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Date: APR 14 1995
Refer to: EM/ER:95-143

Ms. Barbara Driscoll
NM/Federal Facilities Section
Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
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Dear Ms. Driscoll:

SUBJECT: SAMPLING AND ANALYSIS PLANS FOR (1) HAZARDOUS AND SOLID WASTE AMENDMENTS (HSWA) PERCHED ZONE MONITORING WELLS AND (2) SOLID WASTE MANAGEMENT UNIT (SWMU) NO. 0-001 (MORTANDAD SEDIMENT TRAPS)

Enclosed please find two copies of the above referenced document which are two Sampling and Analysis Plans. These plans pertain to alluvial media associated with the canyon systems at Los Alamos National Laboratory (the Laboratory). The first plan addresses a special condition of the Laboratory's HSWA Permit. The second plan addresses SWMU No. 0-001. The SWMU is an active unit referred to as the "sediment traps" in Mortandad Canyon.

The first of these two plans was prepared in response to your request. The second plan was developed by technical personnel supporting this site in Field Unit 4. The document was identified by Dave McInroy and yourself as an appropriate mechanism to provide you this information which was inadvertently left out of all Resource Conservation and Recovery Act Facility Investigation Work Plans.

Also enclosed please find a Certification Statement for the document. Should you have any questions, please contact Dave McInroy at (505) 667-0819 or Court Fesmire at (505) 665-4718.

Sincerely,

Jorg Jansen, Project Manager
Environmental Restoration

Environmental Restoration

Sincerely,

Theodore J. Taylor, Program Manager
Los Alamos Area Office

APR 1 4 1995

JJ/TT/plp

Enclosures: (1) Sampling and Analysis Plan for HSWA Perched Zone Monitoring Wells
(2) Sampling and Analysis Plan for SWMU No. 0-001 (Mortandad Sediment Traps)
(3) Certification Form

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CERTIFICATION

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

Document Title:

Sampling and Analysis Plans For (1) Hazardous and Solid Waste Amendments (Hswa) Perched Zone Monitoring Wells and (2) Solid Waste Management Unit (Swmu) No. 0-001 (Mortandad Sediment Traps)

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Sampling and Analysis Plans for HSWA Perched Zone Monitoring Wells and SWMU No. 0-001 (Mortandad Sediment Traps)

Los Alamos National Laboratory
Environmental Restoration Project

March 1995

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1.0 Introduction and Scope

This document contains two Sampling and Analysis Plans (SAPs) which pertain to alluvial media associated with the canyon systems at Los Alamos National Laboratory (LANL). The first plan addresses a special condition of the Hazardous and Solid Waste Amendments (HSWA) Permit issued to the Los Alamos National Laboratory (LANL) requiring the installation of 13 monitoring wells into the shallow alluvial perched water zones of Los Alamos, Sandia, Mortandad, Potrillo, Fence, and Water Canyons to determine the extent of downgradient saturation and contamination (see Appendix A).

The second plan addresses SWMU No. 0-001. SWMU No. 0-001 is an area referred to as the "sediment traps" in Mortandad Canyon approximately 2.3 km (1.4 mi) upstream of the eastern Los Alamos National Laboratory (LANL) boundary. This SWMU is listed in the HSWA Module VIII, Table A (Permit Id. No. NM0890010515). Mortandad Canyon originates on the western part of the Pajarito Plateau and opens to the Rio Grande to the east. Gauging stations, observation wells, test wells and the sediment traps are located along the length of the canyon.

Both of these SAPs were prepared in response to EPA requests. The SAP for SWMU No. 0-001 was included in this document for the EPA prior to the delivery of the Mortandad Canyon Work Plan, which will be part of the RFI Work Plan for OU 1049.

2.0 Sampling and Analysis Plan for HSWA Perched Zone Monitoring Wells

Special conditions of the Hazardous and Solid Waste Amendments (HSWA) Permit issued to the Los Alamos National Laboratory (LANL) required the installation of 13 monitoring wells into the shallow alluvial perched water zones of Los Alamos, Sandia, Mortandad, Potrillo, Fence, and Water Canyons to determine the extent of downgradient saturation and contamination (see Appendix A). Installation of 17 new alluvial wells was completed in 1990. All well location and construction information for these wells has been published in "Perched Zone Monitoring Wells — Installation" (Purtymun and Stoker, 1990).

Comprehensive sampling of all new HSWA alluvial wells which contained water, as well as six adjacent older alluvial wells was completed in 1990. Results of the sampling event are published in "Perched Zone Monitoring Wells — Analytical Results" (LANL, 1990) and given in Appendix A. Preliminary results from this single sampling event seem to indicate that there are some higher concentrations of constituents in the new HSWA wells when compared to the older wells.

Because the analytical results obtained from the newer HSWA wells differ from the results obtained from the older wells, the EPA has requested that additional sampling of both new wells and older adjacent wells be conducted so that a statistical comparison can be performed. In response to this request the DOE has proposed to conduct four rounds of sampling and analysis during CY 1995. This request was approved by the EPA in a response letter to the DOE dated September 1, 1994. Appendix B contains copies of pertinent correspondence.

2.1 Well Locations and Sampling Results

The required HSWA wells were constructed as close to the permit-specified locations as possible. In some cases water was encountered during the drilling of a well, but after completion, the well went dry. In these cases, the drilling activities were moved to a new location and monitoring wells were installed where water was encountered. These activities are documented in the LANL report cited above (Purtymun and Stoker, 1990). A map of perched zone monitoring well locations is given in Figure 1. A list of the well locations is given in Table 1.

The original comprehensive sampling of the HSWA perched zone monitoring wells was conducted by the Laboratory in September 1990 and included the HSWA wells which contained sufficient water to be

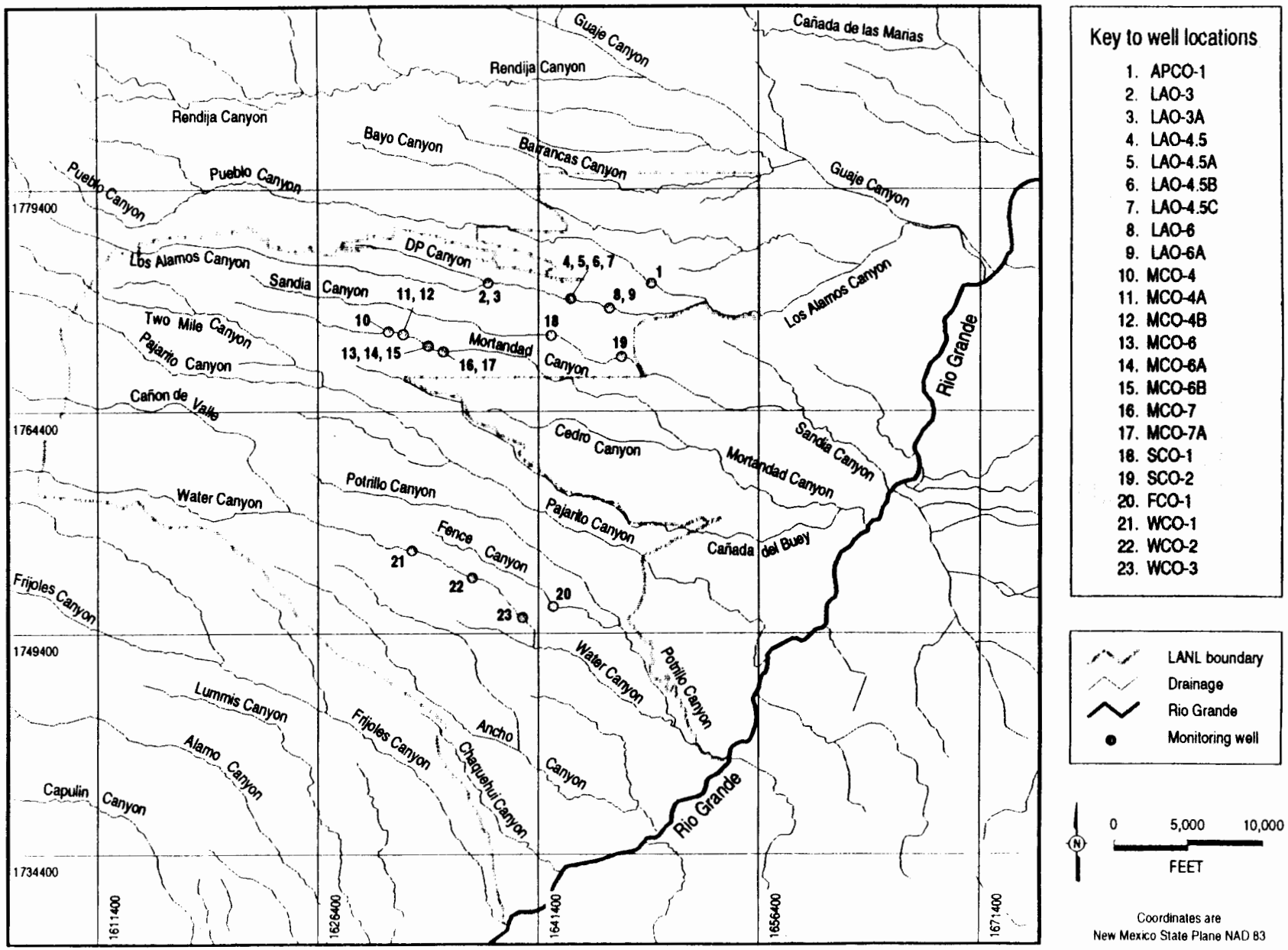


Figure 1. Location of HSWA perched zone monitoring wells.

Table 1. HSWA Perched Zone Monitoring Wells

station	date constructed	x-coordinate	y-coordinate	elevation	depth	screen interval	water level *
APCO-1	08/17/90	1649209.568	1773020.09	6367.53	20	4.7-14.7	6.2
FCO-1	08/22/89	1642412.364	1751182.029	6509.24	29	2.4-12.4	dry
LAO-3	02/01/66	1638010.643	1773098.414	6578.1	32	9-24	6.6
LAO-3A	09/14/89	1637980.841	1773099.766	6579.4	14.7	4.7-14.7	5.5
LAO-4.5	09/14/89	1643659.106	1772087.683	6451.8	62	10-40	4.5
LAO-4.5A	09/14/89	1643500.2341	1772051.7174	6460	20	8.5-18.5	dry
LAO-4.5B	09/16/89	1643512.346	1772054.5935	6459.37	35	24.9-34.9	dry
LAO-4.5C	11/22/89	1643547.324	1772076.536	6457.63	25	13.2-23.2	10.7
LAO-6	02/01/66	1646222.1417	1771329.5017	6395	16	6-16	periodic saturation
LAO-6A	08/17/89	1646221.586	1771344.023	6395.88	15	4.2-14.2	periodic saturation
MCO-4	10/01/63	1631214.392	1769787.861	6900.36	24	14-19	3.3
MCO-4A	11/01/89	1632028.905	1769700.219	6887.53	24	9.4-19.4	dry
MCO-4B	08/21/90	1632036.434	1769696.986	6887.56	34	8.9-28.9	21.7
MCO-6	03/01/74	1633635.349	1769012.809	6878.36	47	27-47	28.9
MCO-6A	11/06/89	1633633.111	1768961.972	6850.18	33	22.7-37.7	dry
MCO-6B	08/13/90	1633630.536	1768983.579	6850.37	48	22-42	33.2
MCO-7	10/01/60	1634517.813	1768509.879	6827.4	77	39-69	39.7
MCO-7A	11/14/89	1634503.498	1768509.283	6827.71	47	34.8-44.8	37.2
SCO-1	08/15/89	1642297.635	1769502.248	6618.67	790	9.3-19.3	dry
SCO-2	08/16/89	1647259.014	1767863.95	6500.67	29	9.4-19.4	dry
WCO-1	10/31/89	1632758.724	1755069.16	6616.41	37	24.4-34.4	dry
WCO-2	10/26/89	1636870.333	1753228.425	6624.57	38	13.5-23.5	dry
WCO-3	10/25/89	1640212.522	1750620.3	6436.43	14	9-14	dry

* Water levels measured when well constructed or last sampled.

sampled (MCO-4B, MCO-6B, MCO-7A, LAO-3A, LAO-4.5C, and APCO-1) as well as the older adjacent wells (MCO-4, MCO-6, MCO-7, LAO-3, and LAO-4.5). In November 1990 the same HSWA wells were resampled by IT Corporation. The results of both sampling events are given in the LANL report cited above (LANL, 1990) and in Appendix C.

Samples from the Laboratory were analyzed for most of the 40 CFR Part 264, Appendix IX constituents, as well as for radionuclides and additional chemical parameters. Samples from IT Corporation were analyzed for all of the Appendix IX constituents. The list of parameters analyzed is given in Table 2.

2.2 Sampling and Analysis Plan

The sampling plan for the alluvial perched groundwater consists of four sampling events spaced seasonally throughout CY1995. This, along with previously collected data, will provide minimum information for performing comparative statistics.

Seventeen new HSWA wells and six old alluvial wells will be monitored four times for presence of water during 1995. All wells containing water will be sampled. Six of the HSWA wells are known to contain water and were previously sampled in 1990 by bailer methods. LAO-6A has been observed to contain water during late spring but was not sampled. Bladder pumps have since been installed in those wells to standardize sampling procedures between the newer and older wells. Any other of the new wells which are observed to contain enough water to sample will be equipped with bladder pumps and sampled during that monitoring event.

Sampling procedures will be conducted in accordance with LANL Environmental Restoration Standard Operating Procedures (LANL-ER-SOPs) pertaining to well purging and sampling of groundwater wells. The applicable SOPs are listed in Table 3 and are reproduced in Appendix D.

Most recent data obtained from annual sampling of the older adjacent wells during environmental surveillance activities show concentration of constituents to be below both EPA and LANL screening action levels for environmental characterization of water. Therefore, water purged from wells before sampling will be distributed onto the ground surface away from any water course, and down gradient from the well being sampled. This will help reduce cost and waste generation, and increase efficiency of sampling.

Two samples will be taken from each groundwater station, one filtered through a 0.45-μm millipore membrane filter and one unfiltered. Filtration will be performed in the field at the time of sample collection into acidified bottles as outlined in LANL-ER-SOP-01.02 (Appendix D). The first of these sampling events will be initiated within the first quarter of 1995. Later sampling events will be conducted approximately quarterly and be completed by the end of the calendar year.

Samples taken during the first monitoring event will be analyzed for the same list of analytes previously required by the special condition of the HSWA Permit. This includes the 40 CFR 264 Appendix IX constituents as well as 10 radiochemical constituents. In addition to these constituents, the samples will also be analyzed for some additional general chemical parameters. The list of constituents and parameters is given in Table 2.

Subsequent sampling events may result in fewer analyses if some Appendix IX constituents are not detected during the first round of sampling as stated in the correspondence letter dated August 19, 1994.

If no organics are detected during the first sampling event, they will be dropped from the list of constituents to be analyzed for the remaining three sampling events.

Samples will be analyzed by laboratories with demonstrated proficiency. EPA specified analytical methods will be used where applicable (EPA-SW-846, EPA 1987). Radionuclides will be analyzed by LANL acceptable methods. The acceptable analytical method by which each constituent will be analyzed

Table 2. List of Constituents

Volatile Organic Compounds

Dichlorodifluoromethane
Chloromethane
Vinyl Chloride
Bromomethane
Chloroethane
Trichlorofluoromethane
1,1-Dichloroethene
Trichlorotrifluoroethane
Iodomethane
Carbon Disulfide
Acetone
Methylene Chloride
t-1,2-dichloroethene
1,1-Dichloroethane
2,2-Dichloropropane
c-1,2-Dichloroethene
2-Butanone
Bromomchloromethane
Chloroform
1,1,1-Trichloroethane
Carbon Tetrachloride
1,1-Dichloropropene
Benzene
1,2-Dichloroethane
Trichloroethene
1,2-Dichloropropane
Dibromomethane
Bromodichloromethane
t-1,3-Dichloropropene
4-Methyl-2-pentanone
Toluene
c-1,3-Dichloropropene
1,1,2-Trichloroethane
Tetrachloroethene
1,3-Dichloropropane
Chlorodibromomethane
2-Hexanone
1,2-Dibromomethane
Chlorobenzene
1,1,1,2-Tetrachloroethane
Ethylbenzene
o,m,p-Xylene (mixed)
Styrene
Bromoform
Isopropylbenzene
Bromobenzene
1,2,3-Trichloropropane
1,1,2,2-Tetrachloroethane
n-Propylbenzene
2-Chlorotoluene
4-Chlorotoluene
1,3,5-Trimethylbenzene
tert-Butylbenzene
1,2,4-Trimethylbenzene
sec-Butylbenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2-Dichlorobenzene
n-Butylbenzene
1,2-Dibromo-3-chloropropane

Non-Volatile Organic Compounds

HEXACHLOROBENZENE
PENTACHLOROPHENOL
PHENANTHRENE
ANTHRACENE
DI-N-BUTYLPHTHALATE
FLUORANTHENE
BENZIDINE
PYRENE
BUTYLBENZYLPHTHALATE
3,3'-DICHLOLROBENZIDENE
BENZO(A)ANTHRACENE
BIS-2-ETHYLHEXYLPHTHALATE
CHRYSENE
DI-N-OCTYLPHTHALATE
BENZO(B)FLUORANTHENE
BENZO(K)FLUORANTHENE
BENZO(A)PYRENE
INDENO-1,2,3,-(CD)-PYRENE
DIBENZ(AH)ANTHRACENE
BENZO(GHI)PERYLENE
N-NITROSODIMETHYLAMINE
ANILINE
PHENOL
BIS 2-CHLOROETHYL ETHER
2-CHLOROPHENOL
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
BENZYL ALCOHOL
1,2-DICHLOROBENZENE
2-METHYLPHENOL
BIS 2-CHLOROISOPROPYLETHER
4-METHYLPHENOL
N-NITROSO-DI-N-PROPYLAMINE
HEXACHLOROETHANE
NITROBENZENE
ISOPHORONE
2-NITROPHENOL
2,4-DIMETHYLPHENOL
BENZOIC ACID
BIS 2-CHLOROETHOXY-METHANE
2,4-DICHLOROPHENOL
1,2,4-TRICHLOROBENZENE
NAPHTHALENE
4-CHLOROANILINE
HEXACHLOROBUTADIENE
4-CHLORO-3-METHYLPHENOL
2-METHYLNAPHTHALENE
HEXACHLOROCYCLOPENTADIENE
2,4,6-TRICHLOROPHENOL
2,4,5-TRICHLOROPHENOL
2-CHLORONAHPTHALENE
2-NITROANILINE
DIMETHYLPHTHALATE
ACENAPHTHYLENE
3-NITROANILINE
ACENAPHTHENE
2,4-DINITROPHENOL
4-NITROPHENOL
DIBENZOFURAN
2,4-DINITROTOLUENE
2,6-DINITROTOLUENE
DIETHYL-PHTHALATE
4-CHLOROPHENYL-PHENYLETHER
FLUORENE
4-NITROANILINE
4,6-DINITRO-2-METHYLPHENOL
N-NITROSODIPHENYLAMINE
AZOBENZENE
4-BROMOPHENYL-PHENYLETHER

Radionuclides

Gross Alpha
Gross Beta
Gross Gamma
238 Plutonium
239, 240 Plutonium
241 Americium
90 Strontium
137 Cesium
Total Uranium
Tritium

Trace Elements

Silver
Aluminum
Boron
Barium
Beryillium
Cadmium
Cobalt
Chromium
Copper
Lithium
Manganese
Molybdenum
Nickel
Tin
Strontium
Vanadium
Zinc

Chemical Parameters

Calcium
Magnesium
Potassium
Sodium
Phosphorous
Sulpher Dioxide
Chlorine
Iron
Total Nitrate as Nitrogen
Total Disolved Solids
pH
Conductance
Hardness
Turbidity
Total Suspended Solids

is listed in Table 4. Filtered and unfiltered samples will be analyzed for radiochemical and inorganic constituents. Organic analyses will only be performed on unfiltered samples.

2.3 QA/QC Procedures

QA/QC procedures outlined in the ER Generic Quality Assurance Project Plan (QAPjP) for RCRA Facility Investigations (LANL, 1991) will be followed for all field and laboratory methods.

Field quality control samples will be taken in accordance with LANL-ER-SOP-01.05 (Appendix B) and the QAPjP. First round sampling will include duplicate samples taken from LAO-3A and MCO-6B (filtered and unfiltered) because previous analysis of these wells showed the greatest difference in lead and barium concentrations when compared to analysis of the older adjacent wells LAO-3 and MCO-6. During the remaining three sampling events, other wells may be chosen for duplicate sampling.

A trip blank for volatile organics will be carried during the first sampling event and subsequent events when volatile organics are to be sampled. If no volatile organics are to be sampled during a sampling event, then no trip blank will be carried.

Table 3. Standard Operating Procedures Pertaining to Groundwater Sampling

LANL-ER-SOP-01.02	Sample Containers and Preservation
LANL-ER-SOP-01.03	Handling, Packaging, and Shipping of Samples
LANL-ER-SOP-01.04	Sample Control and Field Documentation
LANL-ER-SOP-01.05	Field Quality Control Samples
LANL-ER-SOP-06.01	Purging of Wells for Representative Sampling of Groundwater
LANL-ER-SOP-06.02	Field Analytical Measurements of Groundwater Samples
LANL-ER-SOP-06.03	Sampling for Volatile Organics

Laboratory quality control and quality assurance procedures will be conducted in accordance with the QAPjP and laboratory standard operating procedures. This will include quality assurance measurements of precision, accuracy, and sensitivity of analysis within EPA limits and analysis of the appropriate number and type of laboratory quality control samples.

2.4 Schedule and Products

The first of the requested quarterly sampling events is scheduled to begin on or about 6 March 1995. It will proceed as detailed above. The subsequent three sampling events will occur during the second, third, and fourth calendar quarters, respectively. Exact dates of sampling will be dependent on seasonal weather.

Table 4. EPA and LANL Accepted Analysis Methods for Constituents

Analyte	Test Methods
Volatile organics	EPA SW-846 Method 8240 [a, b]
Semivolatile organics	EPA SW-846 Method 8270 [a, c]
Organochlorine Pesticides and PCBs	EPA SW-846 Method 8080 [def]
Inorganics (metals)	EPA SW-846 Method 6010 [a, g]
<u>Radionuclides</u>	
Americium-241	Radiochemical separation and alpha spectrometer [n, o]
Cesium-137	Gamma spectrometry [h, i]
Gamma spectroscopy (all peaks reported)	Gamma spectrometry [h, i]
Gross alpha	Gas flow proportional counter [h, i]
Gross beta	Gas flow proportional counter [h, i]
Isotopic plutonium (^{238}Pu, ^{239}Pu, ^{240}Pu)	Radiochemical separation and alpha spectrometer [n, o]
Isotopic thorium (^{228}Th, ^{230}Th, ^{232}Th)	Radiochemical separation and alpha spectrometer [h, i]
Total uranium	Inductively coupled plasma mass spectroscopy (ICP MS) [n, o]
Isotopic Uranium (^{234}U, ^{235}U, ^{238}U)	Radiochemical separation and alpha spectrometer [h, i]
Radium-226	Radiochemical separation and alpha scintillation counter [h, i]
Strontium-90/Yttrium-90	Gas flow proportional counter [h, i]
Tritium	Distillation and liquid scintillation [h, i]
<u>Miscellaneous</u>	
Boron	LANL Method WI-220, Colorimetry [n, o]
Chloride	EPA Method 300.0 by Ion Chromatography [j, k]
Fluoride	EPA Method 300.0 by Ion Chromatography [j, k]
Nitrate	EPA Method 300.0 by Ion Chromatography [j, k]
Nitrate and Nitrite	LANL Method WI-280, Flow Injection Colorimetry [n, o]
Nitrite	LANL Method WI-310, Flow Injection Colorimetry [n, o]
Sulfate	EPA Method 300.0 by Ion Chromatography [j, k]
Sulfide	EPA Method 376.2, Colorimetry [p, q]
Bromide	EPA Method 320.1, Titrimetric [p, q]
Carbonate	EPA Method 310.1, Titrimetric [p, q]
Phosphate	EPA Method 365.4, Colorimetric [p, q]
Ammonia/Nitrogen	LANL Method WI-210, Automated Colorimetry [n, o]
Silica	LANL Method WI-340, Flow Injection Colorimetry [n, o]
Cyanide (total)	EPA Method 365.4, Colorimetric, Automated UV [p, q]
Mercury	EPA Method 245.1, Manual Cold Vapor Technique [p, q]
Chromium (Hexavalent)	LANL Method WI-260, Flow Injection Colorimetry [n, o]
TOC	EPA Method 415.1, Combustion or Oxidation [p, q]
TSS	EPA Method 160.2, Gravimetric, dried at 103-105° C [p, q]

[a] EPA 1980
[b] See Table V.3 for EPA practical quantitation limits
[c] See Table V.4 for EPA practical quantitation limits
[d] EPA 1986a
[e] See Table V.5 for EPA practical quantitation limits
[f] See Table V.6 for EPA practical quantitation limits
[g] See Table V.7 for EPA estimated instrumental detection limits
[h] DOE 1983
[i] See Table V.8 for DOE method detection limits
[j] EPA 1990
[k] See Table V.9 for EPA method detection limits
[l] U.S. Army Toxic and Hazardous Materials Agency
[m] See Table V.10 for USATHAMA method detection limits
[n] LANL methods manual LA-10300-M
[o] See Table V.8 for LANL method detection limits
[p] EPA 1983
[q] See Table V.9 for EPA method detection limits

variables. Sampling completion dates should be no later than 30 June 1995, 30 September 1995, and 31 December 1995, respectively.

Results from each individual sampling event will be tabulated, put in report form, and sent to the EPA within 30 days of receipt of quality-assured data from the analytical laboratories.

A comprehensive interpretive report, including statistical analysis of the data will be sent to the EPA within 90 days of receipt of quality assured data from the final sampling event of 1995.

