ENVIRONMENTAL MONITORING PLAN

Environmental Monitoring Section

Appendix A

Procedures

February 1995

Environmental Monitoring and Analysis Division
Environmental Protection Department
Lawrence Livermore National Laboratory
University of California, Livermore, California 94551

ENVIRONMENTAL MONITORING PLAN

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Appendix A

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Environmental Monitoring and Analysis Division
Environmental Protection Department
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University of California, Livermore, California 94551

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6. PROCEDURE

Equipment required for flask preparation:

- Fume hood
- Shaker
- Test tube vibrator
- Glass flasks (crimp-top vials)
- Funnels
- Angel hair
- Plastic and brass stoppers
- Hose clamps, hoses, and fittings (on flask)
- Transport cart
- Scale and plastic flask holder
- Silica Gel Weight Form
- AT logbook with Field Tracking Forms (FTF's) taped inside
- Tape for labeling flasks
- Pens (Sharpies and writing)
- "O" rings
- Screwdriver

Equipment required for sampling:

- Sampling rack
- Gilmont Rotameter with current calibration curve
- Pens (Black Sharpie, writing and grease)
- Box of Kimwipes or equivalent
- Sampler repair kit
 - Spare vacuum hoses
 - Extension cords and plugs
 - Spare filters
 - Garbage bag
- Filled silica-gel flasks
- Yellow identification tags with computer-generated labels
- EMG Chain-of-Custody Record forms
- Procedure EMP-AT-L, *Air Tritium Locations*
- Procedure EMP-AT-S, *Air Tritium Sampling*
- Procedure EMP-AT-CA, *Air Tritium Calibrations*
- RAS Tritium Analysis Request Form

Technicians who perform this sampling should ensure that neither they nor the sampling equipment has been exposed to tritium. The technician should not wear a wristwatch that contains any radioactive materials, such as radium or tritium. If there is any question about the potential contamination of the sampling equipment (which includes the vehicle used for sampling), the technician should contact the responsible analyst and obtain a backup set of sampling equipment and another vehicle.

6.1. FILLING AND WEIGHING THE FLASKS

Proper filling of the flasks is important to ensure that silica gel is evenly distributed inside each flask. Uneven distribution of the silica gel results in channeling, which does not allow for a representative sample.

The new silica gel is bright blue in color and is kept in an argon-purged box in Building 151, Room 2348. Silica gel turns pink as it absorbs moisture; therefore, any evidence of pink observed in the silica gel stored in the argon-purged box should be brought to the attention of RAS personnel. It takes about 1¹/₂ jars of silica gel to fill one flask. Funnels, angel hair, and flask stoppers are stored in the argon-purged box. The empty flasks are stored in sampling racks below the fume hoods. The shaker is under the fume hood marked #1, and the test tube vibrator is under fume hood #2.

6.1.1. Collect the new silica gel, funnels, angel hair, and plastic flask stoppers from the argon-purged box and place them under fume hood #1.

6.1.2. Clamp the flask in the shaker. Make sure the flask is free of cracks and that the location identifier is clearly written on the flask. It is also helpful to ensure that all hose clamps and attachment hardware are secured on the flask. Replacement parts are available in the drawer to the left of fume hood #2.

6.1.3. Put the funnels in the flask and turn on the shaker.

6.1.4. Pour the silica gel through the funnel until the gel reaches the bottom lip of the flask.

6.1.5. Remove the flask and take it to fume hood #2.

6.1.6. Place the round portion of the flask on the test tube vibrator, turn on the vibrator, and vibrate the flask until the silica gel begins settling in the flask, usually 1 to 3 inches from the top. The most effective settlement is reached when the flask is rotated 180 degrees every 30 seconds.

6.1.7. Remove the flask from the vibrator, return to the shaker under fume hood #1, and refill with silica gel to the bottom lip of the flask.

6.1.8. Continue alternately filling and vibrating the silica gel until it stops settling and has reached the bottom lip of the flask.

6.1.9. Top off the flask (if necessary) so that the silica gel reaches the bottom lip of the flask.

6.1.10. Put a small amount of angel hair in the flask before sealing with the plastic stopper.

6.1.11. Place the filled flask in the sample carrying rack for transport.

6.1.12. Repeat the entire process until all the needed flasks (19) are filled and in racks.

6.1.13. Put the funnels, any unused angel hair, silica gel, and stoppers back in the argon-purged box. Turn off all equipment used and clean the area (if necessary).

6.1.14. Transfer loaded carrying racks to EPD cart (labeled as such), and take the filled flasks to Room 2135 for weighing.

6.1.15. Before weighing flasks, put the plastic holding device (located near the scale) on the scale and calibrate the scale to zero. Push the "CAL" button and wait for scale to read zero.

Prior to weighing each of the flasks, the technician must remove the plastic stopper. In addition, the technician should, again, visually inspect and ensure each flask has the following on the bottom: Location identifier, hose clamp & attachment fittings, and a brass stopper.

6.1.16. Next, put a filled flask in the plastic holding device and record its displayed weight on the Field Tracking Form (see Attachment A) and on the silica gel weight form (see Attachment B). Replace the plastic stopper. Repeat this step until all of the flasks are weighed.

6.1.17. Proceed to the loading dock and load filled sampling racks into the vehicle. Leave transport cart on the loading dock but out of the way of shipment deliveries.

6.2. COLLECTING THE SAMPLES

6.2.1. Before changing out the first location, check the 19 silica-gel flasks (17 for sample points, 2 for the duplicate QA samples) in the carrying racks. The silica gel should still be blue in color; any sign of pink indicates moisture or contamination, and these flasks should be returned to RAS. Each flask should be sealed with a plastic stopper on the top, hose clamp & attachment fittings, and a brass stopper on the bottom.

Note: If the monitoring unit is not operating when you arrive, follow this procedure to determine when the unit went down.

If there is a General Metal Works (GMW) hi-vol air sampler, open its door. Inside, on the right side, is a small box containing a flow meter with a strip chart. The running time of the unit is denoted by red ink. See where the red ink decreases or stops, and then look around the outer edge of the chart to determine the day as well as the approximate time the unit stopped. If the sampler stopped and then restarted, the off time will also stop the chart recorder. The off-time duration can be determined by subtracting the time difference between recorder date and time, and the actual date and time.

Record that information, and the fact that the unit was down, in the tritium sampling logbook and on the yellow identification tag. Reset the GFI (located where the unit is plugged in) by pressing the reset button located between the two outlets on the GFI box.

If the unit does not start, check the fuse (located inside the blue box) and replace it if there is any doubt about its working condition. If the unit still does not start, check the GFI outlet with a circuit tester. If there is no power to the GFI outlet, call Plant Engineering to get power restored. If there is power to the GFI outlet box, it is probable that the sampling unit has failed and it should be replaced.

If there is no hi-vol at the location or only the AT unit fails, there will be a resettable elapsed time indicator on the AT unit. The indicator will display the total running time. If the AT sample has met the acceptance criteria identified in Section 8 of this procedure, the sample may be submitted for analysis. Be sure to include the total running time on the yellow identification tag and give a brief description of the findings on the FTF in the logbook.

6.2.2. Once at sample location (for location description, see Reference 1), collect the rotameter, grease pen, and remove the "new" sample flask for that location from the carrying rack, and proceed to the sampling unit.

6.2.3. Gently place the "new" flask and rotameter on the ground, securing them so they will not roll or break.

6.2.4. To determine the "flow off" of the sample flask being collected, replace the U-shaped inlet tube (found at the top of the flask in the sampling unit) with the Gilmont Rotameter (see Attachment C). Read the number displayed on the rotameter and with a grease pen write this number directly on the glass flask.

This number is very important as it is used in conjunction with calibration curve to determine the "flow off" in cc/min.

6.2.5. Remove the rotameter and gently place it on the ground.

6.2.6. Keeping the top wing nut secured to the neck of the sample flask, unscrew the bottom brass female fitting from the male brass fitting on the intake air line of the AT sampling unit.

6.2.7. Next, remove the brass stopper from the "new" flask and screw it into the bottom of the sample flask.

6.2.8. Remove the top plastic stopper from the "new" flask and place it in the top of the sample flask.

6.2.9. Once the stoppers are secured on the sample flask, loosen the wing nut and remove the flask from the sampling unit, placing it gently on the ground.

6.2.10. Pick up the "new" flask, place it on the sampling unit, and secure it by tightening the wing nut around the neck of the flask.

6.2.11. Hand tighten the brass fitting to the intake line of the sampling unit.

6.2.12. Place the rotameter in the inlet (top) of the flask and set the flow to 700 cc/min by using the number on the rotameter which reflects to 700 cc/min on the calibration curve (see Reference 3). Adjust the flow by turning the knob located directly behind the hose. Adjustments made with this knob are limited; however, additional adjustments may be made using the valve inside the blue controller box.

6.2.13. Once the flow rate has been set at 700 cc/min, remove the rotameter and replace it with the U-shaped inlet fitting. Sometimes the angel hair obstructs proper seating, so make sure that the inlet fitting has seated tightly on top.

6.2.14. Pick-up rotameter and sample flask and go back to vehicle; once in the vehicle, safely set them down.

6.2.15. Record the following information on the yellow tag/computer-generated label and on the FTF in the logbook (if not already recorded). See attachments D and G for examples:

- Location Identifier (Reference 1)
- Date On/Date Off
- Time On/Time Off
- Sampler's Initials
- On Flow (should always be 700 cc/min)
- Off Flow (extrapolate the number [written with grease pen] from the calibration curve see Reference 3 for more detail).

6.2.16. After the "flow off" is logged on the yellow tag/computer generated label and on the FTF, wipe the number (written with the grease pen) off the flask.

6.2.17. Next, tie the yellow identification tag to the neck of the sample flask and place the flask in carrying case with tag behind neck of flask. Secure "O" ring in the front of the holder to keep the flask from falling out.

6.2.18. Log the start time of the new sample flask placed in the field on the FTF in the logbook ("weight on" should already be listed).

6.3. QUALITY ASSURANCE SAMPLING

Quality Assurance for the sampling program is performed by rotating two designated sampling units through the sampling locations on a bimonthly basis, thus providing duplicate samples. One QA unit is placed next to a permanent sample location on the LLNL site and another is placed next to a permanent offsite location. The QA samples are sent to the laboratory as blind duplicate samples and are analyzed in the same manner as all other samples, thus allowing assessment of the integrity of both analytical and sampling techniques, and giving a measure of precision.

6.4. MAINTENANCE AND/OR PROBLEMS OBSERVED

Field maintenance on the tritium samplers is minimal, consisting of replacing filters, and cracked hoses and dealing with various common electrical problems.

6.4.1. To perform a leak test, place the rotameter securely on the flasks. Plug the airflow inlet by placing your hand over the suction point. Watch the rotameter; the ball should bounce slightly, then drop to "0" flow. If it does not, tighten any loose bolts or fittings and replace any missing screws, rubber gaskets, or clamps.

