNKNOWN(4.1)			14 J				
* 2-PROPANOL(8.79)							

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 331 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL912394A	LL912407A				
	SDG NO:	0823	0823				
	TYPE:	GRAB	GRAB				
ACETONE		22 B	460 BE				
BENZENE		3 J	3 J				
CHLOROFORM		19	19				
ETHYLBENZENE		5 U	5 U				
METHYLENE CHLORIDE		5 U	5 U				
TOLUENE		1 JB	1 JB				
1,1,1-TRICHLOROETHANE		2 J	5 U				
* DISULFIDE, DIMETHYL(16.98)							
* DISULFIDE, DIMETHYL(17)							
* ETHANOL(5.38)							
* UNKNOWN(4.1)							
* 2-PROPANOL(8.79)			24 J				

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012282E	LL012293D	LL012306D			
	SDG NO:	LLL7267	LLL7264	LLL7292			
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE			
G-ALPH		0	7	0			
GROSS-BETA		68	57	51			

S&A REQUEST: 012
LOCATION: BUILDING 511 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

FIELD MEASUREMENTS	SAMP NO:	LL012317	LL012328	LL012339	LL012646	LL012657	LL012668
CONDUCTIVITY (MS/CM)		0.21	0.13	0.13	0.14	0.23	0.2
PH (UNITS)		8.1	8.5	7.9	8.3	8.3	8.2
TEMPERATURE (DEG C)		29	31	29	28	25	26

FIELD MEASUREMENTS	SAMP NO:	LL912178	LL912292	LL912305	LL912316	LL912430	
CONDUCTIVITY (MS/CM)		0.24	0.18	0.16	0.13	0.09	
PH (UNITS)		8	8.6	8	8.5	7.9	
TEMPERATURE (DEG C)		26	29	29	29	28	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 511 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012317C	LL012317D	LL012328B	LL012328C	LL012339B	LL012339C
	SDG NO:	LL003043F	LL012022C	LL003043F	LL012022C	LL012066B	LL001041G
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE
ALUMINUM		232		151 B		332	
ARSENIC		30 UN		30 UN		35 B	
BARIUM		18 B		11 B		12 B	
CADMIUM		33		3 B		5.3	
CALCIUM		6800		6180		6250	
CHROMIUM		12		6 U		6 U	
COPPER		61		24 B		36	
IRON		692		289		493	
LEAD			88		12		19
MAGNESIUM		1080 B		621 B		626 B	
MANGANESE		29		16		20	
MERCURY			0.05 B		0.04 B		0.18 B
NICKEL		6.9 B		7.2 B		7.2 B	
POTASSIUM		6100		760 B		7600	
SODIUM		9260		10900		7430	
ZINC		195 E		72 E		152	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012679B	LL012679C	LL012680B	LL012680C	LL012691B	LL012691C
	SDG NO:	LL001041F	LL012011D	LL003043F	LL012011D	LL001041F	LL012011D
	TYPE:	RINSATE	RINSATE	RINSATE	RINSATE	FIELD BLANK	FIELD BLANK
ALUMINUM		50 U		158 B		50 U	
ARSENIC		30 UN		30 UN		30 UN	
BARIUM		2 U		3.3 B		9.5 B	
CADMIUM		2 U		2.3 B		2.1 B	
CALCIUM		200 U		200 U		200 U	
CHROMIUM		6 U		6 U		6.1 B	
COPPER		3 U		10 U		3.9 B	
IRON		20 U		127		20 U	
LEAD			0.5 B		0.6 B		0.44 U
MAGNESIUM		10 U		11 B		10 U	
MANGANESE		3 U		5 U		3 U	
MERCURY			0.03 B		0.02 B		0.03 B
NICKEL		6 U		8.3 B		6	
POTASSIUM		100 U		100 U		100 U	
SODIUM		200 U		415 B		200 U	
ZINC		6.5 B		4 BE		6.8 B	

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 511 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL012704B	LL012704C
	SDG NO:	LL003043F	LL012022C
	TYPE:	FIELD BLANK	FIELD BLANK
ALUMINUM		60 U	
ARSENIC		30 UN	
BARIUM		2 U	
CADMIUM		2 U	
CALCIUM		200 U	
CHROMIUM		6 U	
COPPER		10 U	
IRON		33 B	
LEAD			0.6 B
MAGNESIUM		10 U	
MANGANESE		5 U	
MERCURY			0.02 B
NICKEL		6.2 B	
POTASSIUM		100 U	
SODIUM		200 U	
ZINC		21 E	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL012317A	LL012339A	LL012679A	LL012680A	LL012691A	LL012704A
	SDG NO:	D105	D107	D113	D105	D113	D111
	TYPE:	T. COMPOSITE	T. COMPOSITE	RINSATE	RINSATE	FIELD BLANK	FIELD BLANK
BENZO(B)FLUORANTHENE		13 U	3 J	11 U	13 U	11 U	10 U
BENZOIC ACID		93	260	56 U	65 U	56 U	50 U
BIS(2-ETHYLHEXYL)PHTHALATE		84 B	400 BE	10 J	6 JB	10 J	10 U
BUTYLBENZYLPHTHALATE		13 U	4 J	11 U	13 U	11 U	10 U
DI-N-BUTYLPHTHALATE		13 JB	4 J	11 U	13 U	11 U	10 U
DIETHYLPHTHALATE		3 J	13 U	11 U	13 U	11 U	10 U
* BENZENE ACETIC ACID (17.81)		110 J					
* BENZENE ACETIC ACID (17.89)		29 J					
* CAFFEINE (27.15)		41 J					
* CAFFEINE (27.23)			100 J				
* INDOLE-2,3-DIONE (25.09)		18 J					
* PHTHALIC ANHYDRIDE (18.70)		18 J					
* UNKNOWN (12.17)			24 J				
* UNKNOWN (12.37)				9 J			
* UNKNOWN (12.53)			23 J				
* UNKNOWN (13.11)		160 J					
* UNKNOWN (16.04)			18 J				
* UNKNOWN (16.36)			16 J				
* UNKNOWN (16.60)		19 J					
* UNKNOWN (17.78)			37 J				

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 511 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: SDG NO: TYPE:	LL012317A D105 T. COMPOSITE	LL012339A D107 T. COMPOSITE	LL012679A D113 RINSATE	LL012680A D105 RINSATE	LL012691A D113 FIELD BLANK	LL012704A D111 FIELD BLANK
* UNKNOWN (19.83)			50 J				
* UNKNOWN (21.73)					3 J		
* UNKNOWN (22.84)					6 J		
* UNKNOWN (22.94)		23 J					
* UNKNOWN (23.12)			230 J				
* UNKNOWN (23.88)		15 J					
* UNKNOWN (25.84)					47 J		
* UNKNOWN (26.02)			210 J				
* UNKNOWN (26.37)			35 J				
* UNKNOWN (28.25)					4 J		
* UNKNOWN (28.30)		31 J					
* UNKNOWN (28.36)			47 J				
* UNKNOWN (28.48)		77 JB					
* UNKNOWN (28.51)					32 J		
* UNKNOWN (28.67)		23 J					
* UNKNOWN (28.74)			220 J				
* UNKNOWN (29.51)			18 J				
* UNKNOWN (29.79)		14 J					
* UNKNOWN (29.84)			12 J				
* UNKNOWN (30.71)					95 J		
* UNKNOWN (30.74)		65 J					
* UNKNOWN (30.84)		160 J					
* UNKNOWN (30.92)			1200 J				
* UNKNOWN (30.93)		52 JB					
* UNKNOWN (30.97)					10 J		
* UNKNOWN (31.11)		800 J					
* UNKNOWN (31.19)			760 J				
* UNKNOWN (31.80)			62 J				
* UNKNOWN (32.53)			35 J				
* UNKNOWN (32.95)			40 J				
* UNKNOWN (33.41)			30 J				
* UNKNOWN (33.64)					9 J		
* UNKNOWN (33.68)						10 J	
* UNKNOWN (33.81)		60 J					
* UNKNOWN ACID (25.86)		24 J					
* UNKNOWN PHTHALATE (26.61)		17 J					

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 511 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL012646A	LL012657A	LL012668A	LL912178A	LL912292A	LL912305A
	SDG NO:	0912	0913	0913	0817	0819	0821
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		3 JB	3 JB	10 B	10 U	76 B	5 JB
CHLOROFORM		21	31	28	26	22	16 B
ETHYLBENZENE		2 JB	3 J	5 U	1 JB	2 JB	2 JB
METHYLENE CHLORIDE		2 J	2 J	2 JB	5 U	2 JB	2 JB
TOLUENE		5 U	1 J	5 U	0.7 JB	5 U	0.9 JB
XYLENE (TOTAL)		5 U	17	5 U	5 U	3 J	1 J
* C3H7-CYCLOHEXANE(37.49)			89 J				
* C3H7-CYCLOHEXANE(40.16)			114 J				
* C3H7-CYCLOHEXANE(47.97)			144 J				
* TRICHLOROTRIFLUOROETHAN(12.87)			131 J				
* UNKNOWN(33.19)			91 J				
* UNKNOWN(42.38)			184 J				
* UNKNOWN(49.55)			25 J				
* UNKNOWN(52.76)			90 J				
* UNKNOWN(55.87)			78 J				
* UNKNOWN(58.41)			108 J				
* 2-PROPANOL(8.79)							

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL912316A	LL912430A
	SDG NO:	0822	0823
	TYPE:	GRAB	GRAB
ACETONE		19 B	190 B
CHLOROFORM		19	16
ETHYLBENZENE		2 JB	1 JB
METHYLENE CHLORIDE		2 JB	5 U
TOLUENE		1 JB	1 JB
XYLENE (TOTAL)		4 J	5 U
* C3H7-CYCLOHEXANE(37.49)			
* C3H7-CYCLOHEXANE(40.16)			
* C3H7-CYCLOHEXANE(47.97)			
* TRICHLOROTRIFLUOROETHAN(12.87)			
* UNKNOWN(33.19)			
* UNKNOWN(42.38)			
* UNKNOWN(49.55)			
* UNKNOWN(52.76)			
* UNKNOWN(55.87)			
* UNKNOWN(58.41)			
* 2-PROPANOL(8.79)			24 J

TABLE L4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING SANITARY EFFLUENTS

S&A REQUEST: 012
LOCATION: BUILDING 511 SANITARY EFFLUENTS
MEDIUM: SURFACE WATER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012317E	LL012328D	LL012339D	LL012679D	LL012680D	LL012691D
	SDG NO:	LLL7267	LLL7264	LLL7292	LLL7216	LLL7267	LLL7216
	TYPE:	T. COMPOSITE	T. COMPOSITE	T. COMPOSITE	RINSATE	RINSATE	FIELD BLANK
G-ALPH		0	32	6.5	0	0	27
GROSS-BETA		20	0	57	62	27	0

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL012704D
	SDG NO:	LLL7245
	TYPE:	FIELD BLANK
G-ALPH		8
GROSS-BETA		49

4.8 LLNL Environmental Problem 3: Runoff/Sediment from the Building 612 Staging Area

Request Number: 13.
Requester: R. Basinski.
Finding and Basis: Hazardous and radioactive wastes are stored in the Building 612 waste staging area. Runoff from precipitation and/or releases from containers in the Building 612 waste staging area containing hazardous constituents may have reached the stormwater drainage system.

4.8.1 Sampling and Analysis Objectives

Statement: Samples were to be collected to determine if contaminants were present above normal levels in the sediments from the stormwater drainage system outside the Building 612 waste staging area.

Supporting Information: The staging area was bermed, but the berm was open at the lower end of the yard. Liquids draining from the bermed area had free access to the stormwater drainage system through this opening in the berm.

4.8.2 Sampling and Analytical Design

4.8.2.1 Sampling Design

Request 13: Runoff/Sediment from the Building 612 Staging Area (Fig. L4.3). Four grab sediment samples were to be collected from the ditch to the depth of the sediment (Sampling Method: Reference E.5.3.1). Sampling was started at approximately 1315 on 11AUG87. The temperature was about 80°F, and there was little or no wind. The ditch to be sampled was approximately 3 ft wide. Because of potential outside influences above the suspect area, the sampling was to start above the area and cover the suspect area. The area was considered homogeneous with respect to physical considerations, but potentially

heterogeneous with respect to contaminant considerations. Because heterogeneity could only be suspected and not absolutely identified, and low concentrations of potential contaminants were suspected, a sampling approach that would recognize potential outside influences was used. The area was not stratified and composite samples were not taken. Starting 10 ft above the area where suspected runoff from the waste staging area initiated, the ditch was to be divided into an 80-segment grid, with samples collected at randomly selected segments. However, when the Sampling Team arrived on-site, they found that the ditch was only 60 ft long; therefore, only three sample locations were used.

Samples collected were LL013012, LL013023, and LL013034 at grids 6, 26, and 46, respectively. Sample LL013045 (grid 66) was not collected. Because the suspected runoff from the area would result in continuous "charging" of the ditch, the necessity of collecting a subsurface sample was eliminated. Small bits of asphalt were seen in the first 6 in. of sediment at all three sampling locations. These samples were collected between 1320 and 1342. The sampling area was located to the west of the 629 storage area and not to the west of the 612 staging area as previously believed. Automobiles traveling on the nearby road may have affected the samples.

4.8.2.2 Analytical Design

The parameters analyzed for LLNL Environmental Problem 3 were volatiles, semivolatiles, ICP-metals, gross alpha, gross beta; special interest in chlorinated solvents. No field measurements were required.

4.8.3 Field and Analytical Data

Field Data: *NA*

Field Data Evaluation: NA

Analytical Data:

Metals. *Analytical data for metals in sediment are presented in Table L4.3.3. Of the 18 metals detected, the following 3 were below the CRQL or the IDL in all three samples: lead, silver, and sodium. Of the remaining metals detected, barium ranged from 153 to 272 mg/kg; beryllium was 0.92 mg/kg; cadmium was 1.1 mg/kg; chromium ranged from 31 to 57 mg/kg; copper, 19 to 22 mg/kg; nickel, 34 to 67 mg/kg; and zinc, 33 to 51 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium.*

Volatile organics. *Analytical results for volatiles are presented in Table L4.3.3. Acetone and methylene chloride were detected in all three samples taken for this environmental problem. A small amount of toluene was detected in one of the samples. The highest concentration of any of the volatiles in these samples was 25 ug/kg of methylene chloride in sample LL013012.*

Extractable organics. *Analytical data for semivolatile organic compounds are presented in Table 4.3.3. Fourteen compounds were detected in two of the samples, and five compounds were detected in the remaining sample. Diacetone alcohol was estimated to be in excess of 20 mg/kg in two of the samples and at 17 mg/kg in the third. The next highest (estimated) concentration was 4.3 mg/kg of an unknown. All other compounds detected were measured or estimated in concentrations of less than 2 mg/kg, and most were less than 1 mg/kg.*

Radiochemistry. Sediment samples averaged 8500 and 26,000 pCi/kg of gross alpha and gross beta, respectively. However, sample LL013012 was the highest with readings of 16,000 and 38,000 pCi/kg gross alpha and beta, respectively.

Analytical Data Evaluation:

Metals. The following metals of interest were detected above the CRQL in the samples for Request 13: barium, beryllium, cadmium, chromium, copper, nickel, and zinc.

Volatile organics. Low levels of methylene chloride were found in samples, but not in the blank.

Extractable organics. Diacetone alcohol had the highest concentration in these samples (17 to 28 mg/kg).

Radiochemistry. Three sediment samples from the Building 612 staging area were analyzed for gross beta and gross alpha. Results are given in Table L4.3.3.

4.8.4 Limitations and Qualifications

Data Quality Level: The sampling plan and sampling are rated Quality Level I. The analytical data are Quality Level II.

Field Data: Three grab samples instead of four were taken because the length of the ditch was only 60 ft instead of the 80 ft originally estimated.

Analytical Data: Most of the compounds were Quality Level II for volatiles and semivolatiles with the exception of diacetone alcohol. The plan called for special attention to chlorinated solvents. None of the tentatively identified compounds contained chlorine and others were marked "unknown" and could not

be evaluated for chlorination. Details on analytical data quality levels are given below.

Metals. The serial dilution and spiked samples were out of control limits with respect to nickel.

Data are Quality Level I except manganese, nickel, and selenium which are Quality Level II in all three samples.

Volatile organics. Acetone levels were similar to those detected in trip blanks. Toluene was detected only in one sample at a level too small to quantify.

Almost all of the entries in the data quality summary for this environmental problem were Quality Level II. In all but one of these cases, the compound was tentatively identified via mass spectrometry.

Extractable organics. All concentrations were estimated. With a single exception all compounds were tentatively identified or listed as unknowns. The data are Quality Level II due mainly to tentative identification by mass spectrometry.

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.

Environmental Problem: LLNL 3
Request Number: LLNL 13

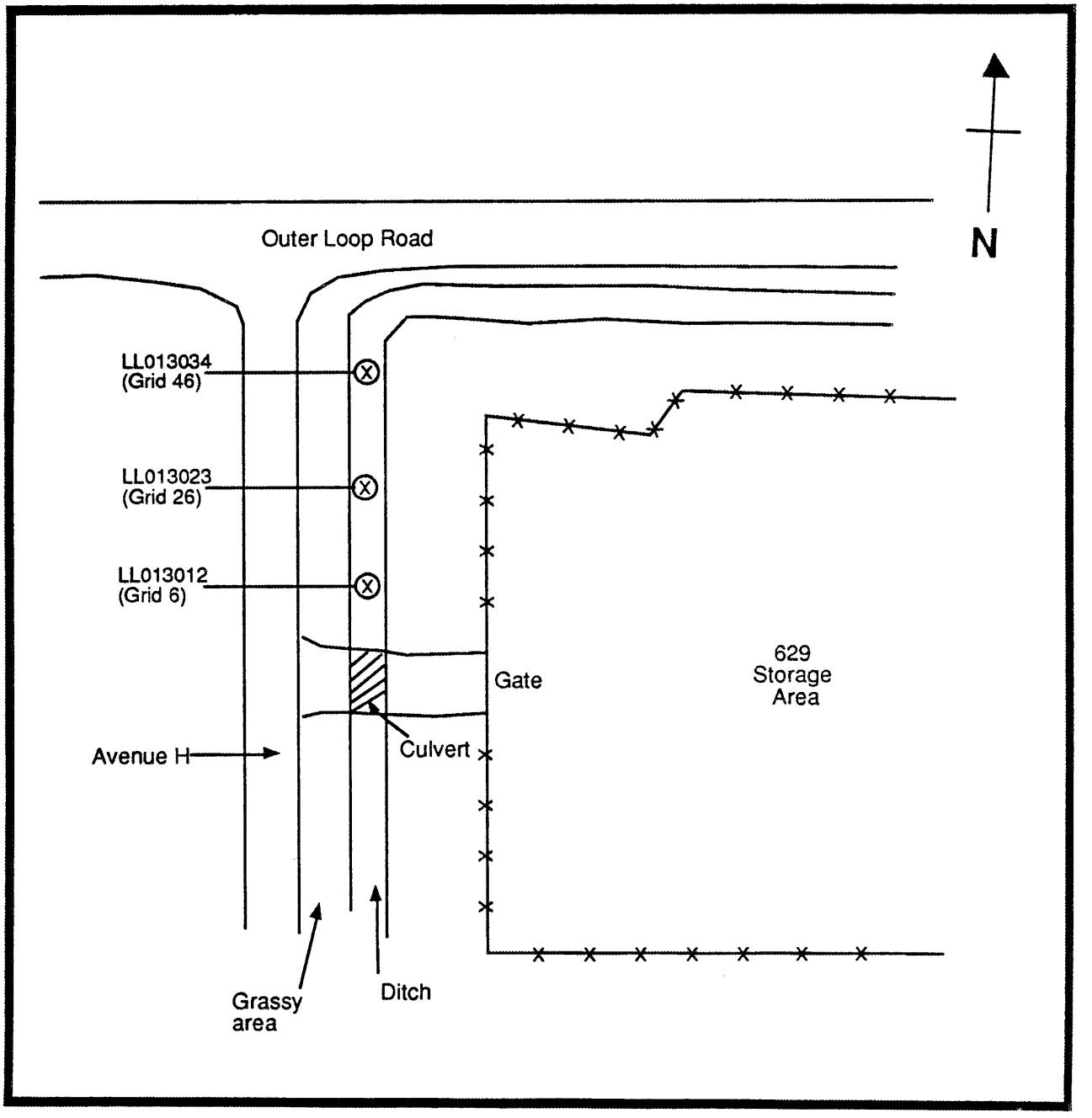

Figure L4.3. Runoff/Sediment from the Building 612 Staging Area (LLNL Request 13)

TABLE L4.2.3 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	HE NUMB HITS	HE 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
LL013	BLDG. 612	DITCH	SEDIMENT	4	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
		MED TOTAL		4	3		0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
		EP TOTAL		4	3		0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3

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TABLE L4.3.3 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 3 DRAFT DO NOT CITE
RUNOFF/SEDIMENT FROM THE BUILDING 612 STAGING AREA

S&A REQUEST: 013
LOCATION: RUNOFF/SEDIMENT FROM BUILDING 612 STAGING AREA
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL013012C	LL013023C	LL013034C			
	SDG NO:	LL011010C	LL011010C	LL011010C			
	TYPE:	GRAB	GRAB	GRAB			
ALUMINUM		31300 *	12200 *	10400 *			
BARIUM		272	175	153			
BERYLLIUM		0.92	0.48 B	0.45 B			
CADMIUM		1.1	0.67 B	0.48 B			
CALCIUM		5070 *	3320 *	3000 *			
CHROMIUM		57 E	32 E	31 E			
COBALT		10	9.9	11			
COPPER		22	19	19			
IRON		31700 *	16500 *	15600 *			
LEAD		8.8 B	11 B	8.4 B			
MAGNESIUM		5780	3440	3230			
MANGANESE		628 *	578 *	650 *			
NICKEL		67 N*	39 N*	34 N*			
POTASSIUM		3700	2700	2300			
SILVER		0.98 B	0.94 U	1.3 B			
SODIUM		396 B	200 B	187 B			
VANADIUM		59	38	43			
ZINC		51	33	33			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL013012B	LL013023B	LL013034B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	GRAB	GRAB	GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE		400 U	380 U	120 J			
* ALIPHATIC HYDROCARBON (4.88)		790 J					
* ARYL HYDROCARBON (8.22)		220 J	550 J				
* DIACETONE ALCOHOL (6.26)				17000 J			
* DIACETONE ALCOHOL (6.35)		23000 J	28000 J				
* POSSIBLE ALCOHOL (7.73)			140 J				
* POSSIBLE ALIPHATIC KETO (3.43)			420 J				
* POSSIBLE AMIDE/AMINE (6.85)			240 J				
* POSSIBLE AMIDE/AMINE (7.91)		340 J	800 J				
* PROBABLE ALIPHATIC HYDR (3.39)		250 J					
* PROBABLE ALIPHATIC HYDR (4.89)			1600 J				
* UNKNOWN (4.58)			190 J				
* UNKNOWN (5.62)				2200 J			
* UNKNOWN (5.65)		1200 J					
* UNKNOWN (5.82)			4300 J				
* UNKNOWN (6.61)		120 J					
* UNKNOWN (6.85)		160 J					
* UNKNOWN (7.07)		360 J	760 J				

TABLE L4.3.3 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 3 DRAFT DO NOT CITE
RUNOFF/SEDIMENT FROM THE BUILDING 612 STAGING AREA

S&A REQUEST: 013
LOCATION: RUNOFF/SEDIMENT FROM BUILDING 612 STAGING AREA
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL013012B	LL013023B	LL013034B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN (7.13)		260 J	670 J				
* UNKNOWN (7.97)		130 J					
* UNKNOWN (8.92)			840 J				
* UNKNOWN (8.94)		400 J					
* UNKNOWN (10.38)				250 J			
* UNKNOWN (10.42)		82 J					
* UNKNOWN (10.44)			280 J				

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL013012A	LL013023A	LL013034A			
	SDG NO:	0829	0829	0830			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		15 B	18 B	16 B			
METHYLENE CHLORIDE		25	17	8			
TOLUENE		2 J	6 U	7 U			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL013012D	LL013023D	LL013034D			
	SDG NO:	LLL7283	LLL7283	LLL7283			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		16000	4100	5400			
GROSS-BETA		38000	22000	18000			

4.9 LLNL Environmental Problem 4: Retention Tanks and Sumps

Request Numbers: 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, and 26.
Requester: J. Boros.
Finding and Basis: Toxic and hazardous pollutants may be released to the publicly owned treatment works or to groundwater as a result of the discharge of retention tanks to the sanitary sewer system. The net result is off-site migration of toxic metals, radioactivity, and possibly organics.

4.9.1 Sampling and Analysis Objectives

Statement: Tanks and sumps included in this environmental problem were to be examined to determine if the constituents listed in section 4.9.2.2 were present at method detection levels.

Supporting Information: Retention tanks were not being adequately characterized. (Tanks were most frequently analyzed for radioactivity, metals, and pH, but there was little analysis for organics.) Migration to groundwater was of concern because sewer integrity was in question due to known infiltration/exfiltration through cracks, possibly earthquake induced. Tanks selected for sampling represented a cross-section of all tanks and included tanks that were old and new, large and small, with good and poor pass/fail test results, tanks that were known to have leaked in the past, and tanks of different construction materials.

4.9.2 Sampling and Analytical Design

4.9.2.1 Sampling Design

A grab sample (Sampling Method: Reference E4.2.3B and E4.2.4) was to be collected from each of the 13 tanks or sumps included in this environmental problem. These tanks were selected by the DOE Survey Team based on their review of site information. Coordination with LLNL personnel was needed to collect representative samples from tanks or sumps that were not in tandem. All tanks or sumps were believed to be accessible from the top and equipped with a pump that could be used to mix the contents before sampling. Although mixing could affect the volatiles, this is the normal operation when the effluent is being discharged to the sanitary system, so the analyses would yield an accurate sample of what was routinely being discharged. The tanks were considered a homogeneous population. Although there were specific differences in suspected discharges, there was enough commonality in discharge to make this assumption. To further assure and support this assumption, each parameter was requested at least three times. The sample was to be collected when the tank/sump was at least half full. The contents of the tank or sump were mixed manually or by pump for at least 2 min before the sample was collected. The TIP was used as a safety precaution when the tanks were being sampled.

Individual requests for LLNL Environmental Problem 4 are described below.

Request 14: Building 131, Tank 21R (Fig. 4.4a). This tank was selected because it was a larger (4000 gal.), older (1971), rubber-lined concrete tank. LLNL continuously analyzes the tank for only alpha, beta, copper, chromium, nickel, zinc, pH, and tritiated water. This was a solo tank with no backup. Data on other metals used in Building 131, plus organics and tritium, were needed. This tank was 12 ft x 12 ft and 7 ft deep. At the time of sampling, there was

approximately 3 ft of water in the tank. The tank was pumped for 2 min prior to sampling. Sample LL014013 was collected from 1622 to 1630 on 04AUG87.

Request 15: Building 141, Sump 41R (Fig. 4.4b). This sump was selected because it was a small (450 gal.), new (1980), polyvinyl chloride (PVC)-lined concrete sump. It was being analyzed for alpha, beta, copper, chromium, nickel, zinc, and pH. Data on other organics, beryllium, mercury, fluorides, and nitrates were needed.

At the time of sampling, there was approximately 18 in. of water in the sump. It was approximately 6 ft from the cover to the water surface. The stainless steel dipper was rinsed, and QC rinsate LL01502 was collected at 1425 prior to sampling the sump. The Sampling Team arrived at the site at 1505 on 04AUG87. The sump could not be mixed by pumping, as had been assumed in the sampling plan, so the sump contents were stirred for 2 min. Sample LL015014 was collected at 1530. The sky was clear and the temperature was 94°F.

Request 16: Building 141, Sump 42R (Fig. 4.4c). This sump was selected because it was a small (450 gal.), new (1980), PVC-lined concrete sump. It was being analyzed for alpha, beta, copper, chromium, nickel, zinc, lead, and pH. Data on other organics, beryllium, mercury, fluorides, and nitrates were needed.

Sump 42R was located east of Building 141 and was the northernmost of three sumps. The 2 ft x 2 ft cover was removed for access, and water was dipped using a stainless steel dipper. The distance to the water was approximately 25 ft. The contents were agitated by raising and lowering the dipper. Sample LL016015 was collected at 1054 on 13AUG87. The weather was clear and windy with a temperature of approximately 80°F.

Request 17: Building 141, Sump 43R (Fig. 4.4d). This sump was selected because it was a small (450 gal.), new (1980), PVC-lined concrete sump. It was being analyzed for alpha, beta, copper, chromium, nickel, zinc, trichloroethylene (TCE), acetone, and pH. Data on other organics, beryllium, mercury, fluorides, and nitrates were needed.

Sump 43R was located to the east of Building 141. It was the southernmost in a series of three sumps. The conditions of sampling were the same as described for sump 42R. The distance to the contents was approximately 7 ft. There was a strong, possibly organic chemical odor in the sump. Sample LL017016 was collected at 1118 on 13AUG87.

Request 18: Building 151, Tank 21R (Fig. 4.4e). This tank was selected because it was a large (4000 gal.), old (1972) sump constructed of concrete. It was being analyzed for alpha, beta, pH, and tritium. Analyses for organics, metals, fluorides, and nitrates were needed.

Tank 21R was a sump for wastes (lab sinks, drains, etc.) from Building 151. The contents were circulated to tank 22R for retention and pumping for disposal. When the sump tank (21R) was filled, it was transferred to tank 22R for retention. The distance to the contents was approximately 12 to 15 ft. The contents could not be circulated or agitated for sampling. Sampling was done with a stainless steel dipper. A PID reading of 14 ppm (benzene equivalent) was noted. Bottle E (TOC) was not collected. Instead bottles F through I were renamed E through H. Sample LL018017 was collected at 1345 on 13AUG87. The day was clear and warm (90°F), with gusty winds.

Request 19: Building 151, Tank 22R (Fig. 4.4f). This tank was selected because it was a large (4000 gal.), new (1983) steel tank. It was being analyzed for

alpha, beta, pH and tritium. Analyses for organics, metals, fluorides, and nitrates were needed.

Tank 22 was the retention tank, receiving wastes from the 21R sump at Building 151. The waste was held until analyzed and either disposed of or treated for disposal. A PID reading of 13.5 ppm (benzene equivalent) was recorded in the tank headspace. The distance from the tank access to the tank contents was approximately 4 to 5 ft. No agitation or mixing was possible before sampling. Samples were collected with a stainless steel dipper. Sample LL019018 was collected at 1405 on 13AUG87.

Request 20: Building 222, Tank 21R (Fig. 4.4g). This tank was selected because it was a large (9800 gal.), old (1970), PVC-lined concrete tank. It was being analyzed only for alpha, beta, copper, chromium, nickel, zinc, and pH. Data on other metals, cyanides, and organics were needed.

The Sampling Team arrived at the site at 1015 on 11AUG87 and spoke with R. Sands about the location, design, and use of the tank. He said tanks 21R and 22R at Building 222 were two of the larger tanks on the compound and the most frequently used. The recirculating pumps were turned on and allowed to run for approximately 15 min prior to sampling. Mr. Sands said this was their normal procedure prior to sampling and prior to discharge. The level meter indicated that tank 21R contents were 75 in. deep. Recirculation was performed to get a homogeneous mixture and to get the sludge off the bottom of the tank. Sample LL020011 was collected at 1050. The temperature was approximately 75°F with a clear sky, low humidity (20%), and winds at 0 to 5 mph.

Request 21: Building 222, Tank 22R (Fig. 4.4h). This tank was selected because it was a large (9800 gal.), old (1970), PVC-lined concrete tank. It was being

analyzed for alpha, beta, copper, chromium, nickel, zinc, and pH. Data on other metals, cyanides, and organics were needed.

This was the second of two tanks sampled at Building 222. Standing water in tank 22R was approximately 13 in., as indicated on the level meter. Recirculation pumps could not operate with this amount of fluid, so the tank was manually mixed with the dipper. Sample LL021012 was collected at 1145 on 11AUG87. The temperature was approximately 80°F with a clear sky, low humidity, and winds at 0 to 5 mph.

Request 22: Building 231, Sump 31R (Fig. 4.4i). This sump was selected because it was a small (250 gal.), old (1959), tar-lined concrete sump. It was being analyzed only for alpha, beta, silver, berylluim, total identifiable chlorinated hydrocarbons (TICH), pH, tungsten, and yttrium. The sump "failed" the analysis (usually high alpha) 30% of the time. Data on conventional metals, other organics, and uranium were needed.

There was a deviation from the sampling plan for this request. Sampling personnel could not obtain access to the area of the sump to be sampled, but were assured by two LLNL personnel that the sump had been closed and filled with sand. Sump 41R was sampled instead. Because sump 41R did not have a pump for mixing the contents, the sample was collected by pumping the contents to a tank and collecting from the top of the tank. Sample LL022013 was collected at 1149 at this site. QC rinsate LL022024 was taken at 1040 prior to collection of the first sample at Request 22.

Request 23: Building 231, Sump 33R (Fig. 4.4j). This sump was selected because it was a small (250 gal.), old (1959), unlined concrete sump. It was being analyzed only for alpha, beta, silver, beryllium, TICH, pH, tungsten and yttrium. The sump "failed" the analysis (usually high alpha) 30% of the time. Data on

conventional metals, other organics, and uranium were needed. The sump to be sampled was observed by Sampling Team members to have been closed and filled with sand, so it was not sampled. No other sump was sampled in its place. Sample LL023014 and field preservative blank LL023025 were not collected.

Request 24: Building 298, Tank 41R (Fig. 4.4k). This tank was selected because it was a small (300 gal.), new (1983), fiberglass tank. It was being analyzed for alpha, beta, silver, beryllium, copper, TICH, tritiated water, and pH. This was a solo tank with no backup. Data on other metals and nonchlorinated organics were needed.

The Sampling Team arrived at the site at 1405 on 11AUG87 and spoke with the operator about the sump, tank design, and use. Team members were told that the waste went from the building to the sump, then the holding tank, and was then discharged if the analysis passed. The sump portal was too small for samplers to obtain samples from the sump. Consequently, the operator pumped approximately 100 gal. from the sump to the holding tank, and the sample was obtained from the tank. This was the same procedure LLNL used to sample the sumps. As stated in the field logbook, "The total volume in the tank after adding 100 gal. from the sump was approximately 500 gal." Sample LL024015 was collected at 1420. The temperature was 85° to 90°F, with a clear sky, low humidity, and wind 0 to 5 mph out of the northwest.

Request 25: Building 321, Sump 31R (Fig. 4.4l). This sump was selected because it was small (200 gal.), old (1958), and constructed of concrete. It was being analyzed only for alpha, beta, and pH. Data on metals, cyanides, oils, organics, nitrates, mercury, and uranium were needed.

The Sampling Team arrived at the site at 1015 on 12AUG87. The temperature was approximately 70°F, and the sky was hazy. Sump 31R held approximately

200 gal. and pumped into two retention tanks. Mixing was not routinely done in the sump, but afterwards in the tanks. The contents of the sump came from the metallurgy and ceramic labs, per J. Loftis. The waste was recirculated in the tanks, sampled, and sent for analysis. The ORNL Sampling Team manually stirred the contents of the sump prior to sampling. The sump depth was approximately 4 ft, and there was about 1 ft of solution in the sump at the time of sampling. The tank numbers were TWCH-1 and TWCH-2. Sample LL025016 and field preservative blank LL025027 were collected at 1030 and 920, respectively. The Sample Request Log Sheet did not match the DOE LLNL Survey Sampling and Analysis Plan. The Log Sheet was corrected.

Request 26: Building 492, Sump 41R (Fig. 4.4m). This sump was selected because it was large (2900 gal.), new (1984), and constructed of concrete and steel. It was being analyzed only for copper, chromium, nickel, zinc, TICH, percent of ethanols, and total dissolved solids (TDS). There was no backup sump. Data on radioactivity, uranium, and nonchlorinated organics were needed.

The Sampling Team arrived on-site at 1500 on 12AUG87. The temperature was approximately 90°F, the sky was clear, and there was little to no wind. The water surface was approximately 20 ft below the top of the sump. The depth of the water was undetermined. The contents of the sump were light pink in color with a pungent, putrid odor. Sample LL026017 was collected at this sump at 1510.

4.9.2.2 Analytical Design

The parameters analyzed and/or measured for LLNL Environmental Problem 4 were as follows:

> **NOTE:** For Requests 14 through 26, a positive volatile field result indicated the need to obtain an additional sample for semivolatile analysis or to evaluate a solid fraction for semivolatiles.

Request 14: The parameters analyzed were volatiles, ICP-metals, AA-mercury, gross alpha, gross beta, tritium, and gamma scan. Field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 15: The parameters analyzed were volatiles, ICP-metals, gross alpha, gross beta, uranium, AA-mercury, and anions. Field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 16: The parameters analyzed were volatiles, ICP-metals, gross alpha, gross beta, uranium, AA-mercury, and anions. Field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 17: The parameters analyzed were volatiles, ICP-metals, gross alpha, gross beta, uranium, AA-mercury, and anions. Field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 18: The parameters analyzed were volatiles, ICP-metals, AA-mercury, gross alpha, gross beta, uranium, and anions. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 19: The parameters analyzed were volatiles, ICP-metals, AA-mercury, gross alpha, gross beta, uranium, and anions. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 20: The parameters analyzed were volatiles, ICP-metals, AA-mercury, cyanide, gross alpha, gross beta, gamma scan, and tritium. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 21: The parameters analyzed were volatiles, ICP-metals, AA-mercury, cyanide, gross alpha, gross beta, gamma scan, and tritium. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 22: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, gross alpha, gross beta, gamma scan, tritium, total uranium, and uranium. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 23: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, gross alpha, gross beta, gamma scan, tritium, total uranium, and uranium. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 24: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, gross alpha, gross beta, gamma scan, and tritium. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 25: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, oil and grease, cyanide, gross alpha, gross beta, gamma scan, tritium, uranium, and anions. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

Request 26: The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, gross alpha, gross beta, gamma scan, tritium, total uranium, and uranium. The field measurements taken were sample temperature and pH. PID readings were taken as a safety precaution when sampling tanks.

4.9.3 Field and Analytical Data

Field Data:

Requests 14 through 26. Temperatures of the contents of these tanks and sumps ranged from 20.4^{o}C for sump 31R in Building 321 to 28.6^{o}C for the contents of the tank in Building 131. The temperature of sump 41R in Building 231 was 28°C. All other temperatures were between 20.7^{o} and 25.5^{o}C.

The contents of the sumps and tanks ranged in pH from 1.9 (acidic) for tank 22R in Building 151 to 11.6 (basic) for the contents of sump 43R in Building 141. Of the 12 samples taken from sump 43R, eight were below the neutral pH of 7, one was neutral, and three were in the alkaline range. These data are recorded in Table L4.3.4.

Conductivity of the contents of the small sump in Building 231 was 0.85 milliSiemens per centimeter (mS/cm). Conductivity of the contents of the large sump in Building 492 was 1.55 mS/cm.

Field Data Evaluation:

Requests 14 through 26. Of the original 13 requests, Request 23 could not be fulfilled because sump 33R in Building 231 was decommissioned and filled with sand. In addition, sump 31R in Building 231 was also filled with sand. For this reason, sump 41R was sampled in its place. The latter sump served Building 231.

pH values ranged from 1.9 to 11.6.

Analytical Data:

Anions. Of a total of 13 requests for this environmental problem, Requests 15, 16, 17, 18, 19, and 25 requested anion analysis. The results of the analyses are shown in Table L4.3.4. Of the five anions normally sought, the samples from sump 42R of Building 141 and tank 21R of Building 151 contained the five anions in concentrations exceeding the method detection limit (MDL) set at ORNL. Two samples contained four anionic constituents, and two samples contained two constituents above the MDL.

The chloride concentrations ranged from 12,000 to 290,000 ug/L; five of the six samples showed chloride above the MDL. All six samples contained fluoride in concentrations ranging from 1000 to 32,000 ug/L. Five of six samples contained nitrate above the MDL, with the highest concentration being observed in tank 22R of Building 151 at 1,300,000 ug/L. Ortho-phosphate was found in two

samples, the concentrations being 8100 and 20,000 ug/L. Sulfate concentrations ranged from 11,000 to 44,000 ug/L and were detected in four samples.

Cyanide. *Three requests for cyanide analysis were made (Requests 20, 21, and 25). Of these, two samples contained cyanide above the quantitation limit. Tank 22R of Building 222 (Request 21) contained 8 ug/L and 3 ug/L of cyanide, and sump 31R of Building 321 (Request 25) contained 9 ug/L of cyanide.*

Metals.

Request 14 (Building 131, tank 21R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 17 metals detected, the following 7 were below the CRQL or the IDL in the sample: aluminum, arsenic, barium, cadmium, calcium, magnesium, and silver. Of the remaining metals detected, chromium was 194 ug/L, copper 822 ug/L, lead 1310 ug/L, mercury 2.6 ug/L, nickel 67 ug/L, and zinc 180 ug/L. Other metals detected were iron, manganese, potassium, and sodium.

Request 15 (Building 141, sump 41R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 18 metals detected, the following 5 were below the CRQL or the IDL in the sample: arsenic, barium, beryllium, cobalt, and mercury. Of the remaining metals detected, cadmium was 29 ug/L, chromium 44,000 ug/L, copper 11,600 ug/L, lead 2950 ug/L, nickel 441 ug/L, and zinc 2090 ug/L. Other metals detected were calcium, iron, magnesium, manganese, potassium, and sodium.

Request 16 (Building 141, sump 42R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 16 metals detected, the following 6 were below the CRQL or the IDL in the sample: arsenic, barium, cadmium, calcium, magnesium, and mercury. Of the remaining metals

detected, chromium was 1190 ug/L, copper 5030 ug/L, lead 1700 ug/L, nickel 157 ug/L, and zinc 326 ug/L. Other metals detected were aluminum, iron, manganese, potassium, and sodium.

Request 17 (Building 141, sump 43R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 17 metals detected, the following 6 were below the CRQL or the IDL in the sample: arsenic, barium, cadmium, magnesium, mercury, and potassium. Of the remaining metals detected, chromium was 190 ug/L, copper 6350 ug/L, lead 3400 ug/L, nickel 14 ug/L, and zinc 1670 ug/L. Other metals detected were aluminum, calcium, iron, manganese, sodium, and total uranium.

Request 18 (Building 151, tank 21R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 17 metals detected, the following 5 were below the CRQL in the sample: arsenic, barium, calcium, magnesium, and silver. Of the remaining metals detected, cadmium was 19 ug/L, chromium 14 ug/L, copper 322 ug/L, lead 163 ug/L, mercury 3 ug/L, nickel 149 ug/L, and zinc 1790 ug/L. Other metals detected were aluminum, iron, manganese, potassium, and sodium.

Request 19 (Building 151, tank 22R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 16 metals detected, arsenic, barium, and magnesium were below the CRQL in the sample. Of the remaining metals detected, cadmium was 12 ug/L, chromium 23 ug/L, copper 362 ug/L, lead 86 ug/L, mercury 9.9 ug/L, nickel 32 ug/L, and zinc 1550 ug/L. Other metals detected were aluminum, calcium, iron, potassium, and sodium. No

Request 20 (Building 222, tank 21R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 18 metals detected, the following 4 were below the CRQL in the sample: arsenic, barium,

magnesium, and vanadium. Of the remaining metals detected, cadmium was 8 ug/L, chromium 158 ug/L, copper 101 ug/L, lead 113 ug/L, mercury 6.2 ug/L, nickel 157 ug/L, silver 13 ug/L, and zinc 157 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, sodium, and vanadium.

Request 21 (Building 222, tank 22R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 19 metals detected, the following 6 were below the CRQL in the sample: arsenic, barium, cobalt, magnesium, potassium, and vanadium. Of the remaining metals detected, cadmium was 12 ug/L, chromium 106 ug/L, copper 279 ug/L, lead 172 ug/L, mercury 23 ug/L, nickel 49 ug/L, silver 54 ug/L, and zinc 143 ug/L. Other metals detected were aluminum, calcium, iron, manganese, and sodium.

Request 22 (Building 231, sump 41R). Analytical data for metals collected from a sealed container are presented in Table L4.3.4. Of the 21 metals detected, arsenic, barium, and magnesium were below the CRQL in the sample. Of the remaining metals detected, beryllium was 225 ug/L, cadmium 8.8 ug/L, chromium 49 ug/L, copper 1070 ug/L, lead 319 ug/L, mercury 0.36 ug/L, nickel 180 ug/L, silver 26 ug/L, and zinc 333 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, sodium, and total uranium.

Request 23 (Building 231, sump 33R). Because this sump had been drained and filled with sand, no sampling was done.

Request 24 (Building 298, tank 41R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 17 metals detected, the following 4 were below the CRQL in the sample: arsenic, barium, cadmium, and magnesium. Of the remaining metals detected, beryllium was 145 ug/L, chromium 95 ug/L, copper 509 ug/L, lead 212 ug/L, mercury 3 ug/L, nickel 19

ug/L, and zinc 202 ug/L. Other metals detected were aluminum, calcium, iron, manganese, potassium, and sodium.

Request 25 (Building 321, sump 31R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 21 metals detected, the following 4 were below the CRQL in the sample: magnesium, selenium, silver, and vanadium. Of the remaining metals detected, antimony was 100 ug/L, barium 1040 ug/L, beryllium 31 ug/L, cadmium 30 ug/L, chromium 69 ug/L, copper 4330 ug/L, lead 2700 ug/L, mercury 0.27 ug/L, nickel 181 ug/L, and zinc 1470 ug/L. Other metals detected were aluminum, calcium, cobalt, iron, manganese, potassium, and sodium.

Request 26 (Building 492, sump 41R). Analytical data for metals collected from an unsealed container are presented in Table L4.3.4. Of the 20 metals detected, the following 7 were below the CRQL in the sample: antimony, arsenic, barium, beryllium, cobalt, mercury and vanadium. Of the remaining metals detected, cadmium was 13 ug/L, chromium 63 ug/L, copper 74 ug/L, lead 265 ug/L, nickel 126 ug/L, and zinc 8610 ug/L. Other metals detected were aluminum, calcium, iron, magnesium, manganese, potassium, and sodium.

Volatile organics. *Analytical data for volatiles are presented in Table L4.3.4. In the 12 samples taken (Requests 14-22 and 24-26), the number of volatiles detected ranged from 6 to 20, with an average of 13. In two containers (Building 131 [tank 21R] and Building 141 [sump 42R]) the concentration of 1,1,1-trichloroethane was approximately 200 ug/L. Carbon tetrachloride was present in six samples, with the greatest concentration being 220 ug/L in sump 43R, Building 141. The 1,2-dichloroethane concentrations were estimated at 370 ug/L in tank 21R at Building 151 (Request 18) and detected at 110 ug/L in tank 22R of Building 151 (Request 19). Methylene chloride was at 650 ug/L in sump 41R of Building 231. The 2-butanone concentrations exceeded 100 ug/L in*

Building 231 (sump 41R), Building 321 (sump 31R), and Building 141 (sump 43R) and exceeded 1000 ug/L in Building 298 (tank 41R). Acetone concentration was 840 ug/L in sump 31R of Building 321 and exceeded 2000 ug/L in the following tanks/sumps: tanks 21R and 22R of Building 151; tanks 21R and 22R of Building 222; and sump 41R of Building 298. Sump 43R in Building 141 showed apparent contamination by at least 16 volatiles, and the Sampling Team had noticed a strong, possibly organic chemical odor in the sump.

Extractable organics. *Analytical data for semivolatile organic compounds are given in Table L4.3.4. Of the four samples, 22 compounds were detected in one, 26 in another, and 30 and 32 in the remaining two. Only one sample (LL026017) had measured or estimated concentrations greater than 1 mg/L of any identifiable compound. In that sample, benzl alcohol was detected in estimated concentrations of 11 mg/L and benzoic acid was detected in estimated concentrations of 8.1 mg/L.*

Total organic carbon. *Results for total organic carbon analysis from seven tanks are shown in Table L4.3.4. The two lowest values of 0.5 and 0.6 ug/mL represent a field blank and rinsate. Values for containers range from 6.2 ug/mL for tank 21R at Building 131 to 880 ug/mL in sump 41R at Building 492. Four tanks/sumps contained less than 100 ug/mL of TOC and three contained over 200 ug/mL.*

Oil and grease. *Oil and grease was requested for one of the 13 requests--sump 31R of Building 321 (Request 25). The result in Table L4.3.4 shows 122,000 ug/L.*

Radiochemistry.

Request 14 (Building 131, tank 21R). Sample LL014013H contained 30 pCi/L and 130 pCi/L of gross alpha and beta, respectively. Sample LL014013I contained 30 pCi/L of tritium.

Request 15 (Building 141, sump 41R). Gross alpha was not detected. Gross beta activity was 76 pCi/L.

Request 16 (Building 141, sump 42R). Gross alpha was not detected. Gross beta was 3.5 pCi/L.

Request 17 (Building 141, sump 43R). Gross alpha was not detected. Gross beta was 24 pCi/L.

Request 18 (Building 151, tank 21R). Gross alpha was 32 pCi/L. Gross beta was 8 pCi/L.

Request 19 (Building 151, tank 22R). Gross alpha was 41 pCi/L. Gross beta was 86 pCi/L.

Request 20 (Building 222, tank 21R). Gross alpha was 38 pCi/L. Gross beta was 110 pCi/L. Tritium measured 65 pCi/L.

Request 21 (Building 222, tank 22R). Gross alpha was 43 pCi/L. Gross beta was 46 pCi/L. Tritium was not detected.

Request 22 (Building 231, sump 41R). Tritium was 590 pCi/L. Uranium was 1,144 pCi/L. Cesium-137 was 7.6 pCi/L.

Request 24 (Building 298, tank 41R). Gross alpha was 18 pCi/L. Gross beta was 40 pCi/L. Tritium was 840 pCi/L.

Request 25 (Building 321, sump 31R). Gross alpha was 41 pCi/L. Gross beta was 95 pCi/L. Tritium was 1500 pCi/L.

Request 26 (Building 492, sump 41R). Gross alpha was 27 pCi/L. Tritium was 120 pCi/L. Gross beta was not detected. Uranium measured 4.5 pCi/L.

Analytical Data Evaluation:

Anions. The quantitation limit at ORNL for the five anions was above the DOE method detection limit. To assess the presence/absence of a constituent, it should be noted that the MDL at the 10 micromho (umho) full scale attenuator setting was less than 1000 ug/L for chloride and fluoride and less than 5000 ug/L for nitrate, phosphate, and sulfate. The two highest nitrate concentrations are noted with the symbol N, reflecting that the spiked sample recovery was not within control limits.

Cyanide. The quantitation limit for cyanide is 2 ug/L. Although calibration verification was performed, no duplicates or spikes were analyzed.

Metals. The listed metals of interest were found above the CRQL in the samples for the following requests:

Request 14. Chromium, copper, lead, mercury, nickel, and zinc.

Request 15. Cadmium, chromium, copper, lead, nickel, and zinc.

Request 16. Chromium, copper, lead, nickel, and zinc.

Request 17. Chromium, copper, lead, nickel, and zinc.

Request 18. Cadmium, chromium, copper, lead, mercury, nickel, and zinc.

Request 19. Cadmium, chromium, copper, lead, mercury, nickel, and zinc.

Request 20. Cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc.

Request 21. Cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc.

Request 22. Beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc.

Request 24. Beryllium, chromium, copper, lead, mercury, nickel, and zinc.

Request 25. Antimony, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

Request 26. Cadmium, chromium, copper, lead, nickel, and zinc.

Volatile organics. As would be expected, the tanks and sumps were contaminated to varying degrees with various volatiles.

Extractable organics.

Request 22. Benzoic acid (58 ug/L), 4-chloro-3 methylphenol (27 ug/L), and 4-methylphenol (67 ug/L) were present.

Request 24. Benzyl alcohol was present at 40 ug/L.

Request 26. Benzyl alcohol was estimated at 11,000 ug/L.

Total organic carbon. Total organic carbon analysis was not requested in the sampling plan. Considering the range of concentrations, these results could prove useful by comparing them with the other organic analyses requested for this problem.

Oil and grease. Although not required, an EPA oil and grease quality control solution was analyzed. The result was 112% of the true value, which is within the allowable limit range specified by EPA.

Radiochemistry. Liquid samples from 12 retention tanks and sumps were analyzed for gross alpha and gross beta activity. In addition, several samples were analyzed for tritium and given a gamma scan. Results are given in Table L4.3.4

4.9.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level I, and sampling is rated Quality Level II. The overall analytical rating is Quality Level II.

Field Data: The rating of Quality Level II for the sampling is due to inconsistent treatment (mixing) prior to taking the sample. The plan called for mixing the contents by hand or by pump for 2 min; the actual times varied from no mixing to 15 min. Although the plan called for sampling when the sump/tank was at least half full, this was not possible at all times because the contents varied.

Analytical Data: The anions are rated Quality Level II even though the MDL at ORNL was above that specified in the DOE Environmental Survey Manual,

because several anions exceeded the ORNL-MDL; thus, the results are useful. The ICP data are Quality Level I with four exceptions for zinc. About one-half of the data for volatiles were Quality Level I or II; Quality Level III was due mainly to detection level. In samples requesting semivolatiles, most of the compounds were detected in very low concentrations. Possible low semivolatiles are due to tentative identification by mass spectrometry and to exceeding the holding times. Details on analytical data quality levels for specific parameters are given below.

Anions. Calibration was verified using the NBS standard; detector response was also verified. Quality control solutions were within $\pm$10%, which is in compliance with EPA requirements. A duplicate for SDG LL025016J was not analyzed; all other duplicate results were in conformance. All spike results were in compliance except the NO_3 result of SDG LL018017E where the recovery was 130%. Holding times were exceeded by over 5 days for fluoride and nitrate for samples LL015014F and LL015025F. Anion data are Quality Level II primarily because the detection limit is above the MDL set by DOE.

Cyanide. The quality control solution from EPA was analyzed and the result was $\pm$10%, which is in compliance. All holding times were met. The cyanide analysis is rated Quality Level II principally due to the absence of duplicate or spike samples.

Metals. Duplicates, spiked samples, and serial dilutions were generally within control limits for these samples. Serial dilution was beyond control limits in some cases with respect to zinc.

Data are Quality Level I in all cases except zinc in the samples LL014013, LL015025, LL022013, and LL022024. Because zinc data for these samples are unusable, they are Quality Level III.

Volatile organics. Many volatiles were present in small concentrations in blank samples. Many were only tentatively identified or identified at concentrations below the quantification limit. In some of the tanks and sumps, many volatiles were present in concentrations exceeding the range of instrument calibration.

Slightly over half of the data were given as Quality Level III on the quality level summary sheet. The great majority of these were either not clearly identified by mass spectrometry or detected at concentrations below the quantitation limit. Quality Levels II and I occurred in about 25% and 21%, respectively, of the entries on the data quality summary sheets for volatiles.

Extractable organics. Most of the concentrations given are small or estimated values. In the only cases where concentrations exceeded 1 mg/L (benzyl alcohol and benzoic acid in sample LL026017), the estimated values exceeded the calibration range of the instrument. The data are Quality Level II due mainly to tentative identification by mass spectrometry (for TICs).

Oil and grease. Although it was not required, an EPA quality control solution was analyzed. The result was within the allowable control limit range. The sample duplicate was within the control limit of $\pm$20% relative percent difference (RPD). All holding times were met. The oil and grease analysis is rated Quality Level I.

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.

Environmental Problem: LLNL 4
Request Number: LLNL 14

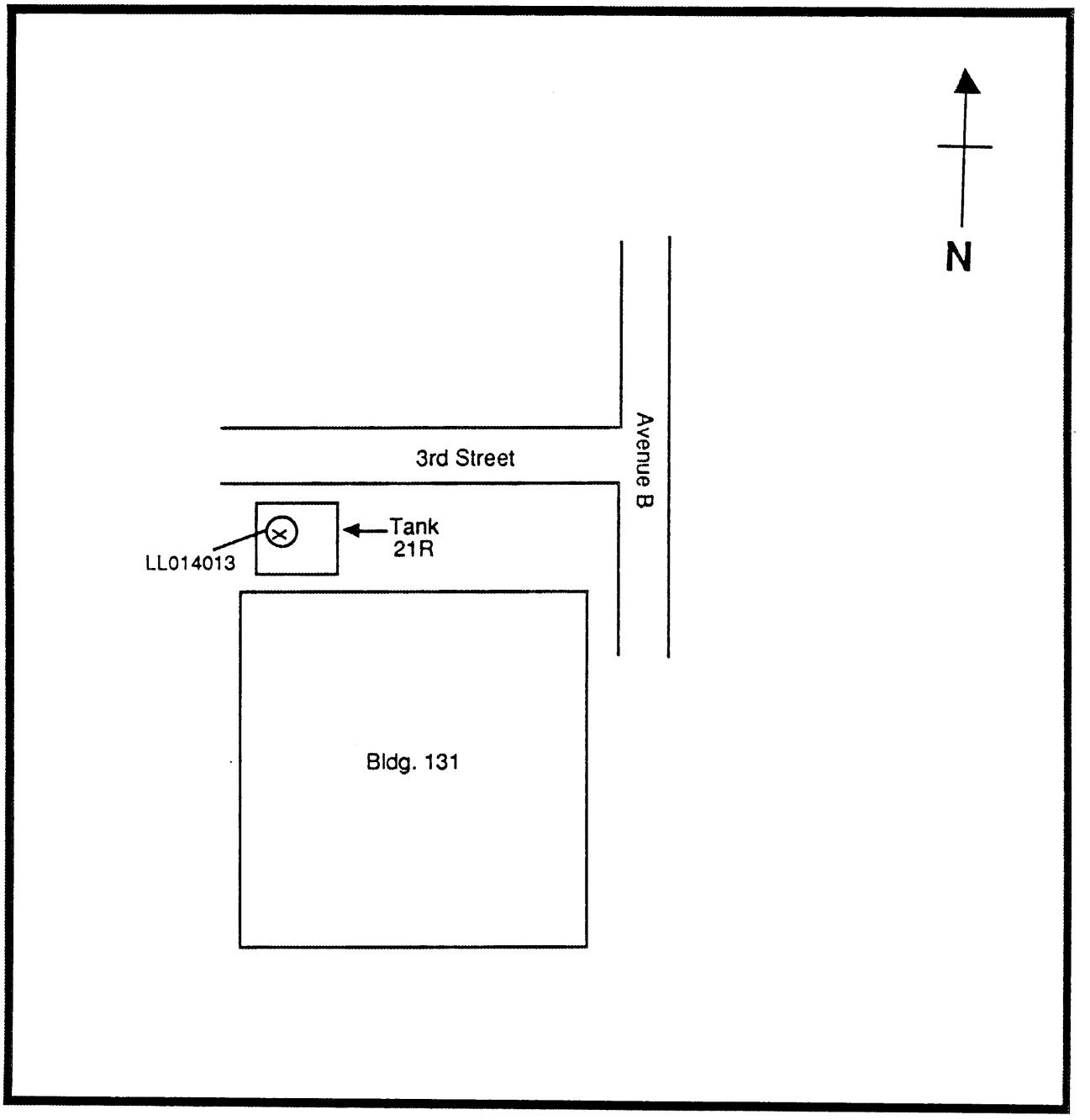


Figure L4.4a. Building 131, Tank 21R (LLNL Request 14)

Environmental Problem: LLNL 4
Request Number: LLNL 15

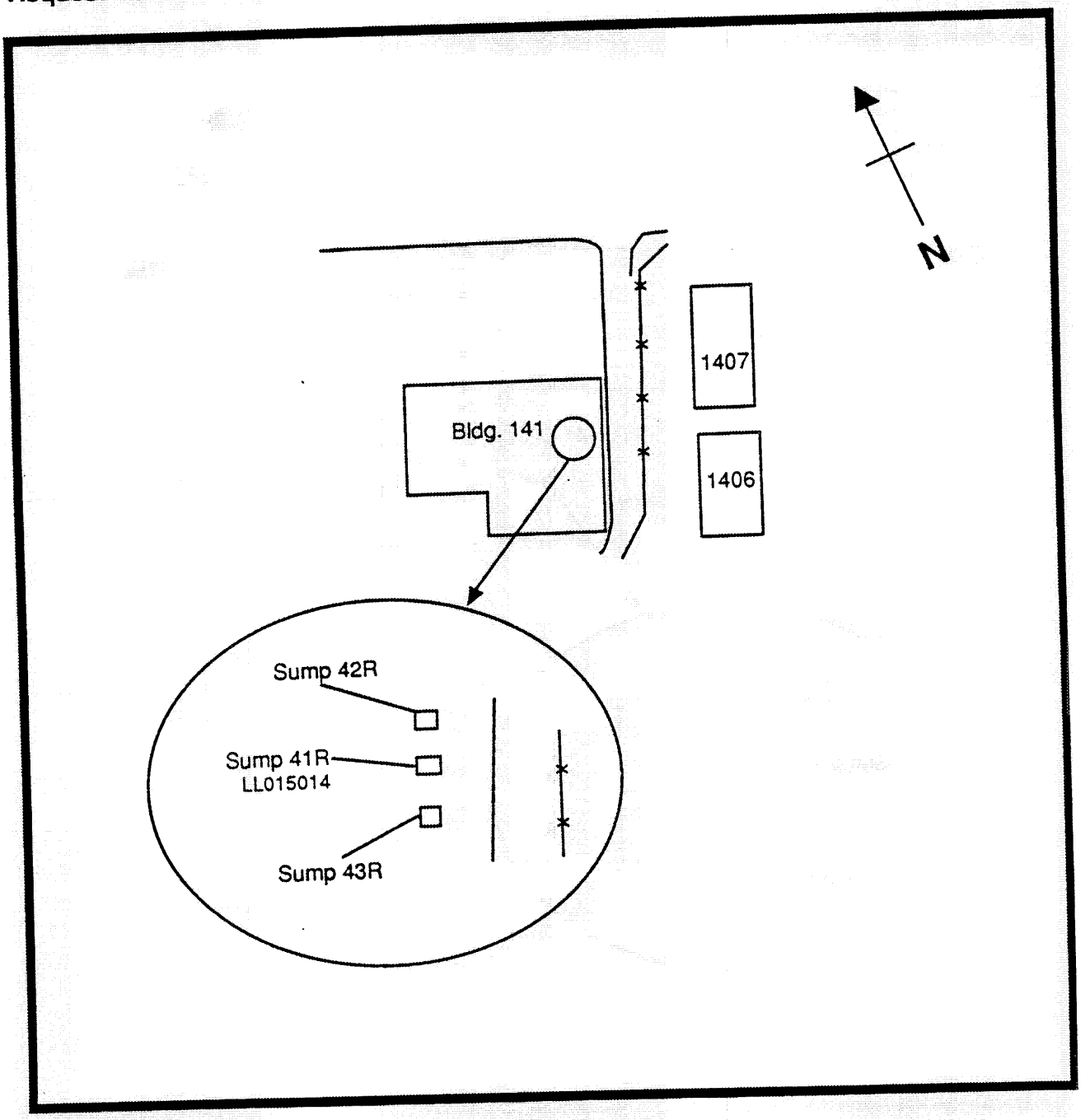


Figure L4.4b. Building 141, Sump 41R (LLNL Request 15)

Environmental Problem: LLNL 4
Request Number: LLNL 16

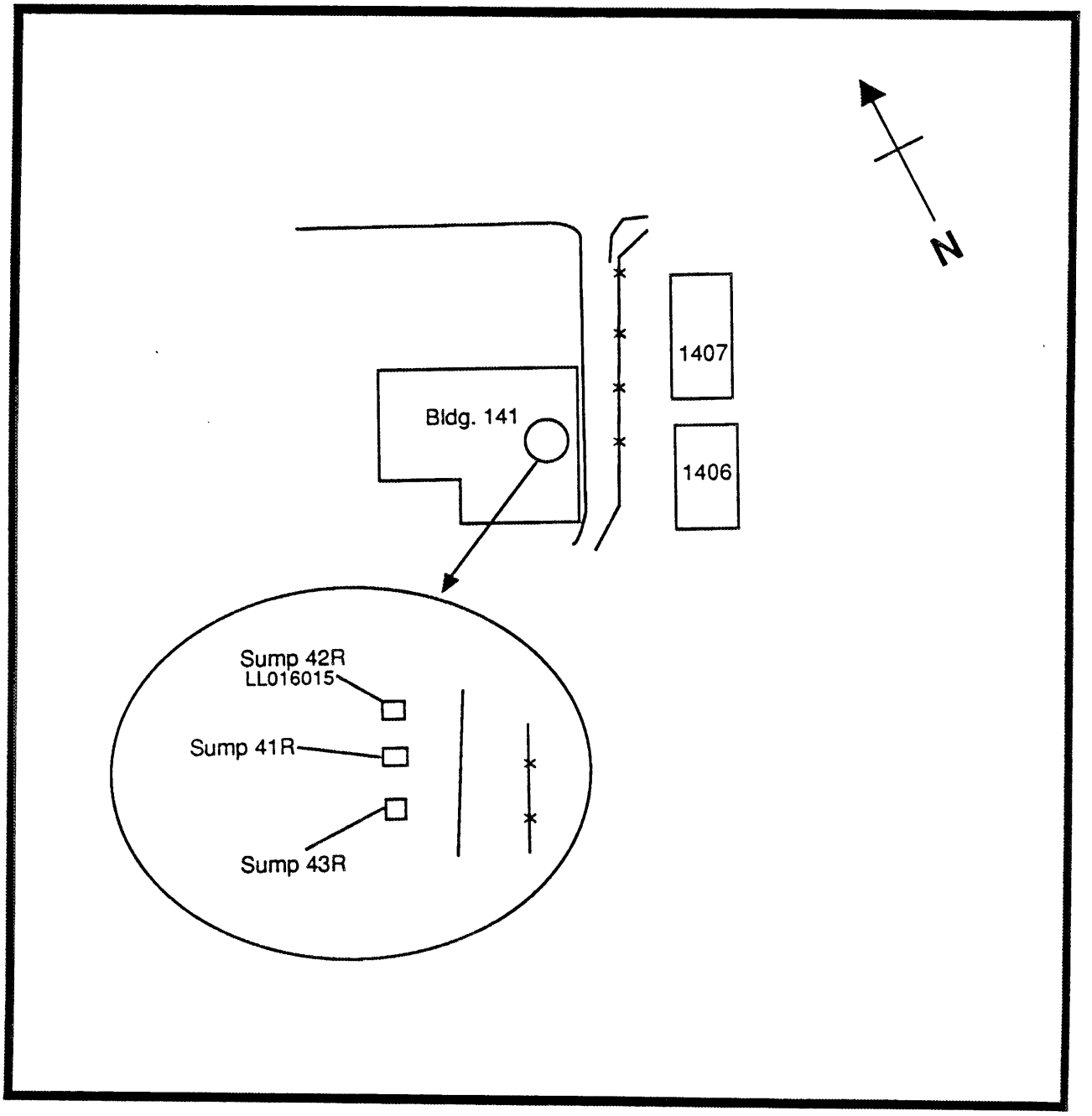


Figure L4.4c. Building 141, Sump 42R (LLNL Request 16)

Environmental Problem: LLNL 4
Request Number: LLNL 17

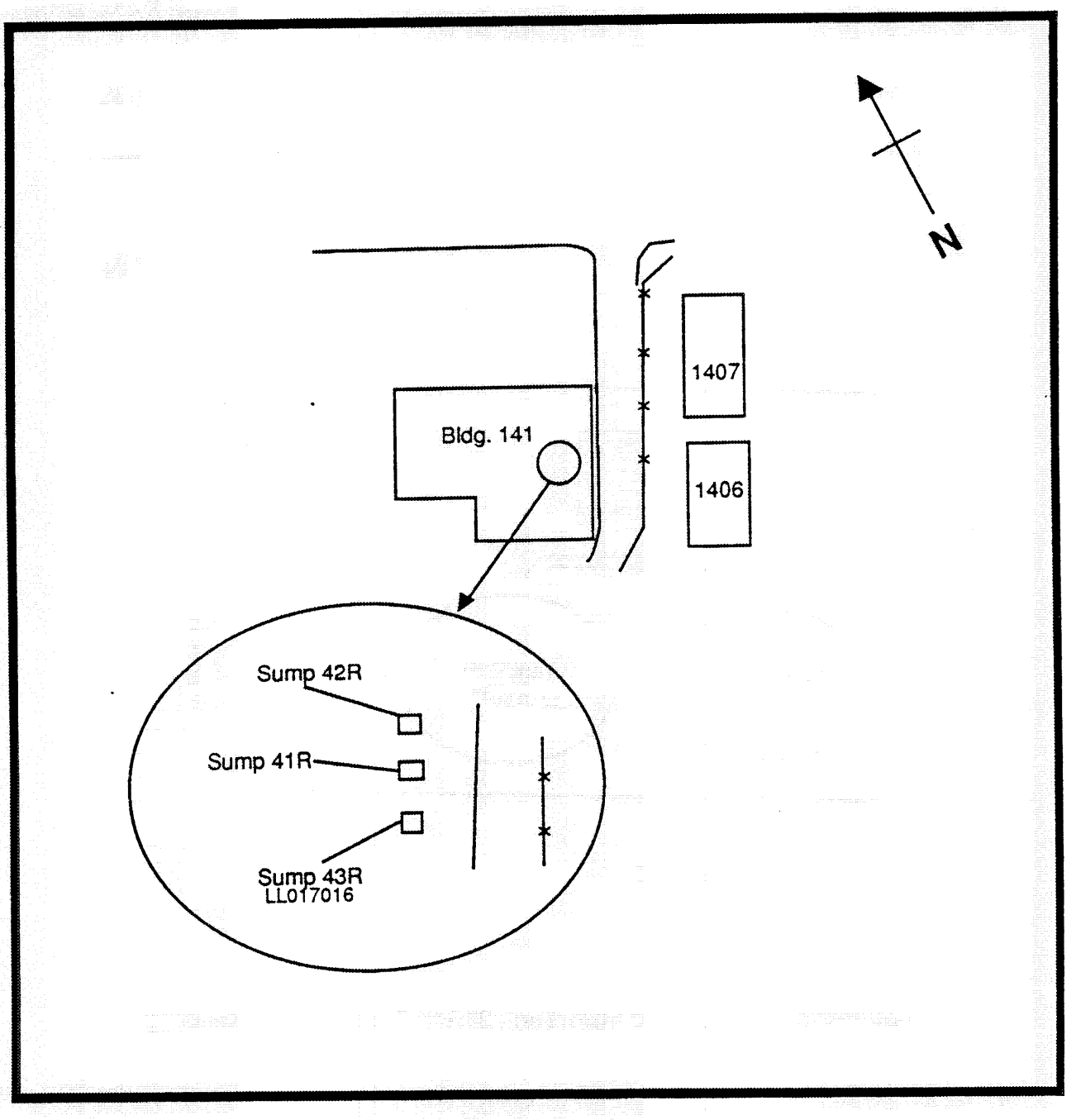
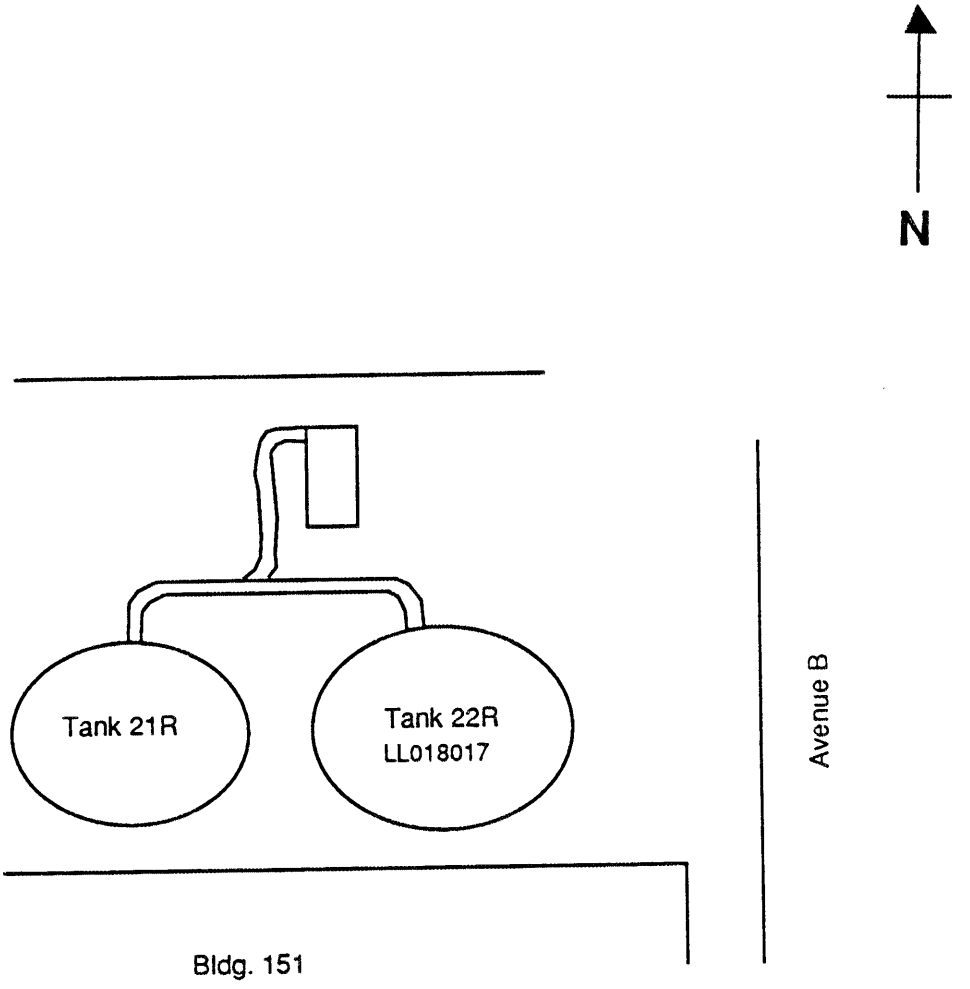


Figure L4.4d. Building 141, Sump 43R (LLNL Request 17)

Environmental Problem: LLNL 4
Request Number: LLNL 18



(Contents are circulated from Tank 21R to Tank 22R for sampling.)

Figure L4.4e. Building 151, Tank 21R (LLNL Request 18)

Environmental Problem: LLNL 4
Request Number: LLNL 19

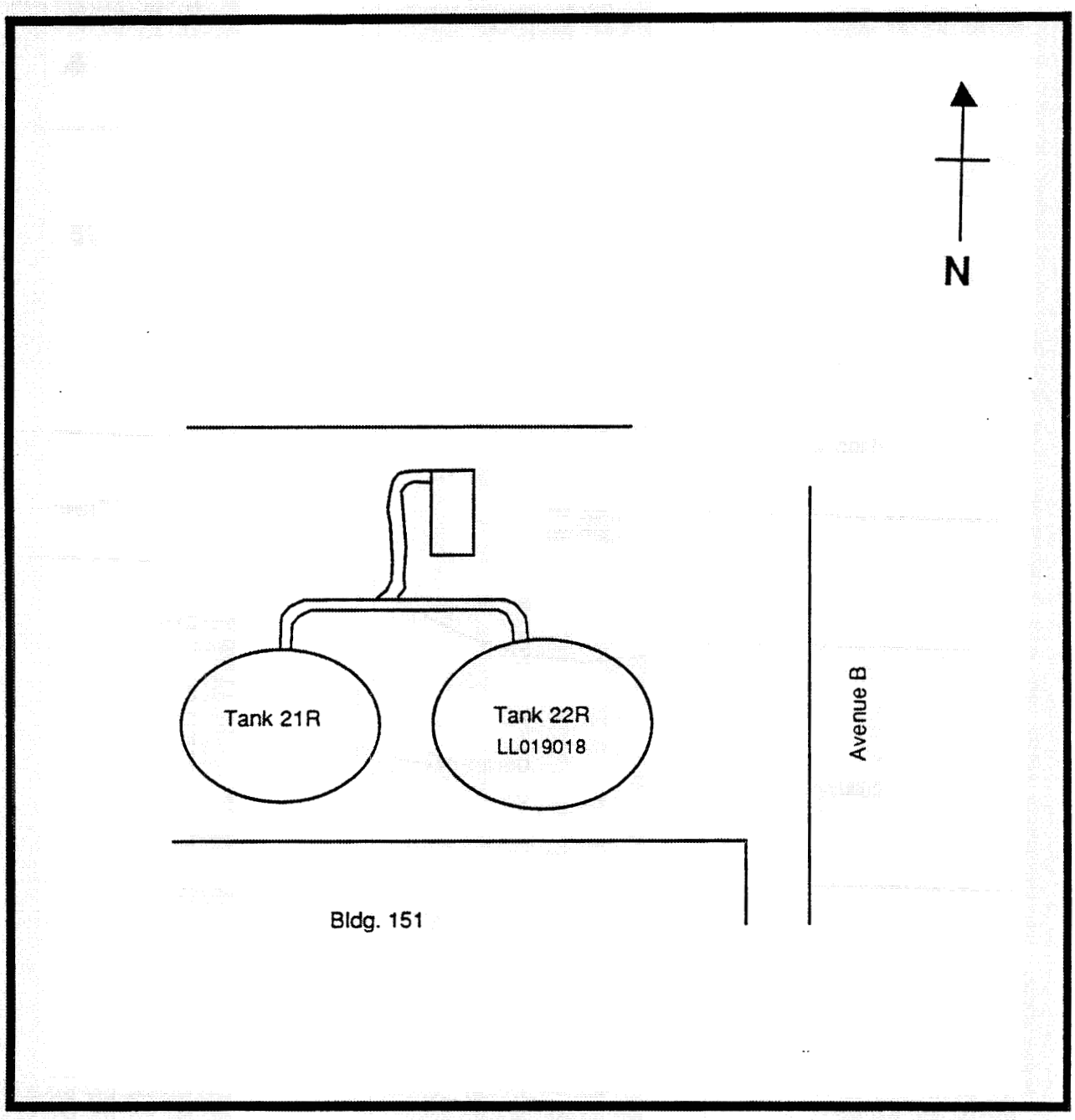


Figure L4.4f. Building 151, Tank 22R (LLNL Request 19)

Environmental Problem: LLNL 4
Request Number: LLNL 20

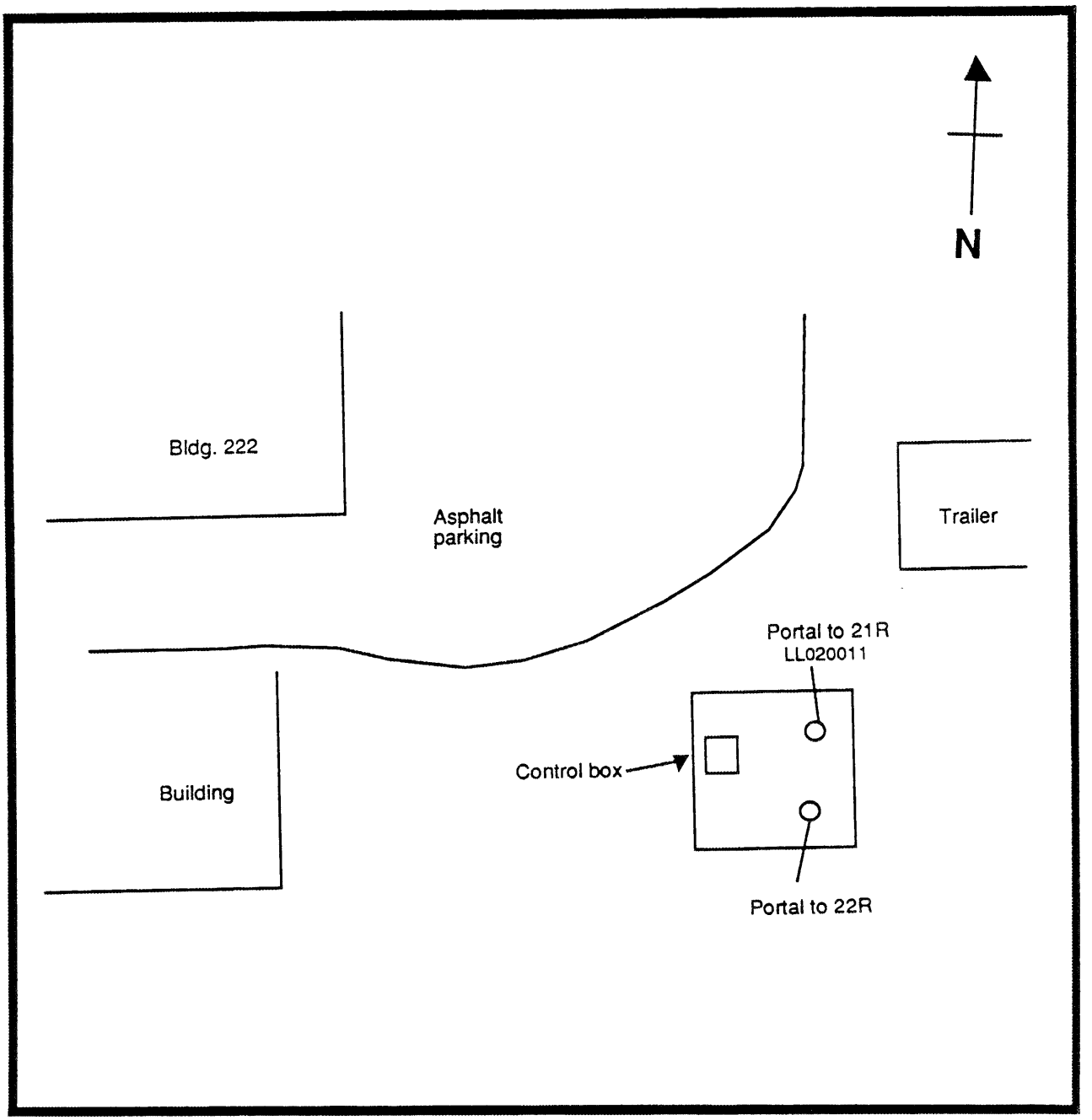


Figure L4.4g. Building 222, Tank 21R (LLNL Request 20)

Environmental Problem: LLNL 4
Request Number: LLNL 21

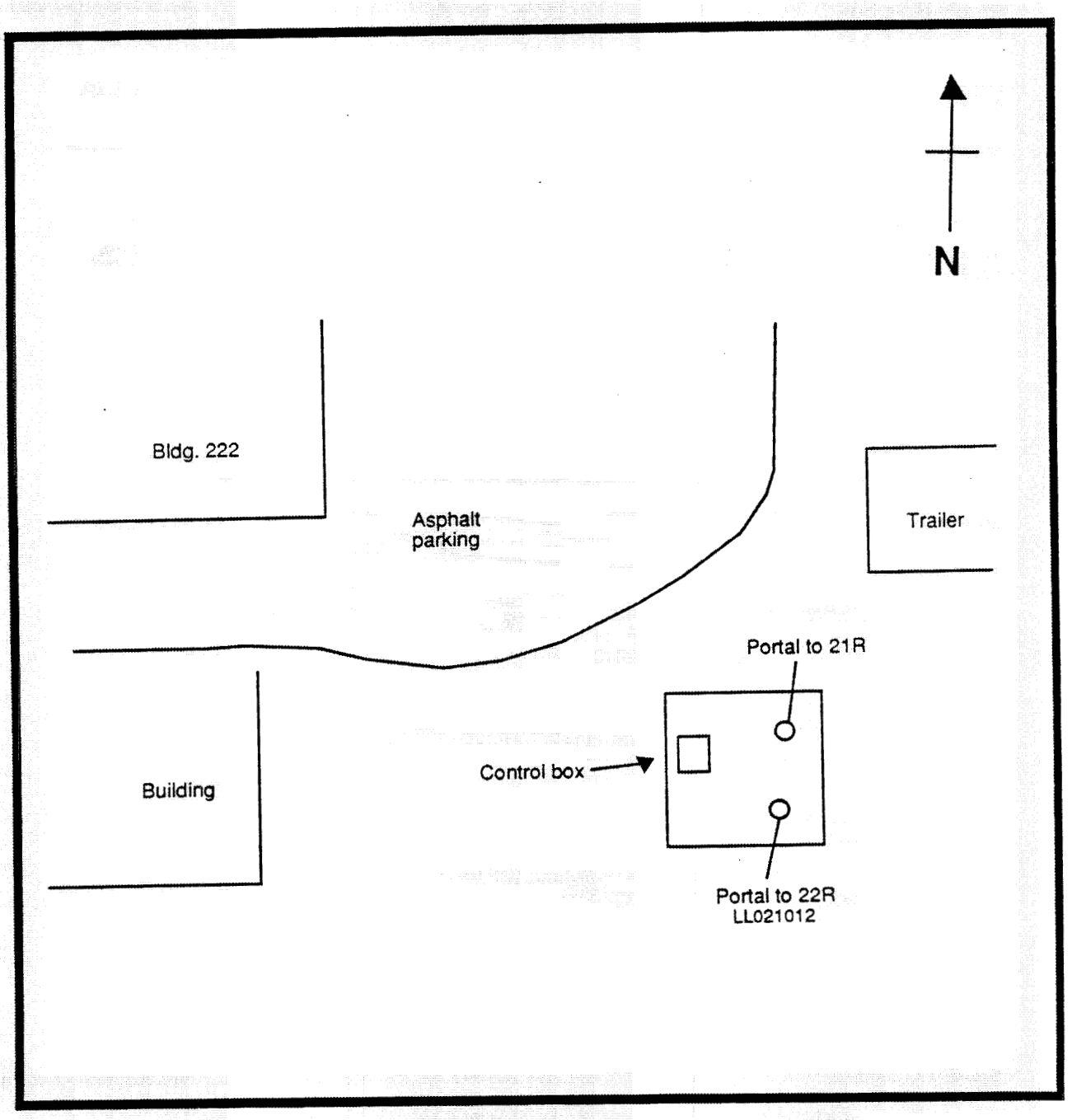


Figure L4.4h. Building 222, Tank 22R (LLNL Request 21)