3.0 Sampling and Analysis Plan for SWMU No. 0-001 (Mortandad Canyon Sediment Traps)

3.1 Background

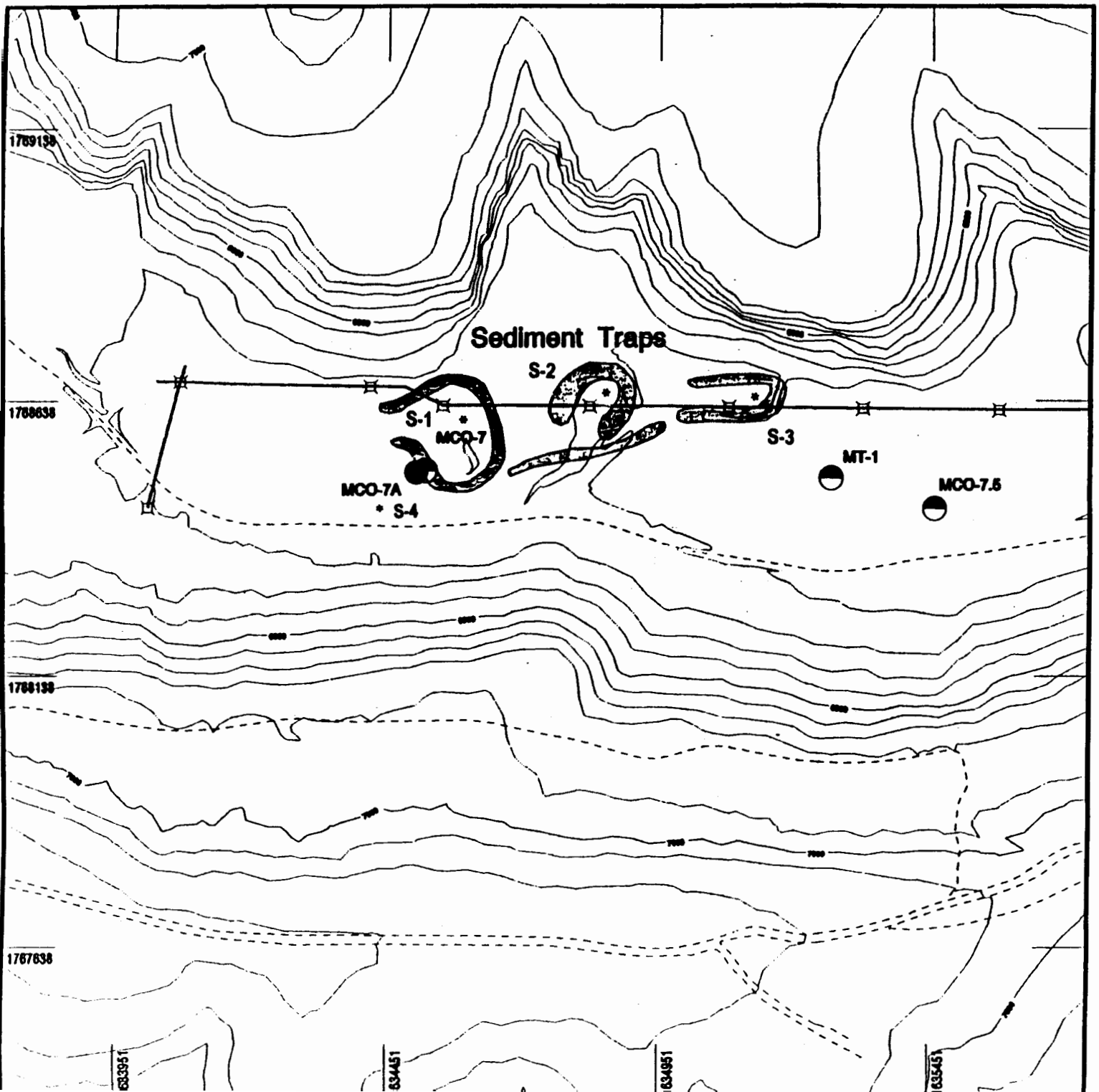
SWMU No. 0-001 consists of at least three sediment traps located in Mortandad Canyon. These traps are large excavated areas below the prevailing grade of the ephemeral stream channel. The sediment traps are surface water containment basins that slow the flow of water as it moves down the canyon to allow most of the sediments to settle out. The water, which consists of storm water runoff and industrial effluent, flows into the first trap and is temporarily retained, allowing the heavier sediments to settle out. When the first trap fills, the water flows into successive traps, allowing more sediment to settle out.

The original two sediment traps, constructed in 1976, were simple pits dug out of the stream channel. They were approximately 15 ft wide by 12 ft long and 7 ft deep. The capacity of each pit was 20,000 gal. A third pit was constructed in 1980. It was 80 ft diameter, 6 ft deep, and had a capacity of about 225,000 gal.

The current trap configuration was constructed in 1986 as excavated basins surrounded by U-shaped berms built from the excavated alluvium (Purtymun, 1986). The berms were planted with vegetation to prevent erosion. Trap 1, the upstream basin, was originally 45 ft wide by 55 ft long and ranged in depth from about 4.5 ft to 10 ft. It had a capacity of 118,000 gal. Trap 2, the next trap downstream, was originally 8 ft wide by 105 ft long and 10 ft deep. It had a capacity of 628,000 gal. Trap 3, the downstream trap, was originally 32 ft wide by 150 ft long and with a depth ranging from 6 feet to 10 feet. It had a capacity of 287,000 gal (see Figure 2). The total capacity of the three basins was originally 1,033,000 gal. In 1988, Trap 1 was enlarged by about 167,000 gal, bringing the total capacity of the three traps to about 1.2 million gal. (Purtymun, 1986). In 1992 the three basins were re-excavated after having been filled as the result of several storm events (LANL, 1993). Sediment from the traps was placed in stockpiles next to the traps.

Since the 1950s, various LANL technical areas (TA) located on the mesas above the canyon have released treated wastewater into the canyon. Presently, the primary contributor of effluent discharge to Mortandad Canyon is the TA-50 Radioactive Liquid Waste Treatment Plant, permitted through the National Pollutant Discharge Elimination System (NPDES), EPA No. 051051. The effluent release area is identified as SWMU No. 50-006 (d), which is addressed in Operable Unit 1147. Other releases into the canyon have included NPDES outfalls at TA-3 and TA-35, and various releases from TA-35 into Ten Site Canyon, a tributary to Mortandad Canyon.

The wastewater effluent contains some low-level radionuclides and may potentially contain some hazardous constituents. As the effluent moves down Mortandad Canyon, most of the residual radioactive constituents are bound or adsorbed onto bed sediments. These contaminated sediments are subject to transport by additional releases of effluent or by storm water runoff.



Mortandad Canyon Sediment Traps

- Power lines > 13.2 kV
- Road, Paved
- Road, Dirt
- ~~Detention Basin~~ SEDIMENT TRAP BORDER
- New Saturated Well
- Old Saturated Well
- Power Points > 13.2 kV
- Sample Location

Contour Interval = 20 feet

0 125.00 575.00
FEET

N

University of California
Los Alamos National Laboratory
Earth and Environmental Sciences

FIMAD

Map Coordinates in New Mexico State Plane Feet
Grid Interval, in feet: 500
Feet per inch on map = 253

Produced by: Elizabeth Zeller
Date: June 14, 1994 FIMAD Plot ID: G1023

Various environmental surveillance studies, reported in LANL's annual environmental surveillance reports of 1987, 1988, and 1991, indicate low-level radionuclide contamination of the sediments in and around SWMU No. 0-001 (LANL 1988, 1989, 1992). Also, relatively small amounts of radionuclides have been found in the small shallow aquifer located in the canyon alluvium. In 1987 sediments from the first two traps were analyzed using the EPA toxicity characteristic leaching procedure to identify hazardous wastes; none were detected. Analyses were conducted for 8 pesticide compounds, 15 extractable organic compounds, 18 volatile organic compounds (VOCs), and 8 metals. (LANL, 1988)

3.2 Sampling and Analysis Plan

The objective of Phase I sampling is to confirm the presence or absence of hazardous constituent contamination at SWMU No. 0-001. No historical information has been found to indicate that hazardous constituents or materials are located at the sediment traps, or that any were ever released from the site.

All sampling activities will conform to applicable ER SOPs. Phase I sampling for SWMU No. 0-001 will include an engineering survey and an environmental survey. The engineering survey consists of an initial walkover to identify structures and features at the site and includes locating, staking, and documenting the extent of the SWMU using such permanent reference points as wells MCO-7A, MCO-7 and MT-1. The environmental survey consists of a radiological grid survey. These two surveys will be used to determine representative sampling locations, which currently are only estimated. Results of the survey will be recorded on the site base map in the New Mexico State Plane Coordinate System. The data will also be incorporated into the Facility for Information Management, Analysis, and Display.

One surface sample will be collected from each of the sediment traps and from the material excavated from the traps in 1992, which was placed southwest of Trap 1, north of the dirt road. Also, one subsurface sample will be collected from 3-ft-deep hand-auger boreholes in each of the traps and from the excavated material. Sampling locations are indicated in Figure 2. Table 5 identifies the analyses to be performed on each sample. Quality assurance for the samples will be consistent with the procedures specified in the LANL Installation Work Plan (1993).

Table 5. Phase I Sampling for SWMU No. 0-001

SWMU	Sample Location	Depth	Metals[1]	VOCs	SVOCs	Radionuclides[2]
0-001	S-1(a)	0-6 in	x	x	x	x
	S-1(b)	2-3 ft	x	x	x	x
	S-2(a)	0-6 in	x	x	x	x
	S-2(b)	2-3 ft	x	x	x	x
	S-3(a)	0-6 in	x	x	x	x
	S-3(b)	2-3 ft	x	x	x	x
	S-4(a)	0-6 in	x	x	x	x
	S-4(b)	2-3 ft	x	x	x	x
Rinsate Blanks			x	x	x	x
Duplicates			x	x	x	x
Performance Evaluation Samples			x	x	x	x

[1] Metals by ICPES
[2] Listed in Table 2

Surface soil samples will be obtained in the first 6 in of soil using a stainless steel or Teflon scoop. Subsurface sampling will be accomplished using a hand auger (power assisted if necessary) to collect samples to a depth of 3 ft.

3.3 Sample Screening and Analyses

Each sample will be screened with a scintillation detector for contact radiation. All sample packages will be screened for surface contamination and contact radiation. Samples will be analyzed for the VOCs, semivolatile organic compounds (SVOCs), metals, and radionuclides listed in Table 2.

4.0 References

Purtymun, 1990: W. D. Purtymun and A.K. Stoker, "Perched Zone Monitoring Well Installation," Los Alamos National Laboratory report LA-UR-90-3230, September 1990.

LANL, 1990: "Perched Zone Monitoring Wells — Analytical Results," Los Alamos National Laboratory Environmental Restoration Program Report LA-UR-90-4300, December 19, 1990.

LANL, 1991: "Generic Quality Assurance Project Plan for RCRA Facility Investigation" for the Los Alamos National Laboratory Environmental Restoration Program, May 1991.

HSWA: Hazardous and Solid Waste Amendments Permit for Los Alamos National Laboratory, EPA I.D. NM0890010515, 1989.

LANL-ER-SOPs: Environmental Restoration Program Standard Operating Procedures, Volume I and Volume II, Los Alamos National Laboratory, September 20,1994.

LANL 1988: "Environmental Surveillance at Los Alamos During 1987," Los Alamos National Laboratory report, LA-11306-ENV, UC-41, May 1988.

LANL 1989: "Environmental Surveillance at Los Alamos During 1988," Los Alamos National Laboratory report, LA-11628-ENV, UC-702 and UC-707, June 1989.

LANL 1992: "Environmental Surveillance at Los Alamos During 1991," Los Alamos National Laboratory report, LA-12572-ENV, UC-902, August 1992.

LANL 1993: "LANL Installation Work Plan," for the Los Alamos National Laboratory Environmental Restoration Program, LANL-LA-UR-93-3987, 1993.

LANL 1993: "Environmental Surveillance at Los Alamos During 1992," Los Alamos National Laboratory report, LA-12764-ENV, UC-902, July 1994.

Purtymun, W. D., and D. Van Etten 1986: LANL internal memorandum HSE8-86-883, from W.D. Purtymun and D.Van Etten, to T.C. Gunderson, HSE-8, Subject: Construction of Retention Ponds in Mortandad Canyon, August 1, 1986.

Appendix A

HSWA Operating Permit Special Conditions

the minimum technological requirements (MTRs) outlined in Section 3004(o) of the Resource Conservation and Recovery Act. The Administrative Authority must approve the plans and specifications for retrofitting prior to commencement of construction.

7. Additional Waste Ban Requirements

The Permittee shall not land dispose any hazardous waste restricted by 40 CFR 268 unless:

(a) The waste meets treatment standards specified in 40 CFR 268.40, .41, .42, or .43;

(b) A variance from the treatment standards has been granted pursuant to 40 CFR 268.44;

(c) A petition has been granted on a case-by-case extension to the effective date, pursuant to 40 CFR 268.5;

(d) A "no-migration" petition has been granted pursuant to 40 CFR 268.6; or

(e) The surface impoundment is exempt under 40 CFR 268.4.

C. SPECIAL PERMIT CONDITIONS

Within the designated timeframes the Permittee shall undertake the following measures concurrent with the RCRA Facility Investigation required in Module VIII D. Each submittal shall be clearly referenced as to the requirement which is being fulfilled.

1. Perched Zone Monitoring

In order to determine the extent of downgradient saturation and contamination, the Permittee shall install, at a minimum, the following wells and borings in the perched saturated alluvium in the specified canyons, within 90 days of the effective date of this permit;

a) PUEBLO CANYON
   1 exploratory boring near TW-1A

b) LOS ALAMOS CANYON
   1 monitoring well near LAO-3
   1 monitoring well near LAO-4.5
   1 monitoring well near LAO-5

c) SANDIA CANYON
   1 monitoring well near PM-1
   1 monitoring well near PM-3

d) MORTENDAD CANYON
   1 monitoring well near MCO-4
   1 monitoring well near MCO-6
   1 monitoring well near MCO-7.5

e) POTRILLO CANYON
   1 monitoring well near State Road 4

f) FENCE CANYON
   1 monitoring well near State Road 4

g) WATER CANYON
   1 monitoring well near State Road 4
   1 monitoring well appr. 1 mile west of State Road 4
   1 monitoring well appr. 2 miles west of State Road 4

Within 30 days of installation of wells, the Permittee shall have gathered groundwater elevation data, and developed and submitted a map to the Administrative Authority which delineates the known extent of perched groundwater at the facility. Within 90 days of installation of wells, the Permittee shall sample each well for Appendix IX constituents, Gross Gamma, Gross Alpha, Total U, ^{3}H, ^{137}Cs, ^{238}Pu, ^{240}Pu. Analytical results from those samples shall be sent to the Administrative Authority within 120 days of well installation.

If wells are not installed in the above referenced saturated zones, the Permittee shall provide sufficient evidence to the Administrative Authority that the referenced zones do not exist at that particular location. Upon approval by the Administrative Authority the particular well(s) will be struck from further requirements.

The monitoring wells installed under this and following sections of this permit shall be constructed using flush-joint, internal upset, threaded (or an equivalent method of joining without rivets, screws and glues) casing manufactured from inert materials. The boreholes for casings and screens shall be a minimum of six (6) inches greater in diameter than the well casing or screen outer diameter. Filter pack and screen slot openings shall be sized based on formation grain size and characteristics. Well screen lengths shall be no more than (10) ten feet in length. The filter pack shall extend no more than (2) two feet above the top of the screen and shall not cross any clay layers which may act as aquitards. If a bentonite seal is used, the bentonite shall be allowed to hydrate a minimum of (12) twelve hours before emplacement of grout. Grout shall be emplaced using a tremie pipe to ensure a consistent seal at depths greater than 5 feet, and grout shall be allowed to set a minimum of twelve hours before initiating development.

Development procedures shall include purging of the well until contaminants introduced during drilling can be assured of being removed. Development shall also include surging with a surge plug, and either bailing or pumping until the nephelometric turbidity units (N.T.U.) can be consistently measured at five (5) or less, if possible. Well head construction shall include a well pad keyed into the well annulus and a system to secure the well from traffic and unauthorized access. Within thirty (30) days of construction and development of the last well required under this section, the Permittee shall submit to the Administrative Authority a report and map including:

1) Survey of location of each well;

2) Surveyed ground level, top of casing and top of well pad referenced to known elevation datum (NGVD,1929);

3) Static water level, referenced to mean sea level;

4) Well construction data (including a diagram for each well, detailing total depth, screen placement, gravel pack, annular seal, borehole and casing size [all measured to within 0.1 foot]), and well log data; and

5) Well development data.

After the information from these wells is reviewed, the Administrative Authority may require the installation of more wells to more fully define the extent of contamination.

2. Monitoring of Surface and Ground Water

Extensive monitoring of surface and ground water is now conducted and documented annually by the Permittee's Environmental Surveillance Program in accordance with DOE Orders. This program shall be continued in order to demonstrate protection of the main aquifer, and the annual reports shall be submitted to EPA. Any pertinent ongoing investigations by the U.S.G.S. that are applicable to this module shall be summarized in the LANL Environmental Surveillance Report. Within 120 days of the effective date of this permit, the Permittee shall submit to the Administrative Authority a summary describing the ongoing monitoring program, including sampling points, media, and constituents analyzed for. If EPA determines that this ongoing monitoring program is not sufficient, then EPA may impose additional monitoring requirement as a modification to this permit.

3. Sediment Traps Mortandad Canyon

The Permittee shall, through the maintenance of existing

Appendix B

Correspondence Letters Relating to Sampling of HSWA Perched Zone Monitoring Wells

Department of Energy
Field Office, Albuquerque
Los Alamos Area Office
Los Alamos, New Mexico 87544

AUG 19 1994

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

William K. Honker, P.E., Chief
RCRA Permits Branch
U. S. Environmental Protection Agency
Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Dear Mr. Honker:

Your letter of July 19, 1994 requests that the Department of Energy (DOE) submit a potentiometric map(s) and conduct additional sampling at wells installed in 1990, located in Los Alamos canyons. The letter directs DOE to submit a schedule for providing this information within 60 days. The letter also requires that the sampling events be initiated within 60 days of receipt of the letter. DOE cannot provide the information requested in the time specified.

Currently, there are not a sufficient number of data to generate potentiometric maps which show, as you have requested, water level conditions for the intermediate aquifer. We have enclosed a more detailed discussion of what currently is known for this aquifer. Our current data does allow us the ability to generate two potentiometric surface maps for the main aquifer, one showing historical conditions and one showing current conditions. The same enclosure details how we propose to create these maps so that we depict, very approximately, the actual conditions for the main aquifer. These maps will include the locations of intermediate wells. Unfortunately, more than 60 days will be required to generate these maps. Therefore, this letter also serves as a request for an extension to December 30, 1994, to submit the maps for your review.

We must also request an extension beyond the 60-day period you have specified to initiate sampling in the Los Alamos Canyon wells. We are currently reviewing the status of Fiscal Years 1995 and 1996 budget requests and will submit plans for conducting this work when funding has been obtained.

DOE proposes to conduct four rounds of sampling and analysis in the future, commencing no later than the first quarter of 1995. The initial round of sampling will be for the same constituents

analyzed in 1990. The remaining three sampling episodes may result in the analysis of fewer constituents based on the initial sampling results (e.g., if no volatile organics are detected in the first round of sampling, they will be eliminated from the list of analytes of interest). Additional information on the proposed sampling and analysis strategy is provided in the enclosure. This sampling approach should end in the last quarter of 1995. DOE will notify the Environmental Protection Agency via a letter if the sampling plan is being delayed for any reason, such as lack of water in the alluvial wells.

If you have any questions regarding this response letter and the enclosure outlining DOE's proposed plans, please contact me at (505) 665-7203.

Sincerely,

Theodore J. Taylor
Program Manager
Environmental Restoration Program

LAAMEP:9TT-021

Enclosure

cc w/enclosure:
Kathleen Sisneros
Water & Waste Management Division
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, NM 87502
W. Spurgeon, EM-452, HQ
J. Vozella, AAMEP, LAAO
T. Taylor, AAMEP, LAAO
B. Swanton, NMED, AIP, LANL, MS-J993
J. Jansen, EM/ER, LANL, MS-M992
RPF, LANL, MS-M707
K. McAda, EPD, AL
J. Levings, ERPO, AL

cc w/o enclosure:
B. Koch, Scientech, LAAO
K. Zamora, Scientech, LAAO
T. Baca, EM, LANL, MS-J591
D. Garvey, ESH-8, LANL, MS-K490

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

2107 1425 3.3

SEP 01 1994

Mr. Theodore J. Taylor, Program Manager
Environmental Restoration Program
Department of Energy
Los Alamos Area Office
Los Alamos, NM 87544

Re: Response Letter on Sampling Ground Water Wells and Map
Los Alamos National Laboratory (NM0890010515)

Dear Mr. Taylor:

The Environmental Protection Agency (EPA) has reviewed your letter dated August 19, 1994 requesting an extension for submittal of the potentiometric map(s) and to conduct additional sampling at wells which were installed as part of the special permitting condition under the HSWA portion of the RCRA permit. EPA grants your request to provide potentiometric maps by December 30, 1994 and to conduct the first of four ground water sampling events in the first quarter of FY95.

Should you have any questions, please contact Barbara Driscoll at (214) 665-7441.

Sincerely,

William K. Honker, P.E.
Chief, RCRA Permits Branch

cc: Mr. Benito Garcia, Bureau Chief
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department

Mr. Jorg Jansen, Program Manager
Environmental Restoration Program
Los Alamos National Laboratory, M992

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

JUL 1 9 1994

Mr. Joseph C. Vozella, Chief
Environment, Safety and Health Branch
Department of Energy
Los Alamos Field Office
Los Alamos, NM 87544

Dear Mr. Vozella:

The Environmental Protection Agency (EPA) completed a Comprehensive Ground Water Monitoring Evaluation Report in March 1993, for Los Alamos National Laboratory (LANL) which made several recommendations related to the ground water monitoring program at LANL. Several of the recommendations made in the report pertain to requirements already existing under the HSWA portion of the RCRA permit. EPA is requiring LANL to complete the following subset of recommendations now:

1. The ground water flow direction of the main aquifer and perched intermediate aquifer, as influenced by the numerous production wells in the LANL area, have not been completely determined. LANL shall produce ground water potentiometric maps which depict the actual conditions at the facility.

2. Special permit condition C of the HSWA portion of the RCRA permit required the installation and sampling of ground water monitoring wells in the Los Alamos Canyon shallow alluvium. As per the permit, the new wells were installed and sampled once in 1990. Preliminary results from the one sampling event seem to indicate that there are increases in concentrations of constituents in the ground water in the new HSWA ground water monitoring wells when compared to the old LAO-series wells. Additional sampling events should be conducted in both series of wells, so that a statistical comparison can be performed.

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LANL shall provide a schedule for completing these required events by August 19, 1994. All sampling events should be initiated within 60 days after receipt of this letter. Should you have any questions, please contact Barbara Driscoll at (214) 655-7441, and after August 1, 1994 at (214) 665-7441.

Sincerely,

WK Honker

William K. Honker, P.E., Chief
RCRA Permits Branch

cc: Mr. Benito Garcia, Bureau Chief
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department

Mr. Jorg Jansen, Program Manager
Environmental Restoration Program
Los Alamos National Laboratory, M992

Appendix C

Perched Zone Monitoring Wells
Analytical Results

TABLE I

SUMMARY OF RADIOCHEMICAL ANALYSES OF SAMPLES FROM PERCHED ZONE MONITORING WELLS

		PARAMETER (pCi/L except where noted, +/- value is analytical standard deviation)								
WELL	LAB[1]	^{3}H	^{238}Pu	$^{239,240}Pu$	^{137}Cs	^{241}Am	Gross Alpha	Gross Beta (cm/L)	Gross Gamma	Total U (mg/L)
MCO-4B	HSE-9	67000±7000	0.0529±0.0213	0.112±0.027	28±69	1.47±0.10	9±3	120±10	110±80	6.4±0.1
MCO-4	HSE-9	43000±4000	0.371±0.042	1.42±0.92	101±70	4.14±0.19	8±3	160±20	80±80	1.5±0.1
MCO-6B	HSE-9	130000±10000	0.0187±0.0148	0.0327±0.0169	163±73	2.27±0.13	34±8	59±6	10±80	18.1±0.4
MCO-6	HSE-9	100000±10000	1.12±0.01	3.18±0.20	90±71	2.52±0.13	10±3	100±10	180±80	5.9±0.1
MCO-7A	HSE-9	21000±2000	0.0172±0.0106	0.0344±0.0137	20±70	0.375±0.042	7±2	18±2	20±80	6.5±0.2
MCO-7	HSE-9	13000±1000	0.0178±0.0154	0.444±0.0155	87±70	0.216±0.034	3±1	12±1	210±80	1.4±0.1
APCO-1	HSE-9	0±300	0.0038±0.0085	0.152±0.026	46±71	0.0584±0.0178	23±6	18±2	80±80	1.7±0.2
LAO-3A	HSE-9	1100±300	0.0047±0.0081	0.0094±0.0094	0±83	0.0389±0.0168	5±2	130±10	10±80	0.1±0.1
LAO-3	HSE-9	1300±300	0.0089±0.0089	0.0045±0.0077	11±63	0.0635±0.0203	5±2	130±10	20±80	6.6±0.7
LAO-4.5C	HSE-9	700±300	0.039±0.0184	0.0742±0.0197	83±70	0.098±0.216	4±1	9±1	120±80	0.3±0.1
LAO-4.5	HSE-9	700±300	0.0084±0.0103	0.0126±0.0094	2±64	0.171±0.0306	2.4±0.9	7.5±0.9	280±80	0.1±0.1

Notes:

[1] Entry indicates particular sampling date and analytical laboratory performing analyses.

HSE-9 samples collected on September 11 (MCO-4B, MCO-4, MCO-6B, MCO-7A, and MCO-7) or September 12, 1990 (MCO-6, APCO-1, LAO-3A, LAO-3, LAO-4.5C, and LAO-4.5) and analyzed by Los Alamos National Laboratory, Environmental and Health Chemistry Group, HSE-9.