6.4.2. Replace the primary intake filter approximately every six months or as needed.

6.4.3. Check the secondary intake and the exhaust filters every six months; however, these normally only require replacement annually.

6.4.4. Because the silica gel units work on a vacuum system, police the area surrounding the unit and remove anything that could get sucked into the inlet filter.

6.4.5. Document any maintenance or problems observed in the field logbook.

6.5. DELIVERING SAMPLES

6.5.1. After gathering all silica-gel sample flasks, fill out an EMS Chain-of-Custody Record form (COC) using the proper sample identifiers (see Reference 1). When the COC is completed, take the samples to the loading dock at B-151 and put them on the silica gel sample carrying cart. Proceed to RAS, Rm. 2135; weigh each of the sample flasks (making sure to remove the yellow identification tag and plastic stopper) and record its "weight off" on the Field Tracking Form and the silica gel weight form. Proceed to RAS, Rm. 2348, and replace the sample flasks and carrying rack under the fume hood. Proceed to Rm. 2143 and fill out a Tritium Request and Work Sheet form (as shown on Attachment E) for each sample.

6.5.2. If you have questions about who to relinquish the sample flasks to, check with the Lead Chemist (currently Everett Guthrie, X3-3666). Make sure that the COC is processed as prescribed in Reference 4 and that the silica gel weight form is left with the samples. In addition, make sure the Tritium Request Forms are filled out and left in the appropriate binder in room 2143. Once the COC is signed and samples are relinquished to an RAS representative, the TSG technician will keep the goldenrod and pink copies and deliver them to the TAMM analyst in charge of airborne tritium monitoring (see Reference 4).

7. DOCUMENTATION/QA RECORDS

7.1. CHAIN-OF-CUSTODY RECORD FORM

Attachment F shows a completed COC form for the tritium air samples. This form is required whenever an environmental sample is generated or created. This COC accompanies the sample(s) from collection in the field through analysis, and then is returned to the responsible analyst when sample results are completed. The COC is a custody form that follows the sample, and it is not used to report analysis data. Sample ID, dates, media, etc. are contained on this form. This is the legal record of the sample and its subsequent handling, and must be signed each time the sample is relinquished to another individual.

7.2. TRITIUM SAMPLING LOGBOOK CONTAINING FIELD TRACKING FORMS

The tritium sampling logbook has Field Tracking Forms (FTF's) taped inside. The logbook is maintained and archived by the environmental technician responsible for tritium sampling. This logbook contains sample ID and location, on and off dates, times and air flows, Quality Assurance sample information, and any maintenance information performed on the unit (see Attachment G). Photocopies of the FTF should be given to the analyst after each route is completed.

8. ACCEPTANCE CRITERIA

8.1. The operations described in this procedure will be considered satisfactorily completed after all the steps given in section 6 have been completed, the samples have been delivered to RAS, and all documentation has been properly completed and distributed.

8.2. Samples will be deemed unacceptable if the flask has been handled in any way that might subject it to cross contamination.

8.3. Samples will be deemed unacceptable if there is any indication that the sample unit has been operating in such a way that quantitative evaluation of flow through the flask is not possible. For example: A sample unit

8.4. Samples will be deemed unacceptable if "off flow" rate is off by more than 20%. For example: Normal flow "on" is 700 cc/min; samples with flows "off" less than 560 cc/min or over 840 cc/min are not acceptable. These samples should not be sent to the lab for analysis unless the analyst specifies otherwise.

8.5. Samples will be deemed unacceptable if the Chain of Custody has been broken or compromised.

8.6. Samples will be deemed unacceptable if the documentation is not correctly completed.

8.7. Samples will be deemed unacceptable if there is indication that "breakthrough" has occurred through the silica gel. Breakthrough means that the water vapor contained in the air passing through the sampler is not trapped on the silica gel.

8.8. Samples will be deemed unacceptable if "channeling" has occurred. Channeling is the result of uneven distribution of silica gel within the flask allowing the moisture to flow in a distinct path through the gel, rather than a broad, dispersed path.

8.9. Samples will be deemed unacceptable if the flasks are not tagged correctly.

9. ATTACHMENTS

- Attachment A: Air tritium sampling unit
- Attachment B: Silica Gel weight form
- Attachment C: Gilmont Rotameter
- Attachment D: Yellow identification tag
- Attachment E: Tritium Request and Work Sheet form
- Attachment F: Chain-of-Custody Record form
- Attachment G: Field Tracking Form

ATTACHMENT A: AIR TRITIUM SAMPLING UNIT

Tritium air sampling procedure EMP-AT-S.

ATTACHMENT B: SILICA GEL WEIGHT FORM

SILICA GEL WEIGHT FORM

Date On _____

Date Off _____

Sample I.D.	Wt. On	Wt. Off
L-MET-01-AT		
L-COW-01-AT		
L-VIS-01-AT		
L-SALV-01-AT		
L-CAFE-01-AT		
L-POOL-01-AT		
L-MESQ-01-AT		
L-B514-01-AT		
L-B624-01-AT		
L-B331-01-AT		
L-B292-01-AT		
L-FIRE-01-AT		
L-VET-01-AT		
L-XRDS-01-AT		
L-ZON7-01-AT		
L-ALTA-01-AT		
L-LCCY-01-AT		
L-QA-01-AT		
L-QA-02-AT		
Revised 9/9/92		

ATTACHMENT C: GILMONT ROTAMETER

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EMP-AT-S
Air Tritium Sampling

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ATTACHMENT D: YELLOW IDENTIFICATION TAG

L-B624

L-B624-01-AT

Date on 7-18-91 Time on 0900

Date off 8-1-91 Time off 0910

700/ 700 cc/min

PA

Initials

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ATTACHMENT E: TRITIUM REQUEST AND WORK SHEET FORM

SAMPLE NUMBER 20660

TRITIUM REQUEST AND WORK SHEET

DATE 4-2-92 SUBMITTED BY: RJW ESTIMATED T.U. _____
ORIGINATOR'S NO: L-MET-01-AT ARGON PROTECTED: YES _____ NO _____
DESCRIPTION: SILICA GEL SOURCE: _____
SPECIAL INFO: _____ DEPOSITION INSTRUCTIONS: _____

PRE DIST: DATE _____ STATION _____ REMARKS _____

FREEZE DRY: DATE _____ STATION _____ ORIG. WT. (gm) _____ DRY WT. (gm) _____

MEAS. H₂O (ml) _____ CALC. H₂O (gm) _____ ALIQ. FACTOR (gm/ml) _____

COMBUSTION: DATE _____ ORIG. WT. (gm) _____ FURN. _____ O₂ (psi) _____

ENRICHMENT: CELL _____ V_g _____ ENRICH _____ X. ARGON _____ NaOH LOT _____ & VOL _____

START _____ END _____ ROOM _____ β = _____

VAC. DIST.: DATE _____ BULB NO. _____ H₂O (gm) _____ ARGON _____

H₂O (ml) _____ ALIQ. FACTOR (gm/ml) _____ REMARKS _____

GAS CONVER: DATE _____ TRAP _____ FURNACE _____ RUN _____ VOL _____

GPC: DATE _____ AX COUNTER _____ V_u _____ V_w _____ RT = _____

TEMP (C°) _____

P_{SAM} _____

P_{PRO} 31.0

P_{SAM} + P_{PRO} _____

P_{TOTAL} 150.0

SCINT COUNT: DATE _____ A = _____ ml B = _____ ml PRINT-OUT _____

SAMPLE NUMBER 20660

Chain-of-Custody Record

Chain-of-Custody Record					
Laboratory: RAS		Project Name/Analyst: TAMM PAVLA TATE		Sample Group Description VALLEY AT	
Sampler: (signature) John Q. Watson				Logbook ID No:	
Sample Identifier:		Date		REMARKS	
sht	location	number	medium		
L	MET	. 01	. AT	✓	
L	QW	. 01	. AT	✓	
L	VIS	. 01	. AT	✓	
L	SALV	. 01	. AT	✓	
L	CAFE	. 01	. AT	✓	
L	POOL	. 01	. AT	✓	
L	MESR	. 01	. AT	✓	
L	B214	. 01	. AT	✓	
L	B224	. 01	. AT	✓	
L	B331	. 01	. AT	✓	
L	B242	. 01	. AT	✓	
L	FIRE	. 01	. AT	✓	
L	VEI	. 01	. AT	✓	
L	XRD3	. 01	. AT	✓	
L	ZON7	. 01	. AT	✓	
L	ALTA	. 01	. AT	✓	

Release Number:		TRR:	
N/A	P.A.HOUSE		

DISPOSITION OF COPIES (After Absorption)	
Original Sample Which Is Analyzed After Receipt In Order Of Sampling	
First Laboratory Which Is Analyzed Immediately At Receipt After Report To Laboratory Or Sampled	
Second Laboratory	
Third Laboratory	
Fourth Laboratory	
Other Laboratories	
ALL SIGNATURES MUST BE MADE ON WHITE COPY	

Environmental Monitoring Section	
Lawrence Livermore National Laboratory	
P.O. Box 806, L-621	
Livermore, CA 94551	

Form OAP-8	
Rev 5	
October 1993	

ATTACHMENT G: FIELD TRACKING FORM

Date on: _____ SILICA GEL RUN

Date off: _____

COC _____ Lab _____

Sample I.D.	Time On	Time Off	Flow Off	Wt. On	Wt. Off
L-MET-01-AT					
L-COW-01-AT					
L-VIS-01-AT					
L-SALV-01-AT					
L-CAFE-01-AT					
L-POOL-01-AT					
L-MESQ-01-AT					
L-B514-01-AT					
L-B624-01-AT					
L-B331-01-AT					
L-B292-01-AT					
L-FIRE-01-AT					
L-VET-01-AT					
L-XRDS-01-AT					
L-ZON7-01-AT					
L-ALTA-01-AT					
L-LCCY-01-AT					
L-QA-01-AT					
L-QA-02-AT					
Revised 9/9/92					

EMP-BD-S300

SAMPLING PLAN TO SUPPORT THE PERMITTING OF NON-STORM
WATER DISCHARGES AND WDR 85-188 AMENDMENTS

Prepared by:

Rhonda L. Welsh
Rhonda Welsh
Scientific Technologist, WGMG

3-8-94
Date

Reviewed by:

Rebecca Ward
Rebecca Ward
Scientific Technologist, WGMG

2-23-94
Date

Robert Vellinger
Robert Vellinger
Environmental Analyst, WGMG

2-25-94
Date

Approved by:

William Hoppes
William Hoppes
Group Leader, WGMG

3/3/94
Date

Lucinda M. Garcia
Lucinda M. Garcia
Quality Assurance Coordinator, EMS

3/7/94
Date

Rebecca A. Failor
Rebecca A. Failor
Section Leader, EMS

3/9/94
Date

William Isherwood
William Isherwood
Division Leader, EMAD

3-9-94
Date

1.0. PURPOSE

This Sampling Plan describes methods to collect aqueous samples from non-storm water discharges to the surface or process waters engineered to ground at the Experimental Test Site (Site 300). These discharges were identified through LLNL's Building Drain Investigation and the Site Wide Building Assessment Projects. This effort will provide analytical results to determine "environmental impact" of identified sources discharges and to support permit applications.