Environmental Problem: LLNL 4
Request Number: LLNL 22

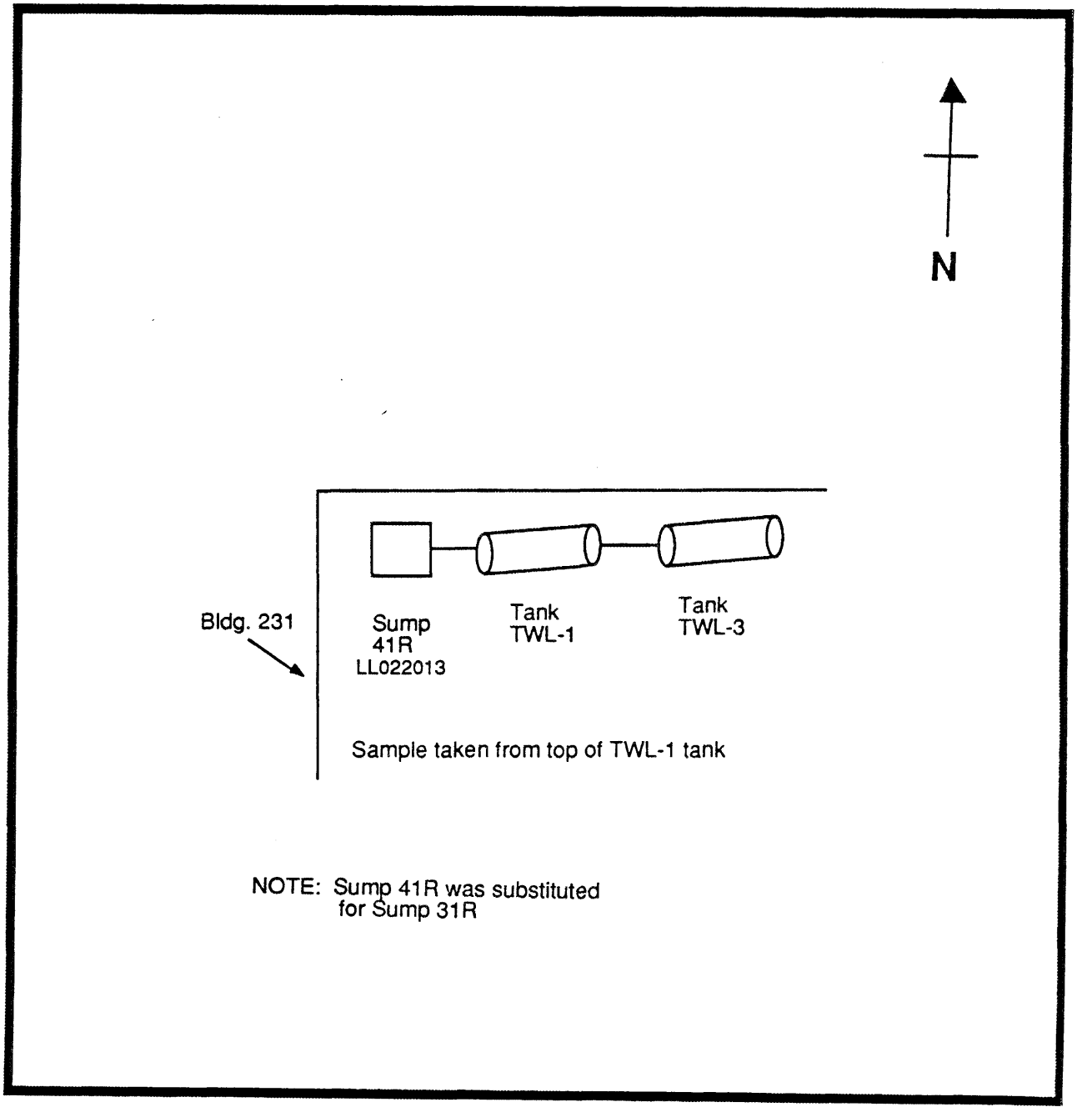


Figure L4.4i. Building 231, Sump 41R (LLNL Request 22)

Environmental Problem: LLNL 4
Request Number: LLNL 23

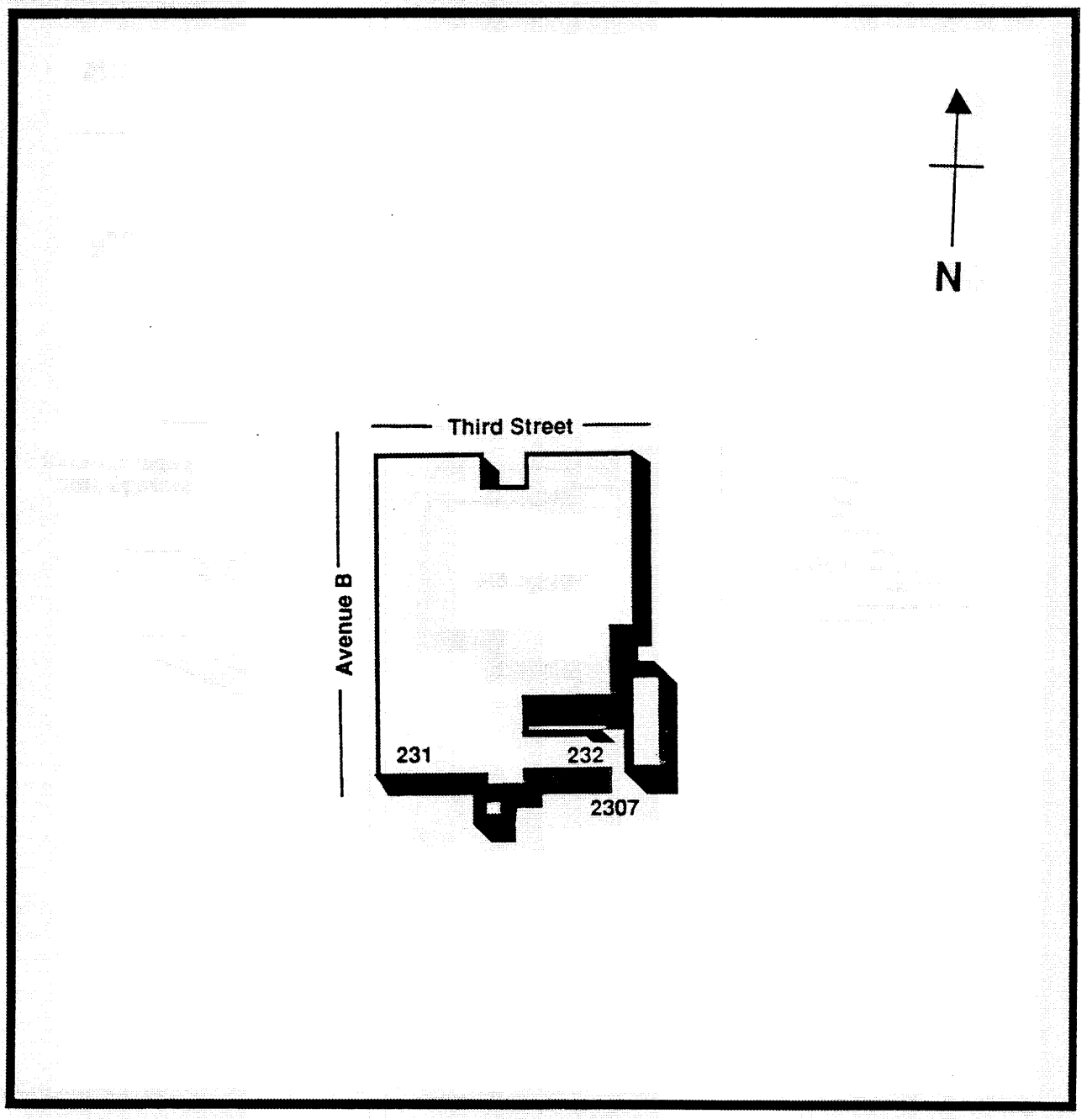


Figure L4.4j. Building 231, Sump 33R (LLNL Request 23)

Environmental Problem: LLNL 4
Request Number: LLNL 24

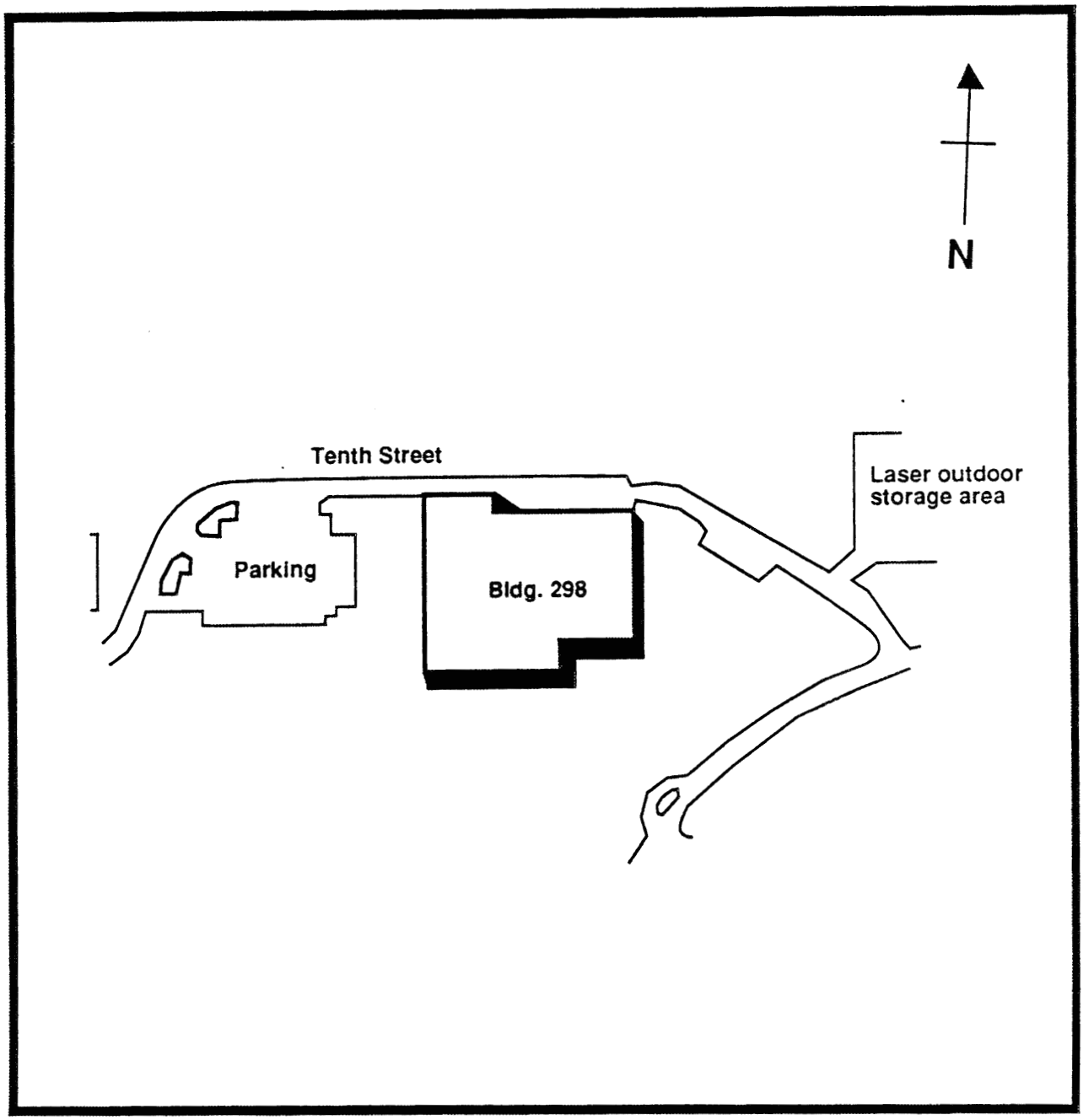


Figure L4.4k. Building 298, Tank 41R (LLNL Request 24)

Environmental Problem: LLNL 4
Request Number: LLNL 25

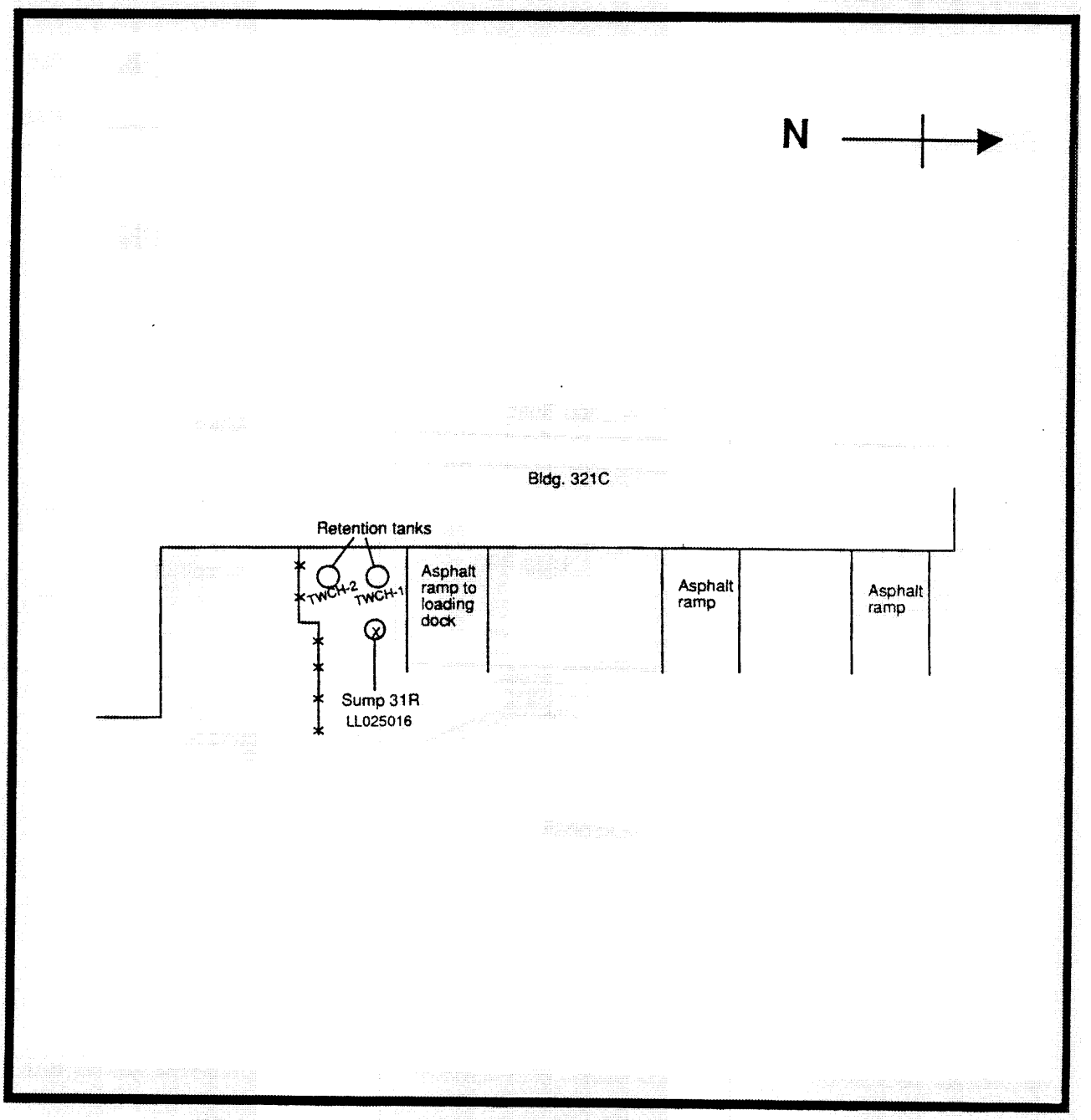


Figure L4.4l. Building 321, Sump 31R (LLNL Request 25)

Environmental Problem: LLNL 4
Request Number: LLNL 26

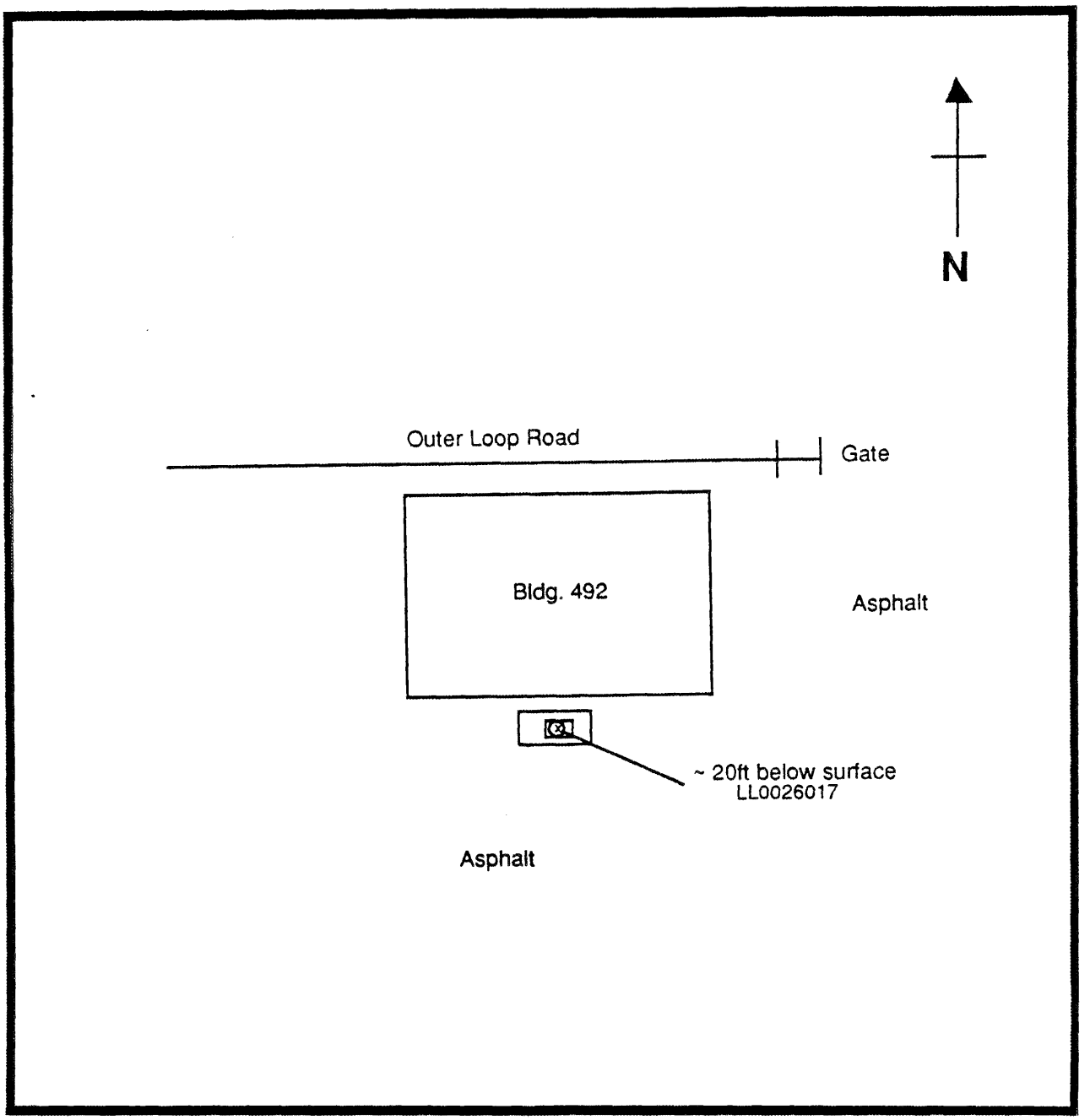


Figure L4.4m. Building 492, Sump 41R (LLNL Request 26)

TABLE L4.2.4 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	HE NUMB HITS	HE 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
LL015	BLDG. 141	SUMP	SUR WATER	1	1	QC RN	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL022	BLDG. 231	SUMP	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL023	BLDG. 231	SUMP	SUR WATER	1	0	QC FL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LL025	BLDG. 321	SUMP	SUR WATER	1	1	QC FL	0	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0
			MED TOTAL	4	3		0	2	3	3	0	0	0	0	0	0	2	2	3	3	2	2
LL014	BLDG. 131	TANK	SEALED CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL022	BLDG. 231	SUMP	SEALED CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
			MED TOTAL	2	2		0	0	2	2	0	0	0	0	0	0	1	1	2	2	2	2
LL015	BLDG. 141	SUMP	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL016	BLDG. 141	SUMP	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL017	BLDG. 141	SUMP	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL018	BLDG. 151	TANK	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL019	BLDG. 151	TANK	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL020	BLDG. 222	TANK	UNSEAL CO	1	1	GRAB	0	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL021	BLDG. 222	TANK	UNSEAL CO	1	1	GRAB	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
LL023	BLDG. 231	SUMP	UNSEAL CO	1	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LL024	BLDG. 298	TANK	UNSEAL CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
LL025	BLDG. 321	SUMP	UNSEAL CO	1	1	GRAB	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1
LL026	BLDG. 492	SUMP	UNSEAL CO	1	1	GRAB	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1
			MED TOTAL	11	10		7	8	10	10	1	1	0	0	0	0	3	3	10	10	10	10
			EP TOTAL	17	15		7	10	15	15	1	1	0	0	0	0	6	6	15	15	14	14

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TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 014
LOCATION: BUILDING 131 TANK 21R
MEDIUM: SEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL014013
PH (UNITS)		8.6
TEMPERATURE (DEG C)		29

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL014013F	LL014013G
	SDG NO:	LL001041F	LL014013G
	TYPE:	GRAB	GRAB
ALUMINUM		156 B	
ARSENIC			7.6 B
BARIUM		4.7 B	
CADMIUM		4.5 B	
CALCIUM		202 B	
CHROMIUM			194
COPPER		822	
IRON		2560	
LEAD			1310
MAGNESIUM		51 B	
MANGANESE		19	
MERCURY			2.6
NICKEL			67
POTASSIUM		150000	
SILVER			0.9 B
SODIUM		15800	
ZINC		180	

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL014013E
	SDG NO:	LL015025E
	TYPE:	GRAB
TOC		6.2

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL014013A
	SDG NO:	0808
	TYPE:	GRAB
ACETONE		5 JB
METHYLENE CHLORIDE		11 B
TRICHLOROETHENE		7
1,1-DICHLOROETHANE		2 J
1,1-DICHLOROETHENE		2 J
1,1,1-TRICHLOROETHANE		210 E

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 014
LOCATION: BUILDING 131 TANK 21R
MEDIUM: SEALED CONTAINER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL014013H	LL014013I
	SDG NO:	LLL7208	LLL7208
	TYPE:	GRAB	GRAB
G-ALPH		30	
GROSS-BETA		130	
H-3			30

S&A REQUEST: 015
LOCATION: BUILDING 141 SUMP 41R CHROMATE SUMP
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL015025G	LL015025H
	SDG NO:	LL001041F	LL012033C
	TYPE:	RINSATE	RINSATE
ALUMINUM		62 B	
BARIUM		3.4 B	
CHROMIUM		9.5 B	
COPPER		5.4 B	
IRON		58 B	
LEAD		31 B	
MAGNESIUM		10 B	
MANGANESE		4.3 B	
MERCURY			0.02 B
NICKEL		9 B	
POTASSIUM		200 B	
SODIUM		421 B	
ZINC		8 B	

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL015025E
	SDG NO:	LL015025E
	TYPE:	RINSATE
TOC		0.6

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 015
LOCATION: BUILDING 141 SUMP 41R CHROMATE SUMP
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL015025A					
	SDG NO:	0810					
	TYPE:	RINSATE					
ACETONE		15 B					
ETHYLBENZENE		1 J					
METHYLENE CHLORIDE		13 B					
TOLUENE		1 JB					

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL015025I					
	SDG NO:	LLL7208					
	TYPE:	RINSATE					
G-ALPH		19					
GROSS-BETA		14					
H-3		220					

S&A REQUEST: 015
LOCATION: BUILDING 141 SUMP 41R CHROMATE SUMP
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL015014					
PH (UNITS)		7					
TEMPERATURE (DEG C)		24					

ANIONS AND CYANIDE (UG/L)	SAMP NO:	LL015014F					
	SDG NO:	LL015014F					
	TYPE:	GRAB					
FLUORIDE		20000					
NITRATE-N		24000					

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL015014G	LL015014H				
	SDG NO:	LL001041F	LL014013G				
	TYPE:	GRAB	GRAB				
ALUMINUM		70400					
ARSENIC			0.8 B				

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 015
LOCATION: BUILDING 141 SUMP 41R CHROMATE SUMP
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL015014G	LL015014H
	SDG NO:	LL001041F	LL014013G
	TYPE:	GRAB	GRAB
BARIUM		38 B	
BERYLLIUM			0.4 B
CADMIUM		29	
CALCIUM		9320	
CHROMIUM			44000
COBALT		22 B	
COPPER		11600	
IRON		6340	
LEAD			2950
MAGNESIUM		14800	
MANGANESE		392	
MERCURY			0.11 B
NICKEL			441
POTASSIUM		27000	
SODIUM		269000	
ZINC		2090	

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL015014E
	SDG NO:	LL015025E
	TYPE:	GRAB
TOC		26

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL015014A
	SDG NO:	0809
	TYPE:	GRAB
ACETONE		51 B
CARBON TETRACHLORIDE		24
ETHYLBENZENE		1 JB
METHYLENE CHLORIDE		12 B
TOLUENE		0.8 JB
TRICHLOROETHENE		15
1,1-DICHLOROETHENE		3 J
1,1,1-TRICHLOROETHANE		170

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 015
LOCATION: BUILDING 141 SUMP 41R CHROMATE SUMP
MEDIUM: UNSEALED CONTAINER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL015014I
	SDG NO:	LLL7208
	TYPE:	GRAB
G-ALPH		0
GROSS-BETA		76

S&A REQUEST: 016
LOCATION: BUILDING 141 SUMP 42R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL016015
PH (UNITS)		3.7
TEMPERATURE (DEG C)		21

ANIONS AND CYANIDE (UG/L)	SAMP NO:	LL016015E
	SDG NO:	LL016015E
	TYPE:	GRAB
CHLORIDE		12000
FLUORIDE		32000
NITRATE-N		5700
O-PHOSPHATE-P		21000
SULFATE		44000

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL016015F	LL016015G
	SDG NO:	LL012066B	LL014013G
	TYPE:	GRAB	GRAB
ALUMINUM		953	
ARSENIC			2.7 B
BARIUM		10 B	
CADMIUM		4.7 B	
CALCIUM		4960 B	
CHROMIUM			1190
COPPER		5030	
IRON		3550	
LEAD			1700
MAGNESIUM		386 B	

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 016
LOCATION: BUILDING 141 SUMP 42R
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL016015F	LL016015G
	SDG NO:	LL012066B	LL014013G
	TYPE:	GRAB	GRAB
MANGANESE		37	
MERCURY			0.07 B
NICKEL			157
POTASSIUM		36000	
SODIUM		12500	
ZINC		326	

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL016015A
	SDG NO:	0825
	TYPE:	GRAB
ACETONE		63 B
CARBON TETRACHLORIDE		28
CHLOROFORM		8
METHYLENE CHLORIDE		12
TOLUENE		39 B
TRICHLOROETHENE		72
VINYL ACETATE		2 J
1,1-DICHLOROETHENE		4 J
1,1,1-TRICHLOROETHANE		200
* ETHANOL (ACN)(9CI)(5.42)		8 J
* UNKNOWN(19.97)		4 J
* UNKNOWN(31.12)		50 J

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL016015H
	SDG NO:	LLL7289
	TYPE:	GRAB
G-ALPH		0
GROSS-BETA		3.5

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 017
LOCATION: BUILDING 141 SUMP 43R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL017016					
PH (UNITS)		12					
TEMPERATURE (DEG C)		23					

ANIONS AND CYANIDE (UG/L)	SAMP NO:	LL017016E					
	SDG NO:	LL016015E					
	TYPE:	GRAB					
CHLORIDE		140000					
FLUORIDE		12000					
NITRATE-N		6200					
SULFATE		21000					

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL017016F	LL017016G				
	SDG NO:	LL012066B	LL014013G				
	TYPE:	GRAB	GRAB				
ALUMINUM		1010					
ARSENIC			1 B				
BARIUM		105 B					
CADMIUM		4.6 B					
CALCIUM		6040					
CHROMIUM			190				
COPPER		6350					
IRON		2910					
LEAD			3400				
MAGNESIUM		731 B					
MANGANESE		32					
MERCURY			0.05 B				
NICKEL			14				
POTASSIUM		2900 B					
SODIUM		366000					
URANIUM, TOTAL		2					
ZINC		1670					

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL017016A					
	SDG NO:	0825					
	TYPE:	GRAB					
ACETONE		150 B					
BROMODICHLOROMETHANE		7					
CARBON TETRACHLORIDE		220 E					

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 017
LOCATION: BUILDING 141 SUMP 43R
MEDIUM: UNSEALED CONTAINER

VOLATILE ORGANICS (UG/L)	SAMP NO: LL017016A SDG NO: 0825 TYPE: GRAB
CHLOROBENZENE	1 J
CHLOROFORM	590 E
DIBROMOCHLOROMETHANE	2 J
ETHYLBENZENE	2 JB
METHYLENE CHLORIDE	850 E
TETRACHLOROETHENE	2 J
TOLUENE	380 BE
TRICHLOROETHENE	3 J
1,1-DICHLOROETHANE	290 E
1,1-DICHLOROETHENE	110
2-BUTANONE	770 E
* CYCLOPENTANE, 1,1,3-TRI(23.06)	4 J
* CYCLOPENTANE, 1,3-DIMET(20.17)	4 J
* ETHANE, 1,2-DIMETHOXY-(17.03)	100 J
* ETHANOL, 2-BUTOXY-(31.04)	170 J
* UNKNOWN(12.74)	20 J
* 2-PROPANOL(8.84)	28 J

RADIOCHEMISTRY (PCI/L)	SAMP NO: LL017016H SDG NO: LLL7289 TYPE: GRAB
G-ALPH	0
GROSS-BETA	24

S&A REQUEST: 018
LOCATION: BUILDING 151 TANK 21R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO: LL018017
PH (UNITS)	2.8
TEMPERATURE (DEG C)	23

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 RETENTION TANKS AND SUMPS

DRAFT DO NOT CITE

S&A REQUEST: 018
LOCATION: BUILDING 151 TANK 21R
MEDIUM: UNSEALED CONTAINER

ANIONS AND CYANIDE (UG/L)	SAMP NO: LL018017E SDG NO: LL018017E TYPE: GRAB
CHLORIDE	80000
FLUORIDE	1000
NITRATE-N	260000 N
O-PHOSPHATE-P	8100
SULFATE	11000

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: LL018017F SDG NO: LL012066B TYPE: GRAB	LL018017G LL014013G GRAB
ALUMINUM	472	
ARSENIC		1.4 B
BARIUM	80 B	
CADMIUM	19	
CALCIUM	4830 B	
CHROMIUM		14
COPPER	322	
IRON	867	
LEAD		163
MAGNESIUM	923 B	
MANGANESE	44	
MERCURY		3
NICKEL		149
POTASSIUM	5800	
SILVER		0.3 B
SODIUM	50800	
ZINC	1790	

VOLATILE ORGANICS (UG/L)	SAMP NO: LL018017A SDG NO: 0826 TYPE: GRAB
ACETONE	2300 BE
CARBON DISULFIDE	2 J
CARBON TETRACHLORIDE	12
CHLOROFORM	3 J
ETHYLBENZENE	1 JB
METHYLENE CHLORIDE	0.7 JB
TOLUENE	4 JB
TRICHLOROETHENE	25

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 018
LOCATION: BUILDING 151 TANK 21R
MEDIUM: UNSEALED CONTAINER

VOLATILE ORGANICS (UG/L)	SAMP NO: LL018017A					
	SDG NO: 0826					
	TYPE: GRAB					
1,2-DICHLOROETHANE	370 E					

RADIOCHEMISTRY (PCI/L)	SAMP NO: LL018017H					
	SDG NO: LLL7289					
	TYPE: GRAB					
G-ALPH	32					
GROSS-BETA	8					

S&A REQUEST: 019
LOCATION: BUILDING 151 TANK 22R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO: LL019018					
PH (UNITS)	1.9					
TEMPERATURE (DEG C)	22					

ANIONS AND CYANIDE (UG/L)	SAMP NO: LL019018E					
	SDG NO: LL018017E					
	TYPE: GRAB					
CHLORIDE	290000					
FLUORIDE	2300					
NITRATE-N	1300000 N					
SULFATE	28000					

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: LL019018F	LL019018G				
	SDG NO: LL012066B	LL014013G				
	TYPE: GRAB	GRAB				
ALUMINUM	711					
ARSENIC		1 B				
BARIUM	123 B					
CADMIUM	12					

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 019
LOCATION: BUILDING 151 TANK 22R
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL019018F	LL019018G
	SDG NO:	LL012066B	LL014013G
	TYPE:	GRAB	GRAB
CALCIUM		7130	
CHROMIUM			23
COPPER		362	
IRON		1980	
LEAD			86
MAGNESIUM		1740 B	
MANGANESE		44	
MERCURY			9.9
NICKEL			32
POTASSIUM		6500	
SODIUM		52100	
ZINC		1550	

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL019018A
	SDG NO:	0826
	TYPE:	GRAB
ACETONE		2700 BE
CARBON DISULFIDE		1 J
CARBON TETRACHLORIDE		8
CHLOROFORM		2 J
ETHYLBENZENE		2 JB
METHYLENE CHLORIDE		0.9 JB
TOLUENE		38 B
TRICHLOROETHENE		45
XYLENE (TOTAL)		6
1,2-DICHLOROETHANE		110
* ETHANOL(5.52)		9 J
* UNKNOWN(14.5)		9 J
* UNKNOWN(9.03)		15 J

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL019018H
	SDG NO:	LLL7289
	TYPE:	GRAB
G-ALPH		41
GROSS-BETA		86

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 020
LOCATION: BUILDING 222 TANK 21R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL020011
PH (UNITS)		5.3
TEMPERATURE (DEG C)		22

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL020011H	LL020011I
	SDG NO:	LL003043F	LL014013G
	TYPE:	GRAB	GRAB
ALUMINUM		372	
ARSENIC			7.1 B
BARIUM		60 B	
CADMIUM		8	
CALCIUM		7580	
CHROMIUM			158
COPPER		101	
IRON		8770	
LEAD			113
MAGNESIUM		1760 B	
MANGANESE		70	
MERCURY			6.2
NICKEL			157
POTASSIUM		10000	
SILVER		13	
SODIUM		50100	
VANADIUM		8 B	
ZINC		157 E	

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL020011E
	SDG NO:	LL020011E
	TYPE:	GRAB
TOC		62

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL020011A
	SDG NO:	0824
	TYPE:	GRAB
ACETONE		2400 BE
CARBON DISULFIDE		1 J
CHLOROFORM		80
ETHYLBENZENE		2 J
METHYLENE CHLORIDE		2 JB

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 020
LOCATION: BUILDING 222 TANK 21R
MEDIUM: UNSEALED CONTAINER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL020011A
	SDG NO:	0824
	TYPE:	GRAB
TOLUENE		12
TRICHLOROETHENE		6
XYLENE (TOTAL)		29
1,1,1-TRICHLOROETHANE		4 J
1,2-DICHLOROETHANE		4 J
2-BUTANONE		40
* CYCLOHEXANE(14.97)		5 J
* ETHANOL(5.38)		8 J
* FURAN, TETRAHYDRO-(11.17)		4 J
* UNKNOWN(12.07)		7 J
* UNKNOWN(4.71)		15 J

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL020011J	LL020011K
	SDG NO:	LLL7268	LLL7268
	TYPE:	GRAB	GRAB
G-ALPH			38
GROSS-BETA			110
H-3		65	

S&A REQUEST: 021
LOCATION: BUILDING 222 TANK 22R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL021012
PH (UNITS)		6.7
TEMPERATURE (DEG C)		23

ANIONS AND CYANIDE (UG/L)	SAMP NO:	LL021012F	LL021012G
	SDG NO:	LL020011F	LL020011F
	TYPE:	GRAB	GRAB
CYANIDE, TOTAL		8	3

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 021
LOCATION: BUILDING 222 TANK 22R
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL021012H	LL021012I
	SDG NO:	LL003043F	LL014013G
	TYPE:	GRAB	GRAB
ALUMINUM		428	
ARSENIC			4.1 B
BARIUM		91 B	
CADMIUM		12	
CALCIUM		7250	
CHROMIUM			106
COBALT		32 B	
COPPER		279	
IRON		5100	
LEAD			172
MAGNESIUM		1350 B	
MANGANESE		48	
MERCURY			23
NICKEL			49
POTASSIUM		4500 B	
SILVER		54	
SODIUM		86700	
VANADIUM		4.6 B	
ZINC		143 E	

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL021012E
	SDG NO:	LL020011E
	TYPE:	GRAB
TOC		31

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL021012A
	SDG NO:	0824
	TYPE:	GRAB
ACETONE		2700 BE
CHLOROFORM		15
ETHYLBENZENE		1 J
METHYLENE CHLORIDE		3 JB
TOLUENE		6
TRICHLOROETHENE		2 J
XYLENE (TOTAL)		11
1,2-DICHLOROETHANE		3 J
* ETHYLETHER(12.12)		14 J
* FURAN, TETRAHYDRO-(11.17)		6 J

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 021
LOCATION: BUILDING 222 TANK 22R
MEDIUM: UNSEALED CONTAINER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL021012J	LL021012K				
	SDG NO:	LLL7268	LLL7268				
	TYPE:	GRAB	GRAB				
G-ALPH			43				
GROSS-BETA			46				
H-3		0					

S&A REQUEST: 022
LOCATION: BUILDING 231 SUMP 31R
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL022024F	LL022024G				
	SDG NO:	LL001041F	LL001041G				
	TYPE:	RINSATE	RINSATE				
ALUMINUM		129 B					
BARIUM		4.3 B					
CADMIUM		2.5 B					
CHROMIUM			7.5 B				
COPPER		15 B					
IRON		512					
MAGNESIUM		69 B					
MANGANESE		14 B					
MERCURY			0.02 B				
NICKEL			20				
POTASSIUM		200 B					
SODIUM		588 B					
VANADIUM		4.4 B					
ZINC		32					

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL022024E					
	SDG NO:	D112					
	TYPE:	RINSATE					
BIS(2-ETHYLHEXYL)PHTHALATE		6 J					
BUTYLBENZYLPHTHALATE		4 J					
DI-N-BUTYLPHTHALATE		1 J					
* HALOGENATED UNKNOWN (26.85)		2 J					
* PHENOL, DICHLORO (21.75)		5 J					
* UNKNOWN (33.66)		4 J					

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 022
LOCATION: BUILDING 231 SUMP 31R
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL022024A
	SDG NO:	0808
	TYPE:	RINSATE
ACETONE		10 B
METHYLENE CHLORIDE		11 B
TOLUENE		0.9 J

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL022024H	LL022024I
	SDG NO:	LLL7209	LLL7209
	TYPE:	RINSATE	RINSATE
G-ALPH			0
GROSS-BETA			68
H-3		190	230
U-234			0.92
U-235			0.24
U-238			0.94

S&A REQUEST: 022
LOCATION: BUILDING 231 SUMP 31R
MEDIUM: SEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL022013
CONDUCTIVITY (MS/CM)		0.85
PH (UNITS)		6.5
TEMPERATURE (DEG C)		28

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL022013G	LL022013H
	SDG NO:	LL001041F	LL014013G
	TYPE:	GRAB	GRAB
ALUMINUM		6410	
ARSENIC			1.4 B
BARIUM		106 B	
BERYLLIUM			225
CADMIUM		8.8	
CALCIUM		7070	
CHROMIUM			49

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 022
LOCATION: BUILDING 231 SUMP 31R
MEDIUM: SEALED CONTAINER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL022013G	LL022013H
	SDG NO:	LL001041F	LL014013G
	TYPE:	GRAB	GRAB
COBALT		196	
COPPER		1070	
IRON		12700	
LEAD			319
MAGNESIUM		4490 B	
MANGANESE		246	
MERCURY			0.36
NICKEL			180
POTASSIUM		9300	
SILVER		26	
SODIUM		76400	
URANIUM, TOTAL		18	
VANADIUM		70	
ZINC		333	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL022013E
	SDG NO:	D112
	TYPE:	GRAB
BENZOIC ACID		58
BIS(2-ETHYLHEXYL)PHTHALATE		7 J
DI-N-BUTYLPHTHALATE		4 J
DIETHYLPHTHALATE		7 J
4-CHLORO-3-METHYLPHENOL		27
4-METHYLPHENOL		67
* BENZENE DERIVATIVE (19.47)		95 J
* CAFFEINE (27.28)		360 J
* UNKNOWN (15.05)		21 J
* UNKNOWN (15.49)		21 J
* UNKNOWN (18.27)		350 J
* UNKNOWN (18.47)		920 J
* UNKNOWN (18.53)		310 J
* UNKNOWN (18.83)		260 J
* UNKNOWN (18.91)		290 J
* UNKNOWN (23.72)		18 J
* UNKNOWN (27.76)		72 J
* UNKNOWN (28.54)		16 J
* UNKNOWN (33.82)		37 J
* UNKNOWN (37.34)		67 J
* UNKNOWN (38.25)		55 J
* UNKNOWN (39.19)		89 J

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 022
LOCATION: BUILDING 231 SUMP 31R
MEDIUM: SEALED CONTAINER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: LL022013E SDG NO: D112 TYPE: GRAB
* UNKNOWN (40.24)	52 J
* UNKNOWN (41.45)	50 J
* UNKNOWN ACID (25.86)	26 J
* 9,10-ANTHRACENEDIONE (28.88)	34 J

VOLATILE ORGANICS (UG/L)	SAMP NO: LL022013A SDG NO: 0808 TYPE: GRAB
METHYLENE CHLORIDE	650 BE
TOLUENE	3 J
XYLENE (TOTAL)	2 J
1,1-DICHLOROETHANE	2 J
1,2-DICHLOROETHANE	5 J
2-BUTANONE	120
* DISULFIDE, DIMETHYL(16.97)	23 J
* UNKNOWN(9.13)	5 J

RADIOCHEMISTRY (PCI/L)	SAMP NO: LL022013I SDG NO: LLL7209 TYPE: GRAB	LL022013J LLL7209 GRAB
CS-137		7.6
H-3	590	
U-234		150
U-235		24
U-238		970

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 024
LOCATION: BUILDING 298 TANK 41R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL024015
PH (UNITS)		3
TEMPERATURE (DEG C)		25

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL024015H	LL024015I
	SDG NO:	LL003043F	LL014013G
	TYPE:	GRAB	GRAB
ALUMINUM		560	
ARSENIC			0.8 B
BARIUM		29 B	
BERYLLIUM			145
CADMIUM		4.6 B	
CALCIUM		6940	
CHROMIUM		95	
COPPER		509	
IRON		910	
LEAD			212
MAGNESIUM		1040 B	
MANGANESE		35	
MERCURY			3
NICKEL			19
POTASSIUM		12000	
SODIUM		17600	
ZINC		202 E	

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL024015E
	SDG NO:	LL020011E
	TYPE:	GRAB
TOC		767

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL024015F
	SDG NO:	D107
	TYPE:	GRAB
BENZYL ALCOHOL		40
BIS(2-ETHYLHEXYL)PHTHALATE		640 BE
DI-N-BUTYLPHTHALATE		2 J
DIETHYLPHTHALATE		4 J
NAPHTHALENE		12 J
1,2,4-TRICHLOROBENZENE		82

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 024
LOCATION: BUILDING 298 TANK 41R
MEDIUM: UNSEALED CONTAINER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: LL024015F SDG NO: D107 TYPE: GRAB
* CAFFEINE (27.33)	400 J
* UNKNOWN (10.63)	71 J
* UNKNOWN (11.40)	44 J
* UNKNOWN (14.52)	64 J
* UNKNOWN (15.85)	700 J
* UNKNOWN (18.39)	52 J
* UNKNOWN (19.55)	240 J
* UNKNOWN (20.01)	310 J
* UNKNOWN (23.32)	270 J
* UNKNOWN (23.82)	45 J
* UNKNOWN (25.94)	75 J
* UNKNOWN (28.36)	41 J
* UNKNOWN (28.54)	110 J
* UNKNOWN (28.81)	540 J
* UNKNOWN (30.25)	59 J
* UNKNOWN (30.31)	51 J

VOLATILE ORGANICS (UG/L)	SAMP NO: LL024015A SDG NO: 0824 TYPE: GRAB
ACETONE	3000 BE
CARBON DISULFIDE	1 J
CARBON TETRACHLORIDE	6
CHLOROFORM	8
ETHYLBENZENE	2 J
METHYLENE CHLORIDE	38 B
STYRENE	19
TOLUENE	4 J
TRICHLOROETHENE	4 J
XYLENE (TOTAL)	11
1,1,1-TRICHLOROETHANE	4 J
1,2-DICHLOROETHANE	11
2-BUTANONE	1300 E
* ETHANOL(5.57)	2 J
* FURAN, TETRAHYDRO-(11.18)	1 J
* UNKNOWN(19.02)	31 J
* UNKNOWN(33.31)	340 J
* UNKNOWN(8.18)	3 J
* UNKNOWN(9.75)	50 J
* 2-PROPANOL(8.99)	39 J

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 024
LOCATION: BUILDING 298 TANK 41R
MEDIUM: UNSEALED CONTAINER

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL024015J	LL024015K				
	SDG NO:	LLL7268	LLL7268				
	TYPE:	GRAB	GRAB				
G-ALPH			18				
GROSS-BETA			40				
H-3		840					

S&A REQUEST: 025
LOCATION: BUILDING 321 SUMP 31R
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL025027E					
	SDG NO:	LL020011E					
	TYPE:	FIELD BLANK					
TOC		0.5					

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL025027F					
	SDG NO:	D108					
	TYPE:	FIELD BLANK					
BIS(2-ETHYLHEXYL)PHTHALATE		3 JB					
* UNKNOWN (7.99)		7 J					

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL025027A					
	SDG NO:	0824					
	TYPE:	FIELD BLANK					
ACETONE		13 B					
CHLOROFORM		21					
METHYLENE CHLORIDE		1 JB					
TOLUENE		1 J					

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 025
LOCATION: BUILDING 321 SUMP 31R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL025016					
PH (UNITS)		8					
TEMPERATURE (DEG C)		20					

ANIONS AND CYANIDE (UG/L)	SAMP NO:	LL025016H	LL025016J				
	SDG NO:	LL020011F	LL025016J				
	TYPE:	GRAB	GRAB				
CHLORIDE			47000				
CYANIDE, TOTAL		9					
FLUORIDE			11000				

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL025016K	LL025016L				
	SDG NO:	LL012055C	LL003043F				
	TYPE:	GRAB	GRAB				
ALUMINUM			8320				
ANTIMONY			100				
BARIUM			1040				
BERYLLIUM			31				
CADMIUM			30				
CALCIUM			8660				
CHROMIUM			69				
COBALT			93				
COPPER			4330				
IRON			18500				
LEAD			2700				
MAGNESIUM			4770 B				
MANGANESE			472				
MERCURY		0.27					
NICKEL			181				
POTASSIUM			6300				
SELENIUM			51 BN				
SILVER			8.8 B				
SODIUM			74800				
VANADIUM			8.8 B				
ZINC			1470 E				

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 025
LOCATION: BUILDING 321 SUMP 31R
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL025016E
	SDG NO:	LL020011E
	TYPE:	GRAB
TOC		249

OIL AND GREASE (UG/L)	SAMP NO:	LL025016G
	SDG NO:	LL025016G
	TYPE:	GRAB
OIL AND GREASE		122000

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL025016F
	SDG NO:	D108
	TYPE:	GRAB
ANTHRACENE		2 J
BIS(2-ETHYLHEXYL)PHTHALATE		190 B
DI-N-BUTYLPHTHALATE		4 J
DI-N-OCTYLPHTHALATE		4 J
DIETHYLPHTHALATE		3 J
FLUORANTHENE		11 J
PHENANTHRENE		11 J
PYRENE		10 J
4-CHLORO-3-METHYLPHENOL		210
4-METHYLPHENOL		6 J
* CAFFEINE (27.77)		53 J
* UNKNOWN (8.01)		110 J
* UNKNOWN (10.10)		140 J
* UNKNOWN (10.41)		88 J
* UNKNOWN (10.64)		95 J
* UNKNOWN (11.07)		100 J
* UNKNOWN (12.71)		47 J
* UNKNOWN (18.99)		21 J
* UNKNOWN (20.83)		56 J
* UNKNOWN (20.93)		25 J
* UNKNOWN (21.56)		21 J
* UNKNOWN (25.39)		73 J
* UNKNOWN (29.60)		57 J
* UNKNOWN (31.12)		35 J
* UNKNOWN ACID (21.27)		100 J
* UNKNOWN ACID (24.22)		990 J
* UNKNOWN ACID (26.76)		140 J
* UNKNOWN ACID (29.10)		570 J

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 025
LOCATION: BUILDING 321 SUMP 31R
MEDIUM: UNSEALED CONTAINER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: LL025016F SDG NO: D108 TYPE: GRAB
* UNKNOWN ACID (33.78)	13 J
* UNKNOWN PHENOL (25.58)	100 J

VOLATILE ORGANICS (UG/L)	SAMP NO: LL025016A SDG NO: 0824 TYPE: GRAB
ACETONE	840 BE
CHLOROFORM	7
ETHYLBENZENE	1 J
METHYLENE CHLORIDE	7 B
TETRACHLOROETHENE	26
TOLUENE	9
TRICHLOROETHENE	24
1,1-DICHLOROETHANE	6
1,1,1-TRICHLOROETHANE	6
1,2-DICHLOROETHENE	100
2-BUTANONE	110
2-HEXANONE	31
4-METHYL-2-PENTANONE	18
* ACETIC ACID, METHYL EST(9.7)	7 J
* ETHANOL (ACN)(9CI)(5.47)	24 J
* UNKNOWN KETONE(27.44)	7 J
* 2-BUTANONE, 3-METHYL-(16.26)	4 J
* 2-PENTANONE(17.93)	6 J
* 2-PROPANOL (ACN)(9CI)(8.84)	44 J

RADIOCHEMISTRY (PCI/L)	SAMP NO: LL025016I SDG NO: LLL7291 TYPE: GRAB	LL025016M LLL7291 GRAB
G-ALPH		41
GROSS-BETA		95
H-3	1500	

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 026
LOCATION: BUILDING 492 SUMP 41R
MEDIUM: UNSEALED CONTAINER

FIELD MEASUREMENTS	SAMP NO:	LL026017
CONDUCTIVITY (MS/CM)		1.6
PH ( )		4.8
TEMPERATURE (DEG C)		25

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL026017H	LL026017I
	SDG NO:	LL003043F	LL001041G
	TYPE:	GRAB	GRAB
ALUMINUM		572	
ANTIMONY		50 B	
ARSENIC			1.6 B
BARIUM		200 B	
BERYLLIUM			0.7 B
CADMIUM		13	
CALCIUM		56500	
CHROMIUM			63
COBALT		10 B	
COPPER		74	
IRON		171000	
LEAD			265
MAGNESIUM		7000	
MANGANESE		1290	
MERCURY			0.08 B
NICKEL			126
POTASSIUM		21000	
SODIUM		104000	
VANADIUM		7.5 B	
ZINC		8610 E	

METALS, INCLUDING CR+6 (UG/ML)	SAMP NO:	LL026017E
	SDG NO:	LL020011E
	TYPE:	GRAB
TOC		880

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL026017F
	SDG NO:	D108
	TYPE:	GRAB
ANTHRACENE		2 J
BENZOIC ACID		8100 E

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 026
LOCATION: BUILDING 492 SUMP 41R
MEDIUM: UNSEALED CONTAINER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: LL026017F SDG NO: D108 TYPE: GRAB					
BENZYL ALCOHOL	11000	E				
BIS(2-ETHYLHEXYL)PHTHALATE	9	JB				
DI-N-BUTYLPHTHALATE	2	J				
DIETHYLPHTHALATE	5	J				
DIMETHYLPHTHALATE	5	J				
FLUORANTHENE	6	J				
PHENANTHRENE	13					
PHENOL	30					
PYRENE	4	J				
4-CHLORO-3-METHYLPHENOL	27					
* BENZENEACETIC ACID (18.52)	44	J				
* CAFFEINE (27.23)	110	J				
* ETHANOL,CHLORO,PHOSPHAT(25.98)	25	J				
* PHTHALIC ANHYDRIDE (19.22)	8	J				
* UNKNOWN (9.25)	7	J				
* UNKNOWN (12.94)	29	J				
* UNKNOWN (13.89)	26	J				
* UNKNOWN (15.08)	1000	J				
* UNKNOWN (17.34)	27	J				
* UNKNOWN (19.59)	28	J				
* UNKNOWN (22.45)	40	J				
* UNKNOWN (30.94)	16	J				
* UNKNOWN (33.84)	25	J				
* UNKNOWN ACID (17.16)	13	J				
* UNKNOWN ACID (17.26)	100	J				
* UNKNOWN ACID (17.68)	570	J				
* UNKNOWN ACID (18.66)	10	J				
* UNKNOWN ACID (19.63)	13	J				
* UNKNOWN ACID (20.19)	21	J				
* UNKNOWN ACID (22.73)	20	J				

VOLATILE ORGANICS (UG/L)	SAMP NO: LL026017A SDG NO: 0824 TYPE: GRAB					
ACETONE	140	B				
ETHYLBENZENE	1	J				
METHYLENE CHLORIDE	2	JB				
TOLUENE	3	J				
2-HEXANONE	5	J				
* ACETALDEHYDE(2.91)	4	J				

TABLE L4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
RETENTION TANKS AND SUMPS

S&A REQUEST: 026
LOCATION: BUILDING 492 SUMP 41R
MEDIUM: UNSEALED CONTAINER

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL026017A
	SDG NO:	0824
	TYPE:	GRAB
* ETHANE, 1,2-DICHLORO-1,(10.74)		11 J
* ETHANE,TRICHLOROTRIFLUO(12.93)		230 J
* ETHANOL(5.47)		19 J
* UNKNOWN ALCOHOL(18.92)		8 J
* UNKNOWN KETONE(17.92)		50 J
* UNKNOWN(12.69)		8 J
* UNKNOWN(23.76)		4 J
* 1-BUTANOL(15.6)		6 J
* 1-HEXANOL(27.39)		44 J

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL026017J	LL026017K
	SDG NO:	LLL7291	LLL7291
	TYPE:	GRAB	GRAB
G-ALPH			27
GROSS-BETA			0
H-3		120	
U-234			1.1
U-235			0.16
U-238			3.2

4.10 LLNL Environmental Problem 5: Building 514 Waste

Request Number: 27.
Requester: R. Basinski.
Finding and Basis: Liquid mixed-wastes are solidified in the Building 514 liquid waste treatment facility. These wastes include oils, solvents, acids, and metal containing wastewaters that are contaminated with radioactivity. Solidified liquid hazardous/radioactive wastes may contain hazardous and radioactive constituents.

4.10.1 Sampling and Analysis Objectives

Statement: Samples of solidified waste from the Building 514 liquid waste treatment facility were to be examined to determine if the solidified waste contained leachable hazardous constituents at or above method detection levels. If leachable hazardous and radioactive constituents were present, off-site disposal at the Nevada Test Site (NTS) or commercial facilities would not be possible. Sampling and analysis would help define the magnitude of the mixed waste storage/treatment/disposal capacity problem at LLNL.

Supporting Information: These solidified wastes were formerly sent to the NTS for disposal. At the time of the Survey, NTS was not accepting these wastes due to concern that leachable hazardous wastes may be present. These wastes have not previously been tested for hazardous characteristics by the toxic characteristic leaching procedure (TCLP).

4.10.2 Sampling and Analytical Design

4.10.2.1 Sampling Design

Request 27: Building 514 Waste (Fig. L4.5). Three batches or groupings of waste were to be sampled. Nine grab samples (Sampling Method: Reference E5.3.1) were to be collected, three from each of the three batches or groupings.

If a selection of waste batches was available, the selection was to be made on a random basis. The Sampling Team was to obtain a waste representative of three different batches or groupings of waste as defined and identified by site personnel. Each group was assumed to be heterogeneous.

The Sampling Team arrived at the site on 12AUG87 at approximately 1000. The sky was clear, the temperature approximately 85°F, and there was no wind. After entering Building 514, the Team was instructed to sign in. They donned plastic boots, gloves, coveralls, and respirators, then entered the storage building where a crate containing several 55-gal. drums was opened. The drums were removed from the crate with the aid of a hydraulic crane. After opening each of the three drums, an immediate alpha and beta scan was done. All three drums were at background levels, and each contained a white sandlike material. The residue in the first and the third drums was very hard, whereas the residue in the second drum was quite soft. The material in the first and third drums was collected with a screwdriver and hammer, neither of which were stainless steel. Three samples were taken from each drum. Each sample was collected in a 1000-ml wide-mouth glass jar. The samples were then double bagged and sent to ORNL. This procedure was followed as the sample material was in large pieces and needed to be further segregated before bottling. The sample material was "crushed" at ORNL Building 7061 and placed in sample containers.

Samples LL027018, LL027029, and LL027030 were taken at 1015 from drum L87127 (batch A); samples LL027041, LL027052, and LL027063 were taken at 1030 from drum L87105 (batch B); samples LL027074, LL027085, and LL027096 were taken at 1045 from drum L87123 (batch C); and QC rinsate LL027109 was taken at 1111.

Data analysis will not be presented within this data document, but will be provided later under separate cover. Analyses were not completed in time to be included in this draft.

4.10.2.2 Analytical Design

The parameters to be analyzed were semivolatiles, PCBs, ICP-metals, AA-mercury, TCLP-metals, and TCLP-semivolatiles. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

4.10.3 Field and Analytical Data

Field Data: *NA*

Field Data Evaluation: NA

Analytical Data: *Analytical data will not be presented within this data document, but will be presented under separate cover.*

Analytical Data Evaluation: NA

4.10.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level I. Sampling is rated Quality Level III since the collected samples were misplaced and were not delivered to the analytical laboratory according to chain-of-custody protocol. Analytical quality levels will be reported with the data under separate cover.

Field Data: Although no field data were requested, the samples were not routed in accordance with normal procedure to the analytical laboratory. In addition to exceeding the holding time for analysis, the samples were kept at room temperature, which would make results of organic components highly questionable.

Analytical Data: See remarks on field data.

Environmental Problem: LLNL 5
Request Number: LLNL 27

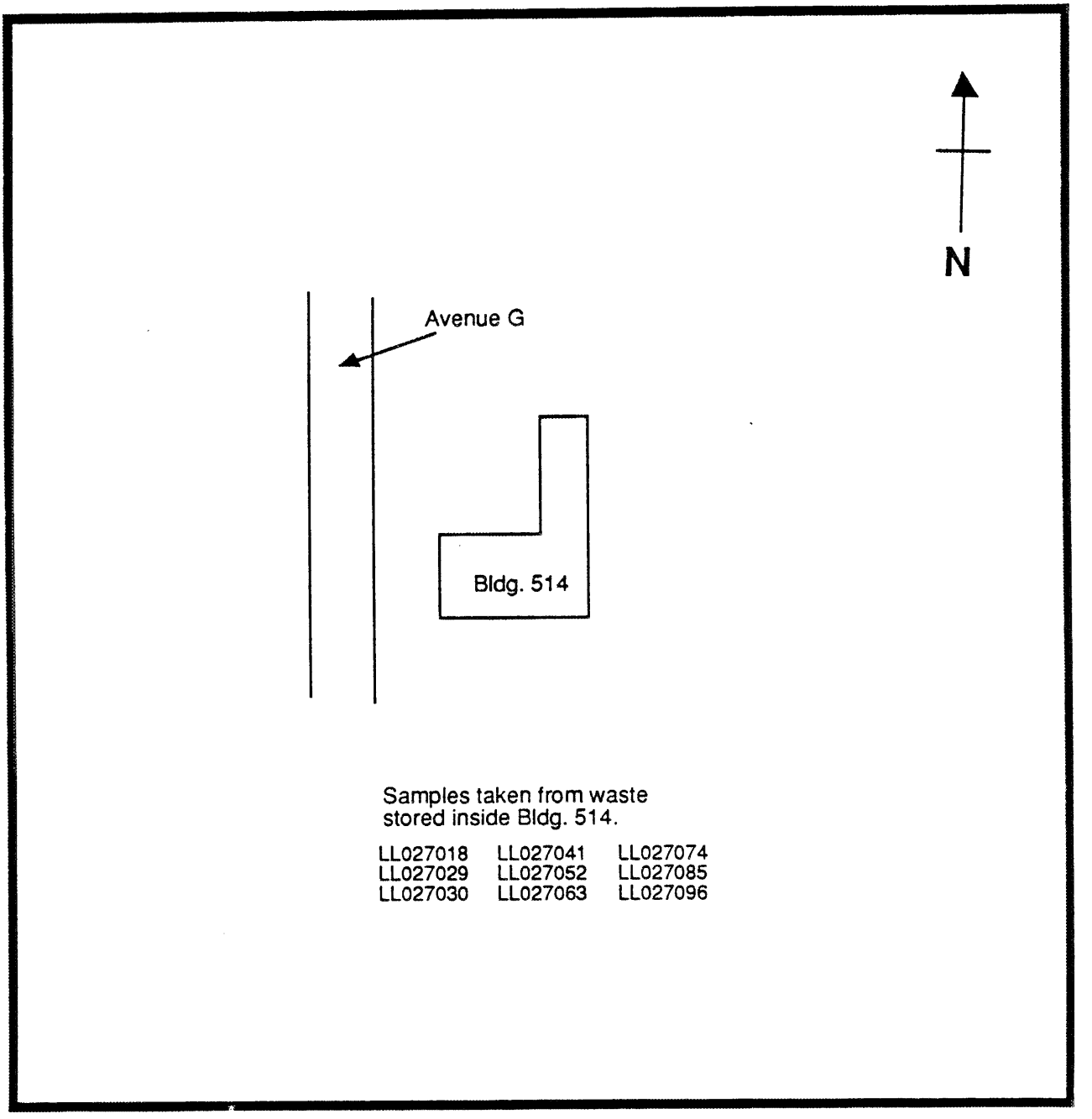

Figure L4.5. Building 514 Waste (LLNL Request 27)

TABLE L4.2.5 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	HE NUMB HITS	HE 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
LL027 *	BLDG. 514	WASTE	SEDIMENT	9	9	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		MED TOTAL		9	9		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LL027	BLDG. 514	WASTE	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		10	10		0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0

* DATA ANALYSES WILL NOT BE PRESENTED WITHIN THIS DATA DOCUMENT, BUT WILL BE PRESENTED UNDER SEPARATE COVER.

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TABLE L4.3.5 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 5 DRAFT DO NOT CITE
BUILDING 514 WASTE

S&A REQUEST: 027
LOCATION: NTS WASTE COMING FROM BLDG. 514 LIQUID WASTE TREATMENT FACILITY BATCH C
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO: LL027109B SDG NO: LL012066B TYPE: RINSATE					
ALUMINUM	76 B					
BARIUM	4.2 B					
CALCIUM	202 B					
IRON	172					
MAGNESIUM	32 B					
NICKEL	6.2 B					
ZINC	5.6 B					

4.11 LLNL Environmental Problem 6: Inactive Sites

Request Numbers: 28, 29, 30, 31, 32, and 33.
Requester: J. Werner.
Finding and Basis: There are many areas at both the main LLNL Site and Site 300 that are, or may be, contaminated with hazardous substances as a result of past, and some ongoing, disposal activities and spills. Hazardous substances may present risk because of fugitive dust emissions (inhalation and oral ingestion routes), surface water discharge via erosion, or groundwater leachate. Numerous areas around the main LLNL Site and Site 300 may be contaminated because of releases (dumping, discharging, erosion, runoff, leachate percolation, and seepage) of hazardous substances. Many sites have been characterized and cleaned up, but many others have not been adequately identified, characterized, or cleaned up. The lack of information about areas known or suspected to be contaminated with hazardous substances may result in continued or future releases. Small sources, such as oil spills, may present a cumulative risk as great as larger sources, such as a landfill.

4.11.1 Sampling and Analysis Objectives

Statement: Soil and sediment samples were to be collected from various locations at the main LLNL Site and Site 300 to determine if the contaminants listed in Sect. 4.11.2.2 were present above normal levels in soil and sediments of the area.

Supporting Information: Please refer to individual Requests 28 through 33 in Sect. 4.11.2.1 for additional information.

4.11.2 Sampling and Analytical Design

4.11.2.1 Sampling Design

Request 28: South of Fence Between Building 321 and First Street, on Both Sides of Drum Rack (Fig. L4.6a). LLNL personnel reported to the Survey team that workers had been rinsing containers and buckets with solvents and dumping the residue behind these drum racks for more than 30 years. Four grab samples of soil (Sampling Method: Reference E5.2.1) at a depth as indicated by PID field screening were to be collected from the area of the drum racks. Samples were to be collected in selected areas from soil behind and, if possible, around the drum racks. The sump area at the end of the drum rack under the pallet of drums was also to be included in the sampling area. The total area of interest was 100 to 500 m^2 and was considered homogeneous with respect to other possible contaminants. The area underneath, around, and behind the drum racks was laid out in a systematic grid of 1 x 80 segments. The Sampling Team randomly selected a segment between 1 and 20 and designated it segment 1. Four samples were collected at grid segments spaced 20 segments apart, beginning with segment 1. Grab samples were to be collected at the depth indicated by the highest PID reading, up to a maximum of 10 ft. Because the reported practice was carried out for approximately 30 years, contamination was suspected at this depth. If there was no indication of contamination when using the PID for a sign of potential contaminants, the Sampling Team was to collect a composite sample from 0 to 10 ft. During the sampling of this site, Sampling Team members were to note other areas around the racks that could possibly be added to the sampling plan.

The Sampling Team arrived on-site at 1510 on 12AUG87. J. Loftis described the site use and explained that the site consisted of three areas: a product storage area, a waste fill area, and a waste drum holding area. Product storage was the largest area. The waste fill area was cement with a surrounding berm. The waste drum holding area contained asphalt drums that were stored on pallets.

All areas were south of Building 321, against a fence. There was approximately 1 ft of asphalt-covered space behind the storage area and the fence. The sample site was located just south of the fence outside of the Building 321 enclosure, approximately 1 ft from the fence. All sample locations were dug to 2.5 ft and logged with PID every foot and at the total depth. The soil was rich and moist. Samples were collected between 1633 and 1710 and were taken at the highest PID reading. Sampling Team members were not able to dig further because of utility and gas lines.

Request 29: Outlet of Culvert Downgradient from 875/878 (Fig. 4.6b). Waste from several different sources in the general service area (GSA), including chrome dip tanks, solvent degreasers, photochemical wastes, and oil changing, may have been discharged to the storm sewer in the past. The culvert selected for sampling drains part of this area. Three grab sediment samples (Sampling Method: Reference E5.2.3) were to be collected to the depth of the sediment or to a maximum of 5 ft at selected locations below the culvert. The Sampling Team located the sampling area at 1350 on 07AUG87. The day was sunny and clear with a temperature of 91°F. The delta area that had been formed below the culvert outlet was the area of interest. It was less than 100 m^2 and was considered homogeneous with regard to physical characteristics and potential contaminants. The delta area was divided into a 1 x 60-segment grid, and three segments were randomly selected for sampling. The soil was very dry and seemed much like fill dirt for the first 4 to 5 in. There was a definite change in the character of the soil at the 6-in. depth. Tree roots were encountered at each grid segment. Sample LL029010 (grid 8) was collected at 1410, sample LL029021 (grid 22) at 1411, and sample LL029032 (grid 35) at 1416.

Request 30: Locations North of 875 and Drum Rack, Near the Sump and Culvert (Fig. 4.6c). Discolored soil and vegetation were observed by the DOE Survey Team in this area. Potential contamination from storm sewer discharges, as well as drum rack leaks and spills, was suspected. Four grab sediment samples (Sampling Method: Reference E5.2.3) were to be collected from a transect down

the culvert. There was a general slope to the culvert from northwest to southeast.

The Sampling Team arrived on-site at 1415 on 07AUG87. The temperature was 95°F and the sky was clear. The total area to be sampled was 100 to 500 m^2. The area was very heterogeneous, with many different contributors, such as a drum rack sump, truck steam cleaning facility, past runoff from the site, and a steam cleaning sump. Because of the diversity of contributors, a systematic sampling scheme was used. The area from the culvert, downgradient, was divided into an 1 x 80-segment grid. The Sampling Team randomly selected a segment between 1 and 20 and designated it sampling point 1. Four samples were collected at grid segments spaced 20 segments apart, beginning with segment 6. Samples LL030013 (grid 6) and LL030024 (grid 26) were collected from 0 to 10 in. (with asphalt being hit at 11 in.) at 1450 and 1455, respectively; sample LL030035 (grid 46) from 0 to 2 ft at 1505; and sample LL030046 (grid 66) from 0 to 2 ft at 1515. The ditch below the culvert was cluttered with debris and some vegetation. The first two grid segments had an asphalt bottom at approximately 11 in. A new asphalt curb had been built at the end of the ditch, and the fill dirt from this activity had fallen into the culvert and downhill from the culvert.

Request 31: GSA Area (Fig. 4.6d). The area that was sampled was the low point of the GSA area. Contaminants from chrome dip tanks, solvent degreasers, photochemical wastes, and oil changing were discharged to the storm sewer and may be present at the sampling site. The area was divided into six separate areas, based on physical observation and/or assumed continuous recharging of the area as shown in Fig. L4.6d. They are identified as follows:

(1) Stained soil area 1
(2) Stained soil area 2
(3) Discolored soil area near drums

(4) "Black steel box"
(5) Discolored soil area near gate
(6) Area of standing water below gate

Areas 1, 2, 3, 4, and 5 were each less than 100 m^2. Each of these areas was to be divided into a 60-segment grid. Area 6 was described by the Survey as 100 to 500 m^2 and was to be divided into an 80-segment grid. Three segments were to be randomly selected for sampling from each of areas 1, 2, 3, 4, and 5. Four segments were to be randomly selected from area 6. Sixteen grab soil samples (Sampling Method: Reference E5.1 and E5.2.1) were to be collected at depths indicated by field PID screening to a maximum of 6 ft.

The Sampling Team arrived on-site at 1115 on 10AUG87. The sky was clear and sunny, and the temperature was 90°F. The Sampling Team inspected each of the six areas to be sampled and staked them off.

Areas 1 and 2 did not look the same as observed during the Survey. Construction work above the area and the dry summer had greatly reduced the stained areas, or at least the visibility of the areas. Only one stained area (area 2) was located. Samples LL031014 (grid 13), LL031025 (grid 16), and LL031036 (grid 35) were collected at this location (areas 1 and 2 in Fig. L4.6d). For sample LL031036, the TIP reading at 3 ft was 0.7. There was no TIP reading for LL031014 and LL031025.

Area 3 was located in soil around the drums except for the front, which was on asphalt. Samples LL031047 (grid 4), LL031058 (grid 22), and LL031069 (grid 49) were collected at this location. There were no TIP readings for these samples.

Area 4 was only slightly stained. The "black box" had been moved to the asphalt area near the road, and no indication of runoff on the asphalt was discovered. Samples LL031070 (grid 9), LL031081 (grid 14), and LL031092 (grid

22) were collected at this location. The TIP reading for samples LL031070 and LL031092 was 0.4. There was no TIP reading for LL031081.

Area 5 showed indication of stains, and the soil was richer, probably due to runoff from the ditch into the area. This extra moisture had promoted abundant plant growth in this area. Samples LL031105 (grid 2), LL031116 (grid 16), and LL031127 (grid 40) were collected at this location. The TIP reading for sample LL031127 was 0.5. There was no TIP reading for LL031105 and LL031116.

Area 6 was not as large as remembered from the Survey; therefore, only two segments were sampled. As in area 5, the soil seemed richer, with plant growth occurring. Samples LL031149 (grid 23) and LL031150 (grid 48) were collected at this location. Samples LL031161 and LL031138 and QC rinsate sample LL031172 were omitted because of the smaller size of area 6. Samples were collected between 1145 and 1310.

Request 32: Drum Rack Sump (827 Complex) (Fig. L4.6e, f., g., h., i.). Stained soil had been observed around the racks and sumps by the Survey Team. Spills and leaks from drum racks containing acetone, toluene, hexane, methylene chloride ($MeCl_2$), and methyl ethyl ketone (MEK) were suspected. Grab samples were to be collected from stained area soils and from sediment in sumps from 827C, D, and E (Sampling Method: Reference E5.1 and E5.2.3). Three stained areas were to be randomly selected for sampling from each of areas 827C, D, and E. Samples were to be collected from 0 to 1 ft. The rationale for this depth was based on observations of the stained areas that indicated the presence of contaminants near the surface. Although sediment had been observed in the sumps during the Survey, it had apparently been cleaned out prior to sampling. Based on Sampling Team observations, it was believed there would not be enough sediment to randomly select specific areas for sampling. Three samples were to be collected from each area if possible. (When the sampling plan was prepared, it was difficult to define a sampling design for this area. It was decided that the Sampling Team would make definite decisions when on-site and would design

and document a sampling design at that time. The most important consideration was to document and sample contamination resulting from "sloppy housekeeping" at the site.)

The Sampling Team arrived at the bunker area at 1300 on 10AUG87. The sky was clear and sunny, and the temperature was 95°F. Samples LL032015, LL032026, and LL032037 were collected across the road from 827C, where a bunker used to drain. The lines out of the building contained no sediment, and no stained areas were observed. At area 827D, drums were located behind sump drain lines containing a small amount of sediment. These lines and a square area at the end of the drain lines were sampled. The area was composited due to the small amount of sediment. No stained areas were observed. Samples LL032071, LL032082, and LL032093 were collected and composited at area 827D. At area 827E, Freon and Amyl BOH tanks were draining into the area, and the lines contained a small amount of sediment. The area was composited due to the small amount of sediment. Northwest of the sump lines, about 15 ft away, a stained area was observed. The area was about 2 ft x 10 ft and was yellow-brown in color. Samples LL032106, LL032117, and LL032128 were collected and composited at the stained area at 827E. Samples LL032139, LL032140, and LL032151 were collected and composited from a stained area near 827E. QC rinsate LL032253 was collected before the first sample at Request 32. Samples LL032048, LL032059, and LL032060 were omitted from the sampling plan for area 827C because stained areas were not found. The following samples were also not collected for Request 32: LL032162, LL032173, LL032184, LL032195, LL032208, LL032219, LL032220, LL032231, and LL032242.

Request 33: Drains Downgradient from Building 805 (Fig. L4.6j). Stained soil was noted in the drains. Three grab sediment samples were to be taken from the drains to the depth of the sediment (Sampling Method: Reference E5.1). The Sampling Team arrived on-site at Building 805 at 1530 on 05AUG87. The day was sunny and clear with a temperature of 94°F. The ditch of interest was 1 ft wide, and there was a metal lid covering the pipe. The area was less than

100 m^2 and was homogeneous with respect to any other known potential contaminants. The original plan called for the area to be divided into a 60-segment grid and three segments randomly selected for sampling. However, instead of using random selection as described, the Sampling Team decided to collect all of the sediment from the drain and composite it into one sample, then place the sample in bottles. This decision was made because there was so little sediment. The area was composited except for three 1-ft sections where black widow spiders lived. Samples LL033016, LL033027, and LL033038 were collected at the same location. The very dry and powdery sediment collected for all three samples was taken at 1545 from 0 to 1 in.

4.11.2.2 Analytical Design

The parameters analyzed and/or measured for LLNL Environmental Problem 6 were as follows:

Request 28: The parameters analyzed were volatiles, semivolatiles, and ICP-metals. Field measurements by PID were made in order to select sample depths.

Request 29: The parameters analyzed were volatiles, semivolatiles, ICP-metals, oil and grease, gross alpha, and gross beta. No field measurements were required.

Request 30: The parameters analyzed were volatiles, semivolatiles, ICP-metals, oil and grease, and gross alpha. No field measurements were required.

Request 31: The parameters analyzed were volatiles, semivolatiles, ICP-metals, and oil and grease. Field measurements by PID were made in order to select sample depths.

Request 32: The parameters analyzed were volatiles, semivolatiles, and oil and grease. (Special interest was given to MEK, TCE, $MeCl_2$, toluene, hexane, and

acetone.) In addition, the Sampling Team was instructed to note the contents of the drum racks. No field measurements were required.

Request 33: The parameters analyzed were volatiles, semivolatiles, ICP-metals, gross alpha, gross beta, and gamma scan. No field measurements were required.

4.11.3 Field and Analytical Data

Field Data:

Request 28. NA

Request 29. NA

Request 30. NA

Request 31. NA

Request 32. NA

Request 33. NA

Field Data Evaluation:

Request 28. NA

Request 29. NA

Request 30. NA

Request 31. NA

Request 32. NA

Request 33. NA

Analytical Data:

Metals.

Request 28. Analytical data for metals in soil are presented in Table L4.3.6. Of the 18 metals detected, beryllium and sodium were below the CRQL in all four samples. Of the remaining metals detected, barium ranged from 158 to 218 mg/kg; cadmium, 0.75 to 2.3 mg/kg; chromium, 30 to 42 mg/kg; copper, 24 to 54 mg/kg; lead, 32 to 54 mg/kg; nickel, 38 to 53 mg/kg; silver, 1.6 to 3.3 mg/kg; and zinc, 58 to 391 mg/kg.

Request 29. Analytical data for metals in sediment are presented in Table L4.3.6. Of the 21 metals detected, antimony, arsenic, and selenium were below the CRQL or the IDL in all three samples. Of the remaining metals detected, barium ranged from 184 to 414 mg/kg; beryllium, 0.78 to 0.86 mg/kg; cadmium, 1.3 to 5.7 mg/kg; chromium, 32 to 43 mg/kg; copper, 36 to 95 mg/kg; lead, 36 to 204 mg/kg; nickel, 24 to 34 mg/kg; silver was 2.1 mg/kg; and zinc ranged from 112 to 477 mg/kg.

Request 30. Analytical data for metals in soil are presented in Table L4.3.6. Of the 20 metals detected, arsenic, beryllium, and selenium were below the CRQL or the IDL in all four samples. Of the remaining metals detected, barium ranged from 181 to 285 mg/kg; cadmium, 0.74 to 1.5 mg/kg; chromium, 32 to 41 mg/kg; copper, 33 to 46 mg/kg; lead, 23 to 64 mg/kg; nickel, 19 to 27 mg/kg; silver, 1.6 to 3.1 mg/kg; and zinc, 108 to 18 mg/kg.

Request 31. GSA areas 1 and 2 analytical data for metals in soil are presented in Table L4.3.6. Of the 18 metals detected, barium ranged from 281 to 301

mg/kg; beryllium was 0.95 mg/kg; cadmium ranged from 0.74 to 0.91 mg/kg; chromium, 26 to 28 mg/kg; copper, 23 to 92 mg/kg; lead, 8.8 to 16 mg/kg; nickel, 27 to 30 mg/kg; silver, 1.6 to 2.1 mg/kg; and zinc, 65 to 68 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium.

GSA area 3 analytical data for metals in soil are presented in Table L4.3.6. Of the 19 metals detected, beryllium and lead were below the CRQL in all three samples. Of the remaining metals detected, barium ranged from 193 to 260 mg/kg; chromium, 25 to 26 mg/kg; copper, 19 to 21 mg/kg; mercury was 0.05 mg/kg; nickel ranged from 23 to 24 mg/kg; silver was 1.7 mg/kg; and zinc ranged from 68 to 71 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium.

GSA area 4 analytical data for metals in soil are presented in Table L4.3.6. Of the 19 metals detected, antimony and beryllium were below the CRQL in all three samples. Of the remaining metals detected, barium ranged from 122 to 254 mg/kg; cadmium, 1.3 to 1.8 mg/kg; chromium, 24 to 28 mg/kg; copper, 32 to 380 mg/kg; lead, 23 to 33 mg/kg; nickel was 27 mg/kg; silver ranged from 1.5 to 1.9 mg/kg; and zinc, 128 to 203 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium.

GSA area 5 analytical data for metals in soil are presented in Table L4.3.6. Of the 18 metals detected, beryllium was below the CRQL in all three samples. Of the remaining metals detected, barium ranged from 151 to 198 mg/kg; cadmium, 1 to 1.3 mg/kg; chromium, 24 to 28 mg/kg; copper, 42 to 44 mg/kg; lead, 16 to 35 mg/kg; nickel, 30 to 31 mg/kg; silver was 1.5 mg/kg; and zinc ranged from 65 to 72 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium.

GSA area 6 analytical data for metals in soil are presented in Table L4.3.6. Of the 18 metals detected, beryllium and cobalt were below the CRQL in all three

samples. Of the remaining metals detected, barium ranged from 130 to 170 mg/kg; cadmium, 0.92 to 1.1 mg/kg; chromium, 16 to 24 mg/kg; copper, 21 to 26 mg/kg; lead, 7.3 to 24 mg/kg; nickel, 19 to 26 mg/kg; silver, 2.1 to 2.4 mg/kg; and zinc, 85 to 101 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium.

Request 32. Analyses for metals were not included in this request.

Request 33. Analytical data for metals in sediment are presented in Table L4.3.6. Of the 19 metals detected, beryllium and sodium were below the CRQL in all three samples. Of the remaining metals detected, antimony was 32 mg/kg; barium ranged from 204 to 211 mg/kg; cadmium, 16 to 28 mg/kg; chromium, 44 to 46 mg/kg; copper, 651 to 1410 mg/kg; lead, 365 to 870 mg/kg; nickel, 25 to 26 mg/kg; silver, 8.9 to 60 mg/kg; and zinc, 908 to 1060 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, sodium, and vanadium.

Volatile organics. *Analytical data for volatiles are presented in Table L4.3.6. Request 28 pertains to the main LLNL Site, while Request 29 and subsequent requests pertain to Site 300. Results are discussed below by request number.*

Request 28. Small amounts of acetone and methylene chloride were identified in all four samples, and chloroform was identified in three of the four samples. The same remarks would hold for the blank samples.

Request 29. Though three separate volatiles were identified over the three samples as a whole, only one volatile was identified per sample, and concentrations were small.

Request 30. Volatiles were detected in each of the four samples. Sample LL030013 had 110 ug/kg of 4-methyl-2-pentanone and had the highest concentrations of volatiles in general for Request 30.

Request 31. This request covers samples from six different areas. Areas 1 and 2 were treated collectively, with three total samples taken. There were 12 volatiles detected in each of these three samples. Concentrations of 2-butanone exceeded 100 ug/kg in all three samples. A compound tentatively identified as a benzene derivative was estimated at 2440 ug/kg in sample LL031014, which also contained an estimated 924 ug/kg of some unknown volatile. According to the Sampling Team's notes, sample LL031014 was the westernmost sample taken in GSA areas 1 and 2. In the samples from area 3, small amounts of six volatiles were detected in two of the samples and eight volatiles in the other. In the three samples from area 4, seven volatiles were detected in one sample and eight in the others. Sample LL031081 had the highest concentrations of most of these compounds, including 52 ug/kg of 2-butanone, 20 ug/kg of 2-hexanone, and 34 ug/kg of 4-methyl-2-pentanone. In the three samples from area 5, an average of six volatiles were detected per sample. None of these were present in large amounts. Small amounts of five volatiles were detected in each sample from area 6 (the same five volatiles were detected in each sample).

Request 32. The Survey and Sampling Teams' notes indicated that acetone, toluene, hexane, $MeCl_2$, and MEK were suspected in the samples covered by this request. There were three composite samples taken from each of three areas and one grab sample from area 827. An average of ten volatiles were detected in the three samples from area D. In sample LL032082 there were 15 ug of benzene per kilogram, 220 ug methylene chloride per kilogram (beyond the calibration range of the instrument), and 40 ug of 2-butanone per kilogram. In the samples from area E, there were 11 volatiles detected in sample LL032106, 17 in sample LL032117, and 8 in sample LL032128. The samples were similar in composition, but LL032117 generally had the highest concentrations of volatiles.

That sample had 760 ug of 2-butanone, 200 ug of methylene chloride, and 340 ug of acetone per kilogram of soil. The most significant of the smaller concentrations in that sample were probably the 10 ug of benzene per kilogram and the 9 ug of 1,2-dichloroethane per kilogram. The Sampling Team had noted that Freon and Amyl BOH tanks were draining into the area. There were 9, 10, and 11 volatiles, respectively, detected in the three sediment samples from area 827. However, only acetone, benzene, methylene chloride, and 1,1,1-trichloroethane were identified in all three samples. Most volatiles present were in small amounts. Benzene ranged from 7 to 16 ug/kg in the three samples. Unknowns were often detected in one sample or another. All three of the grab samples of soil from area 827 contained small amounts of acetone, methylene chloride, and (tentatively) acetic acid. One unknown was also identified in sample LL032037. Volatile concentrations in these three samples were small.

Request 33. Small concentrations of nine volatiles were detected in two of the samples and eight were detected in the other.

Extractable organics. *Analytical results for semivolatile organic compounds are presented in Table L4.3.6. There were 41 samples in which at least one semivolatile organic compound was detected. The number of compounds detected in particular samples ranged from 1 to 27, with a median value of 12. Results are presented below by request number.*

Request 28. The number of detectable compounds in these four samples ranged from three to nine. Bis(2-ethylhexyl)phthalate was measured in concentrations of around 10 mg/kg in three of the four soil samples. One unknown compound was estimated to have concentrations of around 5 mg/kg in two of the samples.

Request 29. There were 17, 27, and 19 compounds detected in these three samples. Bis(2-ethylhexyl)phthalate was detected in estimated concentrations of from 54 to 590 mg/kg, and diacetone alcohol was measured in concentrations ranging from 15 to 120 mg/kg. Benzo(A)pyrene was measured in concentrations

of up to 4.3 mg/kg, and benzo(K)fluoranthene was measured in concentrations of up to 5.8 mg/kg, with the highest concentrations of these occurring in sample LL029010. Fluoranthene was measured in concentrations of from 1.8 to 13 mg/kg. Fluorene was detected in one sample. Phenanthrene was measured in concentrations of up to 17 mg/kg. Pyrene was measured at concentrations of up to 19 mg/kg. With the exception of the diacetone alcohol, the highest concentrations of these compounds tended to appear in sample LL029010. The highest concentration of diacetone alcohol appeared in sample LL029032. One unknown phthalate had an estimated concentration of 6 mg/kg in sample LL029021.

Request 30. The number of detectable compounds in these four samples ranged from four to 18. Bis(2-ethylhexyl)phthalate appeared in concentrations of up to 750 mg/kg in sample LL030024. Measured or estimated diacetone alcohol concentrations ranged from 1.6 to 15 mg/kg. An unknown phthalate ester appeared in sample LL030013 in an estimated concentration of 22 mg/kg. Other unknown phthalate esters appeared in lesser concentrations.

Request 31. The number of detectable compounds in the 15 samples for which data were available ranged from 1 to 24. For the three samples from GSA areas 1 and 2, bis(2-ethylhexyl)phthalate was measured in concentrations of 5.5 mg/kg in one sample and 12 mg/kg in another (sample LL031036), but was undetected in the third sample. In sample LL031036, there were several unknown compounds detected with estimated concentrations in the 11- to 55-mg/kg range. Many unknowns in the other samples had estimated concentrations in excess of 3, but less than 10, mg/kg. Fluorene was also detected in sample LL031036. For the three samples from GSA area 3, the only compound detected in more than one sample was bis(2-ethylhexyl)phthalate, which had its highest concentration of 9.3 mg/kg in sample LL031058. For the three samples from GSA area 4, bis(2-ethylhexyl)phthalate was measured at less than 1 mg/kg in sample LL031070 and was detected in small amounts in the other samples. Sample LL031070 also had several unknowns detected in estimated concentrations of between 1 and 2.1

mg/kg, as well as some unknowns in lesser concentrations. The other two samples from GSA area 4 appeared to have lesser amounts of semivolatile organics in general. For the three samples from GSA area 5, bis(2-ethylhexyl)phthalate was detected in small qualities in all three samples, and two samples had concentrations of less than 3 mg/kg of some unknown compound. For the three samples from GSA area 6, bis(2-ethylhexyl)phthalate again was the only compound identified in all three samples, with measured or estimated concentrations always less than 7 mg/kg. Fluoranthene and phenanthrene were detected in estimated concentrations of 0.6 and 0.5 mg/kg, respectively, in sample LL031150.

Request 32. The number of detectable compounds in the 15 samples for this request ranged from 7 to 26. In the three soil samples from drum rack sump area D, bis(2-ethylhexyl)phthalate appeared in estimated concentrations of from 63 to 89 mg/kg and diacetone alcohol was measured in concentrations of from 20 to 23 mg/kg. Some tentatively identified hydrocarbon was detected in estimated concentrations in excess of 450 mg/kg in all three samples. In the three soil samples from drum rack sump area E, bis(2-ethylhexyl)phthalate was estimated in concentrations of from 9.4 to 62 mg/kg and diacetone alcohol was measured in concentrations between 1.4 and 22 mg/kg. Unknowns (probable hydrocarbons) were detected in estimated concentrations of up to 180 mg/kg in these samples. In the three soil samples from drum rack sump area 827, bis(2-ethylhexyl)phthalate concentration was measured or estimated to be from 4.5 to 25 mg/kg, and diacetone alcohol appeared in measured or estimated concentrations of from 19 to 29 mg/kg. Unusual concentrations of hydrocarbons did not appear in these samples. In the three sediment samples from drum rack sump area 827, bis(2-ethylhexyl)phthalate was detected in concentrations estimated between 76 and 87 mg/kg, and a compound tentatively identified as a hydrocarbon appeared in concentrations estimated at 40 and 65 mg/kg in two of the samples. Dimethyl sulfoxide appeared in measured or estimated concentrations of 5.4 mg/kg in sample LL032139, 7.8 mg/kg in sample LL032140, and in concentrations of 14 mg/kg in sample LL032151.