TABLE II

SUMMARY OF APPENDIX IX INORGANIC ANALYSES ON SAMPLES FROM PERCHED ZONE MONITORING WELLS

		PARAMETER (micrograms/L)																		
WELL	LAB[1]	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Ni	Se	Ag	Tl	Sn	V	Zn	CN (mg/L)	Sulfides (mg/L)
MCO-4B	IT	<30	<40	190	<1	<5	<10	<20	10	<30	<1	<20	<60	<5	<40	<20	<10	81	0.01	2.0
	HSE-9	0.5	15.1	337	2.1	0.9	17.3		16.5	42.3	<0.2	10.9	2.5	0.3	0.4		171	72	0.041	
MCO-4	HSE-9	0.7	19.1	128	<0.1	0.9	15.9		17	2.8	<0.2	14.8	2.4	0.2	0.2		215	20	0.036	
MCO-6B	IT	<30	<40	690	4	<5	30	<20	30	70	<1	<20	<60	<5	<40	<20	30	150	<0.01	1.0
	HSE-9	<0.5	12.7	1670	8.3	0.7	22.5		17	163	<0.2	17.3	2.2	1.3	2.1		155	149	0.046	
MCO-6	HSE-9	<0.5	17.7	231	0.4	0.6	19.8		12.3	16.2	<0.2	16.3	2.6	<0.2	0.2		185	43	0.046	
MCO-7A	IT	<30	<40	420	3	<5	20	<20	30	50	<1	30	<60	<5	<40	<20	40	100	<0.01	1.6
	HSE-9	<0.5	15.8	820	4.7	0.7	28		21.2	94	<0.2	20.3	1	0.4	0.8		147	107	0.026	
MCO-7	HSE-9	<0.5	15.6	254	0.9	<0.5	15.8		49.7	16.8	<0.2	10.3	1	0.6	0.2		126	74	0.026	
APCO-1	IT	<30	<40	970	4	<5	30	40	120	80	<1	50	<60	<5	<40	<20	70	200	<0.01	1.6
	HSE-9	0.5	3.5	301	2.1	1.1	29.5		33	10.6	<0.2	37	1.	1.0	0.5		91	123	0.26	

TABLE II (continued)

		PARAMETER (micrograms/L)																		
WELL	LAB[1]	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Ni	Se	Ag	Tl	Sn	V	Zn	CN (mg/L)	Sulfides (mg/L)
LAO-3A	IT	<30	<40	180	2	<5	20	<20	30	40	<1	<20	<60	<5	<40	<20	10	54	<0.01	2.8
	HSE-9	<0.5	<1	96.1	<0.1	0.6	1.9		<1	<0.5	<0.2	3.4	1.7	<0.2	<0.2		<1	<5	0.015	
LAO-4.5C	IT	<30	<40	95	<1	<5	10	<20	30	<30	<1	<20	<60	<5	<40	<20	<10	52	<0.01	2.2
	HSE-9	<0.5	<1	46.5	0.2	0.6	3.2		3	2	<0.2	4.1	<1.	<0.2	<0.2		4.1	20	0.01	
LAO-4.5	HSE-9	<0.5	<1	41.7	0.4	<0.5	14.4		38	<0.5	<0.2	7.3	1.	<0.2	<0.2		100	34	0.01	

Notes:
[1] Entry indicates particular sampling date and analytical laboratory performing analyses.

IT samples collected on November 1,1990, and analyzed by IT Corporation.

HSE-9 samples collected on September 11 (MCO-4B, MCO-4, MCO-6B, MCO-7A, and MCO-7) or September 12, 1990 (MCO-6, APCO-1, LAO-3A, LAO-3, LAO-4.5C, and LAO-4.5) and analyzed by Los Alamos National Laboratory, Environmental and Health Chemistry Group, HSE-9.

TABLE III

SUMMARY OF APPENDIX IX ORGANIC ANALYSES (COMPOUNDS DETECTED) ON SAMPLES FROM PERCHED ZONE MONITORING WELLS[1]

WELL	LAB[2]	RESULTS
MCO-4B	IT HSE-9	N-Nitrosomorpholine, estimated at 3 ug/l, noted by laboratory as below reporting limit of10 ug/L for method.
MCO-4	HSE-9	Diethyl phthalate, 18 ug/L; also found in blank at 13.7 ug/L, analyst judges to be from laboratory contamination.
MCO-6B	IT HSE-9	N-Nitrosomorpholine, estimated at 2 ug/L, noted by laboratory as below reporting limit of 10 ug/L for method Methylene chloride 6 ug/L, analyst judges to be from sample preparation or storage.
MCO-6	HSE-9	
MCO-7A	IT HSE-9	Organophosphorus pesticide sample fraction exceeded holding time one day, nothing detected; resampled on Nov. 30 for reanalysis
MCO-7	HSE-9	1,1,2-Trichloro-1,2,2-trifluoroethane 6 ug/L, analyst judges to be from sample preparation or storage.
APCO-1	IT HSE-9	Carbon disulfide (same level as laboratory blank, about 35 ug/L; analyst judges to be laboratory contamination)
LAO-3A	IT HSE-9	Carbon disulfide (same level as laboratory blank, about 35 ug/L; analyst judges to be laboratory contamination)

TABLE III (continued)

WELL	LAB[2]	RESULTS
LAO-3	HSE-9	Carbon disulfide (same level as laboratory blank, about 35 ug/L; analyst judges to be laboratory contamination)
LAO-4.5C	IT	
	HSE-9	Carbon disulfide (same level as laboratory blank, about 35 ug/L; analyst judges to be laboratory contamination)
LAO-4.5	HSE-9	Carbon disulfide (same level as laboratory blank, about 35 ug/L; analyst judges to be laboratory contamination). Diethylphthalate, 1800 ug/L; 13.7 ug/l in lab blank.

Notes:
[1] This table notes compounds detected and summarizes related interpretations.
See the detailed appendixes of analytical laboratory reports for details on all compounds all compounds analyzed, limits of quantification, and quality assurance information.

[2] Entry indicates particular sampling date and analytical laboratory performing analyses.
IT samples collected on November 1,1990, and analyzed by IT Corporation.

HSE-9 samples collected on September 11 (MCO-4B, MCO-4, MCO-6B, MCO-7A, and MCO-7) or September 12, 1990 (MCO-6, APCO-1, LAO-3A, LAO-3, LAO-4.5C, and LAO-4.5) and analyzed by Los Alamos National Laboratory, Environmental and Health Chemistry Group, HSE-9.

TABLE IV

SUMMARY OF GENERAL CHEMICAL PARAMETER ANALYSES OF SAMPLES FROM PERCHED ZONE MONITORING WELLS

		PARAMETER (mg/L except where noted)													
WELL	LAB[1]	Ca	Mg	K	Na	P	SO4	Cl	NO3-N	Al	Fe	Mn	TDS	pH (pH)	Cond. (µmho/cm)
MCO-4B	HSE-9	55.4	5.66	45.1	209	0.361	46.5	<0.5	50.2	15	–	0.518	712	7.54	717
MCO-4	HSE-9	55.4	3.64	46.5	142	0.276	40.9	19.2	40.5	1.5	–	0.030	568	7.47	635
MCO-6B	HSE-9	53	10.2	32.8	278	0.876	54.9	34.4	15	113	–	2.56	834	7.31	905
MCO-6	HSE-9	57.6	6.61	54.9	268	0.333	49.4	29.3	70.1	8.3	–	0.265	884	7.37	894
MCO-7A	HSE-9	25	5.78	11.3	112.6	0.924	22.9	28.1	18.8	57.4	–	1.62	220	6.96	220
MCO-7	HSE-9	26.9	5.42	8.90	89.6	0.566	21.6	<0.5	13.7	280	–	0.206	280	7.06	300
APCO-1	HSE-9	22.4	3.43	14.8	103	6.12	40	17.3	4.52	448	2.9	1.05	448	7.04	304
LAO-3A	HSE-9	29.1	5.55	12.1	47.9	0.317	20	17.5	1.16	58	<0.02	0.015	274	7.0	257
LAO-3	HSE-9	29.4	5.67	11.7	47.2	0.328	20.3	17.3	1.05	116	15	0.412	234	7.08	294
LAO-4.5C	HSE-9	18.4	5.16	5.93	46	0.146	20.5	13.3	0.094	2.6	0.037	0.011	188	7.01	185
LAO-4.5	HSE-9	4.12	5.05	5.51	46.8	0.161	17.4	13.5	0.073	2.5	<0.02	0.002	154	7.12	201

Notes:

[1] Entry indicates particular sampling date and analytical laboratory performing analyses.

HSE-9 samples collected on September 11 (MCO-4B, MCO-4, MCO-6B, MCO-7A, and MCO-7) or September 12, 1990 (MCO-6, APCO-1, LAO-3A, LAO-3, LAO-4.5C, and LAO-4.5) and analyzed by Los Alamos National Laboratory, Environmental and Health Chemistry Group HSE-9.

Appendix D

Applicable Environmental Restoration Program Standard Operating Procedures for Groundwater Sampling

Sample Containers and Preservation

1.0 PURPOSE

This procedure describes specific requirements for sample containers, preservation techniques and holding times as specified by field regulations and guidance documents.

2.0 SCOPE

2.1 Applicability

This procedure is applicable to all Environmental Restoration (ER) activities involving the collection and preservation of samples that will be shipped to the Los Alamos National Laboratory Sample Coordination Facility (SCF) for subsequent chemical or physical testing.

2.2 Training

The Field Team Leader (FTL) is responsible for the implementation of this procedure and the FTL and field team members must document that they have read and understand this procedure and the other procedures in Section 1.0, General Instructions.

3.0 DEFINITIONS/ACRONYMS

A. ASTM: American Society for Testing and Materials

B. CLP: Contract Laboratory Program

C. DOT: U.S. Department of Transportation

D. EPA: U.S. Environmental Protection Agency

E. Holding time: The elapsed time between sample collection and initiation of laboratory analysis. The holding time is from date of sampling to date of analysis, not the date the designated laboratory receives the sample.

F. IATA: International Air Transport Association

G. RCRA: Resource Conservation and Recovery Act

H. RFI: RCRA Facilities Investigation

I. SCF: Sample Coordination Facility

J. SW-846: EPA approved test methods for Solid Waste identified in EPA-SW-846.

K. TCLP: Toxicity Characteristic Leaching Procedure (Method 1311), which is a codified (40CFR Parts 261, 264, 265, 268, 271, and 302) procedure.

4.0 BACKGROUND AND/OR CAUTIONS

The use of specific types of sample container and preservation techniques is mandatory for hazardous site investigations because the integrity of any sample is diminished over time. Physical factors (light, pressure, temperature, etc.), chemical factors (changes in pH, volatilization, etc.), and biological factors may alter the original quality of the sample. Because the various target parameters are uniquely altered at varying rates, distinct sample containers, preservation techniques, and holding times have been established to maintain sample integrity for a reasonable and acceptable period of time.

The volume of sample collected should be sufficient to perform all the required analyses, plus an additional amount to provide for any quality control needs, split samples, or repeat examinations. The volumes, preservatives, and holding times listed in Attachments A through F are the EPA requirements. Since the SCF operated by EM-9 will be either performing the analyses or making arrangements for the analyses, sampling schedules and sample needs must be coordinated with the SCF prior to sampling.

All proposed ER Program sampling plans are reviewed at the SCF for adherence to sampling protocols mandated by all applicable EPA regulations and analytical methods. The Sampling and Analysis Plan (SAP) will address the proper analytical protocol. SW-846 provides test procedures and guidance which are recommended for use in conducting the evaluations and measurements needed to comply with the RCRA (Public Law 94-850). These methods are approved by EPA to satisfy the data requirements of 40 CFR 120-270. The topics of concern include the sampling schedule, proper sample sizes and containers, correct preservation techniques, chain-of-custody requirements, and transportation of samples to the SCF. Appendix O of the Los Alamos National Laboratory Installation Work Plan details the duties of the SCF.

5.0 EQUIPMENT

Equipment needed to implement this procedure is listed on the Equipment and Supplies Check List for Sample Containers and Preservation (Attachment G).

6.0 PROCEDURE

A. Contact the SCF for guidance and assistance in obtaining the proper sample containers and preservatives.

B. Refer to an Operable Unit (OU)-specific SAP for site-specific procedures for sample containers and preservation. In addition, follow the protocols established in EPA's SW-846, Test Methods for Evaluation of Solid Waste.

C. Record all pertinent comments and any deviations on the Daily Activity Log per LANL-ER-SOP-01.04.

D. Contact the SCF for guidance and acquisition of the proper sample containers.

1. Identify the containers required for analysis by matrix as shown in Attachments A through F (for example, amber glass, narrow-mouth bottles for polychlorinated biphenyl [PCB] analysis of water samples).

   a. Based on information in the SAP, choose a sample container that is nonreactive with the sample and the particular analytical parameter to be tested.

   b. Use glass or fluorocarbon resin containers with samples analyzed for organic compounds to prevent the introduction of extraneous organic compounds, such as those that might be leached from plastic containers.

   c. The rigid plastic screw caps for the bottles must be Teflon lined to prevent contamination of the sample.

2. Calculate and order the number of each type of container required by including duplicates and blanks with the number of investigative samples specified in the OU-specific SAP.

3. Acquire a sufficient number of containers to ship the proper sample volume. For example, Department of Transportation (DOT) and International Air Transport Authority (IATA) regulations limit the size of a sample container to 16 oz if the contents may include hazardous materials. In this case, two 500-ml or four 250-ml containers would be required to ship a 1-liter fluid sample.

4. Adhere to DOT regulations for on-site transfer of samples to the SCF over public-access roads. Refer to SOP-01.03, Handling, Packaging, and Shipping of Samples, for additional information.

6.1 Containing Procedures

A. If soil, sludge or wastes are submitted to the laboratory in containers other than those in which they were collected, the container should be glass, wide mouth bottles with a Teflon cap liner. For specific methods, see Attachment D.

B. If soil samples are submitted to the laboratory in the sample equipment in which they were collected, the container must have the end covered with Teflon or aluminum foil, have a plastic cap placed over the end, and have the cap taped in place. This procedure reduces the chance for loss of moisture or volatile organic compounds (VOCs).

C. The type and size of container used for water samples and aqueous waste samples varies based on the type of analysis to be performed. Refer to Attachments A and B for specific information on water sample containers and Attachment C for information on aqueous waste sample containers.

D. Sample containers received from SCF will be precleaned to EPA specifications before they are sent to the site. A certificate of cleanliness will be retained by the SCF, with a copy provided with the containers.

6.2 Sample Preservation

A. Regardless of the sample type or container, unless site-specific guidelines state otherwise, samples collected for chemical analysis should be preserved by placing them in an insulated container (cooler) and maintained on ice (ice in bags or chemical "blue" ice) at 4° Centigrade (C).

B. Avoid freezing the sample by wrapping it in bubble pack to isolate from the "blue" ice.

C. Containers for water samples and aqueous waste may arrive at the OU site from the SCF with the proper type and amount of preservatives in them. If so, do not prerinse or overfill.

D. If on-site preservation of aqueous samples is necessary, the proper reagents should be provided to field team members in an easily usable form that can be added at the time of sampling. Reagents that are designated as hazardous by the DOT Hazardous Materials Table, Title 49 Code of Federal Regulations (CFR) 172.101, are shipped pursuant to the appropriate DOT regulations.

E. If using an acid or base preservative, check the pH adjustment with pH paper.

F. Preservation required for the specific analyses requested for aqueous samples may be determined by using Attachments A through C, or by consulting the referenced documents.

G. Solid sediment and solid waste for chemical analysis will always be preserved on ice to 4°C. See Attachments D through F.

H. A sufficient amount of ice should be brought to the field to ensure proper sample cooling immediately following collection. A temperature of 4°C must be maintained until the samples arrive at the SCF.

I. The temperature shall be checked and recorded at the laboratory to determine if preservation has been accomplished.

6.3 Holding Time

A. Analyze samples as soon as possible after collection.

B. Some parameters are required to be analyzed in the field (refer to Attachment A).

C. Allowable holding times are listed and are the maximum times that samples are considered valid, based on available guidance (see Attachments A through F).

D. The OU-specific maximum holding times will be listed in the RFI Workplan.

E. Holding times for SW-846 methods start when the sample is collected. Both the sampler and the laboratory use this time/date.

F. Holding times for the Contract Laboratory Program (CLP) methods for the samples is the day of collection. The laboratory date is date received at the designated laboratory. Delayed shipping will result in missed holding time for the data. Transfer the samples to the SCF as soon as possible.

7.0 REFERENCES

The following procedures are directly associated with this procedure and should be reviewed before field operations commence:

LANL-ER-SOPs in Section 1.0, General Instructions
LANL-ER-SOP-02.07, General Equipment Decontamination
LANL-ER-SOP-06.03, Sampling for Volatile Organics

Title 40 CFR Part 261

Title 49 CFR Part 172.101

EPA (U.S. Environmental Protection Agency), 1982. "Handbook for Sampling and Sample Preservation of Water and Wastewater." Report EPA-600/4-82-029. Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1983. "Methods for Chemical Analysis of Water and Wastes." Report EPA-600/4-79-020. Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1983. "Manual of Groundwater Quality Sampling Procedures." Report EPA/600/2-81-160. Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1986. "Test Methods for Evaluating Solid Waste." Report EPA-SW-846. Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1985. "Practical Guide for Groundwater Sampling." Report EPA/600/2-85/104. U.S. Government Printing Office, Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1986. "RCRA Groundwater Monitoring Technical Enforcement Guidance Document." Document OSWER-9950.1. U.S. Government Printing Office, Washington, D.C.

EPA (U.S. Environmental Protection Agency) Region IV, 1991. "Environmental Compliance Branch Standard Operating Procedures and Quality Assuarance Manual," Appendix A, Environmental Services Division, Athens, Georgia

Korte, Nic, and Peter Kearl, 1985. "Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells: Second Edition." U.S. Department of Energy Report GJ/TMC-08 Technical Measurements Center, Grand Junction Project Office, Grand Junction, Colorado

Williams, M.C., 1990. Handbook for Sample Collection, Preservation, Instrumental Techniques. Los Alamos National Laboratory Report LA-11738-M, Los Alamos, New Mexico

8.0 RECORDS

A. Completed Chain-of-Custody/Request for Analysis Form

B. Completed Daily Activity Log

9.0 ATTACHMENTS

A. Recommendation for Sampling and Preservation of Water Samples According to Measurement (Low- to Medium-Contaminant Concentration Samples)

B. Sampling and Preservation Procedures for RCRA Groundwater Detection Monitoring

C. Containers for Aqueous Waste Samples

D. Preservation Plan for Soil/Sediment Samples

E. Sample Containers for Waste

F. Preservation Plan for Soil/Sediment Waste Samples

G. Equipment and Supplies Check List for Sample Containers and Preservation

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF WATER SAMPLES ACCORDING TO MEASUREMENT[a] (LOW TO MEDIUM CONTAMINANT CONCENTRATION SAMPLES)

Measurement	Volume Requirement millimeter (ml)	Container[b,c]	Preservative[d,e]	Holding Time[f,g]
		Physical Properties		
Color	50	P,G	Ice[h]	48 hrs
Specific Conductance	100	P,G	Ice	24 hrs
Hardness	100	P,G	HNO_3 to pH<2	6 mos
Odor	200	G only	Ice	24 hrs
pH	25	P,G	N/A	Determine on site
Residue				
Filterable	100	P,G	Ice	7 days
Nonfilterable	100	P,G	Ice	7 days
Total	100	P,G	Ice	7 days
Volatile	100	P,G	Ice	7 days
Settleable Matter	1000	P,G	Ice	48 hrs
Temperature	1000	P,G	N/A	Determine on site
Turbidity	100	P,G	Ice	48 hrs
		Metals (except Mercury and Chromium^{+6})		
Dissolved	200	P,G	Filter on site HNO_3 to pH<2	6 mos 6 mos[i]
Suspended	200	P,G	Filter on site	6 mos
Total	100	P,G	HNO_3 to pH<2	6 mos
Chromium^{+6}	200	P,G	Ice	24 hrs
Mercury				
Dissolved	100	P,G	Filter HNO_3 to pH<2	28 days
Total	100	P,G	HNO_3 to pH<2	28 days

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF WATER SAMPLES ACCORDING TO MEASUREMENT[a] (LOW TO MEDIUM CONTAMINANT CONCENTRATION SAMPLES) (Continued)

Measurement	Volume Requirement (ml)	Container[b,c]	Preservative[d,e]	Holding Time[f,g]
		Inorganics, Nonmetallics		
Acidity	100	P,G	Ice	14 days
Alkalinity	100	P,G	Ice	14 days
Bromide	100	P,G	None Required	28 days
Chloride	100	P,G	None Required	28 days
Chlorine	200	P,G	N/A	Determine on site
Cyanides	500	P,G	Cool 4°C Ice NaOH to pH>12 0.6 g ascorbic acid	14 days
Fluoride	300	P,G	Ice	28 days
Iodide	100	P,G	Ice	24 hrs
Nitrogen				
Ammonia	400	P,G	Ice H_2SO_4 to pH<2	28 days
Nitrogen, Total Kjeldahl	500	P,G	Ice H_2SO_4 to pH<2	28 days
Nitrate Plus Nitrite	100	P,G	Ice H_2SO_4 to pH<2	28 days
Nitrate[i]	100	P,G	Ice	48 hrs
Nitrite	50	P,G	Ice	48 hrs
Dissolved Oxygen				
Probe	300	G bottle and top	N/A	Determine on site
Winkler	300	G bottle and top and store in dark	Fix on site	8 hrs
Phosphorus				
Orthophosphate, Dissolved	50	P,G	Filter on site, Ice	48 hrs
Hydrolyzable	50	P,G	Ice H_2SO_4 to pH<2	28 days

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF WATER SAMPLES ACCORDING TO MEASUREMENT[a]
(LOW TO MEDIUM CONTAMINANT CONCENTRATION SAMPLES)
(Continued)

Measurement	Volume Requirement (ml)	Container[b,c]	Preservative[d,e]	Holding Time[f,g]
Total, Dissolved	50	P,G	Filter on site, Ice H_2SO_4 to pH<2	24 hrs
Silica	50	P only	Ice	28 days
Sulfate	50	P,G	Ice	28 days
Sulfide	50	P,G	Ice 2 ml zinc acetate(2N) NaOH to pH >9	24 hrs
Sulfite	100	P,G	N/A	Determine on site
		Organics		
BOD	1,000	P,G	Ice	48 hrs
COD	50	P,G	Ice H_2SO_4 to pH<2	28 days
Oil and Grease	1,000	P,G	Ice H_2SO_4 to pH<2	28 days
Organic Carbon	25	P,G	Ice H_2SO_4 or HCl to pH<2	28 days
Phenolics	500	G only	Ice H_2SO_4 to pH<2	28 days
Cyanides	1,000	P,G	Ice 40% NaOH to pH>12 0.6 g ascorbic acid	14 days
Coliform, Fecal, and Total	250	P,G	Ice Sterile	6 hrs
Oil and Grease	1,000	G	Ice H_2SO_4 to pH<2	28 days
Organic Carbon	25	P,G	Ice H_2SO_4 to pH<2	28 days
Phenols	1,000	G, Teflon™-lined cap	Ice	7 days until extraction; 40 days after extraction
Total Organic Halogen and Purgeable Aromatics	40	G, vial with Teflon™-lined septum	Ice 0.008% $Na_2S_2O_3$[j]	14 days

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF WATER SAMPLES ACCORDING TO MEASUREMENT[a]
(LOW TO MEDIUM CONTAMINANT CONCENTRATION SAMPLES)
(Continued)

Measurement	Volume Requirement (ml)	Container[b,c]	Preservative[d,e]	Holding Time[f,g]
Purgeable Aromatics	40	G, vial with Teflon™-lined septum	Ice 0.008% $Na_2S_2O_3$[k]	14 days
Acrolein and Acrylonitrile	1,000	G, Teflon™-lined septum	Ice 0.008% $Na_2S_2O_3$[k]	14 days
Phenols	1,000	G, Teflon™-lined cap	Ice	7 days until extraction; 40 days after extraction
Benzidines	1,000	G, Teflon™-lined cap	Ice 0.008% $Na_2S_2O_3$[k]	7 days until extraction; 40 days after extraction
Phthalate Esters	1,000	G, Teflon™-lined cap	Ice 0.008% $Na_2S_2O_3$[k]	7 days until extraction; 40 days after extraction
Nitrosamines	1,000	G, Teflon™-lined cap	Ice store in dark 0.008% $Na_2S_2O_3$[k]	7 days until extraction; 40 days after extraction
Nitroaromatics and Isophorone	1,000	G, Teflon™-lined cap	Ice	7 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons	1,000	G, Teflon™-lined cap	Ice	7 days until extraction; 40 days after extraction
Haloethers	1,000	G, Teflon™-lined cap	Ice	7 days until extraction; 40 days after extraction
Chlorinated Hydrocarbons	1,000	G, Teflon™-lined cap	Ice	7 days until extraction; 40 days after extraction

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF WATER SAMPLES ACCORDING TO MEASUREMENT[a] (LOW TO MEDIUM CONTAMINANT CONCENTRATION SAMPLES) (Continued)

Measurement	Volume Requirement (ml)	Container[b,c]	Preservative[d,e]	Holding Time[f,g]
Tetrachlorodibenzo-p-dioxin	1,000	G, Teflon™-lined cap	Ice	7 days until extraction; 40 days after extraction
		Pesticides and PCBs		
Pesticides and PCBs	1,000	G, Teflon™-lined cap	Ice	7 days until extraction; 40 days after extraction
		Radiological Tests		
Alpha, Beta and Radium	1,000	P,G	HNO_3 to pH<2	No limit
Tritium	25	G	None	No limit
Isotopic Uranium	500	P	HNO_3 to pH<2	No limit
^{90}Sr	1,000	P	HNO_3 to pH<2	No limit
^{238}Pu	500	P,G	HNO^3 to pH<2	No limit
^{239}Pu	500	P,G	HNO^3 to pH<2	No limit
^{137}Cs	500	P,G	HNO^3 to pH<2	No limit
^{241}Am	500	P,G	HNO^3 to pH<2	No limit

[a]More specific instructions for preservation and sampling are found with each applicable SAP. A general discussion about sampling water and industrial wastewater is found in EPA Region IV (1991); EPA (1986); and EPA (1985).

[b]Container Types:

P = Plastic (polyethylene)
G = Glass
T = Fluorocarbon resins (PTFE, Teflon™, FEP or PFA)
PP = Polypropylene

[c]Shipping containers (cooling chest with ice or ice pack) should be certified as to the 4°C temperature at the time of sample placement into these containers. Preservation of samples requires that the temperature of collected samples be cooled to 4°C upon collection of sample and during shipment. Field personnel will check the temperature in the container at the time of shipping and ice the samples to maintain a cool temperature during shipment. Maximum-minimum thermometers can be placed into the shipping chest to record temperature history. Chain-of-custody forms will include the temperature in the container at the time of shipment and at delivery to the laboratory in addition to in-transit (maximum) temperature, if available.

[d]Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, samples may be preserved by cooling to 4°C until compositing and splitting are completed.

[e]When any sample is to be shipped by common carrier or sent through the United States mail, it must comply with the DOT Materials Regulations (49 CFR Part 172). The SCF is responsible for ensuring compliance. For preservation requirements, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following material: Hydrochloric acid (HCl) in water solutions at concentrations of 0.22% by weight or less, with pH less than 2.0 but greater than or equal to 1.0.

[f]Samples should be analyzed as soon as possible after collection. The times listed are the maximum periods that samples may be held and still be considered valid. Samples may be held for longer periods only if the permittee, or analytical laboratory, has data on file to show that the specific types of samples under study are stable for a longer time and has received a variance from the EPA Regional Administrator.

[g]Maximum holding time is 24 hours when sulfide is present. Optional testing of all samples with lead acetate paper before the pH adjustment will determine if sulfide is present. If sulfide is present, it can be removed by adding of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and the pH is adjusted to 12 with NaOH.

[h]Shipping containers (cooling chest with ice or ice pack) should be verified as to the 4°C temperature at the time of sample placement into these containers. Preservation of samples requires that the temperature of collected samples be cooled to 4°C upon collection of sample and during shipment. Field personnel will check the temperature in the container at the time of shipping and ice the samples to maintain a cool temperature during shipment. Chain-of-custody forms will include the temperature in the container at the time of shipment and at delivery to Laboratory.