2.0. DISCUSSION

2.1. SURFACE DISCHARGES

In 1987, Congress added Section 402(p) to the 1972 Clean Water Act, establishing a framework for regulating municipal and industrial storm water discharges under the National Pollutant Discharge Elimination System (NPDES) program. The Environmental Protection Agency (EPA) published the final rule implementing Section 402(p) in 1990. This rule required the EPA to establish regulations setting forth NPDES permit application requirements for storm water. The EPA subsequently delegated enforcement and interpretation of this rule to the California State Water Resources Control Board, and the Board then issued the California General Industrial Activity Storm Water Permit (General Permit). The General Permit Section A requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP), part of which requires the identification of non-storm water discharge and subsequent permitting or elimination of these discharges. This sampling plan supports the general NPDES permit activity by categorizing the levels of pollutants being discharged to the ground in some of the identified non-storm water discharges, and supports the permitting of these discharges.

2.2. WDR AMENDMENT

The Porter Cologne Water Quality Control Act requires waste discharges to surface waters or ground waters to be permitted. In 1985, the California Regional Water Quality Control Board issued Order 85-188 to LLNL permitting discharges of domestic wastewater to individual building septic systems and a sewage pond, and industrial wastewater to evaporation ponds. The Building Drain Investigation (BDI) identified several process wastewaters discharging to the domestic wastewater treatment units. The identification of these process discharges, in addition to changes in other aspects of the permit, require the submittal of a permit amendment.

3.0. REFERENCES

1. EPA Permit Application-General Information and Form, 3510-1, and 3510-2C (Revised August 1990)
2. LLNL Site Storm Water Pollution Prevention Plan, UCRL-AR-110573-92-DR
3. EMP-QA-SD, *Sampling Documentation*
4. EMP-QA-CS, *Courier Service Protocol*
5. EMP-QA-DM, *Data Management*
6. EMP-QA-S, *Quality Assurance Sampling, Draft*
7. EMP-GW-CA, *Ground Water Equipment Calibration*

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8. EMP-GW-S, *Ground Water Sampling*
9. EMP-RO-S, *Storm Water Run-off Sampling*

4.0. DEFINITIONS

- 4.1. COC: The Chain of Custody Form (COC) documents handling of each sample, including:
 1. Delivery of the sample from the sampler to the courier.
 2. Delivery from the courier to the analytical laboratory.
 3. Data transfer from the analytical lab to the environmental analyst.
 4. Data transfer from the analyst to the data manager.
 5. Data transfer from the data manager to the archivist for archiving.

The COC is a legal document containing vital information about the samples, including: identification/labeling of the sample (the sample identifier), collection date, sampler's identity, and the analyses that are requested to be performed on the samples by the analytical laboratory. Whenever a sample is collected for analysis, a COC must be generated and must accompany the sample at all times until the entire data results/COC packet is archived.

- 4.2. The Field Tracking Form (FTF) is used in the field to document sampling activities.
- 4.3. The Field Data Form (FDF) is used in the field to document information associated with the non-storm water discharge during a sampling event.

5.0. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The Section Leader ensures that sampling methods meet regulatory guidance and that sampling is conducted in accordance with approved procedures.

5.2. WGMG GROUP LEADER

The Group Leader ensures that sampling procedures meet design criteria; that sampling is conducted in accordance with approved procedures; and that all necessary reports are prepared, approved, distributed, and archived.

5.3. EMS ENVIRONMENTAL ANALYST

The analyst is responsible for designing appropriate sampling methods and communicating them to Technologists, evaluating the resulting data in light of regulatory requirements, and designing changes in sampling methods where appropriate.

5.4. TSG ENVIRONMENTAL TECHNOLOGIST

TSG Technologists are responsible for ensuring that the samples are collected in accordance with the approved procedures.

6.0 PROCEDURE

Equipment required (stored in transportainer (TR) #TY-165 at the end of 6th Street unless otherwise indicated):

Personal protective equipment: rubber boots, safety goggles, rubber gloves
Sample bottles
Tags and labels for sample bottles
Indelible marking pens (LLNL Stores Stock #s 7520-62156, -56629)
Kimwipes or equivalent
Disposable surgical-type gloves (LLNL Stores Stock #s 8415-64994, -64995)
Ice chests
Ice: B175 ice machine (ice bags from LLNL Stores # 8105-27699) (ice must be double-bagged)
Field Tracking Form
Field Data Form
Chain of Custody Form
pH meter with calibration buffer pillows
Deionized water (DI)
Field Blank Water
Tape Measure
Chlorine Residual Test kit
Flashlight
Stainless Steel Bucket

6.1. PREPARATION FOR SAMPLING*

- 6.1.1. All samples will be collected in accordance with EMS sampling protocol defined in EMP-GW-S and EMP-RO-S (References 8 and 9).
- 6.1.2. Calibrate pH meter before taking into field. The pH meter will be used to obtain field pH and temperature.
- 6.1.3. Record calibration information on the FTF.
- 6.1.4. Collect equipment for sampling as listed in the "sampling equipment required section." Proceed to Site 300.
- 6.1.5. In preparation for sampling activities, and in order to achieve and maintain sample integrity following sampling and preservation methods on pages 8-9, samples will be collected in the following order at all locations:
 1. Chlorine Residual will be analyzed immediately with a portable test kit.

2. pH and temperature (analyzed in the field along with a 120 ml sample for conductivity and pH to be analyzed by the analytical laboratory).
3. Volatile organics (EPA 502.2)
4. Total Organic Carbon
5. Oil and Grease
6. Chemical Oxygen Demand
7. Biological Oxygen Demand
8. Anions
9. Total Dissolved and Total Suspended Solids
10. Ammonia
11. Surfactants
12. Phosphorous
13. Metals
14. HE Compounds (only at Building 813 washing machine)

***Prior to the actual sampling event, individual facility managers, along with Plant Engineering staff, must be notified to obtain access and coordinate sampling activities within the discharge areas. A current list of the applicable facility managers and Plant Engineering staff can be obtained from the responsible Analyst.**

6.2. SAMPLING

6.2.1. BUILDING 827 EQUIPMENT DRAIN

- 6.2.1.1. Proceed to Building 827 to collect samples. Samples will be obtained directly from the discharge flowing from the pipe extending out of the hillside directly east of Building 827.
- 6.2.1.2. Calculate discharge flow rate while obtaining samples. Discharge rate will be estimated by calculating amount of discharge collected into a 1-gallon collector container within a recorded period of time.
- 6.2.1.3. Record discharge rate information on the Field Data Form.
- 6.2.1.4. Collect 100 ml of discharge and measure for chlorine with the chlorine test field kit.
- 6.2.1.5. Obtain the remaining samples in the order as stated above in Section 6.2., according to EMS sampling protocol.
- 6.2.1.6. Record date and sampler's initials on pre-labeled bottles.
- 6.2.1.7. Record location, samples taken and sampler's initials on FTF.

- 6.2.1.8. Place samples in ice chest.
- 6.2.1.9. Record all information for each discharge area onto the field data sheet. After the bottles have been filled, dry the bottles and place in an ice chest such that they will not break during transit.
- 6.2.1.10. Before leaving the sampling location, rinse all equipment with D.I. water. If equipment will be stored, decontaminate with detergent and D.I. water and with a final D.I. water rinse. Wrap in plastic bags where possible.

6.2.2. BUILDING 870 FIRE AUXILIARY*

*A coordinated effort will be made with the Fire Department to sample fire auxiliary discharge at the pre-approved scheduled maintenance testing of these units.

- 6.2.2.1. Proceed to Building 870.
- 6.2.2.2. Samples will be collected from Building 870 on the southeast side of the building adjacent to the small stairwell.
- 6.2.2.3. Fire Department personnel will discharge the water at the above named point at a 5 gallons per minute rate.
- 6.2.2.4. Samples will be obtained in the same manner and order as stated above in Sections 6.2.1.2. through 6.2.1.10.

6.2.3. BUILDING 870 TEMPERATURE AND PRESSURE VALVE

- 6.2.3.1. Samples will be obtained for temperature and pressure from Equipment Room 125 from the hot water heater located in the southeast corner of the room.
- 6.2.3.2. Locate the release valve directly on top of the unit.
- 6.2.3.3. Don protective glasses and protective rubber gloves as the discharge water may be hot.
- 6.2.3.4. Place a stainless steel bucket under discharge tubing located on the left side of the unit, which drains directly to the ground, and collect the sample volume.
- 6.2.3.5. Remove the sample bucket and decant sample volume into sample containers.
- 6.2.3.6. Take samples in the manner and order as listed above in Sections 6.2.1.2. through 6.2.1.10.

6.2.4. BUILDING 874 EMERGENCY EYEWASH (HARD PLUMBED)

- 6.2.4.1. Samples will be obtained from Room 100. Manually operate the eyewash to provide required sample volume.
- 6.2.4.2. Samples will be obtained in the manner and order as listed above in Sections 6.2.1.2. through 6.2.1.10.

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6.2.5. BUILDING 873 WASHING MACHINE

- 6.2.5.1. Samples will be obtained from Building 873, Room 112. There are two washers in the room, either may be sampled.
- 6.2.5.2. Locate the discharge hose running from the washer to the mop sink or pipe drain (depending on washer being sampled) in the same room. During a typical washing operation, take samples from the discharge hose. Samples are to be collected during the first wash cycle.
- 6.2.5.3. Samples will be obtained in the manner and order as listed above in Sections 6.2.1.2. through 6.2.1.10.

6.2.6. BUILDING 813 WASHING MACHINE

- 6.2.6.1. Samples will be obtained from Building 813, Room 124.
- 6.2.6.2. Locate the discharge hose running from the washer to the mop sink in the same room. During a typical washing operation, take samples from the discharge hose. Samples are to be collected during the first wash cycle.
- 6.2.6.3. Samples will be obtained in the manner and order as listed above in Sections 6.2.1.2. through 6.2.1.10.

6.2.7. QA SAMPLES

One field blank for each day of samples will be analyzed for the same suite of parameters as the routine samples. A minimum of 20% of the samples will be replicated (as selected by the environmental analyst).

QA samples are taken to estimate the precision and accuracy of the sampling and analysis methods. They should be taken in an equivalent manner to a routine sample. Special attention should be taken to assure duplication of sampling: location, time, method, and analysis.