Request 33. There were 13, 21, and 19 semivolatile organic compounds detected in the three samples for this request. One unknown had an estimated concentration of 2.9 mg/kg. Other than that, the highest measured or estimated concentrations of any compound detected were the 0.97 to 1.2 mg of bis(2-ethylhexyl) phthalate per kilogram of sediment measured in the three samples.

Oil and grease. *Oil and grease analysis was requested for four of six requests and the results are shown in Table L4.3.6. The lowest value of 300 mg/kg was observed in sample LL029032 (Request 29) and sample LL032037 (Request 32). The highest value was 40,500 mg/kg, which was observed in sample LL031070 (Request 31, area 4). Request 31 was sampled as five distinct areas (the plan called for six areas, but areas 1 and 2 were combined due to their small size). Of these, area 4 showed the highest average oil and grease concentrations (14,800 mg/kg). Combined areas 1 and 2, though slightly lower in average concentration (13,800 mg/kg), showed a much narrower range in concentrations suggesting a wider area of contamination.*

Radiochemistry.

Request 29. Three sediment samples averaged 115, 7400, and 23,666 pCi/kg for cesium-137, gross alpha, and gross beta, respectively.

Request 30. Four soil samples averaged 29.5, 8875, and 22,000 pCi/kg for cesium-137, gross alpha, and gross beta, respectively.

Request 31. At GSA areas 1 and 2, average gross alpha was 6933 pCi/kg. Average gross beta was 25,666 pCi/kg. At GSA areas 3, 4, 5, and 6, gross alpha averaged 5475 pCi/kg; gross beta averaged 22,500 pCi/kg.

Request 33. Sediment samples averaged 377, 6366, and 23,666 pCi/kg for cesium-137, gross alpha, and gross beta, respectively.

Analytical Data Evaluation:

Metals. The listed metals of interest were found above the CRQL in the samples for the following requests:

Request 28. Barium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

Request 29. Barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

Request 30. Barium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

Request 31.

GSA areas 1 and 2 - Barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

GSA area 3 - Barium, cadmium, chromium, copper, mercury, nickel, silver, and zinc.

GSA area 4 - Barium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

GSA area 5 - Barium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

GSA area 6 - Barium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

Request 33. Antimony, barium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

Volatile organics. Some localized contamination was present with respect to volatiles.

Extractable organics. The highest contaminant concentrations appeared in the samples from Site 300 (Requests 29, 30, 31, 32, and 33). Bis(2-ethylhexyl)phthalate and diacetone alcohol were especially notable in samples for Requests 29, 30, and 32. Unidentified hydrocarbons were detected in concentrations estimated to be in excess of 450 mg/kg in some of the samples for Request 32. Dimethyl sulfoxide was notable in the sediment sample from drum rack sump area 827 (Request 32).

Oil and grease. Oil and grease analysis is a straightforward gravimetric method; four out of five duplicates were within the 20% RPD with the fifth sample being 21%. Spike recoveries for two samples were about 135%; the higher recoveries suggest that soil organic matter may have been extracted.

Radiochemistry. Gross alpha, beta, and gamma scans were performed on six sediment and 18 soil samples collected from inactive sites at LLNL. Results are given in Table L4.3.6.

4.11.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level II, and the sampling is rated Quality Level I. Overall analytical rating is Quality Level II.

Field Data: The sampling plan for Request 31 was unclear on the number of samples to be taken; the sampling design states 16 samples were to be taken, but the assumptions/considerations section requests 19 samples. The actual samples collected were 15, the lower number collected due to much smaller sizes of the designated areas.

Analytical Data: Of particular note, are the many volatile compounds identified and quantified. Although the quality levels of the organic analysis were reported to be Quality Level II in many cases due to tentative identification by

mass spectrometry and to exceeding the holding times, the results show that the suspect areas are defined as required. Details on analytical quality data are given below.

Metals. Spikes, duplicates, or serial dilutions were beyond control limits for many of the metals in most samples pertaining to this environmental problem. Of particular interest in this problem are the following control-limit flags:

Lead. Duplicate in all samples for Request 28.

Copper. Serial dilution in all samples for Requests 29, 30, and 33; duplicate for all samples in Request 33; spike in all samples for Request 28 and sample LL031149 from GSA area 6 for Request 31.

Zinc. Duplicate samples for Requests 28, 29, 30, and 33, and sample LL031149 only for Request 31 (GSA area 6); spike for all samples in Requests 28, 33, and sample LL031149 only from GSA area 6 for Request 31.

Arsenic and selenium. The spike was out of control limits with respect to these metals in the only samples in which they were detected, which consisted of one sample in each of Requests 29 and 30.

Request 28. All data are Quality Level II.

Requests 29 and 30. All data are Quality Level I except antimony, chromium, magnesium, manganese, and selenium, which are Quality Level II in all samples.

Request 31. In sample LL031149 all data for ICP metals are Quality Level II. Data for AA-metals are Quality Level I. All other samples are Quality Level I except manganese, nickel, and selenium, which are Quality Level II in all samples for this request.

Request 32. Analyses for metals were not included in this request.

Request 33. Data for AA-metals were Quality Level I. All other materials data were Quality Level II except copper, which was Quality Level III in all samples.

Volatile organics. Many volatiles were detected in small concentrations in both the survey samples and the blank samples, many others were detected in amounts too small to quantify, and many compounds were identified tentatively or identified as unknowns.

About 56% of the data was listed on the data quality summary sheet as being Quality Level III. About two thirds of those data were obtained by mass spectrometry or detected in amounts too small to quantify. The remaining data tabulated on the data quality summary sheets were identified as Quality Level II.

Extractable organics. Particularly high values of bis(2-ethylhexyl)phthalate exceeded the calibration range of the instrument in some cases, or were back-calculated from diluted samples. The data are Quality Level II, due mainly to tentative identification by mass spectrometry.

Oil and grease. Calibration verification met the EPA allowable control limit range. The duplicate analysis exceeded the allowable limit of 20% RPD in one out of ten samples and that value was 21% RPD. The oil and grease results are rated Quality Level I.

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.

Environmental Problem: LLNL 6
Request Number: LLNL 28

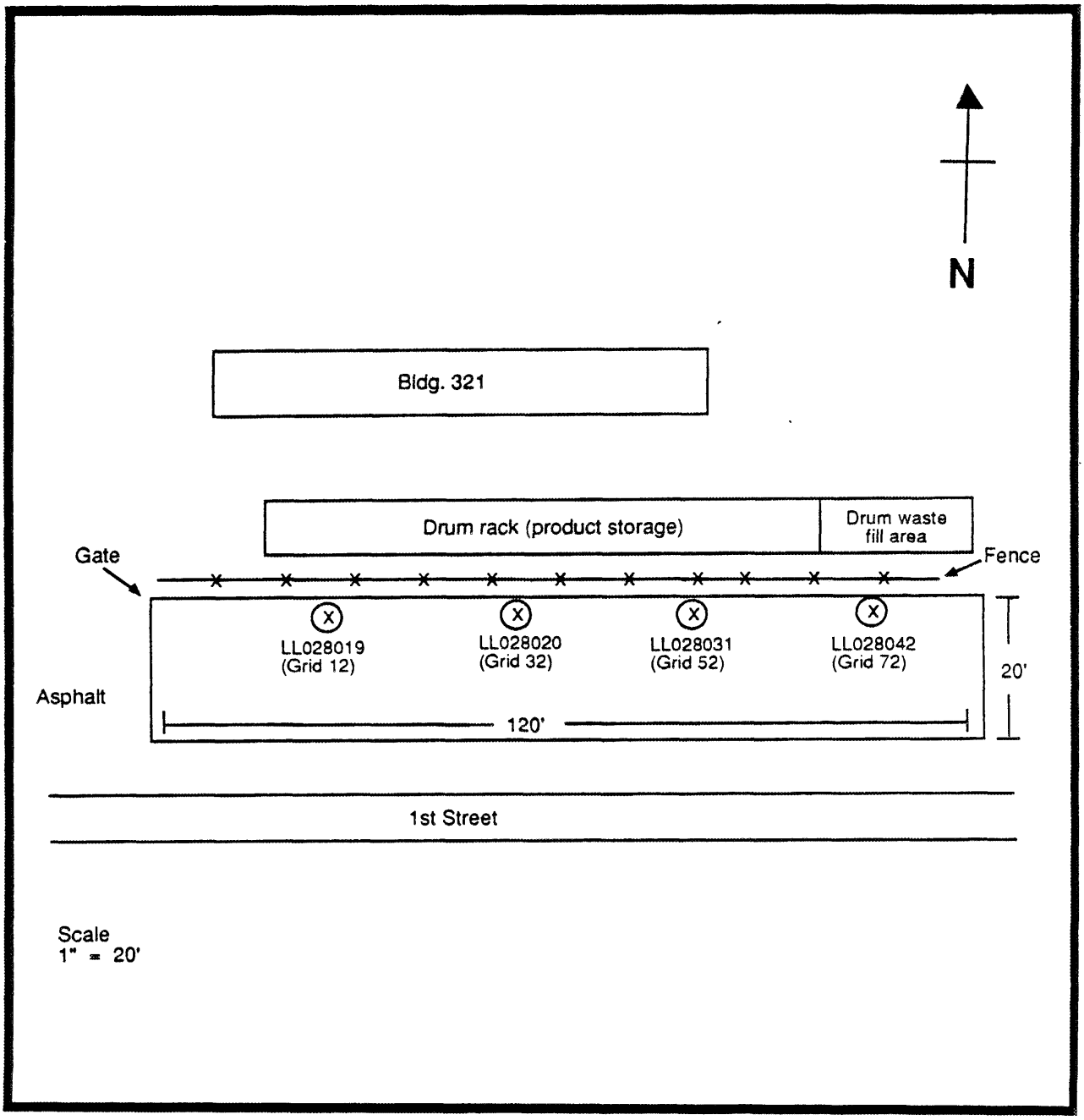

Figure L4.6a. South of Fence Between Building 321 and First Street, on Both Sides of Drum Rack (LLNL Request 28)

Environmental Problem: LLNL 6
Request Number: LLNL 29

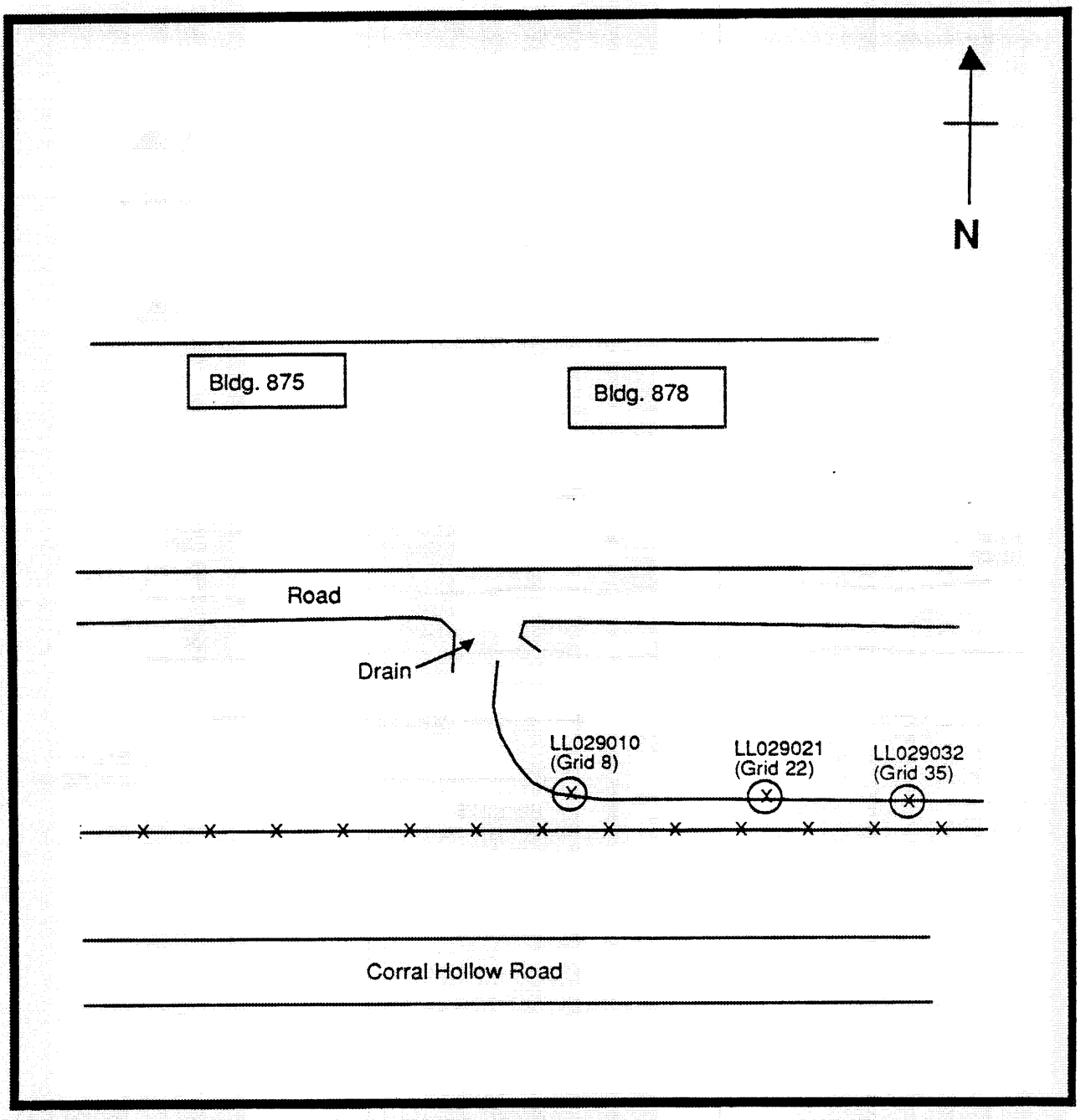

Figure L4.6b. Outlet of Culvert Downgradient from 875/878 (LLNL Request 29)

Environmental Problem: LLNL 6
Request Number: LLNL 30

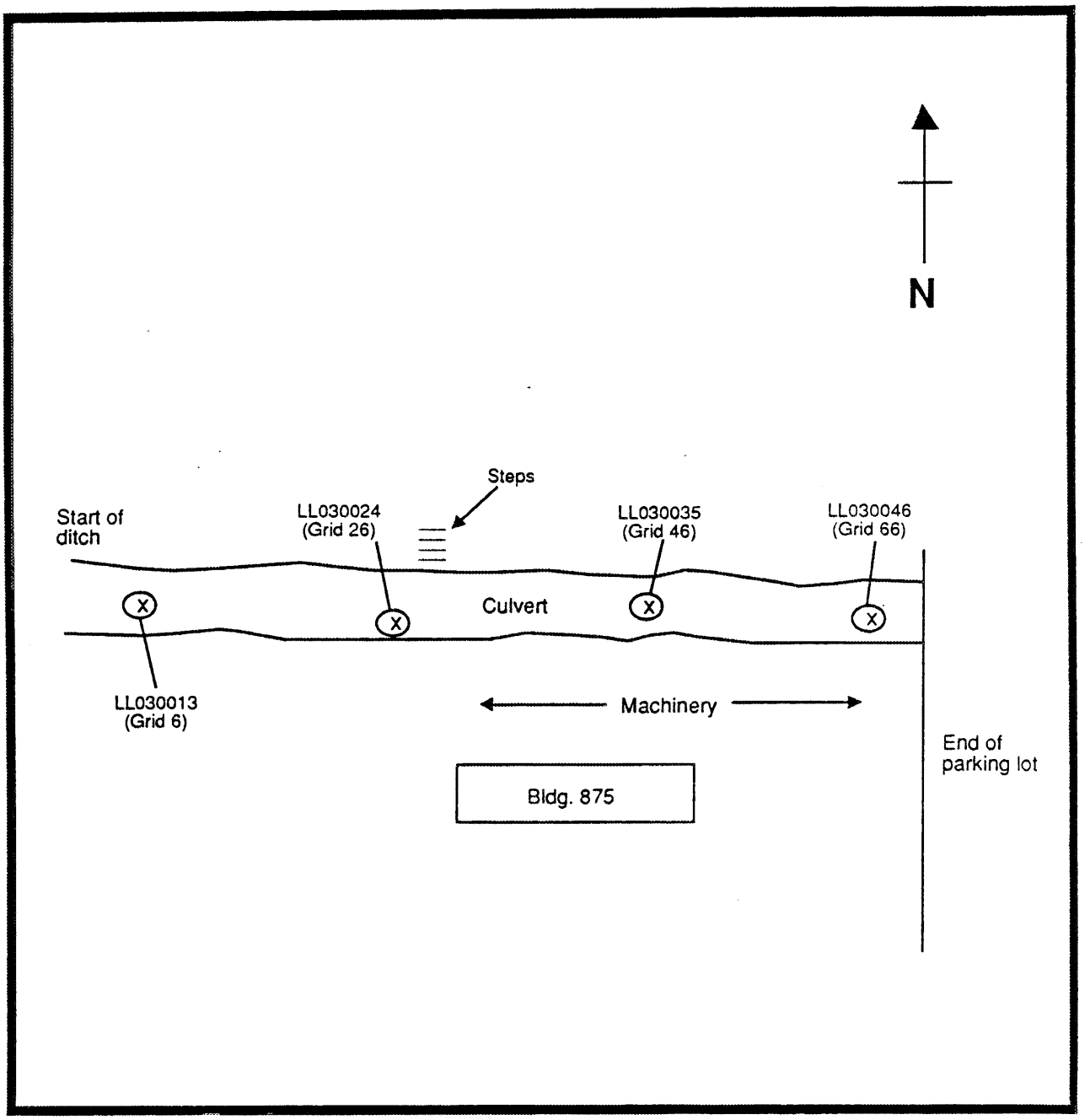

Figure L4.6c. North of 875 and Drum Rack, Near the Sump and Culvert (LLNL Request 30)

Environmental Problem: LLNL 6
Request Number: LLNL 31

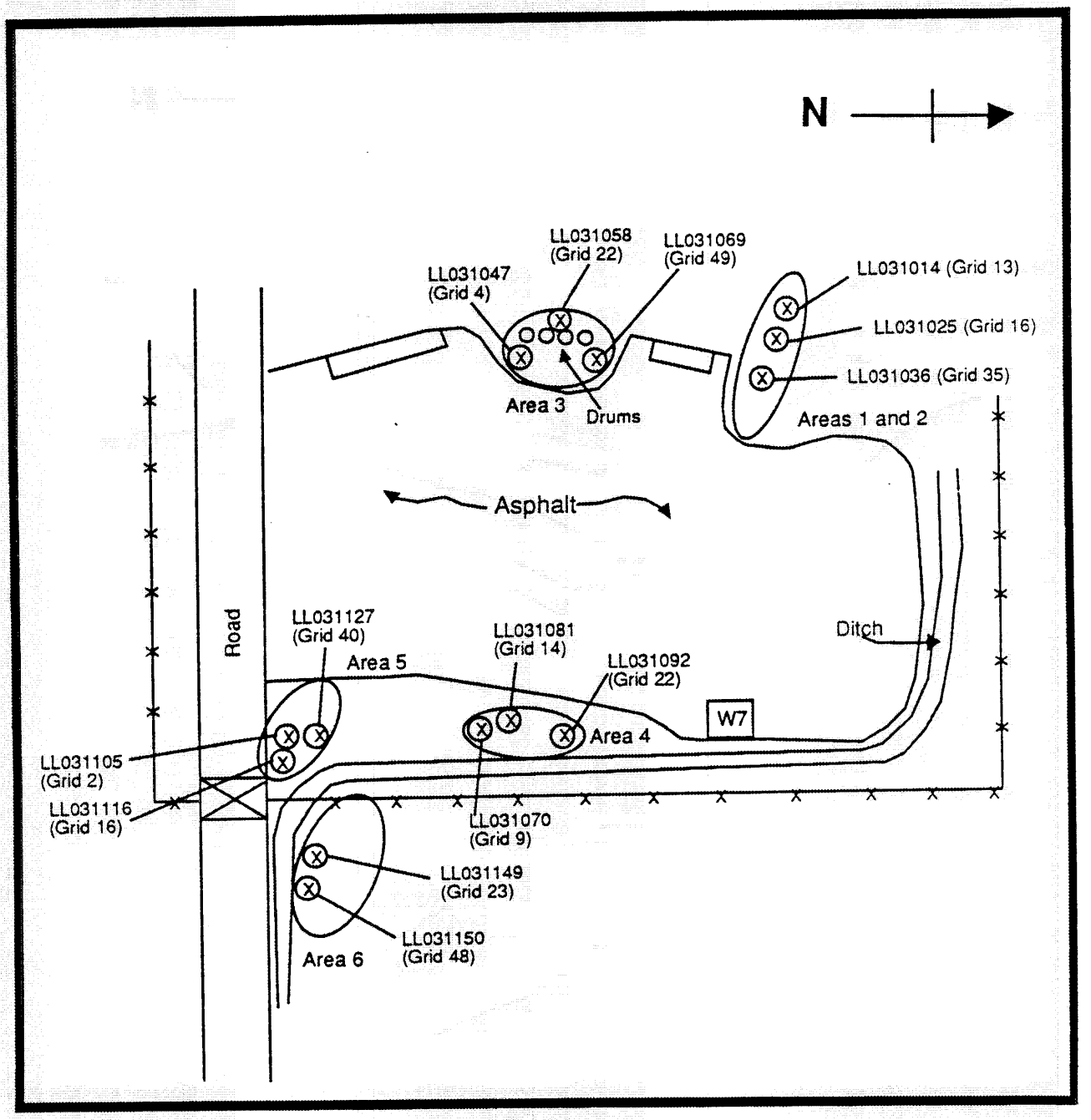

Figure L4.6d. GSA Area (LLNL Request 31)

Environmental Problem: LLNL 6
Request Number: LLNL 32

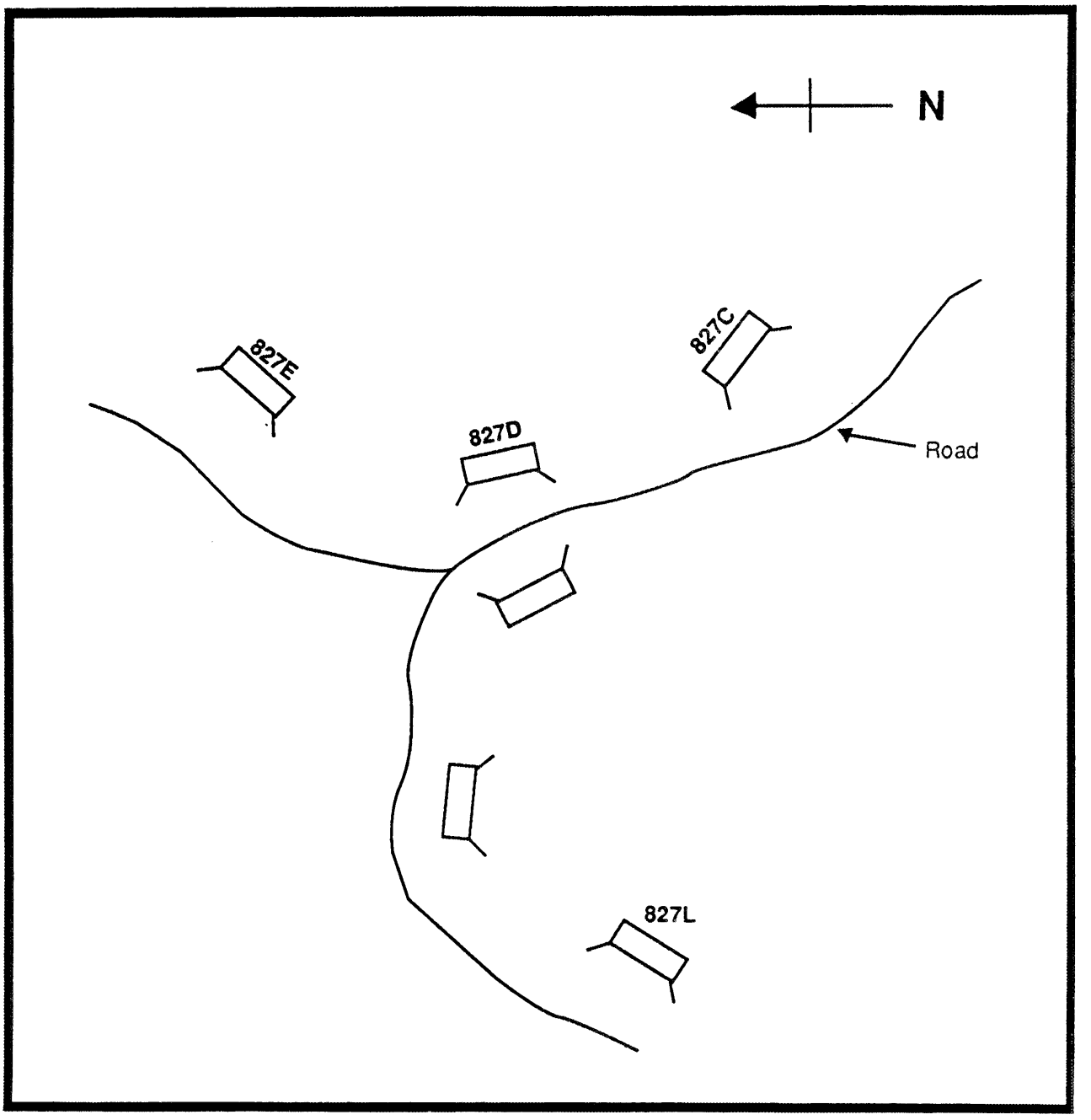

Figure L4.6e. Drum Rack Sump (827 Complex) (LLNL Request 32)

Environmental Problem: LLNL 6
Request Number: LLNL 32

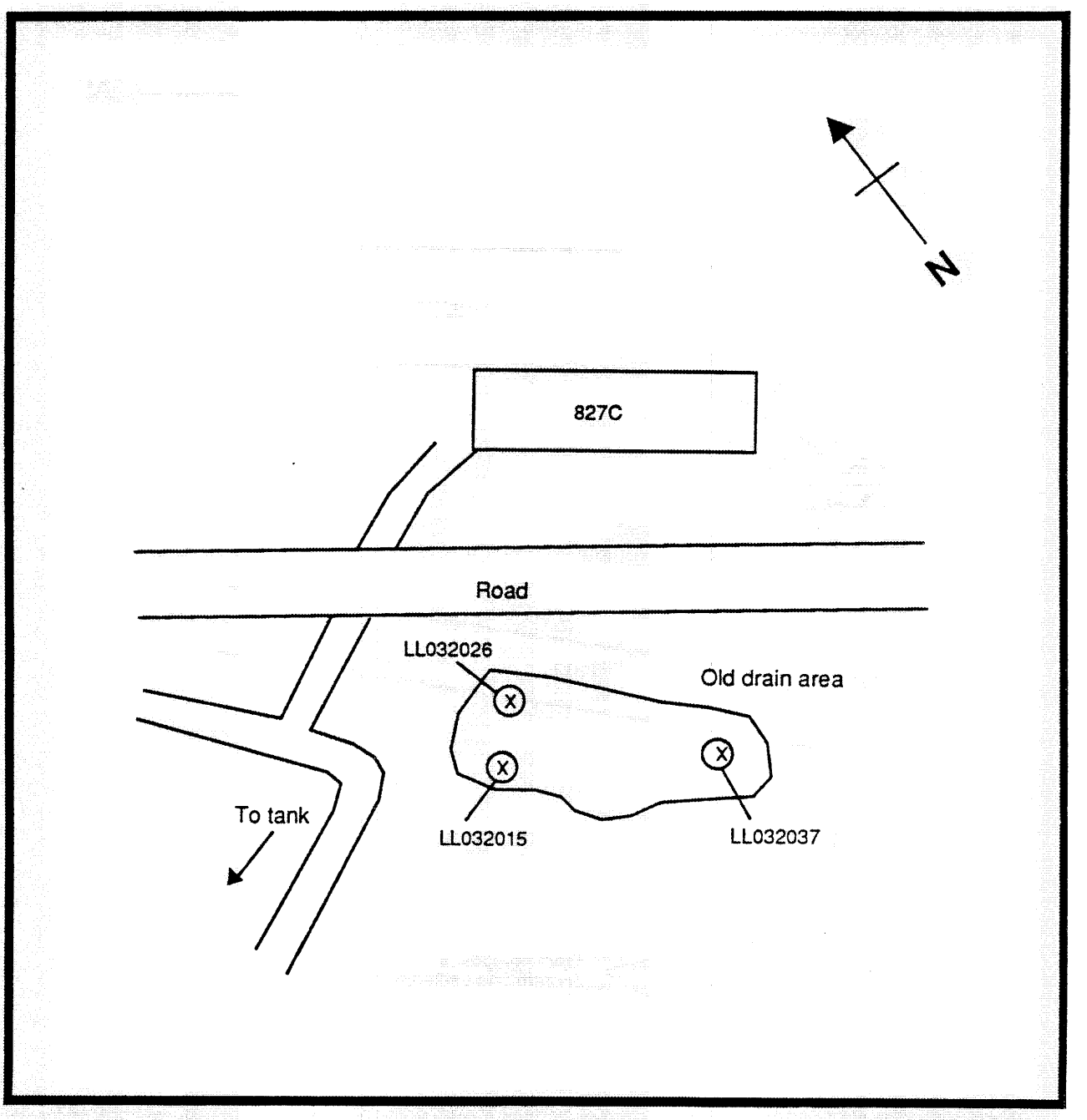

Figure L4.6f. Drum Rack Sump Area 827C (LLNL Request 32)

Environmental Problem: LLNL 6
Request Number: LLNL 32

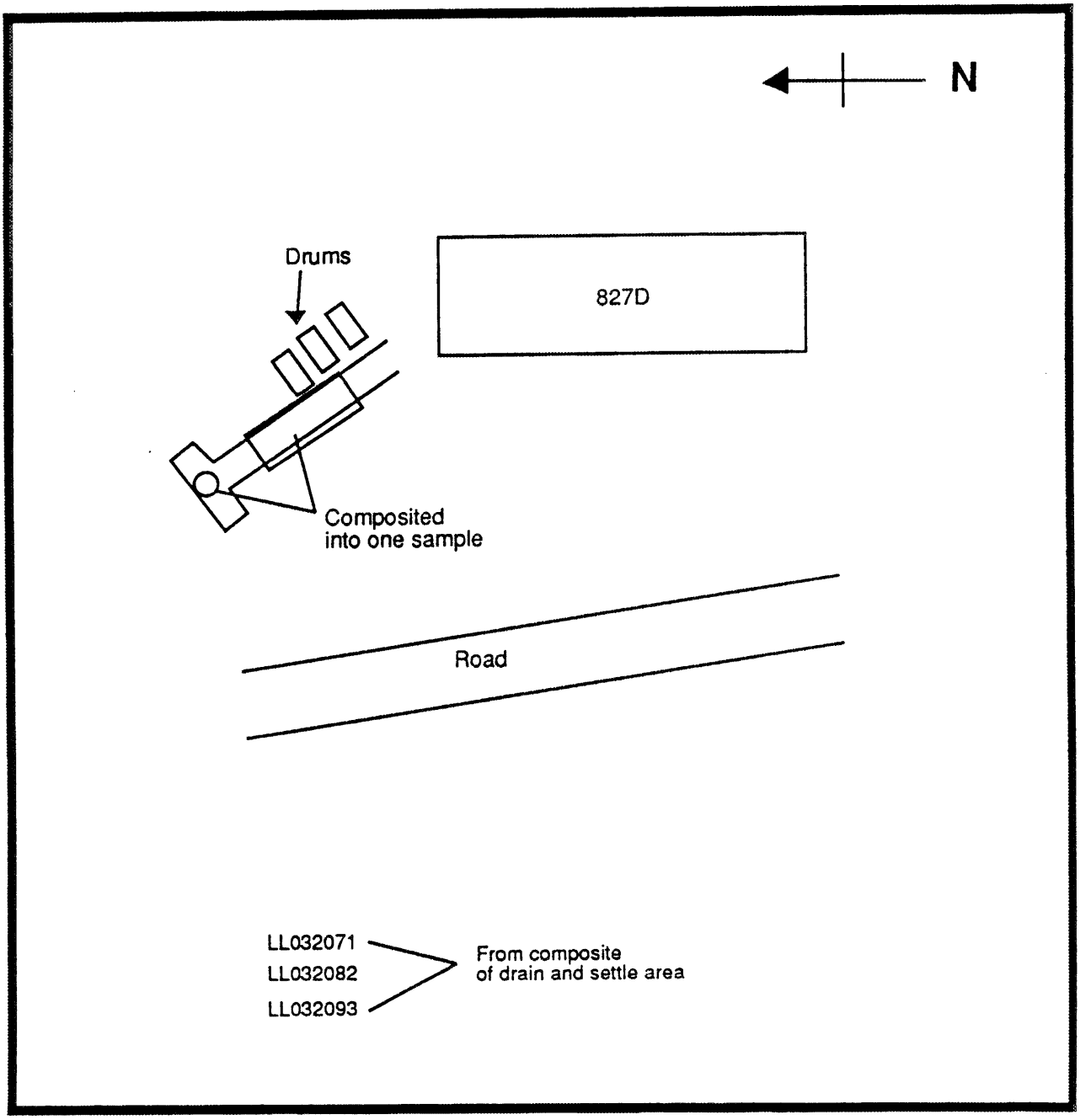

Figure L4.6g. Drum Rack Sump Area 827D (LLNL Request 32)

Environmental Problem: LLNL 6
Request Number: LLNL 32

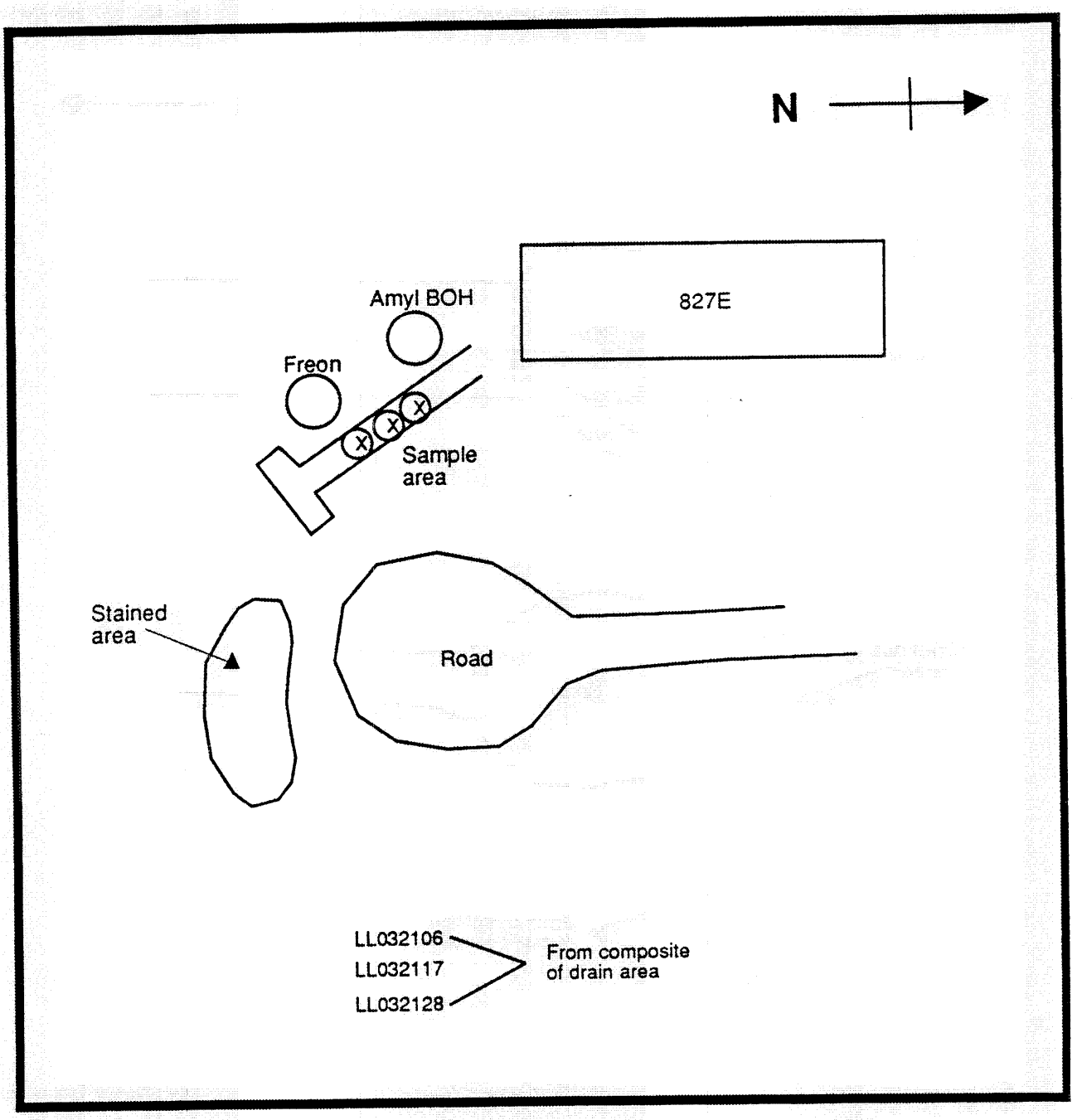

Figure L4.6h. Drum Rack Sump Area 827E (LLNL Request 32)

Environmental Problem: LLNL 6
Request Number: LLNL 32

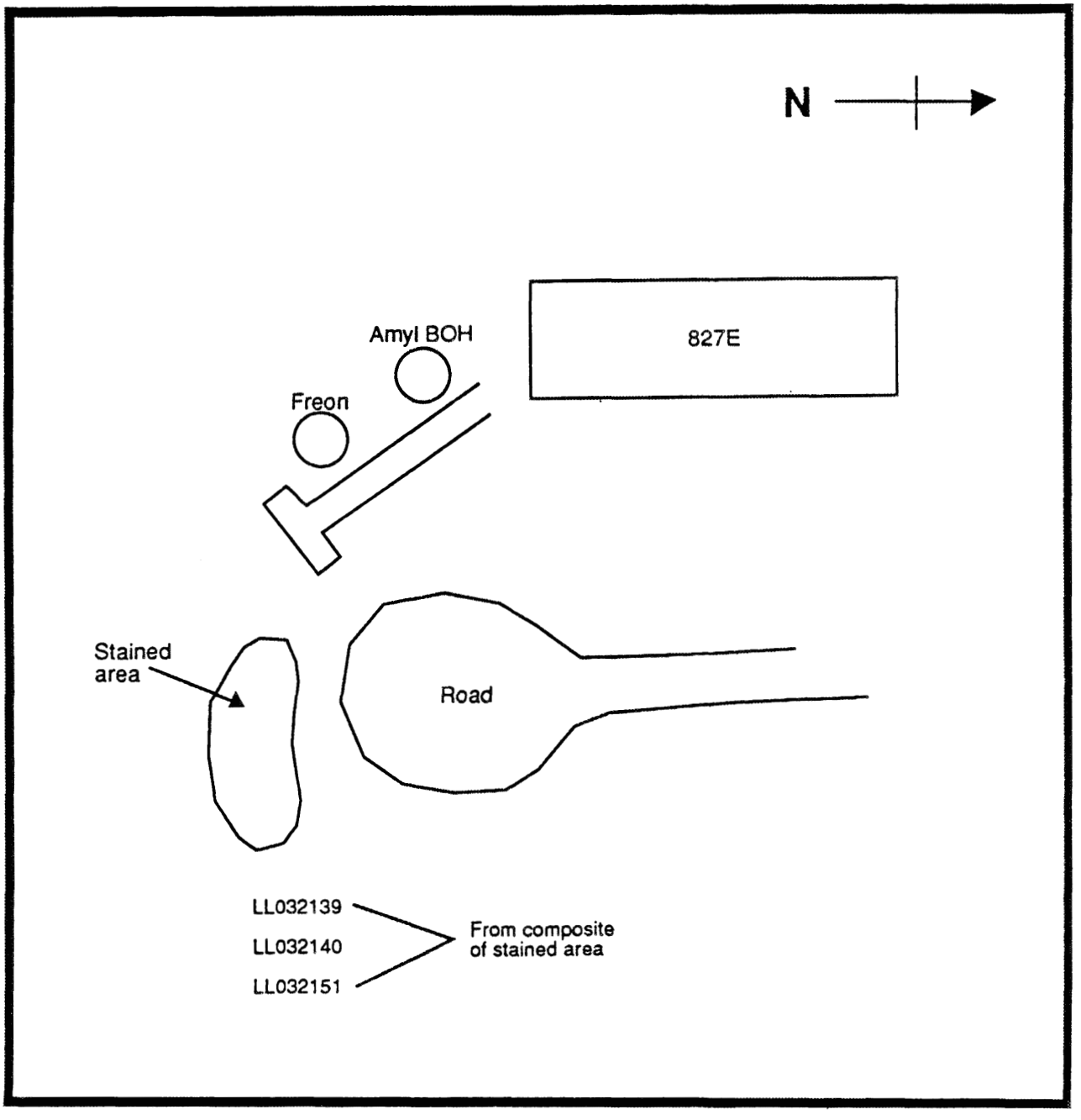

Figure L4.6i. Stained Area near 827E (LLNL Request 32)

Environmental Problem: LLNL 6
Request Number: LLNL 33

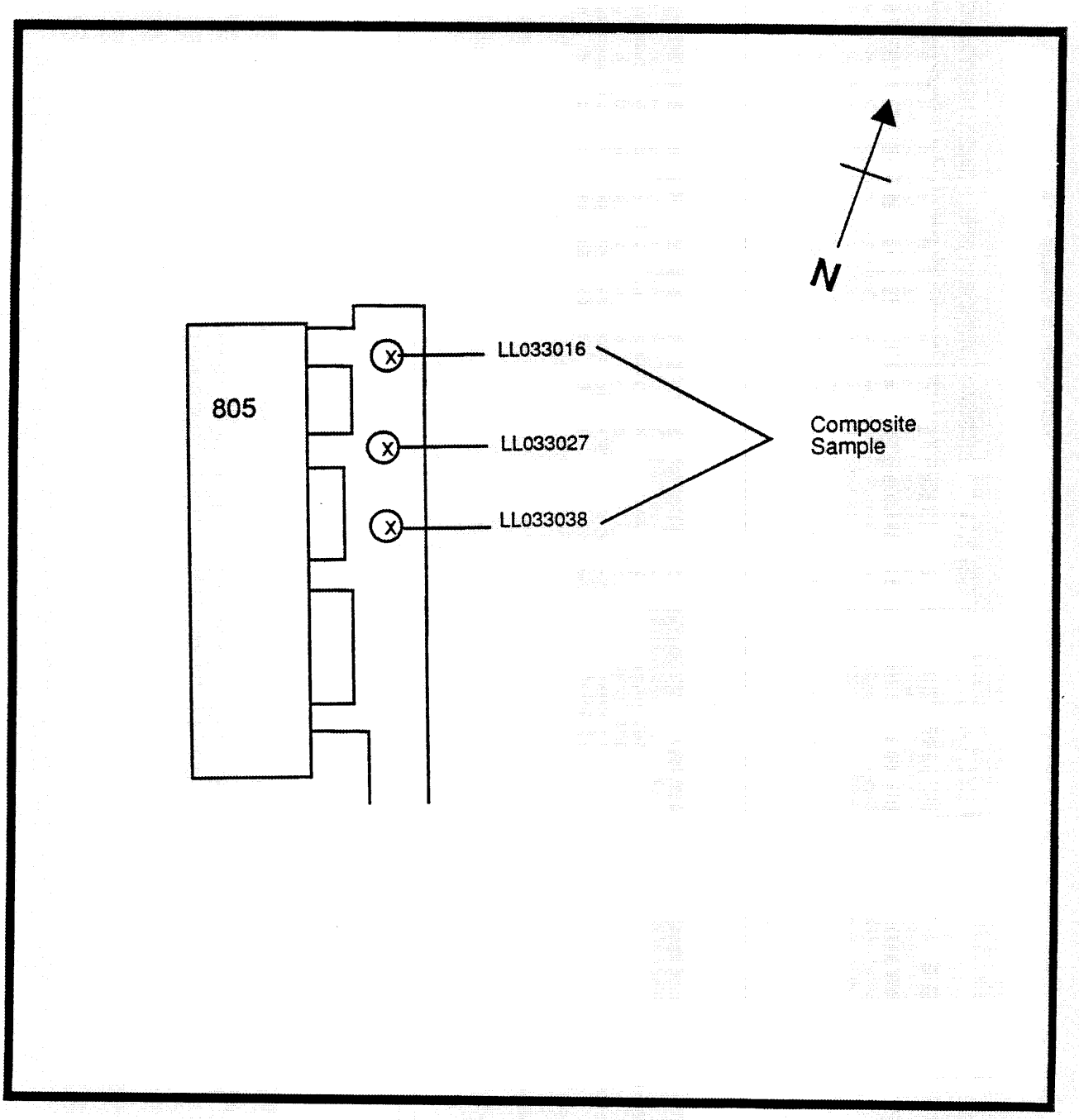

Figure L4.6j. Drains Downgradient from Building 805 (LLNL Request 33)

TABLE L4.2.6 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	HE NUMB HITS	HE 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
LL028	BLDG. 321	DRUMRACKS	SOIL	4	4	GRAB	0	0	4	4	0	0	0	0	0	0	4	4	4	4	0	0
LL030	N OF 875	CULVERT	SOIL	4	4	GRAB	0	0	4	4	4	4	0	0	0	0	4	4	4	4	4	4
LL031	GSA AREA	GSA AREA	SOIL	16	15	GRAB	0	0	15	15	15	15	0	0	0	0	15	15	15	15	15	15
LL032	DRUM RACK	SUMP	SOIL	6	3	GRAB	0	0	0	0	3	3	0	0	0	0	3	3	3	3	0	0
LL032	DRUM RACK	SUMP	SOIL	6	6	S COM	0	0	0	0	6	6	0	0	0	0	6	6	6	6	0	0
			MED TOTAL	36	32		0	0	23	23	28	28	0	0	0	0	32	32	32	32	19	19
LL029	875/878	CULVERT	SEDIMENT	3	3	GRAB	0	0	3	3	3	3	0	0	0	0	3	3	3	3	3	3
LL032	DRUM RACK	SUMP	SEDIMENT	12	3	S COM	0	0	0	0	3	3	0	0	0	0	3	3	3	3	0	0
LL033	BLDG. 805	DRAINS	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	3	3	3	3	3	3
			MED TOTAL	18	9		0	0	6	6	6	6	0	0	0	0	9	9	9	9	6	6
LL031	GSA AREA	GSA AREA	SUR WATER	1	0	QC RN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LL032	DRUM RACK	SUMP	SUR WATER	1	1	QC RN	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0
			MED TOTAL	2	1		0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0
			EP TOTAL	56	42		0	0	29	29	35	35	0	0	0	0	42	42	42	42	25	25

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TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 028
LOCATION: SOUTH FENCE BETWEEN BLDG 321 AND FIRST STREET ON BOTH SIDES OF DRUM RACK
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL028019C	LL028020C	LL028031C	LL028042C		
	SDG NO:	LL028019C	LL028019C	LL028019C	LL028019C		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
ALUMINUM		11100	11200	10700	15700		
BARIUM		173 N	158 N	212 N	218 N		
BERYLLIUM		0.38 B	0.34 B	0.37 B	0.49 B		
CADMIUM		2.3	0.58 B	0.75	1.1		
CALCIUM		4910	10500	6330	4350		
CHROMIUM		34 E	32 E	30 E	42 E		
COBALT		12 *	7 B*	7 B*	9.4 *		
COPPER		54 N	24 N	30 N	26 N		
IRON		19800 *	19800 *	19000 *	24400 *		
LEAD		54 *	14 B*	32 *	11 B*		
MAGNESIUM		5120	5550	4650	5750		
MANGANESE		579 E	547 E	521 E	605 E		
NICKEL		42 N*E	45 N*E	38 N*E	53 N*E		
POTASSIUM		3400	3000	3300	4200		
SILVER		3.3	1.1 B	1.1 B	1.6		
SODIUM		197 B	178 B	174 B	161 B		
VANADIUM		28 E	26 E	29 E	42 E		
ZINC		391 N*	59 N*	77 N*	58 N*		

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL028019B	LL028020B	LL028031B	LL028042B		
	SDG NO:	LL020988	LL020988	LL021088	LL020988		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
BIS(2-ETHYLHEXYL)PHTHALATE		9100	8400	11000	150 J		
BUTYLBENZYLPHTHALATE		420 U	39 J	48 J	110 J		
DI-N-BUTYLPHTHALATE		51 J	380 U	410 U	400 U		
PHENOL		44 J	380 U	410 U	400 U		
* UNKNOWN (6.30)			210 J	310 J			
* UNKNOWN (6.60)				780 J			
* UNKNOWN (7.00)			630 J				
* UNKNOWN (18.30)				130 J			
* UNKNOWN (20.40)			260 J	310 J			
* UNKNOWN (23.10)					300 J		
* UNKNOWN (23.20)			560 J	4700 J	5200 J		
* UNKNOWN (24.10)			24 J	180 J	400 J		
* UNKNOWN (24.20)				130 J			
* UNKNOWN (27.30)					290 J		
* UNKNOWN (31.20)			590 J				

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 028
LOCATION: SOUTH FENCE BETWEEN BLDG 321 AND FIRST STREET ON BOTH SIDES OF DRUM RACK
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL028019A	LL028020A	LL028031A	LL028042A
	SDG NO:	0902	0902	0902	0902
	TYPE:	GRAB	GRAB	GRAB	GRAB
ACETONE		24 B	11 JB	22 B	17 B
CHLOROFORM		10 B	10 B	9 B	6 U
METHYLENE CHLORIDE		2 JB	4 JB	2 JB	2 JB

S&A REQUEST: 029
LOCATION: OUTLET OF CULVERT DOWNGRADIENT FROM 875/878
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL029010C	LL029021C	LL029032C
	SDG NO:	LL009016C	LL009016C	LL009016C
	TYPE:	GRAB	GRAB	GRAB
ALUMINUM		11700 *	20900 *	17400 *
ANTIMONY		4.2 UN	7.4 BN	6 BN
ARSENIC		13 BN	4.4 UN	4.4 UN
BARIUM		184 *	273 *	414 *
BERYLLIUM		0.49 B	0.86	0.78
CADMIUM		3.9	1.3	5.7
CALCIUM		5660 *	5760 *	6970 *
CHROMIUM		40 N*	32 N*	43 N*
COBALT		7.6	11	11
COPPER		80 E	36 E	95 E
IRON		18900 *	24800 *	23700 *
LEAD		113	36	204
MAGNESIUM		5280 *E	6680 *E	6340 *E
MANGANESE		909 *E	874 *E	9520 *E
NICKEL		24 *	25 *	34 *
POTASSIUM		1700	3600	2900
SELENIUM		15 BN	5.9 UN	5.8 UN
SILVER		0.56 U	1.2 B	2.1
SODIUM		677 B	821	1060
VANADIUM		36	48	51
ZINC		352 *	112 *	477 *

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 029
LOCATION: OUTLET OF CULVERT DOWNGRADIENT FROM 875/878
MEDIUM: SEDIMENT

OIL AND GREASE (MG/KG)	SAMP NO:	LL029010E	LL029021E	LL029032E
	SDG NO:	LL029010E	LL029010E	LL029010E
	TYPE:	GRAB	GRAB	GRAB
OIL AND GREASE		400	2600	300

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL029010B	LL029021B	LL029032B
	SDG NO:	LL001018	LL001018	LL001018
	TYPE:	GRAB	GRAB	GRAB
ACENAPHTHENE		2600 J	140 J	390 J
ANTHRACENE		2900 J	300 J	84 J
BENZO(A)ANTHRACENE		5800	870	2000 J
BENZO(A)PYRENE		4300	620	1900 J
BENZO(G,H,I)PERYLENE		3800 U	410	3800 U
BENZO(K)FLUORANTHENE		5800	1400	3700 J
BIS(2-ETHYLHEXYL)PHTHALATE		590000 E	54000 E	140000 E
BUTYLBENZYLPHTHALATE		260 J	400 U	3800 U
CHRYSENE		5900	810	2500 J
DI-N-BUTYLPHTHALATE		3800 U	120 J	3800 U
DI-N-OCTYLPHTHALATE		510 J	400 U	3800 U
DIBENZ(A,H)ANTHRACENE		3800 U	400 J	3800 U
DIBENZOFURAN		840 J	34 J	3800 U
FLUORANTHENE		13000	1800	4800
FLUORENE		2000 J	400 U	3800 U
INDENO(1,2,3-CD)PYRENE		3200 J	360 J	940 J
NAPHTHALENE		540 J	400 U	3800 U
PHENANTHRENE		17000	1700	3800 J
PYRENE		19000	2200	5800
* ARYL HYDROCARBON (8.23)			350 J	
* ARYL HYDROCARBON (8.26)				2200 J
* CARBOXYLIC ACID ESTER (31.17)			270 J	
* CARBOXYLIC ACID ESTER (31.23)				51000 J
* CARBOXYLIC ACID ESTER (31.24)			1600 J	
* DIACETONE ALCOHOL (6.20)		15000 J		120000 J
* DIACETONE ALCOHOL (6.21)			27000 J	
* DIACETONE ALCOHOL (6.30)			1900 J	
* PROBABLE ALIPHATIC HYDR (4.86)				7800 J
* PROBABLE ALIPHATIC HYDR (4.91)				1100 J
* UNKNOWN (5.81)			630 J	
* UNKNOWN (8.08)			49 J	
* UNKNOWN (27.88)				160 J
* UNKNOWN (35.31)			87 J	
* UNKNOWN PHTHALATE ESTER(32.20)			140 J	2300 J
* UNKNOWN PHTHALATE ESTER(32.26)				

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 029
LOCATION: OUTLET OF CULVERT DOWNGRADIENT FROM 875/878
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL029010B	LL029021B	LL029032B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN PHTHALATE ESTER(32.38)			42 J				
* UNKNOWN PHTHALATE ESTER(32.70)		2300 J					
* UNKNOWN PHTHALATE ESTER(32.91)			6000 J				

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL029010A	LL029021A	LL029032A			
	SDG NO:	0827	0827	0827			
	TYPE:	GRAB	GRAB	GRAB			
CHLOROFORM		7 U	23	7 U			
METHYLENE CHLORIDE		7 U	7 U	12			
* ACETIC ACID, METHYL EST(9.65)		8 J					

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL029010D	LL029021D	LL029032D			
	SDG NO:	LLL7248	LLL7248	LLL7248			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		46	40	260			
G-ALPH		10000	10000	2200			
GROSS-BETA		19000	27000	25000			
K-40		11000	13000	12000			

S&A REQUEST: 030
LOCATION: LOCATIONS NORTH OF 875 AND DRUM RACK NEAR THE SUMP AND CULVERT
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL030013C	LL030013D	LL030024C	LL030024D	LL030035C	LL030035D
	SDG NO:	LL009016C	LL009016D	LL009016C	LL009016D	LL009016C	LL009016D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		21700 *		16700 *		26300 *	
ARSENIC		32 BN		3.9 UN		4.8 UN	
BARIUM		200 *		181 *		285 *	
BERYLLIUM			0.63 B		0.58 B		0.46 B
CADMIUM		1.1		1.5		0.75 B	
CALCIUM		8850 *		18100 *		8370 *	
CHROMIUM		32 N*		34 N*		41 N*	

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 030
LOCATION: LOCATIONS NORTH OF 875 AND DRUM RACK NEAR THE SUMP AND CULVERT
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL030013C	LL030013D	LL030024C	LL030024D	LL030035C	LL030035D
	SDG NO:	LL009016C	LL009016D	LL009016C	LL009016D	LL009016C	LL009016D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
COBALT		10		9.1		13	
COPPER		34 E		46 E		34 E	
IRON		26500 *		23000 *		30900 *	
LEAD			38		64		43
MAGNESIUM		8450 *E		7270 *E		9000 *E	
MANGANESE		638 *E		673 *E		690 *E	
NICKEL		19 *		19 *		27 *	
POTASSIUM		2600		2100		4100	
SELENIUM		55 BN		5.3 UN		6.3 UN	
SILVER		1.7		1.6		3.1	
SODIUM		1130		422 B		581 B	
VANADIUM		64		52		67	
ZINC		183 *		156 *		117 *	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL030046C	LL030046D
	SDG NO:	LL009016C	LL009016D
	TYPE:	GRAB	GRAB
ALUMINUM		21300 *	
ARSENIC		4.4 UN	
BARIUM		231 *	
BERYLLIUM			0.71 B
CADMIUM		0.74	
CALCIUM		8660 *	
CHROMIUM		37 N*	
COBALT		11	
COPPER		33 E	
IRON		26700 *	
LEAD			23
MAGNESIUM		7780 *E	
MANGANESE		627 *E	
NICKEL		20 *	
POTASSIUM		3500	
SELENIUM		5.9 UN	
SILVER		2.6	
SODIUM		1110	
VANADIUM		65	
ZINC		108 *	

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 030
LOCATION: LOCATIONS NORTH OF 875 AND DRUM RACK NEAR THE SUMP AND CULVERT
MEDIUM: SOIL

OIL AND GREASE (MG/KG)	SAMP NO:	LL030013E	LL030024E	LL030035E	LL030046E		
	SDG NO:	LL029010E	LL029010E	LL029010E	LL029010E		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
OIL AND GREASE		1000	500	2000	1100		

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL030013B	LL030024B	LL030035B	LL030046B		
	SDG NO:	LL001018	LL001018	LL001018	LL001018		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
BENZO(A)ANTHRACENE		370 U	3700 U	390 U	56 J		
BIS(2-ETHYLHEXYL)PHTHALATE		3700	750000 E	1400	95000 E		
BUTYLBENZYLPHTHALATE		270 J	3700 U	340 J	390		
DI-N-BUTYLPHTHALATE		260 J	3700 U	140 J	370 U		
DI-N-OCTYLPHTHALATE		370 U	230 J	46 J	97 J		
DIETHYLPHTHALATE		260 J	3700 U	110 J	200 J		
FLUORANTHENE		170 J	3700 U	390 U	200 J		
PHENANTHRENE		220 J	3700 U	390 U	290 J		
PYRENE		240 J	3700 U	89 J	150 J		
* CARBOXYLIC ACID ESTER (31.19)		790 J					
* CARBOXYLIC ACID ESTER (31.29)		1500 J					
* DIACETONE ALCOHOL (6.15)					1800 J		
* DIACETONE ALCOHOL (6.20)			15000 J				
* DIACETONE ALCOHOL (6.35)		15000 J					
* DIACETONE ALCOHOL (6.40)				1600 J			
* POSSIBLE ALIPHATIC KETO (5.63)		340 J					
* PROBABLE ALIPHATIC HYDR (4.86)					350 J		
* PROBABLE ALIPHATIC HYDR (4.87)		330 J					
* UNKNOWN (8.13)		270 J					
* UNKNOWN PHTHALATE (32.97)				1600 J			
* UNKNOWN PHTHALATE ESTER(28.13)		300 J					
* UNKNOWN PHTHALATE ESTER(32.25)		270 J					
* UNKNOWN PHTHALATE ESTER(32.35)					32 J		
* UNKNOWN PHTHALATE ESTER(32.93)					180 J		
* UNKNOWN PHTHALATE ESTER(32.99)		22000 J					
* UNKNOWN PHTHALATE ESTER(33.23)		4500 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL030013A	LL030024A	LL030035A	LL030046A		
	SDG NO:	0827	0827	0828	0828		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
ACETONE		92 B	65 B	27 B	33 B		
BENZENE		2 J	2 J	7 U	1 J		
BROMODICHLOROMETHANE		6 U	3 J	7 U	6 U		

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 030
LOCATION: LOCATIONS NORTH OF 875 AND DRUM RACK NEAR THE SUMP AND CULVERT
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL030013A	LL030024A	LL030035A	LL030046A		
	SDG NO:	0827	0827	0828	0828		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
CHLOROFORM		6 U	24	7 U	6 U		
METHYLENE CHLORIDE		17	15	15	21		
TOLUENE		8	8	4 JB	5 JB		
2-BUTANONE		50	12 U	14 U	12 U		
4-METHYL-2-PENTANONE		110	8 J	14 U	12 U		
* ACETIC ACID, METHYL EST(9.6)					11 J		
* ACETIC ACID, METHYL EST(9.64)		19 J					
* ACETIC ACID, METHYL EST(9.65)			9 J	12 J			
* UNKNOWN(31.98)		26 J					
* 1-BUTENE, 4-ISOTHIOCYAN(31.86)					26 J		

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL030013F	LL030024F	LL030035F	LL030046F		
	SDG NO:	LLL7249	LLL7249	LLL7249	LLL7249		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
CS-137		18	35	30	35		
EU-155					70		
G-ALPH		10000	11000	11000	3500		
GROSS-BETA		18000	21000	27000	22000		
K-40		15000	11000	12000	12000		

S&A REQUEST: 031
LOCATION: GSA AREA 1 AND 2
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031014C	LL031014D	LL031025C	LL031025D	LL031036C	LL031036D
	SDG NO:	LL011010C	LL031014D	LL011010C	LL031014D	LL011010C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		16100 *		17000 *		16500 *	
BARIUM		301		281		286	
BERYLLIUM			0.71 B		0.58 B		0.95
CADMIUM		0.74		0.91		0.78	
CALCIUM		8900 *		13200 *		9400 *	
CHROMIUM		26 E		27 E		28 E	
COBALT		9.4		10		9.4	
COPPER		92		24		23	

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 1 AND 2
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031014C	LL031014D	LL031025C	LL031025D	LL031036C	LL031036D
	SDG NO:	LL011010C	LL031014D	LL011010C	LL031014D	LL011010C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
IRON		22200 *		23400 *		22800 *	
LEAD			16		10		8.8
MAGNESIUM		7670		8290		7350	
MANGANESE		684 *		682 *		638 *	
NICKEL		29 N*		30 N*		27 N*	
POTASSIUM		3300		3100		3400	
SILVER		1.7		1.6		2.1	
SODIUM		882		934		1000	
VANADIUM		58		60		64	
ZINC		68		67		65	

OIL AND GREASE (MG/KG)	SAMP NO:	LL031014E	LL031025E	LL031036E			
	SDG NO:	LL031014E	LL031014E	LL031014E			
	TYPE:	GRAB	GRAB	GRAB			
OIL AND GREASE		13400	13500	14600			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL031014B	LL031025B	LL031036B			
	SDG NO:	LL020288	LL011388	LL020488			
	TYPE:	GRAB	GRAB	GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE		5500 D	360 U	12000 D			
DIBENZOFURAN		3600 U	360 U	750 JD			
DIETHYLPHTHALATE		3600 U	360 U	3400 JD			
FLUORENE		3600 U	360 U	610 JD			
PHENANTHRENE		3600 U	1700	2700 JD			
PYRENE		3600 U	930	3400 U			
2-METHYLNAPHTHALENE		3600 U	210 J	590 JD			
* UNKNOWN (12.50)			1100 J				
* UNKNOWN (13.10)			2500 J	8400 J			
* UNKNOWN (13.30)				18000 J			
* UNKNOWN (14.00)			2600 J				
* UNKNOWN (14.20)			3800 J	18000 J			
* UNKNOWN (14.40)		2700 J		44000 J			
* UNKNOWN (15.10)			2000 J				
* UNKNOWN (15.30)			3900 J	11000 J			
* UNKNOWN (15.50)		3400 J		55000 J			
* UNKNOWN (16.00)			2600 J				
* UNKNOWN (16.20)				22000 J			
* UNKNOWN (16.40)			4500 J	7100 J			

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 1 AND 2
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL031014B	LL031025B	LL031036B
	SDG NO:	LL020288	LL011388	LL020488
	TYPE:	GRAB	GRAB	GRAB
* UNKNOWN (16.50)		6100 J		
* UNKNOWN (16.60)		4500 J		49000 J
* UNKNOWN (17.00)				43000 J
* UNKNOWN (17.40)			4200 J	
* UNKNOWN (17.50)		5900 J	3900 J	
* UNKNOWN (18.00)		3300 J		38000 J
* UNKNOWN (18.40)			4100 J	
* UNKNOWN (19.00)		6100 J	1200 J	53000 J
* UNKNOWN (19.10)				6600 J
* UNKNOWN (19.30)			4000 J	
* UNKNOWN (19.50)				52000 J
* UNKNOWN (20.00)		7300 J		
* UNKNOWN (20.30)			4300 J	
* UNKNOWN (20.50)		4900 J		42000 J
* UNKNOWN (21.20)			4400 J	
* UNKNOWN (21.40)			1700 J	53000 J
* UNKNOWN (21.50)		5100 J		
* UNKNOWN (22.10)			4200 J	
* UNKNOWN (22.30)				36000 J
* UNKNOWN (22.40)		3200 J		
* UNKNOWN (22.50)			3500 J	
* UNKNOWN (23.20)				15000 J
* UNKNOWN (23.40)			2100 J	

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL031014A	LL031025A	LL031036A
	SDG NO:	0831	0831	0831
	TYPE:	GRAB	GRAB	GRAB
ACETONE		190 B	160 B	160 B
BENZENE		2 J	2 J	3 J
CHLOROFORM		5 U	2 J	5 U
METHYLENE CHLORIDE		4 J	18	35
TOLUENE		5 U	3 JB	4 JB
2-BUTANONE		150	130	120
2-HEXANONE		74	67	47
4-METHYL-2-PENTANONE		24	17	17
* ACETIC ACID, METHYL EST(9.69)		22 J	17 J	15 J
* BENZENE, DERIVATIVE(50.14)		2440 J		
* UNKNOWN(11.21)				5 J
* UNKNOWN(16.29)		6 J	4 J	4 J
* UNKNOWN(19.57)				3 J

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 1 AND 2
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL031014A	LL031025A	LL031036A			
	SDG NO:	0831	0831	0831			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN(22.88)		4 J					
* UNKNOWN(22.89)			3 J				
* UNKNOWN(34.39)		15 J		11 J			
* UNKNOWN(34.4)			14 J				
* UNKNOWN(38.79)		924 J					

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL031014F	LL031025F	LL031036F			
	SDG NO:	LLL7274	LLL7274	LLL7274			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		24	35	18			
G-ALPH		9200	8100	3500			
GROSS-BETA		22000	32000	23000			
K-40		13000	11000	12000			

S&A REQUEST: 031
LOCATION: GSA AREA 3
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031047C	LL031047D	LL031058C	LL031058D	LL031069C	LL031069D
	SDG NO:	LL011010C	LL031047D	LL011010C	LL031047D	LL011010C	LL031047D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		14700 *		14900 *		15400 *	
BARIUM		193		196		260	
BERYLLIUM		0.68 B		0.65 B		0.68 B	
CADMIUM		0.65 B		0.93		0.72	
CALCIUM		7630 *		7240 *		9180 *	
CHROMIUM		26 E		25 E		25 E	
COBALT		7.2		7.7		7.4	
COPPER		19		19		21	
IRON		22300 *		21000 *		20900 *	
LEAD		14 B		14 B		11 B	
MAGNESIUM		6060		5880		6340	
MANGANESE		572 *		584 *		643 *	
MERCURY			0.02 BN		0.03 BN		0.05 N
NICKEL		24 N*		23 N*		23 N*	

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 3
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031047C	LL031047D	LL031058C	LL031058D	LL031069C	LL031069D
	SDG NO:	LL013034K	LL031047D	LL013034K	LL031047D	LL013034K	LL031047D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
POTASSIUM		2700		2700		2900	
SILVER		1.7		1 B		1 B	
SODIUM		1280		1230		1250	
VANADIUM		64		64		59	
ZINC		71		68		69	

OIL AND GREASE (MG/KG)	SAMP NO:	LL031047E	LL031058E	LL031069E
	SDG NO:	LL031014E	LL031014E	LL031014E
	TYPE:	GRAB	GRAB	GRAB
OIL AND GREASE		700	900	1200

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL031047B	LL031058B	LL031069B
	SDG NO:	LL020388	LL020488	LL020588
	TYPE:	GRAB	GRAB	GRAB
ACENAPHTHENE		380	3500 U	350 U
BIS(2-ETHYLHEXYL)PHTHALATE		350 U	9300 D	70 J
BUTYLBENZYLPHTHALATE		350 U	3500 U	50 J
N-NITROSO-DI-N-PROPYLAMINE		330 J	3500 U	350 U
PENTACHLOROPHENOL		500	17000 U	1700 U
PHENOL		530	3500 U	350 U
PYRENE		390	3500 U	350 U
1,2-DICHLOROBENZENE		280 J	3500 U	350 U
1,2,4-TRICHLOROBENZENE		360	3500 U	350 U
1,4-DICHLOROBENZENE		260 J	3500 U	350 U
2-CHLOROPHENOL		590	3500 U	350 U
2,4-DINITROTOLUENE		300 J	3500 U	350 U
4-CHLORO-3-METHYLPHENOL		670	3500 U	350 U
4-NITROPHENOL		420	17000 U	1700 U
* UNKNOWN (6.30)				220 J
* UNKNOWN (20.40)				220 J
* UNKNOWN (25.50)				240 J

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL031047A	LL031058A	LL031069A
	SDG NO:	0901	0901	0901
	TYPE:	GRAB	GRAB	GRAB
ACETONE		44 B	48 B	66 B

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 3
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL031047A	LL031058A	LL031069A			
	SDG NO:	0901	0901	0901			
	TYPE:	GRAB	GRAB	GRAB			
METHYLENE CHLORIDE		2 JB	3 JB	2 JB			
TOLUENE		2 JB	2 JB	2 JB			
2-BUTANONE		11 U	10 U	37			
2-HEXANONE		6 J	10 U	12			
4-METHYL-2-PENTANONE		11 U	4 J	9 J			
* ACETIC ACID, METHYL EST(9.69)		6 J	8 J	11 J			
* UNKNOWN(17.95)		3 J	4 J	5 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL031047F	LL031058F	LL031069F			
	SDG NO:	LLL7274	LLL7274	LLL7274			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		32	54	27			
G-ALPH		3500	11000	3500			
GROSS-BETA		23000	22000	25000			
K-40		11000	11000	13000			

S&A REQUEST: 031
LOCATION: GSA AREA 4
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031070C	LL031070D	LL031081C	LL031081D	LL031092C	LL031092D
	SDG NO:	LL011010C	LL031014D	LL011010C	LL031014D	LL011010C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		12400 *		10500 *		16800 *	
ANTIMONY		4.2 UN		4.1 UN		5 BN	
BARIUM		122		157		254	
BERYLLIUM			0.43 B		0.75 B		0.6 B
CADMIUM		1.5		1.8		1.3	
CALCIUM		11800 *		11100 *		11800 *	
CHROMIUM		24 E		28 E		28 E	
COBALT		7.2		7.9		8.4	
COPPER		380		36		32	
IRON		18000 *		18600 *		22800 *	
LEAD			33		31		23
MAGNESIUM		5660		5720		7570	

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 4
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031070C	LL031070D	LL031081C	LL031081D	LL031092C	LL031092D
	SDG NO:	LL011010C	LL031014D	LL011010C	LL031014D	LL011010C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MANGANESE		457 *		621 *		648 *	
NICKEL		27 N*		27 N*		27 N*	
POTASSIUM		2500		2900		3800	
SILVER		1.6		1.9		1.5	
SODIUM		1120		967		763	
VANADIUM		53		51		65	
ZINC		133		128		203	

OIL AND GREASE (MG/KG)	SAMP NO:	LL031070E	LL031081E	LL031092E			
	SDG NO:	LL031070E	LL031070E	LL031070E			
	TYPE:	GRAB	GRAB	GRAB			
OIL AND GREASE		40500	3500	400			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL031070B	LL031081B	LL031092B			
	SDG NO:	LL011388	LL020588	LL011388			
	TYPE:	GRAB	GRAB	GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE		850	190 J	190 J			
BUTYLBENZYLPHTHALATE		350 U	60 J	350 U			
DI-N-BUTYLPHTHALATE		50 J	350 U	40 J			
* UNKNOWN (10.30)				1400 J			
* UNKNOWN (16.30)		170 J					
* UNKNOWN (17.30)		360 J					
* UNKNOWN (17.40)		420 J					
* UNKNOWN (17.60)			180 J				
* UNKNOWN (18.00)			190 J				
* UNKNOWN (18.30)		230 J		140 J			
* UNKNOWN (19.00)			250 J				
* UNKNOWN (19.30)		710 J	140 J	140 J			
* UNKNOWN (19.50)			250 J				
* UNKNOWN (20.20)		1000 J		180 J			
* UNKNOWN (20.30)				50 J			
* UNKNOWN (20.40)			200 J				
* UNKNOWN (20.50)			260 J				
* UNKNOWN (21.10)		850 J					
* UNKNOWN (21.30)		1600 J					
* UNKNOWN (22.00)			390 J				
* UNKNOWN (22.30)			280 J				
* UNKNOWN (22.50)			310 J				

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 4
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL031070B	LL031081B	LL031092B			
	SDG NO:	LL011388	LL020588	LL011388			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN (23.10)		1400 J					
* UNKNOWN (23.20)			410 J				
* UNKNOWN (23.40)		2100 J	500 J	320 J			
* UNKNOWN (24.00)		1600 J					
* UNKNOWN (24.10)			570 J				
* UNKNOWN (24.20)			650 J				
* UNKNOWN (24.30)		1500 J					
* UNKNOWN (24.50)		1800 J					
* UNKNOWN (25.00)		1500 J					
* UNKNOWN (25.20)				320 J			
* UNKNOWN (25.60)		1500 J					
* UNKNOWN (26.10)			510 J				
* UNKNOWN (26.20)			710 J				
* UNKNOWN (26.40)		1600 J					
* UNKNOWN (27.20)				390 J			

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL031070A	LL031081A	LL031092A			
	SDG NO:	0901	0901	0901			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		82 B	100 B	89 B			
BENZENE		2 J	5 U	2 J			
CHLOROFORM		2 J	5 U	2 J			
METHYLENE CHLORIDE		22 B	8 B	27 B			
TOLUENE		4 JB	5 U	5 JB			
2-BUTANONE		37	52	33			
2-HEXANONE		15	20	10 U			
4-METHYL-2-PENTANONE		24	34	14			
* ACETIC ACID, METHYL EST(9.69)		17 J	16 J	9 J			
* UNKNOWN(17.95)			9 J				
* UNKNOWN(23.7)			4 J				

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL031070F	LL031081F	LL031092F			
	SDG NO:	LLL7274	LLL7274	LLL7274			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		22 U	30	190			
G-ALPH		2300	5900	4600			
GROSS-BETA		24000	20000	24000			
K-40		12000	11000	14000			

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 5
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031105C	LL031105D	LL031116C	LL031116D	LL031127C	LL031127D
	SDG NO:	LL011010C	LL031014D	LL011010C	LL031014D	LL011010C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		11500 *		10500 *		10900 *	
BARIUM		172		151		198	
BERYLLIUM			0.5 B		0.36 B		0.35 B
CADMIUM		1.3		1		1.1	
CALCIUM		12100 *		11000 *		11800 *	
CHROMIUM		28 E		25 E		24 E	
COBALT		7.6		7.2		6.4 B	
COPPER		43		42		44	
IRON		20200 *		18100 *		19300 *	
LEAD			35		16		23
MAGNESIUM		6820		5980		6020	
MANGANESE		635 *		513 *		685 *	
NICKEL		31 N*		31 N*		30 N*	
POTASSIUM		2000		2700		2000	
SILVER		1.5		1.5		1.5	
SODIUM		861		761		692 U	
VANADIUM		53		51		51	
ZINC		71		65		72	

OIL AND GREASE (MG/KG)	SAMP NO:	LL031105E	LL031116E	LL031127E
	SDG NO:	LL031070E	LL031070E	LL031070E
	TYPE:	GRAB	GRAB	GRAB
OIL AND GREASE		11300	4600	3000

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL031105B	LL031116B	LL031127B
	SDG NO:	LL020488	LL020388	LL020988
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		690 JD	700 JD	940 JD
* UNKNOWN (21.40)				1600 J
* UNKNOWN (22.00)			2600 J	

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL031105A	LL031116A	LL031127A
	SDG NO:	0901	0901	0902
	TYPE:	GRAB	GRAB	GRAB
ACETONE		66 B	63 B	36 B
BENZENE		2 J	5 U	3 J

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 5
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL031105A	LL031116A	LL031127A			
	SDG NO:	0901	0901	0902			
	TYPE:	GRAB	GRAB	GRAB			
CHLOROFORM		3 J	5 U	3 JB			
METHYLENE CHLORIDE		16 B	2 JB	25 B			
TOLUENE		5 JB	5 U	6 B			
4-METHYL-2-PENTANONE		9 J	6 J	10 U			
* ACETIC ACID, METHYL EST(9.69)		12 J	11 J	9 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL031105F	LL031116F	LL031127F			
	SDG NO:	LLL7274	LLL7274	LLL7274			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		22 U	16	23 U			
G-ALPH		6800	3500	7800			
GROSS-BETA		20000	16000	32000			
K-40		11000	11000	12000			

S&A REQUEST: 031
LOCATION: GSA AREA 6
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031149C	LL031149D	LL031150C	LL031150D	LL031161C	LL031161D
	SDG NO:	LL028019C	LL031014D	LL011010C	LL031014D	LL011010C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		8110		9290 *		10200 *	
BARIUM		130 N		165		170	
BERYLLIUM			0.38 B		0.38 B		0.3 B
CADMIUM		0.92		1.1		1	
CALCIUM		11200		10700 *		8130 *	
CHROMIUM		16 E		23 E		24 E	
COBALT		4.7 B*		6 B		6.5 B	
COPPER		21 N		26		25	
IRON		13900 *		15800 *		17200 *	
LEAD			22		24		7.3
MAGNESIUM		4390		5290		5250	
MANGANESE		346 E		520 *		485 *	
NICKEL		19 N*E		25 N*		26 N*	
POTASSIUM		1700		1900		2000	

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 031
LOCATION: GSA AREA 6
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL031149C	LL031149D	LL031150C	LL031150D	LL031161C	LL031161D
	SDG NO:	LL028019C	LL031014D	LL011010C	LL031014D	LL011010C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
SILVER		1.1 B		2.4		2.1	
SODIUM		605 B		704 B		831	
VANADIUM		31 E		40		43	
ZINC		101 N*		87		85	

OIL AND GREASE (MG/KG)	SAMP NO:	LL031149E	LL031150E	LL031161E
	SDG NO:	LL031149E	LL031149E	LL031149E
	TYPE:	GRAB	GRAB	GRAB
OIL AND GREASE		2700	2400	2500

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL031149B	LL031150B	LL031161B
	SDG NO:	LL020288	LL020288	LL020588
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		1200 JD	1700 JD	6900 D
FLUORANTHENE		3700 U	600 JD	3700 U
PHENANTHRENE		3700 U	500 JD	3700 U

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL031149A	LL031150A	LL031161A
	SDG NO:	0902	0902	0902
	TYPE:	GRAB	GRAB	GRAB
ACETONE		7 JB	6 JB	4 JB
BROMODICHLOROMETHANE		1 J	2 J	2 J
CHLOROFORM		7 B	12 B	12 B
METHYLENE CHLORIDE		2 JB	6 B	3 JB
* ACETIC ACID, METHYL EST(9.69)		3 J	3 J	3 J

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL031149F	LL031150F	LL031161F
	SDG NO:	LLL7274	LLL7274	LLL7274
	TYPE:	GRAB	GRAB	GRAB
CS-137		40	40	59
G-ALPH		1100	8900	6800
GROSS-BETA		24000	20000	19000
K-40		11000	11000	13000

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA D
MEDIUM: SOIL

OIL AND GREASE (MG/KG)	SAMP NO:	LL032071C	LL032082C	LL032093C
	SDG NO:	LL032015C	LL032015C	LL032015C
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE
OIL AND GREASE		3800	5200	3900

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL032071B	LL032082B	LL032093B
	SDG NO:	LL001018	LL001018	LL001018
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE
BIS(2-ETHYLHEXYL)PHTHALATE		63000 E	89000 E	80000 E
DI-N-OCTYLPHTHALATE		350 U	220 J	85 J
DIETHYLPHTHALATE		20 J	360 U	350 U
* ARYL HYDROCARBON(MW120)(8.25)		170 J		
* CARBOXYLIC ACID (26.32)				200 J
* DIACETONE ALCOHOL (6.26)			20000 J	
* DIACETONE ALCOHOL (6.30)				21000 J
* DIACETONE ALCOHOL (6.32)		23000 J		
* PHTHALATE ESTER (28.11)		39 J		
* PHTHALATE ESTER (32.63)		83 J		
* PHTHALATE ESTER (32.86)				710 J
* POSSIBLE AMIDE/AMINE (9.12)			350 J	
* POSSIBLE KETONE (6.57)			450 J	
* PROBABLE ALIPHATIC HYDR (4.87)			170 J	
* PROBABLE ALIPHATIC HYDR (6.72)			180 J	
* PROBABLE ALIPHATIC HYDR (6.91)			260 J	
* PROBABLE HYDROCARBON (6.74)				290 J
* PROBABLE HYDROCARBON (6.76)		260 J		
* PROBABLE HYDROCARBON (6.95)				450 J
* PROBABLE HYDROCARBON (36.00)				500000 J
* PROBABLE HYDROCARBON FR(36.00)		460000 J	640000 J	
* UNKNOWN (4.89)		360 J		
* UNKNOWN (5.47)			410 J	
* UNKNOWN (5.50)				1200 J
* UNKNOWN (5.56)		1600 J		
* UNKNOWN (6.58)				660 J
* UNKNOWN (6.60)		600 J		
* UNKNOWN (6.96)		390 J		
* UNKNOWN (7.13)		150 J		
* UNKNOWN (8.12)		170 J		
* UNKNOWN (8.96)		250 J		
* UNKNOWN (9.11)				780 J
* UNKNOWN (29.75)				29 J
* UNKNOWN (29.82)				99 J

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA D
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL032071A	LL032082A	LL032093A			
	SDG NO:	0904	0904	0904			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
ACETONE		52 B	120 B	76 B			
BENZENE		3 J	15	2 J			
CARBON DISULFIDE		5 U	5 J	5 U			
CHLOROFORM		5 U	10	5 U			
ETHYLBENZENE		5 U	4 JB	5 U			
METHYLENE CHLORIDE		41 B	220 BE	41 B			
TOLUENE		5 J	33	4 J			
1,1,1-TRICHLOROETHANE		4 J	5 U	3 J			
2-BUTANONE		11 U	40	11 U			
4-METHYL-2-PENTANONE		11	25	22			
* ACETIC ACID, METHYL EST(9.69)		7 J	14 J	6 J			
* ETHYL ETHER(12.21)		17 J		18 J			
* ETHYL,ETHER(12.21)			13 J				
* UNKNOWN(11.21)			17 J				
* UNKNOWN(23.12)		3 J					

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA E
MEDIUM: SOIL

OIL AND GREASE (MG/KG)	SAMP NO:	LL032106C	LL032117C	LL032128C			
	SDG NO:	LL032106C	LL032106C	LL032106C			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
OIL AND GREASE		600	600	500			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL032106B	LL032117B	LL032128B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
BIS(2-ETHYLHEXYL)PHTHALATE		9400 E	10000 E	62000 E			
DI-N-BUTYLPHTHALATE		29 J	360 U	360 U			
DI-N-OCTYLPHTHALATE		34 J	22 J	43 J			
DIETHYLPHTHALATE		28 J	27 J	24 J			
2-METHYLNAPHTHALENE		370 U	10 J	360 U			
* DIACETONE ALCOHOL (6.28)				1400 J			
* DIACETONE ALCOHOL (6.32)			20000 J				

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA E
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL032106B	LL032117B	LL032128B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
* DIACETONE ALCOHOL (6.39)		22000 J					
* PHTHALATE ESTER (32.57)			46 J				
* PHTHALATE ESTER (32.62)		74 J					
* PROBABLE HYDROCARBON (6.98)		210 J					
* PROBABLE HYDROCARBON (15.94)		180 J					
* PROBABLE HYDROCARBON (18.15)			210 J				
* PROBABLE HYDROCARBON (18.18)		190 J					
* PROBABLE HYDROCARBON (19.17)			580 J				
* PROBABLE HYDROCARBON (19.21)		500 J					
* PROBABLE HYDROCARBON (19.79)			490 J				
* PROBABLE HYDROCARBON (19.82)		340 J					
* PROBABLE HYDROCARBON (21.32)			300 J				
* PROBABLE HYDROCARBON (22.40)			360 J				
* PROBABLE HYDROCARBON (22.78)			520 J				
* PROBABLE HYDROCARBON (22.81)		280 J					
* PROBABLE HYDROCARBON (22.87)			1400 J				
* PROBABLE HYDROCARBON (22.90)		800 J					
* PROBABLE HYDROCARBON (23.25)			290 J				
* PROBABLE HYDROCARBON (24.29)			640 J				
* PROBABLE HYDROCARBON (24.33)		370 J					
* PROBABLE HYDROCARBON (32.22)			58 J				
* PROBABLE HYDROCARBON FR(22.00)		50000 J	50000 J	4700 J			
* PROBABLE HYDROCARBON FR(37.00)		120000 J	180000 J				
* PROBABLE HYDROCARBON FR(38.00)				14000 J			
* SULFUR (27.19)		180 J					
* UNKNOWN (5.48)			250 J				
* UNKNOWN (5.49)		240 J					
* UNKNOWN (5.54)		1200 J					
* UNKNOWN (5.59)			1500 J				
* UNKNOWN (6.62)			800 J				
* UNKNOWN (6.63)		670 J					
* UNKNOWN (8.13)			350 J				
* UNKNOWN (8.16)		250 J					
* UNKNOWN (8.99)			220 J				
* UNKNOWN (9.13)			390 J				
* UNKNOWN (9.16)		270 J					
* UNKNOWN (23.52)		260 J					
* UNKNOWN (25.89)		300 J					

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA E
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL032106A	LL032117A	LL032128A
	SDG NO:	O904	O904	G908
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE
ACETONE		180 B	340 BE	180 B
BENZENE		3 J	10	5 U
CARBON DISULFIDE		6 U	3 J	5 U
CHLOROFORM		3 J	8	5 U
METHYLENE CHLORIDE		59 B	200 B	19 B
TOLUENE		7	24	5 U
1,1,1-TRICHLOROETHANE		5 J	10	5 U
1,2-DICHLOROETHANE		5 J	9	4 J
2-BUTANONE		360 E	760 E	390 E
4-METHYL-2-PENTANONE		7 J	16	11 U
* ACETIC ACID, METHYL EST(9.69)		6 J	20 J	
* ETHYL ETHER(12.15)				8 J
* ETHYL ETHER(12.21)		8 J	9 J	
* FURAN, TETRAHYDRO-(11.21)			11 J	
* UNKNOWN(15.63)			2 J	
* UNKNOWN(15.73)				4 J
* UNKNOWN(17.93)				5 J
* UNKNOWN(19.62)			2 J	
* UNKNOWN(23.74)			5 J	
* UNKNOWN(9.65)				27 J
* 2-PENTANONE(16.29)			2 J	

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA E
MEDIUM: SURFACE WATER

OIL AND GREASE (UG/L)	SAMP NO:	LL032253F
	SDG NO:	LL025016G
	TYPE:	RINSATE
OIL AND GREASE		2000

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL032253E
	SDG NO:	D108
	TYPE:	RINSATE
BIS(2-ETHYLHEXYL)PHTHALATE		3 JB

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA E
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL032253E
	SDG NO:	D108
	TYPE:	RINSATE
DI-N-BUTYLPHTHALATE		1 J

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL032253A
	SDG NO:	0824
	TYPE:	RINSATE
ACETONE		11 B
CHLOROFORM		12
ETHYLBENZENE		1 J

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA 827
MEDIUM: SOIL

OIL AND GREASE (MG/KG)	SAMP NO:	LL032015C	LL032026C	LL032037C
	SDG NO:	LL032015C	LL032015C	LL032015C
	TYPE:	GRAB	GRAB	GRAB
OIL AND GREASE		700	700	300

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL032015B	LL032026B	LL032037B
	SDG NO:	LL001018	LL001018	LL001018
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		5800	4500	25000 E
DI-N-OCTYLPHTHALATE		11 J	17 J	10 J
DIETHYLPHTHALATE		440 U	420 U	21 J
PHENOL		440 U	420	410 U
* ARYL HYDROCARBON (8.20)		190 J		
* ARYL HYDROCARBON (8.21)			170 J	
* DIACETONE ALCOHOL (6.23)			19000 J	
* DIACETONE ALCOHOL (6.29)		21000 J		
* DIACETONE ALCOHOL (6.35)				29000 J
* POSSIBLE ALIPHATIC KETO (6.57)			400 J	640 J
* POSSIBLE ALIPHATIC KETO(6.58)		580 J		
* POSSIBLE AMIDE/AMINE (7.87)				190 J

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA 827
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL032015B	LL032026B	LL032037B
	SDG NO:	LL001018	LL001018	LL001018
	TYPE:	GRAB	GRAB	GRAB
* POSSIBLE AMIDE/AMINE (7.88)		160 J		
* PROBABLE ALIPHATIC HYDR (4.88)			170 J	670 J
* PROBABLE ALIPHATIC HYDR (6.72)				170 J
* PROBABLE ALIPHATIC HYDR (6.91)				250 J
* PROBABLE ALIPHATIC HYDR(4.89)		360 J		
* PROBABLE ALIPHATIC HYDR(6.92)		140 J		
* UNKNOWN (5.48)			1500 J	
* UNKNOWN (5.61)		1900 J		
* UNKNOWN (5.62)				2100 J
* UNKNOWN (7.03)				220 J
* UNKNOWN (7.04)		180 J		
* UNKNOWN (7.08)		110 J		
* UNKNOWN (8.91)		180 J		190 J
* UNKNOWN (8.96)		220 J		
* UNKNOWN (8.97)				290 J
* UNKNOWN (9.10)		310 J		
* UNKNOWN (36.92)			66 J	

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL032015A	LL032026A	LL032037A
	SDG NO:	0903	0903	0903
	TYPE:	GRAB	GRAB	GRAB
ACETONE		13 JB	9 JB	7 JB
METHYLENE CHLORIDE		7 JB	2 JB	7 B
* ACETIC ACID, METHYL EST(9.69)		4 J	3 J	2 J
* UNKNOWN(11.2)				3 J

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA 827
MEDIUM: SEDIMENT

OIL AND GREASE (MG/KG)	SAMP NO:	LL032139C	LL032140C	LL032151C
	SDG NO:	LL032139C	LL032139C	LL032139C
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE
OIL AND GREASE		1500	2500	1400

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA 827
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL032139B	LL032140B	LL032151B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
BIS(2-ETHYLHEXYL)PHTHALATE		87000 E	76000 E	78000 E			
DI-N-OCTYLPHTHALATE		68 J	33 J	27 J			
DIETHYLPHTHALATE		35 J	29 J	350 U			
PHENOL		2000	350 U	350 U			
* DIMETHYL SULFOXIDE (5.95)			7800 J				
* DIMETHYL SULFOXIDE (6.15)				14000 J			
* DIMETHYLSULFOXIDE (6.00)		5400 J					
* DIOCTYL ADIPATE (31.19)				13 J			
* PHTHALATE ESTER (28.09)			19 J	9 J			
* PHTHALATE ESTER (32.24)				53 J			
* PHTHALATE ESTER (32.26)			22 J				
* PHTHALATE ESTER (32.27)		34 J					
* PHTHALATE ESTER (32.40)				10 J			
* PROBABLE HYDROCARBON (28.16)				21 J			
* PROBABLE HYDROCARBON (28.19)		10 J					
* PROBABLE HYDROCARBON FR(38.00)		65000 J		40000 J			
* SULFONYLBISMETHANE (8.67)				1600 J			
* SULFONYLBISMETHANE (9.03)			1700 J				
* SULFONYLBISMETHANE (9.12)		400 J					
* UNKNOWN (5.43)				470 J			
* UNKNOWN (35.64)			19 J				
* UNKNOWN (36.48)			35 J				
* UNKNOWN (39.46)			18 J				
* UNKNOWN (39.83)			22 J				
* UNKNOWN (43.22)			19 J				
* UNKNOWN (44.06)			35 J				
* UNKNOWN (47.02)			18 J				
* UNKNOWN (47.39)			22 J				

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL032139A	LL032140A	LL032151A			
	SDG NO:	G908	G908	G904			
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE			
ACETONE		91 B	210 B	180 B			
BENZENE		16	7	7			
CHLOROFORM		5 U	5 U	5 J			
METHYLENE CHLORIDE		17 B	34 B	85 B			
TOLUENE		19	5 U	11			
1,1,1-TRICHLOROETHANE		8	13	9			
2-BUTANONE		11 U	82	11 U			
* ACETIC ACID, METHYL EST(9.65)		51 J	100 J				

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 032
LOCATION: DRUM RACK SUMP AREA 827
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL032139A	LL032140A	LL032151A
	SDG NO:	G908	G908	G904
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE
* ACETIC ACID,METHYL ESTE(9.46)				87 J
* BUTANOIC ACID, METHYL E(19.38)				17 J
* BUTANOL(15.51)				59 J
* ETHYL ETHER(12.11)			6 J	
* METHANE, TRICHLOROFLUOR(8.9)				13 J
* UNKNOWN(15.69)			58 J	
* UNKNOWN(15.7)		20 J		
* UNKNOWN(19.6)			22 J	
* UNKNOWN(19.61)		5 J		
* UNKNOWN(23.66)			4 J	
* UNKNOWN(24.79)				22 J
* UNKNOWN(25.17)		6 J		

S&A REQUEST: 033
LOCATION: DRAINS DOWNGRADIENT FROM BUILDING 805
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL033016C	LL033027C	LL033038C
	SDG NO:	LL003010C	LL003010C	LL003010C
	TYPE:	GRAB	GRAB	GRAB
ALUMINUM		12400 *E	10700 *E	13600 *E
ANTIMONY		4.4 UN	32 N	6.1 BN
BARIUM		206 *	211 *	204 *
BERYLLIUM		0.51 B	0.48 B	0.51 B
CADMIUM		16	18	28
CALCIUM		32200 *E	31200 *E	29800 *E
CHROMIUM		44 *	46 *	45 *
COBALT		11	12	11
COPPER		1410 N*E	1090 N*E	651 N*E
IRON		25200 *	28100 *	28000 *
LEAD		365	870	403
MAGNESIUM		5560 *	5510 *	6170 *
MANGANESE		552 *E	703 *E	564 *E
NICKEL		26 *	26 *	25 *
POTASSIUM		2200	1900	2300
SILVER		8.9	60	9.3
SODIUM		639 B	619 B	666 B

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 033
LOCATION: DRAINS DOWNGRADIENT FROM BUILDING 805
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL033016C	LL033027C	LL033038C			
	SDG NO:	LL003010C	LL003010C	LL003010C			
	TYPE:	GRAB	GRAB	GRAB			
VANADIUM		33 *	32 *	35 *			
ZINC		1060 N*	974 N*	908 N*			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL033016B	LL033027B	LL033038B			
	SDG NO:	LL122087	LL121987	LL121987			
	TYPE:	GRAB	GRAB	GRAB			
ACENAPHTHENE		340 U	85 J	76 J			
ANTHRACENE		340 U	110 J	81 J			
BENZO(A)ANTHRACENE		120 J	190 J	160 J			
BIS(2-ETHYLHEXYL)PHTHALATE		970	1200	1100			
BUTYLBENZYLPHTHALATE		340 U	49 J	52 J			
CHRYSENE		150 J	240 J	230 J			
DI-N-BUTYLPHTHALATE		340 U	83 J	79 J			
DIBENZOFURAN		340 U	340 U	35 J			
FLUORANTHENE		310 J	520	510			
FLUORENE		340 U	59 J	59 J			
PHENANTHRENE		300 J	600	520			
PYRENE		310 J	540	470			
* UNKNOWN (6.20)		150 J	260 J				
* UNKNOWN (7.50)		200 J					
* UNKNOWN (11.10)			180 J				
* UNKNOWN (23.00)		200 J					
* UNKNOWN (23.30)			280 J				
* UNKNOWN (23.40)		150 J	280 J	290 J			
* UNKNOWN (23.50)				140 J			
* UNKNOWN (24.00)				250 J			
* UNKNOWN (24.20)			2900 J				
* UNKNOWN (25.00)			380 J				
* UNKNOWN (25.30)		330 J	270 J	160 J			
* UNKNOWN (26.40)			440 J				
* UNKNOWN (27.00)				480 J			
* UNKNOWN (27.30)			710 J				
* UNKNOWN (29.00)				470 J			
* UNKNOWN (30.20)			770 J				
* UNKNOWN (30.40)		630 J		560 J			
* UNKNOWN (32.00)		650 J					

TABLE L4.3.6 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 6 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 033
LOCATION: DRAINS DOWNGRADIENT FROM BUILDING 805
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL033016A	LL033027A	LL033038A			
	SDG NO:	0813	0813	0813			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		58 B	62 B	96 B			
BENZENE		1 J	4 J	3 J			
CHLOROFORM		7	2 J	5 U			
METHYLENE CHLORIDE		11	45	26			
TOLUENE		5 JB	9 B	6 B			
1,1,1-TRICHLOROETHANE		3 J	3 J	3 J			
2-BUTANONE		10 U	10 U	51			
4-METHYL-2-PENTANONE		4 J	10 U	8 J			
* METHANE, TRICHLOROFLUOR(9.17)		7 J	16 J	13 J			
* UNKNOWN(9.65)		7 J	6 J	7 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL033016D	LL033027D	LL033038D			
	SDG NO:	LLL7221	LLL7221	LLL7221			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		400	380	350			
G-ALPH		6800	10000	2300			
GROSS-BETA		21000	18000	32000			
K-40		8900	8800	9200			

4.12 LLNL Environmental Problem 7: Burn Pits

Request Number: 34.