[i]Samples should be filtered on site immediately, before adding preservative for dissolved metals.

[j]For samples from nonchlorinated drinking water supplies, concentrated H_2SO_4 should be added to lower sample pH to less than 2. The sample should be analyzed within 14 days.

[k]Should only be used in the presence of residual chlorine.

[l]Use ml volume requirements for water and gram requirements for media other than liquids.

[m]No preservation for media other than water.

SAMPLING AND PRESERVATION PROCEDURES FOR RCRA GROUNDWATER DETECTION MONITORING[a]

Parameter	Minimum Volume Required for Analysis (ml)	Recommended Container[b,c]	Preservative[d,e]	Maximum Holding Time[f,g]
		Indicators of Groundwater Contamination[h]		
pH	25	T,P,G	Field determined	None
Specific Conductance	100	T,P,G	Field determined	None
Total Organic Carbon	4 x 15	G, amber, T-lined cap[i]	Ice	28 days HCl to pH<2
Total Organic Halogen	4 x 15	G, amber, T-lined septa or caps	Ice, add 1.1M sodium sulfite	7 days
		Groundwater Quality Characteristics		
Chloride	50	T, P, G	Ice	28 days
Iron Manganese Sodium	200	T, P	Field acidified to pH <2 with HNO_3	6 months
Phenols	500	G	Ice/H_2SO_4 to pH <2	28 days
Sulfate	50	T, P, G	Ice	28 days
		Drinking Water Characteristics		
Arsenic Barium Cadmium	500	T, P	Total Metals Field acidified to pH <2 with HNO_3	6 months
Chromium	500			6 months
			Dissolved Metals	
Lead		T,P		
Mercury	500	T,P	Field filtration	6 months
Selenium		T,P		
Silver		Dark Bottle	Acidify to pH <2 with HNO_3	

SAMPLING AND PRESERVATION PROCEDURES FOR RCRA GROUNDWATER DETECTION MONITORING[a] (Continued)

Parameter	Minimum Volume Required for Analysis (ml, unless noted otherwise)	Recommended Container[b,c]	Preservative[d,e]	Maximum Holding Time[f,g]
Fluoride	300	T, P	Ice	28 days
Nitrate/Nitrite[i]	1,000	T, P, G	Ice/H_2SO_4 to pH <2	14 days
Endrin Lindane Methoxychlor Toxaphene 2,4 Dichlorophenol 2,4,5 Trichlorophenol Silvex	2,000	T, G	Ice	7 days
Radium Gross Alpha Gross Beta	1 gallon	P, G pH <2 with HNO_3	Field acidified to	6 months
Coliform bacteria	200	PP, G (sterilized)	Ice	6 hours
		Other Groundwater Characteristics of Interest[h]		
Cyanide	250	P, G pH >12. 0.6 g ascorbic acid[j]	Ice, NaOH to	14 days
Oil and Grease	1,000	G only pH <2	Ice H_2SO_4 to	28 days
Semivolatile, Nonvolatile Organics	60	T, G	Ice	14 days
Volatiles	60	G, T-lined	Ice	14 days

[a]References:

EPA (U.S. Environmental Protection Agency) 1986. "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods," Report EPA-SW-846 (3rd edition). Washington, D.C.

EPA (U.S. Environmental Protection Agency) 1983. "Methods for Chemical Analysis of Water and Wastes," Report EPA-600/4-79-020. Washington, D.C.

"Standard Methods for the Examination of Water and Wastewater," 16th edition (1985).

[b]Container Types:

P = Plastic (polyethylene)
G = Glass
T = Fluorocarbon resins (PTFE, Teflon™, FEP or PFA)
PP = Polypropylene

[c]Shipping containers (cooling chest with ice or ice pack) should be certified as to the 4°C temperature at the time of sample placement into these containers. Preservation of samples requires that the temperature of collected samples be cooled to 4°C upon collection of sample and during shipment. Field personnel will check the temperature in the container at the time of shipping and ice the samples to maintain a cool temperature during shipment. Maximum-minimum thermometers can be placed into the shipping chest to record temperature history. Chain-of-custody forms will include the temperature in the container at the time of shipment and at delivery to the laboratory in addition to in-transit (maximum) temperature, if available.

[d]Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, samples may be preserved by cooling to 4°C until compositing and splitting are completed.

[e]When any sample is to be shipped by common carrier or sent through the United States mail, it must comply with the DOT Materials Regulations (49 CFR Part 172). The SCF is responsible for ensuring compliance. For preservation requirements, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following material: Hydrochloric acid (HCl) in water solutions at concentrations of 0.22% by weight or less, with pH less than 2.0 but greater than or equal to 1.0.

[f]Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before the pH adjustment to determine if sulfide is present. If sulfide is present, it can be removed by adding of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then the pH is adjusted to 12 with NaOH.

[g]Based on the requirements for detection monitoring (40 CFR 265.93), the owner/operator must collect a sufficient volume of ground water to allow for the analysis of four separate replicates.

[h]Do not allow any headspace in the container.

[i]For samples from nonchlorinated drinking water supplies, concentrated H_2SO_4 should be added to lower sample pH to less than 2. The sample should be analyzed within 14 days.

[j]Use ascorbic acid only in the presence of oxidizing agents.

CONTAINERS FOR AQUEOUS WASTE SAMPLES[a]

Analyte	Sample Container	Sample Volume	Preservative[b,c]	Holding Time(days)
Hazardous Substance List (HSL) Volatile	G vials (2)	40 ml	Ice	14
HSL Base/Neutral/ Acid[d]	Amber G	1 l	Ice	7/40[e]
HSL Pesticide/PCB	Amber G	1 l	Ice	7/40[e]
HSL Inorganic[f]	P,G	1 l	pH<2,w/HNO_3	180
Non-HSL Metals[g]	P,G	1 l	pH<2,w/HNO_3	180
Cyanide	P,G	0.5 l	pH>11,w/NaOH	14
pH[h]	P,G	N/A	None	N/A
Specific Conductivity[h]	P,G	N/A	None	N/A
Temperature[h]	P,G	N/A	None	N/A
Dissolved Oxygen[h]	G	N/A	None	N/A
Total Dissolved Solids (TDS)	P,G	0.1 l	Ice	7
Total Suspended Solids (TSS)	P,G	0.1 l	Ice	7
Total Phosphate	P,G	1 l	Ice, pH<2, w/H_2SO_4	28
Chloride, Sulfate	P,G	1 l	Ice	28
Carbonate/ Bicarbonate[i]	P,G	1 l	Ice	14
Nitrate	P,G	1 l	Ice	2
Hexavalent Chromium	P,G	1 l	Ice	24

[a]Reference:

1. EPA (U.S. Environmental Protection Agency) 1986. "Test Methods for Evaluating Solid Waste," Report EPA SW-846 (3rd edition). Washington, D.C.

[b]All samples, with the exception of those for total metals, will be filtered within four hours of sample collection and preservatives will be added to the filtrate as specified.

[c]All samples will be kept at 4°C after arrival at the Laboratory.

[d]The HSL base/neutral/acid fractions analytical parameters are the HSL semivolatiles.

[e]Extract within 7 days; analysis within 40 days of extraction.

[f]Includes cesium, molybdenum, and strontium, which are non-HSL metals, but are analyzed using the same methods.

[g]Includes Target Analyte List (TAL) Metals

[h]Field measurements.

[i]These are reported as carbonate and biocarbonate alkalinity.

PRESERVATION PLAN FOR SOIL/SEDIMENT SAMPLES

Analyte	Sample Volume (mL)	Sample Container[f]	Method	Preservative	Holding Time (days)
Volatile Organics	5	40-ml vial (2) with Teflon®-lined silicon rubber septum	Ref. 2	Ice	14
Base/Neutral/Acid Extractable Organics	10-30	Amber G, 1 l	Ref. 3	Ice	7/40[a]
Organochlorine Pesticide/PCB	10-30	Amber G, 1 l	Ref. 4	Ice	7/40[a]
HSL Inorganic[b]	200	P, G, 1 l	Ref. 5	Ice	180
Non-HSL Metals[c]	200	P, G, 1 l	SW-846	Ice	180
Reactivity	—	Amber G	Ref. 6	Ice	N/A
Chloride	20	G, 1 l	EPA 300.0[d]	Ice	N/A
Sulfate	20	G, 1 l	EPA 300.0[d]	Ice	N/A
Nitrate	20	G, 1 l	EPA 300.0[d]	Ice	N/A
Cyanide	200	G, 1 l	Ref. 1	Ice	14
Hexavalent Chromium	100	G, 1 l	S.M. 312b[e]	Ice	1

[a]Extract within 7 days; analysis within 40 days of extraction.

[b]Includes cesium, molybdenum, and strontium, which are non-HSL metals, but are analyzed using the same methods.

[c]Includes Target Analyte List (TAL) metals

[d]Soil/sediments will be leached with laboratory reagent water (20 grams (g) soil to 50 ml water) and water extract will be analyzed using the procedure in "Methods for Chemical Analysis of Water and Wastes," 1983; EPA 600/4-79-020.

[e]Soil/sediment will be leached with laboratory reagent water (5 g soil and 100 ml of water) by shaking for 2 hours, and the water extract will be filtered and subsequently analyzed. This is in accordance with method 312B in Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985.

[f]Container types:
P = Plastic (polyethylene)
G = Glass

Method References

Ref. 1. Method 9010 - "Test Methods for Evaluating Solid Wastes," EPA report EPA-SW-846, Office of Solid Waste and Emergency Response, Washington, D.C. 20460, Revised September 1986.

Ref. 2. Method 8240 - "Test Methods for Evaluating Solid Wastes," EPA report EPA-SW-846, Office of Solid Waste and Emergency Response, Washington, D.C. 20460, Revised September 1986.

Ref. 3. Method 8270 - "Test Methods for Evaluating Solid Wastes," EPA report EPA-SW-846, Office of Solid Waste and Emergency Response, Washington, D.C. 20460, Revised September 1986.

Ref. 4. Method 8080 - "Test Methods for Evaluating Solid Wastes," EPA report EPA-SW-846, Office of Solid Waste and Emergency Response, Washington, D.C. 20460, Revised September 1986.

Ref. 5. Method 6010 or 7000 Series Methods - "Test Methods for Evaluating Solid Wastes," EPA report EPA-SW-846, Office of Solid Waste and Emergency Response, Washington, D.C. 20460, Revised September 1986.

Ref. 6. Method 9010 or 9030 Series Methods - "Test Methods for Evaluating Solid Wastes," EPA report EPA-SW-846, Office of Solid Waste and Emergency Response, Washington, D.C. 20460, Revised September 1986.

SAMPLE CONTAINERS FOR WASTE[a]

Waste Type	Recommended Container	Closure	Analysis
Photosensitive wastes: 1,000 or 2,000 ml	Amber HDPE[b] or amber glass caps with Teflon™ liners for glass bottles	Teflon™ caps for HDPE bottles; Bakelite	Waste characterization per 40 CFR Part 261
Pesticides: hydrocarbon chlorinated; hydro-carbons; petroleum distillates	Wide-mouth, borosilicate glass bottles 1,000 or 2,000 ml	Bakelite caps with Teflon™ liner	Waste characterization per 40 CFR Part 261
Oil wastes	HDPE bottles, wide mouth, 1,000 or 2,000 ml	Teflon™ caps	Waste characterization per 40 CFR Part 261
Strong alkali or hydrofluoric acid	HDPE bottles, 1,000 ml	Teflon™ caps, wide mouth	Waste characterization per 40 CFR Part 261
Aqueous waste--characterization of organics	Borosilicate glass bottles 1,000 or 2,000 ml	Caps with Teflon™ liner	Waste characterization per 40 CFR Part 261
Solids (sludge, soils, and granular)	8-oz wide-mouth glass bottle	Bakelite caps with Teflon™ liners	Waste characterization per 40 CFR Part 261

[a]References

1. Title 40 CFR Part 261.

2. EPA (U.S Environmental Protection Agency) 1986. "Test Methods for Evaluating Solid Waste," Report EPA SW-846 (3rd edition). Washington, D.C.

b High Density Polyethylene (HDPE).

PRESERVATION PLAN FOR SOIL/SEDIMENT WASTE SAMPLES

Analyte	Sample Container	Sample Volume	Preservation	Holding Time (days)
HSL Volatile	40 ml vials (2)	5 g	Ice	14
TCLP Volatile	40 ml vials (2)	5 g	Ice	14
HSL Base/Neutral/ Acid[a]	Amber G	10-30 g	Ice	7/40[b]
TCLP Semivolatiles	Amber G	10-30g	Ice	7/40[b]
HSL Pesticide/PCB	Amber G	10-30 g	Ice	7/40[b]
TCLP Pesticides/ Herbicides	Amber G	10-30g	Ice	7/40[b]
HSL Inorganic[c]	P,G	200 g	Ice	180
Non-HSL Metals[d]	P,G	200 g	Ice	180
TCLP Metals	P,G	200g	Ice	180
Reactivity	Amber G	100 g	Ice	N/A
EP Toxicity	Amber G	100 g	Ice	N/A
Chloride	G[e]	20 g	Ice	N/A
Sulfate	G[e]	20 g	Ice	N/A
Nitrate	G[e]	20 g	Ice	N/A
Cyanide	G	200 g	Ice	14
Hexavalent Chromium	P,G[f]	1,000 g	Ice	24

[a]The HSL base/neutral/acid fractions analytical parameters are the HSL semivolatiles.

[b]Extract within 7 days; analysis within 40 days of extraction.

[c]Includes cesium, molybdenum, and strontium, which are non-HSL metals, but are analyzed using the same methods.

[d]Includes Target Analyte List (TAL) Metals

[e]Soil/sediments will be leached with laboratory reagent water (20 g soil to 50 ml water) and water extract will be analyzed using referenced procedure. Procedure references: "Methods for Chemical Analysis of Water and Wastes," 1983; EPA 600/4-79-020.

[f]Soil/sediment will be leached with laboratory reagent water (5 g soil and 100 ml of water) by shaking for 2 hours. The water extract is filtered and subsequently analyzed. This is in accordance with method 312B in "Standard Methods for Examination of Water and Wastewater," 15th Edition, 1985

EQUIPMENT AND SUPPLIES CHECK LIST FOR SAMPLE CONTAINERS AND PRESERVATION

Forms

_____ Sample Collection Logs

_____ Daily Activity Log

_____ Chain-of-Custody/Request for Analysis Form

Sample Containers, as appropriate

_____ Narrow-mouth amber glass bottles with Teflon™-lined caps (0.5, 1, and 2 liters)

_____ Amber glass vials with Teflon™ septa (40 ml)

_____ 250-ml sterile bottle

_____ Wide-mouth polyethylene bottles (0.5, 1, and 2 liters)

_____ New or cleaned polyethylene narrow-mouth bottles (1 l,.10 l, 500 ml, 125 ml, and 60 ml)

Sampling Materials

_____ Ballpoint pen (indelible dark ink)

_____ Felt-tip marker pen (indelible dark ink)

_____ 1-14 pH indicator paper

_____ Ascorbic acid crystals

_____ Disposable surgical gloves (latex, PVC, other suitable plastic, or rubber)

_____ NaOH pellets

_____ Disposable wipes

_____ Crystalline $Na_2S_2O_3$

_____ Methanol and deionized water in Teflon™ wash bottles

EQUIPMENT AND SUPPLIES CHECKLIST FOR SAMPLE CONTAINERS AND PRESERVATION (Continued)

_____ Concentrated HNO_3, H_2SO_4, and HCl

_____ Temperature probe

_____ Clipboards

_____ Deionized water

_____ Duct tape

_____ Wooden tongue depressors

_____ Aluminum foil

_____ Teflon™ tape

_____ Paper towels

<u>Shipping Materials (acquire from Sample Coordinator Facility)</u>

_____ Cardboard boxes

_____ Ice

_____ Blue Ice or equivalent

_____ Insulated coolers

_____ Heavy-duty poly bags and ties

_____ Strapping tape

_____ Plastic trashcan liners

_____ Canvas bags

_____ Parafilm

_____ Padding for packaging of samples

_____ Ziplock® bags

_____ Bubble pack

_____ Unique sample sticker sheets

_____ Chain-of-Custody/Request for Analysis forms

EQUIPMENT AND SUPPLIES CHECKLIST FOR SAMPLE CONTAINERS AND PRESERVATION (Continued)

_____ Sample labels

_____ Custody seals or custody tape

_____ Other equipment specified in EPA Methods, as needed

Handling, Packaging and Shipping of Samples

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Handling, Packaging, and Shipping of Samples

1.0 PURPOSE

This procedure describes handling, packaging, and shipping of samples collected for the Environmental Restoration (ER) Program. After preparation, the samples are transported to the radiation control (rad) van, chemical analysis (chem) van, or the Sample Coordination Facility (SCF) at TA-59 or TA-35 over public-access roads.

2.0 SCOPE

2.1 Applicability

This procedure is applicable to all ER, rad van, and chem van activities that involve the handling, packaging, or shipping of samples.

2.2 Training

Rad van and chem van personnel, the field team leader (FTL), and field team members must be familiar with the objectives of sample handling, packaging, and shipping and must document that they have read and understood this procedure as well as the other procedures in LANL-ER-SOPs, Section 1.0, General Instructions.

The packaging and transportation of Department of Transportation (DOT)-hazardous materials (including samples and supplies such as acids or gasoline) requires a field team member as well as rad van and chem van operators that are trained according to the Los Alamos National Laboratory (LANL) designation, Driver III. Contact BUS-6 for specific information on training requirements.

Packaging hazardous or radioactive samples requires more extensive training. Contact the training office of BUS-6 for further information if it is necessary.

3.0 DEFINITIONS

A. Environmental samples: Air, soil, water, or other media samples that are collected from streams, wells, and soils or other locations and are not expected to exhibit properties classified by DOT as hazardous.

B. Hazardous samples: Samples of on-site air particulates, soil, or water and materials collected at waste sites that are known or thought to meet the definition of a hazard class as defined in 49 CFR 171.8. In this SOP, "hazardous" does <u>not</u> refer to Resource Conservation Recovery Act (RCRA) hazardous wastes unless so stated.

C. ORM-D material: Other Regulated Material such as a consumer commodity, which although otherwise subject to the regulations of Subchapter C of 49 CFR 100, presents a limited hazard during transportation due to the form, quantity, and packaging. It must be a material for which exceptions are provided in the 49 CFR 172.101 Table.

D. Radioactive material: Any material having a specific activity greater than 2 nanocuries per gram (nCi/g), is the activity per unit mass of the material and in which the radionuclide is evenly distributed. (This is a DOT definition.)

4.0 BACKGROUND AND/OR CAUTIONS

In general, samples taken for the ER Program are expected to have low concentration of potential contaminants, although higher concentrations will be present in some cases. These low-concentration samples that do not satisfy the DOT hazard class definitions are classified as environmental samples and are thus not subject to DOT regulations. Historical data, knowledge-of-process, and field-screening results will assist the team members in making decisions as to whether a sample can be designated as "environmental" or need to be treated as a DOT hazardous material.

The samples are handled according to good field practice for environmental samples and according to regulations for hazardous samples. During shipment of samples, the sample integrity must be maintained. The health and safety of people and the environment must be protected from detrimental effects of hazardous materials if the samples are hazardous materials.

This SOP directs the preparation for shipping of environmental and sanitary waste samples. For DOT hazardous samples, including radioactive samples, this SOP guides the field team members to appropriate assistance.

All sample collection must be coordinated with the SCF coordinator for numbers and types of samples, analyses required, schedule for collection, numbers of containers required, and all other pertinent preparation information. The SCF staff schedules chemical analyses in cooperation with participating commercial and CST-9, Health and Protection Chemistry Group, analytical laboratories.

All samples collected for analysis are transported either to the rad van, chem van, or SCF for analytical services. A sample custodian will review each sample for proper sample size, container, preservative, and labels. The custodian documents any discrepancies in these areas and notifies the FTL of the possible consequences of these discrepancies and possible corrective actions. The custody of samples is then transferred to SCF.

A final data package is to be sent to the SCF staff for review by the participating laboratory. After the data have been validated, the report containing the chemical analyses will be released to the Operable Unit Project Leader (OUPL) and transferred to the ER Program's information management computer system.

5.0 EQUIPMENT

N/A

6.0 PROCEDURE

A. Classify samples collected at a site as either environmental (non-hazardous) or hazardous (including radioactive) samples according to the DOT requirements. Preliminary classification must be made in the field to ensure that the samples are transported on public-access roads safely and according to regulations. Use Sections 6.1 and 6.2 of this SOP as guides to determine characterization of sample types and applicable packaging requirements for the samples. See Attachment A for a flow chart.

B. Preserve and package samples being collected for the Laboratory's ER Program according to EPA requirements. Refer to LANL-ER-SOP-01.02, Sample Containers and Preservation for guidance.

C. Seal and label samples prior to packing the samples. Ensure that the sample containers and containers used for transport exhibit no external contamination. If necessary, decontaminate the containers according to equipment decontamination procedures.

D. Pack all samples so as to minimize the possibility of breakage during shipment. For all liquid samples, place sufficient absorbent material in the transport container to absorb all contained liquids in the event of a sample container breakage. Seal or lock the package so that any tampering can be readily detected.

E. For transport of hazardous samples or materials, prepare a Hazardous Materials Transfer Form, if applicable. Material must be packaged, marked and labeled in accordance with DOT regulations. The Hazardous Materials Transfer Form can be obtained from BUS-6 Customer Service or SCF. The Hazardous Materials Transfer Form must contain <u>two</u> 24-hour emergency telephone numbers, and a copy of the form must be sent to the Emergency Management Office.

F. After all samples are collected, packaged, and preserved, transport them to the rad van, chem van, or SCF under chain-of-custody. After the samples have been verified with the chain-of-custody documentation, a field team member relinquishes custody to rad van, chem van, or SCF personnel. Rad van or chem van personnel must maintain proper control of the samples in their custody and must reseal the packages containing samples before transporting the samples to the SCF.

G. Deliver samples to the rad van, chem van, or SCF during any legal workday between the hours of 8:00 a.m. and 12:00 p.m. and 1:00 p.m. and 5:00 p.m. Special arrangements can be made with the SCF coordinator for sample delivery during off hours.

H. All comments and any deviations from this procedure must be documented on the Daily Activity Log per SOP-01.04, Sample Control and Field Documentation.

6.1 Non-Hazardous or Environmental Samples

In general, samples that are collected in non-laboratory-use areas (for example, from wetlands, wells, and soils) are not expected to be contaminated with levels of hazardous or radioactive materials high enough to be considered hazardous by DOT. Most sampling is being performed to eliminate the question of contamination at waste management sites, and unless historical data, knowledge of process, or screening results suggest that samples are DOT-hazardous, samples will be transported as non-hazardous. Follow the instructions in Attachment B for packaging and handling environmental samples.

Samples taken from inactive sanitary waste lagoon or septic systems are exempt from all DOT and International Air Transport Authority (IATA) requirements if the sample collector can verify that the samples no longer contain infectious material. See Attachment C for instructions on handling sanitary waste.

6.2 Hazardous Samples

Although the sample media in the ER Program is expected to be soil, water, or sludge, the ER Program may have cause to sample pure product waste or highly concentrated hazardous material. If the amount of the hazardous material in the sample is small, it may be shipped under the DOT limited- or small-quantity exceptions. Small quantities of hazardous material are excepted from the DOT requirements for packaging, shipping papers, labels, and placards for that hazardous material and can be shipped as environmental samples. See exception for small quantities in 49 CFR 173.4. Hazardous materials may be transported under the limited quantity exception if that material has an excepted noted in column 8A of Table 49 CFR 172.101. Actual quantities are given in the reference indicated in Column 8A. The shipment of limited quantities must follow all requirements in the referenced section. Excepted radioactive samples must be accompanied by the specified information indicated in Section 6.2.2 of this document. For assistance, contact BUS-6 (667-4127).

6.2.1 Non-Radioactive Samples

Samples known or expected to be classified as DOT-hazardous materials must be transported according to DOT requirements. After determination of the hazardous characteristics, the selection of the appropriate hazard class and packaging exceptions, if any, can be determined from the list and text presented in 49 CFR 173.2. Attachment D provides a listing of the hazard classes and references for definitions and labeling.

Except for sanitary waste, if a known hazardous sample is to be shipped, BUS-6 must be contacted (667-4127) or SCF for assistance. In addition to the more stringent shipping requirements for hazardous samples, additional training requirements must be met to prepare these samples for transportation.

Samples taken from sanitary waste in active septic tanks or sewage lagoons can be classified as Diagnostic Specimens, which exempt them from special handling during ground transportation by 49 CFR 173.196 (h)(1). However, because these samples may be shipped by air for off-site analysis, the field team members must collect them in

the proper containers with all the appropriate packaging, per IATA. See Attachment D for collection and packaging requirements for sanitary waste samples.

CAUTION: nitric acid, which is used as a sample preservative, has restrictive DOT packaging and transportation requirements, with no exceptions allowed. All regulations in 49 CFR 172.101 and 173.158 must be followed when moving any amount of undiluted nitric acid. However, water samples preserved by nitric acid (or any other additive) are no longer forbidden because of the dilution of the nitric acid according to 49 CFR 172.101(d)(1) and can be packaged and shipped following standard practice for shipping environmental samples.

Shipment of samples preserved by DOT-regulated hazardous materials are also addressed by 40 CFR 136.3, Table II, Note 3.

6.2.2 Radioactive Samples

Most of the samples taken at ER sites will be of activity levels of 2 nCi/g or less. Since DOT only regulates radioactive material with a specific activity greater than 2 nCi/g, most samples taken at ER sites may be handled as an environmental samples unless other regulated hazards are identified or presumed to exist in the sample.

Because the DOT specifies curie amounts, which are not field readings, Attachment E, the summary table for DOT requirements for radioactive material, indicates some approximate disintegrations per minute (d/m). The health physics technician can convert d/m to counts per minute (c/m) for field readings. In this way, the health physics technician will be able to determine if a sample is above 2 nCi/g, approximately 4.4×10^3 d/m.

The LANL Radiation Protection Group (ESH-1) has established action levels of radioactivity in the ER Model Site-Specific Health and Safety Plan to alert the health physics technician of increased requirements for workers protection. Action Levels I and II, noted in Attachment E, are below the DOT-regulated radioactivity. Even though the LANL action levels of radioactivity are not regulated by DOT, special safety precautions must be taken if the activity at a sample location indicates one of the action levels. Be sure to follow all requirements in the Site-Specific Health and Safety Plan.