6.3. SAMPLES AND PRESERVATION

Analyte	Method	Sampling requirement	Preservation	Volume/ container	Reporting level (mg/L) best possible
Anions Bromide Chloride Fluoride Nitrate Nitrite Phosphate Sulfate	EPA 300.0	Triple rinse bottle with sample matrix before filling. 48 hours max. hold time.	Store samples in ice chest or refrigerator at 4°C.	500 ml poly	0.005 0.5 0.05 0.5 0.4 0.010 0.5
Chemical Oxygen Demand (COD)	EPA 410.4	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C. preacidified with H ₂ SO ₄ , provided by analytical laboratory.	100 ml poly	1.0
Biological Oxygen Demand (BOD)	EPA 405.1			500 ml	1.0
Metals		Non-Filtered water but preserved.	HNO ₃ to achieve pH < 2. No refrigeration required.	1 L poly	
Arsenic	EPA 206.2				0.002
Antimony	EPA 204.2				0.005
Barium	EPA 200.7				0.0025
Beryllium	EPA 210.2				0.0005
Cadmium	EPA 213.3				0.0005
Cobalt	EPA 200.7				0.025
Chromium	EPA 218.2				0.0010
Copper	EPA 220.2				0.0010
Lead	EPA 239.2				0.0050
Mercury	EPA 245.2				0.00010
Selenium	EPA 270.2				0.0020
Thallium	EPA 279.2				0.0010
Silver	EPA 272.2				0.0005
Nickel	EPA 249.2				0.0050
Zinc	EPA 200.7				0.020
Vanadium	EPA 200.7				0.025
Iron, Total	EPA 200.7				
Aluminum	EPA 200.7				
Ammonia	EPA 350.3		H ₂ SO ₄ refrigerate at 4°C.	500 ml poly	

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6.3. (Continued)

Analyte	Method	Sampling requirement	Preservation	Volume/ container	Reporting level (mg/L) best possible R.L.
Total Organic Carbon	EPA 415	No air space or bubbles can be present. Form positive meniscus and cap bottles immediately after filling.	Preacidified bottles are supplied by analytical laboratory. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial, preacidified with H2SO4, provided by analytical laboratory	1.0
Total Dissolved Solids/Total Suspended Solids	EPA 160.1		Store samples in ice chest or refrigerator at 4°C.	250 ml poly	
Oil and Grease	EPA 413.1		H2SO4 to achieve pH < 2.	1 L wide mouth amber glass bottle	5000
*Phosphorous	EPA 365.2	48 Hrs. max. holding time.		100 ml poly	0.05
Surfactants	EPA 425.1	48 Hrs. max. holding time.		100 ml poly	0.5
**RDX			Performed on site at B222.		0.0030
**HMX			Performed on site at B222.		0.0020
**TNT			Performed on site at B222.		0.0030

*Only to be analyzed for in the washing machine samples.

**Only to be sampled for in the Building 813 washing machine.

6.4. ADDITIONAL SAMPLING REQUIREMENTS

6.4.1. Record the following information concerning each discharge on the Field Data Form.

- Type of equipment
- Equipment operational status
- Equipment location (building and room number)
- Humidity control information
- Discharge flow volume
- Color of discharge volume

7.0. DOCUMENTATION/QA RECORDS

7.1. EVALUATION OF RESULTS

The results of the analyses may be submitted to the Central Valley Regional Water Quality Control Board as part of a NPDES or WDR permit application. The Regional Board will evaluate the analytical data and develop effluent limitations based on numerical and narrative water quality objectives defined in the *Water Quality Control Plan for the California Regional Water Quality Control Board Central Valley Region*. Handle all documentation and records according to References 3, 5, and 6.

7.2. FIELD TRACKING FORM (FTF):

Complete the FTF during sample collection. The sampler must enter the date and time of each sample, their initials, any comments of interest concerning the sample, pH meter calibration information, corresponding COC numbers, and the labs where the samples are sent in the spaces provided. An example of a FTF is included as Attachment A.

7.3. CHAIN-OF-CUSTODY FORM (COC)

The information from the FTFs will be used to complete the COC (Form No. QAP-8-1). FTFs and COCs will be archived in the Document Retention Center (see EMP-QA-DC). An example of a completed COC is included as Attachment B.

7.4. FIELD DATA FORMS

Field Data Forms will be archived in the Document Retention Center (see EMP-QA-DC). An example of a Field Data Form is given in Attachment C.

8.0. ACCEPTANCE CRITERIA

8.1. Samples will not be deemed acceptable if:

- Proper preservative methods and sample hygiene methods were not followed.
- The chain of custody has been broken or compromised.
- The documentation has not been completed.
- The bottles are not properly labeled, dated, and initialed by the sampler.

8.2. Certification and compliance/non-compliance requirements shall all be met in accordance with Section C of the EPA general Storm water permit Requirements.

9.0. ATTACHMENTS

Attachment A: Sample FTF

Attachment B: Sample COC

Attachment C: Sample Field Data Form

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Attachment A: Sample FTF

FIELD TRACKING FORM EMP-GW-S-01

SITE 300 Building Drain Repair Sampling

LOCATION DESIGNATOR 3-S70D-01-EA

SAMPLE IDENTIFIER 3-S70D-01-OW

QA IDENTIFIER 3-QA-59-OW

pH meter _____

Date _____ Time Started _____ Time Sampled _____

COC# _____	Lab: _____
_____	_____
_____	_____

DISCHARGE SAMPLE MEDIA INTO SAMPLE CONTAINERS IN THE ORDER AS LISTED ON THIS FTE

Flow Rate _____ Total Chlorine Residual _____
 Color _____ Conductivity & pH _____
 Odor _____ Temperature _____
 Notes _____

QA-59 _____ COND&pH
 _____ EPA 902.2(x-5)
 (place in individual bag in ice chest)
 _____ TOC¹(v) (GTEL)
 (place in individual bag in ice chest)
 _____ Oil & Grease¹(1L amber-wide mouth)
 _____ COD¹(100ml)
 _____ BOD¹(500ml) (GTEL)
 _____ Ammonia¹(500ml)
 _____ TDS&TSS(250ml) X3 (2to GTEL)
 _____ Ammonia¹(500ml)
 _____ Surfactants¹(100ml)
 _____ Metals¹
 (place in individual bag in ice chest)

SPECIAL INSTRUCTIONS After obtaining samples set clock and at 5 minute point take one extra TDS/TSS sample (This sample will also be sent to GTEL)

AFTER OBTAINING SAMPLES WRAP IMMEDIATELY IN PLASTIC BAG AND PLACE IN ICE CHEST AT 4 C

LABORATORY TREATMENTS

See LABORATORY TREATMENTS sheet
 for definition of footnotes

COMMENTS _____

INITIALS _____

Attachment B: Sample COC

[illegible]

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Attachment C: Sample Field Data Form

BDR Field Data Form

Date: _____

Building: _____

Equipment (Type and ID#)	<u>Operational</u> Status	Room #	Notes
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COMMENTS:

Design Change Package EMP-BDR-Livermore-001

Non-Storm Water Discharge Evaluation Plan

Effective Date: October 5, 1994

Prepared by:

Rhonda L. Welsh 10-25-94
Rhonda Welsh date
TSG Technologist

Approved by:

Rob Vellinger 10-25-94
Rob Vellinger date
WGMG Environmental Analyst

Lucinda M. Garcia 10/27/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Bill Hoppes 10/26/94
Bill Hoppes, for date
WGMG Group Leader

Rebecca A. Failor 10/27/94
Rebecca A. Failor date
Section Leader, EMS

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1. DISCUSSION

The purpose of this Design Change Package is to reduce the number of field blanks required by the Livermore site BDR sampling plan.

The Site 300 Building Drain Repair Project Sampling Plan provided for the quality assurance sampling requirement of one field blank per day for one full suite of analysis. This requirement was applicable to Site 300 sampling plan because several sources were sampled per day. This requirement remained the same for the Site 200 LLNL Main Site Sampling Plan. This level of quality assurance sampling, however, is not applicable to the current sampling quantity at the main site, as only one to two sources may be sampled on a given day. The full suite of analyses taken for one source is very expensive given that the water we use for field blanks, high purity liquid chromatogram water (HPLC) is \$25.00 per bottle and that 4 bottles are used on a given day. Also this water is used by the Technical Services Group for required monitoring and the water source is continually being exhausted. We will reduce the number of samples taken for a field blank as described below.

2. PROCEDURE CHANGE

For all single sources sampled at LLNL main site, 10% of the analyses will be taken for a field blank. Analyses for the field blank samples can be randomly selected or chosen by the analyst according to source specific conditions. For multiple sources sampled on a given day the field blank analyses will remain the same as previously set by the Site 300 BDR Sampling Plan. All quality assurance sampling will be performed according to EMS requirements.

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EMP-BDR-LIVERMORE
Non-Storm Water Discharge
Evaluation Plan

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EMP-BDR-LIVERMORE

NON-STORM WATER DISCHARGE EVALUATION PLAN

Prepared by:

Rhonda L. Welsh 8/9/94
Rhonda L. Welsh
Scientific Technologist, TSG
Date

Reviewed by:

Sandra Mathews 8/16/94
Sandra Mathews
Environmental Analyst, WGMG
Date

Robert J. Vellinger 8/10/94
Robert J. Vellinger
Environmental Analyst, WGMG
Date

Approved by:

William G. Hoppes 8/29/94
William G. Hoppes
Group Leader, WGMG
Date

Lucinda M. Garcia 9/16/94
Lucinda M. Garcia
Quality Assurance Coordinator, EMS
Date

Rebecca A. Failor 9/13/94
Rebecca A. Failor
Section Leader, EMS
Date

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1. PURPOSE

This plan describes the procedures used by the Environmental Monitoring Section to evaluate and collect aqueous samples from point source, non-storm water discharges at the Livermore Site. Non-storm water discharges were identified through LLNL's Building Drain Investigation and the Site Wide Building Assessment Projects. This plan provides a process for source evaluation of non-storm water discharges in order to determine their "environmental impact" to receiving waters of the nation. Additionally, assessments will support permit applications for all of our non-compliant non-storm water discharges we cannot eliminate and seek to permit.

2. APPLICABILITY/DISCUSSION

This plan specifically applies to the source evaluation of non-storm water discharges and subsequent repair, elimination, or permitting of these discharges. This plan describes the process and method procedures to characterize point source, non-storm water discharges. It also provides specific information concerning non-storm water discharge sources that have been identified at the Livermore Site.

In 1987, Congress added Section 402(p) to the 1972 Clean Water Act, establishing a framework for regulating municipal and industrial storm water discharges under the National Pollutant Discharge Elimination System (NPDES) program. The Environmental Protection Agency (EPA) published the final rule implementing Section 402(p) in 1990. This rule required the EPA to establish regulations setting forth NPDES permit application requirements for storm water. The EPA subsequently delegated enforcement and interpretation of this rule to the California State Water Resources Control Board, and the Board then issued the California General Industrial Activity Storm Water Permit (General Permit). The General Permit Section A requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP), part of which requires the identification of non-storm water discharges and subsequent permitting or elimination of these discharges.