Requester: J. Werner.

Finding and Basis: The high explosive (HE) burn pits at Site 300 are potential sources of continued or future groundwater contamination. HE is placed in pit 1 at least weekly (pits 3 and 4 were used in the past) and burned every 6 months when enough waste has accumulated in the cage. The "iron horse" near the entrance to the burn pit may also cause soil and groundwater contamination.

4.12.1 Sampling and Analysis Objectives

Statement: Soil samples were to be examined to determine if the contaminants listed in Sect. 4.12.2.2 are present in the soil in the HE burn pits above normal levels for the area.

Supporting Information: Waste HE or HE-contaminated waste is burned in cages placed in pits or in a device called an "iron horse." Clarifier bags from the HE process areas are burned in the iron horse, which is similar to an elevated and elongated cement mixer. No provisions existed around the iron horse for rain or runoff protection; therefore, residual HE may have been rained on, creating contaminated leachate. Waste HE and rubble contaminated with HE is burned in cages in one of three pits. Each pit is about 20 ft deep, 25 ft long, and 15 ft wide. When enough HE has accumulated for a burn, the pile is ignited. Pit 1 was the most active at the time of the Survey, although all pits have been used. Pit 2 also received trichloroethylene (TCE) and PCB-contaminated wastes. Rainfall during the accumulation period may have caused leachate to form.

4.12.2 Sampling and Analytical Design

4.12.2.1 Sampling Design

Request 34: Burn Pits (Fig. L4.7). Twelve grab soil samples (Sampling Method: Reference E5.1 and E5.2.3) were to be collected from selected areas in pits 1, 2, and 3 and from the device called the "iron horse." Sampling was to be coordinated with B. Cummings. If possible, the Sampling Team was to wait for a pit to be empty so samples could be collected within the pit. If time did not allow for an empty pit, the Team could collect samples outside the pit. Because of the various types of explosives placed in the pits, the pits were considered heterogeneous. The area of each pit and of the iron horse was less than 100 m^2. Each of these areas was to be divided into a 60-segment grid, and three segments from each area were to be selected for sampling. Grab samples were to be collected by hand auger at a depth of 0 to 3 ft.

The Sampling Team arrived at pit 1 at 1450 on 10AUG87. The day was clear, sunny, and hot with a temperature of 93°. QC rinsate LL034131 was taken at 1500 prior to collection of the first sample. Pit 1 had a cage in it that was about 70% full. Samples were collected at grid segments in front of the cage (grid 34), the right side of the cage (grid 41), and the left side of the cage (grid 16). The area was small and the decision was made to composite the samples (LL034017, LL034028, and LL034039). Samples were collected between 1515 and 1535.

Pit 2 was empty except for a deep layer of very fine dust/soil. Samples were collected in the back half of the pit where the cage normally was placed. Because of the small area, the decision was made to composite the samples (LL034040, LL034051, and LL034062). Samples were collected between 1550 and 1618.

Pit 3 contained a large metal plate with sides approximately 4 in. high. There was evidence of burning taking place on this pad (including some cans and metal). Samples were collected around the edges of the metal pad. Because of the small area, the decision was made to composite the samples (LL034073, LL034084, and LL034095). Samples were collected between 1624 and 1634.

The "iron horse" had evidence of ash along only the west side. Because of this, all three samples were collected on this side. The other three sides had hard, rocky soil. Samples were composited because of the small 2 ft x 6 ft area sampled (LL034108, LL034119, and LL034120). Samples were collected between 1642 and 1703.

4.12.2.2 Analytical Design

The parameters analyzed and/or measured were volatiles, semivolatiles, ICP-metals, total uranium, cyclonite (RDX), cyclotetramethylene tetranitramine (HMX), and 2,4,6-trinitrotoluene (TNT). No field measurements were required.

4.12.3 Field and Analytical Data

Field Data: *NA*

Field Data Evaluation: NA

Analytical Data:

Metals. *Analytical results for metals in soil are presented in Table L4.3.7. Nineteen metals were detected above the quantitation limits of the analytical procedure. One metal, antimony, was found slightly above the quantitation limit in one of the 12 samples, but was not found in any other sample. Copper ranged from 33 to 738 mg/kg, and sodium ranged from 1130 to 2260 mg/kg over all samples.*

High explosives. A total of 12 samples were collected from the burn pit site. The samples from burn pit sites 1, 2, and 3 consisted of three grab samples from each site. The samples from the "iron horse" site were three composited samples from the west side of the equipment because the other sides were rocky. The results are shown in Table L4.3.7.

The highest concentrations of HMX were found around the "iron horse" site with an average of 205 ug/g. Around pit 3, the concentration averaged 119 ug/g. The average in pits 1 and 2 were in the tens of ug/g. The RDX concentrations in pit 3 and the "iron horse" site averaged about 20 ug/g; in contrast, pits 1 and 2 contained less than 10 ug/g. TNT was found only in pit 3 and the "iron horse" site. Pit 3 had more TNT than the "iron horse" site (13 vs. 4 ug/g).

Volatile organics. Analytical results for volatiles are presented in Table L4.3.7. Small amounts of three volatiles were detected in two samples and four in the remaining sample from burn pit 1. Only methylene chloride was detected in all three samples from burn pit 1, but it was also detected in the blanks. For burn pit 2, the number of volatiles detected in the three samples ranged from 8 in one to 14 in another. Sample LL034040 had an acetone concentration of 230 ug/kg and a methylene chloride concentration of 320 ug/kg (both out of the calibration range of the instrument). That sample also had 68 ug of toluene per kilogram and 24 ug of benzene per kilogram, and was clearly the most contaminated sample of the three from burn pit 2. In the three samples from burn pit 3, there were 13 volatiles detected in two samples and nine in the other. The samples were roughly similar to each other with regard to volatiles. Each sample had, per kilogram, from 400 to 740 ug of acetone, 53 to 56 ug of benzene, and 180 to 220 ug of trichloroethene. Sample LL034084 had 220 ug of an unknown per kilogram of soil, and sample LL034095 had an estimated 860 ug of an unknown with essentially the same retention time, per kilogram of soil. In the soil from the west side of the "iron horse," there were 14 volatiles detected in two of the samples and only 6 in the other. Most volatiles

detected were present only in small amounts, including vinyl acetate in sample LL034108 and benzene at 5 and 7 ug/kg, respectively, in samples LL034119 and LL034108. Relatively large concentrations (1000 ug/kg) of two unknowns were also estimated in the two samples listed above, and a lesser amount of another unknown, with essentially the same retention time as the other two, was estimated in the remaining sample (LL034120).

Extractable organics. *Analytical results for semivolatile organic compounds are given in Table L4.3.7. The number of detectable compounds in the 12 samples in which target compounds or tentatively identified compounds were detected ranged from 5 (in four samples) to 24 (in two samples). In the three samples for burn pit 1, all semivolatile organic compounds detected were present in estimated concentrations of less than 1 mg/kg. In the samples from burn pit 2, bis(2-ethylhexyl)phthalate was measured at 9.5 mg/kg in one sample and detected in small quantities in the others. With the exception of the 9.5 mg/kg of bis(2-ethylhexyl)phthalate in sample LL034040, all compounds detected in these three samples had estimated concentrations of less than 0.5 mg/kg. For the three samples from burn pit 3, bis(2-ethylhexyl)phthalate was measured in concentrations from 4.8 to 7.2 mg/kg; bis(2-chloroisopropyl)ether was measured at 0.86 mg/kg in one sample and undetected in the others; and several other compounds were detected. One unknown had an estimated concentration of 5.6 mg/kg, but all of the other unknowns had estimated concentrations of less than 3 mg/kg, and most had estimated concentrations of less than 1 mg/kg. In the three samples from the "iron horse" burn pit, bis(2-ethylhexyl)phthalate was the only compound identified in more than one sample. Some unknowns were detected in more than one sample, and apparently one unknown had concentrations estimated at 5.4 and 7.7 mg/kg in two of the respective samples. Another unknown had an estimated concentration of 6 mg/kg in one sample. All other estimated concentrations of unknown compounds were less than 3 mg/kg, and the vast majority were less than 1 mg/kg.*

Radiochemistry. *The average total uranium activity was 460 pCi/kg.*

Analytical Data Evaluation:

Metals. Copper and sodium were detected at the concentrations identified above.

High explosives. The detection limit of RDX was 2 ug/g; two samples from pit 1 and one from pit 2 were at or below the limit. Because the upper limit of calibration was 30 ug/g, the values marked "E" are not expected to be as accurate as those within range. The three munitions were confirmed using the confirmatory cyano HPLC column. Spikes using samples containing a low amount of munitions also confirmed the identified compounds.

Volatile organics. Apparent benzene and toluene contamination was noted in the samples from burn pit 2. Benzene contamination was noted in the samples from burn pit 3. Contamination from eight "unknown" volatiles was detected in samples from burn pit 3 and contamination from six was detected at the "iron horse."

Extractable organics. Only bis(2-ethylhexyl)phthalate was identified unambiguously in concentrations as high as 9500 mg/kg.

Radiochemistry. Three soil samples from each of four burn pit areas were analyzed for gross alpha, gross beta, and uranium activities. Results are given in Table L4.3.7.

4.12.4 Limitations and Qualifications

Data Quality Level: The sampling plan and sampling are rated Quality Level I. The overall analytical rating is Quality Level II.

Field Data: This problem appears to be a straightforward investigation of

contaminants remaining in the burn pit, and the plan and sampling were limited by the small areas of each site.

Analytical Data: The identification and quantification of high explosives meet the major objective of this problem. The finding of volatile organics in the burn pit is unusual because the materials are burned and volatiles should have been vaporized. It is possible, however, that these organics flowed into the soil prior to burning and were not totally vaporized. Details on analytical data quality for specific parameters are given below.

Metals. The following QC data flags were assigned to the metals identified in this sample group: spike-antimony, barium, and copper; serial dilution-chromium, manganese, and vanadium; duplicate-cobalt, iron, and lead; spike and duplicate-zinc; spike, duplicate, and serial dilution-nickel. The overall sample quality for this request is Quality Level II. Overall sample quality for AA-metals is Quality Level I.

High explosives. High explosives data are rated Quality Level I. The CLP does not have a standard method for determination of munitions and munitions by-product in soils. The method used, which has been tested and evaluated rigorously, was that of the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL). Identity confirmation for the test compounds was made using cyano columns, and quantitations were performed using the method of external standards. Two native, low-contaminated samples were spiked with HMX, RDX, and TNT; recoveries were at least 80% for each analyte. Although no blanks were tested with these soil samples, previous blank samples show repeatedly that high explosives were not detected in blanks.

Volatile organics. Many volatiles were commonly present in blank samples. Many concentration values were estimated because the concentrations were below quantification limits, including the large concentrations of unknowns estimated from burn pit 3 and the "iron horse."

About 60% of the entries on the data quality summary sheets were Quality Level III, over half of which corresponded to compounds not clearly identified by mass spectrometry. Some of the Quality Level III data corresponded to concentrations below quantitation limits, and several measurements did not meet internal standards. Most of the remaining 40% of the data summarized were given as Quality Level II.

Extractable organics. Most of the concentrations given are estimated values, even for identifiable compounds. The data are Quality Level II, due mainly to tentative identification by mass spectrometry.

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.

Environmental Problem: LLNL 7
Request Number: LLNL 34

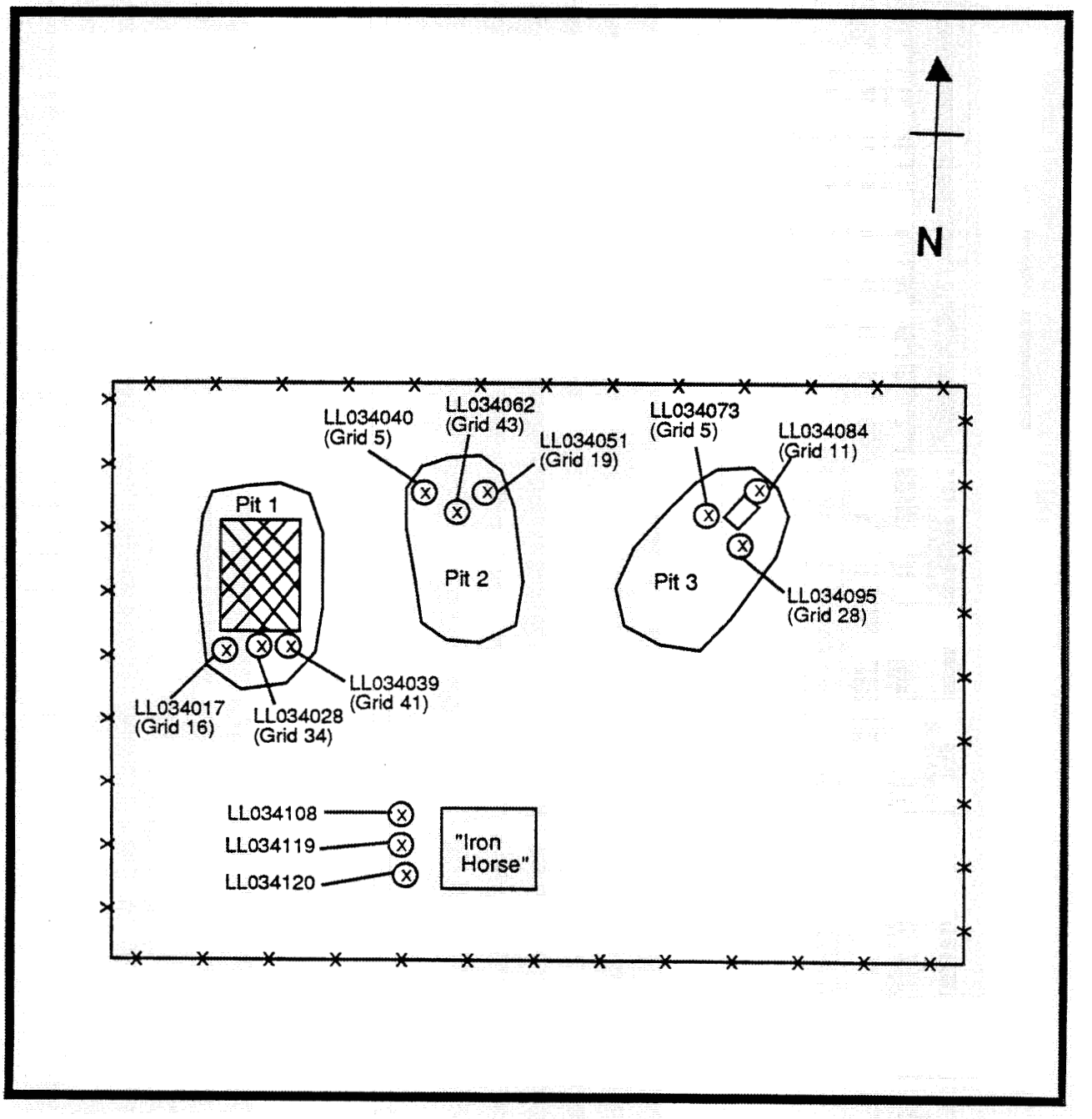

Figure L4.7. Burn Pits (LLNL Request 34)

TABLE L4.2.7 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 7

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	HE NUMB HITS	HE 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
LL034	BURN PIT	PITS	SOIL	12	12	GRAB	0	0	12	12	0	0	12	12	0	0	12	12	12	12	12	12
			MED TOTAL	12	12		0	0	12	12	0	0	12	12	0	0	12	12	12	12	12	12
LL034	BURN PIT	PITS	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	1	0	0	0	1	1	1	1	1
			MED TOTAL	1	1		0	0	1	1	0	0	0	1	0	0	0	1	1	1	1	1
			EP TOTAL	13	13		0	0	13	13	0	0	12	13	0	0	12	13	13	13	13	13

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TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT #1
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL034017D	LL034017E	LL034028D	LL034028E	LL034039D	LL034039E
	SDG NO:	LL028019C	LL031014D	LL028019C	LL031014D	LL028019C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		17300		22400		17400	
BARIUM		157 N		226 N		524 N	
BERYLLIUM			0.83 B		1.2		0.93
CADMIUM		2		3.2		2.2	
CALCIUM		10500		16000		9890	
CHROMIUM		20 E		29 E		34 E	
COBALT		12 *		22 *		9.5 *	
COPPER		355 N		738 N		64 N	
IRON		28900 *		36800 *		45900 *	
LEAD		31 *		39 *		167 *	
MAGNESIUM		8300		11000		8250	
MANGANESE		617 E		802 E		618 E	
NICKEL		26 N*E		46 N*E		41 N*E	
POTASSIUM		3200		4200		3300	
SILVER		3.1		4.5		3.2	
SODIUM		1340		2020		1130	
VANADIUM		65 E		72 E		64 E	
ZINC		1250 N*		313 N*		350 N*	

HIGH EXPLOSIVES (UG/G)	SAMP NO:	LL034017C	LL034028C	LL034039C
	SDG NO:	LL034017C	LL034017C	LL034017C
	TYPE:	GRAB	GRAB	GRAB
HMX		5.9	10	40
RDX		0.92 J	1.6 J	9

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL034017B	LL034028B	LL034039B
	SDG NO:	LL021188	LL021088	LL021088
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		120 J	95 J	130 J
BUTYLBENZYLPHTHALATE		62 J	340 U	360 U
DI-N-BUTYLPHTHALATE		430 U	50 J	360 U
* UNKNOWN (7.00)		820 J		720 J
* UNKNOWN (7.20)				390 J
* UNKNOWN (20.40)		350 J	260 J	170 J
* UNKNOWN (23.10)		270 J	540 J	390 J
* UNKNOWN (24.00)				190 J
* UNKNOWN (24.10)		230 J	190 J	
* UNKNOWN (25.50)				250 J

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT #1
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL034017B	LL034028B	LL034039B			
	SDG NO:	LL021188	LL021088	LL021088			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN (28.00)				430 J			
* UNKNOWN (28.10)		330 J					
* UNKNOWN (31.10)		890 J		340 J			

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL034017A	LL034028A	LL034039A			
	SDG NO:	G904	G904	G904			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		70 B	10 U	82 B			
BENZENE		6 U	4 J	5 U			
METHYLENE CHLORIDE		33 B	50 B	8 B			
TOLUENE		17	9	5 U			
1,1,1-TRICHLOROETHANE		6 U	5 J	5 U			
* ETHYL ETHER(11.92)				34 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL034017F	LL034028F	LL034039F			
	SDG NO:	LLL7295	LLL7295	LLL7295			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		19	38	57			
G-ALPH		5400	6500	15000			
GROSS-BETA		17000	23000	20000			
K-40		12000	11000	11000			
U-234		400	640	410			
U-235		53	290	100			
U-238		580	770	890			

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT #2
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL034040D	LL034040E	LL034051D	LL034051E	LL034062D	LL034062E
	SDG NO:	LL028019C	LL031014D	LL028019C	LL031014D	LL028019C	LL031014D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		20000		21400		22700	
BARIUM		120 N		132 N		132 N	
BERYLLIUM			0.75 B		0.92		0.84 B
CADMIUM		1.1		1.3		1.3	
CALCIUM		11800		10400		10200	
CHROMIUM		19 E		21 E		23 E	
COBALT		9.3 *		10 *		12 *	
COPPER		33 N		70 N		43 N	
IRON		26100 *		27700 *		28900 *	
LEAD		13 B*		12 B*		14 B*	
MAGNESIUM		10900		10500		10800	
MANGANESE		446 E		336 E		448 E	
NICKEL		18 N*E		20 N*E		20 N*E	
POTASSIUM		2900		3200		3500	
SILVER		2.2		2.2		2	
SODIUM		2110		2210		2260	
VANADIUM		85 E		88 E		89 E	
ZINC		95 N*		96 N*		102 N*	

HIGH EXPLOSIVES (UG/G)	SAMP NO:	LL034040C	LL034051C	LL034062C
	SDG NO:	LL034017C	LL034017C	LL034017C
	TYPE:	GRAB	GRAB	GRAB
HMX		11	9.1	13
RDX		2 J	2.3	2

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL034040B	LL034051B	LL034062B
	SDG NO:	LL020988	LL021088	LL020988
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		9500	120 J	39 J
* UNKNOWN (6.60)				260 J
* UNKNOWN (7.00)		190 J		
* UNKNOWN (9.20)				250 J
* UNKNOWN (18.00)		410 J	190 J	
* UNKNOWN (20.40)		290 J	210 J	190 J
* UNKNOWN (23.10)			280 J	160 J
* UNKNOWN (24.10)		81 J	220 J	

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT #2
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL034040A	LL034051A	LL034062A			
	SDG NO:	G904	G908	G908			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		230 BE	150 B	140 B			
BENZENE		24	5 U	4 J			
CHLOROFORM		20	5 U	5 U			
METHYLENE CHLORIDE		320 BE	51 B	43 B			
TOLUENE		68	5 U	9			
1,1,1-TRICHLOROETHANE		31	8	8			
* ETHYL ETHER(11.89)		8 J					
* ETHYL ETHER(12.11)			8 J				
* ETHYL ETHER(12.15)				10 J			
* HEPTANE(22.71)		11 J					
* UNKNOWN(10.93)		7 J					
* UNKNOWN(14.91)		120 J					
* UNKNOWN(15.03)			75 J				
* UNKNOWN(15.07)				19 J			
* UNKNOWN(15.72)			6 J				
* UNKNOWN(19.32)		5 J					
* UNKNOWN(21.2)		6 J					
* UNKNOWN(22.97)			4 J	4 J			
* UNKNOWN(23.34)		4 J					
* UNKNOWN(9.49)		18 J					
* UNKNOWN(9.65)			15 J				
* UNKNOWN(9.68)				13 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL034040F	LL034051F	LL034062F			
	SDG NO:	LLL7295	LLL7295	LLL7295			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		59	30	20			
G-ALPH		1900	13000	7600			
GROSS-BETA		35000	20000	25000			
K-40		10000	11000	12000			
U-234		420	320	340			
U-235		57	19	46			
U-238		510	430	490			

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT #3
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL034073D	LL034073E	LL034084D	LL034084E	LL034095D	LL034095E
	SDG NO:	LL028019C	SN010010D	LL028019C	SN010010D	LL028019C	SN010010D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		26400		25900		25000	
ANTIMONY		11 N		7 UN		7 UN	
BARIUM		1190 N		775 N		676 N	
BERYLLIUM			0.88 B		0.98 B		0.98 B
CADMIUM		2		1.5		2.4	
CALCIUM		16400		15300		16000	
CHROMIUM		24 E		24 E		25 E	
COBALT		14 *		14 *		12 *	
COPPER		613 N		224 N		374 N	
IRON		28200 *		31100 *		28100 *	
LEAD		39 *		63 *		54 *	
MAGNESIUM		11500		11400		11200	
MANGANESE		543 E		608 E		604 E	
NICKEL		33 N*E		36 N*E		25 N*E	
POTASSIUM		4100		4300		4200	
SILVER		3		2.5		2.5	
SODIUM		2190		2060		1990	
VANADIUM		86 E		86 E		85 E	
ZINC		262 N*		158 N*		226 N*	

HIGH EXPLOSIVES (UG/G)	SAMP NO:	LL034073C	LL034084C	LL034095C
	SDG NO:	LL034017C	LL034017C	LL034017C
	TYPE:	GRAB	GRAB	GRAB
HMX		143 E	99 E	115 E
RDX		17	30	17
TNT		11	16	13
2,4-DNT		0.31 J	1 U	0.24 J

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL034073B	LL034084B	LL034095B
	SDG NO:	LL021088	LL021088	LL021188
	TYPE:	GRAB	GRAB	GRAB
BENZOIC ACID		1800 U	1800 U	99 J
BIS(2-CHLOROISOPROPYL)ETHER		360 U	860	360 U
BIS(2-ETHYLHEXYL)PHTHALATE		7200	5700	4800
DI-N-BUTYLPHTHALATE		50 J	110 J	91 J
DIETHYLPHTHALATE		40 J	350 U	360 U
HEXACHLOROBENZENE		200 J	400	300 J
PHENOL		480	350 U	110 J

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT #3
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL034073B	LL034084B	LL034095B			
	SDG NO:	LL021088	LL021088	LL021188			
	TYPE:	GRAB	GRAB	GRAB			
2,4-DINITROTOLUENE		110 J	180 J	160 J			
* UNKNOWN (7.30)			5600 J				
* UNKNOWN (7.40)				1900 J			
* UNKNOWN (8.00)		240 J					
* UNKNOWN (8.10)			650 J	1100 J			
* UNKNOWN (8.30)			160 J				
* UNKNOWN (8.40)		300 J	830 J	310 J			
* UNKNOWN (9.20)			580 J				
* UNKNOWN (11.10)		1200 J	2100 J	2700 J			
* UNKNOWN (12.00)				150 J			
* UNKNOWN (13.10)			130 J				
* UNKNOWN (13.30)			200 J	190 J			
* UNKNOWN (13.40)			150 J	150 J			
* UNKNOWN (14.40)		1100 J	1500 J	2400 J			
* UNKNOWN (15.40)				160 J			
* UNKNOWN (15.50)			160 J				
* UNKNOWN (17.00)		410 J	230 J	220 J			
* UNKNOWN (17.10)		370 J	400 J	320 J			
* UNKNOWN (18.10)		2500 J	2500 J	2500 J			
* UNKNOWN (21.10)		390 J	430 J	460 J			
* UNKNOWN (23.10)				68 J			
* UNKNOWN (24.00)			38 J				
* UNKNOWN (24.10)				36 J			
* UNKNOWN (25.50)			56 J				
* UNKNOWN (26.00)				40 J			
* UNKNOWN (28.10)			320 J	240 J			
* UNKNOWN (31.20)				240 J			

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL034073A	LL034084A	LL034095A			
	SDG NO:	G908	G908	G908			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		740 BE	480 BE	400 BE			
BENZENE		53	54	56			
CHLOROBENZENE		5 U	17	52			
METHYLENE CHLORIDE		10 B	43 B	38 B			
TOLUENE		30	35	58			
TRICHLOROETHENE		210 E	220 E	180			
1,1,1-TRICHLOROETHANE		5 U	5 J	5 J			
4-METHYL-2-PENTANONE		11 U	18	11 U			
* ACETIC ACID, METHYL EST(9.65)			2 J	2 J			

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT #3
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL034073A	LL034084A	LL034095A			
	SDG NO:	G908	G908	G908			
	TYPE:	GRAB	GRAB	GRAB			
* ACETIC ACID, METHYL EST(9.68)		1 J					
* UNKNOWN(12.08)			53 J				
* UNKNOWN(12.11)		54 J		54 J			
* UNKNOWN(19.08)		54 J	53 J	54 J			
* UNKNOWN(23.73)			6 J	12 J			
* UNKNOWN(3.18)				2 J			
* UNKNOWN(40.62)			220 J				
* UNKNOWN(40.63)				860 J			
* UNKNOWN(40.67)		91 J					

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL034073F	LL034084F	LL034095F			
	SDG NO:	LLL7295	LLL7295	LLL7295			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		32	22	23			
EU-155		59	59	59			
G-ALPH		11000	11000	12000			
GROSS-BETA		22000	20000	19000			
K-40		11000	12000	13000			
U-234		340	340	390			
U-235		25	35	130			
U-238		530	490	520			

S&A REQUEST: 034
LOCATION: BURN PIT IRON HORSE
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL034108D	LL034108E	LL034119D	LL034119E	LL034120D	LL034120E
	SDG NO:	LL028019C	SN010010D	LL028019C	SN010010D	LL028019C	SN010010D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		20100		17200		16700	
BARIUM		478 N		445 N		382 N	
BERYLLIUM			1.1		0.79 B		2
CADMIUM		1.9		2.8		1.7	
CALCIUM		12200		11400		10700	
CHROMIUM		31 E		36 E		34 E	

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT IRON HORSE
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL034108D	LL034108E	LL034119D	LL034119E	LL034120D	LL034120E
	SDG NO:	LL028019C	SN010010D	LL028019C	SN010010D	LL028019C	SN010010D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
COBALT		12 *		11 *		11 *	
COPPER		256 N		191 N		57 N	
IRON		37500 *		60900 *		35700 *	
LEAD		36 *		28 *		37 *	
MAGNESIUM		9950		8190		8260	
MANGANESE		671 E		726 E		1100 E	
NICKEL		38 N*E		45 N*E		40 N*E	
POTASSIUM		3600		3100		3200	
SILVER		3.3		3.3		3.1	
SODIUM		1420		1250		1130	
VANADIUM		76 E		65 E		66 E	
ZINC		253 N*		273 N*		292 N*	

HIGH EXPLOSIVES (UG/G)	SAMP NO:	LL034108C	LL034119C	LL034120C			
	SDG NO:	LL034017C	LL034017C	LL034017C			
	TYPE:	GRAB	GRAB	GRAB			
HMX		226 E	229 E	161 E			
RDX		15	24	21			
TNT		8.1	3.1	1.4			
2,4-DNT		0.2 J	1 U	1 U			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL034108B	LL034119B	LL034120B			
	SDG NO:	LL021188	LL021088	LL021088			
	TYPE:	GRAB	GRAB	GRAB			
BIS(2-CHLOROISOPROPYL)ETHER		290 J	350 U	360 U			
BIS(2-ETHYLHEXYL)PHTHALATE		120 J	150 J	56 J			
BUTYLBENZYLPHTHALATE		360 U	350 U	61 J			
DI-N-BUTYLPHTHALATE		46 J	350 U	360 U			
HEXACHLOROBENZENE		140 J	350 U	360 U			
PHENOL		66 J	350 U	360 U			
2,4-DINITROTOLUENE		61 J	350 U	360 U			
* UNKNOWN (6.50)			440 J	210 J			
* UNKNOWN (7.00)			7700 J	5400 J			
* UNKNOWN (7.20)		6000 J	180 J				
* UNKNOWN (7.50)				160 J			
* UNKNOWN (8.00)		320 J					
* UNKNOWN (8.40)		310 J					
* UNKNOWN (11.10)		1100 J	460 J				

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT IRON HORSE
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL034108B	LL034119B	LL034120B			
	SDG NO:	LL021188	LL021088	LL021088			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN (14.40)		900 J	580 J				
* UNKNOWN (17.00)		170 J					
* UNKNOWN (17.10)		220 J					
* UNKNOWN (18.00)			240 J	440 J			
* UNKNOWN (18.10)		2600 J					
* UNKNOWN (19.10)		150 J					
* UNKNOWN (20.40)			350 J	230 J			
* UNKNOWN (21.10)		190 J					
* UNKNOWN (23.10)		490 J	560 J	200 J			
* UNKNOWN (23.20)			290 J	930 J			
* UNKNOWN (24.10)		170 J					
* UNKNOWN (24.40)			320 J				
* UNKNOWN (26.20)		200 J					
* UNKNOWN (27.30)		680 J		690 J			
* UNKNOWN (27.40)				840 J			
* UNKNOWN (28.10)				830 J			
* UNKNOWN (28.20)		590 J					
* UNKNOWN (28.40)				850 J			
* UNKNOWN (29.00)		510 J					
* UNKNOWN (30.50)				710 J			
* UNKNOWN (31.00)		460 J					
* UNKNOWN (31.10)				500 J			
* UNKNOWN (31.20)		580 J					
* UNKNOWN (34.20)				600 J			

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL034108A	LL034119A	LL034120A			
	SDG NO:	0909	0909	0909			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		120 B	150 B	72 B			
BENZENE		7	5	5 U			
CHLOROBENZENE		7	5 J	5 U			
METHYLENE CHLORIDE		16	29	4 J			
TOLUENE		10	9	5 J			
TRICHLOROETHENE		25	10	5 U			
VINYL ACETATE		4 J	11 U	11 U			
1,1,1-TRICHLOROETHANE		2 J	4 J	5 U			
2-BUTANONE		11 U	35	11 U			
4-METHYL-2-PENTANONE		7 J	11 U	11 U			
* ACETIC ACID, METHYL EST(9.7)		6 J	8 J	13 J			
* DIISOPROPYL ETHER(19.12)		22 J	14 J				

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT IRON HORSE
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL034108A	LL034119A	LL034120A
	SDG NO:	0909	0909	0909
	TYPE:	GRAB	GRAB	GRAB
* ETHYL ETHER(12.22)		54 J	53 J	58 J
* UNKNOWN(21.47)			5 J	
* UNKNOWN(23.68)			8 J	
* UNKNOWN(23.72)		9 J		
* UNKNOWN(40.68)			1000 J	
* UNKNOWN(40.74)		1000 J		
* UNKNOWN(40.75)				170 J

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL034108F	LL034119F	LL034120F
	SDG NO:	LLL7295	LLL7295	LLL7295
	TYPE:	GRAB	GRAB	GRAB
CS-137		78	43	65
G-ALPH		3000	5400	9700
GROSS-BETA		27000	24000	22000
K-40		10000	11000	12000
U-234		380	490	450
U-235		78	120	104
U-238		860	680	790

S&A REQUEST: 034
LOCATION: BURN PIT IRON HORSE
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL034131G
	SDG NO:	LL012066B
	TYPE:	RINSATE
BARIUM		3.5 B
IRON		136
MAGNESIUM		11 B
POTASSIUM		160 B
ZINC		9.8 B

TABLE L4.3.7 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 7 DRAFT DO NOT CITE
BURN PIT

S&A REQUEST: 034
LOCATION: BURN PIT IRON HORSE
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO: LL034131A SDG NO: 0825 TYPE: RINSATE
ACETONE	13 B
CHLOROFORM	10
ETHYLBENZENE	1 JB
METHYLENE CHLORIDE	3 J
TOLUENE	2 JB

RADIOCHEMISTRY (PCI/L)	SAMP NO: LL034131I SDG NO: LLL7295 TYPE: RINSATE
G-ALPH	0
GROSS-BETA	40
U-234	0.46
U-235	2700
U-238	0.22

4.13 LLNL Environmental Problem 8: Diesel Tankers

Request Number: 35.
Requester: J. Werner.
Finding and Basis: Surplus diesel tankers (two near the GSA area of Site 300 and three tankers across from Building 811) may pose a fire and explosion threat and a potential soil and groundwater contamination threat. Site personnel assumed that the tankers were empty and that nothing had been dumped into them; however, no testing had occurred.

4.13.1 Sampling and Analysis Objectives

Statement: Surplus diesel tankers were to be inspected to determine if any oil was still left in them and, if so, to determine if PCBs and/or ICP-metals were present above method detection levels.

Supporting information: These tankers were originally parked, along with several other tankers, across from Building 811. Initially filled with diesel fuel oil for supplemental storage, these tankers had not been used for several years. No "gas free" certification was available, however, to indicate that they had been completely emptied. Personnel interviewed on-site by the Survey Team indicated that there were probably several inches of residual oil in each tanker that could not be readily pumped out. At the time of the survey, two tankers were observed near the GSA area. The tankers were parked in tall, dry grass that could present a fire hazard.

4.13.2 Sampling and Analytical Design

4.13.2.1 Sampling Design

Request 35: Diesel Tankers (Fig. L4.8). Six liquid samples were to be collected from two selected tankers, one at each location (Sampling Method: Reference

E4.3.2). The tanks at each site were assumed to be homogeneous because there was no information or evidence to indicate they were used for any other purpose. All tanks at each site were to be sampled. If any of the tanks were empty, the Sampling Team was to collect an additional sample from the other available tanks in that area in order to obtain three total samples from each area. At the GSA area where the Survey observed two tankers, the Sampling Team was to select one tank at random from which to collect an extra sample, giving a total of three samples from this area. Team members were to measure the depth of the liquid in each of the five tankers, using spark-free tools when opening the tankers. Samples were to be collected by opening the valve and collecting the contents of the tanker directly into sample containers.

The Sampling Team arrived at the Building 811 area at 1045 on 06AUG87. The weather was sunny and clear, and the temperature was 86°F. Three tankers were still in place across from Building 811. The first tanker (on the right, facing north) was empty except for a small pool approximately 1/2 in. wide. The middle tanker contained a pool of liquid approximately 1 ft wide with a light "oil" look similar to No. 2 diesel fuel. The third tanker was dry. Samples LL035018, LL035029, and LL035030 were collected from the middle tanker.

When the Sampling Team arrived at the GSA area at 1145 on 07AUG87, there was only one tanker, rather than the two tankers observed by the Survey team. The day was clear and sunny, and the temperature was 90°F. The contents of the tanker had the look of dark "oil." It was possible to collect samples from the top of the tanker with a dipper, so three samples (LL035041, LL035052, and LL035063) were collected by this method.

4.13.2.2 Analytical Design

The parameters analyzed were PCBs and ICP-metals. No field measurements were required.

4.13.3 Field and Analytical Data

Field Data: *NA*

Field Data Evaluation: NA

Analytical Data:

Metals. *Analytical results for metals in samples taken from the abandoned diesel tankers are presented in Table L4.3.8. Sixteen metals were detected above the quantitation limits of the analytical procedure. The following metals were detected near the quantitation limits of the ICP: aluminum, barium, copper, silver, and sodium. For samples taken from the three diesel tankers near GSA area of site 300, sodium and iron were at the highest concentrations, ranging from 50 to 161 mg/kg and 21 to 82 mg/kg, respectively. The remaining metals were one to five orders of magnitude lower in concentration. The following metals were above instrument detection limits but below the contract required quantitation limits (CRQL): arsenic, barium, calcium, magnesium, nickel, and potassium. Samples from the single diesel tanker across from Building 811 showed only two metals (silver and zinc) above the IDL or CRQL.*

Other extractables. *Due to the matrix of samples in Request 35, the standard CLP analytical procedure could not be used. Therefore, no PCBs data are available.*

Analytical Data Evaluation:

Metals. The sampled media are potential source terms, not environmental media.

4.13.4 Limitations and Qualifications

Data Quality Level: The sampling plan and sampling are rated Quality Level I. The analytical data are rated Quality Level III.

Field Data: The samples from the tankers at the 811 site contained very little residual oil. In describing the sampling, this data document states that two of the three tankers were empty, and three samples were taken from the middle tanker. Three more samples were collected from the tanker at Site 300.

Analytical Data: No PCBs could be analyzed due to matrix problems, and the ICP results were Quality Level II and III. Details on analytical data quality are given below.

Metals. The following QC data flag was assigned to the metals identified in this sample group: serial dilution-sodium. The overall sample quality for this request is Quality Level II.

Other extractables. Due to the matrix of samples in Request 35, the standard CLP analytical procedure could not be used. Therefore, no PCBs data are available.

Environmental Problem: LLNL 8
Request Number: LLNL 35

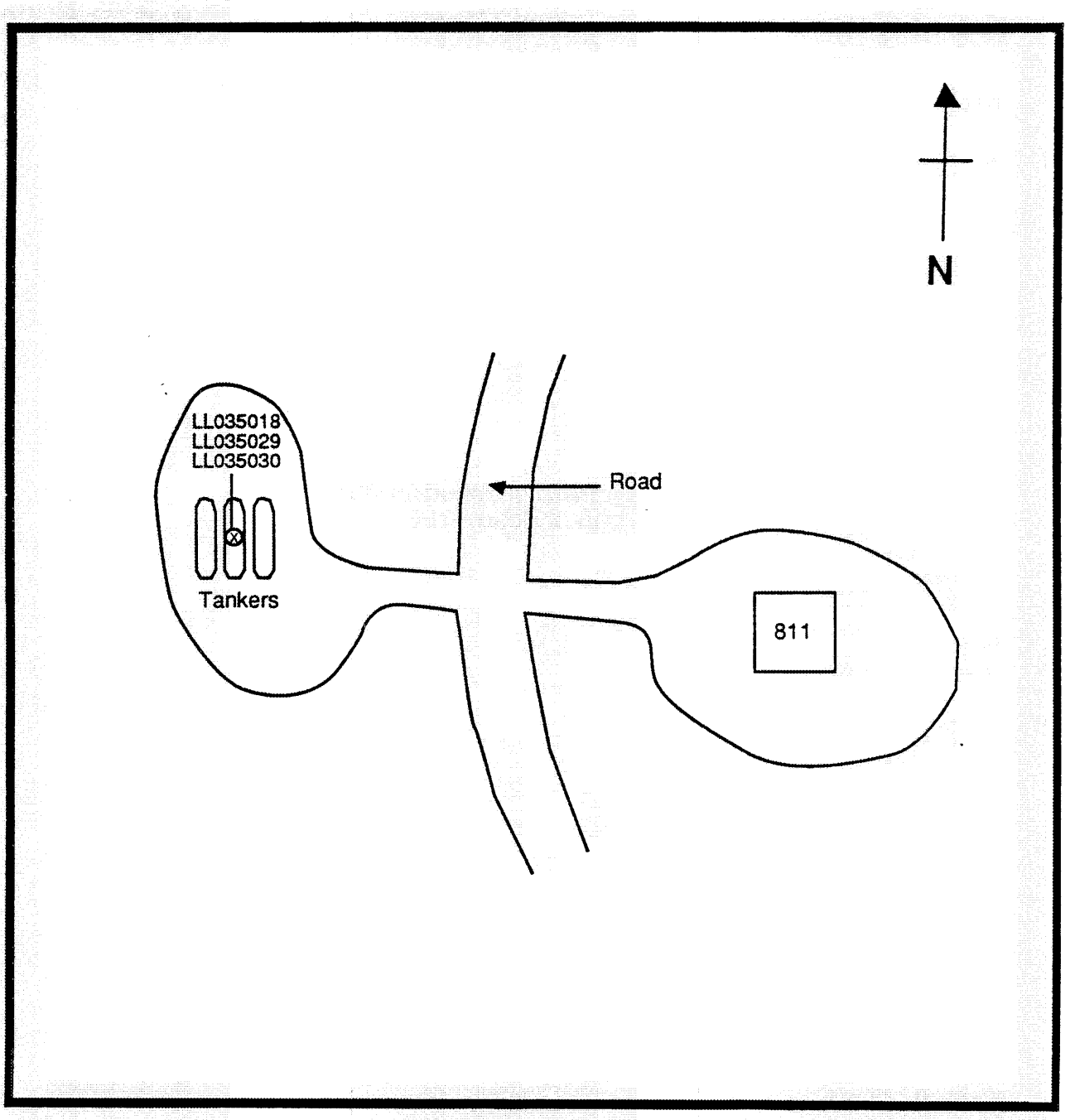

Figure L4.8a. Diesel Tankers Near Building 811 (LLNL Request 35)

Environmental Problem: LLNL 8
Request Number: LLNL 35

No map was provided for this part of Request 35.

Figure L4.8b. Diesel Tankers Near the GSA Area of Site 300 (LLNL Request 35)

TABLE L4.2.8 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 8

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	HE NUMB HITS	HE 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
LL035	DIESEL TANKR	TANKS	UNSEAL CO	6	6	S COM	0	0	6	6	0	0	0	0	0	6	0	0	0	0	0	0
		MED TOTAL		6	6		0	0	6	6	0	0	0	0	0	6	0	0	0	0	0	0
		EP TOTAL		6	6		0	0	6	6	0	0	0	0	0	6	0	0	0	0	0	0

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TABLE L4.3.8 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 8
DIESEL TANKERS

S&A REQUEST: 035
LOCATION: DIESEL TANKER ACROSS FROM BLDG 811
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL035018B	LL035029B	LL035030B
	SDG NO:	LL011010C	LL011010C	LL011010C
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE
BARIUM		0.011 U	0.027 B	0.012 B
COPPER		0.057 U	0.097 B	0.082 B
IRON		0.28 B	0.38 B	0.36 B
MAGNESIUM		0.17 B	0.2 B	0.32 B
POTASSIUM		0.86 B	0.87 B	0.86 B
SILVER		0.034 U	0.066	0.034 U
SODIUM		1.1 UE	1.8 BE	1.1 UE
ZINC		0.098 B	0.093 B	0.13

S&A REQUEST: 035
LOCATION: DIESEL TANKERS NEAR GSA AREA OF SITE 300
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL035041B	LL035052B	LL035063B
	SDG NO:	LL011010C	LL011010C	LL011010C
	TYPE:	S. COMPOSITE	S. COMPOSITE	S. COMPOSITE
ALUMINUM		0.34 U	0.87 B	1.4
ARSENIC		0.25 B	0.33 B	0.5 B
BARIUM		0.063 B	0.1 B	0.18 B
CADMIUM		0.044	0.092	0.15
CALCIUM		7 B	14 B	24 B
CHROMIUM		0.063	0.089	0.14
COPPER		0.27	0.46	0.68
IRON		21	42	82
LEAD		1.1 B	2	3.4
MAGNESIUM		1.4 B	2.9 B	4.7 B
MANGANESE		0.31	0.6	1
NICKEL		0.087 B	0.11 B	0.19 B
POTASSIUM		0.87 B	1.8 B	2 B
SILVER		0.083	0.087	0.034 U
SODIUM		50 E	96 E	161 E
ZINC		1.1	2.3	3.9

4.14 LLNL Environmental Problem 9: GSA Area Dry Wells

Request Number: 36.
Requester: J. Werner.
Finding and Basis: Seven former dry wells at various locations around the GSA area may be causing continued or future groundwater contamination because of potentially inadequate exhumation of the dry wells. The wells were exhumed in 1983, but no sampling and analysis was performed to establish the effectiveness of the cleanup.

4.14.1 Sampling and Analysis Objectives

Statement: Soil samples from seven former dry wells were to be examined to determine if the contaminants listed in Sect. 4.14.2.2 are present above normal levels for the soil of the area.

Supporting Information: Each well was exhumed to a different depth depending on its construction.

4.14.2 Sampling and Analytical Design

4.14.2.1 Sampling Design

Request 36: GSA Area Dry Wells (Fig. 4.36). Three grab soil samples (Sampling Method: Reference E5.2.1) were to be collected at a depth indicated by PID field screening to a maximum depth of 10 ft at each of the seven dry wells. The seven wells were identified as: 874N, 879E, 873E, 873S, 872S, 875S1, and 875S2. The dry wells were used for a variety of discharges until 1980. For this reason, and because of differing cleanup methods used, they were assumed to be heterogeneous. Each well was to be surveyed or marked by LLNL personnel. Each area was 3 x 5 m and was divided into a 60-segment grid; three segments were to be randomly selected for sampling.

After the Sampling Team arrived on the site, the sampling protocol was changed by Team Leader J. Murphy. The PID indicator readings were so low and the process originally called for was so time consuming, it was obvious that little information would be gained by using the original protocol. Therefore, to complete sampling of all the wells in a timely fashion, the protocol was changed to the following: Auger down to 3 ft, and take a core sample for PID screening. If the PID reading was equal to or less than 10 ppm benzene equivalent, auger down another 3 ft and repeat. Otherwise, core samples were to be taken for PID screening at 5-ft intervals. In locations where there were asphalt and gravel, the asphalt and gravel were cleared away by augering down to dirt before sampling began.

An attempt was made to sample dry well 879E (300 area) on 04AUG87. The wind was from the east with gusts to approximately 15 mph. Using a mobile drill rig and shelby tubes, cores were obtained at 1-ft intervals to a depth where the PID measurement peaked. Sample LL036064 (grid 38) was immediately placed in aluminum foil to prevent loss of volatiles, with a portion placed in a 1-L glass container. After a minimum of 15 min, the gas seal in the container was removed and an PID measurement made. The sample portions in the aluminum foil and container were saved until all samples had been processed similarly. The increment of maximum PID value was used to fill the samples for this request. The volatile and semivolatile samples were taken from the soil core in the sealed aluminum wrap; whereas, the metals, ICP, and radiochemistry samples were taken from the soil in the glass container. The calibration was checked between each sample. Sampling was stopped at 1808.

On 05AUG87, the Sampling Team returned to dry well 879E (300 area) at 0940. The sky was clear and the temperature was approximately 90°F. Drilling was begun for sample LL036042 at grid 9. There were two high PID readings for this sample, and both peaks were kept for samples. The reading at the 3-ft depth was 7.1 ppm. This sample was designated LL036235. Sample LL036042 was

collected at the 10-ft depth where the PID reading was 4.3 ppm. Samplers hit rock at approximately 13 ft and could not collect sample material at this depth. The shelby tube was destroyed in the process. Sampling was stopped at 1352.

On 06AUG87, the Sampling Team completed sampling of dry well 879E (300 area). They arrived at the site at 0800. The sky was clear and the temperature was approximately 90°F. Drilling was started at 0838, and hard rock was hit at 2 ft. The drill rig was moved 1 ft west of the original grid (grid 30). The Team decided to disregard the two PID readings at the original grid because exhaust fumes from the truck may have been present. The truck was moved away from the drill rig. New readings were taken to 9 ft. At this point, sampling continued under new instructions from Team Leader J. Murphy. At a depth of 13 ft, rock was encountered. The Team tried to auger through the rock, but it was impossible. No sample was taken at this depth, and the highest PID reading of the day (26.9 ppm) was used as the sample (LL036053).

Dry well 872S was sampled on 07AUG87. Team members arrived at Site 300 (GSA area) at 0759. The sky was clear and the temperature was approximately 70°F. QC rinsate LL036224 was collected on 07AUG87 at 0900, prior to collection of the first sample at dry well 872S. A radiation scan showed a reading of 20 cpm. The drill rig was moved to this location, and drilling was begun using the new protocol of the previous day. Sample LL036144 (grid 17) was obtained at 0900. The drill hit rock at the 4-ft depth, and the Team was unable to continue at this location. Sample LL036155 (grid 46) was collected between 1319 and 1425. Rock was again encountered, and sampling was stopped at 3 ft. Sample LL036133 (grid 7) was collected to a depth of 2 ft, from 1530 to 1700.

Dry well 873E was sampled on 10AUG87. Sampling Team members arrived at Site 300 (GSA area) at 0900. The sky was clear with mild wind, and the temperature was 75°F. A radiation scan showed a reading of 20 cpm. The drive tube was driven to 3 ft, where the PID reading was 24.4 ppm. Using the new sampling

protocol, the next core was at 5 ft. The remaining holes for this well were sampled at 5-ft intervals, depending on PID readings. Sample LL036075 (grid 4) was collected between 1030 and 1137. At sample LL036086 (grid 22), both PID readings were the same. The volatiles sample was taken from the first set, and then sets one and two were combined for the remainder of the samples. Sample LL036097 (grid 41) was collected between 1425 to 1600.

An attempt was made to sample dry well 873S on 11AUG87. The Sampling Team arrived at the site at approximately 0930. The Team could not sample in this area because of underground cables and pipes (per LLNL personnel). Samples LL036100, LL036111, and LL036122 were not collected.

An attempt was made to sample dry wells 875S1 and 875S2 at 1000 on 11AUG87. A bank at the site was too steep to accommodate the drill rig. Samples LL036166, LL036177, LL036188, LL036199, LL036202, and LL036213 were not collected.

Dry well 874N was sampled on 11AUG87. The sky was clear with a light breeze, and the temperature was 75°F. A radiation scan showed a reading of 20 cpm. Sample LL036020 (grid 47) was collected first, using the new sampling protocol. Rock was encountered at 7.4 ft and drilling was stopped at this location. Sample LL036031 (grid 57) was collected at 1325. Rock was encountered at 7.8 ft, and drilling was stopped. Sample LL036019 (grid 40) was collected at 1430. Rock was encountered at 8.29 ft and drilling was stopped at this point.

4.14.2.2 Analytical Design

The parameters analyzed were volatiles, semivolatiles, ICP-metals, AA-mercury, gross alpha, and gross beta. Field measurements for OVA were made in order to select sample depths.

4.14.3 Field and Analytical Data

Field Data: *Only two dry wells provided readings of over 10 ppm benzene equivalent of organic volatile activity. These occurred at wells 873E and 879E. The maximum readings at each of these sites were obtained from the layer nearest the surface.*

Field Data Evaluation: None

Analytical Data:

Metals. *Analytical results for metals in soil are presented in Table L4.3.9. Nineteen to 22 metals were detected above the quantitation limits of the analytical procedure at the four sites sampled.*

Well 872S. Of the 20 metals detected, antimony and cadmium were near the instrument detection limit. Mercury was present below the CRQL in two of three samples.

Well 873E. Twenty metals were detected, with antimony and cadmium near the instrument detection limit and mercury below the CRQL.

Well 874N. Nineteen metals were detected.

Well 879E. Twenty-two metals were detected.

Volatile organics. *Analytical results for volatiles are presented in Table L4.3.9. From two to five volatiles were detected in each of the 12 samples from the GSA area dry wells. Nine of the samples contained either three or four detectable volatiles. Acetone, ethylbenzene, methylene chloride, and toluene were detected in small amounts in samples from at least two of the dry wells. Acetone was also detected in the blanks, and toluene was often detected in the*

blanks. Concentration values of unknowns were estimated to be small in one sample from dry well 872S and one from dry well 874N.

Extractable organics. *Analytical results for semivolatile organic compounds are presented in Table L4.3.9. For the nine samples in which target compounds or tentatively identified compounds were detected, the number of detectable compounds in any particular sample ranged from 3 to 20. Bis(2-ethylhexyl)phthalate was the only compound identified in all three samples from dry well 872S. No compounds identified were present in measurable quantities, and estimated values of compounds either identified or detected were always below 1 mg/kg. Bis(2-ethylhexyl)phthalate was also the only compound identified in all three samples from dry well 873E. In two of these samples, the concentrations of that compound were 37 and 38 mg/kg, and in the other sample the concentration was about an order of magnitude less than that (0.39 mg/kg). In each of the three samples from dry well 873E, there was one unknown compound detected in estimated concentration of over 10 mg/kg. Otherwise, measured or estimated values of identified or detected compounds were always less than 1 mg/kg in the samples from dry well 873E. Diacetone alcohol was measured in concentrations of at least 20 mg/kg in all three samples from dry well 874N. Sample LL036019 had one tentatively identified compound in estimated concentration of 1.8 mg/kg and an unknown in estimated concentration of 4.8 mg/kg. Sample LL036020 had an unknown compound detected with an estimated concentration of 2.5 mg/kg. Other compounds in samples from dry well 874N had measured or estimated concentrations of less than 1 mg/kg.*

Radiochemistry. *Average gross alpha and gross beta activity for soil from dry wells 872S, 873S, 874N, and 879E ranges from 4966 to 9675 pCi/kg and from 20,666 to 29,000 pCi/kg, respectively.*

Analytical Data Evaluation:

Metals. Beryllium ranged from 0.84 to 1.5 mg/kg, and barium ranged from 95 to 401 mg/kg in some wells.

Volatile organics. The samples from these wells did not appear to be much different from the trip blanks with respect to volatiles.

Extractable organics. Bis(2-ethylhexyl)phthalate was present in concentrations of around 38 mg/kg in two samples from dry well 873E, and unknown compounds were detected in estimated concentrations of more than 10 mg/kg in all three samples (one such unknown in each sample) from that same dry well. Diacetone alcohol appeared in concentrations of 20 to 27 mg/kg in each of the three samples from dry well 874N. Other semivolatile organic compounds were measured or estimated in much smaller concentrations and seldom exceeded 1 mg/kg.

Radiochemistry. Soil samples (three each from four dry wells) were analyzed for gross alpha and gross beta activity. Results are given in Table L4.3.9.

4.14.4 Limitations and Qualifications

Data Quality Level: The sampling plan as modified is rated Quality Level I, and the sampling is rated Quality Level II. The overall analytical data rating is Quality Level II.

Field Data: The sampling was originally based on PID readings. Since the readings were so low in most cases, a modified PID and fixed depth approach was taken. Two sites were not sampled due to steepness of the sample site, which prohibited use of the drill rig.

Analytical Data: Although the volatile analyses could have resulted in low results due to excessive holding times, the ICP, AA, and the radiological data are Quality Levels I and II. Details on analytical data quality are given below.

Metals. Wells 872S, 873E, and 879E are in one sample group, and well 874N is in another sample group. The following QC data flags were assigned to the metals identified in the first sample group: duplicate--aluminum, barium, calcium, iron, magnesium, manganese, nickel, and zinc; spike and duplicate--chromium; spike--antimony and mercury; serial dilution--copper; spike and serial dilution--magnesium and manganese. Overall sample quality for this sample group is Quality Level I except for the following metals at Quality Level II: antimony, chromium, magnesium, manganese, and selenium.

The following QC data flags were assigned to the metals identified in the second sample group: serial dilution--chromium; duplicate--aluminum, calcium, iron, and manganese; spike and duplicate--nickel. Overall sample quality for this sample group is Quality Level I except for the following metals at Quality Level II: manganese, nickel, and selenium.

Overall sample quality for AA-metals in Quality Level I.

Volatile organics. Volatiles were detected in blank samples, and concentrations were too small to measure in many cases. Volatile samples are given Quality Level II.

Extractable organics. Concentrations for many compounds were estimated either because they were tentatively identified or unknown, or because concentrations

were small. Data are of Quality Level II, due mainly to tentative identification by mass spectrometry.

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.

Environmental Problem: LLNL 9
Request Number: LLNL 36

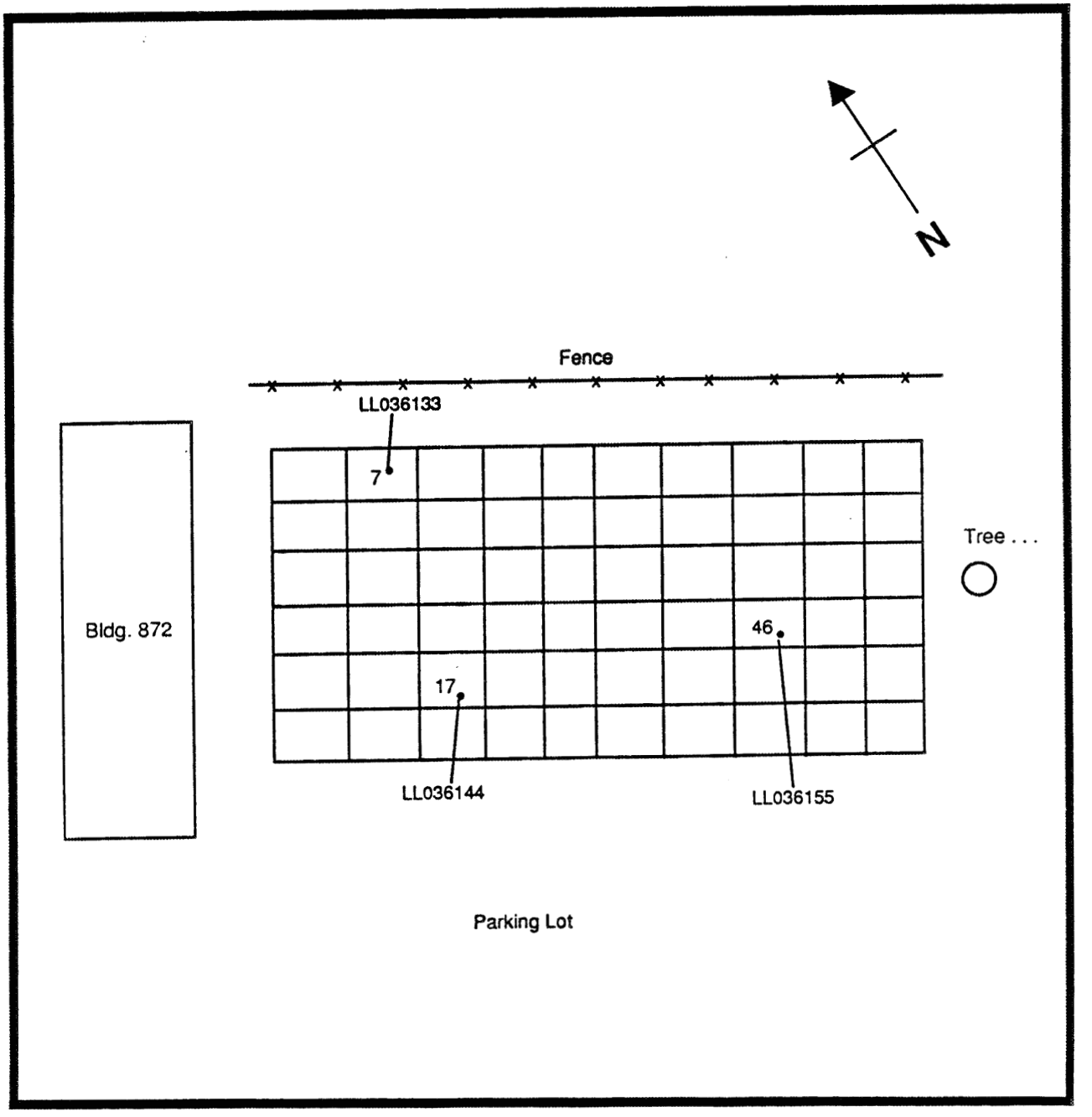

Figure L4.9a. GSA Area Dry Well 879E (LLNL Request 36)

Environmental Problem: LLNL 9
Request Number: LLNL 36

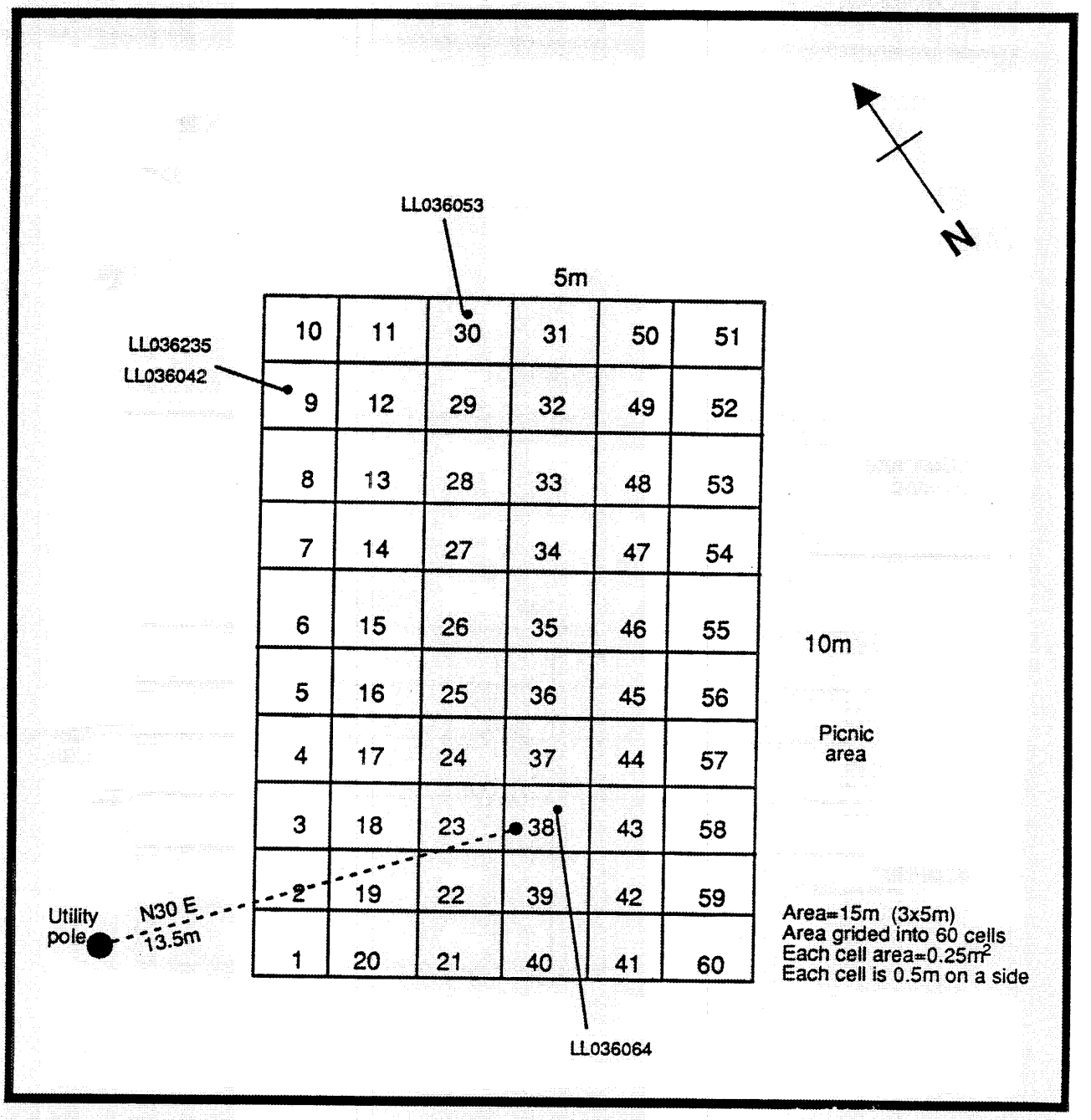

Figure L4.9b. GSA Area Dry Well 872S (LLNL Request 36)

Environmental Problem: LLNL 9
Request Number: LLNL 36

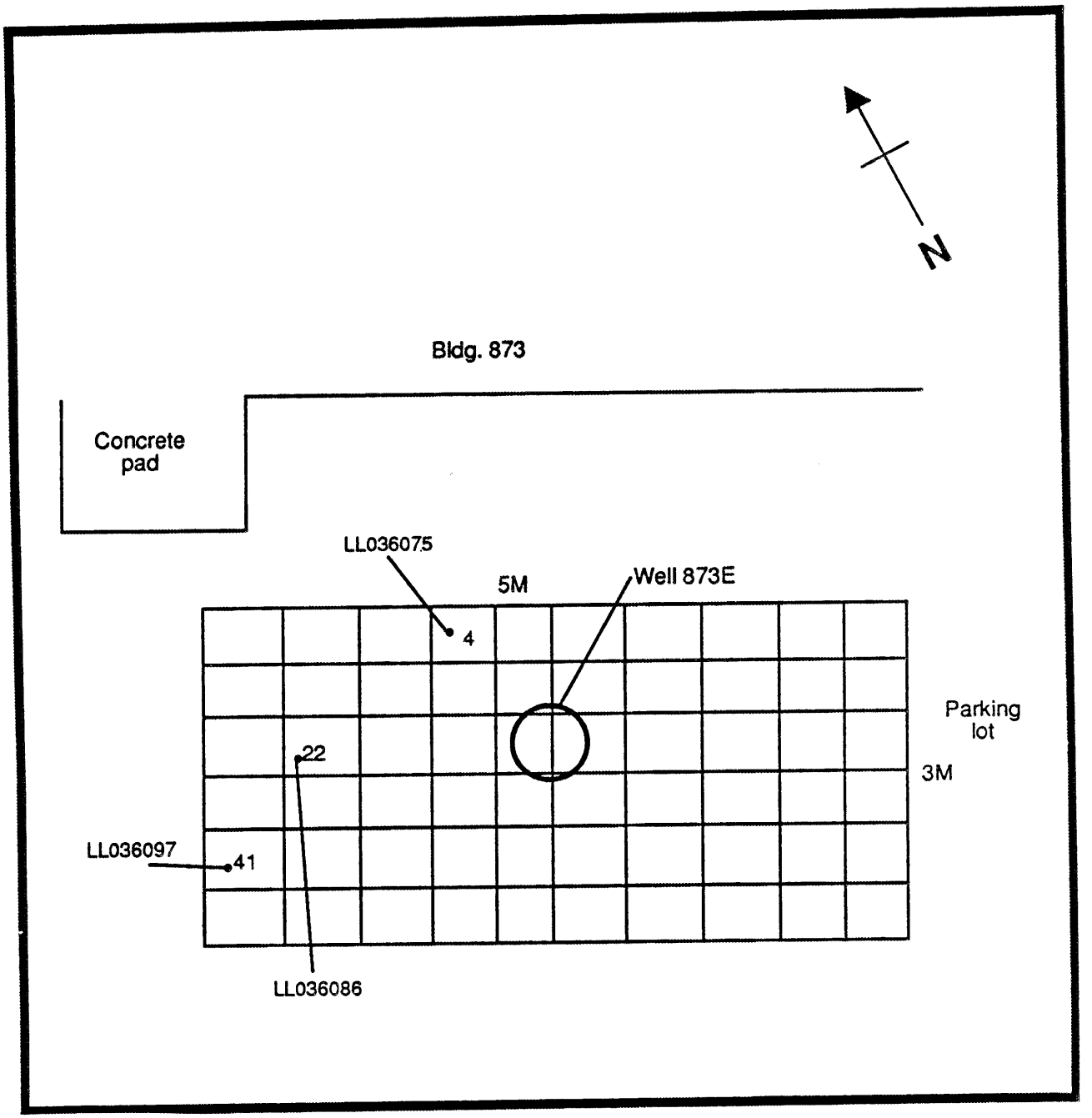

Figure L4.9c. GSA Area Dry Well 873E (LLNL Request 36)

Environmental Problem: LLNL 9
Request Number: LLNL 36

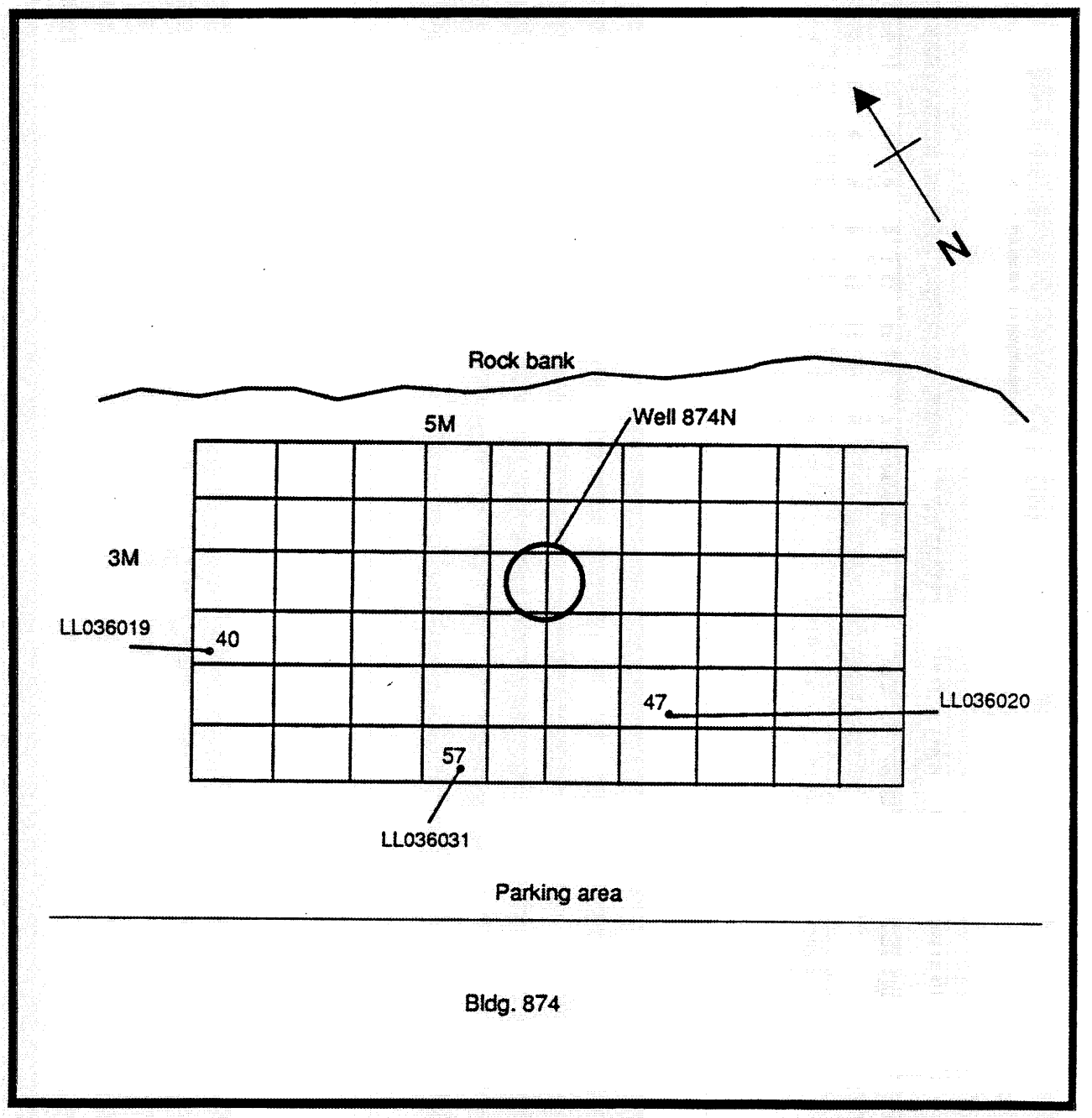

Figure L4.9d. GSA Area Dry Well 874N (LLNL Request 36)

TABLE L4.2.9 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 9

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	HE NUMB HITS	HE 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
LL036	GSA AREA	WELLS	SOIL	22	13	GRAB	0	0	13	13	0	0	0	0	0	1	10	13	12	12	13	13
		MED TOTAL		22	13		0	0	13	13	0	0	0	0	0	1	10	13	12	12	13	13
LL036	GSA AREA	WELLS	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
		EP TOTAL		23	14		0	0	14	14	0	0	0	0	0	1	11	14	13	13	14	14

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TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 872S
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL036133C	LL036133D	LL036144C	LL036144D	LL036155C	LL036155D
	SDG NO:	LL009016C	LL031047D	LL009016C	LL031047D	LL009016C	LL031047D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		24200 *		26800 *		28900 *	
ANTIMONY		4 UN		5 BN		4.1 UN	
BARIUM		261 *		290 *		328 *	
BERYLLIUM		0.97		1.1		1.1	
CADMIUM		0.27 U		0.45 B		0.27 U	
CALCIUM		9710 *		11400 *		7840 *	
CHROMIUM		34 N*		38 N*		38 N*	
COBALT		12		13		13	
COPPER		26 E		28 E		27 E	
IRON		30000 *		31700 *		32400 *	
LEAD		14 B		20 B		15 B	
MAGNESIUM		9040 *E		10100 *E		8970 *E	
MANGANESE		727 *E		740 *E		748 *E	
MERCURY			0.03 BN		0.03 BN		0.01 BN
NICKEL		20 *		24 *		20 *	
POTASSIUM		3100		2900		3300	
SILVER		2		2.9		2.4	
SODIUM		868		585 B		846	
VANADIUM		81		86		86	
ZINC		82 *		94 *		77 *	

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL036133B	LL036144B	LL036155B
	SDG NO:	LL011188	LL011288	LL011188
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		170 J	270 J	110 J
BUTYLBENZYLPHTHALATE		67 J	390 U	390 U
DI-N-BUTYLPHTHALATE		66 J	73 J	140 J
FLUORANTHENE		380 U	71 J	390 U
PYRENE		380 U	81 J	390 U
* UNKNOWN (6.10)			180 J	
* UNKNOWN (6.20)		240 J		180 J
* UNKNOWN (13.00)		150 J		
* UNKNOWN (21.00)				110 J
* UNKNOWN (23.00)				270 J
* UNKNOWN (27.30)		270 J		

TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 872S
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL036133A	LL036144A	LL036155A			
	SDG NO:	0828	0828	0828			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		23 B	25 B	24 B			
TOLUENE		7 U	2 JB	2 JB			
* UNKNOWN(11.07)			11 J				

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL036133E	LL036144E	LL036155E			
	SDG NO:	LLL7247	LLL7247	LLL7247			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		5700	4600	4600			
GROSS-BETA		19000	21000	22000			

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 873E
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:	LL036075	LL036086	LL036097			
VOA (PPM)		24	2.4	3.8			

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL036075C	LL036075D	LL036086C	LL036086D	LL036097C	LL036097D
	SDG NO:	LL009016C	LL031047D	LL009016C	LL031047D	LL009016C	LL031047D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		6010 *		16300 *		20000 *	
ANTIMONY		5.1 BN		4.6 UN		4.8 UN	
BARIUM		95 *		161 *		209 *	
BERYLLIUM		0.22 B		0.84		0.96	
CADMIUM		0.5 B		0.31 U		0.32 U	
CALCIUM		3010 *		12000 *		8760 *	
CHROMIUM		12 N*		25 N*		25 N*	
COBALT		3.5 B		11		11	
COPPER		10 E		23 E		22 E	
IRON		9840 *		22600 *		25400 *	
LEAD		4.4 U		13 B		14 B	
MAGNESIUM		2980 *E		8270 *E		10400 *E	
MANGANESE		223 *E		571 *E		602 *E	

TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 873E
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL036075C	LL036075D	LL036086C	LL036086D	LL036097C	LL036097D
	SDG NO:	LL009016C	LL031047D	LL009016C	LL031047D	LL009016C	LL031047D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
MERCURY			0.06 N		0.02 BN		0.02 BN
NICKEL		12 *		20 *		18 *	
POTASSIUM		780		2600		3000	
SILVER		0.95 B		2.2		1.6	
SODIUM		236 B		463 U		958	
VANADIUM		20		57		73	
ZINC		33 *		58 *		532 *	

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL036075B	LL036086B	LL036097B			
	SDG NO:	LL011388	LL011388	LL011288			
	TYPE:	GRAB	GRAB	GRAB			
ACENAPHTHENE		380 U	65 J	400 U			
BIS(2-ETHYLHEXYL)PHTHALATE		37000	38000	390			
DI-N-BUTYLPHTHALATE		380 U	53 J	400 U			
DIETHYLPHTHALATE		380 U	49 J	400 U			
FLUORANTHENE		53 J	400 J	400 U			
FLUORENE		380 U	52 J	400 U			
PHENANTHRENE		53 J	400 J	400 U			
PYRENE		92 J	510	400 U			
* UNKNOWN (6.10)		410 J					
* UNKNOWN (6.20)			260 J				
* UNKNOWN (13.50)		160 J					
* UNKNOWN (14.20)		260 J					
* UNKNOWN (14.30)		320 J					
* UNKNOWN (15.20)		240 J					
* UNKNOWN (16.30)		390 J					
* UNKNOWN (16.40)		650 J					
* UNKNOWN (17.00)		200 J					
* UNKNOWN (17.30)		250 J					
* UNKNOWN (17.40)		250 J					
* UNKNOWN (18.30)		380 J					
* UNKNOWN (18.40)		360 J					
* UNKNOWN (19.30)		260 J					
* UNKNOWN (20.20)		470 J	640 J				
* UNKNOWN (20.40)			260 J				
* UNKNOWN (21.10)				640 J			
* UNKNOWN (22.10)		330 J					
* UNKNOWN (22.50)		13000 J	15000 J				
* UNKNOWN (23.00)				11000 J			
* UNKNOWN (28.00)			860 J				

TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 873E
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL036075B	LL036086B	LL036097B			
	SDG NO:	LL011388	LL011388	LL011288			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN (29.30)			820 J				

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL036075A	LL036086A	LL036097A			
	SDG NO:	0829	0829	0829			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		16 B	22 B	44 B			
METHYLENE CHLORIDE		22	24	14			
TOLUENE		2 J	2 J	2 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL036075E	LL036086E	LL036097E			
	SDG NO:	LLL7296	LLL7296	LLL7296			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		0	7600	12000			
GROSS-BETA		21000	27000	32000			

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 874N
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:	LL036019	LL036020	LL036031			
VOA (PPM)		1.7	1.7	4.1			

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL036019C	LL036019D	LL036020C	LL036020D	LL036031C	LL036031D
	SDG NO:	LL011010C	LL031047D	LL011010C	LL031047D	LL011010C	LL031047D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		26100 *		24200 *		20600 *	
BARIUM		142		401		118	
BERYLLIUM		1.5		1.5		1.4	
CADMIUM		1.3		0.97		0.91	
CALCIUM		17700 *		23500 *		29200 *	
CHROMIUM		24 E		18 E		19 E	

TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 874N
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL036019C	LL036019D	LL036020C	LL036020D	LL036031C	LL036031D
	SDG NO:	LL011010C	LL031047D	LL011010C	LL031047D	LL011010C	LL031047D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
COBALT		15		14		15	
COPPER		52		47		46	
IRON		30800 *		27900 *		23800 *	
LEAD		12 B		15 B		14 B	
MAGNESIUM		13000		12100		11300	
MANGANESE		366 *		1200 *		1230 *	
MERCURY			2.5 N		0.09 N		0.03 BN
NICKEL		26 N*		32 N*		37 N*	
POTASSIUM		5300		5400		5700	
SILVER			0.05 B		0.05 B		0.02 B
SODIUM		1220		1000		1130	
VANADIUM		62		69		50	
ZINC		86		80		69	

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL036019B	LL036020B	LL036031B
	SDG NO:	LL001018	LL001018	LL001018
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		170 J	330 J	440
* ARYL HYDROCARBON (8.23)				220 J
* ARYL HYDROCARBON (8.26)		610 J	230 J	
* DIACETONE ALCOHOL (6.29)		24000 J		
* DIACETONE ALCOHOL (6.36)				20000 J
* DIACETONE ALCOHOL (6.44)			27000 J	
* POSSIBLE ALIPHATIC KETO (3.42)				190 J
* POSSIBLE ALIPHATIC KETO (5.52)				200 J
* POSSIBLE AMIDE/AMINE (7.91)				280 J
* POSSIBLE AMIDE/AMINE (7.95)			330 J	
* POSSIBLE AMIDE/AMINE (7.96)		740 J		
* PROBABLE ALIPHATIC HYDR (4.91)		1800 J	860 J	
* PROBABLE ALIPHATIC HYDRO(4.89)				630 J
* UNKNOWN (3.41)			300 J	
* UNKNOWN (3.42)		510 J		
* UNKNOWN (5.61)				460 J
* UNKNOWN (5.68)				780 J
* UNKNOWN (5.72)		4800 J		
* UNKNOWN (5.75)			2500 J	
* UNKNOWN (6.86)				130 J
* UNKNOWN (6.90)		330 J		
* UNKNOWN (7.08)				310 J
* UNKNOWN (7.11)			350 J	

TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 874N
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL036019B	LL036020B	LL036031B			
	SDG NO:	LL001018	LL001018	LL001018			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN (7.12)		830 J					
* UNKNOWN (7.14)				170 J			
* UNKNOWN (7.16)			210 J				
* UNKNOWN (7.18)		510 J					
* UNKNOWN (7.79)		130 J					
* UNKNOWN (7.97)				180 J			
* UNKNOWN (8.00)		330 J					
* UNKNOWN (8.94)				340 J			
* UNKNOWN (8.98)			330 J				
* UNKNOWN (8.99)		810 J					
* UNKNOWN (10.42)				110 J			
* UNKNOWN (10.47)		240 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL036019A	LL036020A	LL036031A			
	SDG NO:	0830	0830	0830			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		23 B	27 B	33 B			
ETHYLBENZENE		9 U	2 J	2 J			
METHYLENE CHLORIDE		18	18	16			
TOLUENE		2 JB	2 JB	2 JB			
* UNKNOWN(11.21)			9 J				

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL036019E	LL036020E	LL036031E			
	SDG NO:	LLL7283	LLL7283	LLL7283			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		4100	13000	10000			
GROSS-BETA		22000	30000	35000			

TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 875S2
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL036224F	LL036224G
	SDG NO:	LL003043F	LL012044D
	TYPE:	RINSATE	RINSATE
ALUMINUM		77 B	
IRON		62 B	
LEAD		58 B	
MAGNESIUM		32 B	
MANGANESE		5.4 B	
MERCURY			0.02 B
ZINC		112 E	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	LL036224E
	SDG NO:	D111
	TYPE:	RINSATE
BIS(2-ETHYLHEXYL)PHTHALATE		11 B
BUTYLBENZYLPHTHALATE		4 J

VOLATILE ORGANICS (UG/L)	SAMP NO:	LL036224A
	SDG NO:	G913
	TYPE:	RINSATE
ACETONE		25 B
METHYLENE CHLORIDE		3 JB

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL036224H
	SDG NO:	LLL7247
	TYPE:	RINSATE
G-ALPH		7
GROSS-BETA		0

TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 879E
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:	LL036042	LL036053	LL036064			
VOA (PPM)		7.1	27	1.1			

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL036042C	LL036042D	LL036053C	LL036053D	LL036064C	LL036064D
	SDG NO:	LL009016C	LL031047D	LL009016C	LL031047D	LL009016C	LL031047D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		21400 *		31500 *		26100 *	
ANTIMONY		4.7 UN		6.1 BN		4.6 UN	
ARSENIC		4.7 UN		5 UN		4.6 UN	
BARIUM		136 *		171 *		299 *	
BERYLLIUM		1.1		1.5		1.1	
CADMIUM		0.39 B		0.65 B		0.31 U	
CALCIUM		15300 *		12100 *		13800 *	
CHROMIUM		21 N*		29 N*		31 N*	
COBALT		14		13		12	
COPPER		31 E		40 E		26 E	
IRON		25500 *		33300 *		30200 *	
LEAD		19 B		20 B		18 B	
MAGNESIUM		9760 *E		12800 *E		9450 *E	
MANGANESE		360 *E		291 *E		707 *E	
MERCURY			0.03 BN		0.03 BN		0.02 BN
NICKEL		13 *		14 *		17 *	
POTASSIUM		2900		4200		3500	
SELENIUM		6.2 UN		6.7 UN		6.2 UN	
SILVER		0.96 B		0.88 B		1.9	
SODIUM		1200		916		783	
VANADIUM		69		81		85	
ZINC		73 *		81 *		82 *	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL036235C	LL036235D
	SDG NO:	LL009016C	LL031047D
	TYPE:	GRAB	GRAB
ALUMINUM		20000 *	
ANTIMONY		4.8 UN	
ARSENIC		45 N	
BARIUM		183 *	
BERYLLIUM		0.81	
CADMIUM		0.32 U	
CALCIUM		9860 *	
CHROMIUM		31 N*	
COBALT		9.7	

TABLE L4.3.9 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 9 DRAFT DO NOT CITE
GSA AREA DRY WELLS

S&A REQUEST: 036
LOCATION: GSA AREA DRY WELL 879E
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL036235C	LL036235D				
	SDG NO:	LL009016C	LL031047D				
	TYPE:	GRAB	GRAB				
COPPER		22 E					
IRON		26600 *					
LEAD		28 B					
MAGNESIUM		7580 *E					
MANGANESE		716 *E					
MERCURY			0.02 BN				
NICKEL		18 *					
POTASSIUM		2800					
SELENIUM		68 N					
SILVER		1.9					
SODIUM		1510					
VANADIUM		73					
ZINC		144 *					

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL036042B					
	SDG NO:	LL122287					
	TYPE:	GRAB					
* UNKNOWN (27.10)		310 J					
* UNKNOWN (29.00)		410 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL036042A	LL036053A	LL036064A			
	SDG NO:	0816	0814	0814			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		19 B	19 B	19 B			
ETHYLBENZENE		2 JB	2 JB	2 JB			
METHYLENE CHLORIDE		8	6 J	4 J			
TOLUENE		1 JB	2 JB	1 JB			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL036042E	LL036053E	LL036064E	LL036235E		
	SDG NO:	LLL7242	LLL7242	LLL7242	LLL7242		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
G-ALPH		10000	12000	11000	5700		
GROSS-BETA		25000	23000	30000	30000		

4.15 LLNL Environmental Problem 10: Sewage Treatment Pond and Overflow Basin

Request Numbers: 37 and 38.
Requester: J. Boros.
Finding and Basis: Pond sludges may contain concentrated toxic or hazardous pollutants that may redissolve and be transported off-site to Corral Hollow Creek or to the ground.