For materials exceeding the minimum 2 nCi/g activity, the following information applies. Contact BUS-6 for assistance if the health physics technician indicates readings in the following ranges:

A. For materials with activities of greater than 2 nCi/g but less than Type A quantities, DOT identifies a limited-quantity category and specifications for excepted packaging. Radioactive materials in the limited-quantity category may

be transported with minimum restrictions. See Attachment E for a summary sheet of DOT categories and levels of radioactivity in this category. Limited-quantity shipments must have the following label:

> **This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910.**

B. Type A and B quantity samples are not expected in the ER Program. However, the summary sheet indicates the continuum of shipping requirements for all radioactive material. The summary sheet also indicates d/m for some isotopes that would cause those isotopes to be shipped as Type A material.

Also, be sure to keep the SCF coordinator informed if levels of radioactivity are in the action level or limited-quantity ranges. Refer to Attachment E for activities for these ranges. The SCF coordinator will need to make special arrangements for handling the samples to keep SCF personnel from unknowingly receiving doses of radiation and to keep SCF equipment from contamination.

If 2 nCi/g activity is exceeded, and a package for transportation must be shipped limited quantity, follow the packaging requirements listed in the summary sheet. Contact BUS-6 or SCF for assistance.

7.0 REFERENCES

The following are directly related to this procedure and should be reviewed before field operations:

LANL-ER-SOPs in Section 1.0, General Instructions.

LANL Environmental Safety and Health Administrative Requirements, AR 10-3, Hazardous and Mixed Waste.

40 CFR, 1993. Code of Federal Regulations, Title 49, U.S. Environmental Protection Agency, Parts 100 -149. July 1, 1993, U.S. Government Printing Office, Washington, D.C.

49 CFR. 1994. Code of Federal Regulations, Title 49, U.S. Department of Transportation, Parts 100-199. October 1, 1992. U.S. Government Printing Office, Washington, D.C.

Charlton, Thomas J., P.E., Chief, Standards Division, Office of Hazardous Materials Regulation, Materials Transportation Bureau, DOT, Letter to Myron D. Lair, P.E., Chief, Hazardous Waste Section, ESB, ESD, Region IV, EPA, March 22, 1985.

Dangerous Goods Regulations, International Air Transport Authority. 35th Edition, Effective January 1, 1994.

EPA Region IV, 1991. Standard Operating Procedures and Quality Assurance Manual. Environmental Services Division, Athens, GA.

Los Alamos National Laboratory, 1993. Installation Work Plan for Environmental Restoration. LA-UR-93-3987.

Weitzman, David, "Final Regulation Package for Compliance with DOT Regulations in the Shipment of Environmental Laboratory Samples," Memo from Work Group Chairman, Office of Occupational Health and Safety (PM-273), EPA, April 13, 1981.

8.0 RECORDS

A. Completed Chain-of-Custody/Request for Analysis Form

B. Completed Daily Activity Log

C. Copy of the Hazardous Material Transportation Form, if applicable

It is the responsibility of the OUPL to ensure that records are transmitted to the Records Processing Facility, MS M707.

9.0 ATTACHMENTS

A. Flow Chart for Sample Classification for Shipping

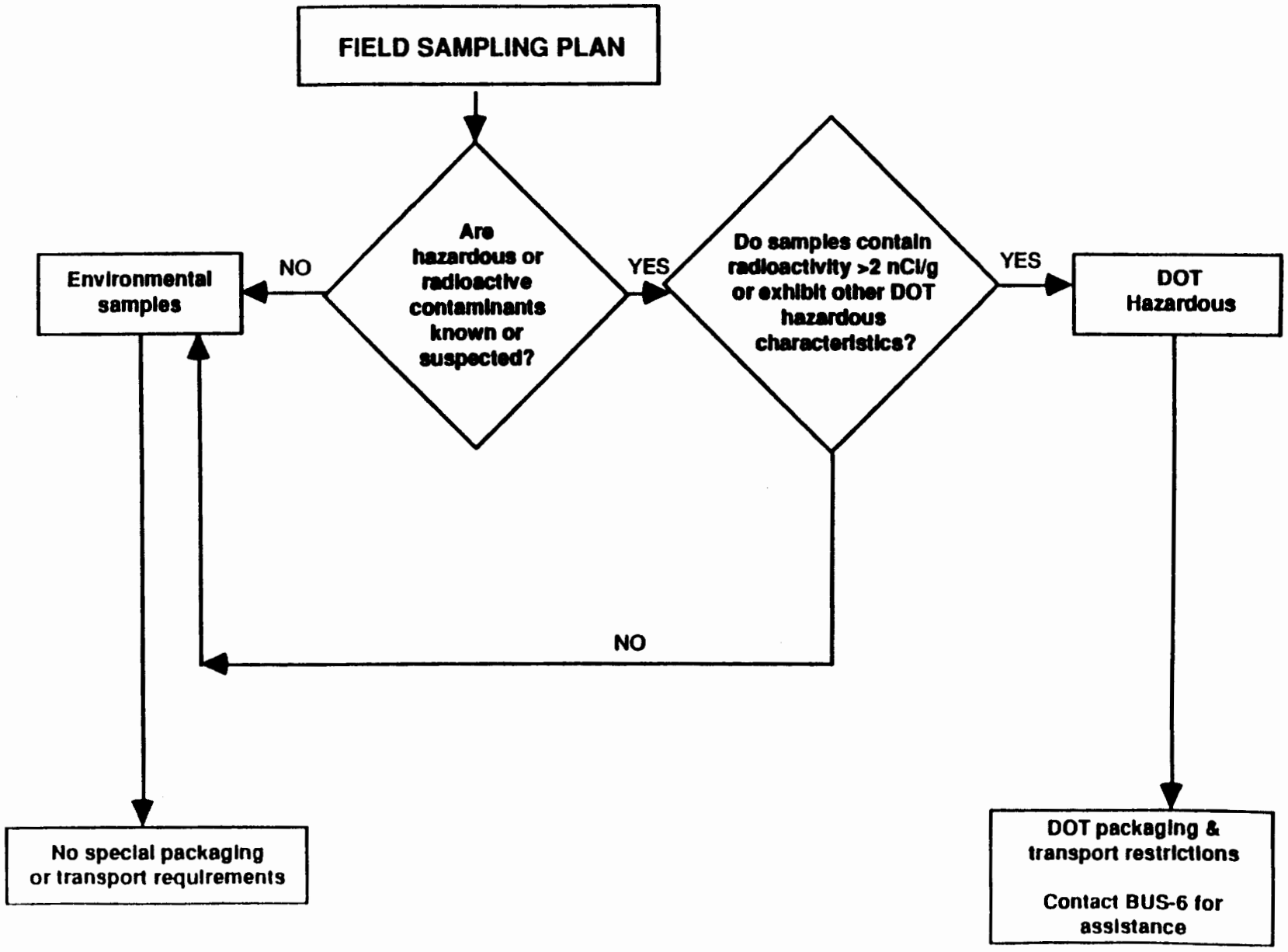
B. Preparation of Environmental Samples for shipment

C. DOT Hazardous Material Classification

D. Preparation of Sanitary Waste Samples for Shipment

E. Range of Material Radioactivities and Corresponding Transportation Requirements

FLOW CHART FOR SAMPLE CLASSIFICATION FOR SHIPPING



PREPARATION OF ENVIRONMENTAL SAMPLES FOR SHIPMENT

Environmental samples must be prepared for delivery in the following manner:

A. Packaging

1. Before any samples are placed in their delivery containers, the exterior of the sample containers should be decontaminated, if appropriate, and wiped dry.

2. For purposes of controlling leakage, sample containers should be placed, properly labeled and securely sealed, into a polyethylene sealable (e.g., Ziplock®) bag and the bag sealed.

3. If there are multiple sample containers, care should be taken to prevent breakage. Styrofoam "peanuts" or other cushioning material should be used as appropriate to prevent multiple samples from being broken during movement.

4. If the FTL deems it necessary for liquid samples, sufficient absorbent material should be placed in the cooler (or other transport container) to absorb all liquid in the event of a sample container breakage.

5. For samples requiring preservation at 4°C ± 2°C, the samples with ice or Blue Ice™ should be placed in a sturdy ice chest. The presence of ice or frozen Blue Ice™ in an amount approximately equal to the volume of samples is sufficient indication that the samples are adequately cooled.

6. When wet ice is used, it must be placed in sealed containers, such as doubled Ziplock® bags, so water does not fill the cooler as the ice melts.

HINT: If wet ice is to be used, try to purchase and use the "old" ice (bags at the bottom of the store's freezer) because newly delivered ice is not as efficient as ice that has been in the store's freezer for several days.

7. If samples are to be immediately chilled to below 4°C before delivery, they must be totally immersed in a separate cooler containing an ice slush solution that is below 4°C. To ensure this tempature before placing samples in the delivery container, a sample container of the same size filled with distilled water can be checked with a thermometer to determine when the samples have reached the desired temperature. The temperature check must be recorded.

8. Water samples must not be frozen or shipped with dry ice.

9. When using Blue Ice™, samples for volatile organic analysis (VOA) must be wrapped with bubble pads because direct contact between the samples and Blue Ice™ can freeze and burst the 40-ml VOA vial.

10. Completed original Chain-of-Custody/Request for Analysis forms (LANL-ER-SOP-01.04) must be placed in watertight containers and placed inside the shipping container lid.

11. The cooler or other transport container must be completely closed and secured with tape.

B. Marking/Labeling

DOT placards, marking, or labeling are not required for non-DOT regulated environmental samples that are taken to the rad van, chem van, or SCF*. However, per 40 CFR 261.4 (d), all samples must be accompanied by

- The sample collector's name, mailing address, telephone number
- The laboratory's name, mailing address, telephone number
- The quantity of the sample
- The date of shipment
- Description of the sample

Some of the required information is contained on the chain-of-custody form. The first two bulleted items are not on the chain-of-custody form, so a piece of paper containing that information might be preprinted to attach to the chain-of-custody form or otherwise placed with the cooler.

Transport containers (ice chests) will be marked Environmental Samples.

* For samples from septic tanks and lagoons that contain sanitary waste, see Attachment D for packaging and shipping requirements.

PREPARATION OF SANITARY WASTE SAMPLES FOR SHIPPING

These instructions are for the handling and shipping of samples from septic tanks and lagoons that contain sanitary waste.

A. Samples from Inactive Septic Systems and Lagoons

A number of septic systems at the Laboratory have been inactive and have not received sanitary waste in a number of years. If the ER Program is taking samples from these septic systems, the field team manager and the OUPL can conclude that the sample media is not infectious using the following prudent and resource-conservative philosophy:

- The types of human pathogens found in sanitary waste cannot maintain a viable state because conditions of pH, temperature, oxygen and other gases, etc., are not favorable.

- Without the addition of new waste and new pathogens, the samples are not infectious.

If the OUPL and the field team manager decide that samples from inactive sanitary waste systems are not infectious, the decision, with the supporting reasons, should be documented in the Daily Activity Log. These samples can be collected and prepared for transport as soil or water samples and designated as environmental samples.

B. Samples from Active Septic Systems and Lagoons

Samples that come from active sanitary systems and are expected to contain human wastes can be designated as diagnostic samples and are excluded from the specific packaging and shipping requirements per 49 CFR 173.196 (h)(1). However, because some ER Program samples must be shipped by air to meet EPA holding-time requirements, collection and preparation of these samples must satisfy IATA requirements.

According to IATA provisions, these shipments can be identified as Diagnostic Specimens "that have a low probability of containing infectious substances." The field team manager or OUPL may determine the following prudent and resource-conservative philosophy:

- Even though there may be infectious substances in the sample, the count would be low, and the probability of sudden illness or death occurring from contact with the infectious substance is low.

- If this determination is made, the responsible party may designate the diagnostic specimen as having a low probability of containing infectious substances.

- This designation reduces the testing requirements for the containers and increases the allowed amounts in a shipping package.

If the OUPL and the field team manager decide that samples from active sanitary waste systems are diagnostic specimens with low probability for causing illness or death, the decision with the supporting reasons should be documented in the Daily Activity Log.

For ground transportation of these samples, these samples can be packaged and transported as though they were environmental samples. The SCF will be responsible for packaging and shipping the samples, whether by ground or air, to an off-site laboratory. However, if these samples will be shipped by air, certain restrictions will apply.

1. Containers

   For material designated as diagnostic specimens, the total volume per shipping container cannot exceed 500 ml, and the maximum volume per inner container must not exceed 100 ml. Therefore, when SCF indicates that the samples will be shipped by air, they must be collected in containers that are typically smaller than those used for analyses. The sampling team must coordinate with the SCF to address this issue before taking samples because SCF is responsible for packaging the shipment per IATA 650. The SCF will provide sample containers that meet IATA 650.

2. Warning Labels

   Although DOT does not require placarding or labeling, safety of laboratory personnel requires that the samples should be identified as sanitary waste. A label will alert all personnel handling the samples as to the sample's potential hazard. A typical warning label attached to the outside of the transport container might read

   This package contains samples of sanitary waste. If leakage is noted, take all prudent precautions and notify the sampling team that collected the samples.

DOT HAZARDOUS MATERIAL CLASSIFICATION (49 CFR 173.2)

Class No.	Name of Class or Division	49 CFR Definition Reference	49 CFR Label Reference
1	Explosives	173.50	172.411
2	Gases	173.115	172.415, 416 and 417
3	Flammable and combustible liquid	173.120	172.419
4.1	Flammable solid	173.124	172.420
4.2	Spontaneously conbustible material	173.124	172.422
4.3	Dangerous when wet material	173.124	172.423
5.1	Oxidizer	173.127	172.426
5.2	Organic peroxide	173.128	172.427
6	Poisonous and infectious materials	173.132 and 134	172.430, 431 and 432
7	Radioactive Material	173.403	172.436, 438 and 440
8	Corrosives	173.136	172.442
9	Other Regulated Material	173.140	172.446

RANGE OF MATERIAL RADIOACTIVITIES AND CORRESPONDING TRANSPORTATION REQUIREMENTS

DOT Definition "Radioactive Material"

Not Regulated in Transport	Limited Quantities	Type A Quantity*	Type B Quantity*
LANL ESH-1 Action Level I** Above background but, < 500 cpm/probe α < 5000 cpm/probe β/γ	See 49 CFR 173.421 Contact BUS-6	See 49 CFR 173.431	
	Packaging: Strong, tight, leakproof External rad ≤ 0.5 mrem Outside package marked "Radioactive" If no inner packaging, otherwise inner packaging "Marked"		
LANL ESH-1 Action Level II** ≥ 500 cpm/probe α ≥ 5000 cpm/probe β/γ ≥ 5 mR/hr	Excepted from: Shipping papers & Certification Specification packaging Labeling Marking		
	2 nCi/g (0.002 μCi/g) 4.4×10^3 d/m		

^{60}Co,	1×10^{10} d/m
^{226}Ra,	1×10^{8} d/m
^{227}Ra,	6×10^{6} d/m
^{230}Th,	4×10^{8} d/m
^{235}U,	4×10^{8} d/m
^{238}Pu,	6×10^{6} d/m
^{239}Pu,	4×10^{6} d/m
^{241}Am,	1×10^{7} d/m

For others, see 49 CFR 173 Subpart I

*Not expected in the ER program

**Follow requirements cited in the Site-Specific H&S

SAMPLE CONTROL AND FIELD DOCUMENTATION

1.0 PURPOSE

This procedure describes the steps necessary to document the traceability of samples collected for the Environmental Restoration (ER) Program.

2.0 SCOPE

2.1 Applicability

This procedure is applicable to all ER Program activities involving samples collected for regulatory analysis.

2.2 Training

The Operable Unit Project Leader (OUPL), Field Team Leader (FTL), Sample Coordination Facility (SCF) staff, and site workers responsible for collecting samples and preparing documentation should be familiar with the objectives of sample contro and documentation. They must document that they have read and understood this procedure.

3.0 DEFINITIONS

Chain-of-Custody: The procedural steps to assure traceability of a sample from initial collection to final disposition.

A sample is in one's custody when one or more of the criteria listed below have been satisfied:

- the sample is in one or more of the field team members physical possession, or
- the sample is in one's view after being in one's physical possession, or
- the sample is in a secure area (accessible only to personnel within the sample chain) and maintained in a manner that any tampering would be evident.

Documentation of the above action provides the evidence that the chain-of custody has been maintained. Chain-of-custody (COC) establishes the traceability of the data derivec from the sample to the location from which it was collected.

Field Team: Those authorized individuals present at a sampling site during sample collection. Their presence at the site must be documented. This can be done through Daily Activity Logs, Field Notebooks, or Tailgate Safety Meeting Forms.

4.0 BACKGROUND AND CAUTIONS

All work performed for the ER Program must be documented. Sample control and documentation is necessary to ensure traceability and defensibility of data and to document the work performed in the field. Data collection must be thoroughly and accurately documented. Failure to have complete documentation may result in loss of the validity of field work and may have serious legal ramifications.

5.0 EQUIPMENT

N/A

6.0 PROCEDURES

A. Obtain preprinted forms and supplies associated with this standard operating procedure (SOP) from the Controlled Documents Coordinator at the Records Processing Facility (RPF), or utilize computer-generated forms.

B. Obtain the ER location identification (ID) for the area where sample collection is planned. The location ID is a unique number corresponding to the geographic coordinates that designate an ER Program location. It is obtained from the Facility Information Management, Analysis, and Display (FIMAD).

C. Make form entries with dark-colored indelible ink; computer or typewritten entries also acceptable.

D. Separate forms or instructions for media-specific sample collection have been developed for recording explicit data. These forms or instructions will be included in the individual SOPs and will be completed when applicable.

E. Documents shall not be destroyed or discarded even if they are illegible or contain inaccuracies that require replacement documents. Any inaccuracies shall be resolved upon discovery by crossing through the error with a single line, correcting it on the original document, and initialing and dating the correction. If the correction is not self-explanatory, the individual shall assign a number to the correction and attach to the original a sheet that fully describes the correction that has been performed.

6.1 Sample Identification

Preprinted forms and labels have been prepared so that identification and chain-of custody records can be maintained and sample disposition can be controlled. These items, with the exception of the unique sample number bar code stickers, are obtained from the Controlled Document Coordinator. The unique sample bar code stickers are obtained from the SCF. The labels and forms associated with this procedure are listed below. Examples are provided as Attachments A through G and are listed below.

- unique sample number bar code stickers - SCF
- sample labels - RPF
- sample collection logs - RPF
- master collection log - RPF
- chain-of-custody/request for analysis - RPF
- custody seals - RPF

Computer-generated versions of these forms are acceptable, provided they are functional equivalents. Slight variations in the placement of information is acceptable on computer-generated forms. However, all computer-generated forms must contain the same information identified in this SOP. All sample numbers must be assigned by the SCF.

6.1.1 Unique Sample Bar Code Stickers

1. The ER Program has established a sample identification system that uses preprinted self-adhesive stickers (Attachment A). The FTL will obtain a sufficient supply of bar code stickers from the SCF to accommodate the total samples required by the operable unit (OU) -specific Sampling and Analysis Plan. Each sheet contains four sets of 20 unique sample bar code stickers. Each set consists of one unique number. Each sticker displays a unique seven-character alphanumeric identifier in both human-readable and bar code form.

2. A unique alphanumeric bar code is used per sample even if the sample has more than one sample container. Apply the same sample number to each container of the same sample.

3. One sticker is affixed to each of the following:

   - sample container lid (except 40 mL vials with Teflon™ septa)
   - sample label (containers may be labeled before going to the field)
   - sample collection log
   - master collection log, if used

4. Discard any remaining stickers.

6.1.2 Sample Labels

1. Sample labels (Attachment B) provide information regarding the samples. Preprinted sample labels will be provided by the Controlled Document Coordinator. Alternatively, any label displaying the complete information as listed below is acceptable.

2. Each label should be completed with the following information:

   - Operable Unit
   - Technical Area

- unique sample bar code or bar code sticker
- date and time of collection
- sample location
- location ID obtained from FIMAD
- type of analysis requested
- preservative (if any)
- printed name and initials of collector

3. Ensure that completed sample labels are affixed to the sample containers immediately following the sampling activity if not done previously.

6.1.3 Sample Collection Logs

1. The FTL is responsible for the completion of the Sample Collection Log (Attachment C) and will record all information pertinent to the collection of sample media on this log. A computer-generated, functionally equivalent form is acceptable.

2. A sample collection log will be completed for each sample collected.

3. Information will be supplied for all spaces provided on the Sample Collection Log. If the space is not applicable to a specific project, write not applicable. Record additional information in the comments section. The comment section may be customized to the OU's data needs.

4. Daily entries on these logs will include the following:

   - Date and Time: The date and time when the sample was collected.

   - Technical Area: One or two-digit number indicating the technical area in which the sampling activities are being executed.

   - Operable Unit: Four-digit number indicating the operable unit where sampling activities are being executed.

   - Name/Signature: Printed name and written signature of preparer.

   - Sample Identification: One unique sample bar code or bar code sticker.

   - Control number: A unique number assigned by the OUPL to each COC.

- Sample Location: General description of sampling location (e.g., borehole HDH-1 by TA-16-03, outfall samples in Mortandad Canyon, etc.).

- Location ID: A unique identifier associated with the geographic coordinate that designates an ER Program site. It is obtained from FIMAD.

- Sample Type: Example descriptions include soil, ground water, surface water, filter air, charcoal tubes, ambient air, personnel air, sludge, drum contents, oil, vegetation, fauna, wipe, sediment, etc.

- Containers Used: Number, volume, and type of containers used [e.g., two 1-liter glass containers, amber container for volatile organic compounds (VOCs)].

- Analysis Requested: Type of contaminant for which sample is being analyzed (e.g., metals, volatile organic analysis, gamma).

- Composite Type: If composite samples are taken, identify the type of composite sample (e.g., 24-hour composite, spatial composite).

- Depth of Sample: Description of sample intervals in inches or feet and indicate unit (e.g., depth of sample in feet, distance on transect in feet).

- Weather: Approximate temperature, sun and moisture conditions.

- Any additional field observations/comments, which may include but are not limited to the following:

  - sample preservation (e.g., ice, cooled to 4°C, HNO_3);

  - calibration procedures for field equipment; or

  - results of photoionization detection and flame ionization detection in parts per million (ppm).

- SOP Number: The unique identifier of the Los Alamos National Laboratory (the Laboratory) ER SOP utilized to collect the sample.

6.1.4 Master Collection Log

1. The Master Collection Log (Attachment D) or functional equivalent is used to track samples from the site to the mobile lab or SCF and to the final laboratory destination. Use of this form is optional. As some

sites require numerous samples, this log is a helpful organizational tool.

2. The following information is included on this log:

- Date: The date of entry.
- Sheet Number: Number all sheets that are used consecutively (e.g., 1 of 2, 2 of 2, etc.).
- Technical Area: One or two-digit number indicating the technical area in which the sampling activities are being executed.
- Operable Unit: Four-digit number indicating the operable unit where sampling activities are being executed.
- Name of Preparer: Printed name of preparer.
- Sample Identification: Place a unique sample bar code or bar code sticker in the box Affix Sample Sticker for each sample included in the Master Collection Log.
- Date and Time Collected: The date and time when the sample was collected.
- Sample Type: Example descriptions include soil, ground water, surface water, filter air, charcoal tubes, ambient air, personnel air, sludge, drum contents, oil, vegetation, fauna, wipe, sediment, etc.
- Sample Location: General description of sampling location (e.g., borehole HDH-1 by TA-16-03, outfall samples in Mortandad Canyon).
- Date Samples Delivered: Include the date the samples are delivered to either the SCF, Mobile Rad Van, or Mobile Chemical Analysis Van.
- QC Samples: Enter yes or no.
- Location ID: A unique identifier associated with the geographic coordinate that designates an ER Program location. It is obtained from FIMAD.

6.1.5 Chain-of-Custody/Request for Analysis Forms

1. COC (Attachment E) forms are used to document the integrity of all samples, maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory.

2. Complete a COC form for each sample. If required, more than one sample number may appear on a single COC form. Obtain preprinted three-part COC forms or use a computer-generated form. A unique chain-of-custody control number must appear on each three-part set of forms. The control number will have the structure "YYYY-XXXX," where YYYY is the OU designation, and XXXX is a unique sequential number assigned by the OUPL or his designee for each OU. These numbers may be assigned in blocks when taking large numbers of samples. Thus, a sample COC control number for OU 1100 would be "1100-0001." The OUPL has the responsibility for ensuring that unique control numbers are assigned to each three-part set of COCs. Preprinted forms assigned from the Controlled Document Coordinator will not have control numbers entered on them.

3. All copies of the COC must accompany the sample(s) to the mobile rad van (or to the SCF if the sample is delivered there directly). After an individual at the rad van or SCF has acknowledged receipt of samples by signing the COC, the FTL will keep the third, or pink copy. The original (top or white) copy will be kept with the samples and the second (yellow) copy will be sent to the RPF by the SCF.

   NOTE: COC signed off by the rad van is not a completed record. The FTL should retain the pink copy for his/her use only!

4. Information will be supplied for all blank spaces on the COC. If the space is not applicable, write N/A.

5. The COC will contain the following information:

   - Date: The date the COC is filled out.

   - Control Number: A unique number on each COC. (Note: Remember to write this number on the Sample Collection Log(s) that coincides with the sample on the COC. Control numbers are issued by the OUPL.

   - Technical Area: One or two-digit number indicating the technical area in which the sampling activities are being executed.

   - Send lab report to: The name and address of the operable unit contact to whom the contract laboratory results should be sent.

   - Operable Unit: Four-digit number indicating the operable unit where sampling activities are being executed.

   - OU Contact: OUPL or designee, as appropriate.

- Contact Phone No: Give the telephone number of the OUPL or designee indicated as the operable unit contact.

- Date Lab Report Required: Give an approximate date that the lab results are needed.

- Field Unique Sample #/ID: Sample number/identification for each sample in shipment. This number must be printed if computer-generated forms are not being used. (You are making 3 copies).

- Date and Time Collected: For each sample in shipment.

- Grab/Comp.: Indicate if it is a grab sample or composite sample.

- Sample Container Volume/Material: Type and material of sample container used and volume (e. g., 1-L glass, amber container for VOCs).

- Matrix: Sample description (e.g., liquid soil, core, sludge).

- Preservative: Type of preservative used.

- Analysis Requested, Test, Method: Analysis requested for each sample. Also note preferred analytical method, if known.

- Remarks: Any additional remarks that supply relevant information pertaining to the samples (e.g., condition on receipt, etc.).

- Relinquished by: When the possession of the samples is transferred from a field team member to the mobile lab or SCF or to any other authorized person, the individual relinquishing the samples prints and signs his/her name and affiliation and records the date and time on the COC document in the "Relinquished By" box. If computer-generated forms are used, the individuals must sign all copies unless carbons (or the equivalent thereof) are used.

- Received by: The individual receiving the samples prints who signs his/her name and affiliation and ensures that the date and time entered by the person relinquishing the samples is correct. CAUTION: If you do not sign the form in the relinquish block, custody will be broken, and you will have to resample. If computer-generated forms are used, the individuals must sign both copies unless carbons are used.