LLNL's Livermore Site non-permitted, non-storm water discharges were identified through LLNL's Building Drain Investigation (BDI) and the Site Wide Building Assessment Projects. The Building Drain Investigation Project immediately eliminated or rerouted deficiencies that were identified as having the potential to significantly impact surface waters. The Building Drain Repair (BDR) Project is currently addressing known deficiencies of less significance. In addition, the Building Drain Management (BDM) Project has employed mechanisms to track and ensure compliance with future changes to building drains. Information is also being collected on discharges that have not been previously identified due to access restrictions, new construction, or program changes.

Non-permitted, non-storm water discharges will be assessed to evaluate their potential impact to receiving waters. LLNL plans to eliminate as many non-storm water discharges as possible. However, permits will be sought for those discharges having minimal or no impact to receiving waters.

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3. REFERENCES

1. EPA Permit Application-General Information and Form, 3510-1- and -2C (August 1990)
2. Livermore Site Storm Water Pollution Prevention Plan, UCRL-AR-110573-92-DR
3. California Regional Water Quality Control Board-San Francisco Bay (1985), Water Quality Order No. 91-13 -DWQ
4. NPDES General Permit No. CAS000001
5. Building Drain Investigation Records
6. Building Drain Repair Documentation
7. Building Drain Maintenance Guidelines
8. Maintenance Operation Practices
9. Site Wide Building Assessment Documentation
10. NPDES Storm Water Monitoring Annual Report -Livermore Site 1993-94
11. EMP-QA-CS, Courier Service Protocol
12. EMP-QA-DM, Data Management
13. EMP-GW-CA, Ground Water Equipment Calibration
14. EMP-GW-S, Ground Water Sampling
15. EMP-RO-S, Storm Water Run-Off Sampling
16. EMP-W-S, Water Sampling
17. EMP-QA-S, Quality Assurance Sampling
18. EMP-QA-SD, Sample Tracking Documentation
19. EMP-QA-DC, Document Retention

4. DEFINITIONS

Air Compressor: A device used to supply air for equipment or tools. A piston compresses air within a hollow chamber and forces it into a closed chamber to create a supply of air.

Back Flow Preventer: Prevents water from a facility's water distribution system from flowing back into the site's potable water distribution system in the event of a pressure drop.

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the Nation.

Boiler: A vessel used to heat water to high temperatures to supply heat to a building or for experiments.

Boiler Drain: A fixture to discharge fluids from boilers prior to maintenance.

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EMP-AP-CA	Air Particulate Sampler	3	01/14/94	03/07/94
EMP-AP-L	Air Particulate Locations	3	01/14/94	03/07/94
EMP-AP-S/DCP-001	Air Particulate Sampling Design Change Package	001	10/10/94	10/17/94
EMP-AT-CA	Air Tritium Calibrations	2	01/14/94	03/07/94
EMP-AT-L	Air Tritium Locations	3	01/14/94	03/07/94
EMP-AT-L/DCP-001	Air Tritium Locations Design Change Package	1	08/14/94	10/17/94
EMP-AT-S	Air Tritium Sampling	3	01/14/94	03/07/94
EMP-BD-S300	Sampling Plan To Support The Permitting of Non-Storm Water Discharge	0	3/7/94	11/21/94
EMP-BDR-Liv/DCP-001	Non-Storm Water Discharge Evaluation Plan DCP	001	10/5/94	11/21/94
EMP-BDR-Livermore	Non-Storm Water Discharge Evaluation Plan	0	9/19/94	11/21/94
EMP-EM-CA	Emergency Air Monitoring Equipment Calibration	0	Future	00/00/00
EMP-EM-S	Emergency Environmental Sampling	4	06/15/94	08/05/94
EMP-GW-CA	Ground Water Equipment Calibrations	1	01/04/93	12/28/92
EMP-GW-L	Site 300 Water Sampling Locations	1	01/04/93	02/24/93
EMP-GW-L/DCP-001	Site 300 Water Sampling Locations Design Change Package	001	10/21/94	11/21/94
EMP-GW-QR	Quarterly Ground Water Report	1	01/04/93	12/28/92
EMP-GW-S	Ground Water Sampling	3	05/01/94	05/02/94
EMP-GW-S/DCP-001	Ground Water Sampling Design Change Package	001	09/23/94	10/17/94
EMP-GW-S/DCP-002	Ground Water Sampling Design Change Package	002	10/14/94	10/17/94
EMP-GW-S/DCP-003	Ground Water Sampling Design Change Package 003	003	1/30/95	02/08/95
EMP-M-SCA	Meteorological Monitoring and Equipment Calibration	0	10/12/93	11/18/93
EMP-N-S	Site 300 Noise/Blast Forecasting	0	Future	00/00/00
EMP-QA-A	Analytical Laboratory Auditing	1	01/04/93	12/28/92
EMP-QA-AER	Site Annual Environmental Report	1	01/01/94	11/18/93
EMP-QA-AR	Analytical Requirements	1	01/04/93	12/28/92
EMP-QA-CD	Changes in Design	1	10/06/92	12/28/92
EMP-QA-CS	Courier Service Protocol	1	01/04/93	12/28/92
EMP-QA-D	Data Analysis	2	10/1/93	11/18/93
EMP-QA-DC	Document Retention	0	Future	00/00/00
EMP-QA-DM	Data Management	1	01/04/93	12/28/92
EMP-QA-DP	Data Packages	0	Future	00/00/00
EMP-QA-NCR	Nonconformance and Discrepancy Reporting	2	07/01/94	09/15/94
EMP-QA-P	Procurement Practices	1	01/04/93	12/28/92
EMP-QA-PW	Procedure Writing	1	10/06/92	12/28/92
EMP-QA-R	Reporting and Review Requirements	0	Future	00/00/00
EMP-QA-S	Quality Assurance Sampling	2	Future	00/00/00
EMP-QA-SA	Quality Assurance Assessments	0	Future	00/00/00

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EMP-QA-SD	Sample Tracking Documentation	4	7/1/94	09/15/94
EMP-QA-SL	Sample Location Designators	1	11/1/94	11/17/94
EMP-QA-SL/DCP-001	Sample Location Designators Design Change Package	0	12/27/94	12/21/94
EMP-R-CA	Radiation Monitoring Calibration	0	05/03/93	05/03/94
EMP-R-DA	Radiological Dose Assessment	0	11/11/93	11/18/93
EMP-R-L	Radiation Monitoring Locations	0	12/13/93	03/07/94
EMP-R-S	External Radiation Monitoring	0	05/01/93	04/15/93
EMP-RA-L	Rain Sampling Locations	1	1/3/94	03/07/94
EMP-RA-L/DCP-001	Rain Sampling Locations Design Change Package	001	10/17/94	10/17/94
EMP-RA-S	Rain Sampling	2	01/03/94	03/07/94
EMP-RA-S/DCP-001	Rain Sampling Design Change Package	001	11/21/94	11/21/94
EMP-RO-L	Storm-Water Runoff Locations	2	01/04/93	12/28/92
EMP-RO-S	Storm-Water Runoff Sampling	2	06/01/94	09/15/94
EMP-RO-S/DCP-001	Storm-Water Runoff Sampling Design Change Package	1	6/8/94	10/17/94
EMP-RT-AL	Retention Tank Analysis List Update	1	11/01/93	11/18/93
EMP-RT-RA	Retention Tank Release Authorization	2	11/12/93	11/18/93
EMP-RT-RA/DCP-001	Retention Tank Release Authorization Design Change Package	001	03/08/94	03/14/94
EMP-S-L	Soil and Arroyo Sediment Sampling Locations	1	01/04/93	12/28/92
EMP-S-S	Soil and Arroyo Sediment Sampling	4	12/12/94	12/12/94
EMP-SW-B196	Sewage Sampling at B196	2	12/19/94	12/21/94
EMP-SW-C196	Sewage Sampling at C196	1	04/15/93	04/15/93
EMP-SW-CA	Sewer Equipment Calibrations	1	04/15/93	04/15/93
EMP-SW-DOC	Sewer Sampling Documentation Manual	0	1/13/95	01/13/95
EMP-SW-DS	Diversion Facility Tank Sampling	1	04/15/93	04/15/93
EMP-SW-HCAR	Hazards Control Off-Shift Sewer Alarm Response	0	11/12/93	11/18/93
EMP-SW-LWRP	Sewage Sampling at LWRP	1	1/27/95	02/08/95
EMP-SW-M	Sewer Equipment Maintenance	1	04/15/93	04/15/93
EMP-SW-OP	Sewer Monitoring Operations	0	Future	00/00/00
EMP-SW-SAS	Satellite Sewer Stations Alarm Sampling	1	04/15/93	04/15/93
EMP-SW-SID	Sewer Spill Identification	1	Future	00/00/00
EMP-SW-SNLL	Sewage Sampling at Sandia National Laboratory	1	04/15/93	04/15/93
EMP-SW-SSM	Satellite Station Maintenance	1	04/15/93	04/15/93
EMP-SW-TP	Sewer Monitoring Test Plan	0	Future	00/00/00
EMP-VG-L	Vegetation and Foodstuff Sampling Locations	1	01/04/93	12/28/92
EMP-VG-S	Vegetation and Foodstuff Sampling	2	01/04/93	12/28/92
EMP-W-OB	Water Sampling - Central Drainage Basin	0	Future	00/00/00
EMP-W-L	Water Sampling Locations	2	01/04/93	12/28/92
EMP-W-S	Water Sampling	3	12/1/94	11/21/94

EMP-AP-CA

AIR PARTICULATE SAMPLER CALIBRATIONS

Prepared by:

Paula Tate 1/12/94
Paula Tate
Environmental Analyst, TAMM
date

Paris E. Althouse 1/12/94
Paris Althouse
Environmental Technician, TSG
date

Reviewed by:

Rebecca Ward 1/12/94
Rebecca Ward
Environmental Technician, TSG
date

Duke Ramsey 1-12-94
Duke Ramsey
Technical Coordinator, TSG
date

Approved by:

Rebecca A. Failor 1/12/94
Rebecca A. Failor
Section Leader, EMS
date

Kris Surano 1/12/94
Kris Surano
Group Leader, TAMM
date

Lucinda M. Garcia 1/12/94
Lucinda M. Garcia
Quality Assurance Coordinator, EMS
date

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1. PURPOSE

This document describes procedures for calibrating the General Metal Works (GMW) high-volume (hi-vol) air samplers.

2. APPLICABILITY/DISCUSSION

High volume samplers are used in the LLNL Environmental Monitoring Section (EMS) Environmental Surveillance Program to collect particulate samples from ambient air. The samples are collected onto filter paper, which is then analyzed for concentrations of a variety of particulate radionuclide and trace metal constituents. Particulates in ambient air are normally of such low concentrations that a large volume of air must be sampled to ensure that a sample of sufficient quantity is collected for analysis. The high-volume air samplers in the EMS monitoring network are run continuously for a period of one week at a flow rate of 400 liters per minute (lpm). Collected particulate data are expressed as concentrations per unit of air volume. The sampled volume is calculated by knowing the sampler flow rate and duration of sampling.