4.15.1 Sampling and Analysis Objectives

Statement: Sludge samples were to be examined to determine if the constituents listed in Sect. 4.15.2.2 were present above normal levels for soil of the area in bottom sludge/soil at the sewage treatment pond and the overflow basin.

Supporting Information: Past practice had diverted a variety of GSA wastewaters from Site 300 operations and services into the sewage treatment pond, with some carryover into the adjacent overflow pond. The overflow pond was rarely used, but evidence of the effect of past practices may have still been present in the characteristic black sludge remaining in the pond.

4.15.2 Sampling and Analytical Design

4.15.2.1 Sampling Design

Request 37: Overflow Pond (Fig. L4.10a). Three grab sludge samples (Sampling Method: Reference E5.3.1) were to be collected from selected areas to the depth of the sludge in the overflow pond. The area of the pond was 100 to 500 m^2. All areas of the pond were believed to be homogeneous with respect to the sludge, with the exception of the depth of the sludge. The pond was to be

divided into three circles, starting at the middle and moving to the outside of the pond, with 20 segments in each circle. The Sampling Team was to randomly select one segment from each circle. A grab sample was to be collected from each selected segment to the depth of the sludge. Because of the fairly routine recharging of the pond, there was thought to be no reason to examine the soil below the sludge. The sludge represented a picture, in time, of any potential contaminants in the pond.

The Sampling Team arrived at the site at 1340 on 06AUG87. The weather was clear, sunny, and breezy, and the temperature was approximately 92°F. The Team divided the basin into a grid 18 strides across, with the middle being nine. The basin was dry and uneven in level and texture. Samples were to be collected to a depth of 8 in. with a cup-setter device. The first sludge sample (grid 5) was collected at 4 in. (LL037010). The area where the second sample (grid 38) was collected was very uneven, with evidence that it had been wet and dry (LL037021). The first and second samples were rocky. The third sample (grid 53) was not so rocky, consisting of finer sediment (LL037032). QC rinsate sample LL037043 was not collected. Samples were collected between 1400 and 1442.

Request 38: Main Sewage Treatment Pond (Fig. L4.10b). Five grab sludge samples (Sampling Method: Reference E5.3.1) were to be collected from the pond to the depth of the sludge. The pond was greater than 500 m^2, and homogeneity, with respect to the sludge, was assumed. The pond was to be divided into a 100-segment grid, and five segments were to be randomly selected for sampling.

The Sampling Team arrived at the sewage treatment pond at 1130 on 07AUG87. The weather was sunny and clear, and the temperature was 92°F. The pond was smaller than originally thought; therefore, it was divided into 80 segments from the bank, and four segments were selected for sampling. Samples were collected

with a 30-ft dipper. The depth of the sludge was fairly uniform, varying in depth from 1 to 1 1/2 ft. Samples were taken directly from the dipper or placed in a stainless steel tray after taking the volatile sample. The volatile sample was placed on ice immediately after it was collected. Samples LL038011 (grid 24), LL038022 (grid 28), LL038033 (grid 60), and LL038055 (grid 90) were collected. Sample LL038044 was not collected because the size of the pond supported the taking of only four samples. Samples were collected between 1200 and 1230.

4.15.2.2 Analytical Design

Request 37: The parameters analyzed were volatiles, semivolatiles, ICP-metals, TCLP-metals, AA-mercury, oil and grease, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was to be run.) No field measurements were required.

Request 38: The parameters analyzed were ICP-metals, AA-mercury, gross alpha, gross beta, gamma scan, and tritium. No field measurements were required.

4.15.3 Field and Analytical Data

Field Data:

Request 37. NA

Request 38. NA

Field Data Evaluation:

Request 37. NA

Request 38. NA

Analytical Data:

Metals. *Analytical results for metals in sediment are presented in Table L4.3.10. Twenty metals were detected above the quantitation limits of the analytical procedure at the two sites sampled.*

Request 37. Of the 20 metals detected, mercury was below the CRQL in two of three samples, and beryllium was below the CRQL in all samples. No parameters exceeded RCRA TCLP levels during normal analysis.

Request 38. Of the 20 metals detected, arsenic, beryllium, and cobalt were below the CRQL in all samples.

Volatile organics. *Analytical results for volatiles are presented in Table L4.3.10. There were three samples taken for Request 37 and four for Request 38. Results are summarized by request number below.*

Request 37. The number of volatiles detected ranged from 6 to 15 in the three sediment samples from the Sewage Treatment Plant overflow pond. Acetone was detected in excess of 100 ug/kg in two samples. About 50 ug of 2-butanone per kilogram of sediment were present in the same two samples (LL037021 and LL037032).

Request 38. In the four sediment samples from the main pond at the Sewage Treatment Plant, four volatiles were detected in each and one unknown was also detected in sample LL038022. With respect to volatiles, these samples did not appear much different from some of the trip blanks.

Extractable organics. *Analytical results for semivolatile organic compounds are presented in Table 4.3.10. The number of compounds detected in particular samples (of seven total samples) ranged from six to 21. In the three sediment samples from the Sewage Treatment Plant overflow pond, only di-n-butylphthalate was identified in all three samples, and it was always in concentrations of less than 1 mg/kg. Several unknown compounds were also identified in concentrations estimated at less than 1 mg/kg. In the four sediment samples from the Sewage Treatment Plant main pond, two phthalates were identified. In two of those samples, bis(2-ethylhexy)phthalate was present in concentrations of from 31 to 42 mg/kg, but it was not detected in the other two samples. Di-n-butylphthalate had estimated concentrations of less than 0.3 mg/kg in all four samples. Unknown compounds appeared with estimated concentrations that frequently exceeded 1 mg/kg, and sometimes exceeded 10 mg/kg. This was especially true in sample LL038022 (highest estimated concentration of an unknown = 46 mg/kg). Sample LL038011 had one unknown compound with an estimated concentration of 170 mg/kg. Unknowns with the same retention time frequently appeared in all four samples.*

Other extractables. *Although Requests 37 and 38 did not specify that analyses for pesticides and PCBs were required, data were acquired. Table L4.3.10 presents the results of the analyses for pesticides and PCBs by GC-ECD. Less than 10 ug/kg of beta-BHC, delta-BHC, and gamma-BHC (Lindane) were detected in sample LL037032. Less than 30 ug/kg of delta-BHC and Endosulfan II were detected in samples LL038022 and LL038055, respectively.*

Oil and grease. *The results of the oil and grease analysis from the sludge of the overflow pond are shown in Table L4.3.10. The concentrations range over a narrow limit of 100 to 200 mg/kg.*

Radiochemistry.

Request 37. Tritium concentrations of the three grab samples were 0, 1000, and 16,000 pCi/kg.

Request 38. Gross alpha concentrations averaged 3200 pCi/kg; gross beta, 17,750 pCi/kg. Tritium analyses showed three samples having no measurable tritium and one sample having 6000 pCi/kg. The major activity from the gamma scan was potassium-40 at 11750 pCi/kg.

Analytical Data Evaluation:

Metals. Of the 20 metals detected, the following metals were below the CRQL in most or all samples: arsenic, beryllium, cobalt, and mercury.

Volatile organics. These samples did not appear to be contaminated with respect to volatiles.

Extractable organics. The sediment in the main pond of the Sewage Treatment Plant was contaminated with semivolatile organic compounds.

Other extractables. In general, the data collected were of low quality due to problems with analytical holding times that were exceeded by more than 40 days and poor calibration linearity. Sample LL038011 was accidentally spiked with matrix spike solution. As a result, no data are available for the matrix spike compounds for this sample.

Oil and grease. The analysis is straightforward, and the calibration verification, sample spike recovery, and sample duplicates are all within the acceptable range for this request.

Radiochemistry. The results of radiochemical analyses are shown in Table L4.3.10.

4.15.4 Limitations and Qualifications

Data Quality Level:

Field Data: The Sampling Plan and field sampling are rated Quality Level II. The overall analytical Quality Level is II. The plan for sampling the main sewage treatment pond called for gridding the pond and taking five samples. The actual sampling was done along the edges, using a 30-ft dipper. Samples were taken for volatiles and semivolatiles from the main sewage treatment pond although the plan did not call for these samples.

Analytical Data: In the overflow pond, volatile compounds were identified in significant concentrations; whereas, in the main pond it is noted that the volatiles did not differ from the trip blanks. In the overflow pond situation, the analyses were made only 1 day after the holding time limit; in the main pond case, the holding time was exceeded 27 days. Details on analytical data quality are given below.

Metals. The following QC data flags were assigned to the metals identified in this sample group: duplicate--aluminum, barium, calcium, chromium, iron, and zinc; spike--lead; serial dilution--copper; duplicate and serial dilution--magnesium and manganese. Overall sample quality for these requests is Quality Level I, except for the following metals at Quality Level II: antimony, chromium, magnesium, manganese, and selenium. Overall sample quality for AA-metals is Quality Level I.

Volatile organics. Certain volatiles were often detected in blank samples, and concentrations were often below quantification limits.

The data quality summary sheets listed 63% of the data included as being of Quality Level III, with most of those being associated with concentrations too small to quantify. The remaining data included in the quality level summary sheets were rated Quality Level II.

Extractable organics. Many unknown compounds were detected; therefore, their concentrations are estimated values. The data are of Quality Level II, due mainly to tentative identification by mass spectrometry.

Oil and grease. Oil and grease data are rated Quality Level I. Although calibration verification was not required, an EPA quality control solution was tested along with another SDG group. Duplicate analysis was within the allowable $\pm$20% RPD, and the sample spike with EPA solution showed results were in conformance (i.e., within a control limit of 75% to 125% recovery).

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.

Environmental Problem: LLNL 10
Request Number: LLNL 37

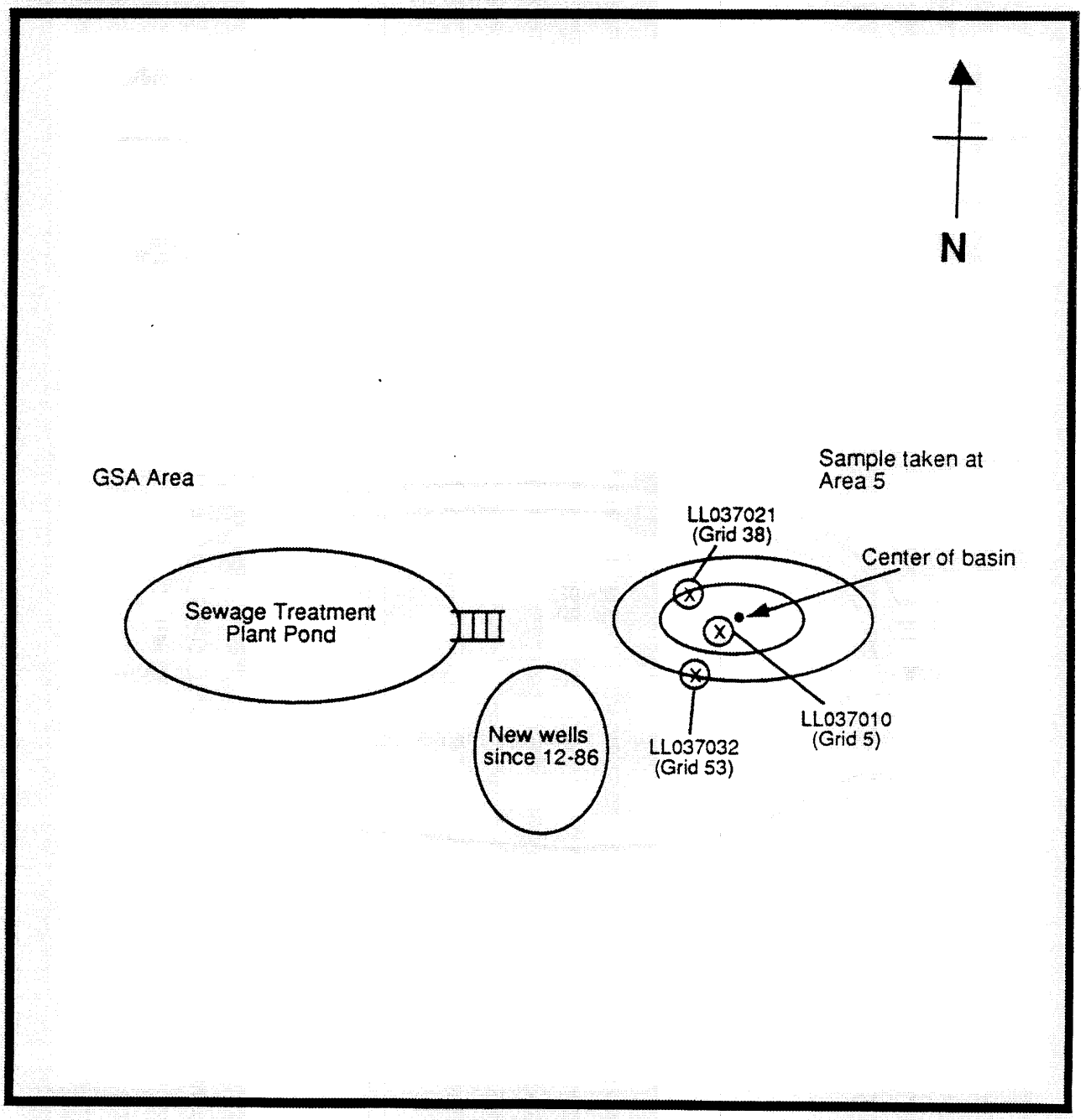

Figure L4.10a. Overflow Pond (LLNL Request 37)

Environmental Problem: LLNL 10
Request Number: LLNL 38

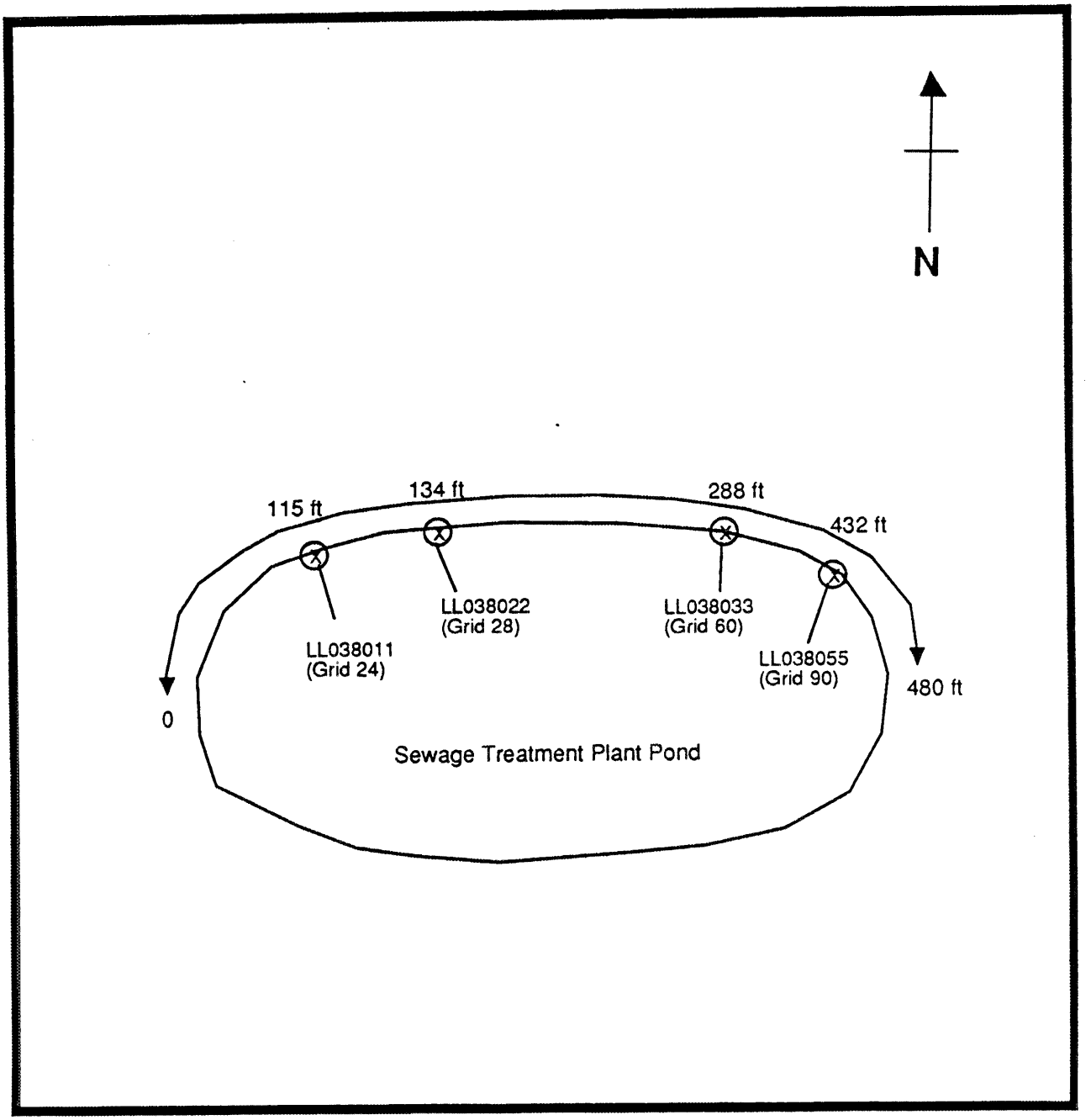

Figure L4.10b. Main Sewage Treatment Pond (LLNL Request 38)

TABLE L4.2.10 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	HE NUMB HITS	HE 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
LL037	STP OVERFLOW	POND	SEDIMENT	3	3	GRAB	0	0	3	3	3	3	0	0	0	0	3	3	3	3	3	3
LL038	STP MAIN	POND	SEDIMENT	5	4	GRAB	0	0	4	4	0	0	0	0	1	1	4	4	4	4	4	4
			MED TOTAL	8	7		0	0	7	7	3	3	0	0	1	1	7	7	7	7	7	7
LL037	STP OVERFLOW	POND	SUR WATER	1	0	QC RN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			MED TOTAL	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			EP TOTAL	9	7		0	0	7	7	3	3	0	0	1	1	7	7	7	7	7	7

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TABLE L4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
SEWAGE TREATMENT POND AND OVERFLOW BASIN

S&A REQUEST: 037
LOCATION: STP OVERFLOW POND
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL037010C	LL037010D	LL037021C	LL037021D	LL037032C	LL037032D
	SDG NO:	LL009016C	LL005012D	LL009016C	LL005012D	LL009016C	LL005012D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		7840 *		12400 *		16200 *	
ARSENIC			1.9		0.96 B		1.7 B
BARIUM		73 *		132 *		192 *	
BERYLLIUM		0.25 B		0.5 B		0.61 B	
CADMIUM		0.26 U		0.26 U		0.35 B	
CALCIUM		2870 *		15100 *		17000 *	
CHROMIUM			29 *		30 *		33 *
COBALT		5.5 B		8.7		10	
COPPER		16 E		30 E		26 E	
IRON		16000 *		20200 *		25300 *	
LEAD			5.1 N		9.6 N		6.6 N
MAGNESIUM		4970 *E		8630 *E		8980 *E	
MANGANESE		400 *E		556 *E		539 *E	
MERCURY			0.04 B		0.05		0.03 B
NICKEL			19		34		32
POTASSIUM		1500		3200		3400	
SILVER		1.4		1.3		2	
SODIUM		898		951		586 B	
VANADIUM		25		31		45	
ZINC		36 *		68 *		69 *	

OIL AND GREASE (MG/KG)	SAMP NO:	LL037010E	LL037021E	LL037032E
	SDG NO:	LL037010E	LL037010E	LL037010E
	TYPE:	GRAB	GRAB	GRAB
OIL AND GREASE		100	200	100

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL037010B	LL037021B	LL037032B
	SDG NO:	LL122087	LL122887	LL122987
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		340 U	200 J	340 U
DI-N-BUTYLPHTHALATE		550	580	690
* UNKNOWN (15.30)			120 J	
* UNKNOWN (16.50)			660 J	
* UNKNOWN (18.00)				160 J
* UNKNOWN (18.20)			210 J	
* UNKNOWN (20.30)		220 J		
* UNKNOWN (21.20)		630 J		
* UNKNOWN (22.10)		600 J		

TABLE L4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
SEWAGE TREATMENT POND AND OVERFLOW BASIN

S&A REQUEST: 037
LOCATION: STP OVERFLOW POND
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: LL037010B SDG NO: LL122087 TYPE: GRAB	LL037021B LL122887 GRAB	LL037032B LL122987 GRAB
* UNKNOWN (23.00)	380 J		
* UNKNOWN (23.50)	340 J		
* UNKNOWN (24.00)		230 J	
* UNKNOWN (24.40)	370 J		
* UNKNOWN (25.20)			170 J
* UNKNOWN (25.30)	290 J		
* UNKNOWN (25.40)	180 J	220 J	
* UNKNOWN (26.30)	180 J		
* UNKNOWN (27.20)			930 J
* UNKNOWN (27.30)		260 J	
* UNKNOWN (27.40)	420 J		
* UNKNOWN (27.50)		400 J	
* UNKNOWN (30.10)			350 J
* UNKNOWN (30.50)		270 J	
* UNKNOWN (32.10)		560 J	
* UNKNOWN (32.50)		800 J	
* UNKNOWN (33.10)		710 J	
* UNKNOWN (36.30)			690 J
* UNKNOWN (37.30)		800 J	

VOLATILE ORGANICS (UG/KG)	SAMP NO: LL037010A SDG NO: 0826 TYPE: GRAB	LL037021A 0821 GRAB	LL037032A 0821 GRAB
ACETONE	32 B	120 B	130 B
BENZENE	0.9 J	2 J	4 J
CARBON DISULFIDE	3 J	3 J	1 J
CHLOROFORM	5 U	0.8 JB	2 JB
ETHYLBENZENE	2 JB	2 JB	5 U
METHYLENE CHLORIDE	10 B	22 B	54 B
TOLUENE	3 JB	9 B	16 B
1,1,1-TRICHLOROETHANE	5 U	5 U	2 J
2-BUTANONE	10 U	46	52
4-METHYL-2-PENTANONE	10 U	5 J	10 J
* HEXANE(19.53)		4 J	6 J
* METHANE, TRICHLOROFLUOR(9.22)			19 J
* METHYLHEXANE(22.99)			8 J
* UNKNOWN(16.2)			2 J
* UNKNOWN(23.66)			4 J
* UNKNOWN(9.65)		13 J	10 J

TABLE L4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
SEWAGE TREATMENT POND AND OVERFLOW BASIN

S&A REQUEST: 037
LOCATION: STP OVERFLOW POND
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL037010F	LL037021F	LL037032F			
	SDG NO:	LLL7241	LLL7241	LLL7241			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		3500	1200	13000			
GROSS-BETA		23000	27000	22000			
H-3		1000	16000	0			

S&A REQUEST: 038
LOCATION: STP MAIN POND
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL038011C	LL038011D	LL038022C	LL038022D	LL038033C	LL038033D
	SDG NO:	LL009016C	LL009016D	LL009016C	LL009016D	LL009016C	LL009016D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		6720 *		8890 *		7360 *	
ARSENIC			1 B		0.94 B		1.3 B
BARIUM		128 *		237 *		115 *	
BERYLLIUM		0.33 B		0.36 B		0.35 B	
CADMIUM		0.64 U		0.5 U		0.57 B	
CALCIUM		20300 *		17900 *		17200 *	
CHROMIUM			34		28		32
COBALT		3.4 B		5.3 B		4.8 B	
COPPER		27 E		23 E		22 E	
IRON		10500 *		17000 *		12200 *	
LEAD			9.8		10		9.7
MAGNESIUM		6440 *E		8330 *E		7500 *E	
MANGANESE		251 *E		390 *E		340 *E	
MERCURY			0.2		0.24		0.15
NICKEL			14 *		15 *		22 *
POTASSIUM		1900		2000		2200	
SILVER		5.2		3.1		4.6	
SODIUM		2370		2390		1840	
VANADIUM		29		38		35	
ZINC		120 *		105 *		72 *	

TABLE L4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
SEWAGE TREATMENT POND AND OVERFLOW BASIN

S&A REQUEST: 038
LOCATION: STP MAIN POND
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL038055C	LL038055D				
	SDG NO:	LL009016C	LL009016D				
	TYPE:	GRAB	GRAB				
ALUMINUM		8250 *					
ARSENIC			0.95 B				
BARIUM		132 *					
BERYLLIUM		0.38 B					
CADMIUM		0.38 U					
CALCIUM		17100 *					
CHROMIUM			28				
COBALT		5.6 B					
COPPER		13 E					
IRON		13800 *					
LEAD			12				
MAGNESIUM		6590 *E					
MANGANESE		304 *E					
MERCURY			0.07				
NICKEL			13 *				
POTASSIUM		2000					
SILVER		2.4					
SODIUM		1300					
VANADIUM		44					
ZINC		53 *					

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	LL038011Z					
	SDG NO:	LL202					
	TYPE:	GRAB					
4,4'-DDT		29 J					

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL038011B	LL038022B	LL038033B	LL038055B		
	SDG NO:	LL011288	LL011288	LL011388	LL011388		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
BIS(2-ETHYLHEXYL)PHTHALATE		610 U	1000 U	42000	31000		
DI-N-BUTYLPHTHALATE		100 J	140 J	130 J	260 J		
DIETHYLPHTHALATE		78 J	1000 U	90 J	85 J		
* UNKNOWN (6.10)				610 J	400 J		
* UNKNOWN (6.20)		450 J					
* UNKNOWN (7.40)				640 J			
* UNKNOWN (7.50)			4000 J				
* UNKNOWN (8.00)			1400 J				
* UNKNOWN (8.10)		600 J	2800 J	610 J	620 J		

TABLE L4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
SEWAGE TREATMENT POND AND OVERFLOW BASIN

S&A REQUEST: 038
LOCATION: STP MAIN POND
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL038011B	LL038022B	LL038033B	LL038055B		
	SDG NO:	LL011288	LL011288	LL011388	LL011388		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
* UNKNOWN (8.20)					420 J		
* UNKNOWN (8.30)		690 J	2100 J	830 J	960 J		
* UNKNOWN (8.40)		64 J					
* UNKNOWN (8.50)		330 J	2100 J	360 J	400 J		
* UNKNOWN (9.20)					260 J		
* UNKNOWN (10.00)					320 J		
* UNKNOWN (13.60)			1700 J				
* UNKNOWN (14.30)		480 J					
* UNKNOWN (16.00)		730 J	8200 J	460 J	620 J		
* UNKNOWN (16.30)		1200 J	2500 J	880 J	1200 J		
* UNKNOWN (16.40)		3400 J	16000 J				
* UNKNOWN (17.40)		2100 J	9400 J	970 J	1200 J		
* UNKNOWN (18.10)				340 J			
* UNKNOWN (18.20)				450 J			
* UNKNOWN (18.30)			2200 J				
* UNKNOWN (18.40)			2000 J				
* UNKNOWN (19.10)		630 J	1000 J		340 J		
* UNKNOWN (19.20)					360 J		
* UNKNOWN (20.20)		680 J	1200 J	1000 J	850 J		
* UNKNOWN (20.40)		910 J			280 J		
* UNKNOWN (22.00)					450 J		
* UNKNOWN (22.50)				22000 J	3900 J		
* UNKNOWN (23.00)		2000 J	26000 J		2200 J		
* UNKNOWN (23.40)			1200 J				
* UNKNOWN (23.50)			1000 J				
* UNKNOWN (24.00)		6400 J					
* UNKNOWN (24.20)			46000 J				
* UNKNOWN (24.30)		170000 J					
* UNKNOWN (25.20)				5100 J			
* UNKNOWN (26.10)		1400 J					
* UNKNOWN (26.50)		1800 J	5100 J	2000 J	1400 J		

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL038011A	LL038022A	LL038033A	LL038055A		
	SDG NO:	0917	0917	0917	0917		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
ACETONE		22 B	46 B	69 B	27 B		
ETHYLBENZENE		2 J	5 J	3 J	2 J		
METHYLENE CHLORIDE		3 JB	5 JB	3 JB	3 JB		
TOLUENE		2 J	3 J	2 J	1 J		
* UNKNOWN(19.59)			8 J				

TABLE L4.3.10 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 10 DRAFT DO NOT CITE
SEWAGE TREATMENT POND AND OVERFLOW BASIN

S&A REQUEST: 038
LOCATION: STP MAIN POND
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL038011E	LL038022E	LL038033E	LL038055E		
	SDG NO:	LLL7266	LLL7266	LLL7266	LLL7266		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
CS-137		160	170	170	130		
G-ALPH		2300	7000	0	3500		
GROSS-BETA		13000	19000	23000	16000		
H-3		0	0	0	6000		
K-40		10000	11000	14000	12000		

4.16 LLNL Environmental Problem 11: 865 Area

Request Number: 39.
Requester: J. Boros.
Finding and Basis: Because releases are a continuing practice, a potential exists for contaminants to be carried downgrade of the 865 complex by surface water runoff or to penetrate the ground, eventually reaching an aquifer. Evidence exists that oily matter and other polluted wastes have been released to the ground in the area of the 865 complex.

4.16.1 Sampling and Analysis Objectives

Statement: Sediment samples were to be examined to determine if contaminants listed in Sect. 4.16.2.2 were present in sediments around the 865 complex above normal levels for the area.

Supporting Information: The ditch contained areas where cattails and other vegetation grow. These plants may be serving to either concentrate or biodegrade the contaminants.

4.16.2 Sampling and Analytical Design

4.16.2.1 Sampling Design

Request 39: 865 Area (Fig. L4.11). Four grab sediment samples (Sampling Method: Reference E5.3.1) were to be collected to the depth of the sediment from the drainage ditch downhill from the 865 complex. The area of interest was 100 to 500 m^2 and was considered homogeneous with respect to outside influences. A systematic approach was to be used to cover all areas of interest, which included the vegetation or cattails.

The Sampling Team arrived at the site at 1345 on 05AUG87. The weather was sunny and clear, and the temperature was 95°F. The Sampling Team was not asked to collect a subsurface sample because the ditch was continually recharged. The ditch, from its onset at the 865 area to a point 10 ft past the vegetation, was to be divided into an 80-segment grid. Team members randomly selected a segment between 1 and 20 and designated it sample point 1. Four samples were collected at grid segments spaced 20 ft apart, beginning with grid 5.

The grid areas were measured, and grids 5, 25, 45, and 65 were selected for sampling. The grids were approximately 1.3 ft each because the length between roads was 110 ft, and the grid was based on 80 segments. There was water in the ditch, and the ditch was rich with grasses, cattails, and other plant life. The sediment was very black, soft, and had an organic/sewer odor. It went to a depth of 3 to 4 in. No unusual situations were encountered. Samples LL039012, LL039023, LL039034, and LL039045 were collected at 1400.

4.16.2.2 Analytical Design

The parameters analyzed were ICP-metals, TCLP-metals, AA-mercury, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded the RCRA TCLP levels during the normal analysis, the TCLP analysis was to be run.) No field measurements were required.

4.16.3 Field and Analytical Data

Field Data: *NA*

Field Data Evaluation: NA

Analytical Data:

Metals. *Analytical results for metals in sediment are presented in Table L4.3.11. Twenty metals were detected above the quantitation limits of the analytical procedure. No parameters exceeded RCRA TCLP levels during normal analysis.*

Volatile organics. *Analytical results for volatiles are presented in Table L4.3.11. From two to four volatiles were detected in each of the four sediment samples. The highest concentration of any volatile was acetone at 44 ug/kg. The only other concentration of volatiles higher than 10 ug/kg of sediment was methylene chloride at 11 ug/kg.*

Extractable organics. *Analytical results for semivolatile organic compounds are presented in Table L4.3.11. Three to 12 compounds were detected in particular samples (of four total samples). Di-n-octyphthalate was identified in three of the four samples (highest estimated concentration was 0.049 mg/kg) and bis(2-ethylhexyl)phthalate was identified only in the remaining sample (estimated concentration was 0.074 mg/kg). Sample LL039023 had several unknowns detected in estimated concentrations of up to 5.2 mg/kg, but the other three samples did not have any unknowns present in estimated concentrations of as high as 1 mg/kg.*

Radiochemistry. *This area contains tritium (average value of 135,000 pCi/kg). Averages for cesium-137 were 27.7 pCi/kg; for gross alpha, 5850 pCi/kg; and for gross beta, 19,500 pCi/kg.*

Analytical Data Evaluation:

Metals. Of the 20 metals detected, beryllium and cadmium were slightly above the CRQL, and mercury was detected at 0.01 to 0.04 mg/kg.

Volatile organics. With respect to volatiles, these samples did not appear much different than some of the trip blanks.

Extractable organics. No particularly significant concentrations of semivolatile organic compounds were apparent in these samples.

Radiochemistry: Four sediment samples were taken from the runoff area around Building 865. They were analyzed for tritium, gross alpha, gross beta, and gamma activities. Results are given in Table L4.3.11.

4.16.4 Limitations and Qualifications

Data Quality Level: The sampling design is rated Quality Level I, and the sampling is rated Quality Level II. The overall analytical data are rated Quality Level I.

Field Data: Samples were collected and analysis subsequently performed on volatiles and semivolatiles that were not requested.

Analytical Data: The metal analysis, though mostly of Quality Level II, were sufficiently accurate to show that TCLP was not required for this problem. Although not explicitly rated, the radiological results show that only the tritium concentration is elevated. Details on analytical data quality are given below.

Metals. The following QC data flags were assigned to the metals identified in this sample group: duplicate--barium, iron, magnesium, and vanadium; duplicate and serial dilution--aluminum, calcium, and manganese; duplicate and spike--zinc; spike, duplicate, serial dilution--copper. Overall sample quality for this request is Quality Level II, except copper at Quality Level III. Overall sample quality for AA-metals is Quality Level I.

Volatile organics. Concentrations were similar to those commonly found in trip blanks and were often too small to quantify, so estimated values were given instead.

In four of the five entries on the data quality summary sheet, the data were Quality Level III due to concentrations too small to measure and/or the compounds also being detected in the corresponding method blanks. The remaining entry was a Quality Level II.

Extractable organics. No identifiable compound appeared in measurable quantities. The data are Quality Level II, due mainly to tentative identification by mass spectrometry.

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.

Environmental Problem: LLNL 11
Request Number: LLNL 39

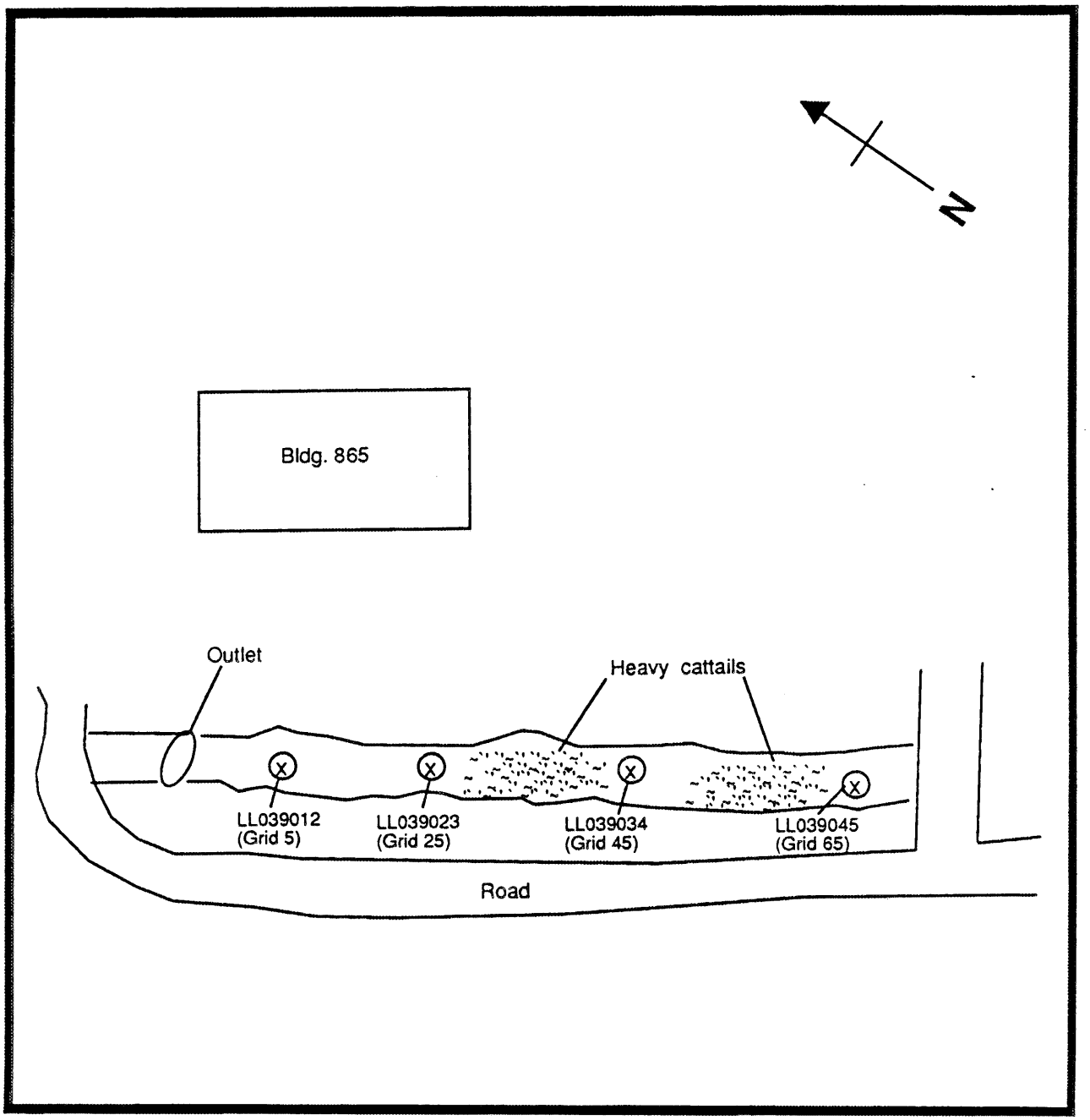

Figure L4.11. 865 Area (LLNL Request 39)

TABLE L4.2.11 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	HE NUMB HITS	HE 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
LL039	865 AREA	DITCH	SEDIMENT	4	4	GRAB	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

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TABLE L4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 DRAFT DO NOT CITE
865 AREA

S&A REQUEST: 039
LOCATION: 865 AREA DITCH
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: LL039012C SDG NO: LL003010C TYPE: GRAB	LL039012D LL039012D GRAB	LL039023C LL003010C GRAB	LL039023D LL039012D GRAB	LL039034C LL003010C GRAB	LL039034D LL039012D GRAB
ALUMINUM	27100 *E		11400 *E		32700 *E	
ARSENIC		12		2.8		1.4 B
BARIUM	254 *		91 *		313 *	
BERYLLIUM	1.2 B		0.51 B		1.9	
CADMIUM	1.3		0.94 B		1.3 B	
CALCIUM	10400 *E		7180 *E		13600 *E	
CHROMIUM		62 N*		22 N*		15 N*
COBALT	16		7.9 B		21	
COPPER	35 N*E		36 N*E		37 N*E	
IRON	31400 *		18000 *		39800 *	
LEAD		27 N*		16 N*		7.7 N*
MAGNESIUM	6610 *		3590 *		7180 *	
MANGANESE	555 *E		289 *E		630 *E	
MERCURY		0.1		0.1		0.03 B
NICKEL		20 N		17 N		18 N
POTASSIUM	4000		1500		4000	
SILVER	3.5		2.3		6.2	
SODIUM	1380		1090		4850	
VANADIUM	81 *		49 *		107 *	
ZINC	472 N*		135 N*		200 N*	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: LL039045C SDG NO: LL003010C TYPE: GRAB	LL039045D LL039012D GRAB
ALUMINUM	15600 *E	
ARSENIC		1.7 B
BARIUM	147 *	
BERYLLIUM	0.67 B	
CADMIUM	0.75 B	
CALCIUM	10300 *E	
CHROMIUM		21 N*
COBALT	9.9 B	
COPPER	27 N*E	
IRON	21300 *	
LEAD		9.9 N*
MAGNESIUM	3830 *	
MANGANESE	409 *E	
MERCURY		0.04
NICKEL		22 N
POTASSIUM	2500	

TABLE L4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 DRAFT DO NOT CITE
865 AREA

S&A REQUEST: 039
LOCATION: 865 AREA DITCH
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL039045C	LL039045D				
	SDG NO:	LL003010C	LL039012D				
	TYPE:	GRAB	GRAB				
SILVER		3.1					
SODIUM		1560					
VANADIUM		55 *					
ZINC		121 N*					

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	LL039012B	LL039023B	LL039034B	LL039045B		
	SDG NO:	LL121987	LL122087	LL122087	LL122087		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
BIS(2-ETHYLHEXYL)PHTHALATE		74 J	390 U	420 U	490 U		
DI-N-OCTYLPHTHALATE		410 U	39 J	42 J	49 J		
* UNKNOWN (6.20)					470 J		
* UNKNOWN (16.40)			220 J		200 J		
* UNKNOWN (17.20)			220 J				
* UNKNOWN (17.50)			1300 J		300 J		
* UNKNOWN (18.20)			720 J				
* UNKNOWN (18.40)			880 J				
* UNKNOWN (19.10)			1000 J				
* UNKNOWN (19.20)			1100 J				
* UNKNOWN (20.10)			1200 J				
* UNKNOWN (20.30)		230 J	5200 J	280 J	600 J		
* UNKNOWN (21.00)			710 J				
* UNKNOWN (23.60)			440 J				
* UNKNOWN (24.00)				220 J			
* UNKNOWN (25.30)		190 J			190 J		
* UNKNOWN (27.10)		930 J					
* UNKNOWN (27.40)		350 J					
* UNKNOWN (27.50)		380 J					
* UNKNOWN (30.40)					530 J		

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL039012A	LL039023A	LL039034A	LL039045A		
	SDG NO:	0813	0813	0813	0814		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
ACETONE		14 B	12 U	12 U	44 B		
CARBON DISULFIDE		2 J	6 U	6 U	2 J		
CHLOROFORM		6 U	6 U	2 J	7 U		
ETHYLBENZENE		6 U	6 U	6 U	4 JB		
METHYLENE CHLORIDE		6 U	11	7	7 U		
TOLUENE		6 U	1 JB	6 U	2 JB		

TABLE L4.3.11 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 11 DRAFT DO NOT CITE
865 AREA

S&A REQUEST: 039
LOCATION: 865 AREA DITCH
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO:	LL039012A	LL039023A	LL039034A	LL039045A		
	SDG NO:	0813	0813	0813	0814		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
* UNKNOWN(9.64)				7 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL039012E	LL039023E	LL039034E	LL039045E		
	SDG NO:	LLL7220	LLL7220	LLL7220	LLL7220		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
CS-137		19	22 U	35	35		
G-ALPH		4600	2200	4600	12000		
GROSS-BETA		17000	17000	20000	24000		
H-3		100000	140000	190000	110000		
K-40		9900	10000	10600	8800		

4.17 LLNL Environmental Problem 12: Site 300 Arroyo Contamination

Request Numbers: 40, 41, 42, and 43.
Requester: J. Boros.
Finding and Basis: A potential exists for off-site migration or groundwater contamination from the past practice of discharging process wastewaters directly onto the ground or into stormwater drains. Insufficient characterization of possible impacts from this practice has been done.

4.17.1 Sampling and Analysis Objectives

Statement: Sediment samples from four locations at Site 300 were to be examined to determine if the contaminants listed in section 4.17.2.2 are present in arroyo sediments above normal levels for the area.

Supporting Information: Surface water is analyzed for radioactivity and limited other pollutants, but metals have not been tracked. If such migration occurred, arroyos and ravines near the site perimeter would be affected.

4.17.2 Sampling and Analytical Design

4.17.2.1 Sampling Design

Request 40: Upstream of GSA Complex-Corral Hollow Creek (Fig. 4.40). This sampling point was upstream of Site 300 runoff/discharges. Three grab sediment samples were to be collected from selected areas of the arroyo to the depth of the sediment (Sampling Method: Reference E5.3.1). The Sampling Team arrived at the site at 1130 on 10AUG87. The temperature was approximately 80°F. Wind was 5 to 10 mph out of the west, and the humidity was approximately 20% to 30%. The arroyo was 30 ft wide and very rocky. The area was considered homogeneous because no plant or other potential influences were present. The

Sampling Team selected an area of the arroyo upstream from the site and divided the area into a 60-segment grid. Three segments were then selected for sampling. If a selected area did not contain sediment, Sampling Team members were to move upstream to the first segment that did contain sediment, removing all rocks from the sampling area.

The location chosen was in a state recreational vehicle park because there was no access to private land. Samples collected may be influenced by the effects of the recreational vehicles, such as lead from fuel, exhaust, etc. The site was located 3.5 miles west of the main gate at Site 300 on Corral Hollow Road. Samples were collected from the main stream channel, which had been plowed out sometime in the past. According to the ranger, any flows during the previous spring (1987) had run through the main channel. He indicated that there was very little, if any, flow that year. Samples LL040015 (grid 11) and LL040037 (grid 54) were noted to consist of extremely dry sediment. Sample LL040026 (grid 42) was also collected as planned. Samples were taken between 1143 and 1202.

Request 41: Runoff at SE Corner of GSA, Above Entry into Corral Hollow Creek (Fig 4.41). Three grab sediment samples were to be collected in the ditch to the depth of the sediment (Sampling Method: Reference E5.3.1). The ditch was 3 ft wide, and the area to be sampled was less than 100 m^2. The area was considered homogeneous with respect to outside influences and the sediment. The Sampling Team was to divide the area into a 1x60-segment grid and randomly select three segments for sampling.

The Sampling Team arrived at the site at 1330 on 10AUG87. The temperature was approximately 90°F and winds were 5 to 10 mph from the west. The site was located on fire station property, approximately 1/2 mile downstream from the entrance to Site 300. The grid was started approximately 130 ft east of the west property boundary. This site was slightly downstream from the original

request location because access onto private property was denied. According to the ranger, there had been little or no flow in the channel that year. Sediment was mostly sand. Samples LL041016 (grid 27) and LL041027 (grid 49) consisted of very dry, sandy sediment. Sample LL041038 (grid 56) was also collected as planned. Samples were taken at 1350.

Request 42: Corral Hollow Creek Downstream From All Site 300 Discharges and Activities (Fig. 4.42). Three grab sediment samples were to be collected from the creek to the depth of the sediment (Sampling Method: Reference E5.3.1). The Sampling Team was advised to coordinate this request with LLNL personnel to ensure that they did not go on private property. The ditch was 3 ft wide, and the area to be sampled was less than 100 m^2. The area was considered homogeneous with respect to outside influences and the sediment. The area was divided into a 1x60-segment grid, and three segments were randomly selected for sampling.

The Sampling Team started sampling at approximately 1430 on 10AUG87. The weather was sunny and hot with a temperature of 93°F. The wind was out of the west at 0 to 5 mph. The sampling location was 0.4 mile east of the fire station on Corral Hollow Road, near the first bridge. An abundance of dry vegetation and leaves indicated that there had been no flow in the creek for quite some time. Silty clay, puddling-type sediments were not visible. Samples LL042017 (grid 12), LL042028 (grid 23), and LL042039 (grid 54) were collected from the creek bottom. All three samples were very dry and sandy. Samples were taken between 1430 and 1445.

Request 43: Drainage Ditch Adjacent to Sewage Pond Leading to Corral Hollow Creek (Fig. 4.43). Three grab sediment samples were to be collected from the ditch to the depth of the sediment (Sampling Method: Reference E5.3.1). The area selected for sampling was less than 100 m^2 and was considered homogeneous with respect to any other influences. The Sampling Team was to select an area

at least 60 ft long between the pond and the road where the most sediment seemed to have accumulated. The area was to be divided into a 60-segment grid, and three segments were to be randomly selected for sampling. This sampling point would have served to check the past practice of dumping wastewater from service and support facilities within the GSA into a ditch draining the immediate area south of those activities and any adverse impact on the ditch prior to Corral Hollow Creek.

When the Sampling Team arrived at the sampling site on 06AUG87, they found that LLNL had placed two new wells in the area, which eliminated the drain that was to be sampled. This was observed by S. Barisas of Department of Energy Headquarters (DOE-HQ). Samples LL043018, LL043029, and LL043030 were not collected.

4.17.2.2 Analytical Design

The parameters analyzed and/or measured for LLNL Environmental Problem 12 were as follows:

Request 40: The parameters analyzed were ICP-metals, TCLP-metals, AA-mercury, gross alpha, gross beta, gamma scan, and tritium. (If any parameter exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 41: The parameters analyzed were ICP-metals, TCLP-metals, AA-mercury, and tritium. (If any parameter exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 42: The parameters analyzed were ICP-metals, TCLP-metals, AA-mercury, gross alpha, gross beta, gamma scan, and tritium. (If any parameter

exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was run.) No field measurements were required.

Request 43: The parameters to have been analzyed were to be ICP-metals, TCLP-metals, AA-mercury, gross alpha, gross beta, gamma scan, and tritium. (If any parameter exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was to be run.) No field measurements were required. (NOTE: No samples were collected for this request.)

4.17.3 Field and Analytical Data

Field Data:

Request 40. NA

Request 41. NA

Request 42. NA

Request 43. NA

Field Data Evaluation:

Request 40. NA

Request 41. NA

Request 42. NA

Request 43. NA

Analytical Data:

Metals. *Analytical results for metals in sediment are presented in Table L4.3.12. Twenty-one metals were detected above the quantitation limits of the analytical procedure at the sites of Requests 40 and 42. Samples for Request 40 were collected for background data. Nineteen metals were detected at the site of Request 41. No parameters exceeded RCRA TCLP levels during normal analysis.*

Request 40. Samples were collected for background data.

Request 41. Of the 19 metals detected, cadmium and lead were below the CRQL.

Request 42. Of the 21 metals detected, antimony, beryllium, cadmium, cobalt, and selenium were below the CRQL.

Request 43. No samples were collected for this request because the drain to be sampled had been eliminated at the site.

Radiochemistry.

Request 40. These results indicate reference for the environmental problem. Tritium, gross alpha, and gross beta averaged 666, 4760, and 25,000 pCi/kg, respectively.

Request 41. Average gross beta was 22,000 pCi/kg. Average gross alpha and tritium are above reference at 9433 and 1346 pCi/kg, respectively.

Request 42. Average gross beta was 19,500 pCi/kg. Average gross alpha and tritium are above reference at 6233 and 4333 pCi/kg, respectively.

Analytical Data Evaluation:

Metals. Of the metals detected for Requests 41 and 42, the following were below the CRQL for most or all samples: antimony, beryllium, cadmium, cobalt, lead, and selenium.

Radiochemistry. Nine sediment samples were taken to characterize the Site 300 Arroyo contamination. Three samples (Request 40) were taken for reference. The remaining six samples served to determine the extent of downstream contamination. Gross alpha, beta, tritium, and gamma activities were determined. Results are given in Table L4.3.12.

4.17.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level II, and the sampling is rated Quality Level I. The overall analytical rating is Quality Level II.

Field Data: The field sampling plan is rated Quality Level II as a reference sample (Request 40) should have requested volatile and semivolatile analyses in order to allow comparison with other similar problems of this site. Since the site to be sampled for Request 43 was eliminated and confirmed by a Survey Team member, the reduced number of samples was justified.

Analytical Data: The analytical request included a request for TCLP to be performed if the total metal concentration of the target metals exceeded the regulatory limit. TCLP was not performed although selenium exceeded the TCLP limit for Request 40. It should be noted that the sample represented reference and was taken outside the site proper in a state recreational vehicle park. No explicit mention is made of the gamma scan requests of Requests 40 and 42. The scan showed potassium-40, which is a natural gamma emitting nuclide

common in soils, rocks, and sediments. Details on analytical data quality are given below.

Metals. The following QC data flags were assigned to the metals identified in this sample group: duplicate--aluminum, barium, calcium, iron, and zinc; serial dilution--copper; spike--antimony, nickel, and selenium; spike and duplicate--chromium, lead; duplicate and serial dilution--magnesium, manganese. Overall sample quality for this request is Quality Level I, except the following metals at Quality Level II: antimony, chromium, magnesium, manganese, and selenium. Overall sample quality for AA-metals is Quality Level I.

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.

Environmental Problem: LLNL 12
Request Number: LLNL 40

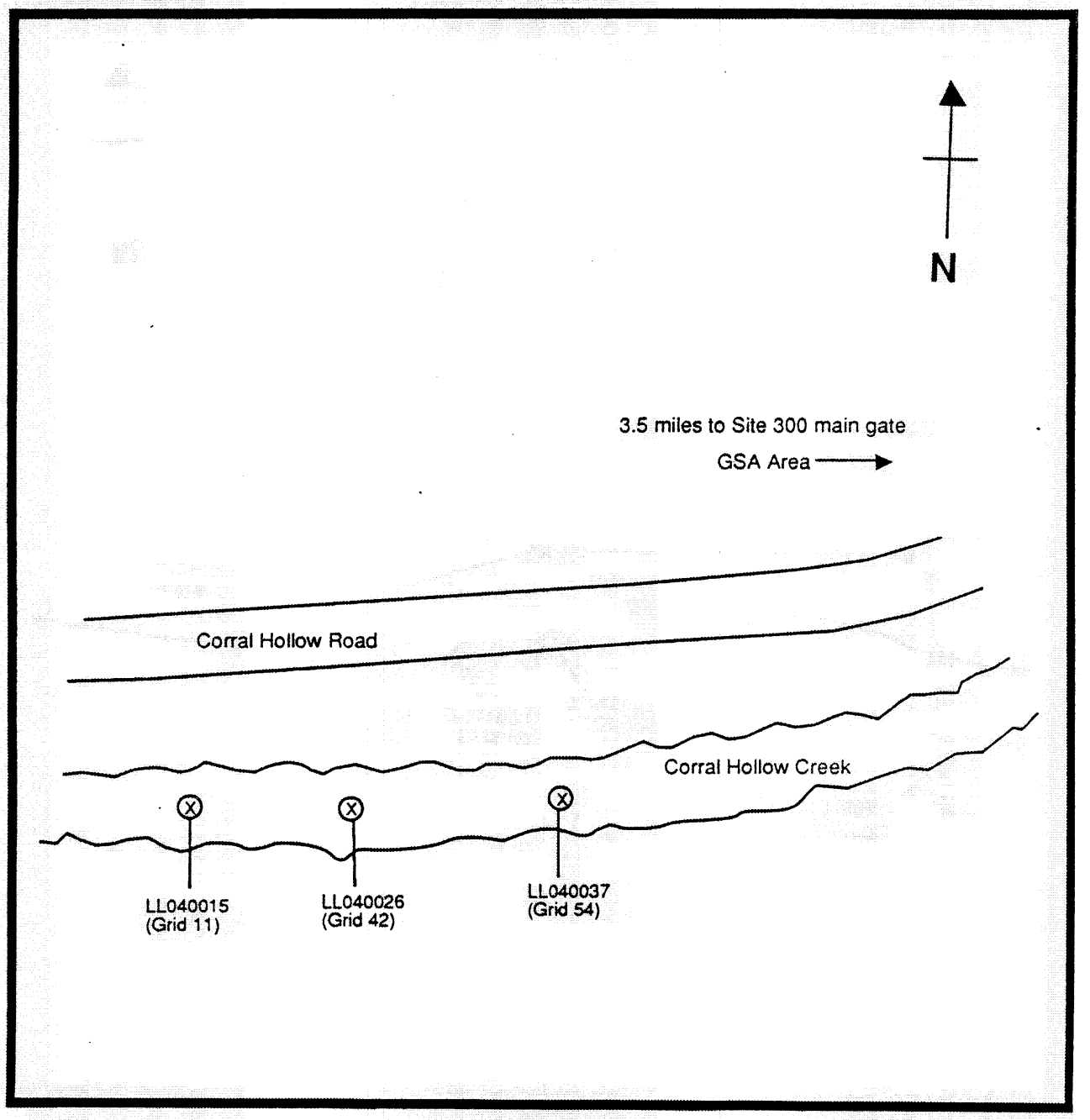

Figure L4.12a. Upstream of GSA Complex-Corral Hollow Creek (LLNL Request 40)

Environmental Problem: LLNL 12
Request Number: LLNL 41

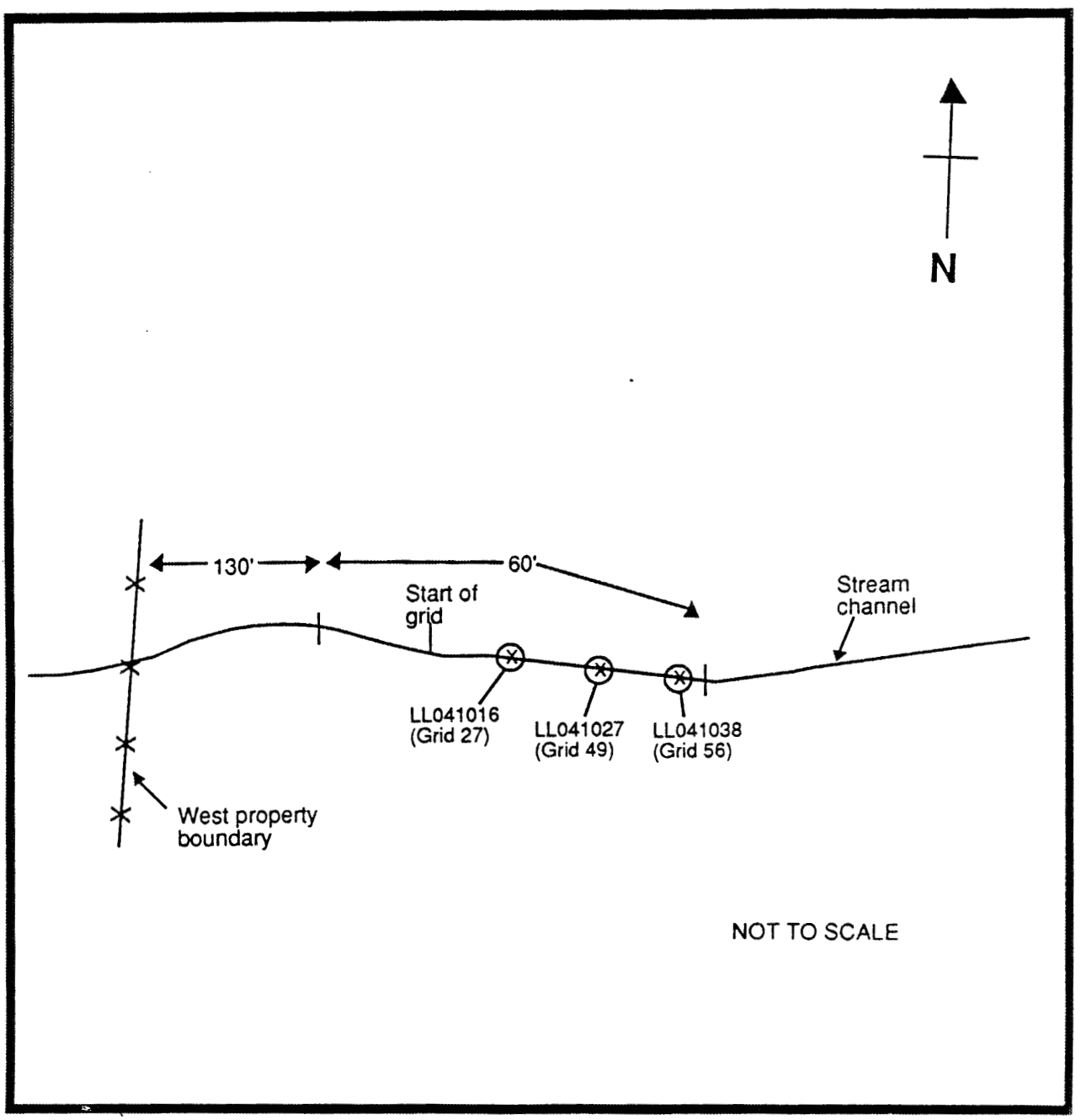

Figure L4.12b. Runoff at SE Corner of GSA, Above Entry into Corral Hollow Creek (LLNL Request 41)

Environmental Problem: LLNL 12
Request Number: LLNL 42

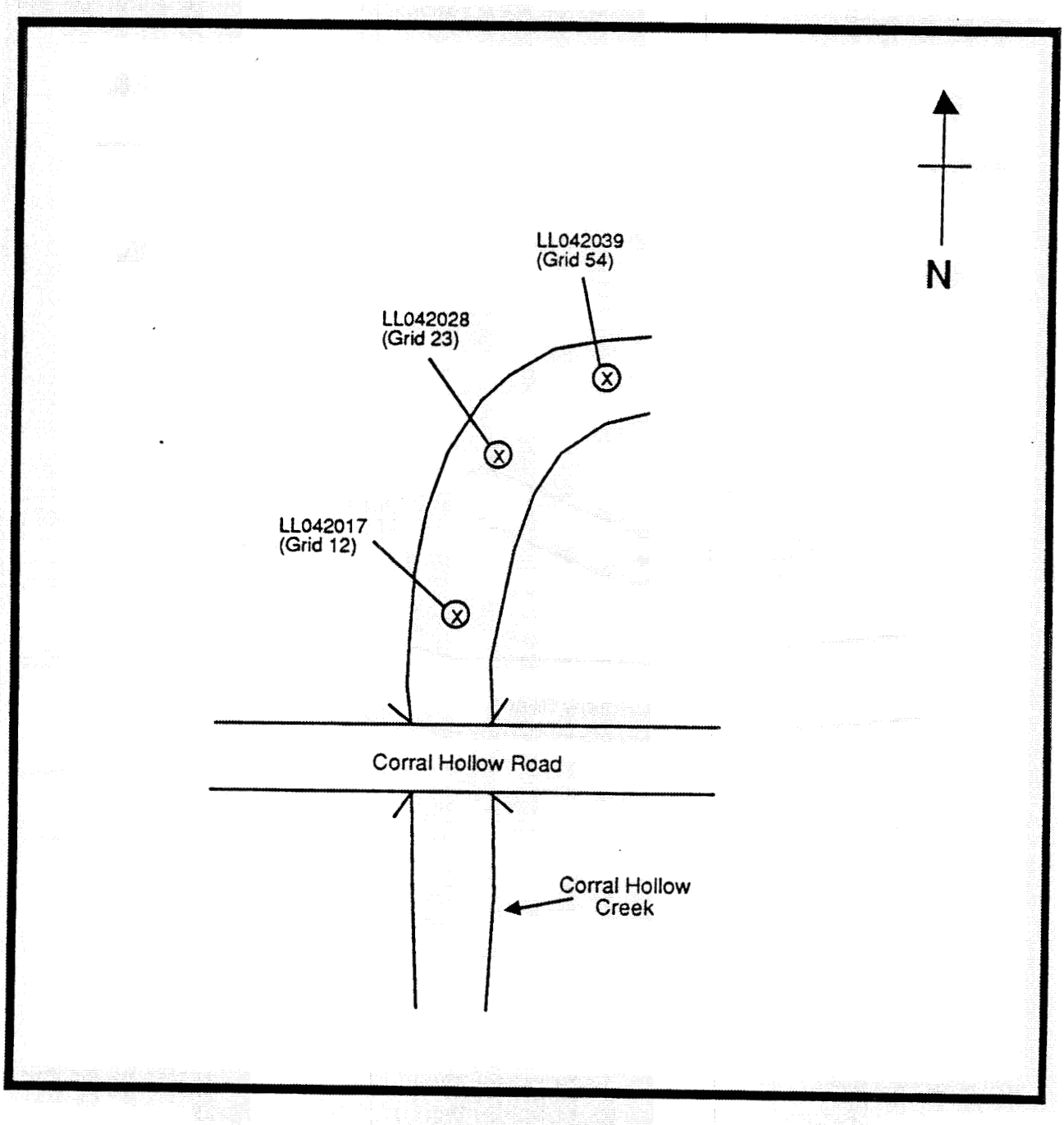

Figure L4.12c. Corral Hollow Creek Downstream From All Site 300 Discharges and Activities (LLNL Request 42)

Environmental Problem: LLNL 12
Request Number: LLNL 43

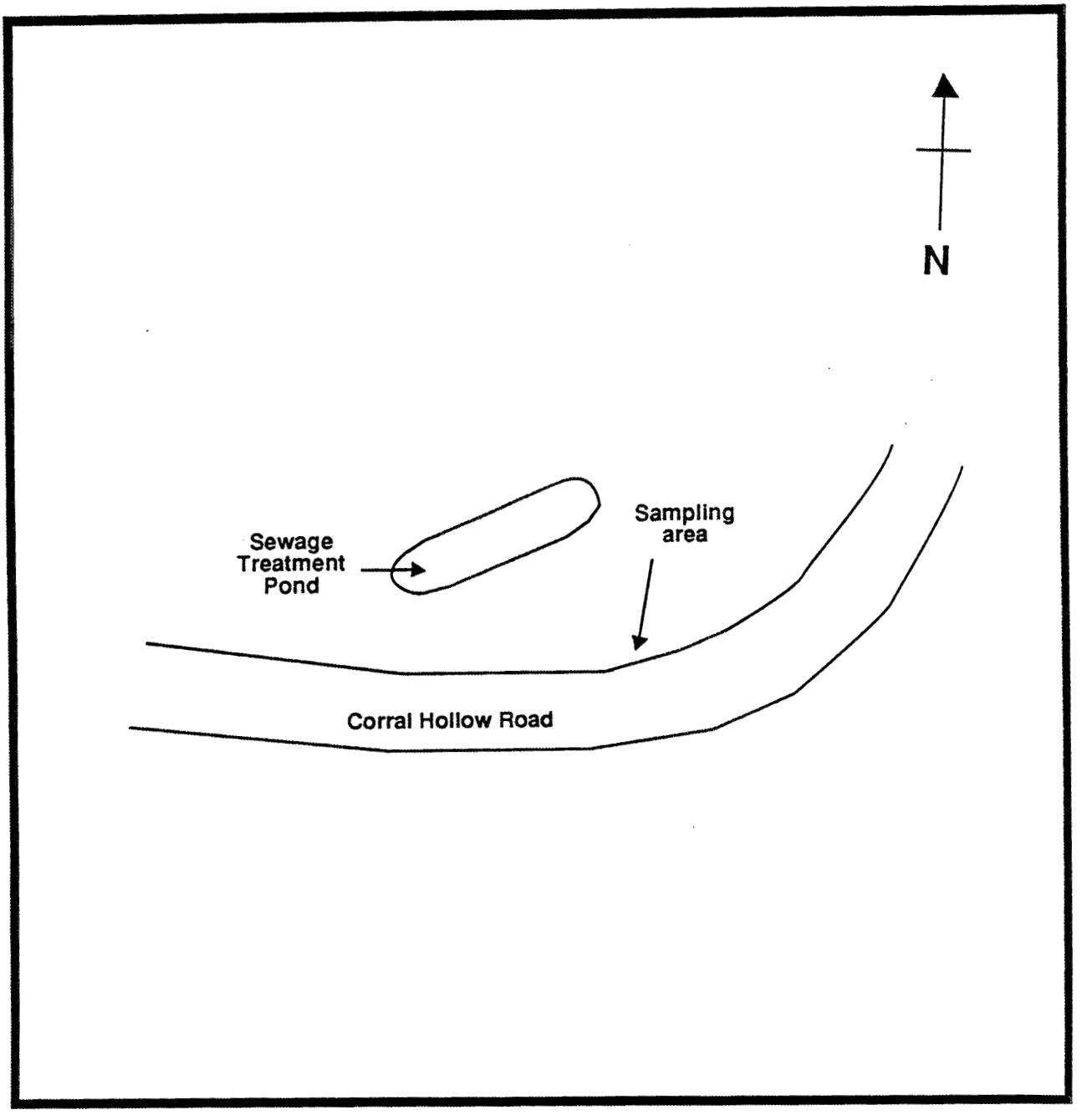

Figure L4.12d. Drainage Ditch Adjacent to Sewage Pond Leading to Corral Hollow Creek (LLNL Request 43)

TABLE L4.2.12 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 12

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	HE NUMB HITS	HE 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
LL040	CORRAL H CRK	ARROYO	SEDIMENT	3	3	BKGRN	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
LL041	CORRAL H CRK	DITCH	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
LL042	CORRAL H CRK	CREEK	SEDIMENT	3	3	GRAB	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3
LL043	CORRAL H CRK	DITCH	SEDIMENT	3	0	GRAB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		MED TOTAL		12	9		0	0	9	9	0	0	0	0	0	0	0	0	0	0	9	9
		EP TOTAL		12	9		0	0	9	9	0	0	0	0	0	0	0	0	0	0	9	9

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TABLE L4.3.12 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 12 DRAFT DO NOT CITE
SITE 300 ARROYO CONTAMINATION

S&A REQUEST: 040
LOCATION: UPSTREAM OF GSA COMPLEX - CORRAL HOLLOW CREEK
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL040015A	LL040015B	LL040026A	LL040026B	LL040037A	LL040037B
	SDG NO:	LL009016C	LL001018D	LL009016C	LL001018D	LL009016C	LL001018D
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
ALUMINUM		20200 *		11800 *		11400 *	
ARSENIC			5.6 *N		3.8 *N		3.5 *N
BARIUM		231 *		120 *		91 *	
BERYLLIUM		0.76		0.37 B		0.37 B	
CADMIUM		0.37 B		0.28 U		0.28 U	
CALCIUM		30500 *		7150 *		13800 *	
CHROMIUM			55		30		36
COBALT		11		7.4		8	
COPPER		34 E		19 E		19 E	
IRON		31900 *		21300 *		22400 *	
LEAD			11		6.5		5.7
MAGNESIUM		10500 *E		7570 *E		7310 *E	
MANGANESE		666 *E		532 *E		624 *E	
MERCURY			0.1		0.1		0.05
NICKEL			68		46		48
POTASSIUM		3100		1700		1600	
SELENIUM		39 BN		5.6 UN		5.5 UN	
SILVER		0.57 U		0.75 B		1.1 B	
SODIUM		1070		591 B		523 B	
VANADIUM		46		31		30	
ZINC		74 *		43 *		46 *	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL040015C	LL040026C	LL040037C
	SDG NO:	LLL7296	LLL7296	LLL7296
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
EU-155		810	43	8900
G-ALPH		30000	4300	19000
GROSS-BETA		2000	26000	0
H-3		17000	0	11000
K-40			12000	

TABLE L4.3.12 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 12 DRAFT DO NOT CITE
SITE 300 ARROYO CONTAMINATION

S&A REQUEST: 041
LOCATION: RUNOFF AT SE CORNER GSA, ABOVE ENTRY INTO CORRAL HOLLOW CREEK
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL041016A	LL041016B	LL041027A	LL041027B	LL041038A	LL041038B
	SDG NO:	LL009016C	LL011010D	LL009016C	LL011010D	LL009016C	LL011010D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		6760 *		6380 *		26700 *	
BARIUM		73 *		85 *		646 *	
BERYLLIUM		0.25 B		0.23 B		1.4	
CADMIUM		0.27 U		0.28 U		0.37 B	
CALCIUM		6420 *		7620 *		29000 *	
CHROMIUM		21 N*		20 N*		30 N*	
COBALT		5 B		4.4 B		24	
COPPER		12 E		11 E		38 E	
IRON		15300 *		14200 *		28100 *	
LEAD		7 B		4.9 B		16 B	
MAGNESIUM		4310 *E		4080 *E		10200 *E	
MANGANESE		292 *E		251 *E		201 *E	
MERCURY			0.47		0.03 B		0.05
NICKEL		18 *		18 *		29 *	
POTASSIUM		1200		1100		2900	
SILVER		0.94 B		0.57 U		0.58 B	
SODIUM		323 B		354 B		1960	
VANADIUM		27		28		83	
ZINC		32 *		30 *		66 *	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL041016C	LL041027C	LL041038C
	SDG NO:	LLL7296	LLL7296	LLL7296
	TYPE:	GRAB	GRAB	GRAB
G-ALPH		10000	4300	14000
GROSS-BETA		16000	21000	30000
H-3		0	40	4000
K-40		15000	10000	14000

TABLE L4.3.12 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 12 DRAFT DO NOT CITE
SITE 300 ARROYO CONTAMINATION

S&A REQUEST: 042
LOCATION: CORRAL HOLLOW CREEK DOWNSTREAM FROM ALL SITE 300 DISCHARGES AND ACTIVITIES
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL042017A	LL042017B	LL042028A	LL042028B	LL042039A	LL042039B
	SDG NO:	LL009016C	LL039012D	LL009016C	LL039012D	LL009016C	LL039012D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		6070 *		5360 *		4710 *	
ANTIMONY		7.4 BN		4 UN		4.2 UN	
ARSENIC			2.8		1.9		2.3
BARIUM		85 *		76 *		53 *	
BERYLLIUM		0.23 B		0.19 B		0.2 B	
CADMIUM		0.57 B		0.27 U		0.28 U	
CALCIUM		7200 *		16600 *		32500 *	
CHROMIUM			15 N*		15 N*		16 N*
COBALT		4.2 B		3.5 B		3.1 B	
COPPER		13 E		10 E		11 E	
IRON		13600 *		11700 *		10600 *	
LEAD			3.7 N*		3.6 N*		4 N*
MAGNESIUM		4030 *E		4000 *E		3580 *E	
MANGANESE		257 *E		383 *E		433 *E	
MERCURY			0.04 B		0.06		0.14
NICKEL			19 N		18 N		23 N
POTASSIUM		1100		940		750	
SELENIUM		5.4 UN		5.3 UN		5.9 BN	
SODIUM		573 B		534 B		160 B	
VANADIUM		26		20		17	
ZINC		34 *		30 *		25 *	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL042017C	LL042028C	LL042039C
	SDG NO:	LLL7296	LLL7296	LLL7296
	TYPE:	GRAB	GRAB	GRAB
G-ALPH		8900	2000	7800
GROSS-BETA		26000	14000	19000
H-3		10000	2000	1000
K-40		13000	12000	13000

4.18 LLNL Environmental Problem 13: Firing Tables

Request Number: 44.
Requester: R. Basinski.
Finding and Basis: Hazardous waste leachate from the firing tables at Site 300 may be contaminating the subsurface and groundwater. Water used for dust suppression after each shot and runoff from precipitation percolate through the gravel substrate.

4.18.1 Sampling and Analysis Objectives

Statement: Sediment samples were to be examined to determine if the contaminants listed in Sect. 4.18.2.2 were present in sediments above normal levels for the area.

Supporting Information: Gravel from the firing tables was disposed of at the Site 300 hazardous waste landfill. The gravel contained beryllium and uranium and had failed the test for EP toxicity for lead. Water used for dust suppression after each shot and runoff from precipitation percolated through the gravel substrate, including the gravel disposed of as a hazardous waste. Groundwater and soil that may have been contaminated have not been assessed.

4.18.2 Sampling and Analytical Design

4.18.2.1 Sampling Design

Request 44: Firing Tables (Fig. L4.13a through L4.13c). Nine sediment samples were to be collected in drainage ditches at three selected firing tables to the depth of the sediment (Sampling Method: Reference E5.3.1). Firing tables 850, 851, and 801 were selected for sampling because they were the most active areas. Based upon observations during the Survey, the firing tables had runoff areas or

ditches that would probably contain potential contaminants from the tables. These ditches or runoff areas should show the same characteristics as the gravel areas because one would not expect any binding to the gravel, and the gravel was washed after shots. It was not considered practical to sample the gravel because only the dust would contain contaminants and the probability of collecting enough dust for sampling was considered low. The Sampling Team was to select a runoff area from each of the three firing tables, divide the area into a 1x60-segment grid, and randomly select three segments for sampling.

The Sampling Team arrived at firing table 851 at 1100 on 05AUG87. The weather was sunny and clear, and the temperature was 87°F. The area selected for sampling at firing table 851 was the only area where water would travel if it percolated through gravel at the firing table. An LLNL employee at this firing table stated that water had never been observed in the french drain system. The ditch selected had water in it. Sediment was approximately 4 in. deep. Samples LL044075 (grid 2), LL044086 (grid 31), and LL044097 (grid 35) were collected between 1115 and 1122. At sample LL044075, the ditch was wet and water accumulated in the first sample hole.

The Sampling Team arrived at firing table 850 at 1145. The day was sunny, and the temperature was 90°F. Sampling Team members talked with an LLNL employee who said no water from the firing table washdown ever reached the "environment." He added that recently they had used "a lot" of water to settle new gravel, and they never noticed water entering the ditch. The area selected was the only route that water would travel. The ditch was concrete and had very little sediment (approximately 1/4 in.) for the first 100 ft. However, as it neared the road, there was an area where most of the contaminants, if present, would fall out. A deep pool would be formed because the drainpipe across the road was 4 ft above the bottom of the pool. Three areas in this pool area were selected, and samples LL044042 (grid 12), LL044053 (grid 25), and LL044064 (grid

45) were collected to a depth of 6 in. No moisture was encountered during collection of sample LL044042.

The Sampling Team arrived at firing table 801 at 1315. The day was sunny with a clear sky, and the temperature was 95°F. Although most of the water coming from firing table 801 would come down the ditch on the right side of the road (facing the firing table), it was felt that some percentage would come down the left side. Two samples were collected 10 and 20 ft from the uppermost end of the right ditch, and one sample was collected from the left side. Both ditches had a "ditch witch" run monthly to maintain the ditch. Therefore, the sides of the ditch had approximately 2/3 of the bottom sediment. Each sample contained 1/3 from the ditch bottom and 1/3 from each side. The bottom 1/3 was collected from 0 to 3 in. deep. Cattails were located throughout the ditch, and water was in the ditch. Samples LL044019 (grid 3), LL044020 (grid 46), and LL044031 (grid 50) were collected at 1330. QC rinsate LL044100 was collected at 1750 after samples were obtained and following decontaminating of the equipment.

4.18.2.2 Analytical Design

The parameters analyzed were ICP-metals, AA-mercury, TCLP-metals, gross alpha, gross beta, gamma scan, and total uranium. (If any parameter exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was to be run.) No field measurements were required.

4.18.3 Field and Analytical Data

Field Data: *NA*

Field Data Evaluation: NA

Analytical Data:

Metals. *Analytical results for metals in sediment are presented in Table L4.3.13. Twenty-two to 24 metals were detected above the quantitation limits of the analytical procedure at the three sites sampled.*

Firing table 801. Of the 23 metals detected, five were below the CRQL: thallium, selenium, mercury, beryllium, and arsenic.

Firing table 850. Of the 22 metals detected, three were below the CRQL: arsenic, mercury, and thallium.

Firing table 851. Of the 24 metals detected, four were below the CRQL: antimony, arsenic, selenium, and thallium.