  NOTE: The individual accepting custody of a sample or set of samples must verify that all containers identified on the chain-of-custody form are contained in the packages(s) being accepted.

signature on the COC acknowledges that the sample containers have been received.

- Possible Hazard Identification: Indicate if sample(s) is hazardous material and/or suspected to contain high levels of hazardous substances by checking the appropriate space(s): Radiological, Highly Toxic, Flammable, Skin Irritant, Non-Hazard, or Other. If "Other" is selected, indicate in writing what the other hazard is.

- Sample Disposal: Indicate what actions will be taken for final disposal of the samples. Check spaces provided for Return to Client, Disposal by SCF, and Archive. If archived, indicate the number of months. Normally all samples are returned to the SCF and eventually disposed of.

- Comments: Any additional comments are included here.

6. The FTL is responsible for ensuring delivery of the samples to the SCF, the Mobile Rad Van, or the Mobile Chem Van and for the completion of the COC form. The FTL will inspect the form for completeness and accuracy.

6.1.6 Custody Seals

1. Custody seals (Attachment F or functional equivalent) will be used to ensure samples are not tampered with during their shipment to the SCF.

2. The lid of every sample container will be sealed with custody seal. Th custody tape will be in contact with the bottle and lid.

3. The custody seal for every sample will be initialed and dated by a member of the sampling team.

4. The sealed sample containers will then be delivered to the SCF, the Mobile Rad Van, or Mobile Chemical Laboratory.

6.2 Field Investigation Summaries

Field Log Books will be used for detailed summaries of information pertaining to tl field investigation and for recording additional field data (e.g., unusual events suc as storms, etc.) Include information for the Daily Report Form (Attachment G) in th Log Book. The Log Books can be obtained from the Controlled Documents Coordinator. Log Books will be used by field personnel to record all pertinent fiel information. Review LANL-ER-SOP-03.12 for guidance on use of field notebooks These Log Books are tracked documents; unique identifying numbers will be issu by the Controlled Documents Coordinator. Log books will be bound notebooks, p paginated with consecutively numbered pages.

6.2.1 Daily Activity Entries

1. The FTL is responsible for preparing daily field reports that briefly summarize each day's progress.

2. If Daily Activity Log Forms (Attachment H) are used, paginate each sheet of the Daily Activity Log for each day (e.g., 1 of 4, 2 of 4, etc.).

3. Entries in the logs will include the following:

   - Date: Month, day, and year at the start of each day and at the top each page.

   - Time: The time of each activity.

   - Technical Area: One or two-digit number indicating the technical area in which the sampling activities are being executed.

   - Operable Unit: Four-digit number indicating the operable unit in which sampling activities are being executed.

   - Signature: Preparer must sign the entries at the end of each day.

   - Comments: The comments section may include, but is not limite, the following:

     - a general description of daily activities

     - deviations from approved plans or procedures, including justification for deviation

     - field team members' names

     - a description of general field conditions encountered

     - special problems

     - sketches and calculations as they pertain to the job

     - performance of subcontractors, such as their equipment's suitability and adequacy

     - names and affiliations of all personnel onsite doing work for the ER Program

     - supplies and equipment used

- when photographs are taken in the field, the time, date, location roll identification number, picture number on the roll, general compass direction, a description of the subject matter, and the photographer's name

- decontamination practices, such as the time decontamination is performed and results of equipment inspection after decontamination

- a description of waste generated as a result of the field investigation

- any additional field observations pertinent to the investigation

6.2.2 Daily Summary

All OUPLs performing field work must report daily to the Environmental Restoration Program Office. This policy is to regularly apprise the Program Office of all field activities so that the Program Office can report when called to do so by the Department of Energy-Los Alamos Area Office.

Daily reports are reported on the Synchronize calendar system in the FIMAD The reports are made in a pop-up note in the "To-Do" section of the OU's calendar in Synchronize. These reports must be made at the end of each field day and must include an overview of activities performed, unusually high screening analytical results, and any unexpected events. Synchronize will enable all interested personnel connected to have access to field information.

If you do not have Synchronize available, contact FIMAD at 665-2451 and obtain an account to access the electronic calendar system. Until Synchronize is available, submit daily reports through electronic mail

(Eudora) to the Field Coordinator at e-mail number, royb @ er2.lanl.gov, and send a copy to your programmatic project leader.

If you do not have access to Synchronize or Eudora, fax your daily report (Attachment H) to 665-4747.

The Daily Report Form includes the following:

1. Name: Name of preparer

2. Position or Title: Position or title of preparer

3. Date: Month, day, and year

4. OU#: Operable Unit number

5. Time: Time of Daily Report Form preparation

6. PRS#: Number(s) of Potential Release Sites surveyed or sampled in the day's activities

7. Field Activities: Using the given information in the form, complete for the day's activities. Be brief but thorough.

7.0 REFERENCES

LANL-ER-SOPs in Section 1.0, General Instructions
LANL-ER-SOP-03.12, Field Notebook
LANL-ER-AP-02.1, Procedure for the Laboratory ER Records Management

8.0 RECORDS

Field Notebooks
Daily Activity Logs (if completed)
Sample Collection Log
Master Collection Log (optional)
Chain-of-Custody/Request for Analysis Form
Daily Report Form

These records shall be transferred to the ER Records Processing Facility in accordance with the Administrative Procedure for the Laboratory ER Records Management (LANL-ER-AP-02.1).

9.0 ATTACHMENTS

Attachment A - Unique Sample Bar Code Sticker
Attachment B - Sample Labels
Attachment C - Sample Collection Log
Attachment D - Master Collection Log
Attachment E - Chain-of-Custody/Request for Analysis
Attachment F - Custody Seal
Attachment G - Daily Report Form
Attachment H - Daily Activity Log

UNIQUE SAMPLE NUMBER STICKERS

EXAMPLE ONLY

SAMPLE LABELS

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

Los Alamos National Laboratory Environmental Restoration
SAMPLE COLLECTION LOG

Date: _____ Time_____

Technical Area _____ Operable Unit _____

AFFIX BAR CODE STICKER HERE

Name/Signature _____

Control No. (from Chain of Custody form)_____

Location ID No _____ Sample Type _____

Sample Location _____

Composite _____ YES _____ NO

Composite Type_____

Depth of Sample _____ (in) (ft)

Weather _____

Containers Used	Analysis Requested

LANL ER SOP#_____ was used to collect this sample.

COMMENTS_____

Los Alamos National Laboratory Environmental Restoration
MASTER COLLECTION LOG

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

NAME (print) _____

AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____

Los Alamos National Laboratory Environmental Restoration
CHAIN OF CUSTODY/REQUEST FOR ANALYSIS

Date: _____ COC _____

Technical Area _____ Send Lab Report to: _____ MS_____

Operable Unit _____

OU Contact _____ Date Lab Report Required _____

Contact Phone No. _____

Field Unique Sample #/ID (Write in Sample ID Number in space below.)	Date & Time Collected	GRAB	COMP	Sample Container Volume/Mat'l	Matrix (Liquid, Soil, Core, Sludge, Etc.)	Preservative	ANALYSIS REQUESTED TEST	METHOD	REMARKS (Condition of receipt, etc.)

Relinquished by: *(Signature)*: Affiliation:	Date:	Relinquished by: *(Signature)*: Affiliation:	Date:	Relinquished by: *(Signature)*: Affiliation:	Date:
Received by: *(Signature)*: Affiliation:	Time:	Received by: *(Signature)*: Affiliation:	Time:	Received by: *(Signature)*: Affiliation:	Time:

POSSIBLE HAZARD IDENTIFICATION:
(Please Indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances)

Radiological____ Highly Toxic_____ Flammable _____ Skin Irritant_____ Non-hazard_____ Other____

SAMPLE DISPOSAL:

Return to client____ disposal by Lab____ Archive____ (indicate number of month(s):__

COMMENTS: _____

Original - ECF YELLOW - RPF PINK - ETL Copy LANL-ER-SOP-01.04, R2

Los Alamos National Laboratory Environmental Restoration
CUSTODY SEAL

(Example Only)

Los Alamos
Los Alamos National Laboratory
Los Alamos, NM 87545

LAB SAMPLE

DO NOT TAMPER

Date _____

Initials _____

This label is red.

Los Alamos National Laboratory Environmental Restoration Program
DAILY REPORT FORM

Name _____ Date _____

Position or Title _____ OU# _____

Time _____ PRS# _____

Field Activities:

Surveys (i.e., Geodetic, Geophysical, Radiation, etc.)

_____

_____

Drilling Activities: (Number and type hole drilled, type of drilling (split spoon auger, air rotary, etc. Depth completed (daily and total))

_____

_____

Sampling: (Number of samples collected, types of sample media collected analyses requested)

_____

_____

_____

Field Monitoring Results: (Instrument reading above background, high analytical results)

_____

_____

_____

Unexpected Events:

_____

_____

_____

Los Alamos National Laboratory Environmental Restoration
DAILY ACTIVITY LOG

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

Site Work Plan _____

Signature _____

Comments:

_____ CHECK HERE IF CONTINUED ON BACK OF THIS SHEET

Los Alamos National Laboratory **Environmental Restoration Program** Standard Operating Procedure	No: LANL-ER-SOP-1.04 Rev: 1

Sample Control and Field Documentation

	(Print Name)	(Signature)	(Date)
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Effective Date: 1-5-93

Sample Control and Field Documentation

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Sample Control and Field Documentation

1.0 PURPOSE

This procedure describes the steps necessary to document the traceability of samples collected for the Environmental Restoration (ER) Program.

2.0 SCOPE

2.1 Applicability

This procedure is applicable to all ER Program activities involving samples collecte for regulatory analysis.

2.2 Training

The Operable Unit Project Leader (OUPL), the Field Team Leader (FTL), Sample Coordination Facility staff, and site workers responsible for collecting samples and preparing documentation should be familiar with the objectives of sample control and documentation. They must document that they have read this procedure and the remaining procedures in Section 1.0, General Instructions of the Los Alamos National Laboratory ER Program Standard Operating Procedures.

3.0 DEFINITIONS

Chain-of-custody: The procedural steps that result in the assurance that a sample has remained in a person's custody from initial collection to final disposition.

A sample is one's custody when the criteria listed below have been satisfied:

- the sample is in one's physical possession, or
- the sample is in one's view at all times, or
- the sample is in one's physical possession and then it was secured in a manne so that it could not be tampered with.

Documentation of the above action provides the evidence that the chain-of custody has been maintained. Chain-of-Custody establishes the traceability of the sample to the location from which it was collected and the data derived from the sample.

4.0 BACKGROUND AND CAUTIONS

All work performed for the ER Program must be documented. Sample control and documentation is necessary to ensure the reliability and defensibility of data and to verify the quality of the work performed in the field. Data collection must be through and accurately documented. Failure to have complete documentation may result in loss of the validity of field work and may have serious legal ramifications.

5.0 EQUIPMENT

N/A

6.0 PROCEDURES

A. Obtain forms and supplies associated with this SOP from the Sample Coordination Facility (SCF).

B. Obtain the ER site ID(s) for the area where sample collection is planned. The site ID is a unique number based upon geographic coordinates that designate an ER Program site. It is obtained from the Facility for Information Management and Display (FIMAD).

C. Make form entries with black indelible ink.

D. Separate forms for media-specific sample collection have been developed for recording explicit data. These forms will be included in the individual Standard Operation Procedures and will be completed when applicable.

E. Documents shall not be destroyed or discarded even if they are illegible or contain inaccuracies that require replacement documents. Any inaccuracies shall be resolved upon discovery by crossing through the error, correcting it on the original document, and initialing and dating the correction. If the correction is not self-explanatory, the individual shall assign a number to the correction and attach a sheet to the original that fully describes the correction that has been performed

6.1 Sample Identification

Forms and labels have been prepared so that identification and chain-of-custody records can be maintained and sample disposition can be controlled. These items are obtained from the SCF. The labels and forms associated with this procedure are listed below. Examples are provided as examples A through G.

- unique sample bar code stickers
- sample label stickers
- sample collection logs
- master sample collection log
- chain-of-custody/request for analysis forms
- custody seals
- Daily Activity Log

6.1.1 Unique Sample Bar Code Stickers

1. The ER Program has established a sample identification system that uses preprinted self adhesive labels (Attachment A). The FTL will obtain a sufficient supply of sheets of labels to accommodate the total samples required by the OU-specific Sampling and Analysis Plan. Each sheet contains four sets of 20 unique sample bar code labels. Each set consists of one unique number. Each label displays a unique seven-character alphanumeric identifier in both human readable and bar code form.

2. Only one unique bar code sticker is used per sample even if the sample has more than one sample container. Apply the same sample number to each container of the same sample.

3. One label is affixed to each of the following:

   •sample container lid (except 40 ml vials with Teflon ™ septa);
   •sample label (containers may be labeled before going to the field);
   •chain-of -custody/request for analysis form;
   •sample collection log; and
   •master sample collection log.

4. Discard any remaining stickers.

6.1.2 Sample Labels

1. Sample labels (Attachment B) provide information regarding the samples. Preprinted sample labels will be provided by the SCF. Alternatively any label displaying the complete information as listed below is acceptable.

2. Each label should be completed with the following information:

   - Operable Unit;
   - Technical Area;
   - unique sample bar code sticker;
   - date and time of collection;
   - Sample location;
   - Site ID obtained from the Facility for Information Management, Analysis, and Display (FIMAD);
   - type of analysis requested;
   - preservative (if any); and;
   - signature of collector.

3. Ensure that completed sample labels are affixed to the sample containers immediately following the sampling activity if not previously done.

6.1.3 Sample Collection Logs

1. The FTL is responsible for the completion of the Sample Collection Log (Attachment C) and will record all information pertinent to the collection of sample media on this log.

2. A sample collection log will be completed for each sample collected.

3. The logs will be paginated for each sheet prepared on a single day (i.e., if a total of 24 pages is completed, number 1 of 24, 2 of 24, etc.).

4. Information will be supplied for all spaces provided on the Sample Collection Log. If the space is not applicable to a specific project, write N/A. Record additional information in the comments section.

5. Daily entries on these logs will include:

   - Date and Time: The date and time when the measurement was made in the following formats: DD-MMM-YY (e.g., 01-JAN-92), and the 24-hour clock time (e.g., 0837 for 8:37 a.m. an 1912 for 7:12 p.m.);

   - Sheet Number: Number all sheets that are used consecutively (e.g., 1 of 2, 2 of 2, etc.);

   - Technical Area (TA): Two-digit number indicating the TA in which the sampling activities are being executed;

   - Operable Unit (OU): Four-digit number indicating the OU where sampling activities are being executed;

   - Site Work Plan: The title and number of the site work plan that pertains to the sampling event;

   - Signature: Name and title of preparer;

   - Sample Identification: Affix one unique sample bar code sticker;

   - Control number: A preprinted number from the Chain-of-Custody/Request for Analysis form.

   - Sample Location: General description of sampling location (e.g. borehole HDH-1 by TA-16-03, outfall samples in Mortadad Canyon, etc.).

- Site ID: A unique identifier associated with the geographic coordinate that designates an ER Program site. It is obtained fro FIMAD.

- Sample Type: Example descriptions include soil; ground water; surface water; filter air; charcoal tubes; ambient air; personnel air sludge; drum contents; oil; vegetation; fauna; wipe; sediment, etc Also include sample collection method (e.g., SUMMA® canister, bailer, Shelby tube, stainless steel scoops, animal traps, etc.)

- Containers Used: Number, volume, and type of containers used (e.g., two, 1-liter glass containers).

- Amount Collected: Approximate volume of sample in container.

- Composite Type: If composite samples are taken, identify the typ of composite sample (e.g., 24-hour composite, spatial composite

- Depth of Sample: Description of sample intervals (e.g., depth of sample in feet, distance on transect in feet).

- Weather: Approximate temperature, sun and moisture conditions

- Any additional field observations/comments, which may include but are not limited to the following:

  sample preservation (e.g., ice, cooled to 4° C, HNO_3);

  calibration procedures for field equipment; or

  results of photoionization detection (PID) and flame ionizatior detection (FID) in parts per million (ppm).

NOTE: SCF provides pre-cleaned containers.

6.1.4 Master Collection Log

1. The Master Collection Log (Attachment D) is used to track samples from the site to the SCF and to the final laboratory destination. Use of this form is optional. As some sites require numerous samples, this log is a helpful organizational tool.

2. The following information is included on this log:

   - Date: The date (Day-Month -Year) of entry.

   - Sheet Number: Number all sheets that are used consecutively (e.g., 1 of 2, 2 of 2, etc.).

- Technical Area (TA): Two-digit number indicating the TA in which the sampling activities are being executed.

- Operable Unit (OU): Four-digit number indicating the OU where sampling activities are being executed.

- Site Work Plan: The title and number of the site work plan that pertains to the sampling event.

- Signature: Name and title of preparer.

- Sample Identification: Place a unique sample bar code sticker in the box Affix Sample Sticker for each sample included in the master Collection Log.

- Date and Time Collected: The date and time when the sample was collected, made in the following formats: DD-MMM-YY (e.g., 01-JAN-92), and the 24-hour clock time (e.g., 0837 for 8:37 a.m. and 1912 for 7:12 p.m.).

- Sample Type: Example descriptions include soil; ground water; surface water; filter air; charcoal tubes; ambient air; personnel air; sludge; drum contents; oil; vegetation; fauna; wipe; sediment, etc. Also include sample collection method (e.g., SUMMA® canister, bailer, Shelby tube, stainless steel scoops, animal traps, etc.).

- Sample Location: General description of sampling location (i.e., borehole HDH-1 by TA-16-03, outfall samples in Mortadad Canyon).

- Date Samples Shipped: Include the date the samples are shipped to the SCF.

- QC Samples: Number and type of Quality Control Samples.

- Control number: A preprinted number from the Chain-of-Custody/Request for Analysis form coinciding with the first sample collected for that sampling event that will be recorded on the Sample Collection Log for the first sample taken.

- Site ID: A unique identifier associated with the geographic coordinate that designates an ER Program site. It is obtained from FIMAD.

6.1.5 Chain-of-Custody/Request for Analysis Forms

1. Chain-of-Custody/Request for Analysis (Attachment E) forms are used to document the integrity of all samples, maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory.

2. Complete a Chain-of-Custody/Request for Analysis form for each sample set at each sampling station. Obtain this three-part form from the SCF.

3. All copies of the Chain-of-Custody/Request for Analysis form will accompany the sample to the SCF. The original (top copy) will be kept by the SCF. The second copy will be given to the ER Records Processing Facility (RPF) and the third copy will be sent to the FTL.

4. Information will be supplied for all blank spaces on the Chain-of-Custody/Request for Analysis form. If the space is not applicable, write N/A.

5. The Chain-of-Custody/Request for Analysis form will contain the following information:

   - Date: The date the Chain-of-Custody/Request for Analysis is filled out.

   - Control Number: A preprinted unique number on each Chain-of-Custody/Request for Analysis form. (Note: Remember to write this number on the Sample Collection Log that coincides with the first sticker, affixed to the Chain-of-Custody/Request for Analysis form.

   - Technical Area (TA): Two-digit number indicating the TA in which the sampling activities are being executed.

   - Send lab report to: The name and address of the SCF Coordinator to whom the contract laboratory results should be sent.

   - Operable Unit (OU): Four-digit number indicating the OU where sampling activities are being executed.

   - Site Work Plan: The title and number of the site work plan that pertains to the sampling event.

   - OU Contact: OUPL or FTL, as appropriate.

   - Contact Phone No: Give the telephone number of the OUPL or FTL indicated as the OU contact.

- Date Samples Shipped: Include the date that the samples are shipped to the SCF.

- Date Lab Report Required: Give an approximate date that the lab results are needed.

- Field Unique Sample Number/Identification: Sample number/identification for each sample in shipment. This number must be written by hand (you are making 3 copies).

- Date and Time Collected: (for each sample in shipment).

- Indicate if it is a grab sample or composite sample.

- Sample Container: Type of sample container used and volume (e.g, 1 liter glass bottle).

- Matrix: Sample description (e.g., environmental matrix, liquid soil, core, sludge).

- Preservative: Type of preservative used.

- Analysis: Analysis requested for each sample. Also note preferred analytical method if known.

- Remarks: any addition remarks that supply relevant information pertaining to the samples (i.e., condition on receipt, etc.).

- Relinquished by: When the possession of the samples is transferred to the SCF, the individual relinquishing the samples signs his/her name and affiliation and records the date and time on the Chain-of-Custody/Request for Analysis document in the "Relinquished By" box.

- Received by: The individual receiving the samples signs his/her name and affiliation and ensures that the date and time entered by the person relinquishing the samples is correct. The shipping company is not a part of the chain-of-custody procedures. However, the shipping company's waybill number documents the method of transportation. CAUTION: If you do not sign the form in the relinquish block, custody will be broken and you will have to resample.

- Possible Hazard Identification: Indicate if sample(s) is hazardous material and/or suspected to contain high levels of hazardous substances. Check spaces provided for Radiological, Highly toxic, Flammable, Skin irritant, Non-hazard, and other.

- Sample Disposal: Indicate what actions will be taken for final disposal of the samples. Check spaces provided for Return to Client, Disposal by Lab, and Archive. If archived, indicate the number of months.

- Comments: Any additional comments are included here.

- Sampling Team: The names (printed) and initials of those field team members involved with the sampling and the name of the FTL. Only these persons are to be involved in the chain-of-custody procedures.

6. The FTL is responsible for shipping the samples to the SCF or the Radioactive Contamination Screening Van and for the completion of the Chain-of-Custody/Request for Analysis form. The FTL will inspect the form for completeness and accuracy.

6.1.6 Custody Seals

1. Custody seals (Attachment F) will be used to ensure samples are not tampered with during their shipment to the SCF.

2. The lid of every sample container will be sealed with custody seal. For 40 millimeter vials, the custody tape will be wrapped around the bottle and lid horizontally and not over the exposed septa.

3. The custody seal for every sample will be initialed and dated by a member of the sampling team.

4. The sealed sample containers will then be hand carried to the SCF or th Radioactive Contamination Screening Van.

6.2 Field Investigation Summaries

Daily Activity Log (Attachment G) forms have been developed for detailed summaries of information pertaining to the field investigation and for recording additional field data. The forms can be obtained from the SCF.

6.2.1 Daily Activity Logs

1. The FTL is responsible for preparing daily field reports that briefly summarize each day's progress.

2. Paginate each sheet of the Daily Activity Log for each day (e.g., 1 of 4, 2 of 4, etc.).

3. Entries on the Daily Activity logs will include:

- Date: The date and time of the activity made in the following formats: DD-MMM-YY (e.g., 01-JAN-92), and the 24-hour clock time (e.g., 0837 for 8:37 a.m. and 1912 for 7:12 p.m.).

- Sheet Number: Number all sheets that are used consecutively (e.g., 1 of 2, 2 of 2, etc.).

- Technical Area (TA): Two-digit number indicating the TA in which the sampling activities are being executed.

- Operable Unit (OU): Four-digit number indicating the OU where sampling activities are being executed.

- Site Work Plan: The title and number of the site work plan that pertains to the sampling event.

- Signature: Name and title of preparer.

- Comments: The comments section may include, but is not limited to, the following:

  - deviations from approved plans or procedures;

  - a description of general field conditions encountered;

  - special problems;

  - sketches and calculations as they pertain to the job;

  - performance of subcontractors, such as their equipment's suitability and adequacy;

  - names and affiliations of all ER Program personnel on site;

  - supplies and equipment used;

  - when photographs are taken in the field, the time, date, location, roll identification number, picture number on the roll, general compass direction, a description of the subject matter, and the photographer's name;

  - decontamination practices, such as time decontamination is performed and results of equipment inspection after decontamination;

- a description of waste generated as a result of the field investigation; and
- any additional field observations pertinent to the investigation.

7.0 REFERENCES

LANL-ER-SOPs in Section 1.0, General Instructions

8.0 RECORDS

Sample Collection Log
Master Collection Log (optional)
Chain-of-Custody/Request for Analysis Form
Daily Activity log

9.0 ATTACHMENTS

Attachment A - Unique Sample Bar Code Sticker
Attachment B - Sample Labels
Attachment C - Sample Collection Log
Attachment D - Master Collection Log
Attachment E - Chain-of-Custody/Request for Analysis form
Attachment F - Custody Seal
Attachment G - Daily Activity Log

UNIQUE SAMPLE NUMBER STICKERS

XXX0000

EXAMPLE ONLY

SAMPLE LABELS

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX SAMPLE STICKER HERE
LOCATION:	DATE:
SITE ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
SIGNATURE:	

EXAMPLE ONLY

Los Alamos National Laboratory Environmental Restoration
SAMPLE COLLECTION LOG

Date: _____ Time (24 hour clock) _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

Site Work Plan _____

Signature _____

AFFIX SAMPLE STICKER HERE

Control No. _____ Sample Type _____

Sample Location _____ Site ID No _____

Composite _____ Yes _____ No

Composite Type _____

Depth of Sample _____

Weather _____

COMMENTS _____

Containers Used	Amount Collected

EXAMPLE ONLY

LEGEND

1. A sample collection log is to be completed for samples in each sampling interval and reaffix stickers to form when the sample label is prepared.
2. Date: Use DD-MMM-YY; e.g., 01-JAN-91.
3. Time: Use 24-hour clock; i.e., 1835 for 6:35 PM.
4. All entries on the log are to be completed. If not applicable, mark N/A.
5. Page: Each sample team should number sheet ___ of ___ for the day's activities for all sheets prepared on a single day, i.e., if there is a total of 24 pages, number 1 of 24, 2 of 24, etc.
6. Control No.: obtain from chain of custody/request for analysis form.
7. Sample Location: Use boring or monitor well number, grid location (transect), sample station I.D., or coordinate to physical features with distances. Include sketch in comment section, if necessary.
8. Sample Type: Use the following - soil; water (surface or ground); air (filter, tubes, ambient, personnel); sludge, drum contents; oil; vegetation; wipe; sample.
9. Site ID No. FIMAD supplied unique site designation.
10. Composite Type: i.e., 24-hour, list sample numbers in composite, spatial composite.
11. Depth of Sample: Give units, write out units such as feet.
12. Weather: Approximate temperature, sun, and moisture conditions.
13. Containers Used: List each container type as number, volume, material type (e.g., 2 - 1L glass, 4 - 40 ml glass vial, 1 - 400 ml plastic, 1 - 3 inch steel tube, 1 - 8 oz. glass jar).
14. Amount Collected: Volume of container.