While it is not critical that a constant flow rate be maintained, it is vital that the flow rates are known for the entire sampling period. Historically, flow rates were measured at the beginning and end of sampling periods, and interpolation was used for calculating average total flow rate. However, the samplers now used by EMS have automatic mass flow correction capability. That is, a system is employed by the samplers that ensures a constant mass flow rate. The flow correction system, based on internal mass flow measurements, increases the sampling motor speed as the filters become loaded with particulates. The system also corrects for changes in barometric pressure, ambient temperatures, and AC line voltage. The hi-vol units also employ circular chart recorders that continually record air flow rates. The use of chart recorders allows verification of flow throughout the sampling period, and calculation of total flow if operational consistency is not maintained during the entire week. However, the air samplers still require calibration.

EMS has three calibration units that are used to verify hi-vol flow rates. The first is a Miriam Model 50MCE 2-2F venturi calibrator. The unit consists of a filter adapter, laminar flow element, and two pressure drop ports connected to a manometer. Because of the size and difficulty of properly transporting the assembly, this unit is primarily used at the EMS equipment repair facility (Building 596).

The second calibrator is a portable Lucite venturi assembly, which includes a filter adapter, venturi body, and magnehelic gauge. It is of one-piece construction and its ease of handling lends well to field application. Therefore, it is the principal unit used for standardizing the hi-vol air samplers in the field.

The third calibrator unit is a GMW model BGI/G28-35. This top-loading venturi calibrator has an adjustable orifice and thus can offer variable loading resistance to the hi-vol sampler. Calibrator pressure drop is read out via the manometer or magnehelic. A calibration curve that is traceable to NIST standards is supplied by the manufacturer. This is a backup calibrator and is not used in the field.

The Miriam and Venturi calibrators are serviced and calibrated to NIST standards annually by the Hazards Control Industrial Hygiene Instrument Laboratory. Copies of the calibration curves are kept by both Hazards Control and EMS.

The Miriam Model 50MCE 2-2F and the GMW model BGI/G28-35 are seldom used to record routine air flows but are used, with their variable load resistance capabilities, to check the automatic mass flow ranges of the flow control unit.

The air sampler flows are checked each week, when filters are changed, to verify flow at the beginning and end of the sampling period and to evaluate flow set-point consistency.

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Weekly flow readings are documented on the Field Tracking Form (FTF) located in the field logbook. Repairs to the hi-vol sampler, motors, or flow controllers are made as required, and details of these repairs are recorded on the FTF in the field logbook. Motor sor motor brushes are changed on a routine preventative maintenance schedule as discussed in Reference 2, EMP-AP-S.

3. REFERENCES

1. GMW High-Volume Air Samplers Operation Manual
2. EMP-AP-S, *Air Particulate Sampling*
3. EMP-QA-DC, *Document Retention*
4. EMP-QA-NCR, *Nonconformance and Discrepancy Reporting*

4. DEFINITIONS

Hi-Vol: High-volume air sampler, used to pull air through filter paper at a preset flow rate.

GMW: General Metal Works Company Inc., manufacturer of hi-vol air samplers.

lpm: Liters per minute. Measure of air flow rate per unit of time.

NIST: United States National Institute of Standards and Technology, formally the National Bureau of Standards (NBS).

Venturi: A constriction that, when placed in an airflow stream, creates a pressure differential.

Laminar Flow: Even, unobstructed airflow.

Manometer: Liquid U-tube device that changes the height of liquid level with reduced air pressure or partial vacuum.

Magnehelic: Low pressure or vacuum-indicating gauge.

Motor Brushes: Carbon-graphite, spring-loaded motor contacts that conduct power to the interior rotating motor windings.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS Section Leader ensures that sampling and calibration procedures meet and conform to the appropriate regulatory guidance.

5.2. TAMM GROUP LEADER

The TAMM Group Leader is responsible for assuring that the procedure is carried out.

5.3. TAMM ANALYST

The TAMM Analyst is responsible for ensuring that the calibration of the hi-vol sampling units is performed as prescribed by this procedure. The analyst is also

responsible for seeing that annual calibration of each calibration unit is performed by Hazards Control and/or GMW.

5.4. TSG TECHNICIAN

The TSG Technician is responsible for calibrating the hi-vol sampling units as prescribed by this procedure.

6. PROCEDURE

Equipment Required:

Calibration logbook (TS477, room 1030)
Miriam Model 50MCE 2-2F flow calibrator unit
LLNL venturi field flow calibrator
General Metals Works Co. Model BGI/G28-35 calibrator unit
All calibration units must have current calibration curves available.
These curves are identified by a number issued by HC and found on a label affixed to the calibration units.
GMW Hi-vol air sampler
Flow controller adjustment pin (located inside GMW hi-vol housing)
Whatman 41 cellulose filter paper (8 x 11 inches)
Calibration data and curves (currently calibrated)
Field logbook with Field Tracking Forms

6.1. MIRIAM MODEL 50MCE 2-2F CALIBRATOR (REPAIR FACILITY UNIT)

6.1.1. Place and secure the high-volume air sampler lid in the open position.

6.1.2. Clean all dust and debris from the sampler interior and sample support pan.

6.1.3. Loosen the four swing-away nuts and remove the aluminum hold-down filter frame.

6.1.4. Place a new filter paper on the stainless-steel support grid and reinstall the hold-down filter frame.

6.1.5. Start the hi-vol air sampler and allow it to run for a few minutes to reach equilibrium (as stated in the calibrator manual). This allows the motor and the controller's probe sensor to warm-up (the controller probe sensor is heat sensitive).

6.1.6. Turn off the power to the hi-vol. Place the filter adapter and flow calibrator on the hi-vol. Align the edges of the filter adapter of the calibrator unit squarely with edges of the hold-down filter frame.

6.1.7. Place the manometer near the hi-vol on a steady, level surface. Turn the "T" leg 90 degrees to give the unit a steady base. Using the thumb-screw leg located on the bottom of the unit, level the manometer while observing the bubble level located in the top of the unit.

6.1.8. Open the valves on the manometer unit's hose barb counterclockwise one to two turns from their seated, closed positions. Allow the fluid to equilibrate a few minutes before continuing.

6.1.9. After the manometer fluid has equilibrated, adjust the oil level to zero on the manometer scale using the fluid control screw located at the bottom of the unit.

6.1.10. Connect the end of the rubber hose marked #1 to the manometer valve marked #1. Connect the end of the hose marked #2 to the manometer valve #2.

6.1.11. Start the hi-vol air sampler and allow it to run for a few minutes to reach equilibrium.

6.1.12. Complete the attachment of the tube marked #1 to the orifice marked #1, and tube #2 to orifice #2 on the calibrator.

6.1.13. Referring to the current calibration curve, verify flow rate vs. static pressure. If the flow rate is incorrect, make the necessary controller adjustments to set flow at 400 lpm. Flow adjustments can be made by turning the adjusting screw clockwise to increase flow and counterclockwise to decrease flow. See section 7 for calibrator flow documentation.

6.2. PORTABLE VENTURI CALIBRATION UNIT (FIELD UNIT)

6.2.1. Record the sampler ID number, date, calibration unit used, and your initials on the FTF inside the field logbook.

6.2.2. Place and secure the high-volume air sampler lid in the open position.

6.2.3. Check the rubber gasket on the flared end of the calibrator to be sure there are no tears or cuts, then place the flared end of the calibrator onto the air filter using care to align edges with the filter hold-down frame.

6.2.4. To determine the flow rate, read the number off the magnehelic (inches in water). Using the calibration curve (see Attachment A for example) convert that number to liters/min. Record the 'flow off' in the field notebook.

6.2.5. Remove the calibration unit from the hi-vol.

6.2.6. Loosen the four swing-away nuts and remove the aluminum hold-down filter frame.

6.2.7. Process the sample and place a new filter paper on the stainless steel support grid as described in EMP-AP-S. Replace the aluminum hold-down frame and tighten the four swing-away nuts.

6.2.8. Allow the air sampler to run for a few minutes to reach equilibrium.

6.2.9. Process the used filter as per Reference 2.

6.2.10. Place the flared end of the calibrator onto the air filter using care to align edges with the aluminum hold-down frame.

6.2.11. Determine the flow rate with the clean new filter paper using the magnehelic reading and convert it to liters/minute using the calibration curve.

6.2.12. If flow is not at the desired 400 lpm, turn the flow controller adjustment screw clockwise to increase flow, counterclockwise to reduce flow. This adjustment is highly sensitive and often delayed; therefore, wait a few minutes for the system to stabilize after adjustment. The adjustment screw on some units is inside the small six-inch door on the front of the sampler; on other units it is in the control box, located behind the large lower front door. If a control locknut is used to hold the flow adjustment screw in position, loosen it before making the flow adjustment and retighten it after adjustment is complete.

6.2.13. Note any adjustments made to the 'flow on' in the field logbook. If the correct flow cannot be achieved, the sampler, motor, flow controller, etc., may need to be replaced. On the FTF in the field logbook and the service-maintenance log located inside the hood of each individual sampler, note any problems, sampler's initials, the date, and the repairs made. In this way, the failure and repair history of each sampler can be tracked. If necessary, return the equipment to the repair facility.

6.2.14. Remove the calibration unit and return the calibration equipment to its proper storage area.

6.3. GENERAL METAL WORKS BGI/G28-35 CALIBRATOR UNIT (VARIABLE RESISTANCE UNIT)

- 6.3.1. Place and secure the high-volume air sampler lid in the open position.
- 6.3.2. Clean dust and debris from the sampler interior and sample support pan.
- 6.3.3. Loosen the four swing-away nuts and remove the aluminum hold-down filter frame.
- 6.3.4. Place a new filter paper on the stainless-steel support grid.
- 6.3.5. Allow the sampler to run for five minutes to stabilize the airflow through the filter, then turn the sampler off.
- 6.3.6. Place the 8 x 11 inch calibrator flat plate assembly over the clean filter paper.
- 6.3.7. Replace the filter hold-down rectangular bracket, and tighten the four wing nuts securely.
- 6.3.8. Insert the four-inch-diameter loading cylinder onto the calibrator head assembly and tighten the threaded collar securely. Be sure the black knob on top is rotated fully counterclockwise to the open, maximum flow position.
- 6.3.9. Connect the magnehelic or manometer pressure gauge via tubing to the loading cylinder nipple.
- 6.3.10. Turn on the hi-vol sampler.
- 6.3.11. Referring to the manufacturer-supplied, NIST-traceable calibration curve, verify flow rate vs. static pressure. If flow rate is not 400 lpm, adjust the hi-vol sampler flow control unit to obtain the correct 400 lpm flow.
- 6.3.12. This calibrator allows you to produce a variable resistance load to the sampler, simulating loading of a dirty filter. By rotating the black knob on the top of the cylinder slightly clockwise, additional loading can be imposed on the sampler. Do not exceed the maximum loading setting, indicated by a blue mark on the cylinder knob.