Radiochemistry.

Firing table 801. The average concentration of cesium-137 was 33.7 pCi/kg. Gross alpha was 700 pCi/kg. Gross beta was 28,333 pCi/kg.

Firing table 850. The average concentration of cesium-137 was 49 pCi/kg. The average gross alpha was 6300 pCi/kg; gross beta was 20,666 pCi/kg.

Firing table 851. Cesium-137 was 33 pCi/kg. Gross alpha was 17,000 pCi/kg and gross beta was 62,000 pCi/kg.

Analytical Data Evaluation:

Metals. No parameters exceeded RCRA TCLP levels during normal analysis.

Radiochemistry. Sediment samples were taken below three firing tables. Three samples from each firing table were analyzed for gross alpha, beta, and gamma activity. Results are given in Table L4.3.13.

4.18.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level II, and sampling is rated Quality Level I. The overall analytical rating is Quality Level I.

Field Data: The plan called for sampling material in the runoff area because the gravel bed itself would contain an insufficient amount of contaminants and the gravel is washed down with water. Comments are recorded citing LLNL employees noting no water reaching the french drain or "environment."

Analytical Data: Analytical results were adequate to characterize the sampled areas for the metals and radiological contamination. None of the target metals exceeded the TCLP limits in concentration. Details on analytical data quality are given below.

Metals. The following QC data flags were assigned to the metals identified in this sample group: duplicate--barium, iron, magnesium, nickel, and vanadium; spike--antimony; spike and duplicate--zinc, chromium; spike, duplicate, and serial dilution--copper; spike and serial dilution--aluminum, calcium, and manganese. Overall sample quality for this request is Quality Level II, except copper at Quality Level III in samples LL044019, LL044020, LL044075, LL044086, and LL044097. Overall sample quality for AA-metals is Quality Level I.

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.

Environmental Problem: LLNL 13
Request Number: LLNL 44

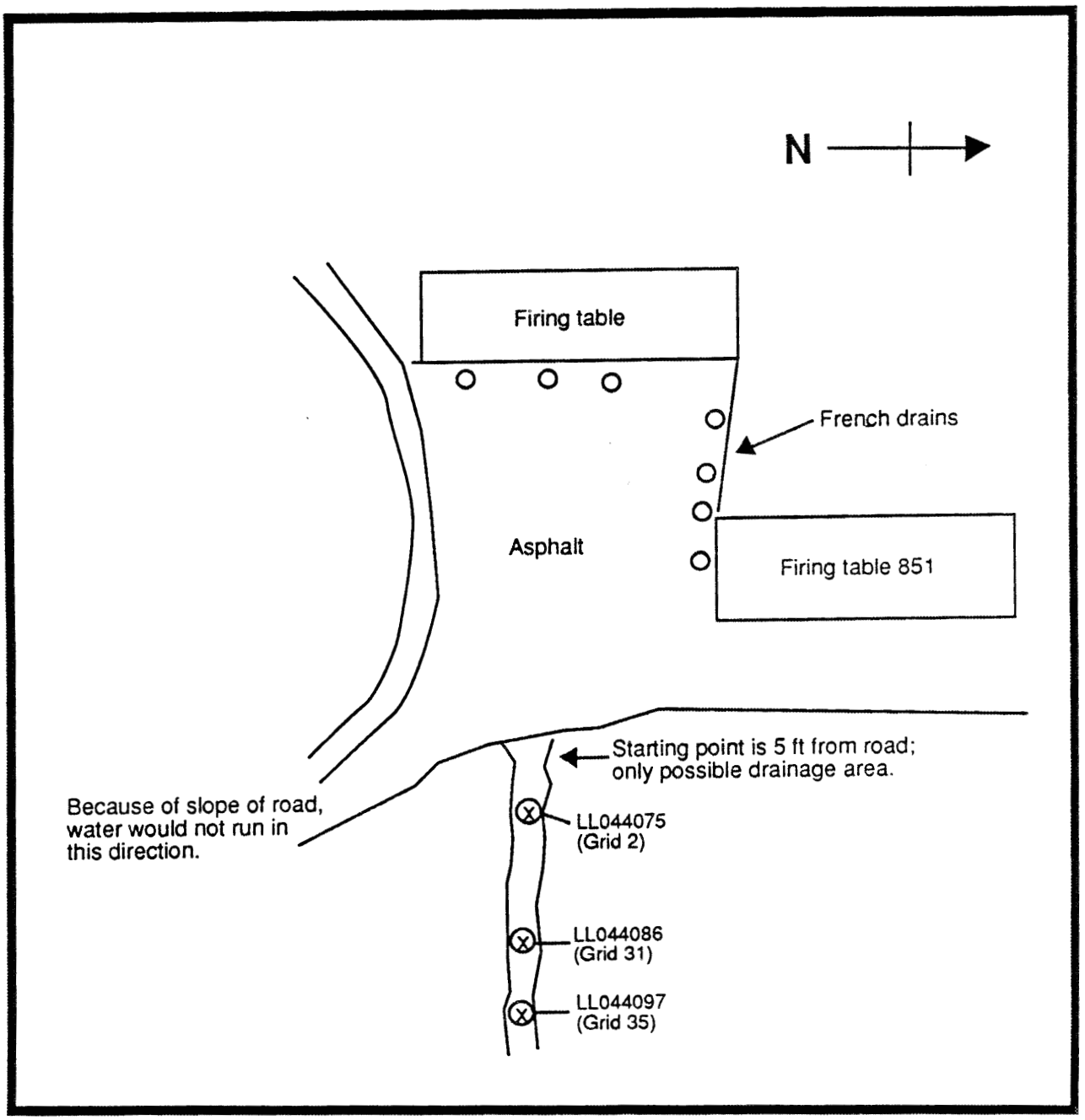

Figure L4.13a. Firing Table 851 (LLNL Request 44)

Environmental Problem: LLNL 13
Request Number: LLNL 44

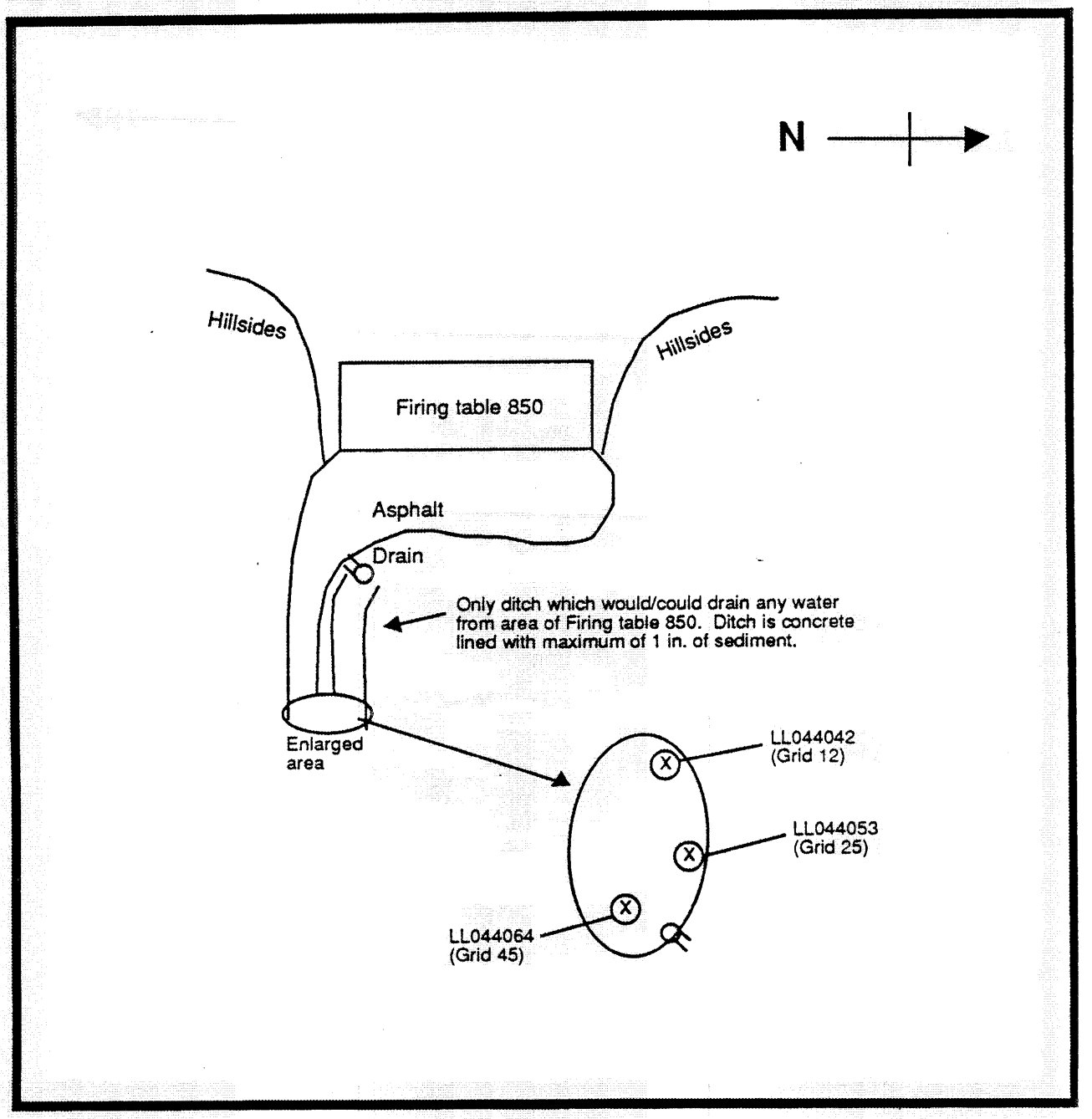

Figure L4.13b. Firing Table 850 (LLNL Request 44)

Environmental Problem: LLNL 13
Request Number: LLNL 44

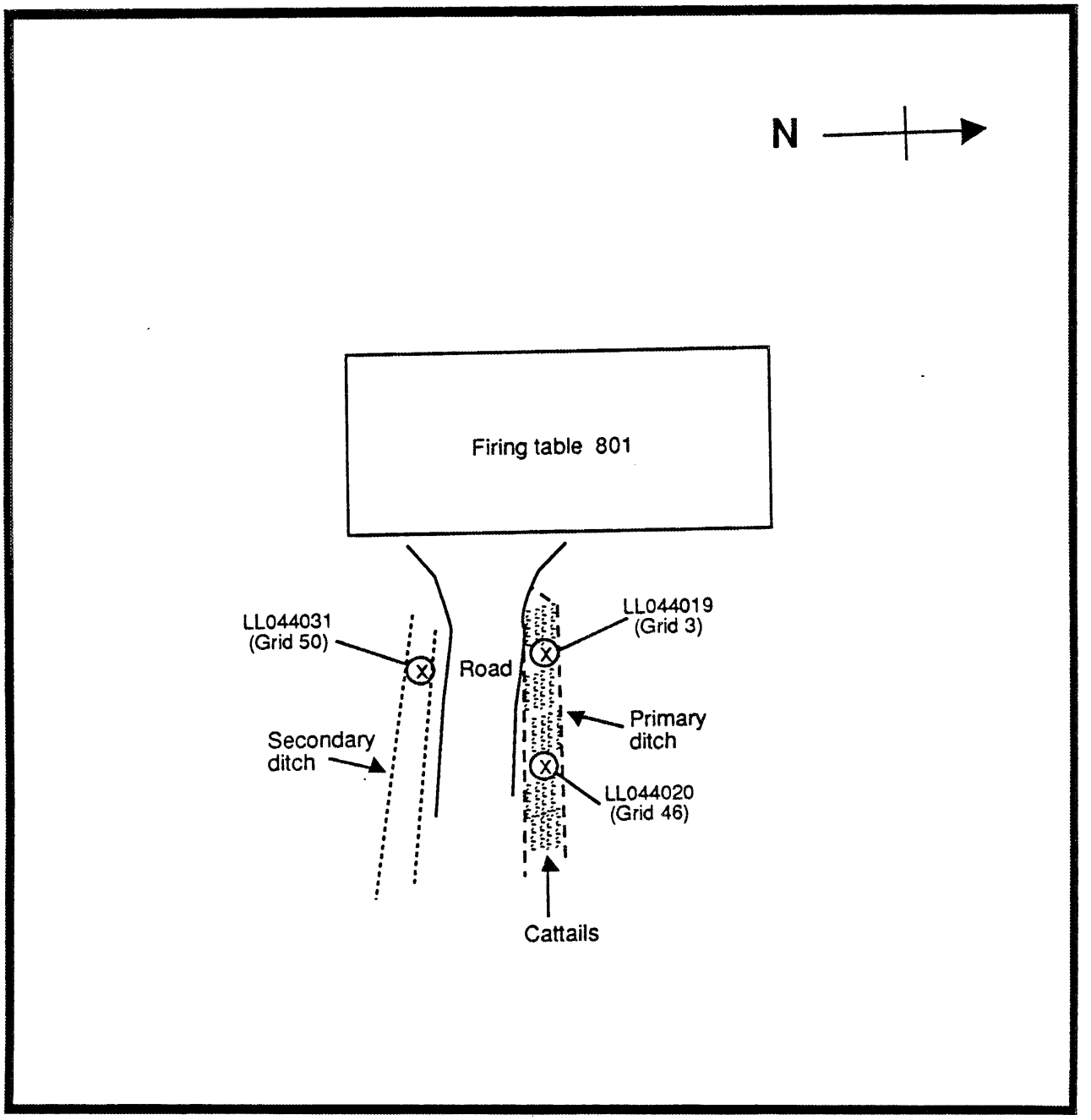

Figure L4.13c. Firing Table 801 (LLNL Request 44)

TABLE L4.2.13 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 13

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	HE NUMB HITS	HE 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
LL044	FIRING TABLE	DITCHES	SEDIMENT	9	9	GRAB	0	0	9	9	0	0	0	0	0	0	0	0	0	0	9	9
		MED TOTAL		9	9		0	0	9	9	0	0	0	0	0	0	0	0	0	0	9	9
LL044	FIRING TABLE	DITCHES	SUR WATER	1	1	QC RN	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
		MED TOTAL		1	1		0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
		EP TOTAL		10	10		0	0	10	10	0	0	0	0	0	0	0	0	0	0	10	10
		TOTAL		344	292		7	10	181	181	39	39	12	13	22	35	142	158	216	216	169	169

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TABLE L4.3.13 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 13 DRAFT DO NOT CITE
FIRING TABLES

S&A REQUEST: 044
LOCATION: FIRING TABLE 801
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: LL044019A	LL044019B	LL044020A	LL044020B	LL044031A	LL044031B
	SDG NO: LL003010C	LL039012D	LL003010C	LL039012D	LL003010C	LL039012D
	TYPE: GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM	30300 *E		14100 *E		11300 *E	
ARSENIC		1.3 B		0.84 B		0.94 B
BARIUM	238 *		114 *		115 *	
BERYLLIUM		0.51 B		0.54 B		0.15 B
CADMIUM	1.1		0.28 U		0.68 B	
CALCIUM	14400 *E		8070 *E		5580 *E	
CHROMIUM		17 N*		14 N*		11 N*
COBALT	15		7.7		6.3 B	
COPPER	37 N*E		17 N*E		20 N*E	
IRON	33700 *		19700 *		16200 *	
LEAD		23 N*		10 N*		19 N*
MAGNESIUM	9080 *		5870 *		4030 *	
MANGANESE	627 *E		350 *E		417 *E	
MERCURY		0.02 B		0.02 B		0.02 B
NICKEL	18 *		13 *		10 *	
POTASSIUM	3700		2300		1600	
SELENIUM		0.23 B		0.12 U		0.05 U
SILVER	2.3		2		1.8	
SODIUM	1870		882		820	
THALLIUM		0.56 B		0.12 B		0.29 B
URANIUM, TOTAL	6.1		7.9		3	
VANADIUM	83 *		40 *		36 *	
ZINC	91 N*		210 N*		56 N*	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO: LL044019D	LL044020D	LL044031D
	SDG NO: LLL7219	LLL7219	LLL7219
	TYPE: GRAB	GRAB	GRAB
CS-137	20 U	65	16 U
G-ALPH	3200	8900	11000
GROSS-BETA	30000	17000	38000
K-40	10000	9100	9100

TABLE L4.3.13 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 13 DRAFT DO NOT CITE
FIRING TABLES

S&A REQUEST: 044
LOCATION: FIRING TABLE 850
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL044042A	LL044042B	LL044053A	LL044053B	LL044064A	LL044064B
	SDG NO:	LL003010C	LL039012D	LL003010C	LL039012D	LL003010C	LL039012D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		14600 *E		21400 *E		19000 *E	
ARSENIC			1.1 B		1 B		1 B
BARIUM		232 *		204 *		181 *	
BERYLLIUM			1.1		1.2		1.2
CADMIUM		0.82		1.2		1.1	
CALCIUM		11200 *E		8550 *E		7290 *E	
CHROMIUM			17 N*		18 N*		16 N*
COBALT		9.2		11		9.7	
COPPER		39 N*E		222 N*E		79 N*E	
IRON		21600 *		27600 *		26200 *	
LEAD			25 N*		26 N*		24 N*
MAGNESIUM		4090 *		5360 *		6130 *	
MANGANESE		883 *E		528 *E		500 *E	
MERCURY			0.03 B		0.03 B		0.02 B
NICKEL		11 *		13 *		16 *	
POTASSIUM		2100		3100		2500	
SILVER		1.8		1.8		1.7	
SODIUM		1100		1520		1320	
THALLIUM			0.26 B		0.2 B		0.2 B
URANIUM, TOTAL		8		7.9		9.6	
VANADIUM		49 *		69 *		67 *	
ZINC		63 N*		119 N*		239 N*	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL044042D	LL044053D	LL044064D
	SDG NO:	LLL7219	LLL7219	LLL7219
	TYPE:	GRAB	GRAB	GRAB
CS-137		35	40	73
G-ALPH		10000	5700	3200
GROSS-BETA		18000	22000	22000
K-40		8300	9100	8800

TABLE L4.3.13 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 13 DRAFT DO NOT CITE
FIRING TABLES

S&A REQUEST: 044
LOCATION: FIRING TABLE 851
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	LL044075A	LL044075B	LL044086A	LL044086B	LL044097A	LL044097B
	SDG NO:	LL003010C	LL039012D	LL003010C	LL039012D	LL003010C	LL039012D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		21800 *E		21000 *E		19800 *E	
ANTIMONY		7.8 BN		6 UN		5.7 UN	
ARSENIC			1.3 B		1.2 B		1.2 B
BARIUM		163 *		179 *		151 *	
BERYLLIUM			2.7		1.9		4.2
CADMIUM		1.1		0.4 B		0.66 B	
CALCIUM		12100 *E		10600 *E		8240 *E	
CHROMIUM			23 N*		20 N*		19 N*
COBALT		12		11		7.5 B	
COPPER		35 N*E		42 N*E		40 N*E	
IRON		24000 *		22200 *		23500 *	
LEAD			38 N*		46 N*		35 N*
MAGNESIUM		7920 *		6980 *		7150 *	
MANGANESE		348 *E		363 *E		420 *E	
MERCURY			0.05		0.05		0.05
NICKEL		18 *		14 *		13 *	
POTASSIUM		2900		3300		2700	
SELENIUM			0.27 U		0.21 B		0.18 U
SILVER		7.4		19		24	
SODIUM		1600		1650		1230	
THALLIUM			1 B		0.68 B		0.44 B
URANIUM, TOTAL		59		81		95	
VANADIUM		58 *		54 *		49 *	
ZINC		122 N*		162 N*		80 N*	

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	LL044075D	LL044086D	LL044097D
	SDG NO:	LLL7219	LLL7219	LLL7219
	TYPE:	GRAB	GRAB	GRAB
CS-137		12	32	54
G-ALPH		14000	20000	17000
GROSS-BETA		40000	68000	78000
K-40		11000	15000	14000

TABLE L4.3.13 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 13 DRAFT DO NOT CITE
FIRING TABLES

S&A REQUEST: 044
LOCATION: FIRING TABLE 851
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	LL044100A	LL044100B				
	SDG NO:	LL001041F	LL001041G				
	TYPE:	RINSATE	RINSATE				
ALUMINUM		123 B					
BARIUM		6 B					
CALCIUM		868 B					
CHROMIUM			60				
COPPER		11 B					
IRON		1740					
LEAD			9.5				
MAGNESIUM		81 B					
MANGANESE		26					
MERCURY			0.03 B				
NICKEL		68					
POTASSIUM		160 B					
ZINC		15 B					

RADIOCHEMISTRY (PCI/L)	SAMP NO:	LL044100C					
	SDG NO:	LLL7219					
	TYPE:	RINSATE					
G-ALPH		0					
GROSS-BETA		3.2					

4.19 SNLL Environmental Problem 1: Arroyo Seco

Request Numbers: 1, 2, 3, and 4.
Requester: J. Boros.
Finding and Basis: On occasion, contaminated waters have been discharged to storm drains and subsequently to Arroyo Seco, possibly resulting in off-site migration or groundwater contamination. Contaminated wastewaters from cooling water blowdown have, and may continue to be, released to storm drains. SNLL has not adequately characterized the stormwater runoff of arroyo sediments.

4.19.1 Sampling and Analysis Objectives

Statement: Sediment samples were to be collected to determine if contaminants listed in Sect. 4.19.2.2 were present above normal levels in arroyo sediments.

Supporting Information: Recommended sampling points were selected (with the exception of point 1) because they were located short distances downstream from major stormwater drains. Point 1 was upstream from SNLL plant activities and effluent.

4.19.2 Sampling and Analytical Design

4.19.2.1 Sampling Design

Request 1: Arroyo Seco, Upstream of the SNLL Boundary (Fig. S4.1a). Three grab sediment samples were to be collected from selected areas in the arroyo to a depth of 3 ft (Sampling Method: References E5.2.1 or E5.2.3). No effluent or SNLL plant activity enters Arroyo Seco upstream of this point.

The Sampling Team arrived on-site at the outside of Sandia Arroyo Seco at 1005 on 11AUG87. The temperature was approximately 80°F. The terrain was rocky around the culvert area. The arroyo was assumed to be homogeneous.

The Sampling Team chose a sampling area of less than 100 m^2 from an area where sediments were observed and were expected to accumulate. There were banks on each side of this area. The area was divided into a 1x60-segment grid and three segments were selected at random. Three grab sediment samples were collected at depth by augering on the lower side of each point where sediment was observed. PID was used to determine that the sampling area was free of contaminants. Sample SN001019 (grid 5) was collected at a depth of 0 to 10 in. at 1015; sample SN001020 (grid 31) was collected at a depth of 0 to 8 in. at 1045; and sample SN001031 (grid 41) was collected at a depth of 0 to 12 in. at 1100. QC rinsate SN001042 was collected before the first sample was taken for SNLL Request 1.

Request 2: Arroyo Seco, Downstream of Terra-cotta Pipe on Wall near Building 968, the Tritium Research Laboratory (Fig. S4.1b). The purpose of SNLL Request 2 was to check sediment downstream of the effluent of the terra-cotta pipe carrying cooling water to the arroyo because the pipe was a potential tritium release point. Three grab sediment samples were to be collected from the selected area of the arroyo to a depth as indicated by field PID screening (Sampling Method: Reference E5.2.3). If no indication of volatiles was found, a composite sample representing 0 to 5 ft was to be taken. Although obtaining samples for volatile analysis by using a motorized auger may have presented a risk, this method was to be used because attaining sample depth of greater than 3 ft by using "hand" techniques was questionable.

The Sampling Team arrived at the sampling location at 1320 on 11AUG87. The day was clear, sunny, and hot with a temperature of 93°F. The sampling area

chosen was to be less than 100 m^2, assumed homogeneous, and from an area of the arroyo where sediments were observed and expected to accumulate.

The Sampling Team selected for sampling only 10 yd of the total area of the arroyo because of the extremely dry season and questionable chance of further water migration. This area was divided into a 1x60-segment grid, and three segments were selected at random. Three grab sediment samples were taken. The first hole augered was wet soil, damp at the surface and wet from 6 in. to 2.9 ft. Since water had been observed earlier flowing out of the pipe and information gathered showed this was a quarterly process, the "recharge" of the area allowed the assumption that any potential contaminants could be found in the top 5 ft of sediment at any time. Sample SN002010 (grid 24) was collected at a depth of 0 to 2.8 ft at 1340; sample SN002021 (grid 35) was collected at a depth of 0 to 3 ft at 1350; and sample SN002032 (grid 55) was collected at a depth of 0 to 2.1 ft at 1405.

Request 3: Arroyo Seco, Downstream at West Edge of Bridge (Fig. S4.1c). The sampling point for SNLL Request 3 was adjacent to a fenced yard where a variety of metal parts and equipment were stored for Building 918. This was downstream of the largest stormwater drains carrying runoff from the southern half of the site. Three grab sediment samples were to be collected from the selected area of the arroyo (Sampling Method: Reference E5.2.3 subsurface).

The Sampling Team arrived on-site at approximately 1430 on 11AUG87. The day was hot and dry. The sampling area chosen was to be less than 100 m^2, assumed homogeneous, and from an area of the arroyo where sediments were observed and were expected to accumulate. The area was to be divided into a 1x60-segment grid, and three segments were to be selected at random. Three grab sediment samples were to be collected. Augering was to be done to a maximum of 5 ft, using PID to help determine if there were volatile contaminants. The sampling design could not be followed, however, because the

arroyo was so rocky. Rather than applying the grid, the Sampling Team selected for sampling the following three low areas where sediment had accumulated.

1. Straight south of gate 206 in the scrap yard area.
2. Thirty feet down from the first area.
3. Fifty-four feet from the second area.

Sample SN003011 was collected at a depth of 0 to 3 ft at 1440; sample SN003022 was collected at a depth of 0 to 2.8 ft at 1500; and sample SN003033 was collected at a depth of 0 to 3.2 ft at 1510. The potential contaminant migration path was via stormwater, and although SNLL was a fairly dry area, the recharge should have been sufficient to substantiate potential contaminants in the top 5 ft of sediment/soil.

Request 4: Arroyo Seco, Downstream of Sandia Drive Bridge near South End of D Street (Fig. S4.1d). The sampling point for SNLL Request 4 was immediately downstream of the 170,000 gal. fuel-oil storage tank near Sandia Drive. This was the major oil-handling facility on-site. The sampling area chosen was to be less than 100 m^2 and from an area of the arroyo where sediments were observed and expected to accumulate. The area was to be divided into a 60-segment grid, and three segments were to be selected at random. Three grab sediment samples were to be collected at depths as indicated by field PID screening (Sampling Method: Reference E5.2.3). Augering was to be done at 1-ft intervals to a maximum of 5 ft to help determine the depths. The area was assumed to be homogeneous because it was some distance from any SNLL discharges.

The Sampling Team arrived at the site at 1020 on 13AUG87. After the Sampling Team looked over the site, however, it was determined that the sampling design instructions for randomly selecting three segments from a systematic grid would not produce the best results. Instead, sampling locations were selected based on the most likely area of deposition.

The first location was selected where discharge initially enters the arroyo. The second location was selected approximately 12 ft downstream behind cement blocks placed in the arroyo in an area that pools. The third location was selected at random approximately 100 ft downstream. All three locations were dug and logged with PID to 2.5 ft. Three grab samples were taken from a composite of sediment from the entire hole as there were no significant PID readings. At the time of sampling, there was a slight discharge (approximately 2 L/min) into the arroyo. However, no flow continued down the arroyo as the discharge immediately seeped into the ground.

Sample SN004012 was collected at 1056 at a depth of 0 to 2.5 ft. Water was located at 6 in. and wire at 2 ft. Sample SN004023 was collected at 1103 at a depth of 0 to 2.5 ft. Sample SN004034 was collected at 1140 at a depth of 0 to 2.5 ft. The soil was moist at the last two locations.

4.19.2.2 Analytical Design

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

Request 1: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was to be run.) Field measurements for PID were taken to determine that the area was free of contaminants.

Request 2: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP

analysis was to be run.) Field measurements for PID were made in order to select sample depths.

Request 3: The parameters analyzed were volatiles, semivolatiles, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was to be run.) Field measurements for PID were made to determine the presence of volatile contaminants.

Request 4: The parameters analyzed were volatiles, semivolatiles, pesticides, PCBs, ICP-metals, TCLP-metals, gross alpha, gross beta, gamma scan, and tritium. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was to be run.) Field measurements for PID were made in order to select sample depths.

4.19.3 Field and Analytical Data

Field Data:

Request 1. NA

Request 2. NA

Request 3. NA

Request 4. NA

Field Data Evaluation:

Request 1. NA

Request 2. NA

Request 3. NA

Request 4. NA

Analytical Data:

Metals.

Request 1. Analytical data for metals in sediment are presented in Table S4.3.1. Of the 20 metals detected, the following 4 were below either the CRQL or the IDL in all three samples: antimony, beryllium, silver, and sodium. Of the remaining metals detected, arsenic ranged from 3 to 3.3 mg/kg; barium, 113 to 367 mg/kg; cadmium, 0.66 to 0.72 mg/kg; chromium, 24 to 30 mg/kg; copper, 16 to 17 mg/kg; lead, 5.2 to 8.9 mg/kg; nickel, 27 to 33 mg/kg; and zinc, 37 to 44 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 2. Analytical data for metals in sediment are presented in Table S4.3.1. Of the 20 metals detected, the following 4 were below the CRQL or the IDL in all three samples: antimony, beryllium, silver, and sodium. Of the remaining metals detected, arsenic ranged from 2.9 to 3.7 mg/kg; barium, 173 to 248 mg/kg; cadmium, 0.81 to 1.0 mg/kg; chromium, 29 to 40 mg/kg; copper, 14 to 45 mg/kg; lead, 7.7 to 16 mg/kg; nickel, 32 to 36 mg/kg; and zinc, 40 to 265 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 3. Analytical data for metals in sediment are presented in Table S4.3.1. Of the 20 metals detected, the following 5 were below either the CRQL or the IDL in all three samples: antimony, beryllium, cobalt, silver, and sodium. Of the remaining metals detected, arsenic ranged from 3.5 to 9 mg/kg; barium, 97 to 155 mg/kg; cadmium, 0.7 to 0.75 mg/kg; chromium, 31 to 40 mg/kg; copper, 19 to 64 mg/kg; lead, 7.7 to 14 mg/kg; nickel, 35 to 42 mg/kg; and zinc, 42 to 92 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

Request 4. Analytical data for metals in sediment are presented in Table S4.3.1. Of the 20 metals detected, the following 4 were below either the CRQL or the IDL in all three samples: antimony, beryllium, silver, and sodium. Of the remaining metals detected, arsenic ranged from 2.8 to 4.6 mg/kg; barium, 89 to 94 mg/kg; cadmium, 0.85 to 0.9 mg/kg; chromium, 23 to 43 mg/kg; copper, 16 to 24 mg/kg; lead, 4.9 to 8.3 mg/kg; nickel, 27 to 44 mg/kg; and zinc, 37 to 77 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.

PCBs and other extractables. *Table S4.3.1 presents the results of the analyses for pesticides and PCBs by GC-ECD. Low (<20 ug/kg) concentrations of Endrin and gamma-BHC were detected in only one of the samples collected (SN004012).*

Extractable organics. *Analytical results for semivolatile organic compounds are presented in Table S4.3.1. There were 12 samples for the four requests within this environmental problem. The number of semivolatile organics detected in particular samples ranged from one to 21, with only two samples having more than ten compounds detected. In the three samples for SNLL Request 1, the highest measured or estimated concentration of a semivolatile organic compound was 0.79 mg of bis(2-ethylhexyl)phthalate per kilogram of sediment. In the three*

samples for SNLL Request 2, bis(2-ethylhexyl)phthalate was identified in two samples in measured concentrations of 16 and 310 mg/kg. Diethylphthalate was measured at 2.1 mg/kg in sample SN002010, in which bis(2-ethylhexyl)phthalate was not detected. All other compounds detected in these samples were present in estimated concentrations of less than 1 mg/kg. In the three samples for SNLL Request 3, unknowns were present in estimated quantities of 1.2, 1.6, and 3.2 mg/kg in sample SN003033, but no other compounds were detected in measured or estimated concentrations of as high as 1 mg/kg in these samples. In the three samples for SNLL Request 4, unknowns with similar retention times were detected in all samples. The estimated concentrations were 2.3, 9.3, and 8.4 mg/kg in samples SN004012, SN004023, and SN004034, respectively. All other compounds detected had concentrations estimated at less than 1 mg/kg.

Volatile organics. *Analytical results for volatiles are presented in Table S4.3.1. Results are discussed by request number below.*

Request 1. This is an upstream sample that may be used for reference purposes. An average of five volatiles were detected in small concentrations in each of the three samples.

Request 2. There were six volatiles detected in two of the samples, one volatile (17 ug of methylene chloride per kilogram of sediment) detected in another, and no volatiles detected in sample SN002010. There were two unknowns with estimated concentrations of 200 and 320 ug/kg of sediment in sample SN002032.

Request 3. There were six, seven, and eight volatiles detected in the three respective samples. A compound tentatively identified as a benzene derivative was estimated at 116 ug/kg of sediment in sample SN003011, an unknown compound was estimated at 140 ug/kg of sediment in sample SN003033, and an unknown compound was estimated at 160 ug/kg in sample SN003022. Other volatiles concentrations were all less than 50 ug/kg.

Request 4. Acetone and methylene chloride were detected in small amounts in all three samples and in the corresponding blanks. The only other volatile detected in the three samples was a small amount of a compound tentatively identified as tetrahydrofuran in sample SN004034.

Radiochemistry. All samples of sediment from Arroyo Seco contained tritium contamination. The upstream samples contained an average of 16,000 pCi/kg tritium. Downstream samples ranged from 14,000 to 31,000 pCi/kg. Downstream samples of sediment contained gross alpha and gross beta activities that were not different from upstream values.

Cesium-137 concentrations, found in samples for Requests 3 and 4, were not greater than 360 pCi/kg.

Analytical Data Evaluation:

Metals. The listed metals of interest were found above the CRQL in the samples for the following SNLL requests:

Request 1. Arsenic, barium, cadmium, chromium, copper, lead, nickel, and zinc.

Request 2. Arsenic, barium, cadmium, chromium, copper, lead, nickel, and zinc.

Request 3. Arsenic, barium, cadmium, chromium, copper, lead, nickel, and zinc.

Request 4. Arsenic, barium, cadmium, chromium, copper, lead, nickel, and zinc.

PCBs and other extractables. In general, the data collected is of low quality due to problems with analytical holding times that were exceeded by more than 40 days and poor calibration linearity. The surrogate recoveries for the samples in

Request 4 do not indicate that significant errors resulted from extractions performed a few days after the holding time expired.

Extractable organics. No contamination with semivolatile organic compounds was apparent in these samples.

Volatile organics. Some local contamination with volatiles was apparent for Requests 2 and 3.

Radiochemistry. Three sediment samples taken upstream of the SNLL boundary and nine sediment samples taken downstream were analyzed for gross alpha, gross beta, gamma scan, and tritium. Analytical results are given in Table S4.3.1.

4.19.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level I, and field sampling is rated Quality Level I. The overall analytical rating is Quality Level II.

Field Data: No limitations or qualifications were apparent.

Analytical Data: The volatile holding time for the first three sites was exceeded by 6 days and by 14 days beyond for the fourth site. Semivolatile samples were extracted before the holding time limit. However, several compounds were identified in these samples; thus, some information was gained. Metal analysis were sufficiently accurate to permit the conclusion that TCLP need not be performed. Details on analytical data quality are given below.

Metals. The duplicate sample was outside control limits for aluminum, calcium, iron, and manganese in SNLL Requests 1, 2, and 3. The spike was outside

control limits for antimony and lead in SNLL Requests 1, 2, and 3 and also for antimony in Request 4. The duplicate sample was outside control limits for cobalt and zinc in SNLL Request 4, and the spike for zinc was also outside control limits in Request 4.

Data were Quality Level I for metals, except manganese, nickel, and selenium in SNLL Requests 1 through 3 and all metals (except AA) in Request 4. These exceptions were all Quality Level II. AA-metals data were of Quality Level I.

PCBs and other extractables. Although it is possible to detect compounds at less than the method quantitation limit, the certainty of the quantitation is decreased. Where a compound was detected at a concentration less than the CRQL, the method quantitation limit is accompanied by a "J" flag. This format is designed to indicate that the compound may be present in the sample at a level that is too low for the method to accurately measure. To indicate which column was used for quantitation, the values reported are accompanied by one (packed) or two (capillary) stars. While quantitation on a capillary column is contrary to CLP protocols, enough information is provided to determine the accuracy of the data.

Contamination of the sample during handling and/or preparation is always a possibility. Method blanks and field blanks were included in the sampling and analysis procedures to determine whether contamination occurred, its source, and its concentration. Where the data for the blanks indicate that contamination occurred, the data for the compound(s) in question in the field samples associated with the blank have been annotated with a "B" flag. Another known interference occurs when sulfur is present in the sample extract. Generally, interference with the identification and quantitation of the early eluting compounds is the result. Because of the large number of samples that arrived at the same time, clean-up of the sample extracts could not be performed.

The only means for the detection of pesticides and PCBs by GC-ECD is their retention time. If a change in the operating conditions results in a shift in retention times from that of the standard, positive identifications can be difficult to make. Therefore, the most important data quality indicator is the retention time of the surrogate added to each sample during extraction. Mirex was substituted for the standard surrogate, dibutylchlorendate (DBC). Although this is a potentially significant deviation from the CLP protocols, the results of a direct comparison indicated no significant difference in the behavior of the two. As a result, the advisory limits for DBC were adopted for the recoveries of Mirex. As indicated by the wide acceptance limits for surrogate recoveries, quantitation of the pesticides and PCBs should generally be considered approximate.

Instances occurred where the linearity evaluations specified by the CLP protocols indicated that a problem existed. However, an additional linearity evaluation procedure was included with the analyses that provides a means for evaluating the data collected. The single working standard called for in the CLP protocols was replaced by a five-point calibration, providing linearity information about all of the compounds instead of a select few. While providing perhaps a more accurate calibration scheme, it also allows the linearity of each compound to be evaluated directly. Where the linearity is not acceptable, qualifications to the data are made. For the reasons discussed above, the data quality level for other extractables is Quality Level III.

Extractable organics. In only a few cases was a compound identified in measurable quantities. The data are of Quality Level II, due mainly to tentative identification by mass spectrometry.

Volatile organics. Over three-fourths of the entries on the data quality summary sheets indicated Quality Level III, all because of either a tentative identification

of a compound via mass spectrometry or because of concentrations that were detected in amounts too small to quantify. All but one of the remaining entries in the data quality summary sheets were Quality Level II. Many of the compounds detected were also found in the method blanks. Because many volatiles were detected in quantities too small to measure, only an estimate is given. Some of the volatiles detected were often present in small concentrations in blank samples. Volatiles were often detected in only one sample for a particular 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.

Environmental Problem: SNLL 1
Request Number: SNLL 1

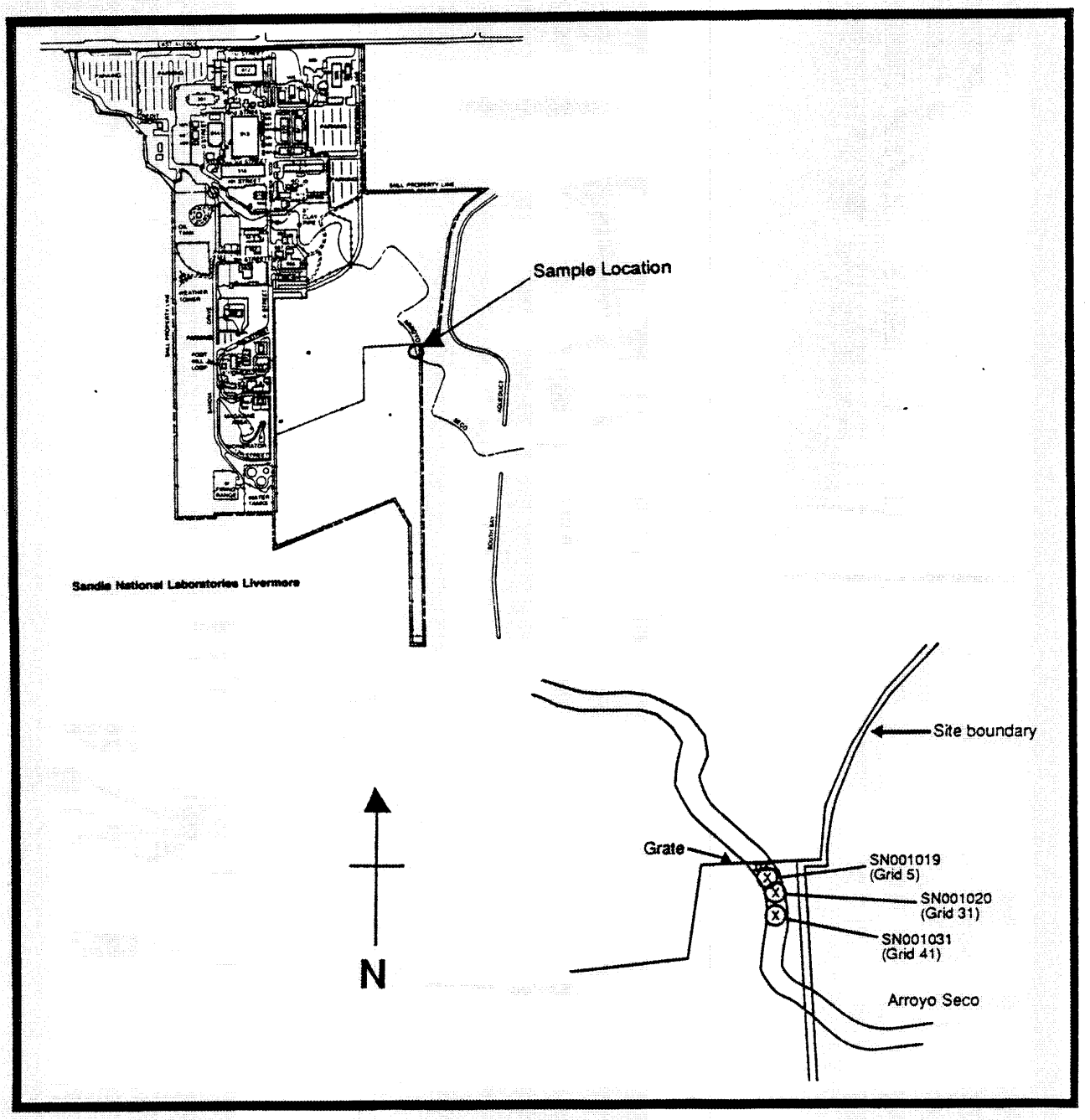

Figure S4.1a. Arroyo Seco, Upstream of the SNLL Boundary
(SNLL Request 1)

Environmental Problem: SNLL 1
Request Number: SNLL 2

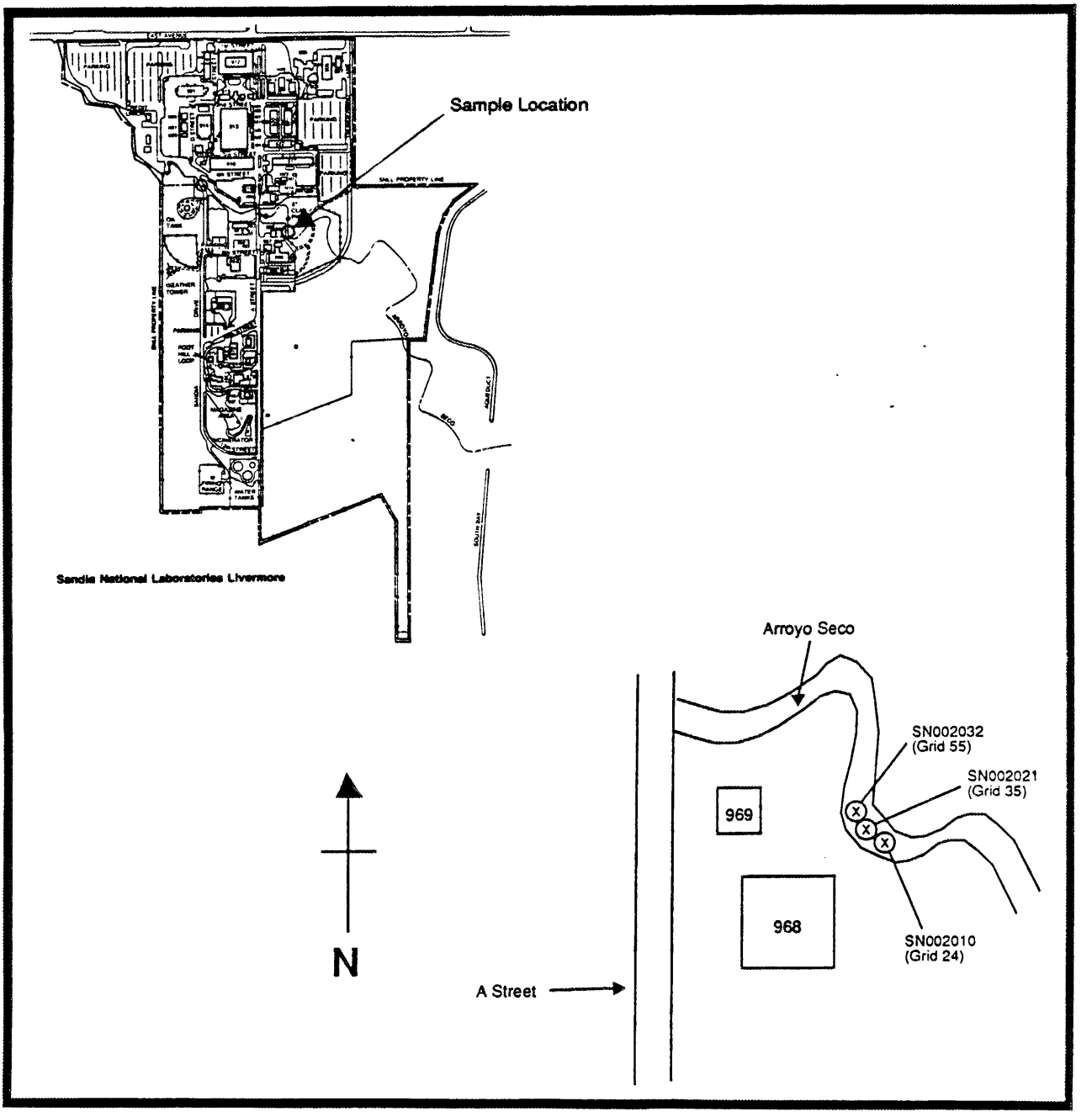

Figure S4.1b. Arroyo Seco, Downstream of Terra-cotta Pipe Wall Near Building 968, the Tritium Research Laboratory (SNLL Request 2)

Environmental Problem: SNLL 1
Request Number: SNLL 3

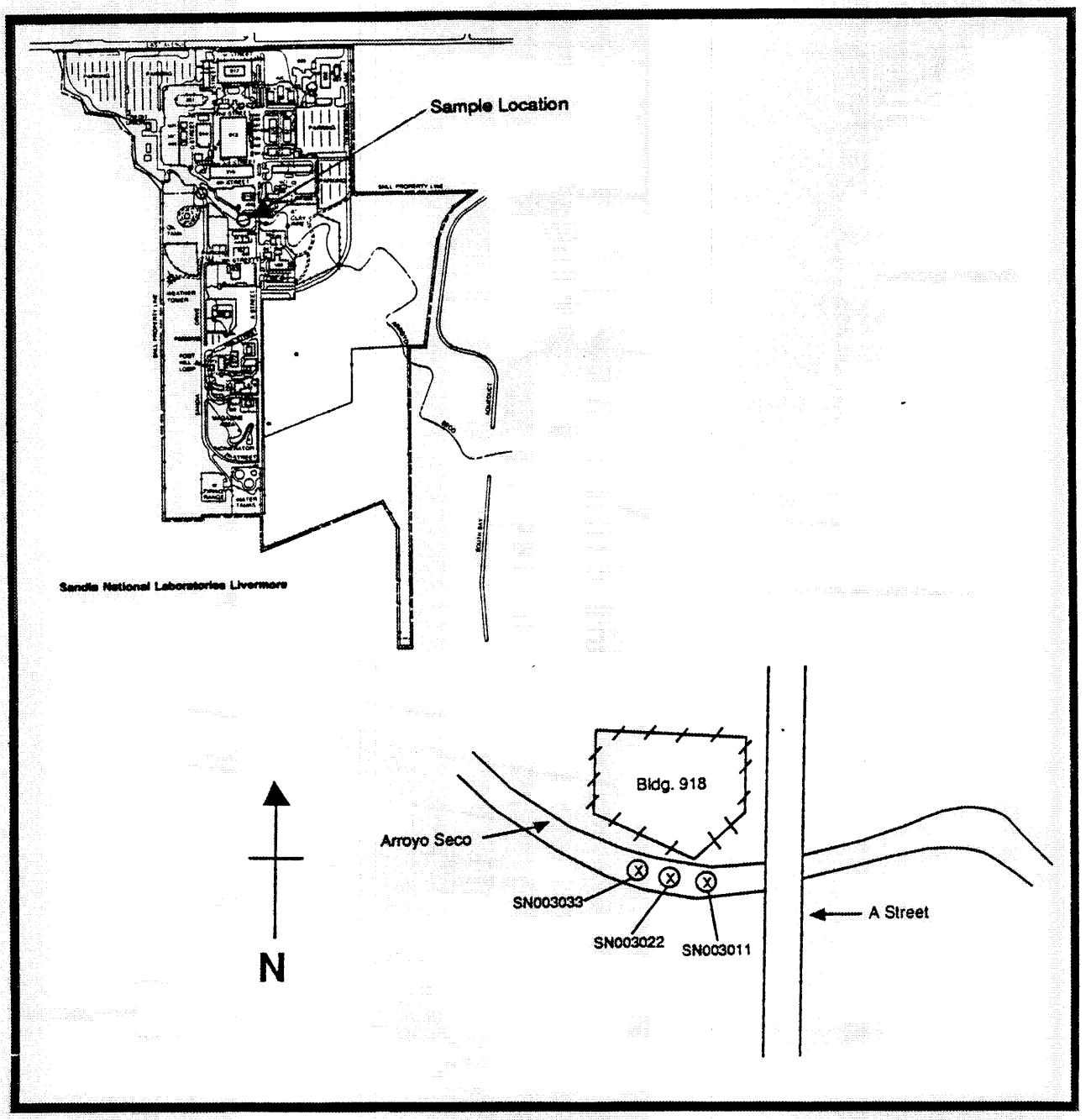

Figure S4.1c. Arroyo Seco, Downstream at West Edge of Bridge
(SNLL Request 3)

Environmental Problem: SNLL 1
Request Number: SNLL 4

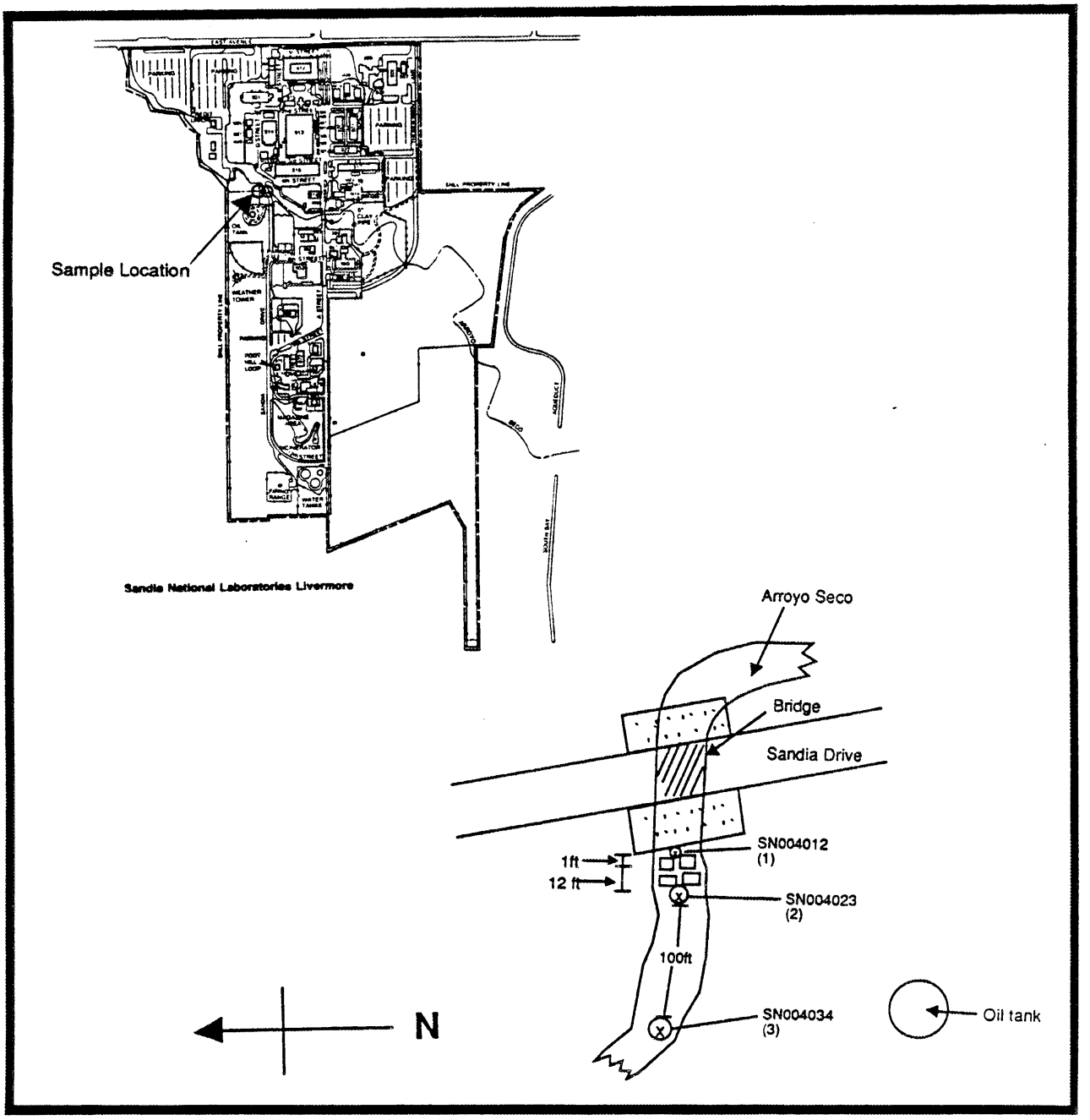

Figure S4.1d. Arroyo Seco, Downstream of Sandia Drive Bridge Near South End of D Street (SNLL Request 4)

TABLE S4.2.1 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 1

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	METALS NUMB HITS	METALS 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
SN001	ARROYO SECO	ARROYOS	SEDIMENT	3	3	BKGRN	3	3	0	3	3	3	3	3	3	3
SN002	ARROYO SECO	ARROYOS	SEDIMENT	3	3	GRAB	3	3	0	0	3	3	3	3	3	3
SN003	ARROYO SECO	ARROYOS	SEDIMENT	3	3	GRAB	3	3	0	0	3	3	3	3	3	3
SN004	ARROYO SECO	ARROYOS	SEDIMENT	4	3	GRAB	3	3	1	3	3	3	3	3	3	3
		MED TOTAL		13	12		12	12	1	6	12	12	12	12	12	12
SN001	ARROYO SECO	ARROYOS	SUR WATER	1	1	QC RN	1	1	0	0	0	1	1	1	1	1
		MED TOTAL		1	1		1	1	0	0	0	1	1	1	1	1
		EP TOTAL		14	13		13	13	1	6	12	13	13	13	13	13

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TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYO SECO

S&A REQUEST: 001
LOCATION: ARROYO SECO UPSTREAM OF SNLL BOUNDARY
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN001019C	SN001019D	SN001020C	SN001020D	SN001031C	SN001031D
	SDG NO:	SN001019C	LL011010C	SN001019C	LL011010C	SN001019C	LL011010C
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
ALUMINUM			8660 *		10200 *		7720 *
ANTIMONY			4.8 BN		4 UN		4.3 BN
ARSENIC		3.3		3.1		3	
BARIUM			138		367		113
BERYLLIUM			0.33 B		0.37 B		0.32 B
CADMIUM			0.68		0.72		0.66
CALCIUM			5460 *		5300 *		5020 *
CHROMIUM		30		24		24	
COBALT			6.6 B		7.1		5.3 B
COPPER			16		17		17
IRON			17300 *		18100 *		17800 *
LEAD		8.9 N		7.5 N		5.2 N	
MAGNESIUM			4520		4710		4350
MANGANESE			468 *		1890 *		315 *
NICKEL		33		27		30	
POTASSIUM			2100		2400		1900
SILVER			0.8 U		1.1 B		0.77 U
SODIUM			172 B		204 B		160 B
VANADIUM			30		31		26
ZINC			43		44		37

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN001019B	SN001020B	SN001031B
	SDG NO:	LL020288	LL020388	LL020388
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
BIS(2-ETHYLHEXYL)PHTHALATE		60 J	50 J	790
* UNKNOWN (6.30)		280 J	270 J	310 J
* UNKNOWN (23.40)			210 J	180 J
* UNKNOWN (25.20)			150 J	

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN001019A	SN001020A	SN001031A
	SDG NO:	0830	0830	0830
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND
ACETONE		47 B	41 B	27 B
BENZENE		3 J	1 J	1 J
CHLOROFORM		2 J	5 U	5 U
METHYLENE CHLORIDE		21	11	10
TOLUENE		5 B	2 JB	2 JB
* ACETIC ACID, METHYL EST(9.69)		4 J	6 J	

TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYO SECO

S&A REQUEST: 001
LOCATION: ARROYO SECO UPSTREAM OF SNLL BOUNDARY
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN001019A	SN001020A	SN001031A			
	SDG NO:	0830	0830	0830			
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND			
* UNKNOWN(11.22)		4 J					

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	SN001019E	SN001020E	SN001031E			
	SDG NO:	LLL7283	LLL7283	LLL7283			
	TYPE:	BACKGROUND	BACKGROUND	BACKGROUND			
G-ALPH		1900	7600	7600			
GROSS-BETA		18000	18000	19000			
H-3		15000	20000	13000			
K-40		11000	12000	9500			

S&A REQUEST: 001
LOCATION: ARROYO SECO UPSTREAM OF SNLL BOUNDARY
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	SN001042F	SN001042G				
	SDG NO:	LL003043F	SN001042G				
	TYPE:	RINSATE	RINSATE				
ALUMINUM		252					
BARIUM		7.5 B					
CHROMIUM			4 B				
IRON		426					
LEAD			0.9 B				
MAGNESIUM		66 B					
MANGANESE		7.9 B					
NICKEL			5.4 B				
POTASSIUM		100					
ZINC		22 E					

VOLATILE ORGANICS (UG/L)	SAMP NO:	SN001042A					
	SDG NO:	0822					
	TYPE:	RINSATE					
ACETONE		6 JB					
CHLOROFORM		15					

TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1
ARROYO SECO

S&A REQUEST: 001
LOCATION: ARROYO SECO UPSTREAM OF SNLL BOUNDARY
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO: SN001042A SDG NO: 0822 TYPE: RINSATE
ETHYLBENZENE	1 JB
METHYLENE CHLORIDE	2 JB
TOLUENE	1 JB

RADIOCHEMISTRY (PCI/L)	SAMP NO: SN001042H SDG NO: LLL7268 TYPE: RINSATE	SN001042I LLL7268 RINSATE
G-ALPH	5	
GROSS-BETA	27	
H-3		0

S&A REQUEST: 002
LOCATION: ARROYO SECO DOWNSTREAM OF TERRACOTA PIPE ON WALL NEAR BUILDING 968
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: SN002010C SDG NO: SN001019C TYPE: GRAB	SN002010D LL011010C GRAB	SN002021C SN001019C GRAB	SN002021D LL011010C GRAB	SN002032C SN001019C GRAB	SN002032D LL011010C GRAB
ALUMINUM		16700 *		9350 *		7690 *
ANTIMONY		9.2 BN		6.2 BN		4.1 UN
ARSENIC	3.7		2.9		3	
BARIUM		248		175		173
BERYLLIUM		0.59 B		0.38 B		0.31 B
CADMIUM		1		0.81		0.33 B
CALCIUM		4770 *		2890 *		3640 *
CHROMIUM	40		33		29	
COBALT		9.1 B		6.6 B		9.8
COPPER		45		15		14
IRON		22500 *		15700 *		14800 *
LEAD	16 N		9.4 N		7.7 N	
MAGNESIUM		5080		3520		3910
MANGANESE		602 *		443 *		619 *
NICKEL	36		32		34	
POTASSIUM		3400		2100		1700
SILVER		1.2 U		0.84 U		0.93 B

TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYO SECO

S&A REQUEST: 002
LOCATION: ARROYO SECO DOWNSTREAM OF TERRACOTA PIPE ON WALL NEAR BUILDING 968
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN002010C	SN002010D	SN002021C	SN002021D	SN002032C	SN002032D
	SDG NO:	SN001019C	LL011010C	SN001019C	LL011010C	SN001019C	LL011010C
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
SODIUM			629 B		301 B		230 B
VANADIUM			46		31		25
ZINC			265		42		40

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN002010B	SN002021B	SN002032B			
	SDG NO:	LL020488	LL020588	LL020288			
	TYPE:	GRAB	GRAB	GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE		460 U	16000	310000			
BUTYLBENZYLPHTHALATE		55 J	350 U	340 U			
DI-N-BUTYLPHTHALATE		63 J	350 U	340 U			
DIETHYLPHTHALATE		2100	350 U	340 U			
* UNKNOWN (6.30)		190 J					
* UNKNOWN (19.10)		260 J					
* UNKNOWN (23.40)		610 J					
* UNKNOWN (24.20)				280 J			
* UNKNOWN (26.10)		230 J					
* UNKNOWN (27.10)		460 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN002010A	SN002021A	SN002032A			
	SDG NO:	0830	0831	0831			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		19 U	16 B	24 B			
BENZENE		10 U	1 J	1 J			
METHYLENE CHLORIDE		17	7	11			
TOLUENE		10 U	3 JB	3 JB			
* UNKNOWN(32.21)			10 J				
* UNKNOWN(32.23)				200 J			
* UNKNOWN(44.47)			48 J				
* UNKNOWN(44.76)				320 J			

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	SN002010E	SN002021E	SN002032E			
	SDG NO:	LLL7283	LLL7283	LLL7283			
	TYPE:	GRAB	GRAB	GRAB			
EU-155		70					
G-ALPH		8600	8600	3000			
GROSS-BETA		20000	14000	20000			

TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1
ARROYO SECO

S&A REQUEST: 002
LOCATION: ARROYO SECO DOWNSTREAM OF TERRACOTA PIPE ON WALL NEAR BUILDING 968
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	SN002010E	SN002021E	SN002032E
	SDG NO:	LLL7283	LLL7283	LLL7283
	TYPE:	GRAB	GRAB	GRAB
H-3		20000	25000	20000
K-40		14000	14000	11000

S&A REQUEST: 003
LOCATION: ARROYO SECO DOWNSTREAM AT WEST EDGE OF BRIDGE
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN003011C	SN003011D	SN003022C	SN003022D	SN003033C	SN003033D
	SDG NO:	SN001019C	LL011010C	SN001019C	LL011010C	SN001019C	LL011010C
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM			6930 *		10400 *		8730 *
ANTIMONY			5.6 BN		4.2 UN		4.1 UN
ARSENIC		9		3.5		3.8	
BARIUM			97		155		142
BERYLLIUM			0.26 B		0.39 B		0.34 B
CADMIUM			0.75		0.7		0.59 B
CALCIUM			3020 *		3600 *		5120 *
CHROMIUM		40		31		31	
COBALT			5.2 B		6.6 B		6.7 B
COPPER			19		26		64
IRON			15700 *		18800 *		19000 *
LEAD		7.7 N		11 N		14 N	
MAGNESIUM			4350		4590		5580
MANGANESE			307 *		503 *		753 *
NICKEL		38		42		35	
POTASSIUM			1800		2700		2300
SILVER			1.2 B		1.1 B		1.4 B
SODIUM			119 B		160 B		135 B
VANADIUM			20		31		26
ZINC			42		52		92

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN003011B	SN003022B	SN003033B
	SDG NO:	LL020388	LL020288	LL020388
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		40 J	50 J	50 J

TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYO SECO

S&A REQUEST: 003
LOCATION: ARROYO SECO DOWNSTREAM AT WEST EDGE OF BRIDGE
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN003011B	SN003022B	SN003033B
	SDG NO:	LL020388	LL020288	LL020388
	TYPE:	GRAB	GRAB	GRAB
DI-N-BUTYLPHTHALATE		360 U	50 J	100 J
* UNKNOWN (6.30)		290 J	310 J	390 J
* UNKNOWN (7.00)		270 J		280 J
* UNKNOWN (8.20)				320 J
* UNKNOWN (8.40)			240 J	
* UNKNOWN (12.00)				380 J
* UNKNOWN (12.10)			180 J	
* UNKNOWN (14.00)				600 J
* UNKNOWN (15.10)				260 J
* UNKNOWN (15.20)				290 J
* UNKNOWN (16.00)				370 J
* UNKNOWN (16.40)				340 J
* UNKNOWN (17.10)				310 J
* UNKNOWN (19.10)				490 J
* UNKNOWN (19.30)			380 J	
* UNKNOWN (22.10)				1600 J
* UNKNOWN (22.50)				290 J
* UNKNOWN (23.40)				3200 J
* UNKNOWN (24.10)			520 J	
* UNKNOWN (25.20)				1200 J
* UNKNOWN (26.10)			280 J	
* UNKNOWN (26.20)				330 J
* UNKNOWN (27.20)			170 J	860 J
* UNKNOWN (30.00)				490 J
* UNKNOWN (30.10)				770 J

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN003011A	SN003022A	SN003033A
	SDG NO:	0831	0831	0831
	TYPE:	GRAB	GRAB	GRAB
ACETONE		11 B	22 B	43 B
BENZENE		5 U	0.9 J	1 J
ETHYLBENZENE		2 JB	5 U	5 U
METHYLENE CHLORIDE		5 J	6	9
TOLUENE		2 JB	3 JB	6 B
* ACETIC ACID, METHYL EST(9.69)				7 J
* BENZENE DERIVATIVE(50.43)		116 J		
* UNKNOWN(32.24)			13 J	
* UNKNOWN(32.28)		14 J		140 J
* UNKNOWN(34.43)				7 J
* UNKNOWN(44.57)				46 J

TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYO SECO

S&A REQUEST: 003
LOCATION: ARROYO SECO DOWNSTREAM AT WEST EDGE OF BRIDGE
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN003011A	SN003022A	SN003033A			
	SDG NO:	0831	0831	0831			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN(44.72)		11 J					
* UNKNOWN(44.76)			160 J				

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	SN003011E	SN003022E	SN003033E			
	SDG NO:	LLL7283	LLL7283	LLL7283			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		19 U	14 U	30			
G-ALPH		1900	8600	0			
GROSS-BETA		11000	18000	26000			
H-3		14000	26000	31000			
K-40		8000	9400	10000			

S&A REQUEST: 004
LOCATION: ARROYO SECO DOWNSTREAM OF SANDIA DRIVE BRIDGE NEAR SOUTH END OF D STREET
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN004012C	SN004012D	SN004023C	SN004023D	SN004034C	SN004034D
	SDG NO:	LL009016D	LL028019C	LL009016D	LL028019C	LL009016D	LL028019C
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM			7250		7630		7550
ANTIMONY			7.6 BN		7.1 UN		6.9 UN
ARSENIC		4.6		3.9		2.8	
BARIUM			90 N		89 N		94 N
BERYLLIUM			0.22 B		0.22 B		0.25 B
CADMIUM			0.9		0.85		0.87
CALCIUM			2140		2290		2900
CHROMIUM		43		28		23	
COBALT			5 B*		7.2 *		5.5 B*
COPPER			16 N		24 N		16 N
IRON			14800 *		17400 *		17600 *
LEAD		8.3		5.8		4.9	
MAGNESIUM			4610		5080		4610
MANGANESE			304 E		459 E		437 E
NICKEL		44 *		29 *		27 *	
POTASSIUM			1500		1400		1900

TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYO SECO

S&A REQUEST: 004
LOCATION: ARROYO SECO DOWNSTREAM OF SANDIA DRIVE BRIDGE NEAR SOUTH END OF D STREET
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN004012C	SN004012D	SN004023C	SN004023D	SN004034C	SN004034D
	SDG NO:	LL009016D	LL028019C	LL009016D	LL028019C	LL009016D	LL028019C
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
SILVER			1.3 B		1.4 B		1.1 B
SODIUM			99 B		135 B		76 B
VANADIUM			25 E		24 E		26 E
ZINC			77 N*		48 N*		37 N*

PCBS & OTHER EXTRACTABLES (UG/KG)	SAMP NO:	SN004012B	SN004023B	SN004034B			
	SDG NO:	LL202	LL202	LL202			
	TYPE:	GRAB	GRAB	GRAB			
ENDRIN		19 J	29 U	22 U			
GAMMA-BHC (LINDANE)		9.6 J	14 U	11 U			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN004012B	SN004023B	SN004034B			
	SDG NO:	LL021188	LL021188	LL021188			
	TYPE:	GRAB	GRAB	GRAB			
BIS(2-ETHYLHEXYL)PHTHALATE		230 J	210 J	190 J			
BUTYLBENZYLPHTHALATE		390 U	89 J	38 J			
* UNKNOWN (6.30)		410 J	390 J	370 J			
* UNKNOWN (7.00)		500 J	350 J				
* UNKNOWN (7.40)		210 J					
* UNKNOWN (8.40)		380 J	340 J				
* UNKNOWN (18.40)		270 J					
* UNKNOWN (23.10)				390 J			
* UNKNOWN (23.20)		2300 J		150 J			
* UNKNOWN (23.30)			9300 J	8400 J			
* UNKNOWN (24.10)		580 J	310 J	140 J			
* UNKNOWN (26.00)		180 J	180 J				
* UNKNOWN (27.00)		300 J					
* UNKNOWN (28.10)		370 J		200 J			

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN004012A	SN004023A	SN004034A			
	SDG NO:	0910	0910	0910			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		10 JB	11 B	12 B			
METHYLENE CHLORIDE		6 B	7 B	5 B			
* FURAN, TETRAHYDRO-(11.21)				3 J			

TABLE S4.3.1 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 1 DRAFT DO NOT CITE
ARROYO SECO

S&A REQUEST: 004
LOCATION: ARROYO SECO DOWNSTREAM OF SANDIA DRIVE BRIDGE NEAR SOUTH END OF D STREET
MEDIUM: SEDIMENT

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	SN004012E	SN004023E	SN004034E			
	SDG NO:	LLL7297	LLL7297	LLL7297			
	TYPE:	GRAB	GRAB	GRAB			
CS-137		26 U	18	15 U			
G-ALPH		2000	13000	6500			
GROSS-BETA		22000	20000	32000			
K-40		11000	11000	11000			

4.20 SNLL Environmental Problem 2: Building 913 (South) Retention Tank

Request Number: 5.
Requester: R. Basinski.
Finding and Basis: The Building 913 (south) retention tank may be receiving hazardous wastes and discharging them to the sanitary sewer system.

4.20.1 Sampling and Analysis Objectives

Statement: Water samples were to be collected to determine if contaminants listed in Sect. 4.20.2.2 were present at or above method detection levels in the retention tank of Building 913 (south).

Supporting Information: The south retention tank, which received wastewaters from laboratory sinks, had been routinely analyzed only for uranium and beryllium prior to discharge. Analysis for other hazardous constituents had not been routinely performed.

4.20.2 Sampling and Analytical Design

4.20.2.1 Sampling Design

Request 5: Building 913 (South) Retention Tank (Fig. S4.2). Four grab water samples (Sampling Method: Reference E4.2.4), one per day over a 4-day period, were to be taken from the Building 913 (south) retention tank prior to discharge. These samples were to be collected at the same time that the facility sampled the contents. Following normal operational procedure, the contents of the tank were to be mixed before sampling.

The Sampling Team arrived on-site at 1048 on 10AUG87. The day was sunny with an approximate temperature at the start of 65°F. The tank found inside

Building 913 was smaller than the 800 gal. size originally thought and had not received wastes for several weeks. Sample SN005046 was deleted. The port to enter the tank was a steel cover, 12 in. in diameter. It was about 7 ft from the port to water. Although the tank had been emptied approximately two weeks earlier, it was not emptied on a regular schedule but at intervals when sufficient liquid was present. At the time collection of sample SN005013 was made, the tank was receiving wastes. The contents of the tank were mixed before sampling as was normal operating procedure.

For the second day's sampling, the Sampling Team arrived on-site at 1454 on 11AUG87. The tank appeared to have less liquid, indicating a possible discharge since the day before. The tank was agitated for 5 min prior to collecting sample SN005024. The same procedure for sampling was followed as on the first day. QC rinsate SN005057 was collected 11AUG87 at 1725.

For the third day's sampling, the Sampling Team arrived on-site at 0904 on 12AUG87. The tank was agitated for 5 min prior to the collection of sample SN005035. A PID reading indicated 15 ppm benzene equivalent in the tank near the entrance.

4.20.2.2 Analytical Design

The parameters analyzed were volatiles, semivolatiles (with special interest in solvents F001 to F005), ICP-metals, TCLP-metals, TCLP-semivolatiles, gross alpha, and gross beta. (If any parameters exceeded RCRA TCLP levels during normal analysis, the TCLP analysis was to be run.) No field measurements were required.

4.20.3 Field and Analytical Data

Field Data: NA

Field Data Evaluation: NA

Analytical Data:

Metals. *Analytical data for metals in an unsealed container are presented in Table S4.3.2. Of the 18 metals detected, the following 6 were below the CRQL or the IDL in all three samples: barium, cobalt, magnesium, mercury, potassium, and vanadium. Of the remaining metals detected, beryllium was 5.7 ug/L; cadmium ranged from 12 to 16 ug/L; chromium, 37 to 593 ug/L; copper, 4170 to 6370 ug/L; lead, 273 to 386 ug/L; nickel, 343 to 795 ug/L; and zinc, 2080 to 2440 ug/L. Because RCRA TCLP levels were not exceeded during normal analyses, TCLP analysis was not performed.*

Volatile organics. *Analytical results for volatiles are presented in Table S4.3.2. Acetone was detected in concentrations of greater than 3000 ug/L in all three samples from this retention tank. Toluene was also present in excess of 500 ug/L in all three samples. Values of acetone and toluene were all above the calibration range. All three samples also contained an estimated 1200 to 1300 ug/L of a compound tentatively identified as 2-propanol. The samples were quite similar to each other with respect to volatiles.*

Extractable organics. *Analytical results for semivolatile organic compounds are presented in Table S4.3.2. There were 22 compounds detected in two of the samples and 20 compounds detected in the remaining sample for this request. In sample SN005013, there were six compounds, including bis(2-ethylhexyl)phthalate and five unknown hydrocarbons, present in measured or estimated concentrations between 0.1 to 0.2 mg/L. In sample SN005024, one unknown was detected in an estimated concentration of 0.11 mg/L. Otherwise, all compounds detected for that sample had concentrations detected or estimated below 0.1 mg/L.*

Radiochemistry. Average values of 87 pCi/L of alpha activity and 134 pCi/L of beta activity were obtained.

Analytical Data Evaluation:

Metals. The following metals of interest were detected above the CRQL for the samples in this request: beryllium, cadmium, chromium, copper, lead, nickel, and zinc.

Volatile organics. All three of the samples appear contaminated with acetone, toluene, and a compound similar to 2-propanol.

Extractable organics. No contamination is apparent in these samples.

Radiochemistry. Gross alpha and beta determinations were made for three water samples collected over a 3-day period. Results are given in Table S4.3.2.

4.20.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level I, and the field sampling is rated Quality Level II. The overall analytical data are rated Quality Level I.

Field Data: Only three of the four samples requested for this problem were sampled. The elimination of one of the samples was based on the observation that on arrival the tank was empty, but later that day a sample was collected. Because a sample per day was stipulated in the plan, elimination of the fourth sample was not justified.

Analytical Data: The plan addressed the F001 to F005 solvents; the results show that none of the compounds in the list exceeded the limits. Because none

of the semivolatile target compounds nor the target ICP metals exceeded the TCLP limit, the TCLP test was not necessary. Details on analytical data quality are given below.

Metals. Vanadium was undetected in two of the samples, and serial dilution was out of control limits for zinc in one sample. In most cases, however, the metals present were readily detected with minimal problems. Data are Quality Level I, with no exceptions, for metals.

Volatile organics. Two of the volatile contaminants (acetone and toluene) in these samples were also common in blank samples, though in much smaller amounts than were detected in this container. Volatile compounds were often detected below the quantitation limit.

For three of the samples, the data were Quality Level I or II (mostly I) in about half the cases, and Quality Level III in the other half due to tentative concentrations detected in amounts too small to quantify. In the remaining sample, the surrogate was out of control limits, so those data were Quality Level III. Ethylbenzene was detected in the method blank for all four samples.

Extractable organics. All concentrations were estimated except for the concentrations of bis(2-ethylhexyl)phthalate. The data are of Quality Level II, due mainly to tentative identification by mass spectrometry.

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.

Environmental Problem: SNLL 2
Request Number: SNLL 5

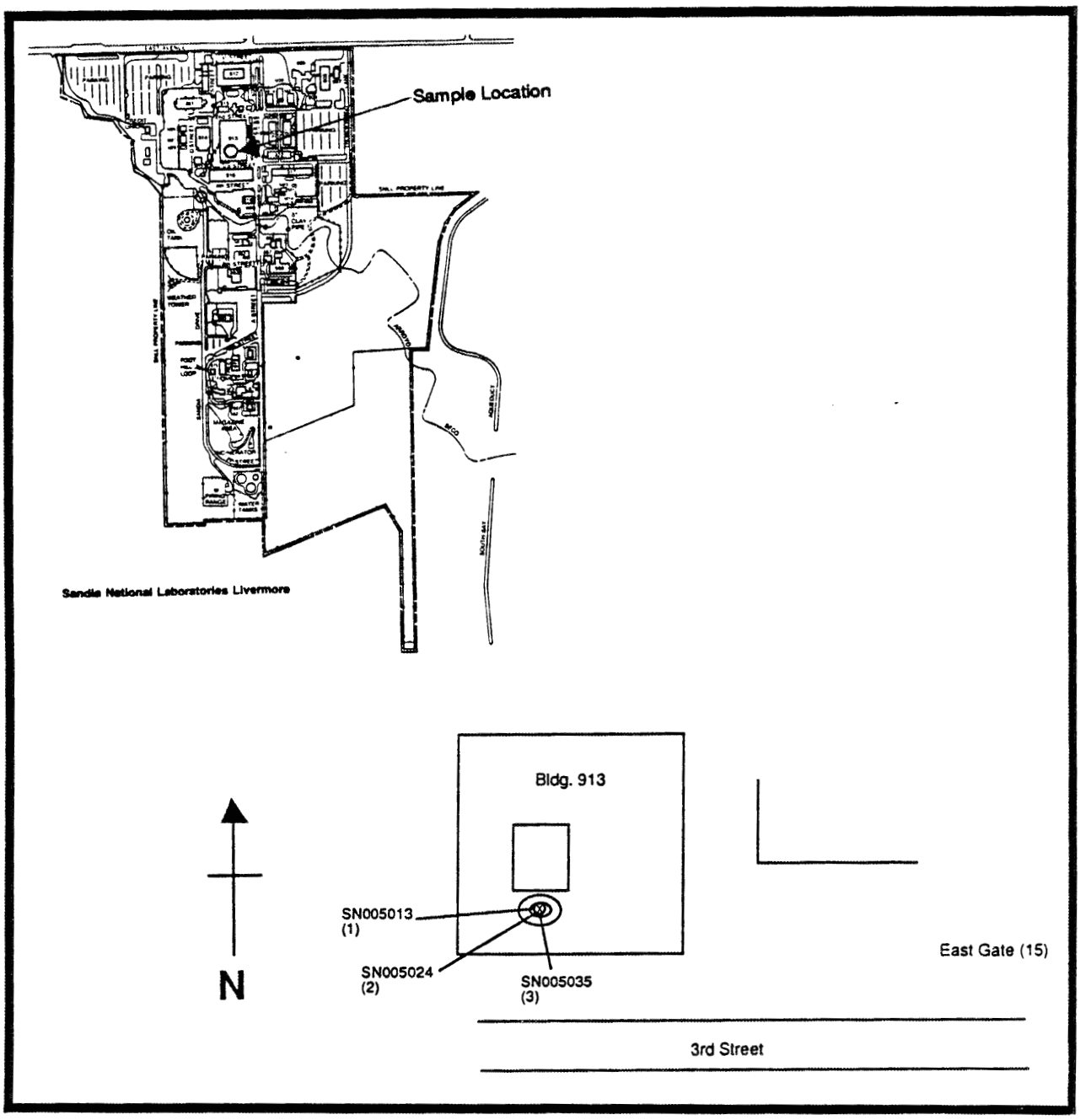

Figure S4.2. Building 913 (South) Retention Tank (SNLL Request 5)

TABLE S4.2.2 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 2

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	METALS NUMB HITS	METALS 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
SN005	BLDG. 913	BLDG 913	SUR WATER	1	1	QC RN	1	1	0	0	0	1	1	1	1	1
			MED TOTAL	1	1		1	1	0	0	0	1	1	1	1	1
SN005	BLDG. 913	BLDG 913	UNSEAL CO	4	3	GRAB	3	3	0	0	3	3	3	3	3	3
			MED TOTAL	4	3		3	3	0	0	3	3	3	3	3	3
			EP TOTAL	5	4		4	4	0	0	3	4	4	4	4	4

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TABLE S4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING 913 (SOUTH) RETENTION TANK

S&A REQUEST: 005
LOCATION: BUILDING 913 RETENTION TANK
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	SN005057H	SN005057I				
	SDG NO:	LL003043F	SN001042G				
	TYPE:	RINSATE	RINSATE				
CHROMIUM			2.1 B				
IRON		72 B					
MAGNESIUM		16 B					
MERCURY			0.04 B				
ZINC		11 BE					

VOLATILE ORGANICS (UG/L)	SAMP NO:	SN005057A					
	SDG NO:	0822					
	TYPE:	RINSATE					
ACETONE		150 B					
CHLOROFORM		19					
ETHYLBENZENE		1 JB					
METHYLENE CHLORIDE		2 JB					
TOLUENE		3 JB					
* 2-PROPANOL(8.84)		150 J					

RADIOCHEMISTRY (PCI/L)	SAMP NO:	SN005057J					
	SDG NO:	LLL7295					
	TYPE:	RINSATE					
G-ALPH		0					
GROSS-BETA		27					

S&A REQUEST: 005
LOCATION: BUILDING 913 RETENTION TANK
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	SN005013I	SN005013J	SN005024I	SN005024J		
	SDG NO:	LL003043F	SN005013J	LL012066B	SN001042G		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
ALUMINUM		2770		1820			
BARIUM		43 B		38 B			
BERYLLIUM		5.7		5 B			
CADMIUM		16		12			

TABLE S4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING 913 (SOUTH) RETENTION TANK

S&A REQUEST: 005
LOCATION: BUILDING 913 RETENTION TANK
MEDIUM: UNSEALED CONTAINER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	SN005013I	SN005013J	SN005024I	SN005024J		
	SDG NO:	LL003043F	SN005013J	LL012066B	SN001042G		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
CALCIUM		11000		9930			
CHROMIUM		593			43		
COBALT		40 B		34 B			
COPPER		6370		5020			
IRON		7870		6530			
LEAD		386			319		
MAGNESIUM		1100 B		979 B			
MANGANESE		150		141			
MERCURY			0.04 B		0.04 B		
NICKEL		795		595			
POTASSIUM		1300 B		1300 B			
SODIUM		6000		4710 B			
VANADIUM		4.1 B		4 U			
ZINC		2440 E		2130			

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	SN005035I	SN005035J				
	SDG NO:	LL012066B	SN001042G				
	TYPE:	GRAB	GRAB				
ALUMINUM		951					
BARIUM		39 B					
BERYLLIUM		4.8 B					
CADMIUM		12					
CALCIUM		10300					
CHROMIUM			37				
COBALT		30 B					
COPPER		4170					
IRON		5460					
LEAD			273				
MAGNESIUM		1010 B					
MANGANESE		116					
MERCURY			0.06 B				
NICKEL		343					
POTASSIUM		1400 B					
SODIUM		4940 B					
VANADIUM		4 U					
ZINC		2080					

TABLE S4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING 913 (SOUTH) RETENTION TANK

S&A REQUEST: 005
LOCATION: BUILDING 913 RETENTION TANK
MEDIUM: UNSEALED CONTAINER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: SDG NO: TYPE:	SN005013E C826 GRAB	SN005024E C826 GRAB	SN005035E C826 GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		130	32	15
DI-N-BUTYLPHTHALATE		2 J	10 U	10 U
4-METHYLPHENOL		10 U	10 U	2 J
* DIMETHYLETHYLPHENOL (17.96)				8 J
* UNKNOWN (15.47)			15 J	
* UNKNOWN (15.61)			10 J	
* UNKNOWN (16.47)				5 J
* UNKNOWN (17.44)			12 J	
* UNKNOWN (17.57)			9 J	
* UNKNOWN (18.67)			110 J	
* UNKNOWN (19.24)				7 J
* UNKNOWN (19.50)				4 J
* UNKNOWN (20.05)				4 J
* UNKNOWN (20.30)				3 J
* UNKNOWN (20.74)			14 J	
* UNKNOWN (20.75)				3 J
* UNKNOWN (20.96)			13 J	
* UNKNOWN (20.97)				4 J
* UNKNOWN (21.10)				5 J
* UNKNOWN (21.61)			59 J	
* UNKNOWN (21.65)				15 J
* UNKNOWN (21.66)		95 J		
* UNKNOWN (21.75)		77 J		
* UNKNOWN (21.76)				9 J
* UNKNOWN (22.53)				7 J
* UNKNOWN (23.15)				7 J
* UNKNOWN (24.92)		34 J		11 J
* UNKNOWN (26.53)			28 J	
* UNKNOWN (28.57)			18 J	
* UNKNOWN (30.44)		58 J		
* UNKNOWN HYDROCARBON (15.47)				7 J
* UNKNOWN HYDROCARBON (15.48)		26 J		
* UNKNOWN HYDROCARBON (15.61)		21 J		
* UNKNOWN HYDROCARBON (16.20)				27 J
* UNKNOWN HYDROCARBON (16.21)			88 J	
* UNKNOWN HYDROCARBON (16.22)		170 J		
* UNKNOWN HYDROCARBON (16.48)			19 J	
* UNKNOWN HYDROCARBON (16.49)		37 J		
* UNKNOWN HYDROCARBON (17.26)		36 J		
* UNKNOWN HYDROCARBON (17.45)		21 J		
* UNKNOWN HYDROCARBON (17.56)		17 J		
* UNKNOWN HYDROCARBON (18.11)				20 J

TABLE S4.3.2 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 2 DRAFT DO NOT CITE
BUILDING 913 (SOUTH) RETENTION TANK

S&A REQUEST: 005
LOCATION: BUILDING 913 RETENTION TANK
MEDIUM: UNSEALED CONTAINER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	SN005013E	SN005024E	SN005035E
	SDG NO:	C826	C826	C826
	TYPE:	GRAB	GRAB	GRAB
* UNKNOWN HYDROCARBON (18.12)			68 J	
* UNKNOWN HYDROCARBON (18.13)		130 J		
* UNKNOWN HYDROCARBON (19.50)			12 J	
* UNKNOWN HYDROCARBON (19.51)		26 J		
* UNKNOWN HYDROCARBON (19.89)				20 J
* UNKNOWN HYDROCARBON (19.91)		160 J	76 J	
* UNKNOWN HYDROCARBON (20.76)		56 J		
* UNKNOWN HYDROCARBON (20.98)		31 J		
* UNKNOWN HYDROCARBON (21.13)			46 J	
* UNKNOWN HYDROCARBON (21.14)		110 J		22 J
* UNKNOWN HYDROCARBON (21.57)				15 J
* UNKNOWN HYDROCARBON (21.58)			59 J	
* UNKNOWN HYDROCARBON (21.59)		120 J		
* UNKNOWN HYDROCARBON (23.16)		58 J	19 J	
* UNKNOWN HYDROCARBON (24.25)			49 J	
* UNKNOWN HYDROCARBON (24.67)		33 J		

VOLATILE ORGANICS (UG/L)	SAMP NO:	SN005013A	SN005024A	SN005035A
	SDG NO:	0822	0822	0822
	TYPE:	GRAB	GRAB	GRAB
ACETONE		3100 BE	3100 BE	3200 BE
CHLOROFORM		7	6	5
ETHYLBENZENE		1 JB	1 JB	2 JB
METHYLENE CHLORIDE		10 B	9 B	8 B
TOLUENE		640 BE	530 BE	550 BE
* ETHANOL(5.47)		35 J	32 J	32 J
* 2-PROPANOL(9.08)		1200 J		
* 2-PROPANOL(9.13)			1200 J	1300 J

RADIOCHEMISTRY (PCI/L)	SAMP NO:	SN005013K	SN005024K	SN005035K
	SDG NO:	LLL7268	LLL7295	LLL7295
	TYPE:	GRAB	GRAB	GRAB
G-ALPH		120	89	51
GROSS-BETA		51	210	140

4.21 SNLL Environmental Problem 3: Paint Spray Booth Wastewater

Request Number: 6.
Requester: R. Basinski.
Finding and Basis: The paint spray booth wastewaters are discharged directly into the sanitary system and may contain hazardous wastes or constituents.