Los Alamos National Laboratory Environmental Restoration
MASTER COLLECTION LOG

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

Site Work Plan _____

Signature _____

AFFIX SAMPLE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples _____ Site I.D. _____	Sample Type _____ Date Samples Shipped _____ Control Number _____
AFFIX SAMPLE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples _____ Site I.D. _____	Sample Type _____ Date Samples Shipped _____ Control Number _____
AFFIX SAMPLE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples _____ Site I.D. _____	Sample Type _____ Date Samples Shipped _____ Control Number _____
AFFIX SAMPLE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples _____ Site I.D. _____	Sample Type _____ Date Samples Shipped _____ Control Number _____
AFFIX SAMPLE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples _____ Site I.D. _____	Sample Type _____ Date Samples Shipped _____ Control Number _____
AFFIX SAMPLE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples _____ Site I.D. _____	Sample Type _____ Data Samples Shipped _____ Control Number _____

EXAMPLE ONLY

Los Alamos National Laboratory Environmental Restoration
CHAIN OF CUSTODY/REQUEST FOR ANALYSIS

Date: _____ Control No. (Pre-printed Number)

Technical Area _____ Send Lab Report to: _____ MS _____

Operable Unit _____ Site Work Plan _____

OU Contact _____ Date Samples Shipped _____

Contact Phone No. _____ Date Lab Report Required _____

Field Unique Sample #/ID (Write in Sample ID Number in space below.)	Date & Time Collected	GRAB	COMP	Sample Container Volume/mat'l	Matrix (Liquid, Soil, Core, Sludge, Etc.)	Preservative	ANALYSIS REQUESTED		REMARKS (Condition of receipt, etc.)
							TEST	METHOD	

EXAMPLE ONLY

Relinquished by: (Signature): Affiliation:	Date:	Relinquished by: (Signature): Affiliation:	Date:	Relinquished by: (Signature): Affiliation:	Date:
Received by: (Signature): Affiliation:	Time:	Received by: (Signature): Affiliation:	Time:	Received by: (Signature): Affiliation:	Time:

POSSIBLE HAZARD IDENTIFICATION:
(Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances.)
Radiological ____ Highly Toxic ____ Flammable ____ Skin Irritant ____ Non-hazard ____ Other ____

SAMPLE DISPOSAL:
Return to client ____ Disposal by Lab ____ Archive ____ (Indicate number of months) ____

COMMENTS: _____

SAMPLING TEAM (Print Names and Initial): _____

WHITE - To accompany samples YELLOW - Project Leader PINK - Copy to

Los Alamos National Laboratory Environmental Restoration
CUSTODY SEAL

(Example Only)

Los Alamos
Los Alamos National Laboratory
Los Alamos, NM 87545

LAB SAMPLE

DO NOT TAMPER

Date _____

Initials _____

This label is red.

Los Alamos National Laboratory Environmental Restoration
DAILY ACTIVITY LOG

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

Site Work Plan _____

Signature _____

Comments:

EXAMPLE ONLY

☐ CHECK HERE IF CONTINUED ON BACK OF THIS SHEET.

PURGING OF WELLS FOR REPRESENTATIVE SAMPLING OF GROUNDWATER

1.0 PURPOSE

This procedure describes methods for evacuating stagnant water from a well bore in sufficient quantities so that water samples collected are representative of the formation interval open to the well bore.

2.0 SCOPE

2.1 Applicability

This procedure for the purging of wells is applicable to field team members responsible for collecting groundwater samples for the Environmental Restoration program.

2.2 Training

The field team members are responsible for obtaining representative water samples for analysis. The field team members must document that this procedure has been read and understood along with all of the procedures in Section 1.0, General Instructions.

3.0 DEFINITIONS

A. Hydrogen-Ion activity (pH): The effective concentration (activity) of dissociated hydrogen ions [H+] determines the acidity of an aqueous solution.

B. Redox-potential (Eh): Chemical reactions whereby a participating element changes its valence state, losing or gaining orbital electrons. This may be referred to as oxidation-reduction potential.

C. Specific (Electrical) conductance: A measure of the ease with which a conduction current flows through a substance under the influence of an applied electric field. The conductance measurement provides an indication of ion concentration.

4.0 BACKGROUND AND/OR CAUTIONS

Groundwater that remains in the well bore is subject to chemical reactions over time that may significantly alter the composition of the formation water that initially entered the borehole. This water will not be representative of the water in the formation.

Upon exposure to atmospheric pressure and atmospheric oxygen content, the well water oxidation-reduction potential (Eh) and hydrogen-ion activity (pH) are subject to change. Reactions with the casing material may also affect water composition. Solubility may increase, dissolving constituents that under normal conditions would remain in the formation; or solubility

may decrease, precipitating constituents that under normal conditions would migrate through the aquifer in solution.

Ideally, a well should be purged until the water temperature, specific conductivity, and pH stabilize, where it is possible to collect groundwater samples representative of the formation water. However, the well may be purged dry before this state is reached. Samples collected after the well has been purged can then be sent to a laboratory for analysis.

The choice of equipment for well evacuation depends on the well yield, depth to water, casing diameter, the constituents to be analyzed for, and the requirements in the Site Work Plan and Sampling and Analysis Plan.

The decision to use any well evacuation system, whether listed below or not, should be based on what is best for that particular situation. Descriptions of a few well-evacuation systems, their advantages, and their limitations follow:

4.1 Bailer

With a stainless steel or Teflon™ bailer, water is removed from the well bore by a vessel of known volume. The vessel fills with water, and the unit is retrieved with a line or rope. The bailer purges the well's entire water column by removing standing water at the groundwater surface. Recharge is pulled into the well from the screened interval below.

For shallow, small-diameter wells with low yields, evacuation of the well by bailer is recommended. Bailers are mechanically simple, lightweight and highly portable, constructed in many sizes, and require no external power source. Bailers are easily operated and cleaned and are inexpensive. In addition, considerable time and cost savings are possible by using dedicated equipment to reduce the decontamination task and to limit the possibility of cross-contamination (EPA 1991) The primary limitation of bailers is their limited-volume purging capability, especially in deep wells where purging is labor intensive and time consuming. Bailers may also disturb the water by the pressure changes created by purging. Another disadvantage is that sampling personnel are directly exposed to any contaminants present.

4.2 Reciprocating Piston Submersible Pump

The pump assembly is suspended from the discharge tubing and submerged in the well. Water is transported through the discharge tube to the surface by piston action. A portable air compressor is used to drive the pump.

The reciprocating piston submersible pump is a portable system that can purge wells with water depths up to 500 ft. These pumps develop high pumping rates and can be operated in 2-inch-diameter wells. The pump is self-priming, and the compressed gas (air or nitrogen) that drives the pump does not contact the purged water. The pump is constructed from stainless steel or Teflon™ and can be decontaminated easily.

4.3 Electric Submersible Pump

The pump assembly is suspended from the discharge tubing and submerged in the well. The turbine in the pump bowl creates sufficient pressure to force water up the discharge pipe. Usually, a portable generator is required for power to the electric pump (unless electricity is available) and a truck-mounted winch may be required to move and lower the pump into the well.

The submersible pump may be used for purging both shallow, small-diameter wells and deep, large-diameter wells requiring large rates of discharge. Manufacturers offer small diameter stainless steel and Teflon™ constructed pumps capable of efficient purging at significant depths. The pump may be portable and self-contained.

Disadvantages of the submersible pump are (1) the pump can be difficult to decontaminate and transport along with auxiliary equipment; (2) the pump motor may be damaged by dry pumping, and the gears may be damaged by water containing high levels of suspended sediment; (3) large-capacity pumps are expensive; and (4) with negative displacement, pumps can significantly aerate the sample, thus changing the in situ chemistry and stripping low molecular weight volatiles. Careful monitoring during operation is needed to obtain optimum pump performance and to preclude the possibility of equipment damage.

Site workers preparing for field operations should read and understand the procedures outlined in LANL-ER-SOPs 2.0, Health and Safety in the Field. In addition, site workers should refer to site-specific Operable Unit Health and Safety plans for the particular health and safety equipment to be used.

5.0 EQUIPMENT

Equipment required for this procedure is listed in Attachment A.

6.0 PROCEDURE

The following procedure for purging a well is applicable regardless of which pump has been selected to best meet the constraints of the job. Procedural variations or additions specific to the type of pump used directly follow the general instructions.

A. Make provisions for proper storage and disposal of the extracted well water, as described in SOP-01.06, Management of RFI-General Wastes, and coordinate sampling effort with the Sample Coordination Facility.

B. Assemble the equipment and supplies listed in Attachment A.

may decrease, precipitating constituents that under normal conditions would migrate through the aquifer in solution.

Ideally, a well should be purged until the water temperature, specific conductivity, and pH stabilize, where it is possible to collect groundwater samples representative of the formation water. However, the well may be purged dry before this state is reached. Samples collected after the well has been purged can then be sent to a laboratory for analysis.

The choice of equipment for well evacuation depends on the well yield, depth to water, casing diameter, the constituents to be analyzed for, and the requirements in the Site Work Plan and Sampling and Analysis Plan.

The decision to use any well evacuation system, whether listed below or not, should be based on what is best for that particular situation. Descriptions of a few well-evacuation systems, their advantages, and their limitations follow:

4.1 Bailer

With a stainless steel or Teflon™ bailer, water is removed from the well bore by a vessel of known volume. The vessel fills with water, and the unit is retrieved with a line or rope. The bailer purges the well's entire water column by removing standing water at the groundwater surface. Recharge is pulled into the well from the screened interval below.

For shallow, small-diameter wells with low yields, evacuation of the well by bailer is recommended. Bailers are mechanically simple, lightweight and highly portable, constructed in many sizes, and require no external power source. Bailers are easily operated and cleaned and are inexpensive. In addition, considerable time and cost savings are possible by using dedicated equipment to reduce the decontamination task and to limit the possibility of cross-contamination (EPA 1991) The primary limitation of bailers is their limited-volume purging capability, especially in deep wells where purging is labor intensive and time consuming. Bailers may also disturb the water by the pressure changes created by purging. Another disadvantage is that sampling personnel are directly exposed to any contaminants present.

4.2 Reciprocating Piston Submersible Pump

The pump assembly is suspended from the discharge tubing and submerged in the well. Water is transported through the discharge tube to the surface by piston action. A portable air compressor is used to drive the pump.

The reciprocating piston submersible pump is a portable system that can purge wells with water depths up to 500 ft. These pumps develop high pumping rates and can be operated in 2-inch-diameter wells. The pump is self-priming, and the compressed gas (air or nitrogen) that drives the pump does not contact the purged water. The pump is constructed from stainless steel or Teflon™ and can be decontaminated easily.

C. Verify that the equipment and meters are in good working order (obtain and review the manufacturer's operations, calibration, and instructions for the pH and conductivity meters to be used.) Record all calibration information on the Daily Activity Log in SOP-01.04.

D. In the field, locate the monitor wells to be sampled, and the appropriate staging and decontamination areas. If the amount of contamination differs significantly between wells, plan to purge and sample the least contaminated wells first.

E. Secure the work zone. Preclude passerby traffic through the work zone with barriers or cones. Place new plastic sheeting on the ground around the well in case something is dropped or must be placed on the ground.

F. Decontaminate the equipment that will come in contact with the sample water before sampling the first well, and between samples, in accordance with SOP-02.07, General Equipment Decontamination. It is preferable that new rope be used for bailers.

G. Measure and record the depth to water in the well, if possible, from the reference point established for that well, in accordance with SOP-07.02, Fluid Level Measurement.

H. To determine the well bore volume use the following relationship:

$$V(\text{gallons}) = \frac{(d^2)\pi}{4} \quad (h_2 - h_1) \times 7.48$$

Where V = the volume in gallons
π = the constant 3.1416
d = the well diameter, in feet
h_2 = the well's total depth, in feet
h_1 = the depth to water, in feet

Determine the height of the water column standing in the well by subtracting depth to water, in feet, from the total well depth. Measure the well's diameter, in feet. Calculate the volume in gallons and enter these data on the Water Quality Sampling Record found in SOP-06.02.

I. A minimum of three casing volumes must be extracted before sampling. If the well is pumped dry before sampling, refer to the Sampling Plan for guidance.

J. Set the intake in the well at the approximate midpoint of the screened interval, if applicable or possible, and begin extraction.

K. If required by the site safety officer or the Site Health and Safety Plan (SHSP), monitor the air above the wellhead and the breathing zone for explosion and fire potential and for toxicity, using SHSP approved equipment.

L. Record the discharge rate (usually by calibrated bucket and stopwatch) and the time periodically, and calculate and tabulate the gallons discharged since the start of pumping. Also measure and record the temperature and specific conductance of the well fluid, as described in SOP-06.02, Field Analytical Measurements on Groundwater Samples.

M. When the temperature and specific conductance have begun to stabilize, also begin to monitor the pH. If a flow-through cell is used, all pH readings should be made while the groundwater flow through the cell is halted, to eliminate streaming potentials.

N. When a minimum of three times the casing volume of fluid has been extracted, and field pH, specific conductance, and temperature have stabilized, the well is ready to sample. If these parameters do not stabilize, refer to the Site-Specific Work Plan and Sampling Plan for guidance.

O. Record the final, stable readings of pH, specific conductance, and temperature on the field parameter section of the form.

P. After shutting down the pump, measure and record the water-level drawdown in the well. These data may provide limited information about saturated zone hydraulics.

Q. When sampling is completed, or at the end of the day, carefully clean the outside of the meters with a damp disposable towel to remove any visible dirt. Return them to a secure area and check the battery charge.

R. Decontaminate the pump assembly and other pieces of equipment that contacted the well fluid in accordance with SOP-02.07.

S. Restore the site to its original presampled condition.

T. Store the extracted groundwater as directed in the Site Work Plan and Sampling and Analysis Plan until its composition and proper disposal can be determined.

7.0 REFERENCES

The following procedures are directly associated with this procedure and should be reviewed before field operations:

LANL-ER-SOPs in Section 1.0, General Instructions.
LANL-ER-SOPs in Section 2.0, Health and Safety in the Field.
LANL-ER-SOP-06.02, Field Analytical Measurements of Groundwater Samples.
LANL-ER-SOP-07.02, Fluid Level Measurement.

Barcelona, M. J., J. P. Gibb, J. A. Helfrich, and E. E. Garske. 1985. "Practical Guide to Groundwater Sampling." U.S. Environmental Protection Agency report EPA/600/2-85/104. U.S. Government Printing Office, Washington, D.C.

EPA, 1986. "RCRA Ground Water Monitoring Technical Enforcement Guidance Document." OSWER, Washington, D.C.

EPA, Region IV, 1991. "Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual." Environmental Services Division, Athens, GA.

Korte, N., and P. Kearl. 1984. "Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells." U.S. Department of Energy, Grand Junction, CO.

Morrison, R.D. 1983. "Groundwater Monitoring Technology, Procedures, Equipment and Applications." TIMCO Manufacturing, Inc., 85-90, Evanston, IL.

8.0 RECORDS

The following records are generated as a result of this procedure:

A. Daily Activity Logs which may include the following:

- Instrumentation and calibration information
- Order of sampling of the wells, and any comments regarding relative levels of contaminants
- Determination of casing volumes
- Health and safety monitoring
- Well discharge rate.

B. Water Quality Sampling Record, as appropriate

C. Water Quality Stabilization Record, as appropriate

D. Fluid Level Measurement Record, as appropriate

E. Completed Chain-of-Custody/Request for Analysis Form.

9.0 ATTACHMENT

A. Equipment and Supplies Checklist for Purging of Wells for Representative Sampling of Groundwater

EQUIPMENT AND SUPPLIES CHECKLIST FOR PURGING OF WELLS FOR REPRESENTATIVE SAMPLING OF GROUNDWATER

_____ Purging pump or bailer

_____ Water level measurement device

_____ Calculator

_____ Thermometer

_____ Conductivity meter (and extra cup)

_____ pH meter (and extra probe)

_____ Air compressor or bottled nitrogen (as needed)

_____ Standard reference solutions for calibrating specific conductance and pH meters

_____ Portable generator, if needed

_____ 55-gallon drums or other water storage containers

_____ Flow measuring equipment

_____ Daily Activity Log

_____ Water Quality Sampling Record forms

_____ Water Quality Stabilization Record forms

_____ Fluid Level Measurement Record forms

_____ Chain-of-Custody/Request for Analysis forms

_____ Sample Collection Logs

_____ Variance Log

_____ Custody Seals

_____ Unique Sample Stickers

_____ Sample Labels

FIELD ANALYTICAL MEASUREMENTS OF GROUNDWATER SAMPLES

1.0 PURPOSE

This procedure describes acceptable methods for obtaining field measurements of the temperature, specific conductance, pH, alkalinity, turbidity, and dissolved oxygen of groundwater that closely represent the conditions that exist in the aquifer for the Environmental Restoration (ER) program.

2.0 SCOPE

2.1 Applicability

This procedure is applicable for field analytical measurements on groundwater samples for the ER program.

2.2 Training

The field team leader is responsible for ensuring that field team members collecting samples are practiced in the operation and calibration of the field analytical equipment. In addition all field team members using this procedure must document that they have read and understand this procedure, and the procedures in Section 1.0, General Instructions.

3.0 DEFINITIONS

A. Alkalinity: Various soluble mineral salts found in natural water and arid soils having a pH greater than 7. In water analysis it represents the carbonates, lucarbonates, bicarbonates, hydroxides, and occasionally the horates, chlorates, silicates, and phosphates.

B. pH: A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with alkalinity and decreasing as acidity increases. Originally stood for the words "potential of hydrogen."

C. Specific conductance: A measure of the ease with which an applied electric field can flow through a material. It is the reciprocal of resistivity and is measured in micromhos per centimeter at 25°C.

D. Dissolved oxygen: The amount of oxygen dissolved in water, in parts per million (ppm) by weight, or in milligrams per liter (mg/l).

E. Turbidity (nephelometric): A measure of the intensity of light scattered by sample particulates relative to a standard reference suspension. The range of water turbidity is measured from 0 to 40 Nephelometric Turbidity Units (NTU). Five NTU is the sample acceptance criteria (EPA 1986).

4.0 BACKGROUND AND/OR CAUTIONS

Field analytical parameters are normally measured along with well purging and groundwater sampling activities. Measurements of temperature, turbidity, specific conductance, and pH, done in advance of sampling, are also used as the final indication that a well is purged of stagnant water. The alkalinity and dissolved oxygen of groundwater are highly dependent on the availability and partial pressures of carbon dioxide and oxygen in the underground environment. Preservation of samples selected for turbidity analyses is not practical. Because the value of these parameters begins to change with prolonged exposure to atmospheric conditions, well head measurements generally yield the most accurate representation of in situ values.

Some properties or constituents in groundwater begin to change within minutes to hours of sample collection. If dependable results are required to more accurately characterize the in situ chemical properties of groundwater, immediate analysis may be advisable. The development of sophisticated and reliable portable field equipment now makes the analysis for many unstable constituents or properties possible at the collection site.

Site workers preparing for field operations should read and understand the procedures outlined in LANL-ER-SOPs, Section 2.0, Health and Safety in the Field. In addition, site workers should refer to site-specific Operable Unit Health and Safety plans for the particular health and safety equipment to be used.

5.0 EQUIPMENT

Equipment to implement this procedure is listed in Attachment A.

6.0 PROCEDURE

A. For quality control, field determinations should be repeated, from the beginning, on the same samples that are selected for lab replicates. Samples to be replicated may be selected on the basis of sample availability, but generally constitute 10 to 20% of the samples collected (SOP-01.05, Field Quality Control Samples, and the Sampling and Analysis Plan for details).

6.1 Field Parameter Measurement

A. Review SOP-06.01, Purging of Wells for Representative Sampling of Groundwater, SOP-01.04, Sample Control and Field Documentation, and SOP-01.06, Management of RFI-Generated Waste.

B. Assemble the equipment and supplies listed in Attachment A and the manufacturer's operations manuals.

C. Verify that the equipment/meters are in good working order. (Review the manufacturer's instruction manuals for operation and calibration of the instruments to be used in the field.)

D. Refer to the site-specific documentation to locate the wells to be sampled and the appropriate staging and decontamination areas. If the amount of known or suspected contamination differs significantly between wells, plan to sample the least contaminated first.

E. Coordinate all sampling efforts with the Sample Coordination Facility.

The remainder of this section contains individual descriptions of field analytical methods for measuring temperature, specific conductance, pH, dissolved oxygen, and turbidity. Refer to the site-specific documents for details about the number, types, and locations of measurements to be made.

6.1.1 Temperature

A. Obtain an immersion thermometer or thermocouple.

B. Ascertain that the field instrument has been calibrated to within ± 1.0°C against a thermometer calibrated to National Institute of Standards and Technology. (The field instrument is compared to the reference thermometer at two different temperatures that bracket the temperature range normally measured in the field. Calibration must be done at least annually, and whenever the instrument is suspected of misuse, damage, or erratic or erroneous readings.)

C. Read the temperature immediately upon stabilization, and record on the Water Quality Sampling Record (Attachment B).

6.1.2 Specific (Electrical) Conductance

A. Obtain a specific-conductance meter that is battery operated, equipped with temperature compensator, and reads directly in micromhos/cm at 25°C. This meter is recommended to save time in converting resistance values to specific conductance and to ensure that the value is read in the field. Record reading on the Water Quality Sampling Record.

B. For all meters, follow the instructions in the manufacturer's operations manual for use and calibration of the equipment.

6.1.3 pH

A. Obtain a pH meter to be used for field measurements and the appropriate operation manual.

B. Operate the meter in accordance with the manufacturer's instructions. For purposes of this procedure, record pH value to the nearest 0.02 unit, on the Water Quality Sampling Record.

6.1.4 Dissolved Oxygen

A. Dissolved oxygen may be measured by several methods (dissolved oxygen meter or colorimeter).

B. Follow instructions in the operation manual supplied with the instrument, and record the final value of dissolved oxygen concentration to the nearest 0.1 mg/l on the Water Quality Sampling Record.

6.1.5 Turbidity

A. Obtain a turbidimeter (Hach Model 2100, 2100A or acceptable equivalents) capable of turbidity measurements (Nephelometric) in conformance with EPA's Method 180.1 (EPA 1983).

B. Operate the equipment in conformance with the manufacturer's instructions and EPA's Method 180.1.

C. Record the results of turbidity testing in the "comments" sections of the Water Quality Sampling Record and the Groundwater Stablization Record.

6.2 Documentation

A. Obtain a sufficient number of the appropriate ER program field record and instrument test forms (refer to Attachments B through E) to record all measurements. Also refer to SOP-06.13 and SOP-01.04.

B. Additional comments may be provided on the Daily Activity Log, refer to SOP-01.04

C. Refer to Attachment F, Data Form Completion, for detailed documentation instructions for most forms.

6.3 Postoperation Activities

A. When the work is completed, or at the end of the day, carefully clean the outside of the sampling instruments with a damp disposable towel to remove any visible dirt. Clean and decontaminate equipment per SOP-02.07, and replenish supplies.

B. Restore the site to the presampling conditions and fill open sampling holes as described in the site-specific documents.

C. Prepare samples and transport according to SOP-01.04, Sample Control and Field Documentation.

D. Return equipment to the equipment manager. Report malfunction, performance deviations, or damage.

7.0 REFERENCES

The following procedures directly relate to this procedure and should be reviewed before field operations:

LANL-ER-SOPs in Section 1.0, General Instructions.
LANL-ER-SOPs in Section 2.0, Health and Safety in the Field.
LANL-ER-SOP-06.01, Purging of Wells for Representative Sampling of Groundwater.
LANL-ER-SOP-06.13, Surface Water Sampling.

Bates, R. L. and J. J. Jackson. 1984. "Dictionary of Geological Terms," Third Edition prepared by the American Geological Institute, Alexandria, VA.

Driscol F., 1986. "Groundwater and Wells," Second Edition. Johnson Division, St. Paul, MN.

EPA. 1983. "Methods for Chemical Analysis of Water and Wastes." U.S. Environmental Protection Agency document EPA/600/4-79-020. U.S. Government Printing Office, Washington, D.C.

EPA. 1986. RCRA Ground Water Monitoring Technical Enforcement Guidance Document. OSWER, U.S. Government Printing Office, Washington, D.C.

Korte, N., and P. Kearl. 1984. "Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells." DOE, Grand Junction, CO.

U.S. Geological Survey. 1977. 11 Chapter 2 - "Groundwater" prepared January 1980 in National Handbook of Recommended Methods for Water Data Acquisition. Office of Water Data Coordination, U.S. Geological Survey, U.S. Government Printing Office: 1981-341-614/131, Washington, D.C.

8.0 RECORDS

A. Completed Water Quality Sampling Record

B. Completed Water Quality Stabilization Record

C. Completed Daily Activity Log which may include any additional comments or deviations from the procedure.

9.0 ATTACHMENTS

A. Equipment and Supplies Checklist for Field Analytical Measurements of Groundwater Samples

B. Water Quality Sampling Record

C. Water Quality Stabilization Record

D. Data Form Completion

EPA, 1986. "RCRA Ground Water Monitoring Technical Enforcement Guidance Document." OSWER, Washington, D.C.

EPA, Region IV, 1991. "Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual." Environmental Services Division, Athens, GA.

Korte, N., and P. Kearl. 1984. "Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells." U.S. Department of Energy, Grand Junction, CO.

Morrison, R.D. 1983. "Groundwater Monitoring Technology, Procedures, Equipment and Applications." TIMCO Manufacturing, Inc., 85-90, Evanston, IL.

8.0 RECORDS

The following records are generated as a result of this procedure:

A. Daily Activity Logs which may include the following:

- Instrumentation and calibration information
- Order of sampling of the wells, and any comments regarding relative levels of contaminants
- Determination of casing volumes
- Health and safety monitoring
- Well discharge rate.

B. Water Quality Sampling Record, as appropriate

C. Water Quality Stabilization Record, as appropriate

D. Fluid Level Measurement Record, as appropriate

E. Completed Chain-of-Custody/Request for Analysis Form.

9.0 ATTACHMENT

A. Equipment and Supplies Checklist for Purging of Wells for Representative Sampling of Groundwater

EQUIPMENT AND SUPPLIES CHECKLIST FOR FIELD ANALYTICAL MEASUREMENTS OF GROUNDWATER SAMPLES (Continued)

Chain-of-Custody/Request for Analysis Forms

Sample Collection Logs

Custody Seals

Unique Sample Stickers

Sample Labels

C. Verify that the equipment/meters are in good working order. (Review the manufacturer's instruction manuals for operation and calibration of the instruments to be used in the field.)

D. Refer to the site-specific documentation to locate the wells to be sampled and the appropriate staging and decontamination areas. If the amount of known or suspected contamination differs significantly between wells, plan to sample the least contaminated first.

E. Coordinate all sampling efforts with the Sample Coordination Facility.

The remainder of this section contains individual descriptions of field analytical methods for measuring temperature, specific conductance, pH, dissolved oxygen, and turbidity. Refer to the site-specific documents for details about the number, types, and locations of measurements to be made.

6.1.1 Temperature

A. Obtain an immersion thermometer or thermocouple.

B. Ascertain that the field instrument has been calibrated to within ± 1.0°C against a thermometer calibrated to National Institute of Standards and Technology. (The field instrument is compared to the reference thermometer at two different temperatures that bracket the temperature range normally measured in the field. Calibration must be done at least annually, and whenever the instrument is suspected of misuse, damage, or erratic or erroneous readings.)