7. DOCUMENTATION/QA RECORDS

All air sampler calibration unit data must be recorded in the calibration logbook. This logbook is different from the field logbook and is stored and maintained by a designated TSG technician. Current calibration curves and data plots for the sampler calibration units calibrated by Hazards Control Department will be kept on file by Hazards Control Industrial Hygiene Instrument Calibration Laboratory. EMS will achieve calibration curves and hi-vol flow rate weekly historical records produced on a circular strip-chart recorder. Strip charts are changed weekly with the filter paper, and the chart record is filed according to the requirements of Reference 3.

When using the portable field venturi flow calibrator, note in the field logbook any flow adjustments required, and the flow on (which should be 400 lpm). If the correct flow cannot be achieved, the sampling unit, motor, flow controller, etc., may need to be replaced. On the service-maintenance log located inside the hood of each individual sampler, note the repairs made, initials, and date. When repairs are made, date, initials of person performing repairs, and details of repair should also be noted in the field logbook. In this way the failure and repair history of each sampler can be tracked. Completed field logbooks are archived by EMS (according to the requirements of Reference 3).

8. ACCEPTANCE CRITERIA

Hi-vol air sampler units are calibrated weekly, using the portable venturi calibrator, when filters are collected and replaced. The flow rate at the time the sampled filter is removed, and the initial flow rate when the clean filter is put on, are both recorded in the field

notebook for each site. The flow on should be always be 400 lpm, if it is not, the flow controller is recalibrated to 400 lpm.

The calibrator units will not be acceptable for use if they have not been serviced and calibrated by Hazards Control Industrial Hygiene Calibration Laboratory, by the manufacturer, or by another approved facility using NIST-traceable methods. Annual multipoint calibration is required for the routinely used Venturi calibrator because it is subject to harsh field conditions. The Hazards Control Industrial Hygiene Calibration Laboratory sends EMS a notice when calibration is required. All calibration units, whether used on a regular basis or not (unless removed from service), are calibrated annually.

9. ATTACHMENTS

Attachment A: Sample calibration curve.

SIZE NO. 2

CALIBRATION CHART

GILMONT®
INSTRUMENTS INC.

Flowmeter Catalog No. F1200
Serial No. 22601 - 22800

11C0044

CALIBRATION CHECK
7/21/93 w/ Bios 2000
CALIBRATION - SAME
CURVE AS PREVIOUS

FLOAT PROPERTIES

Diameter = 0.125" Weight = 0.0424 GM Density = 2.53 GM/ML

* MEASURED AND FLOWING AT 1 ATM. AND 70° F

WATER
ML/MIN.
R

SCALE READING AT CENTER OF BALL

NOTE: Values of R above should be used only with computerized theory

ATTACHMENT A
SAMPLE CALIBRATION CURVE

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EMP-AP-L

AIR PARTICULATE LOCATIONS

Prepared by:

Paula Tate 1/12/94
Paula Tate date
Environmental Analyst, TAMM

Paris Althouse 1-12-94
Paris Althouse date
Environmental Technologist, TSG

Reviewed by:

David Graves 1-12-94
David Graves date
Environmental Technologist, TSG

Rebecca Ward 1-12-94
Rebecca Ward date
Environmental Technologist, TSG

Approved by:

for RF/Rebecca Ward 1.12.94
Rebecca A. Failor date
Section Leader, EMS

Kris Surano 1/12/94
Kris Surano date
Group Leader, TAMM

Lucinda M. Garcia 1/13/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

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1. PURPOSE

This procedure, which describes the locations of the Environmental Monitoring Section's 28 air particulate sampling locations, is to be used in conjunction with EMP-AP-S, *Air Particulate Sampling* (Reference 1).

2. DISCUSSION

Environmental air sampling is conducted to evaluate potential doses to populations from inhaled or ingested radionuclides (Reference 2). The Environmental Monitoring Section (EMS) monitors air particulates to assess potential environmental impacts from Laboratory operations. The configuration of the air particulate monitoring network involves several elements: the number of sampling/monitoring sites, their geographical location, historical wind patterns, effects of topography, and access logistics. The LLNL air particulate sampling network design is also guided by Reference 2, which stipulates that sampling locations should include locations of maximum predicted ground-level concentrations from stack releases, locations in the nearest community, and background locations. To address these factors, air particulate samplers are placed at facility boundaries and at off-site locations, both upwind and downwind from the facility. Resources, manpower, and logistics (such as availability of AC power, access, and security) must also be considered and often have affected the selection of sampling locations.

Each sampling location is identified with alphanumeric designators in accordance with Reference 3. Attachment A is a map showing the locations of the LLNL perimeter samplers; Attachment B is a map showing the locations of the off-site, Livermore Valley samplers; and Attachment C is a map showing the locations of Site 300 samplers.

Some samples are collected on private property and some sampling location names/designators involve the use of private individuals' names. It is the policy of LLNL and EMS that the names and addresses of private parties, and directions to such sampling locations, remain in strict confidence; this information is furnished only on a need-to-know basis. Sampling technicians who need this proprietary information to perform their sampling activities should contact the responsible Environmental Analyst.

3. REFERENCES

1. EMP-AP-S, *Air Particulate Sampling*
2. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
3. EMP-QA-SL, *Sample Location Designators*
4. EMP-AT-L, *Air Tritium Locations*
5. EMP-QA-S, *Quality Assurance Sampling*

4. DEFINITIONS

N/A

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5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS section leader has final approval authority for the selection of all sample locations.

5.2. TAMM GROUP LEADER

The TAMM group leader ensures that sampling locations meet design criteria and applicable procedures.

5.3. TAMM ENVIRONMENTAL ANALYST (AIR)

The TAMM Environmental Analyst is responsible for determining sample locations and assigning new designators to new sample locations. The Analyst is also responsible for providing proprietary information to Environmental Technicians responsible for sample collection.

5.4. EMS QA COORDINATOR

The QA Coordinator is responsible for approving design changes that involve air sampling locations and archiving all design changes and revisions to this procedure.

5.5. TSG ENVIRONMENTAL TECHNICIANS (OR TECHNOLOGIST)

The TSG Environmental Technicians are responsible for collecting air particulate samples at the locations described in this procedure.

6. PROCEDURE

Equipment Required:

N/A

6.1. SAMPLING LOCATIONS

Quality Assurance for the sampling program is performed by rotating a designated sampling unit through the permanent sampling locations on a bimonthly basis, thus providing duplicate samples. The QA sample is sent to the laboratory as a blind duplicate sample and is analyzed in the same manner as all other samples, thus allowing assessment of the integrity of both analytical and sampling techniques and giving a measure of precision. Attachment A is a map of the Livermore-site perimeter air particulate sampling locations, Attachment B shows the off-site sampling locations, and Attachment C shows the Site 300 sampling locations.

6.2. LIVERMORE-SITE PERIMETER LOCATIONS

6.2.1. BUILDING 531 (L-B531)

Driving north from the South Gate guard shack, turn right on South Outer Loop Drive and proceed to Avenue H. Turn left on Avenue H and then left on Third Street and park on the west side of B531. The sampler is located behind B531 at the northwest corner.

6.2.2. COWBARN (L-COW)

Driving east on the northern portion of Outer Loop Road, turn north on Avenue T and travel until the road dead-ends at 11th Street. The sampler is located in the fenced-in area on the north side of the road northeast of Building 592.

6.2.3. VISITORS CENTER (L-VIS)

Driving east on East Gate Drive, go past the East Entrance guard station and turn right into the Visitors Center parking lot, and park. The sampler is located approximately 75 feet from the parking lot on the south side of a small arroyo that divides the parking lot from the Visitors Center. The sampler is located at a power panel on the east side of the trailers.

6.2.4. CREDIT UNION (L-CRED)

Driving east on East Gate Drive, proceed past the guard station and turn south onto Greenville Road. Turn right into the UNCLE Credit Union/East Badge Office parking lot and park in front of the Credit Union. The sampler is located on the east side of the Credit Union Building.

6.2.5. SALVAGE YARD (L-SALV)

Driving south on South Outer Loop Road from the intersection of East Gate Drive, travel 0.2 miles to an unmarked road on the left (just before the trailer staging area). Follow this road approximately 200 feet to an unmarked gate with lock #PB222 (the key is on the key chain for the Bronco). Unlock the gate, drive through and turn south. Follow the perimeter fence along Greenville Road until you reach another locked gate (lock #PB222). Unlock the gate and proceed along the perimeter fence until the road turns west. Follow the road to the west and continue approximately 0.2 miles. The sampler is located between the East Avenue fence and the salvage yard.

It is the responsibility of the sample technician to ensure all gates are locked after the samples are collected.

6.2.6. SOUTH CAFETERIA (L-CAFE)

Driving south on South Gate Drive, drive past the guard station and make a right turn on the perimeter access road just before East Avenue. Proceed approximately 300 feet to a point right behind the South Cafeteria. The sampler is located next to the East Avenue fence, on the south side of the cafeteria.

6.2.7. MESQUITE (L-MESQ)

Proceed west on Mesquite Way towards Vasco Road, turn right on the road just before the Sunshine Building (B-041, LLNL mail services). The sampler is located inside the LLNL fence at the northwest corner of the Sunshine Building.

6.2.8. MET TOWER (L-MET)

Drive west on West Gate Drive towards the West Gate. Just before you get to the guard shack, turn right onto the gravel road. Drive approximately 0.5 miles and turn right just after the Meteorological Tower fence line. Travel approximately 400 feet along this road, and the sampler is located next to the telephone pole.

6.3. LIVERMORE VALLEY SAMPLING LOCATIONS

6.3.1. EAST AVENUE FIREHOUSE (L-FIRE)

From the intersection of East Avenue and Vasco Road, drive 1.2 miles west on East Avenue. Turn right on Loyola Avenue and then turn left into the back parking lot of the fire station. The sampler is located in the back parking lot next to a telephone pole.

6.3.2. SANDIA TANK (L-TANK)

Drive from South Gate Drive across East Avenue to the entrance of Sandia National Laboratory, Livermore. Identify yourself to the guard (if one is present), and follow the main road to the right past the parking area and up the hill to the gate at the base of the water towers. Open the EMS combination lock on the gate and continue (on foot) south towards the southeast corner of the fence. The sampler is located on the southeast side of the water towers.

It is the responsibility of the sample technician to ensure the gate is locked after the sample is collected.

6.3.3. ZONE 7 (L-ZON7)

Drive north on Greenville Road from the LLNL East Entrance. After approximately a half mile, turn right on Patterson Pass Road and proceed east for 0.6 miles. Turn left into the Livermore Zone 7 Water Treatment Facility. The sampler is located on top of the clarifier, which is on the left side of the access road, before the parking area.

6.3.4. (L-PATT)

This location involves proprietary information. Sampling Technicians who need this proprietary information to perform their sampling activities should contact the responsible Environmental Analyst.