4.21.1 Sampling and Analysis Objectives

Statement: Water samples were to be collected to determine if contaminants listed in Sect. 4.21.2.2 were present at or above method detection levels in paint spray booth scrubbing wastes.

Supporting Information: Scrubber waters from the spray booth came into contact with gaseous emissions from solvents, thinners, and paints. These waters were discharged to the sanitary system. They had not been analyzed for hazardous wastes or constituents.

4.21.2 Sampling and Analytical Design

4.21.2.1 Sampling Design

Request 6: **Paint Spray Booth Wastewaters (Fig. S4.3).** Three grab water samples (Sampling Method: Reference E4.2.4) were to be collected consecutively from the discharge stream of the approximately 10 ft x 10 ft wastewater tank in the paint spray booth.

The Sampling Team arrived on-site on 10AUG87. The day was sunny with the outside temperature in the mid-70s. The barometric pressure was about 31.5 in. of mercury. The tank had a steel grate with removable sections. It contained no agitator for mixing although the original sampling design called for the water

to be well mixed before sampling. The distance to the water was approximately 6 ft. Field preservative blank SN006047 was prepared first at 0935. Sample SN006014 was collected at 1145, sample SN006025 at 1150, and sample SN006036 at 1200. At the time sampling was being done, the facility was under negative pressure.

4.21.2.2 Analytical Design

The parameters analyzed were volatiles, semivolatiles (with special interest in solvents F001 to F005), ICP-metals, and AA-mercury. No field measurements were required.

4.21.3 Field and Analytical Data

Field Data: NA

Field Data Evaluation: NA

Analytical Data:

Metals. Analytical data for metals in surface water are presented in Table S4.3.3. Of the 14 metals detected, the following 7 were below either the CRQL or the IDL in all three samples: aluminum, barium, cadmium, magnesium, nickel, potassium, and sodium. Of the remaining metals detected, lead was 12 ug/L; chromium ranged from 388 to 447 ug/L; mercury, 0.55 to 0.59 ug/L; and zinc, 158 to 171 ug/L. Other metals detected were calcium, iron, and manganese. No TCLP analyses were requested.

Volatile organics. Analytical results for volatiles are presented in Table S4.3.3. Methylene chloride was present in concentrations of around 1100 ug/L in all

three of these wastewater samples. This was beyond the range of instrument calibration.

Extractable organics. *Analytical results for semivolatile organics are presented in Table S4.3.3. There were 20 compounds detected in two of the samples and 14 detected in the remaining sample for this request. None were detected in measured or estimated concentrations of greater than 0.032 mg/L in these paint spray booth wastewater samples.*

Radiochemistry. *Average gross alpha was 12 pCi/L and gross beta was 43 pCi/L.*

Analytical Data Evaluation:

Metals. The following metals of interest were detected above the CRQL in the samples for this request: chromium, lead, mercury, and zinc.

Volatile organics. These wastewater samples appeared to be contaminated with methylene chloride.

Extractable organics. No contamination with semivolatile organic compounds was apparent in these samples.

Radiochemistry. Three wastewater samples were analyzed for gross alpha and beta activity. Results are given in Table S4.3.3.

4.21.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level I, and the field sampling is rated Quality Level II. The overall analytical rating is Quality Level I.

Field Data: The plan called for assuring a well-mixed sample. The tank was not equipped with a mixer but no attempt was made to mix the solution prior to sampling, and no explanation was offered why a manual system could not be used.

Analytical Data: None of the F001 to F005 solvent compounds exceeded the limits for this class of solvents. Details on analytical data quality are given below.

Metals. Serial dilution was beyond control limits with respect to zinc in all samples. Data are Quality Level I, with no exceptions, for metals.

Volatile organics. Many compounds were detected in amounts below the quantitation limit, and some of the compounds detected are common contaminants that were often detected in blank samples.

Most volatile concentrations were below quantitation limits and were Quality Level III. Most other data, including the methylene chloride values, were Quality Level II.

Extractable organics. The only compound identified was bis(2-ethylhexyl)phthalate. All other compounds detected were tentatively identified, and many of those were listed as "unknown." Data are of Quality Level II, due mainly to mass spectral uncertainty for the tentatively identified compounds.

Environmental Problem: SNLL 3
Request Number: SNLL 6

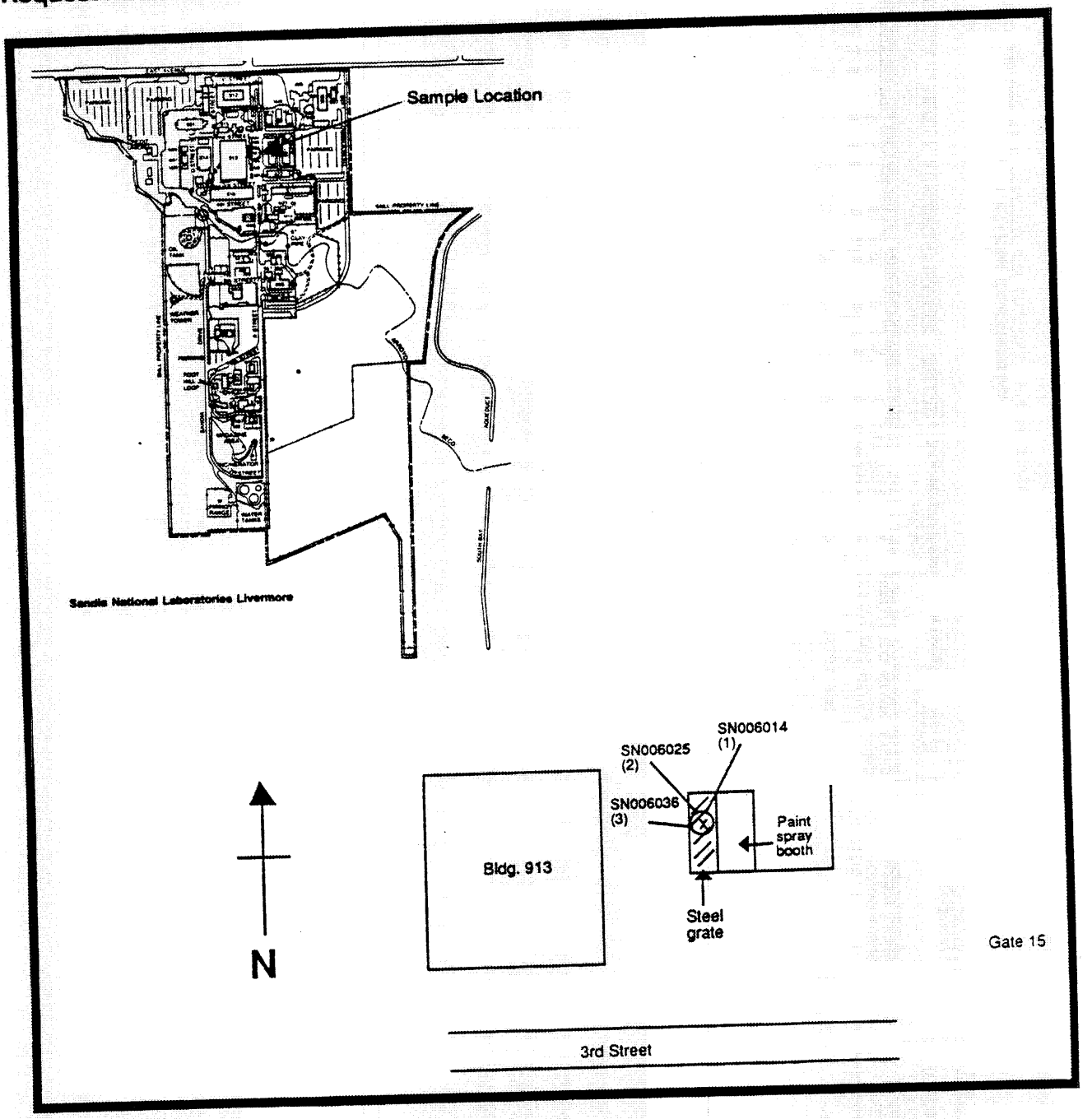

Figure S4.3. Paint Spray Booth Wastewater (SNLL Request 6)

TABLE S4.2.3 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 3

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	METALS NUMB HITS	METALS 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
SN006	SPRAY BOOTH	SPRAY BOOTH	SUR WATER	1	1	QC FL	1	1	0	0	0	1	1	1	1	1
SN006	SPRAY BOOTH	SPRAY BOOTH	SUR WATER	3	3	GRAB	3	3	0	0	3	3	3	3	3	3
		MED TOTAL		4	4		4	4	0	0	3	4	4	4	4	4
		EP TOTAL		4	4		4	4	0	0	3	4	4	4	4	4

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TABLE S4.3.3 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 3 DRAFT DO NOT CITE
PAINT SPRAY BOOTH WASTEWATERS

S&A REQUEST: 006
LOCATION: PAINT SPRAY BOOTH WASTEWATERS
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	SN006014I	SN006014J	SN006025I	SN006025J	SN006036I	SN006036J
	SDG NO:	LL003043F	SN001042G	LL003043F	SN001042G	LL003043F	SN001042G
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		95 B		117 B		98 B	
BARIUM		87 B		102 B		94 B	
CADMIUM		3 B		4.3 B		3.2 B	
CALCIUM		15600		16700		15500	
CHROMIUM		402			447	388	
IRON		6140		6630		5820	
LEAD			12		12		12
MAGNESIUM		568 B		602 B		537 B	
MANGANESE		76		81		76	
MERCURY			0.55		0.59		0.57
NICKEL		6.1 B			9 B	6 U	
POTASSIUM		760 B		760 B		760 B	
SODIUM		3790 B		4100 B		3910 B	
ZINC		158 E		171 E		158 E	

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	SN006047D	SN006047H	SN006047I
	SDG NO:	SN001042G	LL003043F	SN005013J
	TYPE:	FIELD BLANK	FIELD BLANK	FIELD BLANK
ALUMINUM			60 U	
BARIUM			2 U	
CADMIUM			2 U	
CALCIUM			200 U	
CHROMIUM			6 U	
IRON			99 B	
LEAD		1.2 B		
MAGNESIUM			18 B	
MANGANESE			5 U	
MERCURY				0.02 B
NICKEL			6.7 B	
POTASSIUM			100 U	
SODIUM			200 U	
ZINC			16 BE	

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	SN006014E	SN006025E	SN006036E	SN006047E
	SDG NO:	C825	C825	C825	C825
	TYPE:	GRAB	GRAB	GRAB	FIELD BLANK
BIS(2-ETHYLHEXYL)PHTHALATE		10 JB	20 B	7 JB	10 U
* UNKNOWN (9.31)		3 J			

TABLE S4.3.3 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 3 DRAFT DO NOT CITE
PAINT SPRAY BOOTH WASTEWATERS

S&A REQUEST: 006
LOCATION: PAINT SPRAY BOOTH WASTEWATERS
MEDIUM: SURFACE WATER

EXTRACTABLE ORGANICS (UG/L)	SAMP NO: SDG NO: TYPE:	SN006014E C825 GRAB	SN006025E C825 GRAB	SN006036E C825 GRAB	SN006047E C825 FIELD BLANK		
* UNKNOWN (9.32)			3 J	3 J			
* UNKNOWN (12.23)		3 J					
* UNKNOWN (12.32)			6 J	5 J			
* UNKNOWN (12.46)			2 J				
* UNKNOWN (12.70)				2 J			
* UNKNOWN (13.00)			2 J				
* UNKNOWN (13.60)				3 J			
* UNKNOWN (14.09)				7 J			
* UNKNOWN (14.10)		3 J					
* UNKNOWN (14.12)			11 J				
* UNKNOWN (14.50)		4 J		4 J			
* UNKNOWN (14.51)			2 J				
* UNKNOWN (14.69)		3 J		3 J			
* UNKNOWN (14.70)			2 J				
* UNKNOWN (15.13)			2 J				
* UNKNOWN (15.14)				1 J			
* UNKNOWN (16.48)				2 J			
* UNKNOWN (17.47)			1 J				
* UNKNOWN (17.48)		3 J					
* UNKNOWN (17.97)			2 J	2 J			
* UNKNOWN (18.70)			4 J	3 J			
* UNKNOWN (18.75)		32 J					
* UNKNOWN (23.28)			2 J				
* UNKNOWN (23.29)				1 J			
* UNKNOWN (25.81)		8 J		7 J			
* UNKNOWN (25.82)			11 J				
* UNKNOWN (33.38)				13 J			
* UNKNOWN (33.39)		15 J					
* UNKNOWN (36.41)		12 J					
* UNKNOWN AROMATIC (7.99)				2 J			
* UNKNOWN AROMATIC HYDROC(11.50)			2 J				
* UNKNOWN AROMATIC HYDROC(12.22)			3 J	2 J			
* UNKNOWN HYDROCARBON (12.33)		5 J					
* UNKNOWN HYDROCARBON (32.29)		10 J	10 J	12 J			
* UNKNOWN HYDROCARBON (33.38)			15 J				
* UNKNOWN HYDROCARBON (35.43)				11 J			
* UNKNOWN HYDROCARBON (35.44)		15 J	13 J				
* UNKNOWN HYDROCARBON (36.41)			14 J				
* UNKNOWN HYDROCARBON (36.42)				12 J			

TABLE S4.3.3 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 3 DRAFT DO NOT CITE
PAINT SPRAY BOOTH WASTEWATERS

S&A REQUEST: 006
LOCATION: PAINT SPRAY BOOTH WASTEWATERS
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	SN006014A	SN006025A	SN006036A	SN006047A		
	SDG NO:	0816	0816	0816	0816		
	TYPE:	GRAB	GRAB	GRAB	FIELD BLANK		
ACETONE		78 B	94 B	10 U	6 JB		
CHLOROFORM		0.9 J	1 J	0.9 J	18		
ETHYLBENZENE		1 JB	2 JB	2 JB	2 JB		
METHYLENE CHLORIDE		1100 E	1100 E	1100 E	5 J		
TOLUENE		2 JB	2 JB	1 JB	1 JB		
XYLENE (TOTAL)		2 J	1 J	2 J	5 U		
1,1,1-TRICHLOROETHANE		2 J	2 J	2 J	5 U		
4-METHYL-2-PENTANONE		6 J	6 J	5 J	10 U		

RADIOCHEMISTRY (PCI/L)	SAMP NO:	SN006014K	SN006025K	SN006036K	SN006047J		
	SDG NO:	LLL7268	LLL7268	LLL7268	LLL7268		
	TYPE:	GRAB	GRAB	GRAB	FIELD BLANK		
G-ALPH		30	0	5	0		
GROSS-BETA		0	68	62	8		

4.22 SNLL Environmental Problem 4: Inactive Sites

Request Numbers: 7, 8, 9, 10, and 11.
Requester: J. Werner.
Finding and Basis: Ongoing or potential groundwater or soil contamination may be caused by past releases of hazardous substances to the ground. Areas of suspected contamination exist on the site. Some of these sites have not been adequately identified, characterized, or cleaned up. Lack of information about areas suspected to be contaminated with hazardous substances may result in continued or future releases. (One of these suspect areas was the Navy landfill. The Survey Team planned to propose the installation and sampling of several new groundwater monitoring wells in this area; however, it was decided not to do this second phase of sampling.)

4.22.1 Sampling and Analysis Objectives

Statement: Sediment and soil samples were to be collected to determine if contaminants listed in Sect. 4.22.2.2 were present above normal levels in soils in areas of suspected contamination.

Supporting Information: None.

4.22.2 Sampling and Analytical Design

4.22.2.1 Sampling Design

Request 7: Ditch Before Culvert at the Bottom of the Navy Landfill behind 913 (Fig. S4.4a). Six grab sediment samples, three at the surface and three at depth, were to be collected by augering to a depth as indicated by field PID screening (Sampling Method: Reference E5.1 and E5.2.3). Augering was to be continued taking a PID reading every foot, with a sample collected at the depth of the

greatest PID reading. If there was no PID reading indication, the sample from a depth of 0 to 10 ft was to be composited for organic analysis. Request 7 was made because past disposal in the Navy landfill may have included hazardous wastes, with the ditch serving as a surface conduit for seepage out of the landfill. The sampling area chosen was to be less than 100 m^2 and assumed to be homogeneous. The area was to be divided into a 6 x 10 m grid of 60 segments; three segments were to be selected at random.

When the Sampling Team arrived at the site at 0930 on 13AUG87, the sky was clear and the temperature was 80°F. Because of the age of the landfill, it was assumed that organics would be at a greater depth than metals. A new protocol per Field Team Leader J. Murphy, however, called for surface samples to be collected from 0 to 3 in., with samples composited from 0 to 3 ft, and the remainder composited from 3 to 10 ft. However, samples were collected as dictated by field conditions. No PID readings were taken.

Sample SN007060 (grid 29) was collected at surface 0 to 3 in. at 0945. For sample SN007037 (grid 29), core 1 was collected intact (0 to 5 ft) at 1000. Sample SN007059 (grid 23) was collected at surface 0 to 3 in. at 1115. For sample SN007026 (grid 23), core 1 was collected intact (0 to 5 ft) at 1120. Moisture was present at 5 ft, and drilling was completed through to dry soil. For sample SN007015 (grid 22), core 1 was collected intact (0 to 3 ft only) at 1150. Moisture was present. Sample SN007048 (grid 22) was collected at surface 0 to 3 in. at 1150.

Request 8: High Explosives Burn Pit (Fig. S4.4b). Three sub-surface grab soil samples were to be collected at selected areas in the high explosives burn pit (Sampling Method: Reference E5.2.3). These samples were to be collected to the depth of the pit (approximately 10 ft) and the 0 to 10 ft cores composited. The area of the pit was less than 100 m^2 and assumed to be homogeneous with respect to any outside influences; however, because of use and age, potential

contaminant layering was to be considered very heterogeneous. The pit was to be divided into a 60-segment grid with three segments randomly selected for sampling. No high explosives were ever in the pit. Only lithium, potassium, and sodium were in the pit according to SNLL personnel.

The Sampling Team arrived at the burn pit at 1345 on 13AUG87. The day was clear, sunny, and windy with a temperature of 87°F. Although the sampling and analysis plan called for the area to be divided into a 60-segment grid, the Sampling Team divided the area into a 8 x 8 ft, 64-segment grid. Three segments were selected at random. Some brick, rocks, debris, and burned paper were at the pit surface. Earth was fairly soft and "fill" dirt was hit at 3 to 4 ft. Different zones or types of dirt and debris were encountered. The new protocol started for Request 7 was followed for this request.

Sample SN008016 (grid 14) was collected at a depth of 0 to 8.5 ft at 1430. A volatile grab sample was taken at 4 ft at 1420. Metal scraps were encountered. Sample SN008027 (grid 19) was collected at a depth of 0 to 9 ft at 1430. A volatile grab sample was taken at 3.4 ft at 1420. Metal scraps, glass, and porcelain were found from 0 to 4 ft. Fill dirt and metal were also found. Sample SN008038 (grid 53) was collected at a depth of 0 to 9.5 ft at 1450. A volatile grab sample was taken at 4 ft at 1445. Rock was hit at 4 ft. The rock was penetrated, and a clay zone was hit from 4.5 to 9.5 ft. QC rinsate SN008049 was collected at 1304 before the first sample for Request 8 was taken.

Request 9: Old Fire Extinguisher Training Area (Fig. S4.4c). Four grab soil samples were to be collected, at depths up to 10 ft as determined by field PID measurement screening, from selected areas in the training area (Sampling Method: Reference E5.2.3). The area was to be divided into an 80-segment grid. The first sample was to be randomly selected and subsequent samples were to be measured each 20 ft thereafter. The systematic approach was to be used to

ensure that the downgradient side of the area was covered. The total area was to be between 100 and 500 m^2 and assumed to be homogeneous with respect to outside influences. Gasoline was reported to have been poured on the ground and burned in this area.

For the first day's sampling, the Sampling Team arrived with Sandia Site escorts at 1000 on 12AUG87. The sky was clear and the temperature was 75°F. The Sampling Team divided the area into an 8 x 10 m grid of 80 segments. Extra time was spent locating underground cables and pipes in order to drill around them. Per new protocol by Field Team Leader J. Murphy, drilling was started at the surface and PID readings started at 3 ft. PID was continued until readings exceeded 10 ppm, then continued at 5 ft intervals until depth was obtained. A radiochemistry scan was 20 cpm. Other new protocol per J. Murphy called for PID readings to be taken at 0 to 3 ft only.

For the second day's sampling, the Sampling Team members arrived at the Sandia Site at 0700 on 13AUG87. The day was cloudy, windy, and the temperature was 70°F. A radiochemistry scan of the area was 20 cpm. The new protocol called for by the Field Team Leader for the first day's sampling (12AUG87) was followed.

For sample SN009040 (grid 65), core 1 was sandy but collected intact (0 to 3 ft) at 1040 on 12AUG87. Core 2 was collected intact with moisture noticed at 5 1/2 ft. Core 3 was sandy but collected intact. Cores 4 and 5 were collected intact. Starting at 3-ft intervals, PID readings of the above cores were 7.4 at 1258, 5.5 at 1357, 4.3 at 1420, 3.1 at 1445, and 1.6 at 1510. For sample SN009017 (grid 5), core 1 was collected intact at 0710 on 13AUG87. SN009017 was collected at 0 to 3 ft only per the Field Team Leader. The PID reading was 2.2 at 0800. For sample SN009028 (grid 25), core 1 was collected intact (0 to 3 ft) at 0750 on 13AUG87. The PID reading was 0.5 at 0824. For sample SN009039 (grid 45),

core 1 was collected (0 to 3 ft) at 0815 on 13AUG87. The PID reading was 0.0 at 0845.

Request 10: Edge of Arroyo Seco on the North Side of the Sandia Crossing (Fig. S4.4d). Six stratified grab soil samples were to be taken from the surface from selected areas of the edge of Arroyo Seco (Sampling Method: References E5.1 and E5.2.3). According to the Survey, the area was less than 100 m^2. The Sampling Team was to divide it into a 1x60-segment grid with three segments selected at random. Three surface samples were to be collected at three selected stained areas, which were assumed to be homogeneous with respect to each other. If there were more than three such areas, the selection was to be random. Additional samples were to be taken at three randomly selected grid segments in areas that were not stained. These samples were to be collected at a depth of 1 to 3 ft. The DOE Survey Team had observed paint sludge on the ground as well as other debris, including wooden pallets and buckets. This area was used as a construction staging area.

The Sampling Team arrived at the sampling location at 1440 on 12AUG87. The day was clear and sunny with a temperature of 95°F. The Sampling Team found stained areas that were white, hard (did not look like concrete), and very thin. Because only two stained areas were found outside (west) of the grid, sample SN010065 was not collected. Sample SN010010 (grid 8) was collected at a depth of 1 to 2 ft at 1530. A concrete slab was hit at 2 ft. Sample SN010021 (grid 29) was collected at a depth of 1 to 2 ft from grid 29 at 1540. The spot was very rocky. About one-third of the sample, taken approximately 5 ft down the bank and 5 ft from the fence, was collected. Sample SN010054 was collected at a depth of 0 to 3 in. outside the grid of stained area 2 at 1540. Sample SN010043 was collected at a depth of 0 to 3 in. outside the grid of stained area 1 at 1555. Sample SN010032 (grid 53) was collected at a depth of 0 to 1 ft and from sediment deposited in the ditch from a wash. This sample was collected at 1600. Grid 53 happened to fall in an eroded drain area. A lot of rich sediment

had collected on the edge of the area but above the stream bottom of Arroyo Seco. Two-thirds of the sample was taken from this area and the sample was composited.

Request 11: Old Paint and Drum Storage Area (Fig. S4.4e). Six grab soil samples were to be collected in the area to a depth indicated by field PID screening (Sampling Method: Reference E5.2.3). At the time of the Survey, the total area under consideration was greater than 500 m^2. There were two suspect areas within the total area. Those were considered homogeneous to each other, but both were to be sampled. Three samples were to be collected from each suspect area. The area was to be divided into 60-segment grid, with three segments selected at random for sampling. This area was formerly used as a paint and drum storage area. Some sampling had occurred about 30 to 50 yds north of the area, but not in the area itself.

The Sampling Team arrived on-site at 1520 on 13AUG87. The day was clear, sunny, and windy with a temperature of 86°F. The Team divided the total area into areas 1 and 2. All of area 1 and three-fourths of area 2 were then divided into a 60-segment grid. Three segments were selected at random from each area. A drill rig augered holes to a depth of 1 ft (including asphalt and/or crushed rock). A posthole digger was then used for the collection of grab samples.

Sample SN011011 (grid 12) was collected at a depth of 4 to 5 ft at 1557. A TIP reading of 0.3 to 0.5 jumped to 0.7 at 3 ft and peaked at 1.0 at 4 ft. The reading stayed at this level to 5 ft. Sample SN011022 (grid 14) was collected at a depth of 0 to 5 ft at 1612. The TIP reading was 0.2 at each 1-ft interval. Sample SN011033 (grid 30) was collected at a depth of 0 to 5 ft at 1620. The TIP readings taken to 5 ft. read 0.2. Samples SN011044, SN011055, and SN011066 were not collected due to a rock pile.

4.22.2.2 Analytical Design

The parameters analyzed and/or measured for SNLL Environmental Problem 4 were as follows:

Request 7: The parameters analyzed were volatiles, semivolatiles, ICP-metals, gross alpha, gross beta, and uranium (with special interest in MEK, $MeCl_2$, Freon 113, TCE, TCA, and PCE). PID field measurements were made.

Request 8: The parameters analyzed were volatiles, semivolatiles, ICP-metals, gross alpha, gross beta, and gamma scan (with special interest in MEK, $MeCl_2$, Freon 113, TCE, TCA, and PCE). No field measurements were required.

Request 9: The parameters analyzed were volatiles, semivolatiles (special interest in benzene, xylene, and toluene), and ICP-metals. PID field measurements were made in order to select sample depths.

Request 10: The parameters analyzed were volatiles, semivolatiles, and ICP-metals. No field measurements were required.

Request 11: The parameters analyzed were volatiles, semivolatiles, and ICP-metals. PID field measurements were made in order to select sample depths.

4.22.3 Field and Analytical Data

Field Data:

Request 7. The SNLL sampling and analysis plan requested that pH and PID readings be taken. However, the PID reading was eliminated by the Team Leader; no mention was made in the field notes regarding eliminating pH

measurements. Normally pH is requested for water samples in the field. Although not a standard request, pH could be measured if distilled water was available to mix with the soil samples.

Request 8. NA

Request 9. PID readings were requested to assist in selecting sample depths. The highest readings are provided in Table S4.3.4. Additional readings for sample SN009040 are provided in the Sampling Design section as part of sampling documentation.

Request 10. PID readings were requested, but were not documented.

Request 11. NA

Field Data Evaluation:

Request 7. Due to a change in PID reading requests, pH may have been eliminated. If so, field notes should have recorded this change. The change in taking PID readings occurred one day after sampling started, and this partly explains the presence/absence of PID readings.

Request 8. NA

Request 9. PID readings in Table S4.3.4 indicate the highest PID reading for each sample location.

Request 10. NA

Request 11. NA

Analytical Data:

Metals.

Request 7. Analytical data for metals in sediment are presented in Table S4.3.4. Of the 18 metals detected, lead and sodium were below the CRQL in all six samples. Of the remaining metals detected, barium ranged from 169 to 364 mg/kg; beryllium was 0.77 mg/kg; cadmium ranged from 0.75 to 1.5 mg/kg; chromium, 48 to 90 mg/kg; copper, 24 to 44 mg/kg; nickel, 103 to 134 mg/kg; silver, 2.1 to 2.9 mg/kg; and zinc, 51 to 76 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium.

Request 8. Analytical data for metals in soil are presented in Table S4.3.4. Of the 18 metals detected, sodium was below the CRQL in all three samples. Of the remaining metals detected, barium ranged from 322 to 438 mg/kg; beryllium was 0.86; cadmium ranged from 2.1 to 10 mg/kg; chromium, 66 to 85 mg/kg; copper, 78 to 402 mg/kg; lead, 188 to 376 mg/kg; nickel, 131 to 1930 mg/kg; silver, 5.1 to 9.6 mg/kg; and zinc, 216 to 3910 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium.

Request 9. Analytical data for metals in soil are presented in Table S4.3.4. Of the 18 metals detected, beryllium, lead, and sodium were below either the CRQL or the IDL in all four samples. Of the remaining metals detected, barium ranged from 190 to 249 mg/kg; cadmium, 0.76 to 0.93 mg/kg; chromium, 36 to 50 mg/kg; copper, 21 to 28 mg/kg; nickel, 38 to 51 mg/kg; silver, 1.6 to 1.7 mg/kg; and zinc, 31 to 60 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium.

Request 10. Analytical data for metals in soil are presented in Table S4.3.4. Of the 19 metals detected, arsenic and sodium were below the CRQL in all five samples. Of the remaining metals detected, barium ranged from 158 to 422

mg/kg; beryllium was 0.75 mg/kg; cadmium, 0.95 to 9.3 mg/kg; chromium, 36 to 54 mg/kg; copper, 22 to 40 mg/kg; lead, 7.6 to 63 mg/kg; nickel, 41 to 132 mg/kg; silver, 3.6 to 4 mg/kg; and zinc, 89 to 1900 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium.

Request 11. Analytical data for metals in soil are presented in Table S4.3.4. Of the 18 metals detected, beryllium and sodium were below the CRQL in all three samples. Of the remaining metals detected, barium was 172 to 382 mg/kg; cadmium, 0.87 to 2.9 mg/kg; chromium, 31 to 40 mg/kg; copper, 19 to 100 mg/kg; lead, 28 to 277 mg/kg; nickel, 37 to 43 mg/kg; silver, 1.6 to 2.1 mg/kg; and zinc, 31 to 418 mg/kg. Other metals detected were aluminum, calcium, cobalt, iron, magnesium, manganese, potassium, and vanadium.

Volatile organics. Analytical results for volatiles are presented in Table S4.3.4. Results are discussed by request number below.

Request 7. From 4 to 13 volatiles were detected in the six samples for this request. The highest concentrations of volatiles, as well as the most volatiles detected, were in sample SN007060. That sample contained 49 ug/kg of 2-butanone and 85 ug/kg of 4-methyl-2-pentanone. A small amount of styrene was also detected in that sample. Methylene chloride, an item of interest indicated in this request, was present only in small amounts in these samples and also in the blanks.

Request 8. There were five volatiles detected in one sample, four in another sample, and only one in the third sample. A small amount of a compound tentatively identified as tetrahydrofuran was present in sample SN008027. Methylene chloride, an item of interest indicated in this request, was present only in small amounts in two samples and undetected in the other. The highest concentration of methylene chloride was 26 ug/kg.

Request 9. Small amounts of four volatiles were detected in each of the four samples. Three of these (acetone, methylene chloride, and toluene) were also always detected in associated blank samples. Tetrahydrofuran was also identified in small amounts in all four samples. This area is an old fire extinguisher training area where gasoline was reported to have been poured on the ground and burned at one time. Toluene, an item of interest indicated in this request, was barely detected in all these samples as well as in the blanks. Xylene and benzene, other items of interest noted in this request, were not detected in any of the samples.

Request 10. From 4 to 15 volatile compounds were identified in each of the five samples for this request. Samples SN010021 and SN010032 had estimated concentrations of greater than 150 ug of an unknown volatile (same retention time in both samples) per kilogram of soil. Sample SN010032 had an estimated 108 ug of a compound tentatively identified as a benzene derivative and an estimated 170 ug of a compound tentatively identified as pinene, per kilogram of soil. Sample SN010043 had an estimated 256 ug of a tentatively identified benzene derivative (with essentially the same retention time as the tentatively identified benzene derivative in sample SN010032) per kilogram of soil. Samples SN010043 and SN010054 also had 8 ug of benzene per kilogram of soil. The Survey Team had observed paint sludge on the ground and debris in this area. White stained patches were noted by the Sampling Team.

Request 11. From two to six volatiles were identified in the three samples for this request. Methylene chloride was a bit higher (47 ug/kg) in SN011011 than in the other two samples. SN011011 also had a small amount of tetrahydrofuran tentatively identified. These samples are from an old paint and drum storage area.

Extractable organics. *Analytical data for semivolatile organic compounds are presented in Table S4.3.4. Data are given for 21 samples within this environmental problem. The number of detectable compounds in particular samples ranged from nine to 24, with a median value of 16.*

Request 7. For the six samples from the ditch before the culvert at the bottom of the Navy landfill, bis(2ethylhexy)phthalate and diacetone alcohol were present in the highest measured or estimated concentrations. Bis(2-ethylhexyl)phthalate concentrations were estimated from 22 to 44 mg/kg in three of the samples, but measured concentrations were about two orders of magnitude smaller in two of the other three samples, and it was undetected in the remaining sample. The samples with small or undetected concentrations were all from 0 to 3 in. while the higher estimated concentrations came from 0 to 3 ft or 0 to 5 ft. Diacetone alcohol estimated concentrations ranged from 11 to 27 mg/kg across the six samples. Dioctyl adipate was identified in concentrations of from 1.4 to 1.6 mg/kg across all six samples. Tentatively identified hydrocarbons and unknowns were also detected in estimated concentrations of up to 2.2 mg/kg in these samples, but most of those concentrations were estimated at below 1 mg/kg. Tentatively identified triazine compounds were detected in estimated concentrations of 1.2 and 1.3 mg/kg in two of the samples.

Request 8. Diacetone alcohol was estimated in concentrations of 19, 22, and 27 mg/kg in these three samples from the high explosives burn pit. Bis(2-ethylhexyl)phthalate was also identified in all three samples, but in two of the samples the concentrations were measured at less than 0.6 mg/kg, and in the other sample the concentration was estimated at 18 mg/kg. Dioctyl adipate was identified in concentrations of 1.5 to 1.6 mg/kg in all three samples. The following compounds were identified in estimated concentrations of less than 0.1 mg/kg in sample SN008016 and undetected in the others: benzo(A)pyrene, chrysene, di-n-butylphthalate, and fluoranthene. Sample SN008016 also contained an estimated 0.26 mg/kg of n-nitrosodiphenylamine, but that compound

was also undetected in the other samples. Di-n-octyphthalate was detected in estimated concentrations of 0.020 mg/kg or less in samples SN008016 and SN008038. A measured concentration of 0.67 mg/kg of a triazine compound appeared in sample SN008038. Other tentatively identified compounds or unknowns were detected in concentrations estimated at less than 4 mg/kg and usually at less than 1 mg/kg.

Request 9. Diacetone alcohol was detected in all four samples in concentrations ranging from 9.9 to 26 mg/kg. Dioctyl adipate was also detected in all four samples, in concentrations of about 1.5 mg/kg. Small quantities (less than 0.2 mg/kg) of chrysene and di-n-octyphthalate were detected in at least one sample. The highest measured or estimated concentration of bis(2-ethylhexyl)phthalate was slightly less than 1 mg/kg. Unknown siloxanes and other unknowns were present in estimated concentrations of up to 2.6 mg/kg, but most had estimated concentrations of less than 1 mg/kg.

Request 10. Diacetone alcohol was detected in concentrations ranging from 6.2 to 24 mg/kg. Dioctyl adipate was detected in a concentration of 1.4 mg/kg in four of the samples and estimated at 7.5 mg/kg in the remaining sample. Bis(2-ethylhexyl)phthalate was identified in an estimated concentration of 17 mg/kg in one sample, but measured or estimated at an less than 1 mg/kg in the others. Other compounds were identified in small amounts (less than 0.1 mg/kg) in individual samples. Tentatively identified hydrocarbon was detected in estimated concentrations of 190 and 140 mg/kg in samples SN010032 and SN010043, respectively. Other tentatively identified or unknown compounds were detected in concentrations estimated at up to 2.9 mg/kg but usually at less than 1 mg/kg.

Request 11. Diacetone alcohol was identified in concentrations of from 12 to 29 mg/kg in these three samples from an old paint and drum storage area. Dioctyl adipate was also identified in concentrations of 1.5 to 1.6 mg/kg in all three samples. Bis(2-ethylhexyl)phthalate was present in estimated concentrations of

31 and 59 mg/kg in samples SN011022 and SN011033, respectively. Unknown or tentatively identified compounds were present in estimated concentrations of up to 1.6 mg/kg, but most of these concentration estimates were less than 1 mg/kg.

Radiochemistry. *Gross alpha activity for sediment and soil samples from the Navy landfill, burn pit, and old paint and drum storage areas averaged 6200 pCi/kg and gross beta averaged 22,000 pCi/kg. Total uranium activity for Request 7, which ranged from 64 to 136 pCi/kg, averaged 89 pCi/kg. The gamma scan for Request 8 showed potassium-40 to be dominant with 10,950 pCi/kg and one sample had cesium-137 at 35 pCi/kg.*

Analytical Data Evaluation:

Metals. The listed metals of interest were detected above the CRQL in the samples for the following requests:

Request 7. Barium, beryllium, cadmium, chromium, copper, nickel, silver, and zinc.

Request 8. Barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

Request 9. Barium, cadmium, chromium, copper, nickel, silver, and zinc.

Request 10. Barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

Request 11. Barium, cadmium, chromium, copper, lead, nickel, silver, and zinc.

Volatile organics. Benzene, chloroform, 1,1,1-trichloroethane and 2-butanone were the only compounds unambiguously identified in Request 10.

Extractable organics. Bis(2-ethylhexyl)phthalate and diacetone alcohol were often identified in measured or estimated concentrations of more than 10 mg/kg. Dioctyl adipate also was often present in concentrations of around 1.5 mg/kg. In the soil samples taken from the edge of Arroyo Seco on the north side of Sandia Crossing, there were two samples in which a tentatively identified hydrocarbon was present in estimated concentrations of between 100 and 200 mg/kg. The soils and sediments at these inactive sites appear to have some contamination as a result of past use.

Radiochemistry. Samples for Requests 7, 8, and 11 were analyzed for gross alpha and beta activity. In addition, six samples for Request 7 were analyzed for uranium, and gamma scans were performed on three samples for Request 8. Results are given in Table S4.3.4.

4.22.4 Limitations and Qualifications

Data Quality Level: The sampling plan is rated Quality Level II for Requests 7, 9, and 11, and Quality Level I for Requests 8 and 10. The field sampling is rated Quality Level II for Requests 7 and 11, and Quality Level I for Requests 8, 9, and 10. The overall analytical rating is Quality Level II for Request 7 and Quality Level I for Requests 8, 9, 10, and 11.

Field Data: To understand the field sampling relative to the sampling plan, careful attention must be given to the date of sampling. Request 9 was the initial sampling site where the sampling protocol was modified. Only one sample out of four was collected on the first day for this request. Next, the Team collected samples for Request 10. The following day the Team returned to the site of Request 9 to complete the sampling. The sampling proceeded with Requests 7, 8, and 11. Some confusion regarding sampling was noted whereby the sampling plan (modified) called for compositing samples from 0 to 3 ft, with

the remainder being composited from 3 to 10 ft (Request 7); instead, the samples were taken from 0 to 3 ft or 0 to 5 ft without explanation of deviation from the modified plan. Only three samples were collected for Request 11, which called for three each from two suspect areas. Field notes state that three samples from area 2 could not be taken, thus reducing the number of samples. The notes state, however, that area 1 encompassed most of area 2, which suggests that additional samples could have been taken from area 1.

Analytical Data: The Quality Level II rating for Request 7 is due mainly to Quality Level II data for most results, plus exceeding the holding time for volatiles. It is interesting to note is that the high bis(2-ethylhexyl)phthalate concentrations were found in the subsurface samples. Analysis revealed sufficient information regarding metals, organic, and radionuclides to justify a rating of Quality Level I, although the holding time was exceeded for volatiles in Requests 8, 9, 10, and 11. The two stained surface samples were characterized by high zinc and silver concentrations in Request 10. In the drum storage area, lead was the dominant contaminant. Details on analytical data quality are given below.

Metals. Duplicate, spike, and serial dilution were out of control limits for nickel in all samples for Requests 7, 8, 9, and 11. In the five samples for Request 10, the duplicate and spiked samples were out of control limits for nickel. The spiked sample was beyond control limits for copper in all samples for Requests 7, 8, 9, and 11. The duplicate and spiked samples were beyond control limits for zinc in all samples except those for Request 10, which were within control limits for duplicates, spiked samples, and serial dilution for zinc. The duplicate, spiked sample, or serial dilution was beyond control limits for several of the other metals analyzed.

Data were Quality Level II for all metals for all samples in Requests 7, 8, 9, and 11. Data were Quality Level II for manganese, nickel, and selenium for all

samples in Request 10; data were Quality Level I for other metals in Request 10.

Volatile organics. Toluene was frequently identified in the trip blanks. Many volatiles were detected at levels below quantitation limits.

All but two of the entries on the data quality summary sheets indicated Quality Level II or III, with all Quality Level III entries relating to concentrations too small to quantify. The ratio of Quality Level III entries to Quality Level II entries was about 1.5. In about half the cases where the concentrations were too small to measure, the compound was also detected in the method blank.

Extractable organics. Many of the high concentration values of bis(2-ethylhexyl)phthalate were estimated and were flagged as being out of calibration range of the instrument. Measured concentrations from nearby samples often showed much lower (1 to 2 orders of magnitude lower) concentrations, so these high estimates should be viewed with particular caution. Also, bis(2-ethylhexyl)phthalate is a common compound and was frequently detected in the method blank in these samples. The data are Quality Level II due mainly to tentative identification by mass spectrometry or to the problems discussed above.

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.

Environmental Problem: SNLL 4
Request Number: SNLL 7

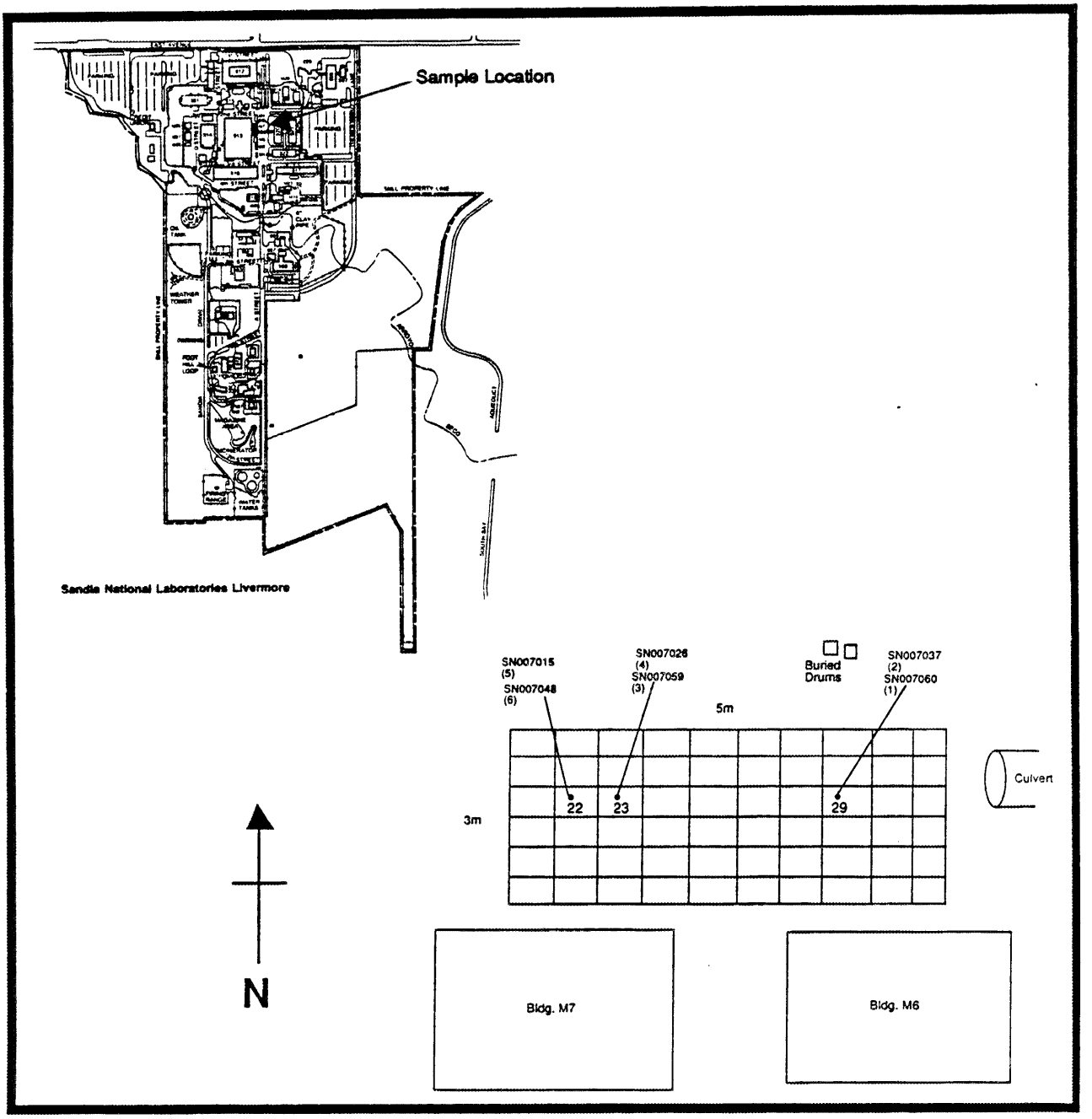

Figure S4.4a. Ditch Before Culvert at the Bottom of the Navy Landfill behind 913 (SNLL Request 7)

Environmental Problem: SNLL 4
Request Number: SNLL 8

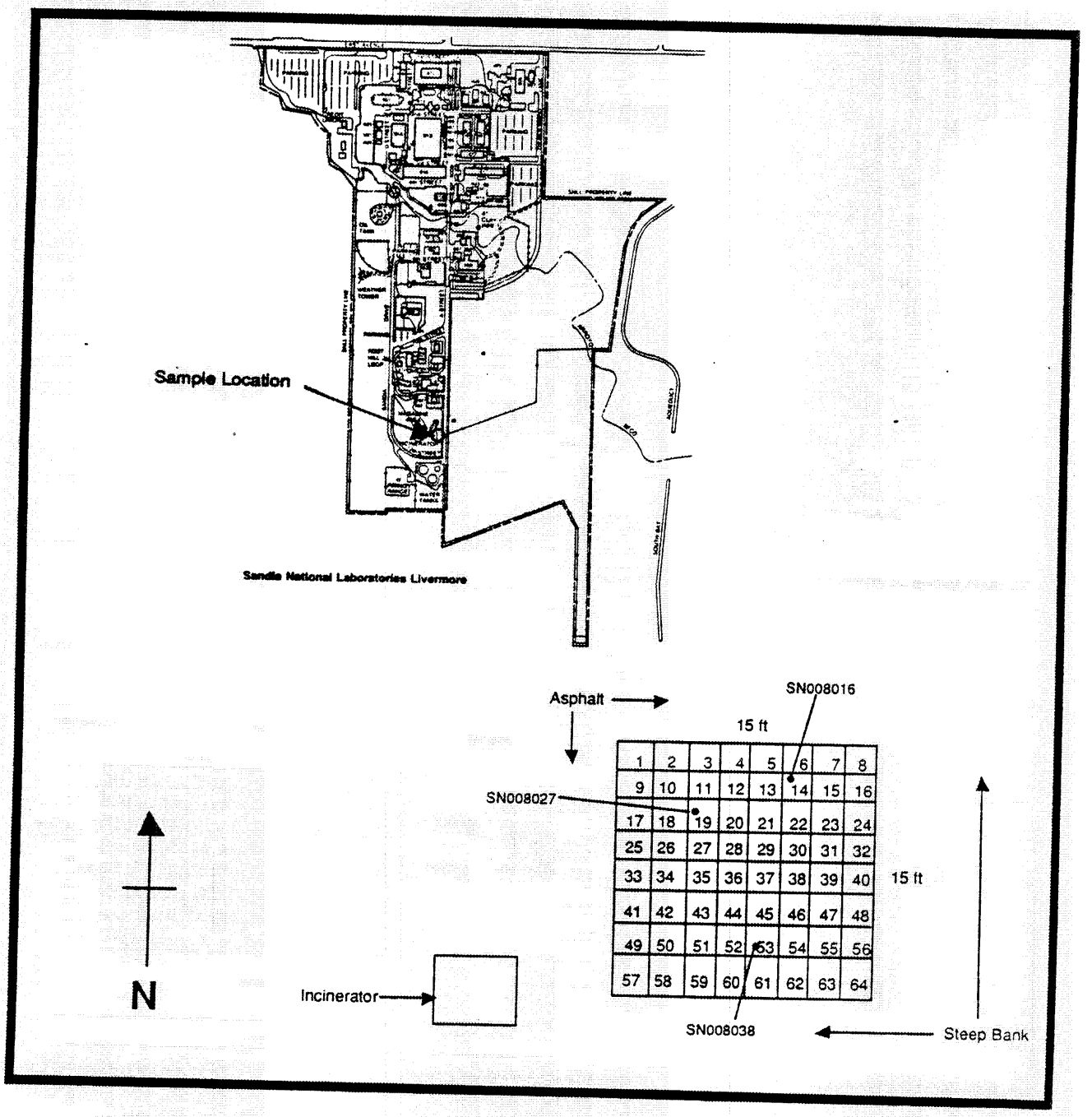

Figure S4.4b. High Explosives Burn Pit (SNLL Request 8)

Environmental Problem: SNLL 4
Request Number: SNLL 9

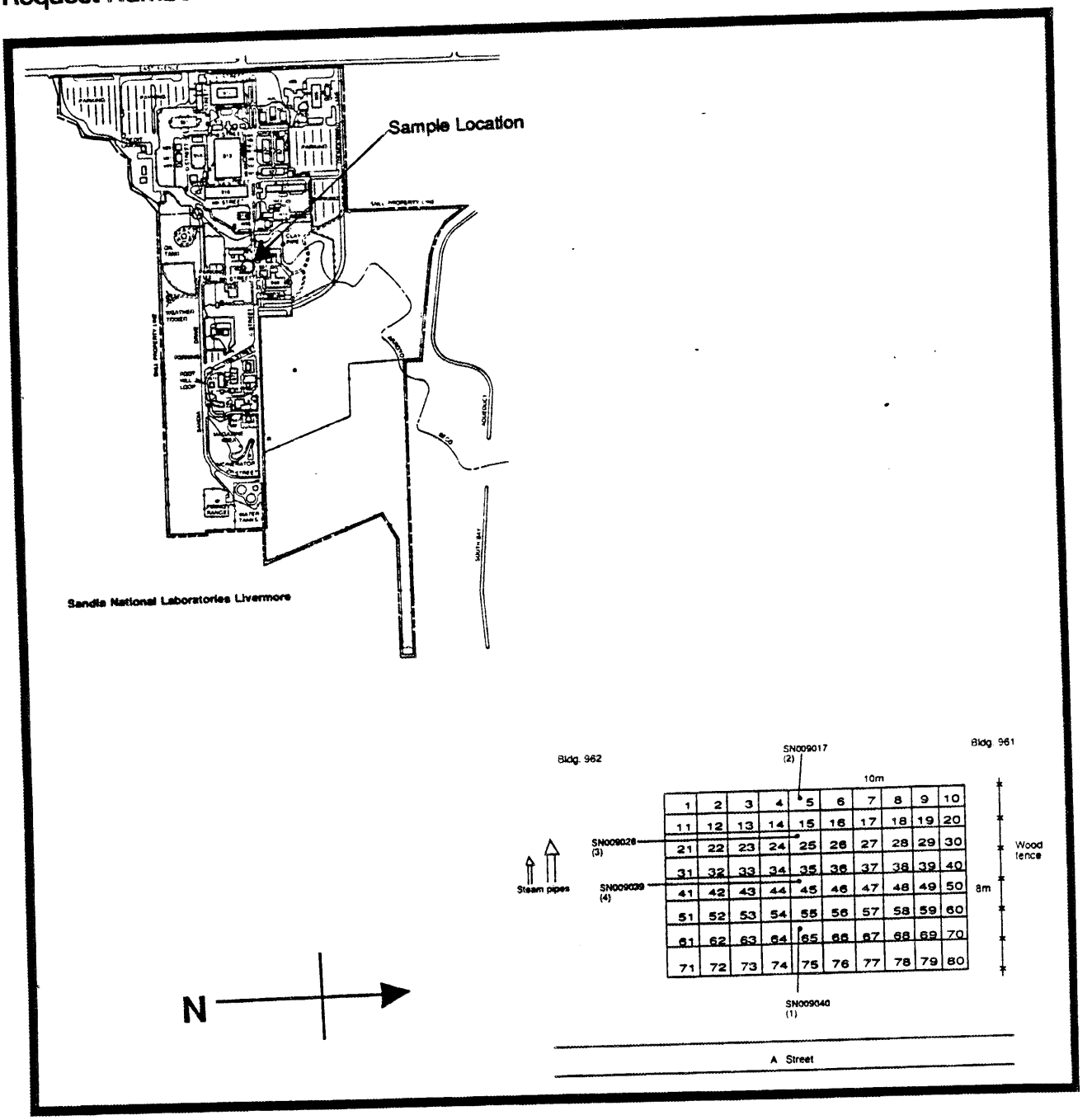

Figure S4.4c. Old Fire Extinguisher Training Area (SNLL Request 9)

Environmental Problem: SNLL 4
Request Number: SNLL 10

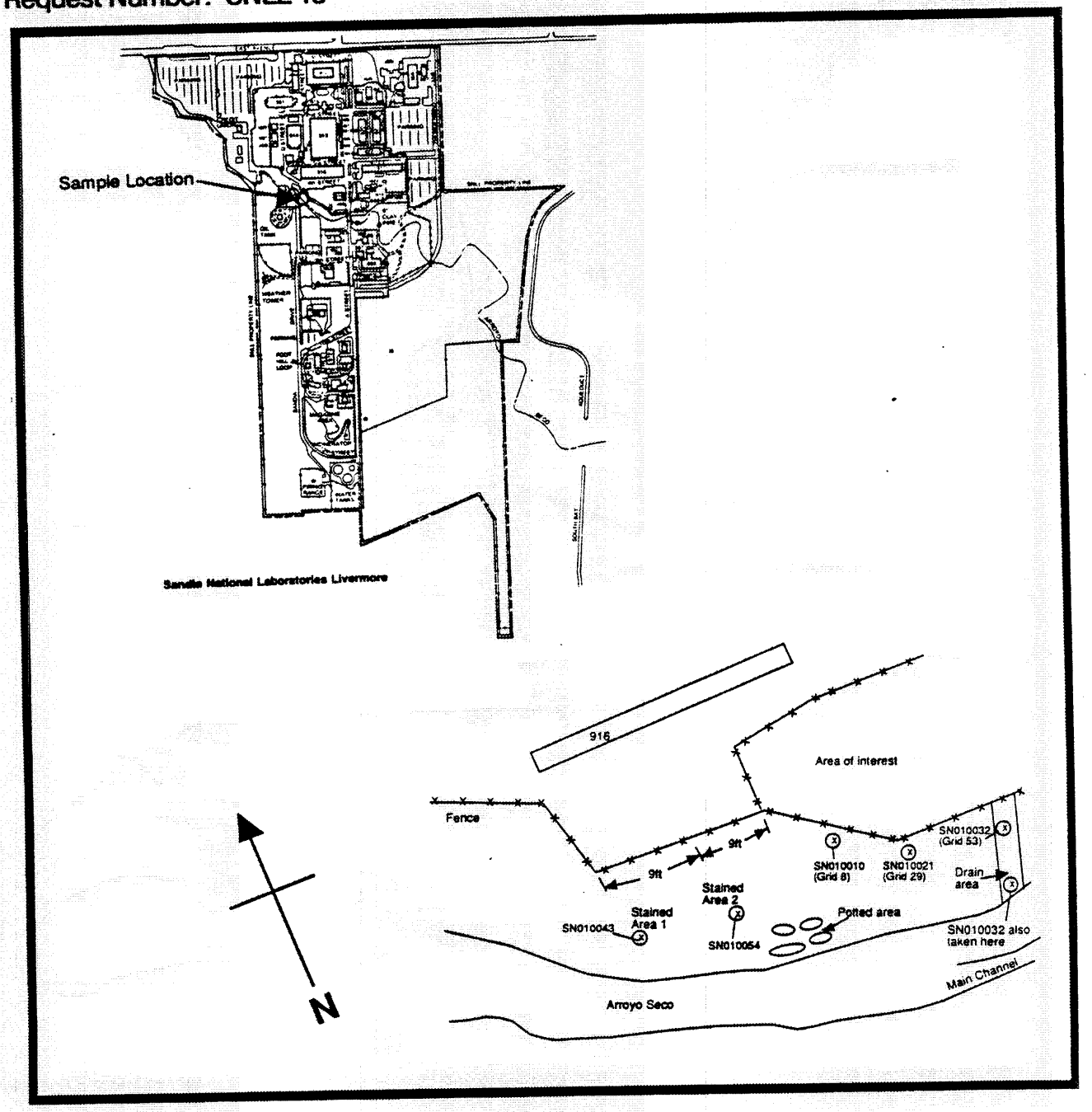

Figure S4.4d. Edge of Arroyo Seco on the North Side of the Sandia Crossing (SNLL Request 10)

Environmental Problem: SNLL 4
Request Number: SNLL 11

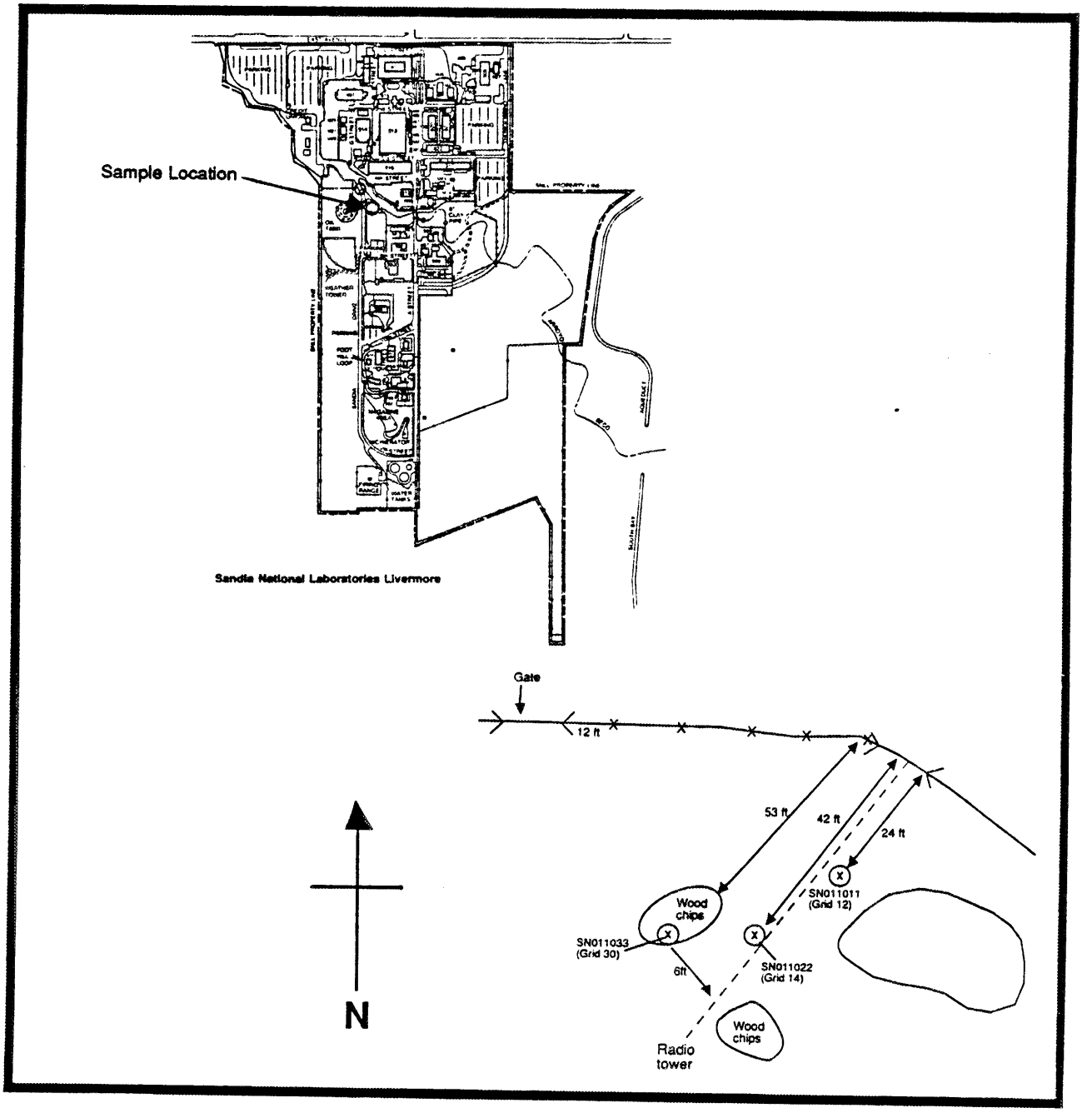

Figure S4.4e. Old Paint and Drum Storage Area (SNLL Request 11)

TABLE S4.2.4 SAMPLING AND ANALYSIS DATA SUMMARY
ENVIRONMENTAL PROBLEM - 4

REQUEST NUMBER	LOCATION	TYPE LOCATION	MEDIA	NUMB REQ	NUMB COLL	TYPE	METALS NUMB HITS	METALS 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
SN008	EXP BURN PIT	INACTIVE SI	SOIL	3	3	GRAB	3	3	0	0	3	3	3	3	3	3
SN009	OLD FIRE TRA	INACTIVE SI	SOIL	4	4	GRAB	4	4	0	0	4	4	4	4	0	0
SN010	SANDIA CROSS	INACTIVE SI	SOIL	6	5	GRAB	5	5	0	0	5	5	5	5	0	0
SN011	OLD PAINT ST	INACTIVE SI	SOIL	6	3	GRAB	3	3	0	0	3	3	3	3	3	3
		MED TOTAL		19	15		15	15	0	0	15	15	15	15	6	6
SN007	NAVY LANDFIL	INACTIVE SI	SEDIMENT	6	6	GRAB	6	6	0	0	6	6	6	6	6	6
		MED TOTAL		6	6		6	6	0	0	6	6	6	6	6	6
SN008	EXP BURN PIT	INACTIVE SI	SUR WATER	1	1	QC RN	1	1	0	0	1	1	1	1	1	1
		MED TOTAL		1	1		1	1	0	0	1	1	1	1	1	1
		EP TOTAL		26	22		22	22	0	0	22	22	22	22	13	13
		TOTAL		49	43		43	43	1	6	40	43	43	43	34	34

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TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 007
LOCATION: DITCH BEFORE CULVERT AT THE BOTTOM OF THE NAVY LANDFILL BEHIND 913
MEDIUM: SEDIMENT

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN007015C	SN007026C	SN007037C	SN007048C	SN007059C	SN007060C
	SDG NO:	LL028019C	LL028019C	LL028019C	LL028019C	LL028019C	LL028019C
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ALUMINUM		18700	19800	23400	11800	12600	12400
BARIUM		291 N	364 N	302 N	180 N	186 N	169 N
BERYLLIUM		0.61 B	0.68 B	0.77	0.36 B	0.37 B	0.4 B
CADMIUM		1.1	0.95	1.5	0.75	1.1	1.1
CALCIUM		6690	4080	7880	3760	4160	3850
CHROMIUM		77 E	74 E	90 E	48 E	65 E	56 E
COBALT		14 *	13 *	14 *	13 *	14 *	12 *
COPPER		37 N	32 N	42 N	24 N	44 N	27 N
IRON		28000 *	29200 *	37200 *	19600 *	22800 *	20900 *
LEAD		12 B*	11 B*	11 B*	7.7 B*	12 B*	9.6 B*
MAGNESIUM		11200	8120	16100	6890	8880	7790
MANGANESE		909 E	712 E	967 E	670 E	906 E	662 E
NICKEL		114 N*E	122 N*E	134 N*E	103 N*E	129 N*E	121 N*E
POTASSIUM		3100	2500	4000	2300	2400	2300
SILVER		2.2	2.1	2.5	2.5	2.5	2.9
SODIUM		229 B	304 B	351 B	147 B	138 B	154 B
VANADIUM		46 E	49 E	52 E	34 E	37 E	35 E
ZINC		59 N*	51 N*	76 N*	55 N*	71 N*	63 N*

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN007015B	SN007026B	SN007037B	SN007048B	SN007059B	SN007060B
	SDG NO:	LL001018B	LL001018B	LL001018B	LL001018B	LL001018B	LL001018B
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		44000 E	22000 E	41000 E	410	340 U	410
DI-N-OCTYLPHTHALATE		12 J	390 U	400 U	350 U	340 U	340 U
1,3,5-TRIAZINE-2,4-DIAMINE,					1300	360	1200
* DIACETONE ALCOHOL (6.10)						27000 J	
* DIACETONE ALCOHOL (6.18)		13000 J		11000 J			
* DIACETONE ALCOHOL (6.23)					14000 J		
* DIACETONE ALCOHOL (6.26)			16000 J				
* DIACETONE ALCOHOL (6.27)							22000 J
* DIOCTYL ADIPATE (31.05)		1600 J					
* DIOCTYL ADIPATE (31.06)						1400 J	1400 J
* DIOCTYL ADIPATE (31.07)			1600 J	1600 J	1400 J		
* PHTHALATE ESTER (32.05)		39 J					
* PHTHALATE ESTER (32.06)				18 J			
* PHTHALATE ESTER (32.07)			13 J				
* PHTHALATE ESTER (32.52)						25 J	
* PROBABLE HYDROCARBON (5.90)							380 J
* PROBABLE HYDROCARBON (5.91)						440 J	
* PROBABLE HYDROCARBON (6.49)			140 J	180 J			600 J

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 007
LOCATION: DITCH BEFORE CULVERT AT THE BOTTOM OF THE NAVY LANDFILL BEHIND 913
MEDIUM: SEDIMENT

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO: SDG NO: TYPE:	SN007015B LL001018B GRAB	SN007026B LL001018B GRAB	SN007037B LL001018B GRAB	SN007048B LL001018B GRAB	SN007059B LL001018B GRAB	SN007060B LL001018B GRAB
* PROBABLE HYDROCARBON (6.72)		320 J		530 J			
* PROBABLE HYDROCARBON (6.73)			430 J			970 J	900 J
* PROBABLE HYDROCARBON (6.87)					160 J		
* PROBABLE HYDROCARBON (6.93)		470 J	660 J	790 J			1300 J
* PROBABLE HYDROCARBON (6.94)						1400 J	
* PROBABLE HYDROCARBON (31.21)			21 J				
* PROBABLE HYDROCARBON (31.49)			14 J				
* UNKNOWN (5.42)					730 J		
* UNKNOWN (5.46)							220 J
* UNKNOWN (5.53)			1000 J				
* UNKNOWN (5.54)							280 J
* UNKNOWN (5.60)		2000 J					
* UNKNOWN (5.61)						2000 J	
* UNKNOWN (5.62)				2200 J			
* UNKNOWN (5.90)			110 J	150 J			
* UNKNOWN (6.49)						630 J	
* UNKNOWN (6.56)					310 J		
* UNKNOWN (6.60)		650 J					
* UNKNOWN (6.61)			710 J			870 J	720 J
* UNKNOWN (6.62)				710 J			
* UNKNOWN (7.36)			92 J				
* UNKNOWN (8.07)		180 J				210 J	
* UNKNOWN (8.08)			310 J	330 J			300 J
* UNKNOWN (8.96)			260 J				
* UNKNOWN (8.97)		220 J		240 J			
* UNKNOWN (9.00)					130 J		
* UNKNOWN (9.07)		550 J					
* UNKNOWN (9.08)				340 J			
* UNKNOWN (9.09)			170 J				
* UNKNOWN (10.08)							200 J
* UNKNOWN (31.20)		48 J					
* UNKNOWN SILOXANE (5.70)					110 J		
* UNKNOWN SILOXANE (5.75)		180 J					
* UNKNOWN SILOXANE (5.76)			98 J				130 J
* 1,3,5-TRIAZINE-2,4-DIAM(23.31)						360 J	1200 J
* 1,3,5-TRIAZINE-2,4-DIAM(23.36)					1300 J		

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 007
LOCATION: DITCH BEFORE CULVERT AT THE BOTTOM OF THE NAVY LANDFILL BEHIND 913
MEDIUM: SEDIMENT

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN007015A	SN007026A	SN007037A	SN007048A	SN007059A	SN007060A
	SDG NO:	0910	0910	0910	0910	0911	0911
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
ACETONE		16 B	14 B	15 B	48 B	18 B	73 B
BENZENE		6 U	6 U	6 U	3 J	0.9 J	4 J
CHLOROFORM		6 U	6 U	6 U	2 J	5 U	3 J
ETHYLBENZENE		6 U	6 U	6 U	2 JB	2 JB	3 JB
METHYLENE CHLORIDE		16 B	12 B	12 B	18 B	7 B	25 B
STYRENE		6 U	6 U	6 U	5 U	5 U	2 J
TOLUENE		5 JB	2 JB	4 JB	10 B	3 JB	18 B
2-BUTANONE		12 U	12 U	12 U	10 U	10 U	49
4-METHYL-2-PENTANONE		12 U	12 U	12 U	17	10 U	85
* ACETIC ACID, METHYL EST(9.64)							7 J
* ACETIC ACID, METHYL EST(9.69)					5 J		
* FURAN, TETRAHYDRO-(11.16)			3 J	5 J		4 J	19 J
* FURAN, TETRAHYDRO-(11.17)					11 J		
* FURAN, TETRAHYDRO-(11.21)		4 J					
* UNKNOWN(32.09)							27 J
* UNKNOWN(44.31)							24 J
* UNKNOWN(44.5)					3 J		

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	SN007015D	SN007026D	SN007037D	SN007048D	SN007059D	SN007060D
	SDG NO:	LLL7297	LLL7297	LLL7297	LLL7297	LLL7297	LLL7297
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
G-ALPH		14000	5400	6500	8900	810	6500
GROSS-BETA		21000	24000	23000	16000	14000	25000
U-234		98	220	130	110	100	120
U-235		19	47	24	29	5.4	12
U-238		96	140	110	100	86	150

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 008
LOCATION: HIGH EXPLOSIVES BURN PIT
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN008016C	SN008027C	SN008038C			
	SDG NO:	LL028019C	LL028019C	LL028019C			
	TYPE:	GRAB	GRAB	GRAB			
ALUMINUM		17600	18600	17100			
BARIUM		357 N	438 N	322 N			
BERYLLIUM		0.52 B	0.86	0.49 B			
CADMIUM		4.5	10	2.1			
CALCIUM		8160	9730	6820			
CHROMIUM		68 E	85 E	66 E			
COBALT		18 *	17 *	27 *			
COPPER		271 N	402 N	78 N			
IRON		55300 *	59100 *	34200 *			
LEAD		188 *	323 *	376 *			
MAGNESIUM		9960	8780	8900			
MANGANESE		919 E	896 E	693 E			
NICKEL		198 N*E	1930 N*E	131 N*E			
POTASSIUM		3500	3600	4000			
SILVER		9.6	9.4	5.1			
SODIUM		499 B	503 B	426 B			
VANADIUM		46 E	49 E	43 E			
ZINC		516 N*	3910 N*	216 N*			

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN008016B	SN008027B	SN008038B			
	SDG NO:	LL001018B	LL001018B	LL001018B			
	TYPE:	GRAB	GRAB	GRAB			
BENZO(A)PYRENE		43 J	380 U	390 U			
BIS(2-ETHYLHEXYL)PHTHALATE		18000 E	590	560			
CHRYSENE		62 J	380 U	390 U			
DI-N-BUTYLPHTHALATE		40 J	380 U	390 U			
DI-N-OCTYLPHTHALATE		20 J	380 U	15 J			
FLUORANTHENE		52 J	380 U	390 U			
N-NITROSODIPHENYLAMINE		260 J	380 U	390 U			
1,3,5-TRIAZINE-2,4-DIAMINE,				670			
* DIACETONE ALCOHOL (6.26)				19000 J			
* DIACETONE ALCOHOL (6.31)		27000 J	22000 J				
* DIOCTYL ADIPATE (31.19)			1500 J				
* DIOCTYL ADIPATE (31.20)		1500 J					
* DIOCTYL ADIPATE (31.22)				1600 J			
* PHTHALATE ESTER (32.21)		190 J					
* PHTHALATE ESTER (32.58)		86 J					
* PROBABLE HYDROCARBON (6.51)				160 J			
* PROBABLE HYDROCARBON (6.74)		490 J	310 J				
* PROBABLE HYDROCARBON (6.75)				790 J			

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 008
LOCATION: HIGH EXPLOSIVES BURN PIT
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN008016B	SN008027B	SN008038B
	SDG NO:	LL001018B	LL001018B	LL001018B
	TYPE:	GRAB	GRAB	GRAB
* PROBABLE HYDROCARBON (6.93)		830 J		
* PROBABLE HYDROCARBON (6.94)			550 J	
* PROBABLE HYDROCARBON (6.95)				1400 J
* PROBABLE HYDROCARBON (25.06)				230 J
* PROBABLE HYDROCARBON (28.20)		67 J		
* UNKNOWN (5.51)		1900 J		
* UNKNOWN (5.59)			2200 J	
* UNKNOWN (5.64)				3800 J
* UNKNOWN (5.92)				160 J
* UNKNOWN (6.59)		1100 J		
* UNKNOWN (6.60)			1000 J	
* UNKNOWN (6.63)				1300 J
* UNKNOWN (8.08)		370 J		
* UNKNOWN (8.09)			400 J	
* UNKNOWN (8.11)				640 J
* UNKNOWN (8.96)		390 J		
* UNKNOWN (8.97)			680 J	
* UNKNOWN (8.98)				520 J
* UNKNOWN (9.08)		850 J		
* UNKNOWN (23.36)		270 J		
* UNKNOWN (23.64)				160 J
* UNKNOWN (31.51)				23 J
* UNKNOWN SILOXANE (5.76)		170 J		
* UNKNOWN SILOXANE (5.77)				180 J
* UNKNOWN SILOXANE (5.78)			190 J	
* 1,3,5-TRIAZINE-2,4-DIAM(23.36)				670 J

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN008016A	SN008027A	SN008038A
	SDG NO:	0909	0909	0909
	TYPE:	GRAB	GRAB	GRAB
ACETONE		29 B	18 B	24 B
BENZENE		1 J	2 J	6 U
METHYLENE CHLORIDE		16	26	6 U
TOLUENE		4 J	3 J	6 U
* FURAN, TETRAHYDRO-(11.22)			4 J	

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 008
LOCATION: HIGH EXPLOSIVES BURN PIT
MEDIUM: SOIL

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	SN008016D	SN008027D	SN008038D
	SDG NO:	LLL7297	LLL7297	LLL7297
	TYPE:	GRAB	GRAB	GRAB
CS-137		35	20 U	20
G-ALPH		4300	4300	6500
GROSS-BETA		20000	19000	25000
K-40		11000	9900	12000

S&A REQUEST: 008
LOCATION: HIGH EXPLOSIVES BURN PIT
MEDIUM: SURFACE WATER

METALS, INCLUDING CR+6 (UG/L)	SAMP NO:	SN008049F
	SDG NO:	LL012066B
	TYPE:	RINSATE
ALUMINUM		86 B
BARIUM		4 B
CADMIUM		2.4 B
IRON		338
MAGNESIUM		24 B
NICKEL		13 B
ZINC		13 B

EXTRACTABLE ORGANICS (UG/L)	SAMP NO:	SN008049E
	SDG NO:	D108
	TYPE:	RINSATE
* UNKNOWN (7.19)		4 J
* UNKNOWN (12.19)		3 J
* UNKNOWN (21.75)		2 J

VOLATILE ORGANICS (UG/L)	SAMP NO:	SN008049A
	SDG NO:	0825
	TYPE:	RINSATE
ACETONE		7 JB
CHLOROFORM		17
ETHYLBENZENE		1 JB

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 008
LOCATION: HIGH EXPLOSIVES BURN PIT
MEDIUM: SURFACE WATER

VOLATILE ORGANICS (UG/L)	SAMP NO:	SN008049A
	SDG NO:	0825
	TYPE:	RINSATE
METHYLENE CHLORIDE		3 J
TOLUENE		1 JB

RADIOCHEMISTRY (PCI/L)	SAMP NO:	SN008049G
	SDG NO:	LLL7297
	TYPE:	RINSATE
G-ALPH		11
GROSS-BETA		59

S&A REQUEST: 009
LOCATION: OLD FIRE EXTINGUISHER TRAINING AREA
MEDIUM: SOIL

FIELD MEASUREMENTS	SAMP NO:	SN009017	SN009028	SN009039	SN009040
PHOTOVAC (PPM)		2.2	0.5	0	7.4

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN009017C	SN009028C	SN009039C	SN009040C
	SDG NO:	LL028019C	LL028019C	LL028019C	LL028019C
	TYPE:	GRAB	GRAB	GRAB	GRAB
ALUMINUM		18500	16900	14200	12400
BARIUM		249 N	224 N	210 N	190 N
BERYLLIUM		0.6 B	0.52 B	0.46 B	0.41 B
CADMIUM		0.76	0.93	0.8	0.84
CALCIUM		3520	2900	2580	2440
CHROMIUM		45 E	38 E	36 E	50 E
COBALT		9.6 *	9.1 *	9.9 *	7.8 *
COPPER		28 N	23 N	23 N	21 N
IRON		26300 *	20600 *	19000 *	17100 *
LEAD		10 B*	12 B*	7.8 B*	7.1 U*
MAGNESIUM		5220	4230	3590	3490
MANGANESE		681 E	593 E	673 E	542 E
NICKEL		51 N*E	48 N*E	38 N*E	43 N*E
POTASSIUM		2800	3700	4300	3100

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 009
LOCATION: OLD FIRE EXTINGUISHER TRAINING AREA
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN009017C	SN009028C	SN009039C	SN009040C		
	SDG NO:	LL028019C	LL028019C	LL028019C	LL028019C		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
SILVER		1.6	1.7	1.4 B	1.7		
SODIUM		225 B	332 B	382 B	287 B		
VANADIUM		48 E	44 E	43 E	39 E		
ZINC		60 N*	45 N*	35 N*	31 N*		

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN009017B	SN009028B	SN009039B	SN009040B		
	SDG NO:	LL001018B	LL001018B	LL001018B	LL001018B		
	TYPE:	GRAB	GRAB	GRAB	GRAB		
BIS(2-ETHYLHEXYL)PHTHALATE		310 U	990	580	390 U		
CHRYSENE		370 U	93 J	370 U	390 U		
DI-N-OCTYLPHTHALATE		370 U	120 J	14 J	390 U		
* DIACETONE ALCOHOL (6.20)					22000 J		
* DIACETONE ALCOHOL (6.21)		9900 J					
* DIACETONE ALCOHOL (6.23)				14000 J			
* DIACETONE ALCOHOL (6.33)			26000 J				
* DIOCTYL ADIPATE (31.09)		1500 J	1500 J				
* DIOCTYL ADIPATE (31.12)				1500 J			
* DIOCTYL ADIPATE (31.14)					1600 J		
* PROBABLE HYDROCARBON (5.90)		300 J					
* PROBABLE HYDROCARBON (6.74)		860 J					
* PROBABLE HYDROCARBON (6.77)				280 J			
* PROBABLE HYDROCARBON (6.93)		1300 J					
* PROBABLE HYDROCARBON (6.96)				450 J			
* UNKNOWN (5.54)			960 J				
* UNKNOWN (5.57)		840 J					
* UNKNOWN (5.62)			1500 J				
* UNKNOWN (5.67)				1800 J			
* UNKNOWN (5.70)					2600 J		
* UNKNOWN (5.71)				690 J			
* UNKNOWN (5.74)		1800 J		1100 J			
* UNKNOWN (6.65)		720 J					
* UNKNOWN (6.67)					1100 J		
* UNKNOWN (6.70)				1100 J			
* UNKNOWN (8.10)		400 J					
* UNKNOWN (8.13)					480 J		
* UNKNOWN (8.14)				590 J			
* UNKNOWN (9.01)		120 J					
* UNKNOWN (35.12)			1500 J				
* UNKNOWN SILOXANE (5.77)					240 J		
* UNKNOWN SILOXANE (22.23)			1000 J				

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4
INACTIVE SITES

S&A REQUEST: 009
LOCATION: OLD FIRE EXTINGUISHER TRAINING AREA
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN009017B	SN009028B	SN009039B	SN009040B
	SDG NO:	LL001018B	LL001018B	LL001018B	LL001018B
	TYPE:	GRAB	GRAB	GRAB	GRAB
* UNKNOWN SILOXANE (24.48)			700 J		
* UNKNOWN SILOXANE (28.23)			76 J		
* UNKNOWN SILOXANE (29.85)			72 J		
* UNKNOWN SILOXANE (32.76)			74 J		
* UNKNOWN SILOXANE (34.09)			660 J		
* UNKNOWN SILOXANE (35.32)			610 J		
* UNKNOWN SILOXANE (36.34)				17 J	
* UNKNOWN SILOXANE (36.47)			720 J		
* UNKNOWN SILOXANE (37.56)			760 J		
* UNKNOWN SILOXANE (38.72)			680 J		
* UNKNOWN SILOXANE (40.13)			700 J		
* UNKNOWN SILOXANE (41.23)				10 J	
* UNKNOWN SILOXANE (41.59)					23 J
* UNKNOWN SILOXANE (41.88)			700 J		
* UNKNOWN SILOXANE (44.12)			630 J		
* UNKNOWN SILOXANE (46.98)			590 J		
* UNKNOWN SILOXANE (47.53)				68 J	

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN009017A	SN009028A	SN009039A	SN009040A
	SDG NO:	0911	0911	0911	0911
	TYPE:	GRAB	GRAB	GRAB	GRAB
ACETONE		26 B	15 B	9 B	18 B
METHYLENE CHLORIDE		5 JB	5 JB	5 JB	5 JB
TOLUENE		1 JB	1 JB	1 JB	1 JB
* FURAN, TETRAHYDRO-(11.16)		6 J	4 J	4 J	4 J

S&A REQUEST: 010
LOCATION: EDGE OF ARROYO SECO AT THE NORTHSIDE OF SANDIA CROSSING
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN010054C	SN010054D
	SDG NO:	LL011010C	SN010010D
	TYPE:	GRAB	GRAB
ALUMINUM		10100 *	
BARIUM		158	

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 INACTIVE SITES

DRAFT DO NOT CITE

S&A REQUEST: 010
LOCATION: EDGE OF ARROYO SECO AT THE NORTHSIDE OF SANDIA CROSSING
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN010054C	SN010054D
	SDG NO:	LL011010C	SN010010D
	TYPE:	GRAB	GRAB
BERYLLIUM		0.4 B	
CADMIUM		9.3	
CALCIUM		15400 *	
CHROMIUM		54 E	
COBALT		5.7 B	
COPPER		40	
IRON		18500 *	
LEAD			63 N*
MAGNESIUM		4660	
MANGANESE		323 *	
NICKEL		68 N*	
POTASSIUM		2600	
SILVER		3.6	
SODIUM		473 B	
VANADIUM		33	
ZINC		1900	

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN010054B
	SDG NO:	LL001018B
	TYPE:	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		340 J
DI-N-OCTYLPHTHALATE		7 J
* ALKOXY ARYL HYDROCARBON(16.10)		190 J
* DIACETONE ALCOHOL (6.12)		6200 J
* DIOCTYL ADIPATE (31.18)		7500 J
* PROBABLE HYDROCARBON (6.87)		73 J
* PROBABLE HYDROCARBON (30.12)		200 J
* PROBABLE HYDROCARBON (31.33)		150 J
* PROBABLE HYDROCARBON (32.18)		260 J
* PROBABLE HYDROCARBON (34.10)		260 J
* PROBABLE HYDROCARBON (37.53)		230 J
* UNKNOWN (5.43)		120 J
* UNKNOWN (6.54)		190 J
* UNKNOWN (12.10)		100 J
* UNKNOWN (23.48)		73 J
* UNKNOWN (28.26)		340 J
* UNKNOWN (37.44)		420 J
* UNKNOWN SILOXANE (13.68)		97 J

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4
INACTIVE SITES

S&A REQUEST: 010
LOCATION: EDGE OF ARROYO SECO AT THE NORTHSIDE OF SANDIA CROSSING
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO: SN010054A SDG NO: 0903 TYPE: GRAB
ACETONE	77 B
BENZENE	8
CARBON TETRACHLORIDE	2 J
CHLOROFORM	6
METHYLENE CHLORIDE	84 B
TOLUENE	15 B
1,1,1-TRICHLOROETHANE	14
2-BUTANONE	35
* ACETIC ACID, METHYL EST(9.69)	16 J
* DIMETHYLPENTANE(21.55)	5 J
* HEXANE(19.58)	3 J
* METHYLHEXANE(23.08)	13 J
* UNKNOWN(23.75)	7 J

S&A REQUEST: 010
LOCATION: EDGE OF ARROYO SECO ON THE NORTHSIDE OF SANDIA CROSSING
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO: SN010010C SDG NO: LL011010C TYPE: GRAB	SN010010D SN010010D GRAB	SN010021C LL011010C GRAB	SN010021D SN010010D GRAB	SN010032C LL011010C GRAB	SN010032D SN010010D GRAB
ALUMINUM	13600 *		12700 *		9770 *	
ARSENIC	4.1 UN		4.1 UN		4.1 UN	
BARIUM	189		199		192	
BERYLLIUM	0.44 B		0.42 B		0.38 B	
CADMIUM	0.64 B		0.95		1.7	
CALCIUM	4600 *		4390 *		3320 *	
CHROMIUM	40 E		38 E		36 E	
COBALT	9		9.9		8.2	
COPPER	23		25		22	
IRON	22400 *		20900 *		17300 *	
LEAD		34 N*		32 N*		7.6 N*
MAGNESIUM	6350		5750		4700	
MANGANESE	627 *		589 *		493 *	
NICKEL	52 N*		132 N*		45 N*	
POTASSIUM	3000		3400		2400	
SILVER	1.2 B		0.87 B		0.82 U	

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 010
LOCATION: EDGE OF ARROYO SECO ON THE NORTHSIDE OF SANDIA CROSSING
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN010010C	SN010010D	SN010021C	SN010021D	SN010032C	SN010032D
	SDG NO:	LL011010C	SN010010D	LL011010C	SN010010D	LL011010C	SN010010D
	TYPE:	GRAB	GRAB	GRAB	GRAB	GRAB	GRAB
SODIUM		192 B		245 B		133 B	
VANADIUM		37		36		35	
ZINC		89		96		168	

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN010043C	SN010043D
	SDG NO:	LL011010C	SN010010D
	TYPE:	GRAB	GRAB
ALUMINUM		12900 *	
ARSENIC		8.8 BN	
BARIUM		422	
BERYLLIUM		0.75	
CADMIUM		4.7	
CALCIUM		168000 *	
CHROMIUM		42 E	
COBALT		4.9 B	
COPPER		40	
IRON		15100 *	
LEAD			16 N*
MAGNESIUM		10700	
MANGANESE		484 *	
NICKEL		41 N*	
POTASSIUM		2400	
SILVER		4	
SODIUM		687 U	
VANADIUM		64	
ZINC		457	

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN010010B	SN010021B	SN010032B	SN010043B
	SDG NO:	LL001018B	LL001018B	LL001018B	LL001018B
	TYPE:	GRAB	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		250 J	500	710	17000 E
DI-N-OCTYLPHTHALATE		350 U	340 U	160 J	42 J
FLUORANTHENE		350 U	340 U	22 J	340 U
PYRENE		350 U	340 U	340 U	32 J
1,3,5-TRIAZINE-2,4-DIAMINE,				42	
* ALKOXY ARYL HYDROCARBON(16.07)			1500 J		
* ATRAZINE (23.49)		360 J			
* ATRAZINE (23.56)				95 J	

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 010
LOCATION: EDGE OF ARROYO SECO ON THE NORTHSIDE OF SANDIA CROSSING
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN010010B	SN010021B	SN010032B	SN010043B
	SDG NO:	LL001018B	LL001018B	LL001018B	LL001018B
	TYPE:	GRAB	GRAB	GRAB	GRAB
* CARBOXYLIC ACID (26.24)				47 J	
* DIACETONE ALCOHOL (6.25)		20000 J			
* DIACETONE ALCOHOL (6.27)			22000 J		
* DIACETONE ALCOHOL (6.28)					20000 J
* DIACETONE ALCOHOL (6.31)				24000 J	
* DIOCTYL ADIPATE (31.17)			1400 J		
* DIOCTYL ADIPATE (31.18)		1400 J			
* DIOCTYL ADIPATE (31.21)					1400 J
* DIOCTYL ADIPATE (31.22)				1400 J	
* PHTHALATE ESTER (32.59)					140 J
* PHTHALATE ESTER (32.65)					290 J
* PROBABLE HYDROCARBON (6.71)		180 J			
* PROBABLE HYDROCARBON (6.72)				380 J	
* PROBABLE HYDROCARBON (6.74)			550 J		230 J
* PROBABLE HYDROCARBON (6.92)		260 J			
* PROBABLE HYDROCARBON (6.93)			780 J	600 J	330 J
* PROBABLE HYDROCARBON (32.00)				190000 J	140000 J
* PROBABLE HYDROCARBON (32.17)			79 J		
* PROBABLE HYDROCARBON (34.08)			52 J		
* UNKNOWN (5.47)					1100 J
* UNKNOWN (5.50)		2200 J		1700 J	
* UNKNOWN (5.59)			2900 J		
* UNKNOWN (6.58)		780 J		880 J	520 J
* UNKNOWN (6.61)			1200 J		
* UNKNOWN (8.06)		400 J			
* UNKNOWN (8.08)			500 J	160 J	
* UNKNOWN (8.09)					210 J
* UNKNOWN (8.95)		570 J			
* UNKNOWN (8.96)			510 J		
* UNKNOWN (8.98)					180 J
* UNKNOWN (9.08)					1500 J
* UNKNOWN (9.10)			230 J		
* UNKNOWN (10.11)		180 J			
* UNKNOWN (12.10)			530 J		
* UNKNOWN (15.53)			150 J		
* UNKNOWN (37.43)			95 J		
* UNKNOWN (38.06)			48 J		
* UNKNOWN SILOXANE (5.77)			370 J		140 J
* 1,3,5-TRIAZINE-2,4-DIAM(23.39)				42 J	

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 010
LOCATION: EDGE OF ARROYO SECO ON THE NORTHSIDE OF SANDIA CROSSING
MEDIUM: SOIL

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN010010A	SN010021A	SN010032A	SN010043A
	SDG NO:	0903	0903	0903	0903
	TYPE:	GRAB	GRAB	GRAB	GRAB
ACETONE		22 B	32 B	43 B	99 B
BENZENE		1 J	5 U	1 J	8
CHLOROFORM		5 U	5 U	5 U	6
ETHYLBENZENE		5 U	2 JB	5 U	5 U
METHYLENE CHLORIDE		9 B	2 JB	11 B	99 B
TOLUENE		3 JB	2 JB	3 JB	19 B
1,1,1-TRICHLOROETHANE		5 U	5 U	2 J	13
2-BUTANONE		10 U	10 U	10 U	41
* ACETIC ACID, METHYL EST(9.69)				8 J	22 J
* ACETIC ACID, METHYL EST(9.74)				108 J	
* BENZENE DERIVATIVE(50.54)					256 J
* BENZENE DERIVATIVE(50.58)					5 J
* DIMETHYLPENTANE(21.55)					6 J
* FURAN, TETRAHYDRO-(11.21)					12 J
* METHYLHEXANE(23.13)				170 J	
* PINENE(32.31)					3 J
* UNKNOWN(19.63)					6 J
* UNKNOWN(23.8)			82 J		
* UNKNOWN(32.01)				18 J	
* UNKNOWN(34.33)					49 J
* UNKNOWN(38.87)				38 J	
* UNKNOWN(38.93)			280 J	160 J	
* UNKNOWN(44.76)				13 J	
* UNKNOWN(58.05)					

S&A REQUEST: 011
LOCATION: OLD PAINT AND DRUM STORAGE AREA 1
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN011011C	SN011022C	SN011033C
	SDG NO:	LL028019C	LL028019C	LL028019C
	TYPE:	GRAB	GRAB	GRAB
ALUMINUM		11700	11100	10700
BARIUM		382 N	192 N	172 N
BERYLLIUM		0.38 B	0.36 B	0.34 B
CADMIUM		2.9	1.1	0.87
CALCIUM		5260	2930	2470

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4
INACTIVE SITES

DRAFT DO NOT CITE

S&A REQUEST: 011
LOCATION: OLD PAINT AND DRUM STORAGE AREA 1
MEDIUM: SOIL

METALS, INCLUDING CR+6 (MG/KG)	SAMP NO:	SN011011C	SN011022C	SN011033C
	SDG NO:	LL028019C	LL028019C	LL028019C
	TYPE:	GRAB	GRAB	GRAB
CHROMIUM		40 E	34 E	31 E
COBALT		8.3 *	7.8 *	7.4 *
COPPER		100 N	24 N	19 N
IRON		18000 *	17200 *	16100 *
LEAD		277 *	28 *	8.1 B*
MAGNESIUM		3920	3830	3640
MANGANESE		485 E	563 E	506 E
NICKEL		43 N*E	38 N*E	37 N*E
POTASSIUM		3200	3000	3200
SILVER		2.1	1.8	1.6
SODIUM		392 B	193 B	190 B
VANADIUM		38 E	38 E	37 E
ZINC		418 N*	60 N*	31 N*

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN011011B	SN011022B	SN011033B
	SDG NO:	LL001018B	LL001018B	LL001018B
	TYPE:	GRAB	GRAB	GRAB
BIS(2-ETHYLHEXYL)PHTHALATE		390 U	31000 E	59000 E
* DIACETONE ALCOHOL (6.14)				12000 J
* DIACETONE ALCOHOL (6.26)			24000 J	
* DIACETONE ALCOHOL (6.30)		29000 J		
* DIOCTYL ADIPATE (31.05)		1600 J	1500 J	1500 J
* PHTHALATE ESTER (32.05)			25 J	
* PHTHALATE ESTER (32.06)				58 J
* PHTHALATE ESTER (32.50)		25 J		
* PROBABLE HYDROCARBON (5.95)		210 J		
* PROBABLE HYDROCARBON (6.72)			460 J	310 J
* PROBABLE HYDROCARBON (6.76)		630 J		
* PROBABLE HYDROCARBON (6.92)			710 J	440 J
* PROBABLE HYDROCARBON (6.95)		1000 J		
* PROBABLE HYDROCARBON (12.43)		110 J		
* PROBABLE HYDROCARBON (24.96)		310 J		
* UNKNOWN (5.53)			1600 J	
* UNKNOWN (5.54)				1400 J
* UNKNOWN (5.59)		920 J		
* UNKNOWN (5.89)			130 J	
* UNKNOWN (6.52)		400 J		
* UNKNOWN (6.58)				540 J
* UNKNOWN (6.59)			690 J	
* UNKNOWN (6.64)		990 J		

TABLE S4.3.4 ANALYTICAL DATA SUMMARY BY MEDIUM FOR ENVIRONMENTAL PROBLEM 4 DRAFT DO NOT CITE
INACTIVE SITES

S&A REQUEST: 011
LOCATION: OLD PAINT AND DRUM STORAGE AREA 1
MEDIUM: SOIL

EXTRACTABLE ORGANICS (UG/KG)	SAMP NO:	SN011011B	SN011022B	SN011033B			
	SDG NO:	LL001018B	LL001018B	LL001018B			
	TYPE:	GRAB	GRAB	GRAB			
* UNKNOWN (8.09)			110 J				
* UNKNOWN (8.10)		260 J					
* UNKNOWN (8.97)			230 J	230 J			
* UNKNOWN (8.98)		170 J					
* UNKNOWN (9.07)			530 J	1000 J			
* UNKNOWN (10.20)		160 J					
* UNKNOWN SILOXANE (5.74)				160 J			
* UNKNOWN SILOXANE (5.75)			170 J				
* UNKNOWN SILOXANE (5.80)		250 J					

VOLATILE ORGANICS (UG/KG)	SAMP NO:	SN011011A	SN011022A	SN011033A			
	SDG NO:	0909	0909	0910			
	TYPE:	GRAB	GRAB	GRAB			
ACETONE		26 B	22 B	13 B			
BENZENE		2 J	6 U	6 U			
CHLOROFORM		2 J	6 U	6 U			
METHYLENE CHLORIDE		47	13	3 JB			
TOLUENE		3 J	3 J	6 U			
* FURAN, TETRAHYDRO-(11.21)		3 J					

RADIOCHEMISTRY (PCI/KGD)	SAMP NO:	SN011011D	SN011022D	SN011033D			
	SDG NO:	LLL7297	LLL7297	LLL7297			
	TYPE:	GRAB	GRAB	GRAB			
G-ALPH		11000	6500	1900			
GROSS-BETA		22000	22000	30000			

5.0 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

This chapter covers quality assurance and quality control requirements addressed by QA/QC plans for the LLNL/SNLL Sites. Section 5.1 reviews the QA/QC plan for the LLNL/SNLL Sites 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 LLNL/SNLL Sampling and Analysis Data Document, the LLNL/SNLL Sampling and Analysis Plans, and the DOE Environmental Survey Manual (7/87 and 8/87).