C. Read the temperature immediately upon stabilization, and record on the Water Quality Sampling Record (Attachment B).

6.1.2 Specific (Electrical) Conductance

A. Obtain a specific-conductance meter that is battery operated, equipped with temperature compensator, and reads directly in micromhos/cm at 25°C. This meter is recommended to save time in converting resistance values to specific conductance and to ensure that the value is read in the field. Record reading on the Water Quality Sampling Record.

B. For all meters, follow the instructions in the manufacturer's operations manual for use and calibration of the equipment.

6.1.3 pH

A. Obtain a pH meter to be used for field measurements and the appropriate operation manual.

WATER QUALITY SAMPLING RECORD, Continued

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION
WATER QUALITY SAMPLING RECORD, Continued

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

Site Work Plan: _____

Signature: _____

AFFIX FIRST SAMPLE STICKER HERE

AFFIX LAST SAMPLE STICKER HERE

BORE VOL CALCULATION (GAL)*

$\frac{d^2 \pi}{4} (h_1 - h_2) \times 7.48$

*Depth of Well (h_2) (Ft) _____

Depth-to-water (h_1) (Ft) _____

Well Diameter (Ft) _____

One Bore volume (Gal) _____

Screened Interval (Ft) _____

Instrument(s) Used _____

*Groundwater Only

SAMPLING INFORMATION

Withdrawal Devices _____

Filter Size _____

Thermometer ID _____

Ec Meter ID _____

pH Meter ID _____

Pump ID _____

CALIBRATION INFORMATION

Date/Time of Last Ec Calibration _____ Lot No. _____ Date _____

Time of pH Calibration _____

For Standard Solution pH 7, Instrument Reading _____ pH solution Lot No. _____ Date _____

For Standard Solution pH 4, Instrument Reading _____ pH solution Lot No. _____ Date _____

For Standard Solution pH 10, Instrument Reading _____ pH solution Lot No. _____ Date _____

SHIPPING INFORMATION

Lab(s) Shipped To: _____ _____ _____

Date(s) Shipped: _____ _____ _____

Method of Shipment: _____ _____ _____

COMMENTS: _____

EXAMPLE
CONTACT THE PROGRAM OFFICE FOR MASTER FORMS

THIS IS CONTINUED ON BACK OF THIS SHEET

C. Prepare samples and transport according to SOP-01.04, Sample Control and Field Documentation.

D. Return equipment to the equipment manager. Report malfunction, performance deviations, or damage.

7.0 REFERENCES

The following procedures directly relate to this procedure and should be reviewed before field operations:

LANL-ER-SOPs in Section 1.0, General Instructions.
LANL-ER-SOPs in Section 2.0, Health and Safety in the Field.
LANL-ER-SOP-06.01, Purging of Wells for Representative Sampling of Groundwater.
LANL-ER-SOP-06.13, Surface Water Sampling.

Bates, R. L. and J. J. Jackson. 1984. "Dictionary of Geological Terms," Third Edition prepared by the American Geological Institute, Alexandria, VA.

Driscol F., 1986. "Groundwater and Wells," Second Edition. Johnson Division, St. Paul, MN.

EPA. 1983. "Methods for Chemical Analysis of Water and Wastes." U.S. Environmental Protection Agency document EPA/600/4-79-020. U.S. Government Printing Office, Washington, D.C.

EPA. 1986. RCRA Ground Water Monitoring Technical Enforcement Guidance Document. OSWER, U.S. Government Printing Office, Washington, D.C.

Korte, N., and P. Kearl. 1984. "Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells." DOE, Grand Junction, CO.

U.S. Geological Survey. 1977. 11 Chapter 2 - "Groundwater" prepared January 1980 in National Handbook of Recommended Methods for Water Data Acquisition. Office of Water Data Coordination, U.S. Geological Survey, U.S. Government Printing Office: 1981-341-614/131, Washington, D.C.

DATA FORM COMPLETION

Use an indelible dark ink pen. Make an entry in each blank. For entry blanks for which no data are obtained, enter UNK for Unknown, NA for Not Applicable, or ND for Not Done. To change an entry, draw a single line through it, add the correct information above it, and date and initial the change. For all forms, complete the following information:

1. Technical Area (TA). Two-digit number indicating the TA in which the sampling is being done or sample is being studied.

2. Operable Unit. Four-digit number indicating the operable unit in which the sampling is being done or sample is being studied.

3. Sample Identification:

   - If the Daily Activity Log addresses only one sample, attach a sticker from the batch of stickers that match the sticker number on the sample, and line through the box labeled "Attach Last Sample Number Here."

   - If the Daily Activity Log addresses a sequential number of samples, put the first matching sample sticker in the box marked "First" and put the last matching sample sticker in the box marked "Last."

   - If sample identifiers used are not sequential, be sure to affix the lowest sample sticker number in the left box, record the remaining sample identifiers on the form ano Daily Activity Log, and line through the "Last" box.

4. Log Date and Time. The date and time when the measurement was made, in the following formats: DD-MMM-YY (e.g., 01-JAN-88) and the 24-hour clock time (e.g., 0837 for 8:37 a.m. and 1912 for 7:12 p.m.).

5. Sheet Number. Number all the sheets that are used for this activity, by day or by some practical unit.

6. Weather and Other Comments. Record all other conditions pertinent to the sample collection in this section on the Daily Activity Log in SOP-01.04.

For the specific following forms, complete the additional information as indicated below.

WATER QUALITY SAMPLING RECORD

1. Lot Control Number. A two-digit number denoting that a given set of samples should be analyzed as a lot or group. (Normally, this number is not assigned by persons in the field collecting surface water samples.)

EQUIPMENT AND SUPPLIES CHECKLIST FOR FIELD ANALYTICAL MEASUREMENTS OF GROUNDWATER SAMPLES

_____ For Temperature

Calibrated, partial-immersion thermometer graduated in 0.5°C or 1.0° F within the range of 0-50°C

or

A thermocouple calibrated within ± 0.5°C greater than the range 0-50°C or expected use.

Manufacturer's operation manual.

_____ For Specific Conductance

Specfic conductance meter and the manufacturer's operation manual.

_____ For pH

pH meter and manufacturer's operations manual.

Standard pH solution.

_____ For Dissolved Oxygen

Colorimeter and manufacturer's operation manual,

or

Oxygen meter with sensor and manufacturer's operation manual.

_____ For Turbidity

Equipment specified in EPA's "Methods for Chemical Analyses of Water and Wastes," Method 180.1 with a range of 0 to 40 Nephelometric Turbidity Units.

_____ Forms

Water Quality Sampling Record

Water Quality Stabilization Record

Daily Activity Log

15. Depth to water. Record depth in feet for groundwater sampling.

16. Well Diameter. Record diameter in feet for groundwater sampling.

17. One Bore Volume. Calculate volume in gallons using the equation on the form.

18. Screened Interval. Record in feet.

19. For a well, include information on the left side of the continuation page.

20. Instruments Used. The types of instruments used to obtain measurements, monitor air quality, or facilitate the collection of a sample or test performance.

21. Calibration Information. After performing the alkalinity titration test and immediately before sample collection, record the following information:

    a. Date/Time of Last Ec Calibration. Date and time that the specific conductivity meter was last calibrated.

    b. Time of pH Calibration. Time the pH meter was calibrated.

    c. Standard Solution pH Readings. The pH readings are to be recorded as the probe is immersed in standard solutions of pH 7.0, 4.0 and 10.0. Include expiration dates and lot numbers of the standard solutions.

22. Shipping Information. Information that includes the date, method, laboratory where the samples were shipped, and a comments section.

23. Comments. Add results of turbidity testing.

WATER QUALITY STABILIZATION RECORD (Attachment C)

This form contains data that are collected during well purging. These are described below.

1. Minimum purge volume. Total volume of well water to be extracted, at a minimum, is three to five well volumes before sampling may begin.

2. Time. The time when a field measurement of purged water was performed in the format HH:MM.

3. Total Volume Withdrawn. Using a bucket or flowmeter, the field sampler will note the number of gallons of water purged from the well at the time that a field measurement is taken. This entry is cumulative and represents the total volume of water purged before sampling may begin. A second column is provided so that the field sampler can equate

WATER QUALITY SAMPLING RECORD

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION
WATER QUALITY SAMPLING RECORD

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

Site Work Plan: _____

Signature: _____

AFFIX FIRST SAMPLE STICKER HERE

AFFIX LAST SAMPLE STICKER HERE

Well Number: _____

_____ Surface Lot Control No. _____

_____ Groundwater Sample Type _____

Sampling Period: Start _____ Complete _____

Sampling Method _____ Date Sent _____

COMMENTS: _____

*Initial Groundwater Depth _____ *Sample Depth _____

EXAMPLE
CONTACT THE PROGRAM OFFICE FOR MASTER FORMS

PARAMETER MEASUREMENTS:

Potential of Hydrogen-Ion Activity	pH	S.U.	_____
Specific Conductance	Ec	umhos/cm	_____
Temperature	Tmp	°C	_____
Dissolved Oxygen	DO	mg/l	_____

* Groundwater samples only

SAMPLE TYPES

D - Duplicate
T - Trip
F - Field
R - Replicate
K - Known
A - Acid Blank

SAMPLING METHODS:

D - Depth Integrated
B - Bailer
C - Composite
G - Grab
AL - Air Lift Sampler
BP - Bladder Pump
PP - Peristaltic Pump
SL - Suction Lift Pump
SP - Submersible Pump
O - Other

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WATER QUALITY STABILIZATION RECORD

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION
WATER QUALITY STABILIZATION RECORD

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

Site Work Plan: _____

Signature: _____

TIME	TOTAL VOLUME WITHDRAWN		Ph	Ec (umhos/cm)	TEMP (°C)	COMMENTS
	(Gals)	(Bore Volume)				

EXAMPLE
CONTACT THE PROGRAM OFFICE FOR MASTER FORMS

☐ CHECK HERE IF CONTINUED ON BACK OF THIS SHEET

cleaner than other pumps. More care, however, must be exercised when sampling with them because the flow rate is not controllable and there is a greater potential for splashing and aeration of the sample.

C. Syringe samplers. Only a limited number of commercial, syringe-type samplers are available (two vendors are IEA and TIMCO). These devices are limited in sample volume and are specific to sampling for volatiles. Essentially, they operate with an evacuated chamber that is lowered down the well and allowed to fill from the pressure of the water. The entire mechanism is then brought to the surface with the sample. The sample can then be transferred to a sample vial, or the entire unit may be sent as the sample container, if preservation with chemical additives is not desired.

D. Bailers. The Teflon™ closed top, bottom charging type is the most appropriate bailer to collect water samples for volatile analysis. The bottom emptying device with a tap is also desirable. Several vendors provide acceptable designs. Generally, bailers can collect a representative sample, provided that the sampling personnel use extra care in the collection process.

Construction materials for pumps, bailers, and tubing are limited to stainless steel, Teflon™, and glass. The tendency of organics to leach into and out of many materials makes the selection of materials critical for these trace analyses. Plastics such as Tygon, for example, will be avoided. There are numerous ways of introducing foreign contaminants into a sample; these must be avoided by following strict sampling procedures and using only trained personnel.

Treatment of the sample with sodium thiosulfate preservative is required only when there is residual chlorine in the water. Residual chlorine could cause free radical chlorination and change the identity of the original contaminants.

If floating organics are of concern (as determined by field measurement for floating organics), a representative sample cannot be obtained with confidence.

The sensitivity of the analysis and the fragility of the samples require that all volatile samples are collected in duplicate.

Holding time for the analysis of volatiles is 7 days; vials for volatile organic analysis (VOA) may be kept for up to 14 days when preserved with acid. The samples will be shipped to the EM-9 Sample Coordination Facility (SCF) daily or following each completed sampling effort. The bottles must be shipped on their sides to aid in maintaining the airtight seal during shipment. Sample shippers (coolers) will be sealed with custody seals. They must also be adequately packed and cooled to ensure that they arrive intact. Refer to SOP-01.03, Handling, Packaging, and Shipping of Samples for further instructions.

5.0 EQUIPMENT

Equipment required to implement this procedure is listed in Attachment A.

2. Sample Type. A one-character code distinguishing the type of sample collected. This classification permits the analysis of data for specific groups of samples. The codes are identified on the form.

3. Sampling Method. A two-character code identifying the method used to collect a soil, rock, or water sample. The codes are identified on the form.

4. Well Number. Record number of well sampled.

5. Comments. Includes preservation method, acidified or nonacidified, type of acid (if acid was used to preserve water sample), and any additional information.

6. Parameter Measurements. The measurements listed below are recorded at the time the sample is collected.

   a. Hydrogen-Ion Activity--the pH units at the time of collection.

   b. Specific Conductance--The specific conductance of the water sample in micromhos/cm in (µmhos/cm) at 25°C at the time of collection.

   c. Temperature--The temperature of the water sample in degrees Celsius (°C) at the time of collection.

   d. Dissolved Oxygen--The dissolved oxygen content of the water sample in mg/l at the time of collection.

7. Withdrawal Device. The sampling device used to collect the surface water sample.

8. Filter Size. Size of filter in use.

9. Thermometer ID. The identification of the thermometer used.

10. Conductivity Meter ID. The control number and manufacturer of the meter used to measure the specific conductance of samples or calibration solutions.

11. pH Meter ID. The control number and manufacturer of the meter used to measure the pH of the samples.

12. Pump ID. Identification of the pump in use.

13. Alkalinity Kit ID. Identification and model or serial number of the alkalinity kit used.

14. Depth of well. Record depth in feet for groundwater sampling.

K. If a bailer is used, follow these guidelines:

1. Spread new plastic sheet on the ground around the wellhead, inside a secure, delineated zone, to establish a clean working area.

2. Decontaminate all sampling equipment per SOP-02.07.

3. Cool the bailer and sample containers before use to approximate the groundwater temperature. Avoid exposing them to direct sunlight.

4. Lower the Teflon™ closed top, bottom charging bailer into the water column slowly, noting the depth. Stop when the bailer reaches the well's screened interval.

5. Slowly recover the bailer; either retrieve the bailer, using a reel to collect the cable, or collect the cable in a cleaned stainless steel bucket.

6. Use the bailer's bottom discharge tube (Teflon™) to fill the 40-ml vials by slow drainage.

7. Repeat step 5 as necessary to acquire sufficient sample quantities.

8. The vials (40-ml) should be competely filled to prevent volatilization, and extreme caution should be exercised when filling a vial to avoid any turbulence which could also produce volatilization. The sample should be carefully poured down the side of the vial to minimize turbulence. As a rule, it is best to gently pour the last few drops into the vial so that surface tension holds the water in a "convex meniscus." The cap is then applied and some overflow is lost, but air space in the bottle is eliminated. After capping, turn the bottle over and tap it to check for bubbles. If any bubbles are present, repeat the procedure once. If a second try is required, use a new sample container. When collecting water samples for purgeable organic compounds, duplicate samples should always be collected from each location.

   Water samples to be analyzed for purgeable organic compounds should be stored in 40-ml septum vials with screw cap and Teflon™-silicone disk in the cap to prevent contamination of the sample by the cap. The disks should be placed in the caps (Teflon™ side to be in contact with the sample) by the sample container vendor before the beginning of the sampling program.

9. After each use, the sampling equipment must be decontaminated in accordance with SOP-02.07.

10. A sampling blank should be acquired periodically to test the decontamination procedure's efficiency.

11. A trip blank of distilled deionized water should be carried throughout the sampling, preservation, and shipping process.

gallons as bore volumes purged (see equation on page 2 of the Water Quality Sampling Record).

4. pH. The pH readings of water sampled during the purging process.

5. Ec. The specific conductance readings of water sampled during the purging process in µmhos/cm.

6. Temp (°C). The temperature of the water sampled during the purging process.

7. Comments. Includes preservation method, acidified or nonacidified, type of acid (if acid was used to preserve water sample), and any additional information. Add results of turbidity testing.

EPA. 1981. "Manual of Groundwater Quality Sampling Procedures." U.S. Environmental Protection Agency report EPA-600/2-81-160. Washington, D.C.

EPA. 1982. "Handbook for Sampling and Sample Preservation of Water and Wastewater," U.S. Environmental Protection Agency report EPA-600/4-82-029. Washington, D.C.

EPA. 1985. "Practical Guide for Groundwater Sampling.: U.S. Environmental Protection Agency report EPA/600/2-85/104, September 1985. Washington, D.C.

EPA. 1986. "RCRA Ground Water Monitoring Technical Enforcement Guidance Document." OSWER, Washington, D.C.

EPA Region IV, 1991. "Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual Environmental Services Division." Athens, GA.

Nielsen, David M., and Gillian L. Yeates. 1985. "A Comparison of Sampling Mechanisms Available for Small-Diameter Groundwater Monitoring Wells." Groundwater Monitoring Review, Spring 1985: 83-99.

8.0 RECORDS

The following records are generated as a result of this procedure:

A. Completed Daily Activity Log including any deviation or other pertinent information

B. Completed Chain-of-Custody/Request for Analysis Form

C. Completed Sample Collection Log including any deviation or other pertinent information.

9.0 ATTACHMENTS

A. Equipment and Supplies Checklist for Sampling Volatile Organics.

SAMPLING FOR VOLATILE ORGANICS

1.0 PURPOSE

This procedure describes the collection of groundwater samples from wells for analysis of volatile organic compounds (VOCs), and the selection of equipment and materials to be used in this process.

2.0 SCOPE

2.1 Applicability

This procedure applies to all personnel responsible for obtaining VOC samples for the Environmental Restoration program.

2.2 Training

The field team leader and the field team member shall be familiar with the objectives of VOC sampling and must document that they have read and understand this procedure and the procedures in Section 1.0, General Instructions.

3.0 DEFINITIONS

N/A

4.0 BACKGROUND AND/OR CAUTIONS

Sample retrieval systems potentially suitable for the valid collection of volatile organic samples are reciprocating piston-type submersible pumps; gear-driven submersible pumps; syringe samplers; and bailers (Barcelona 1984; Bennett 1988; Nielsen 1985; EPA 1986; EPA Region IV 1991). Field conditions and other considerations will limit the choice of system. The focus of concern must be to provide a valid sample for analysis, one that has been subjected to the least amount of turbulence and subsequent aeration possible. Sampling mechanisms capable of obtaining samples for VOC analyses are described below:

A. Reciprocating piston-type submersible pumps. These systems are portable, self-contained, and capable of delivery flow rates of 30 gallons per hour at lifts up to 500 feet. The pump fits into 2-inch wells, which is the most common monitor well diameter. The flow rate of the pump is varied by increasing or decreasing the driving pressure supplied to the pump from a compressed air container. The gas driving the pump does not contact the sample being purged.

B. Gear-driven submersible pumps. These pumps are not as complicated or as expensive as the bladder pumps. They provide comparable samples and are often easier to handle and

F. Quality Control Samples: Samples used in a planned check of the operation of a measurement system to obtain a measure of the quality of the data generated.

G. Reagent Blank: Usually an organic-free aqueous solution that is as free of analyte as possible and contains all the reagents in the same volume as used in the processing of the samples. A reagent blank must be carried through the complete sample preparation procedure and contains the same preservation reagent concentrations in the final solution as in the sample solution used for analysis.

H. Trip Blank: Usually an organic-free aqueous solution that is as free of analyte as possible and is transported to the sampling site and returned to the Sample Coordination Facility (SCF) without being opened. A trip blank is usually prepared by the SCF prior to the sampling event.

4.0 BACKGROUND AND/OR CAUTIONS

The majority of ER field efforts require the collection of samples for various quality control purposes. These include the isolation of site effects (control samples), definition of background (background sample), evaluation of field/laboratory methodology (duplicate samples), and assessment of the integrity of the sampling equipment (equipment rinsate blanks).

Sampling procedures outlined in the Sampling and Analysis Plans (SAPs) will be applied to QC samples in the same way they are applied to samples taken in the field. QC sample containers must be labeled and transported, and the samples analyzed in a manner identical to all other samples taken at a site.

5.0 EQUIPMENT

Equipment required for this procedure is only that specified by the Operable Unit (OU) Sampling and Analysis Plans.

6.0 PROCEDURE

The requirements for field QC samples will be evaluated as part of the OU-specific Sampling and Analysis Plan. QC sample requirements for radiological samples differ from those for nonradiological samples. Summaries of these requirements for radiological and nonradiological sampling are provided in Attachments A and B, respectively. The requirements are also provided in the Generic Quality Assurance Project Plan for Resource and Conservation Recovery Act (RCRA) Facility Investigation (LANL, 1991). In addition to the QC samples listed in these summaries, projects may require other types of samples be collected to obtain information concerning the sampling site (e.g., background and control samples). Determine the need for these samples during the preparation activities.

6.0 PROCEDURE

A. Assemble the equipment and supplies listed in Attachment A. Ensure the proper operation of all sampling equipment. If any equipment requires calibration, be sure to record this information on the Daily Activity Log (SOP-01.04, Sample Control and Field Documentation).

B. Coordinate the sampling effort with the SCF. The SCF will give guidance regarding sample containers, preservation, and shipment to the SCF.

C. Locate monitor wells to be sampled and establish an appropriate decontamination area. Select the staging area and areas for managing purged water and expendable sampling materials. Provide barricades to public access or intrusion by non-essential personnel.

D. Decontaminate all sampling equipment before taking the first sample and between sampling intervals, in accordance with SOP-02.07, General Equipment Decontamination.

E. Purge wells before sampling, as specified in SOP-06.01, Purging of Wells for Representative Sampling of Ground Water. Ensure that the wells were not pumped dry and that flow was at rates too low to cause turbulence in the formation.

F. Perform other sampling tasks as specified in SOP-06.02, Field Analytical Measurements on Ground Water Samples before collecting volatile samples.

G. Determine if there is residual chlorine in the water to be sampled. If there is residual chlorine, treat the sample vials with a crystal of sodium thiosulfate before sample collection (SOP-01.02, Sample Containers and Preservation).

H. Determine contamination levels of wells. Monitor wells should be sampled from least to most contaminated to reduce the possibility for cross-contamination.

I. Collect VOC samples using the most appropriate sampling mechanism.

J. If a pump is used for sampling, follow the instructions for the specific pump. If a syringe is used, follow these steps:

   1. If necessary, evacuate the syringe and lower the sampling device to just below the well screen.

   2. Remove the constriction from the device and allow the syringe to fill with sample, applying slight suction.

   3. Bring unit to the surface. If necessary, transfer the sample to vials.

6.6 Trip Blank

Request that trip blanks be prepared by the SCF providing the sample containers for the sampling activities and that they be shipped with those containers. The number to be requested depends upon the number and type of samples to be collected. (See Attachments A and B for guidance.) Maintain the trip blanks with the sample containers throughout the sampling event and return them to the laboratory with the collected samples. Do NOT open the trip blanks.

7.0 REFERENCES

The following procedures are directly associated with this procedure and should be reviewed before field operations:

LANL-ER-SOPs in Section 1.0, General Instructions

LANL (Los Alamos National Laboratory), May 1991. "Generic Quality Assurance Project Plan for RCRA Facility Investigations for the Los Alamos National Laboratory Environmental Restoration Program, Los Alamos, New Mexico (current version).

LANL (Los Alamos National Laboratory), November 1991. "Installation Work Plan for Environmental Restoration," Los Alamos, New Mexico (current version).

Sisk, S.W., 1981, "NEIC Manual for Ground Water Subsurface Investigations at Hazardous Waste Sites," EPA Office of Enforcement, National Enforcement Investigation Center, Denver, Colorado. (Sisk, 1981, _____)

8.0 RECORDS

Records to be generated during sampling are listed in the applicable sampling procedures.

9.0 ATTACHMENTS

A. Quality Control Sample Summary for Radiological Samples

B. Quality Control Sample Summary for Nonradiological Samples

6.1 Documentation

For each sample collected, initiate a Sample Collection Log, Chain-of-Custody/Request for Analysis form, and affix a Sample Label to the sample container. SOP-01.04, Sample Control and Documentation, contains copies of the forms and labels and instructions for completing them.

6.2 Postoperation Activities

A. If decontamination of sampling equipment is necessary, decontaminate as instructed in SOP-02.07, General Equipment Decontamination.

B. Make sure all wells are properly labeled and the location ID is readily visible on the protective casing. Make sure all samples are properly labeled.

C. Prepare samples and transport them to the SCF according to SOP-01.02, SOP-01.03, and SOP-01.04.

D. The field team leader will contact the SCF (EM-9) to ensure that samples arrived safely and instructions for sample analyses are clearly understood. Record this information on the Daily Activity Log.

7.0 REFERENCES

The following procedures are directly associated with this procedure and should be reviewed before packaging, labelling, and shipping samples:

LANL-ER-SOPs in Section 1.0, General Instructions.
LANL-ER-SOP-02.07, General Equipment Decontamination.
LANL-ER-SOP-06.01, Purging of Wells for Representative Sampling of Ground Water.
LANL-ER-SOP-06.02, Field Analytical Measurements on Ground Water Samples.

Barcelona, M. J., J. A. Helfrich, E. E. Garske, and J. P. Gibb. 1984. "A Laboratory Evaluation of Groundwater Sampling Mechanisms." Groundwater Monitoring Review, Spring 1984: 32-41.

Barcelona, M. J., J. A. Helfrich, and E. E. Garske. 1985. "Sampling Tubing Effects on Groundwater Samples." Analy. Chem. 57: 460-63.

Bennett, Robert Co. 1988. " Operation Manual for the Bennett Sampling Pump." Amarillo, TX

DOE. 1985. "Field Technical Representative Manual." 2nd ed. U.S. Department of Energy, Uranium Mill Tailings Remedial Action Project Office, Albuquerque Operations Office document, June 1985. Albuquerque, NM.

Quality Control Sample Summary for Nonradiological Samples[a]

QC Sample Type	Matrix of Samples	Frequency	Purpose
Field Blank	Soil Water	1 per 20 samples* 1 per 20 samples*	To determine reagent and field contamination from other than sampling matrix.
Reagent Blank	Water	1 per 20 samples*	To determine any contamination from preparation and processing of samples.
Field Duplicate (Replicate)	Soil Water	1 per 20 samples 1 per 10 samples	To evaluate the reproducibility of the sampling technique.
Rinsate Blank	Soil Water	1 per 20 samples* 1 per 10 samples**	To evaluate decontamination procedures.
Trip Blank	Water	1 per shipping container for VOA[b] analyses only.	To determine contamination during storage and transport.

[a]Generic Quality Assurance Project Plan for RCRA Facility Investigations for the LANL ER Program, May 1991, Section 5 (subject to annual update).

[b]VOA - Volatile Organic Compounds

* or 1 per shipment if less than 20 samples are collected in a day.
** or 1 per shipment if less than 10 samples are collected in a day.