5.1 Field QA/QC

The LLNL/SNLL 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 water, soils, and sediment/sludge samples was 95%.

Table 5.2 summarizes sampling completeness for the LLNL/SNLL effort. Overall completeness was 84%; 75% of the soil samples and 83% of the water samples were collected. Of the 58 samples deleted or not collected, 28 water samples were not obtained. Of these, 23 were deleted because the discharge effluent of two buildings had a common stream (Buildings 175 and 169 in Environmental

Table 5.1. Quality Assurance/Quality Control Project Plan Locator

	Essential Elements**	Data Document	S&A Plans	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)	5.0	6.3	APPEND F
6.	SAMPLING PROCEDURES	3.1	3.0, 4.0	APPEND E
7.	SAMPLING CUSTODY	3.0, 5.2	5.0	APPEND I
8.	CALIBRATION PROCEDURES AND FREQUENCY	5.1	6.6.4	APPEND E
9.	ANALYTICAL PROCEDURES	3.0	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, APPEND C	6.11	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)	5.0, APPEND 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 manual in effect at the time of LLNL/SNLL sampling: 7/87 and 8/87 editions.

** Reference EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Plans" (EPA 1983).

Table 5.2. Field Sampling Completeness for the LLNL/SNLL Sites

	Number of Samples			
Media Type	Planned	Collected[a]	Deleted	Not Collected
Surface Water[b]	167	139	23	5
Soils	106	80	26	-
Sediment	80	76	4	-
Sludge	17	17	0	-
Total	370	312	53	5

[a] The samples do not represent rinsate samples for QA purposes.

[b] Includes effluent in tanks and sumps.

Problem 2 of LLNL) and one sample was not collected due to the small size of the impoundment, thus reducing the number required. Of the 26 soil samples deleted, 22 were deleted from the LLNL Site and 4 were deleted from the SNLL Site. All were deleted due to the sampling sites being smaller than originally anticipated, the location being extremely steep and dangerous, or initially defined "stained" areas for sampling being absent. Of the four sediment samples deleted, three were deleted because the ditch had been covered (Request 10 of LLNL) and one was deleted due to shortness of the stream to be sampled (Request 13 of LLNL). If the reasons cited are acceptable, then over 98% of the planned total samples are accounted for.

Item 8. Calibration Procedures and Frequency. An important factor in the collection of accurate field data is instrument calibration. The guidance provided in the LLNL and SNLL Sampling and Analysis Plans was followed; dates, standards, and problems were recorded in the field logbooks. Only minor instrument calibration problems were encountered; these are noted in the text associated with the particular environmental problem.

Item 11. Internal Quality Control Checks. The LLNL/SNLL plans 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 requested for the LLNL/SNLL effort. In cases where multiple bottles were indicated for a given analysis, only a single bottle was analyzed.

Item 12. Performance and System Audits. An EPA audit team conducted an on-site inspection to evaluate the sampling effort at the LLNL/SNLL Site to document the extent to which procedures identified in the LLNL/SNLL Sampling and Analysis Plans were being followed with respect to implementing specified field tests, field calibration, chain of custody, record keeping, quality assurance,

Table 5.3. Field QC Samples Planned for the LLNL/SNLL Sites

		Solids	Water	Air
Rinsate Blanks	Organics	1/20	1/20	1/20
	Metals	1/20	1/20	1/20
	Rads	NA[a]	NA[a]	NA[a]
Trip Blanks	Organics	NA	1/20	1/20
	Metals	NA	NA	NA
	Rads	NA	NA	NA

NA = Not available, not applicable, or not recommended.

1/20 = One QC sample for 1 to 20 samples, 2 for 20 to 40, 3 for 40 to 60, etc.

[a] Hand-held instruments were used to detect radioactive contamination.

TABLE 5.4 LIVERMORE 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
LLN02013A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN05016A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN07018A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN07018B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN09010A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN12015A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN12015B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN12015C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	2
LLN14017A	TRIP BLANK		WATER	2	0	0	0	0	0	0	0	0	0	0	0	1
LLN14017B	TRIP BLANK		WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN14017C	TRIP BLANK		WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN15018A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN15018B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN15018C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN19012A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN19012B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN19012C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN23018A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN23018B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN23018C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN27012A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN27012B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN27012C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN29014A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN29014B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN29014C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN31018A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN31018B	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN31018C	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LLN33010A	TRIP BLANK	TRIP BLANK	WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL001041A	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL001041B	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL001041C	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL001041D	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	1	0	0	1	0	0
LL001041E	QC RINSATE	ARROYO	SURF WATER	2	0	0	0	0	1	0	0	0	0	0	0	0
LL001041F	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL001041G	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	1	0	0	0	1	0	0	0
LL001041H	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL001041I	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL001041J	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL003043A	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL003043B	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL003043C	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	1	0	0	1	0	0
LL003043D	QC RINSATE	ARROYO	SURF WATER	2	0	0	0	0	1	0	0	0	0	0	0	0
LL003043E	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL003043F	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	1	0	0	0	1	0	0	0
LL003043G	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	1
LL003043H	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL003043I	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL006046A	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL006046B	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL006046C	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL006046D	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL006046E	QC RINSATE	ARROYO	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0

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TABLE 5.4 LIVERMORE 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
LL006046F	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL006046G	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL006046H	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL006046I	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL010042A	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL010042B	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL010042C	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL010042D	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL010042E	QC RINSATE	ARROYO	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0
LL010042F	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL010042G	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL010042H	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL010042I	QC RINSATE	ARROYO	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL012679A	QC RINSATE	SEWERS	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL012679B	QC RINSATE	SEWERS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL012679C	QC RINSATE	SEWERS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL012679D	QC RINSATE	SEWERS	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL012680A	QC RINSATE	SEWERS	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL012680B	QC RINSATE	SEWERS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL012680C	QC RINSATE	SEWERS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL012680D	QC RINSATE	SEWERS	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL012691A	FIELD BLNK	SEWERS	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL012691B	FIELD BLNK	SEWERS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL012691C	FIELD BLNK	SEWERS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL012691D	FIELD BLNK	SEWERS	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL012704A	FIELD BLNK	SEWERS	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL012704B	FIELD BLNK	SEWERS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL012704C	FIELD BLNK	SEWERS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL012704D	FIELD BLNK	SEWERS	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL015025A	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL015025B	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL015025C	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL015025D	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL015025E	QC RINSATE	SUMP	SURF WATER	1	0	1	0	0	0	0	0	0	0	0	0	0
LL015025F	QC RINSATE	SUMP	SURF WATER	1	1	0	0	0	0	0	0	0	0	0	0	0
LL015025G	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL015025H	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL015025I	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL022024A	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL022024B	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL022024C	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL022024D	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL022024E	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL022024F	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL022024G	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL022024H	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL022024I	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL023025A	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL023025B	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL023025C	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL023025D	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL023025E	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL023025F	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL023025G	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0

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TABLE 5.4 LIVERMORE 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
LL023025H	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL023025I	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL023025J	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL025027A	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL025027B	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL025027C	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL025027D	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL025027E	FIELD BLNK	SUMP	SURF WATER	1	0	1	0	0	0	0	0	0	0	0	0	0
LL025027F	FIELD BLNK	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL025027G	FIELD BLNK	SUMP	SURF WATER	1	1	0	0	0	0	0	0	0	0	0	0	0
LL025027H	FIELD BLNK	SUMP	SURF WATER	1	1	0	0	0	0	0	0	0	0	0	0	0
LL027109A	QC RINSATE	WASTE	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL027109B	QC RINSATE	WASTE	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL027109C	QC RINSATE	WASTE	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL027109D	QC RINSATE	WASTE	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL031172A	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL031172B	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL031172C	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL031172D	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL031172E	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL031172F	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL031172G	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL031172H	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	0	1	0	0	0	0	0	0
LL031172I	QC RINSATE	GSA AREA	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL032253A	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL032253B	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL032253C	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL032253D	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL032253E	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL032253F	QC RINSATE	SUMP	SURF WATER	1	0	0	0	0	0	1	0	0	0	0	0	0
LL034131A	QC RINSATE	PITS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL034131B	QC RINSATE	PITS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL034131C	QC RINSATE	PITS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL034131D	QC RINSATE	PITS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL034131E	QC RINSATE	PITS	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL034131F	QC RINSATE	PITS	SURF WATER	1	0	0	0	1	0	0	0	0	0	0	0	0
LL034131G	QC RINSATE	PITS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL034131H	QC RINSATE	PITS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL034131I	QC RINSATE	PITS	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL036224A	QC RINSATE	WELLS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL036224B	QC RINSATE	WELLS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL036224C	QC RINSATE	WELLS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL036224D	QC RINSATE	WELLS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL036224E	QC RINSATE	WELLS	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL036224F	QC RINSATE	WELLS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL036224G	QC RINSATE	WELLS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL036224H	QC RINSATE	WELLS	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL037043A	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL037043B	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL037043C	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL037043D	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
LL037043E	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
LL037043F	QC RINSATE	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL037043G	QC RINSATE	POND	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0

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TABLE 5.4 LIVERMORE 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
LL037043H	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	1	0	0	0	0	0	0
LL037043I	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL037043J	QC RINSATE	POND	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
LL044100A	QC RINSATE	DITCHES	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL044100B	QC RINSATE	DITCHES	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
LL044100C	QC RINSATE	DITCHES	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0

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TABLE 5.4 SANDIA 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
SN001042A	QC RINSATE	ARROYOS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN001042B	QC RINSATE	ARROYOS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN001042C	QC RINSATE	ARROYOS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN001042D	QC RINSATE	ARROYOS	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN001042E	QC RINSATE	ARROYOS	SURF WATER	2	0	0	0	0	0	0	1	0	0	1	0	0
SN001042F	QC RINSATE	ARROYOS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
SN001042G	QC RINSATE	ARROYOS	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
SN001042H	QC RINSATE	ARROYOS	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
SN001042I	QC RINSATE	ARROYOS	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
SN005057A	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN005057B	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN005057C	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN005057D	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN005057E	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
SN005057F	QC RINSATE	BLDG 913	SURF WATER	1	0	1	0	0	0	0	0	0	0	0	0	0
SN005057G	QC RINSATE	BLDG 913	SURF WATER	1	0	1	0	0	0	0	0	0	0	0	0	0
SN005057H	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
SN005057I	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
SN005057J	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
SN005057K	QC RINSATE	BLDG 913	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
SN006047A	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN006047B	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN006047C	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN006047D	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN006047E	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
SN006047F	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	1	0	0	0	0	0	0	0	0	0	0
SN006047G	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	1	0	0	0	0	0	0	0	0	0	0
SN006047H	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
SN006047I	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
SN006047J	FIELD BLNK	SPRAY BOOT	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
SN008049A	QC RINSATE	INACTIVE S	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN008049B	QC RINSATE	INACTIVE S	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN008049C	QC RINSATE	INACTIVE S	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN008049D	QC RINSATE	INACTIVE S	SURF WATER	1	0	0	0	0	0	0	0	0	0	0	0	1
SN008049E	QC RINSATE	INACTIVE S	SURF WATER	1	0	0	0	0	0	0	0	0	0	1	0	0
SN008049F	QC RINSATE	INACTIVE S	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0
SN008049G	QC RINSATE	INACTIVE S	SURF WATER	1	0	0	0	0	0	0	0	0	1	0	0	0
SN008049H	QC RINSATE	INACTIVE S	SURF WATER	1	0	0	0	0	1	0	0	0	0	0	0	0

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sample handling, sample shipment, and sample collection techniques. The field sampling effort and sample management facility were the focus of the inspection. The EPA audit did not find any serious deficiencies in the sampling effort for the LLNL/SNLL Environmental Survey. Several minor deficiencies were noted. Quick response to these recommendations was implemented, including:

1. All logbook pages were signed and dated and blank portions were marked with a slash.

2. General weather observations, sampling times, and locations were recorded in the narrative portion of the Task Team Activity Log Sheet.

3. All visitors and other site personnel were identified in the Task Team Activity Log Sheet.

4. All errors were corrected by drawing a single line through the error and initialing and dating.

5. Custody forms were signed prior to relinquishing samples to Federal Express for delivery to the laboratory.

6. Multiple entries made by Team members in the narrative portion of the Task Team Activity Log were signed and dated by the appropriate Team member(s).

7. All composite samplers were locked and custody sealed before being left unattended.

The complete text of the EPA audit of field sampling activities can 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).

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 principals 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 B to 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 LLNL/SNLL 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.

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 LLNL/SNLL Site. These case files include

Table 5.5. Data Quality Objective

Analyte(s)	Method	Precision	Accuracy
Volatile organics	7/87 CLP SOW	As specified in protocol	
Semivolatile organics	7/87 CLP SOW	As specified in protocol	
Pesticides/PCBs	7/87 CLP SOW	As specified in protocol	
PCBs in oil	*	Not available	Not available
High explosives	*	Not available	Not available
ICP metals	7/85 CLP SOW	As specified in protocol	
Potassium	*	0.5 mg/L	10%
Mercury	EPA 245.1	4 ug/L	10% for conc. > ug/L
Oil and grease	EPA 413.1 and 9071	STD DEV 1 mg/L	10%
Cyanide	EPA 335.2	STD DEV 0.03 mg/L @ 0.28 mg/L CN	-15% @ 0.28 mg/L CN

*Non-EPA methods are cited in Chapter 6.0 of this Data Document.

Table 5.5. Data Quality Objective (Continued)

Analyte(s)	Method	Precision	Accuracy
Total organic carbon (TOC)	EPA 415.1	± 4-8 mg/L	+1% bias for distilled water
Anions	EPA 300.0	STD DEV 1 mg/L at 10 mg/L	20% for drinking water 40% for wastewater
Asbestos	*	35-71% for wastewater; unknown for soils	Factor of 10 for waste-water; only fiber type and concentration range specified for soils
Hexavalent chromium	EPA 3060 and 7196	Not available	Not available
Gross alpha & beta in water	Survey Manual	20% at 95% confidence level	15%
Isotopic uranium	Survey Manual	15%	Not available
Total uranium in water	Survey Manual	+ 0.5 ug/L @ 95% confidence	5%
Total strontium	Survey Manual	12% @ 95% confidence level	-5% bias (wastewater; +25% bias (soil)
Gamma spectrometry	Survey Manual	20%	10%
Tritium	EPA 906.0	30%	30%

*Non-EPA methods are cited in Chapter 6.0 of this Data Document.

all of the raw data and documentation associated with a site in an auditable structure.

Evaluations of the quality of the 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 LLNL/SNLL samples were being analyzed. These included 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 LLNL/SNLL 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 LLNL/SNLL sampling and analysis effort was provided by four laboratories within ORNL. Battelle-Columbus Division (BCD), Columbus, Ohio, and the Analytical Chemistry Division at the Oak Ridge Gaseous Diffusion Plant (ORGDP), Oak Ridge, Tennessee, also were involved in sample analysis of semivolatile organics under the coordination of ORNL. Argonne National Laboratory (ANL) analyzed samples for Environmental Problem 5. Detailed data quality assessments are presented for the samples associated with a given environmental problem/location in Chapter 4.0. Results obtained for the analysis of volatiles, semivolatiles, and pesticides/PCBs were reviewed by the Data

Usability Team. The team was composed of representatives from DOE, EPA (EMSL-LV), LEMSCO, and Martin Marietta Energy Systems. The organic data were reviewed according to protocol defined in revision 3 of the SOP FOR OAK RIDGE DATA VALIDATION. A copy of this document appears in Appendix D. The team determined the usability of "validated" organic data, organized by environmental problem, based on the following criteria:

1. Holding Times
2. Initial Calibration
3. Continuing Calibration
4. Blanks
5. Tunes
6. Surrogate
7. Internal Standards
8. Tentatively Identified Compounds
9. Pesticide Retention Standard
10. Analyte Retention Time (Pesticide fraction)

All sample results were assigned a Quality Level I, II, or III depending upon compliance with requirements for each of the ten review criteria.

Data quality assessment/data usability determination for ICP metals was determined using a procedure similar to that developed by U.S. EPA for use in EPA contract compliance determinations. The ORNL protocol 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

Each element in a given SDG is assigned a Quality Level 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 LLNL/SNLL results is entitled "Analysis Quality Level Evaluation" and can be found in Appendix D. The checklist was used to verify that the components essential to sampling, analysis, and quality control were integrated into the environmental problem evaluation. Data were evaluated on an SDG basis for those analytical methods in which multiple analyte concentrations were determined (e.g., anions, AA, high explosives). 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. For those analytical methods in which a single analyte was determined or only a few sample requests were received, all data were combined to determine the quality of the analytical method.

To perform the evaluation, the pertinent information either 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. The numerical average of the six performance criteria was used to assign a Quality Level I, II,

or III to the sample data of a given analytical method. Data quality results associated with the overall LLNL/SNLL data set are located in Chapter 4.0 of this data document.

In subsequent discussion, overall data quality for the LLNL/SNLL 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 LLNL/SNLL 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 93% of all samples planned for collection. By general types of analysis, the percentage of samples for which analytical data were obtained for LLNL and SNLL Sites, respectively, is as follows:

- Volatile organic compounds, 98% / 100%
- Semivolatile organic compounds, 93% / 100%
- Pesticides and polychlorinated biphenyls (pesticides/PCB), 85% / 46%
- High explosives, 100% / NR
- Inorganic metals, 95% / 100%
- Total organic carbon, 100% / NR

- Anions, 100% / NR
- Cyanide, 100% / NR
- Exotics, 96% / 100%
- Radiological parameters, 100% / 100%

NR implies that no analytical requests for this type of analysis were made for the SNLL Site. Exotics refer to samples in which the determination of oil and grease, PCBs in oil, chromium (VI), and total uranium analyses were requested.

Program objectives for completeness were satisfied for all analytical methods except for pesticides/PCBs. Seven of the collected samples from each site were not analyzed for pesticides/PCBs. The deviation from 100% completeness in LLNL semivolatiles, inorganic metals, and pesticides/PCB reflects the fact that cooler 25, containing nine samples for Environmental Problem 5, was misplaced. The requested analyses are currently being performed and will be reported under separate cover.

Instances where analytical data were not obtained were mainly the result of the following problems:

- Sample not collected
- Sample collected but analysis not performed
- Sample identity lost
- Sample lost during chemical processing
- Sample results lost during instrument 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. LLNL and SNLL coolers were shipped by Federal Express and delivered to the ORNL receiving department. Air bills were removed by the receiving department and retained. Coolers were delivered to the Chemical and Physical Analysis (CAPA) sample receiving room, 4500S Room S-159. Coolers were opened and inventoried in the secure specimen storage area, Room S-159A. Samples designated for organic analysis were delivered on the same day to the Organic Analysis Laboratory. Samples retained by Chemical and Physical Analysis (CAPA), Low-level Radiochemical Analysis (LLRA), and Environmental Analysis Laboratory (EAL) were placed in appropriate storage conditions (e.g., refrigerated).

The first coolers were received on August 6, 1987. Coolers were received as follows:

August 6, 1987	3 coolers
August 7, 1986	4 coolers
August 8, 1987	2 coolers
August 11, 1987	4 coolers
August 12, 1987	6 coolers
August 13, 1987	5 coolers
August 14, 1987	8 coolers
August 17, 1987	5 coolers

Two sets of forms filled out by the Sampling Team were received with each cooler: The "DOE Environmental Survey Chain of Custody (COC) for Inorganics/Organics" and the "Request for Analytical Services, Department of Environmental Management."

Coolers were inventoried upon opening, and a "Shipping Container Log-in Form" was completed listing the contents of the cooler, noting LLNL/SNLL identification numbers, sample tag numbers, and discrepancies, if any. Sample tags were attached to all samples. A "cooler folder" was created to permanently file the packing lists, chains of custody, log-in sheets, and sample tags. The "ORNL CAPA Group Receipt Record/Chain of Custody" form was used when transferring samples outside of CAPA custody. There were a number of discrepancies found between chain of custody forms and sample tag information. Discrepancies occurred in sampling date, bottle ID, cooler and tag number, and samples not listed on the chain of custody form. The LLNL/SNLL Field Sampling Team was notified by telephone and these discrepancies were resolved prior to dissemination of samples to the appropriate in-house analytical services group. The following samples were received broken:

Sample ID	Tag #
LL012351C	0373
LL012566A	0455
LL012566D	0458
LL012908B	2096
LL012908D	2098
LL012419C	0397
LL012851B	2092
LL012362A	0375
LL912010C	2139
LL012975A	2126

Cooler 25 contained samples for Request 27, Environmental Problem 5 (solid waste), but was misplaced before it reached the Sample Receiving Room.

Field and travel blank results indicate that contamination of target analytes during sampling or sample transportation was minor. For all analytes, field and transportation contamination occurred in less than 11.2% 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; 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.

Objectives for adherence to CLP requirements were met for all required holding times. Generally, semivolatile and pesticide extracts were not analyzed within 40 days of sample collection. Exceeding the analysis time may have allowed degradation or transformation of the target analytes. This is particularly true when extraction times are missed and not quite so serious when timely extracts are stored below 4°C for longer than the 40 days.

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.

Table 5.6. Adherence to Holding Time Requirements

	Analyses Within Holding Time Requirements (%)			
	Extraction Time		Analysis Time	
Analysis Type	Analyses	Objective	Analyses	Objective
Volatiles	NA		41 (111 of 273)	90
Semivolatiles	92 (185 of 202)	85	NA	
Pesticides/PCBs	91 (32 of 35)	85	NA	
Inorganic Metals+	100 (389 of 389)	98	NA	
Mercury	NA	NA	100 (109 of 109)	90
Anions	NA	NA	65 (22 of 34)*	50
Cyanide	NA	NA	100 (6 of 6)	90
Total Organic Carbons	NA	NA	100 (9 of 9)	90
Oil & Grease	NA	NA	100 (39 of 39)	90
Chromium (VI)	NA	NA	100 (5 of 5)	90
Rads	NA	NA	100 (215 of 215)	90

NA = Not applicable.

+ Calculation based on total results of ICP, GFAA, and CVAA analytes.

* Because various anions differ in holding time requirements, percentage compliance of this analytical method only was based on the number of analytes rather than on the number of samples.

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 the EPA (EMSL-LV) were analyzed for CLP analytes during the LLNL/SNLL 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 inorganic and nontarget-list parameters and for all but one of the organic samples (score=62.3) analyzed at ORNL. Of the three pertinent organic QB samples submitted by BCD, two of the results were scored as unacceptable. ORGDP submitted three organic QB samples that reflect their performance relevant to the analysis of LLNL samples. They received scores of 71.2, 85.6, and 93.6. Remedial action was taken by ORNL and BCD to correct problems encountered with the analysis of organic samples. Tables summarizing the performance scores of each laboratory, copies of the respective EPA QB evaluation reports, and remedial action responses 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 (RPD) for 87% of all aqueous measurements and for 83% of all soil measurements. The adherence to precision requirements are summarized for each analysis method according to the sample matrix in Table 5.7. The values appearing within the parentheses denote the actual number of analytes in compliance with CLP requirements in

Table 5.7. Adherence to Precision Requirements

	Analyses Within CLP Precision Requirements (%)			
	Water Samples		Soil Samples	
Analysis Type	Analyses	Objective	Analyses	Objective
Volatiles	100 (5 of 5)	80	100 (5 of 5)	70
Semivolatiles				
ORNL	61 (27 of 44)	80	**	70
BCD	**	80	67 (37 of 55)	70
ORGDP	**	80	86 (38 of 44)	70
Pesticides/PCBs	**	80	75 (9 of 12)	70
Inorganic Metals+	100 (125 of 125)	80	92 (198 of 216)	70
Anions	100 (6 of 6)	80	**	70
Cyanide	*	80	**	70
Total Organic Carbons	100 (7 of 7)	80	**	70
Oil & Grease	*	80	100 (4 of 4)	70
Total Uranium	*		100 (2 of 2)	70
Rads	36 (5 of 14)	80	60 (36 of 60)	70

** No sample of this matrix type analyzed.

+ Calculation based on total results of ICP, GFAA, and CVAA analytes.

* No duplicate samples were prepared for this sample matrix.

Note: All calculations are based on the number of analytes in compliance for a given analytical method.

comparison to the total number of analytes measured. The observed imprecision in semivolatile measurements obtained by the ORNL and BCD laboratories is probably reflective of the extended time elapsed between sample extraction and analysis. Imprecision in radiochemical data is most probably due to the fact that sample activities were so low large errors in results for duplicate samples were unavoidable. Gross alpha measurements on soil samples are especially difficult to duplicate because of the uneven distribution of alpha radioactivity in soil and because solid material on the counting planchets can cause erratic results.

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 sample of 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 as no CLP requirements are available for these methods.

The program objectives for accuracy of analytical measurements were to meet CLP tuning criteria for 90% of all GC-MS analyses and to meet inorganic CLP continuing calibration criteria for 90% of all ICP and GFAA analyses; to meet volatile water surrogate recoveries for 85% of all analyses; to meet semivolatile water surrogate recoveries for 75% of all analyses; and to meet pesticide water surrogate recoveries for 75% of all analyses.

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 97% and 99% of volatile and semivolatile organic data, respectively.

The remaining results of accuracy of QC measurements associated with the LLNL/SNLL 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.

Entries for percentage compliance for initial and continuing calibration results are summarized in Table 5.8.

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. Compliance of pesticide/PCB calibration did not meet the 90% objective. The assessment of the initial calibration data, determined using results tabulated on CLP Form 8D, indicated that the performance of the three standards, Aldrin, Endrin, and 4,4'-DDT, did not conform to CLP compliance in either of the two initial calibration runs. Over 83% of pesticide/PCB analytes met CLP compliance for continuing calibration, as based on results summarized on CLP Form 9. A more complete discussion of the remedial action and impact on pesticide/PCB analytical results is presented in Sect. 5.2.1.2.3.

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

Table 5.8. Adherence to Calibration Requirements

	Analyses With Acceptable Calibrations (%)			
	Water Samples		Soil Samples	
Analysis Type	Analyses	Objective	Analyses	Objective
Volatiles	96 (339 of 352)	90	96 (466 of 484)	90
Semivolatiles				
ORNL	90 (183 of 204)	90	**	90
BCD	**	90	99 (135 of 136)	90
ORGDP	**	90	99 (230 of 323)	90
Pesticides/PCBs	**		78 (200 of 256)	90
Inorganic Metals+	99 (525 of 527)	90	98 (970 of 985)	90
Total Organic Carbons	100 (5 of 5)	90	**	90
Anions	100 (25 of 25)	90	**	90
Cyanide	100 (1 of 1)	90	**	90
Rads	99 (349 of 351)*	90	99 (349 of 351)*	90

+ Calculations based on total of ICP, GFAA, and CVAA analytes.
* Instrument calibration used for both water and soil samples.
** No samples of this matrix type were analyzed.

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 CRQL (%)			
	Water Samples		Soil Samples	
Analysis Type	Analyses	Objective	Analyses	Objective
Volatiles	97 (1252 of 1292)	95	*	95
Semivolatiles				
ORNL	100 (210 of 210)	95	NS	95
BCD	NS		NR	95
ORGDP	NS		NR	95
Pesticides/PCBs	NS	95	96 (26 of 27)*	95
Inorganic Metals+	99 (244 of 247)	95	100 (424 of 424)	95
Total Organic Carbons	100 (2 of 2)	95	NS	95
Anions	100 (4 of 4)	95	NS	95
Cyanide	**	95	NS	95
Rads	NA	95	NA	95

\+ Calculations based on total of ICP, GFAA, and CVAA analytes.

* Water blanks were used for both water and soil SDGs.

** One water blank prepared and used to correct sample data. Blank absorbance was not recorded.

NS = No samples of this matrix submitted for analysis.

NA = No blanks analyzed, detector background determined.

NR = No blanks received or reported.

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	*	80	*	80
Semivolatiles	*	80	*	80
Pesticides/PCBs	*	80	*	80
Inorganic Metals +	98 (122 of 125)	80	99 (206 of 207)	80
Anions	NA	80	NS	80
Cyanide	NA	80	NS	80
Rads	93 (55 of 59)	80	90 (62 of 69)	80

\+ Calculations based on total of ICP, GFAA, and CVAA analytes.

* Not applicable.

NA = Not analyzed.

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)	100 (5 of 5)	80	100 (5 of 5)	70
Volatiles (IS)	99 (401 of 402)	90	91 (391 of 429)	80
Volatiles (SC)	97 (505 of 522)	90	77 (387 of 505)	80
Semivolatiles (TC)				
ORNL	68 (60 of 88)	80	NS	
BCD	NS	80	36 (40 of 110)	70
ORGDP	NS	80	90 (79 of 88)	70
Semivolatiles (IS)				
ORNL	44 (24 of 54)	90	NS	
BCD	NS		75 (18 of 24)	80
ORGDP	NS		75 (85 of 114)	80
Semivolatiles (SC)				
ORNL	63 (289 of 456)	90	NS	70
BCD	NS		33 (173 of 503)	80
ORGDP	NS		83 (314 of 378)	80
Pesticides/PCBs (TC)	NS		46 (11 of 24)	70
Pesticides/PCBs (SC)	NS		97 (30 of 31)	80
Inorganic Metals+	97 (136 of 140)	80	73 (125 of 177)	70
Total Organic Carbons	100 (3 of 3)	80	NS	70
Anions	86 (6 of 7)	80	NS	70
Cyanide	NA	80	NS	70
Rads	91 (42 of 46)	80	79 (23 of 29)	70

+ Calculations based on total of ICP, GFAA, and CVAA analytes.

NA = Matrix spikes not analyzed for this matrix.
NS = No samples of this matrix submitted for analysis.
TC = Calculations based on the results of target compound recovery.
IS = Calculations based on the results of internal standard compound recovery.
SC = Calculations based on the results of surrogate compound recovery.

Note: All calculations are based on the number of analytes in compliance for a given analytical method.

within ±20% of the true value. Results from both inorganic metal and radiometric analyses indicate excellent accuracy for these procedures.

The performance of matrix spike organic samples was based on the recovery of target compounds (TC), internal standard (IS) compounds, and surrogate compounds (SC). The performance objective for matrix spike samples was not realized for all aqueous semivolatile TC spikes and for a portion of soil TC and SC spikes. IS spike recoveries in soil samples did not meet the data quality objective in semivolatile analysis by 5%. Recovery of target compounds in the analysis in pesticides/PCB soil samples also did not meet performance objectives. Poor recovery of the matrix spikes in semivolatile samples is probably due to the extended length of time that elapsed between sample preparation and analysis. Noncompliance of pesticide/PCB samples is primarily due to the fact that one of the two samples selected for matrix spike/matrix spike duplicate analysis contained Lindane, which chromatically interferes with the spiked TCs.

The performance of all matrix spike inorganic samples met performance objective. Although not incorporated into results listed in Table 5.11, CLP compliance for ICP serial dilution samples was 95%.

5.2.1.2 Data Quality by Type of Analysis

General observations and facts that should be considered when interpreting data from the LLNL/SNLL Sites 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, high explosives, inorganic metals, total organic carbons, anions, cyanide, nontarget parameters, hexavalent chromium, percent solids, and radiochemical analytes.

5.2.1.2.1 Volatile Organic Compounds

A number of analytes and tentatively identified compounds (TICs) are suspected of being introduced to the samples rather than originating from the samples themselves. Common laboratory contaminants identified by the method blank analyses include methylene chloride and ketones (particularly acetone). No TCLs were present above the CLP limit, and no TICs were found in any of the blanks analyzed.

No TCL compounds below the CRQL were reported because of the time involved to confirm these low-level hits. Instrumentation was not available to perform this analysis, which otherwise would have required an intense manual effort.

True method blanks were not conducted for soil analyses. Instead, a water method blank was analyzed with each SDG containing soil samples. If cross contamination occurred during chemical processing of soil samples, it is possible such contamination was not indicated by the aqueous method blank.

The 7/87 revision of the EPA CLP protocol for low-level soil analysis requires the extraction be performed at 40°C. However, due to lack of equipment, all soil samples were extracted at ambient temperature (i.e., 20° to 25°C) using a needle sparge apparatus.

Deviation from CLP QA/QC protocol included several instances when vinyl chloride and 1,2-dichloroethene were outside QC limits for the continuing calibration checks. Because these two compounds were not observed in any samples, remedial action was not deemed necessary. Noncompliance to CLP limits was observed in a number of surrogate recoveries and internal standard recoveries. These are so noted on the CLP reporting forms; time restraints did not permit reanalysis of these samples. Approximately 60% of volatile samples were not analyzed within the 14-day holding time.

5.2.1.2.2 Semivolatile Organic Compounds

Semivolatile organic compound analyses are prone to their own 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. Bis(2-ethylhexyl)phthalate, butylbenzylphthalate, and di-n-butylphthalate were present in ORNL water method blanks at concentrations below the CLP limit. Phthalates at concentrations of 10 times the CRQL or blank value, whichever is higher, are considered real hits by the ORNL Organic Analysis Laboratory.

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 biased 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.

ORNL processed three water blanks on two separate days, along with 14 soil samples. None of the blanks were analyzed at ORGDP, but BCD shows receipt of two blanks. However, according to BCD records, both blanks were assigned the sample ID LL00000. BCD assigned each blank a laboratory ID upon receipt (87AA01250 and 87AA01213). No further information has been obtained to identify the dates of extraction for each of these blanks. One of the blanks was analyzed each day that BCD samples were analyzed. The blank labeled 87AA01250 consistently showed levels of bis(2-ethylhexyl)phthalate of

approximately 700 to 800 ug/kg. About half of the runs using this blank showed approximately 60 to 100 ug/kg of butylbenzylphthalate. The blank labeled 87AA01213 showed levels of di-n-butylphthalate around 300 to 400 ug/kg, with levels of bis(2-ethylhexyl)phthalate around 30 to 40 ug/kg. In approximately four of the runs, trace amounts of benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzo(g,h,i)perylene were present. Due to the uncertainty in the identity of the blank samples, results were not included in the data base. Sample values for these contaminants also found in the blanks should be considered suspect.

Noncompliance to CLP limits was observed in a number of surrogate recoveries, matrix spike and matrix spike duplicate recoveries, and internal standard recoveries.

Request 27, Environmental Problem 5, requested the analysis of semivolatile compounds. Because the cooler containing these samples was misplaced, no semivolatile data have yet been generated for this site. Samples are currently being analyzed and results will be reported under separate cover.

5.2.1.2.3 Pesticides and Polychlorinated Biphenyls

All sample preparations were carried out according to the EPA's 7/87 CLP Statement of Work for Organic Analysis. An exception to these procedures was the use of Mirex instead of dibutylchlorendate (DBC) as a pesticide surrogate compound. Mirex was chosen because it had greater stability relative to DBC and because it had similar retention times when using either the quantitative or confirmation column. It is recognized that the use of a different surrogate is a significant departure from the specified protocol. However, subsequent studies show the recovery of Mirex and DBC to be similar under controlled conditions (Table 5.12); therefore, the same QC recovery limits were used.

Table 5.12. Mirex and DBC Surrogate Recoveries Comparison

Soil Matrix

Date of Analysis	Request No.	ACD	Surrogate Recoveries DBC	Mirex	Type of Analysis
880427	91868	880329-000 SB	36.7	39.2	PCBs
880427	91868	880329-000 A SB	36.2	34.5	PCBs
880428	91872	880329-000 A SB	41.0	50.1	PCBs
880502	91871	880329-000 A SB	32.6	42.7	PCBs
880512	91882	880405-000 SB	76.3	54.3	PCBs
880517	91875	880331-000 SB	59.6	52.9	PCBs
880526	91876	880331-000 SB	42.1	42.1	PCBs
880526	91876	880331-000 A SB	42.8	42.3	PCBs
880602	91874	880331-000 B SB	43.0	43.1	PCBs
880602	91874	880331-000 C SB	49.8	49.4	PCBs
880602	91877	880331-000 D SB	38.6	39.8	PCBs
880602	91877	880331-000 E SB	40.6	40.9	PCBs

Water Matrix

Date of Analysis	Request No.	ACD	Surrogate Recoveries DBC	Mirex	Type of Analysis
880416	91863	880405-000 WB	29.6	28.9	PCB Rinse
880510	91908	880428-000 WB	38.7	42.4	PE
880525	91925	880513-000 WB	37.3	21.1	PCBs
880525	91929	880517-000 WB	35.2	22.5	PCBs
880607	91946	880525-017 WB	73.9	45.8	Control

PE: EPA Performance Evaluation Sample.

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 biased 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 10.0% relative standard difference (RSD) linearity criteria is required on columns being used for pesticides/PCBs quantitation. The linearity check yielded %RSD values outside QC limits for the packed and the capillary columns for both SDGs. The nonlinearity occurs with the Eval Mix A standard and is probably caused by a contaminated GC system which causes a small breakdown of pesticides. This particularly affects low-level standard results. The sample analyses were continued, but the results from Eval Mix A were not used. Instead, a five-point IND AB linearity check was incorporated into all sequences and was used to calibrate and determine linearity of the instruments. Calibration factors used for calculating sample results were obtained by averaging the concentration (in ppb) per area for all occurrences of a specific compound in all standards. Therefore, a calibration factor was determined using a minimum of five standards for each single component pesticide. The CLP calculation method involves the determination of the calibration from the nearest standard. Table 5.13 compares the calibration factors and sample concentrations as calculated by each method. The percent breakdown of Endrin and 4,4'-DDT has been calculated using concentrations rather than areas because the calibration factor for these two pesticides and their respective breakdown products do not show a 1:1 relationship.

Table 5.13. Comparison of Data Calculation Methods —Lawrence Livermore and Sandia—

SDG #	EPA Sample #	ACD #	Pesticide	RRF (CLP)	RRF (Reported)	Sample CONC (CLP)	Sample CONC (Reported)
LL101	LL001018SS	870807-086	Gamma-BHC	23497.8250	29606.1538	55	43
			Heptachlor	19669.1450	24729.5445	50	40
			Aldrin	23831.8950	21179.9753	43	48
			Dieldrin	10392.6900	13186.0976	281	220
			Endrin	13447.6850	13800.4356	142	140
			4, 4' -DDT	6150.7850	6283.3637	156	150
	LL001029SS	870807-087	Gamma-BHC	23497.8250	29606.1538	94	74
			Heptachlor	19669.1450	24729.5445	84	67
			Aldrin	23831.8950	21179.9753	74	83
			Endrin	13447.6850	13800.4356	215	210
			4, 4' -DDT	6150.7850	6283.3637	331	320
	LL001030SS	870807-088	Gamma-BHC	23497.8250	29606.1538	48	38
			Heptachlor	19669.1450	24729.5445	45	36
			Aldrin	23831.8950	21179.9753	40	45
			Dieldrin	10392.6900	13186.0976	234	180
			Endrin	13447.6850	13800.4356	125	120
			4, 4' -DDD	13859.8450	12548.8854	22	18
			4, 4' -DDT	6150.7850	6283.3637	178	170
	LL002019SS	870807-089	Gamma-BHC	23729.1700	29606.1538	27	21
			Heptachlor	19988.3800	24729.5445	31	25
			Aldrin	23893.4150	21179.9753	36	40
			Dieldrin	10316.6550	13186.0976	170	130
			Endrin	13941.3800	13800.4356	90	90
			4, 4' -DDT	5736.7400	6283.3637	133	120
	LL002020SS	870807-090	Gamma-BHC	23729.1700	29606.1538	44	36
			Heptachlor	19988.3800	24729.5445	37	30
			Aldrin	23893.4150	21179.9753	35	40
			Dieldrin	10316.6550	13186.0976	179	140
			Endrin	13941.3800	13800.4356	92	92
			4, 4' -DDD	14508.4350	12548.8854	20	17
			4, 4' -DDT	5736.7400	6283.3637	126	110
	LL002031SS	870807-091	Gamma-BHC	23729.1700	29606.1538	29	23
			Heptachlor	19988.3800	24729.5445	34	27
			Aldrin	23893.4150	21179.9753	32	36
			Dieldrin	10316.6550	13186.0976	224	180
			Endrin	13941.3800	13800.4356	88	89
			4, 4' -DDD	14508.4350	12548.8854	32	28
			4, 4' -DDT	5736.7400	6283.3637	312	290
LL202	LL008015SS	870810-338	Gamma-BHC	3721.4600	4104.6459	31	28
			Heptachlor	3415.7900	3678.7816	37	34
			Aldrin	3882.3300	2918.2286	32	43
			4, 4' -DDT	766.3200	642.1016	122	150
	LL008026SS	870810-339	Gamma-BHC	3721.4600	4104.6459	16	15
			Heptachlor	3415.7900	3678.7816	29	27
			Aldrin	3882.3300	2918.2286	28	37
	LL008037SS	870810-340	Gamma-BHC	3721.4600	4104.6459	23	21
			Heptachlor	3415.7900	3678.7816	32	29
			Aldrin	3882.3300	2918.2286	30	40
			Endrin*	15283.2100	12516.6391	20	24
	LL006013SS	870810-341	Gamma-BHC	3721.4600	4104.6459	13	12
			Heptachlor	3415.7900	3678.7816	29	27
			Aldrin	3882.3300	2918.2286	28	38
			4, 4' -DDT	766.3200	642.1016	93	110
	LL006024SS	870810-342	Gamma-BHC*	24872.1100	25808.9366	44	43
			Heptachlor*	22499.0700	22352.9586	41	42
			Aldrin*	24941.3300	19292.8391	36	46
			4, 4' -DDT*	8655.5800	5619.8475	119	180

Table 5.13. Comparison of Data Calculation Methods (Continued)
—Lawrence Livermore and Sandia—

SDG #	EPA Sample #	ACD #	Pesticide	RRF (CLP)	RRF (Reported)	Sample CONC (CLP)	Sample CONC (Reported)
	LL006035SS	870810-343	Gamma-BHC	3723.3200	4104.6459	21	19
			Heptachlor	3530.6000	3678.7816	29	28
			Aldrin	3916.4900	2918.2286	27	36
			4, 4' -DDT	788.7600	642.1016	115	140
	LL036235SS	870810-344	Gamma-BHC	3723.3200	4104.6459	54	49
			Heptachlor	3530.6000	3678.7816	67	64
			Aldrin	3916.4900	2918.2286	60	81
			4, 4' -DDT	788.7600	642.1016	232	280
	LL036042SS	870810-345	Gamma-BHC	3723.3200	4104.6459	12	11
			Heptachlor	3530.6000	3678.7816	25	24
			Aldrin	3916.4900	2918.2286	23	32
			4, 4' -DDT	788.7600	642.1016	132	160
	LL036053SS	870810-346	Gamma-BHC	3723.3200	4104.6459	24	21
			Heptachlor	3530.6000	3678.7816	30	28
			Aldrin	3916.4900	2918.2286	31	41
			Dieldrin	2784.7200	2370.2319	105	120
			Endrin*	14223.6000	12516.6391	99	110
			4, 4' -DDT	788.7600	642.1016	264	150
	LL036064SS	870810-347	Gamma-BHC	3723.3200	4104.6459	17	16
			Heptachlor	3530.6000	3678.7816	20	19
			Aldrin	3916.4900	2918.2286	22	30
			Dieldrin	2784.7200	2370.2319	62	73
			Endrin*	14223.6000	12516.6391	84	95
			4, 4' -DDT	788.7600	642.1016	99	120
	LL011032SS	870813-255	Beta-BHC*	8970.5000	4257.0133	5	11
	LL038033SS	870812-116	Gamma-BHC	2741.7400	4104.6459	41	27
			Heptachlor	2519.2600	3678.7816	43	29
			Aldrin	2669.4000	2918.2286	39	36
	LL038055SS	870812-117	Gamma-BHC	2741.7400	4104.6459	29	19
			Heptachlor	2519.2600	3678.7816	29	20
			Aldrin	2669.4000	2918.2286	32	29
	LL009016SS	870812-118	Gamma-BHC	2741.7400	4104.6459	23	16
			Heptachlor	2519.2600	3678.7816	21	14
			Aldrin	2669.4000	2918.2286	20	18
SN202	NO PESTICIDES ABOVE DETECTION LIMITS						

Table 5.13. Comparison of Data Calculation Methods (Continued)
—Lawrence Livermore and Sandia—

SDG #	EPA Sample #	ACD #	Pesticide	RRF (CLP)	RRF (Reported)	RFP % Difference
LL101	LL001018SS	870807-086	Gamma-BHC	23497.8250	29606.1538	-26.00%
			Heptachlor	19669.1450	24729.5445	-25.73%
			Aldrin	23831.8950	21179.9753	11.13%
			Dieldrin	10392.6900	13186.0976	-26.88%
			Endrin	13447.6850	13800.4356	-2.62%
			4,4'-DDT	6150.7850	6283.3637	-2.16%
	LL001029SS	870807-087	Gamma-BHC	23497.8250	29606.1538	-26.00%
			Heptachlor	19669.1450	24729.5445	-25.73%
			Aldrin	23831.8950	21179.9753	11.13%
			Endrin	13447.6850	13800.4356	-2.62%
			4,4'-DDT	6150.7850	6283.3637	-2.16%
	LL001030SS	870807-088	Gamma-BHC	23497.8250	29606.1538	-26.00%
			Heptachlor	19669.1450	24729.5445	-25.73%
			Aldrin	23831.8950	21179.9753	11.13%
			Dieldrin	10392.6900	13186.0976	-26.88%
			Endrin	13447.6850	13800.4356	-2.62%
			4,4'-DDD	13859.8450	12548.8854	9.46%
			4,4'-DDT	6150.7850	6283.3637	-2.16%
	LL002019SS	870807-089	Gamma-BHC	23729.1700	29606.1538	-24.77%
			Heptachlor	19988.3800	24729.5445	-23.72%
			Aldrin	23831.8950	21179.9753	11.36%
			Dieldrin	10392.6900	13186.0976	-27.81%
			Endrin	13447.6850	13800.4356	1.01%
			4,4'-DDT	6150.7850	6283.3637	-9.53%
	LL002020SS	870807-090	Gamma-BHC	23497.8250	29606.1538	-24.77%
			Heptachlor	19669.1450	24729.5445	-23.72%
			Aldrin	23831.8950	21179.9753	11.36%
			Dieldrin	10392.6900	13186.0976	-27.81%
			Endrin	13447.6850	13800.4356	1.01%
			4,4'-DDD	14508.4.50	12548.8854	13.51%
			4,4'-DDT	6150.7850	6283.3637	-9.53%
	LL002031SS	870807-091	Gamma-BHC	23497.8250	29606.1538	-24.77%
			Heptachlor	19669.1450	24729.5445	-23.72%
			Aldrin	23831.8950	21179.9753	11.36%
			Dieldrin	10392.6900	13186.0976	-27.81%
			Endrin	13447.6850	13800.4356	1.01%
			4,4'-DDD	14508.4350	12548.8854	13.51%
			4,4'-DDT	5736.7400	6283.3637	-9.53%
LL202	LL008015SS	870810-338	Gamma-BHC	3721.4600	4104.6459	-10.30%
			Heptachlor	3415.7900	3678.7816	-7.70%
			Aldrin	3882.3300	2918.2286	24.83%
			4,4'-DDT	766.3200	642.1016	16.21%
	LL008026SS	870810-339	Gamma-BHC	3721.4600	4104.6459	-10.30%
			Heptachlor	3415.7900	3678.7816	-7.70%
			Aldrin	3882.3300	2918.2286	24.83%
	LL008037SS	870810-340	Gamma-BHC	3721.4600	4104.6459	-10.30%
			Heptachlor	3415.7900	3678.7816	-7.70%
			Aldrin	3882.3300	2918.2286	24.83%
			Endrin*	15283.2100	12516.6391	18.10%
	LL006013SS	870810-341	Gamma-BHC	3721.4600	4104.6459	-10.30%
			Heptachlor	3415.7900	3678.7816	-7.70%
			Aldrin	3882.3300	2918.2286	24.83%
			4,4'-DDT	766.3200	642.1016	16.21%

Table 5.13. Comparison of Data Calculation Methods (Continued)
—Lawrence Livermore and Sandia—

SDG #	EPA Sample #	ACD #	Pesticide	RRF (CLP)	RRF (Reported)	RFP % Difference
	LL006024SS	870810-342	Gamma-BHC*	24872.1100	25808.9366	-3.77%
			Heptachlor*	22499.0700	22352.9586	0.65%
			Aldrin*	24941.3300	19292.8391	22.65%
			4,4'-DDT*	8655.5800	5619.8475	35.07%
	LL006035SS	870810-343	Gamma-BHC	3723.3200	4104.6459	-10.24%
			Heptachlor	3530.6000	3678.7816	-4.20%
			Aldrin	3916.4900	2918.2286	25.49%
			4,4'-DDT	788.7600	642.1016	18.59%
	LL036235SS	870810-344	Gamma-BHC	3723.3200	4104.6459	-10.24%
			Heptachlor	3530.6000	3678.7816	-4.20%
			Aldrin	3916.4900	2918.2286	25.49%
			4,4'-DDT	788.7600	642.1016	18.59%
	LL036042SS	870810-345	Gamma-BHC	3723.3200	4104.6459	-10.24%
			Heptachlor	3530.6000	3678.7816	-4.20%
			Aldrin	3916.4900	2918.2286	25.49%
			4,4'-DDT	788.7600	642.1016	18.59%
	LL036053SS	870810-346	Gamma-BHC	3723.3200	4104.6459	-10.24%
			Heptachlor	3530.6000	3678.7816	-4.20%
			Aldrin	3916.4900	2918.2286	25.49%
			Dieldrin	2784.7200	2370.2319	14.88%
			Endrin*	14223.6000	12516.6391	12.00%
			4,4'-DDT	788.7600	642.1016	18.59%
	LL036064SS	870810-347	Gamma-BHC	3723.3200	4104.6459	-10.24%
			Heptachlor	3530.6000	3678.7816	-4.20%
			Aldrin	3916.4900	2918.2286	25.49%
			Dieldrin	2784.7200	2370.2319	14.88%
			Endrin*	14223.6000	12516.6391	12.00%
			4,4'-DDT	788.7600	642.1016	18.59%
	LL011032SS	870813-255	Beta-BHC*	8970.5000	4257.0133	52.54%
	LL038033SS	870812-116	Gamma-BHC	2741.7400	4104.6459	-49.71%
			Heptachlor	2519.2600	3678.7816	-46.03%
			Aldrin	2669.4000	2918.2286	-9.32%
	LL038055SS	870812-117	Gamma-BHC	2741.7400	4104.6459	-49.71%
			Heptachlor	2519.2600	3678.7816	-46.03%
			Aldrin	2669.4000	2918.2286	-9.32%
	LL009016SS	870812-118	Gamma-BHC	2741.7400	4104.6459	-49.71%
			Heptachlor	2519.2600	3678.7816	-46.03%
			Aldrin	2669.4000	2918.2286	-9.32%
SN202	NO PESTICIDES ABOVE DETECTION LIMITS					

Noncompliance to CLP limits was observed in a number of continuing calibration checks, blanks, surrogate recoveries, matrix spike/matrix spike duplicates, and internal standard recoveries. These are so noted on the CLP reporting forms. Time restraints did not permit reanalysis of these samples.

Fourteen samples appear to have been spiked with the matrix spike solution; however, no record exists to document the addition of the six spike compounds. Due to the uncertainty of the results, the data from the six matrix spike analytes of the following samples were removed from the data tables:

SDG LL101 -- LL001018SS, LL001029SS, LL001030SS, LL002019S, LL002020SS, LL002020SS, LL002031SS.

SDG LL202 -- LL0080105SS, LL008026SS, LL008037SS, LL006013SS, LL009016SS, LL006035SS, LL006024SS.

Beta-BHC was confirmed in the method blank and Dieldrin was detected at a concentration below the quantitation limit. Beta-BHC was detected in two samples at concentrations below the quantitation limit. Possible phthalate contamination occurring in the same chromatographic region as Beta-BHC should be noted. The most commonly used BHC isomer is Lindane. When it is not present in the sample, the confirmation of Beta-BHC is suspect. Dieldrin was detected in several samples in SDG LL202 at a concentration below the quantitation limit.

5.2.1.2.4 PCBs in Oils

A non-CLP procedure was used to determine the concentration of PCBs in oil. The quality of the data from a single analysis day was assessed by analyzing a PCB standard prior to the survey samples. Proper detector response was verified at this time by comparison to the standard response obtained on the previous analysis day. An in-house quality control sample was then analyzed following this calibration. The result was within $\pm$10% of the true value. No

blanks, laboratory control, or duplicate samples were run. A survey sample was spiked with two different levels of Aroclor 1260. Spike recoveries were within 85% to 115%.

5.2.1.2.5 High Explosives

There is no standard CLP procedure for the determination of high explosives. A procedure similar to that used by workers at the U. S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire, was followed. The precision and accuracy of the method was followed using standards, defining linearity, using a method blank, and preparing matrix spike samples.

The retention times of the six munitions or munitions by-products drift slightly. These effects may be attributed to sample matrix, minor variation in eluent composition, and general aging of the column. Because a set of standards was always analyzed with a given set of samples, identifying the munitions was usually not difficult. Usually, a pair of standards was run in front and in back of a batch of samples. Occasionally, an additional pair of standards was analyzed in the midst of the batch. This procedure is routinely accepted among practicing analytical chemists as a reliable method for determining retention times for a batch of samples run at one time.

The six munitions standards were present at four concentration ranges to determine linearity and detection limits of the method. A test for blank levels was performed by analyzing a sample of clean, washed laboratory sand for explosives--no spurious peaks were detected. Soil and water samples were spiked with HMX, RDX, and TNT to determine method accuracy. The recovery of each munitions was at least 80% for each analyte. Apparent recovery values exceeding 100% were observed, but were not unexpected. The test procedure assumed tacitly that the three native munitions were uniformly distributed in the soil; that assumption may not have been entirely true. Although there was

no matrix spike performed for Tetryl, 2,4-DNT, and 2,6-DNT, none of these high explosives were detected in any samples above the reporting limit.

5.2.1.2.6 Inorganic Metals

In general, inorganic analyses were performed according to EPA CLP protocol; however, some deviations from the stated protocol did occur. A brief discussion of the more common protocol violations and their impact is provided below. The analysis of TCLP-metals was requested for samples in Environmental Problems 5 and 13. The cooler containing samples for Environmental Problem 5 was misplaced; therefore, TCLP data have not currently been generated. Because the metal concentrations of the TCLP analytes in Environmental Problem 13 were below the regulatory level in the original samples, analysis of a TCLP leach extract was not required.

ICP Analyses. Difficulty was encountered in maintaining the sodium primary, sodium secondary, and aluminum primary ICP channel calibration within the 10% CLP limit for the continuing calibration verification. Because sodium was not deemed an element of primary significance (particularly at the 500 ppb concentration level), an ICP run was not terminated if all other elemental standards met the CLP control limit.

The ICP spike levels for arsenic and selenium were selected according to the spike levels specified in CLP protocol for the GFAA method. These levels were close to the ICP detection limits for these two elements. Consequently, recoveries of these elements from water and soil samples often did not fall within the CLP control limits. Instances where antimony results exceeded CLP criteria in these matrices were attributed to loss of the analyte during sample digestion.

The ICP serial dilution sample was prepared by diluting the original digested water or soil sample by a factor of 5. If the concentration of the diluted

sample was not greater than 10 times the IDL for a given element, a percent difference was not calculated for that element.

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 oil samples. Conostan oil standards were chosen for the laboratory control sample. Duplicate and serial dilution analyses were performed, although spike analysis was inadvertently omitted. Analysis results for the laboratory control sample suggest that the sample preparation method was not effective for the analysis of arsenic, selenium, and silver in an oil matrix. The laboratory control sample did not contain antimony, beryllium, or cobalt. For these reasons, the qualitative presence of arsenic, antimony, beryllium, cobalt, and selenium in the oil matrix could be documented only. Sodium results appear to be biased by +45%, possibly due to laboratory contamination.

GFAA and CVAA Analyses. All analyses met required holding times. All solid samples contained a brown residue after sample preparation. Many of the site survey samples submitted for GFAA analyses contained high analyte concentrations that caused "memory effect" problems with the graphite furnace instrumentation. In order to avoid these problems, some analyses were made on diluted samples only, without first analyzing the undiluted samples.

Several spike recovery and duplicate sample results did not meet CLP limits; affected samples are so noted with either "N" or "N*" on the CLP reporting forms. Efforts to provide a homogeneous soil sample by stirring with a Teflon rod prior to sampling were not successful. Sample concentrations and spike recoveries were such that no standard addition procedures were required for GFAA analyses.

Potassium. A flame photometric procedure was used to determine the concentration of potassium in LLNL/SNLL samples. However, CLP analysis and

QA/QC protocol were followed. A single deviation from this protocol was encountered; results of one out of 13 laboratory control analyses exceeded the upper control limit by less than 2%. Samples associated with this control were not redigested as all other quality control results were in compliance. No suitable laboratory control sample was available for the analysis of potassium in an oil matrix. Duplicate oil samples were prepared and met CLP requirements.

5.2.1.2.7 Total Organic Carbon

There are no established CLP requirements for QC sample results for TOC analysis. Therefore, CLP requirements similar to those established for inorganic analyte analysis were used as a guideline for the quality assessment of TOC results. All calibration verification results fell within 95% to 105% of the true value. One blank was prepared with each SDG; the value of the calibration blank was subtracted from the gross TOC result of each sample before reporting the net TOC result for that sample. At least one duplicate and one spike sample were prepared for each SDG. CLP protocol does not specify guidelines for spike or duplicate results for TOC analysis. All spike results were within 100% to 111%; all duplicate results were within 0% to 4% RPD.

5.2.1.2.8 Anions

Because CLP procedure was not followed for LLNL/SNLL samples, the QA procedures differ from those required by CLP protocol. The CLP method detection limit (MDL) was not met for any of the analytes. The MDL, at maximum instrument sensitivity, was <1000 ug/L for Cl^- and F^- and <5000 ug/L for NO_3^-, PO_4^{-3}, and SO_4^{-2}. All blank results were less than these MDLs. An anion standard prepared from NBS materials was used to calibrate the instrument. Proper detector response was verified at this time by comparison to the standard response obtained from the previous analysis day. An in-house prepared quality control solution was analyzed following each calibration. All responses were within $\pm$10% of the true value. No laboratory control samples were analyzed.

Duplicates were analyzed in three of four SDGs. DOE Site Survey control limits of ±10 RPD for F^- and NO_3^- were met for all duplicates. The CLP control limit of ±85% to 115% recovery was used in determining spike sample conformance. All but one analyte result (NO_3^-) met CLP requirements.

5.2.1.2.9 Cyanide

Analysis of cyanide was not performed using a CLP procedure. A calibration verification standard was not analyzed. However, the quality control solution EPA WP018-Conc. 2 was analyzed with the Survey samples. The results were within the control limit of ±10% of the true value. The gross absorbance of the blank was subtracted from that of the samples to provide a net absorbance. Cyanide concentration was then determined based on the net absorbance of a sample. No additional QC samples were prepared and analyzed.

5.2.1.2.10 Nontarget List Parameters

Oil and Grease. The analysis of oil and grease was performed according to DOE Environmental Survey protocol. Although not required, an EPA oil and grease quality control standard was analyzed with one of the nine SDGs as a calibration check. The result was 112% of the true value and was within the allowable control limit range specified by EPA (i.e., 27 to 37 mg/L). Survey protocol does not require any calibration or preparation blank analysis. However, for each SDG an extraction solvent blank was analyzed and the result subtracted from the gross weight of residue collected. No laboratory control sample was required. Four of the nine SDGs contained duplicate samples. All duplicate results, except for a single soil sample, were within a control limit of ±20 RPD. The soil duplicate exceeded the control limit by 1%. Although not required by Survey protocol, four SDGs contained spiked samples. Half the recovery results were within the 75% to 125% control limit. All samples were analyzed within the required holding times.

5.2.1.2.11 Hexavalent Chromium

A standard EPA procedure exists for the analysis of chromium (VI) in water; there is no equivalent procedure defined for soil samples. Results for soil samples were not considered reliable and were not reported. The optical absorbance of the matrix interferes significantly with the analyte chromophore, making the determination of the cation impossible. A calibration verification solution was not analyzed because there was no in-house quality control standard available. A reagent calibration blank was analyzed. Its gross absorbance was subtracted from that of water samples to provide a net absorbance. Chromium (VI) concentration was then determined from this net absorbance. Aqueous spike samples were analyzed for the SNLL samples and LLNL samples. Duplicate results met CLP requirements. Spiked samples were analyzed for both sites, although only results from the LLNL Site met the 75% to 125% recovery requirement.

5.2.1.2.12 Total Uranium

Total uranium concentration was determined for two SDGs prepared and analyzed on the same day. A calibration verification check standard was not analyzed. An NBS SRM was used to calibrate the instrument. Three quality control solutions were analyzed following the calibration. All results were within $\pm$10% of the true values. A preparation blank was analyzed. Its result was less than the method detection limit (<1 ug/L). Two duplicates were analyzed in one of the SDGs. All results were within the $\pm$20% control limit. Duplicates were not analyzed in the other SDG. However, three replicate measurements made on each sample of the SDG agreed within $\pm$10%. No spiked samples were prepared and analyzed.

5.2.1.2.13 Percent Solids

The accuracy of the determination was maintained by daily checks of the temperature of the drying oven with a thermometer located at the top of the oven. The temperature exceeded the 103° to 105°C range on 4 days. The greatest deviation was by -3.5^{o}C. The Mettler balance was calibrated 3 days prior to the analysis of LLNL/SNLL samples. The calibration of the electronic balance was checked daily using Class S metric weights at the 1-, 5-, 10-, and 100-g levels. The measured mass did not vary by more than +0.2 mg from the known value at the 1-, 5-, and 10-g levels. The measured value at the 100-g level varied between -0.4 to +0.3 mg of the known value. A single measurement of percent solids was made for each sample.

5.2.2 Radiological Quality Assurance

The basic purpose of the 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 valid interpretations can be made. This purpose is accomplished by assuring that: (1) proper sample procedures are followed; (2) the instruments yield accurate, reproducible results; and (3) 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 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 instrument 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.

Table E.1 in Appendix E shows the laboratory performance on 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 Environmental Survey, an R value between 80 and 120 is considered acceptable.

5.2.2.1 Gross Alpha-Beta Measurements

In order to ensure accuracy of the results obtained by the gross alpha-beta measurements, both alpha and beta standards traceable to NBS were counted daily when the LB-4000 and LB-5100 instruments were in use, and blanks (i.e., instrument backgrounds) were also obtained daily. In addition to these routine checks, prior to initiation of the measurements of LLNL/SNLL samples, the instruments underwent a full calibration, which included the determination of plateaus.

The results of the daily calibration checks, done with an alpha standard (RNS1-8A) consisting of americium-243 and a beta standard (RNS2-40B) consisting of strontium-90 and yttrium-90, are in Appendix Table E.2. The mean alpha efficiency of the LB-5100 was 21.2% with a standard deviation of 0.3% and a range of 20.8% to 21.9%. The mean beta efficiency of the LB-5100 was 44.6% with a standard deviation of 0.3% and a range of 44.1% to 45.4%. 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). The mean beta efficiency of the LB-4000 was 36.0% with a standard deviation of 1.6% and a range of 32.68% to 39.87%. All alpha efficiency measurement checks indicated a result within the acceptable range of 21 +2%. All beta efficiency measurement checks indicated a result within the acceptable range of 36 +4%. Because all alpha and 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 LLNL/SNLL samples.

The result of the instrument background (i.e., blank) measurements are given in Appendix Tables E.3 and E.4 for alpha and beta. Examination of these tables indicates that the instrument backgrounds were relatively constant throughout the measurement period of LLNL/SNLL. The alpha background of the LB-5100 had a mean of 0.10 cpm, a standard deviation of 0.02 cpm, and a range of 0.07 to 0.11 cpm. The beta background of the LB-5100 had a mean of 0.85 cpm, a standard deviation of 0.04 cpm, and a range of 0.80 to 0.90 cpm. The alpha background of the LB-4000 had a mean of 0.02 cpm, a standard deviation of 0.006 cpm, and a range of 0.02 to 0.04 cpm. The beta background of the LB-4000 had a mean of 0.74 cpm, a standard deviation of 0.15 cpm, and a range of 0.55 to 1.27 cpm. Both the alpha and the beta backgrounds of the instruments, therefore, were of low enough levels that they did not adversely affect the measurements.

5.2.2.2 Isotopic Alpha Measurements

Alpha measurements on individual isotopes (e.g., plutonium-239) are performed using a Nuclear Data ND-9900 proportional counting system. The mean alpha efficiency of the ND-9900 was 22.8% with a standard deviation of 4.7% and a range of 18% to 37%. The mean alpha instrument background of the ND-9900

was 0.030 cpm with a standard deviation of 0.010 cpm and a range of 0.012-0.046 cpm. All of the measurement checks show results within the acceptable range, indicating that the ND-9900 was operating properly during the period of the LLNL/SNLL measurements. Table E.5 of the efficiency and background data for each of the 12 detectors appears in Appendix E.

Data on the calibration of the 12 detectors in this system are presented in Table E.6. This data indicates that each detector in the system was well within the specified calibration limits during the time period of the LLNL/SNLL measurements.

5.2.2.3 Gamma Spectral Measurements

In order to ensure accuracy and reproducibility of results obtained by the gamma spectral measurements (gamma scans), a secondary standard consisting of cesium-137 and cobalt-60 were counted daily; a mixed-radionuclide standard traceable to NBS was counted routinely; and instrument backgrounds (i.e., blanks) were counted routinely. The gamma standards are used to check whether the energy calibration and efficiency of the instrument remains constant.

LLRAG utilizes six gamma-ray detectors which are attached to a common computer (a MicroVAX) for data collection and analysis.

Appendix Table E.7 presents the results of the daily checks with the gamma standards for each of the six detectors. The count rates, centroids, and peak widths for the cesium-137 (661 keV) and cobalt-60 (1332 keV) peaks are used in the QC check. Examination of the data in these tables indicates that the peak widths were very constant during the LLNL/SNLL measurements. The centroids exhibited only slight variations, and these variations were accounted for by the analyzer system, which provides an energy calibration for each gamma-ray spectrum. The count rates for each of the gamma rays were also relatively constant, showing a range (minimum-to-maximum value) of 8% or less. The

results indicate that the efficiency of each detector was constant during the period of the LLNL/SNLL measurements.

Appendix Table E.8 presents a summary of the measured intensities of all the gamma rays observed in the instrument background (i.e., blanks) for the six gamma-ray detectors. The data indicate that the background was low and relatively constant.

5.2.2.4 Liquid Scintillation Measurements

Tritium samples were counted using a Packard 460C Tri-Carb liquid scintillation counter. A Packard tritium standard is counted daily to ensure the accuracy and reproducibility of the results obtained by the system. Instrument backgrounds (i.e., blanks) are also counted daily. The results for the standard and instrument background counts performed during the time that the LLNL/SNLL samples were counted are given in Appendix Table E.9 along with the efficiency data for that time period. The instrument background for the 460C was 13.8 cpm, with a standard deviation of 1.3 cpm and a range of 11.9 to 16.6 cpm. The efficiency of the 460C was 59.5%, with a standard deviation of 0.3% and a range of 58.9% to 60.1%. All the data indicate that the 460C was accurately calibrated, sufficiently constant, and had a low enough instrument background so no degradation of sample results occurred during the period of the LLNL/SNLL tritium measurements.

5.2.2.5 Interlaboratory Comparisons

During the period of the LLNL/SNLL measurements, LLRAG participated in the EPA Cross Check Program for gross alpha and gross beta in water, strontium-90 in water, tritium in water, total uranium in water, and gamma isotopics in water. The results measured by LLRAG, and presented in Tables E.10 and E.11, did not exceed the warning limits, indicating that sufficiently accurate results were being obtained by LLRAG procedures and instruments.

5.2.2.6 Conclusions

The results of the QC checks presented above indicate that the performances of the alpha-beta instrument and the gamma-ray spectrometers were adequate to ensure accuracy and reproducibility of the results obtained using them. In addition, the instrument background seen by each instrument/detector was sufficiently low and sufficiently constant to ensure accurate removal of instrument background effects.

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 routines to ensure that the data are of the highest quality possible. These verification and validation 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 LLNL/SNLL 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 documented.

Data consistency problems include 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.

6.0 REFERENCES

1-1. DOE Environmental Survey Sampling and Analysis Plan Lawrence Livermore National Laboratory; U.S. Department of Energy. Office of Environmental Audit. July 1987; DOE/EH/OEV-09-SAP.

1-2. DOE Environmental Survey Sampling and Analysis Plan Sandia National Laboratories Livermore; U.S. Department of Energy. Office of Environmental Audit. July 1987; DOE/EH/OEV-08-SAP.

1-3. The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, July 1987 (Draft).

1-4. The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 1-4.

1-5. Environmental Survey Preliminary Report - Lawrence Livermore National Laboratory, Livermore, California; U.S. Department of Energy. Office of Environmental Audit. December 1987.

1-6. Environmental Survey Preliminary Report - Sandia National Laboratories, Livermore, California; U.S. Department of Energy. Office of Environmental Audit. January 1988; DOE/EH/OEV-08-P.

BIBLIOGRAPHY

The following bibliography provides general materials and sources used for the analytical methods described in Chapter 3.0.

Volatile and Semivolatile Organics, Pesticides/PCBs in Water, Soil, and Sediment

U.S. EPA Contract Laboratory Program Statement of Work for Organics Analysis Multi-Media, Multi-Concentration, Revision 7/87.

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental

Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3.

PCBs in Oil

ORNL Master Analytical Manual, Oak Ridge National Laboratory: Oak Ridge, TN, 1981 (original issue), Method 1-221019.

F001 to F005 Solvents

Environmental Reporter - Federal Regulations - 4 (Effluent Standards), Section 261.30 (d) (The Bureau of National Affairs, Inc., 1231 25th St., N.W., Washington DC) pp. 69-70.

High Explosives

M. P. Maskarinec, L. H. Johnson, and S. K. Holladay, "Recommendations for Holding Times of Environmental Samples" in Proceedings of USEPA Symposium on Waste Testing and Quality Assurance, Vol. II, Washington, DC, July 11-15, 1988; pp. H29-45.

T. F. Jenkins, C. F. Bauer, D. C. Leggett, and C. L. Grant, Reverse-Phase HPLC Method of Analysis of TNT, RDX, HMX, and 2,4-DNT in Munitions Wastewater, U. S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH, CRREL Report 84-29, December 1984.

T. F. Jenkins, D. C. Leggett, C. L. Grant, and C. F. Bauer, "Reversed-Phase High-Performance Liquid Chromatographic Determination of Nitroorganics in Munitions Wastewater," Anal. Chem., 58, 170-175 (1986).

C. F. Bauer, C. L. Grant, and T. F. Jenkins, "Interlaboratory Evaluation of High-Performance Liquid Chromatographic Determination of Nitroorganics in Munition Plant Wastewater," Anal.Chem., 58, 176-182 (1986).

T. F. Jenkins and M. E. Walsh, Development of an Analytical Method for Explosive Residues in Soil, U. S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH, CRREL Report 87-7, June 1987.

T. F. Jenkins and C. L. Grant, "Comparison of Extraction Techniques for Munitions Residues in Soils," Anal.Chem., 59, 1326-1331 (1987).

M. P. Maskarinec, D. L. Manning, R. W. Harvey, W. H. Griest, and B. A. Tomkins, "Determination of Munitions Components in Water by Resin

Adsorption and High-Performance Liquid Chromatography-Electrochemical Detection," J. of Chromatography, 302, 51-63 (1984).

M. P. Maskarinec, D. L. Manning, and R. W. Harvey, "Application of Solid Sorbent Collection Techniques and High Performance Liquid Chromatography with Electrochemical Detection to the Analysis of Explosives in Water Samples. Final Report," Oak Ridge National Laboratory, Oak Ridge, TN, ORNL/TM-10190, November, 1986.

ORNL Master Analytical Manual, Oak Ridge National Laboratory: Oak Ridge, TN, 1988, Method 1221030.

Total Organic Carbon

Methods for the Chemical Analysis of Water and Wastewater, EPA-600/4-79-020, Method 415.1.

ICP-Atomic Emission Spectrometry

"Inductively Coupled Plasma-Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes," U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis Multi-Media, Multi-Concentration; SOW No. 785.

Methods for the Chemical Analysis of Water and Wastes; Environmental Monitoring and Support Laboratory: Cincinnati, OH, March 1983; EPA-600/4-79-020; Method 200.7.

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3.

Potassium

Standard Methods for the Examination of Water and Wastewater, 16th ed., American Public Health Association: Washington, DC, 1985, Method 322 B.

Operating Manual for the Coleman Models 51 and 51Ca Flame Photometers, The Perkin-Elmer Corporation: Oak Brook, IL, 1983.

Atomic Absorption, Furnace Technique

Methods for the Chemical Analysis of Water and Wastes; Environmental Monitoring and Support Laboratory: Cincinnati, OH, March 1983; EPA-600/4-79-020; Method 200 Series.

Environmental and Effluent Analysis Manual, Martin Marietta Energy Systems: Oak Ridge, TN, 1977 (original issue), Method EC-140.

Mercury

Cyrus Feldman, "Perchloric Acid Procedure for Wet-Ashing Organics for the Determination of Mercury (and Other Metals)," Anal. Chem. 1974, 46, 1606-1609.

Methods for the Chemical Analysis of Water and Wastes; Environmental Monitoring and Support Laboratory: Cincinnati, OH, March 1983; EPA-600/4-79-020; Method 245.1.

U.S. EPA Contract Laboratory Statement of Work for Inorganic Analysis Multi-Media, Multi-Concentration SOW No. 787, Methods 245.1 and 245.5 CLP-M.

Total Cyanide

Test Methods for Evaluating Solid Wastes, SW-846, 2nd ed., EPA: Washington, DC, July 1982, Method 9010.

Methods for the Chemical Analysis of Water and Wastes; Environmental Monitoring and Support Laboratory: Cincinnati, OH, March 1983; EPA-600/4-79-020; Method 335.2.

Recoverable Oil and Grease

Methods for the Chemical Analysis of Water and Wastes; Environmental Monitoring and Support Laboratory: Cincinnati, OH, March 1983; EPA-600/4-79-020; Method 413.1.

Test Methods for Evaluating Solid Wastes, SW-846, 2nd ed., EPA: Washington, DC, July 1982, Method 9071.

Standard Methods for the Examination of Water and Wastewater, 16th ed., American Public Health Assoc.: Washington, DC, 1985, Method 503 A.

Anions by Ion Chromatography

Methods for the Chemical Analysis of Water and Wastes; Environmental Monitoring and Support Laboratory: Cincinnati, OH, March 1983; EPA-600/4-79-020; Method 300.0.

Standard Methods for the Examination of Water and Wastewater, 16th ed., American Public Health Assoc.: Washington, DC, 1985, Method 429.

Hexavalent Chromium

Test Methods for Evaluating Solid Wastes, SW-846, 2nd ed., EPA: Washington, DC, July 1982, Methods 3060 and 7196.

Percent Solids

USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis Multi-Media, Multi-Concentration SOW No. 785, Method 335.2 (Sed.).

Methods for the Chemical Analysis of Water and Wastes; Environmental Monitoring and Support Laboratory: Cincinnati, OH, March 1983; EPA-600/4-79-020; Metals-4.

Determination of Alpha and Beta (Gross Activity) in Water

Standard Methods for the Examination of Water and Wastewater, 16th ed., American Public Health Association: Washington, DC, 1985. Method 703.

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3, pp. D508-511.

Isotopic Uranium in Water

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3, pp. D587-593.

Isotopic Uranium in Soil

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3, pp. D594-601.

Total Uranium in Water

Environmental and Effluent Analysis Manual, Martin Marietta Energy Systems: Oak Ridge, TN, 1977 (original issue), Method EC-1910.

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3, pp. D610-615.

Total Radioactive Strontium in Water

Environmental and Effluent Analysis Manual, Martin Marietta Energy Systems: Oak Ridge, TN, 1977 (original issue), Method EC-1840.

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3, pp. D679-686.

Total Radioactive Strontium in Soil

Environmental and Effluent Analysis Manual, Martin Marietta Energy Systems: Oak Ridge, TN, 1977 (original issue), Method EC-1840.

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3, pp. D687-696.

Gamma-Ray Emitting Nuclides in Water and Soil

Environmental and Effluent Analysis Manual, Martin Marietta Energy Systems: Oak Ridge, TN, 1977 (original issue), Method EC-1340.

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3, pp. D722-726.

Tritium in Water and Soil

Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032, Method 906.0.

The Environmental Survey Manual; U.S. Department of Energy. Office of the Assistant Secretary Environment, Safety, and Health. Office of Environmental Audit. National Technical Information Service, U.S. Department of Commerce: Springfield, VA, August 1987; DOE/EH-0053, Vol. 3.