6.3.5. (L-ALTA)

This location involves proprietary information. Sampling Technicians who need this proprietary information to perform their sampling activities should contact the responsible Environmental Analyst.

6.3.6. (L-RRCH)

This location involves proprietary information. Sampling Technicians who need this proprietary information to perform their sampling activities should contact the responsible Environmental Analyst.

6.3.7. FCC STATION (L-FCC)

The Federal Communications Commission (FCC) Station is on Lorraine Street. From Vasco Road proceed west on Dalton Road to its end, turn right on Ames Road and proceed to its end. Turn left on Raymond Road and then left on Lorraine Street. The FCC station is located on the right-hand side of the road. Turn up the driveway and proceed past the main office building on the right to the first small building. The sampler is just past the small building, on a cement pad next to the air conditioning unit.

6.3.8. ABANDONED LIVERMORE CORPORATION YARD (L-LCCY)

Leaving LLNL from the south main entrance, follow East Avenue west toward town. Turn right on Maple Street and continue past First Street. Just past First Street, turn onto Railroad Ave. The abandoned Livermore City Corporation Yard is on the east end of the avenue at 2500 Railroad Avenue, behind Tri-Valley Cobbler. The yard is locked and the key (#AA10) is found on the Bronco keychain. Park outside the corp yard in spaces available. Unlock the gate and proceed into the yard. The sampler is located on the east side of the only building.

It is the responsibility of the sample technician to ensure the gate is locked after the sample is collected.

6.3.9. LIVERMORE WATER RECLAMATION PLANT (L-LWRP)

Leaving LLNL from the south main entrance, follow East Avenue west until it turns into Fourth Street. Follow Stanley Boulevard to Murrieta Boulevard. Take a right on Murrieta and then a left on Jack London Boulevard. LWRP is located at the northwest corner of where Jack London Boulevard dead-ends into Kitty Hawk Road. Proceed on Jack London Boulevard to main entrance, follow main road to the right (past the digester tanks). Unit is at the edge of the easternmost overflow pond.

6.3.10. VA HOSPITAL (L-HOSP)

From LLNL, travel west on East Avenue until it ends and turns into 4th Street. Follow 4th Street to L Street. Proceed south on L street (which becomes Arroyo Road) and follow it for 3.1 miles to the entrance of the hospital. Turn right to enter the hospital grounds and proceed up the hill on Sycamore Road toward the old incinerator and fire station. The sampler is on the right side of the incinerator building, before the road veers to the left. (Alternate route: From the intersection of Wetmore Avenue and State Highway 84, proceed southeast on Wetmore Avenue until it dead-ends. Turn right onto Arroyo Road and follow it 2.3 miles, following the road signs to the VA Hospital.)

6.3.11. (L-ERCH)

This location involves proprietary information. Sampling Technicians who need this proprietary information to perform their sampling activities should contact the responsible Environmental Analyst.

6.4. SITE 300 SAMPLING LOCATIONS

6.4.1. GOLF COURSE (3-GOLF)

This sampling location is located northwest of the Site 300 Cafeteria. Traveling from LLNL to Site 300 on Corral Hollow Road, enter S-300 main entrance. Sampler is located on the northwest side of Main Entrance Road, 50 feet before the guard shack. The sampler is next to the telephone pole.

6.4.2. LINAC ROAD (3-LIN)

From the East Command Post, turn right onto Route 2 and proceed 0.9 miles to the intersection of Route 3 and Route 1. Turn right on Route 1 and proceed about 1.6 miles to the gate at 812E. Call "Mike" on the two-way radio to ask for a 1060 (gate opened). Proceed through gate and drive about 1.25 miles to the second dirt road on the right. Turn onto this dirt road and drive about 0.3 miles; the air particulate sampler will be on your right. Once sample is collected and you are out of the gate at 812E, notify "Mike" that you are finished and back on pavement. At this time "Mike" will either secure the gate himself, or inform you to do so.

6.4.3. EAST COMMAND POST (3-ECP)

The sampler is under the meteorological tower between the Meteorological Building and the East Command Post on top of the hill. From the Site 300 Main Gate, drive through the second gate and proceed on Route 3 about 2.5 miles to the East Command Post. Turn right and go about 0.1 miles to the "Y" in the road. Take the left fork toward Trailer 988 and proceed on the dirt road to the top of the hill, where the air particulate sampler is located.

6.4.4. EAST OF 801 (3-801E)

This location was previously described as northeast of air sampler 10 (old air sampling location 040-10). Travel Route 1 about 0.2 miles to the sign that is marked "Tank 5." Make a very sharp left-hand turn and go to the top of the hill. Proceeding along the fire trail to the right, travel approximately 0.6 miles to the "T" in the road and turn right. This road will bring you around in front of the air sampler.

6.4.5. SOUTHWEST OF EAST OBSERVATION POST (3-EOBS)

From the entrance of Bunker 801, drive approximately 0.1 miles north to the first road on the right (just after a "Well 1" sign). Drive up the road approximately 0.4 mile to where the road splits, take the left-hand fork, drive approximately 0.3 miles to the East Observation Post. The sampler is on the north side of the Observation Post.

6.4.6. NORTH POWER STATION (3-NPS)

Proceeding north on Route 3, past Post 865, drive through the Advanced Test Accelerator (ATA) South Gate and proceed approximately 0.5 miles to the ATA North Gate Drive. Go through the gate and travel approximately 0.4 miles to the intersection of Routes 3 and 4. Turn right and follow the road to the top of the hill. The sampler is on the cement pad to the left.

6.4.7. WEST OBSERVATION POST (3-WOPS)

Starting at the intersection of Doall Road and Route 4, go south on Route 4 to the stop sign and turn left. Proceed approximately 0.4 miles to a sign indicating West Observation Post (WOP) and Tank 3. There, take the road to the right and drive to the WOP (at the top of the hill). The sampler is near the north side of the WOP.

6.4.8. WEST COMMAND POST (3-WCP)

The sampler is located at the West Command Post on Route 4. From the intersection of Route 4 and Doall Road, proceed south on Route 4 approximately 1.6 miles to the road just before Building 859. The sampler is next to a telephone pole on the right-hand side of the road, across the street from the West Command Post.

6.4.9. TRACY FIREHOUSE (L-TFIR)

(See map in Attachment C) Traveling east on Interstate 580/205, take the first Tracy exit. Follow Business 205 into the town of Tracy and turn onto Central Avenue. The firehouse is on the southwest corner of 9th Avenue and Central. Enter the firehouse through the back door, go past the front desk and up the stairs at the end of the hall. At the top of the stairs there is a recreation room. At the far end of the room is a small access stairway to the roof where the sampler is located.

7. DOCUMENTATION/QA RECORDS

Samplers must complete Field Tracking Forms and Chain-of-Custody Record Forms when collecting air tritium samples.

8. ACCEPTANCE CRITERIA

Only samples taken at official sampling locations will be used in the assessments of LLNL impacts on the environment, unless special samples are authorized in an approved sampling plan.

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9. ATTACHMENTS

- Attachment A: Map of LLNL on-site air particulate sampler locations.
- Attachment B: Map of LLNL off-site air particulate sampler locations.
- Attachment C: Map of LLNL Site 300 air particulate sampler locations.

Attachment A: Map of LLNL on-site air particulate sampler locations.

Attachment B: Map of LLNL off-site air particulate sampler locations.

- Air sampling locations
- ▲ Tritium sampling locations
- LLNL perimeter

Scale: Miles

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Attachment C: Map of LLNL Site 300 air particulate sampler locations.

Design Change Package EMP-AP-S-001

Air Particulate Sampling

Effective Date: October 10, 1994

Prepared by:

Duane Rueppel 10/5/94
Duane Rueppel, date
Group Leader, TSG

Approved by:

Paula Tate 10/6/94
Paula Tate date
Environmental Analyst, TAMM

Kris Surano 10/7/94
Kris Surano, date
Group Leader, TAMM

Lucinda M. Garcia 10/7/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Rebecca A. Failor 10/7/94
Rebecca A. Failor, date
Section Leader, EMS

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1. DISCUSSION

Air particulate filter exchange at Site 300, currently scheduled for every Monday, is disrupted every time there is a Monday holiday. This sampling must either be done on overtime (paying a sampling technologist to work on the holiday) or by pulling a sampling technologist not assigned to the air route from their routine duties to do the air filter exchange on a Tuesday. In addition, since the Site 300 air filter exchange only takes half a day, rescheduling that route from Monday to Wednesday would allow the technologist assigned to air to use Wednesday afternoon for maintenance activities or to prepare for the Thursday air tritium silica gel exchange.

2. PROCEDURE CHANGE

Section 2 of EMP-AP-S, Revision 2 states:

"The air particulate network is divided into two routes. The Site 300 route is composed of Site 300 monitoring locations and one downtown Tracy location. The Valley route encompasses LLNL site locations and the Livermore Valley locations. Sampling occurs on a weekly basis for each of the two routes, on Monday and Tuesday respectively."

Change the last sentence of this paragraph to read:

"Air filters are exchanged on a weekly basis for each of the two routes; Valley filters are exchanged on Tuesdays and Site 300 filters are exchanged on Wednesdays."

EMP-AT-CA

AIR TRITIUM CALIBRATIONS

Prepared by:

Paula Tate 1/12/94
Paula Tate date
Environmental Analyst, TAMM

Reviewed by:

Paris E. Althouse 1-12-94
Paris Althouse date
Environmental Technologist, TSG

Rebecca Ward 1-12-94
Rebecca Ward date
Environmental Technologist, TSG

Kris Surano 1/12/94
Kris Surano date
Group Leader, TAMM

Approved by:

for BF / R. Hoppes 1/12/94
Rebecca A. Failor date
Section Leader, EMS

Kris Surano 1/12/94
Kris Surano date
Group Leader, TAMM

Lucinda M. Garcia 1/13/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

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1. PURPOSE

This procedure provides instructions for calibrating and verifying the flow of air through the various tritium air samplers that comprise the Environmental Monitoring Section (EMS) air tritium monitoring network. The sampling network locations are detailed in Reference 1.

2. APPLICABILITY/DISCUSSION

To measure atmospheric tritium concentrations, airborne tritiated water vapor is collected in silica gel as outlined in Reference 2. To calculate the concentration of tritium in the atmosphere, the volume of air that has passed through the silica gel during the two-week sampling period must be known accurately. A Gilmont Rotameter is used to measure this flow, both at the start and end of the two-week sampling period. The rotameter is operated in the 'normal thru' mode, with no adjustment valve to affect calibration.

The rotameter is calibrated annually by LLNL's Hazards Control Industrial Hygiene Calibration Laboratory using standards traceable to National Institute for Standards and Technology (NIST). Flow calibration data (calibration curve) are maintained by both Hazards Control Department and EMS. The calibration equipment used by Hazards Control Department to calibrate this and many other LLNL rotameters is itself NIST traceable. The NIST documentation for the LLNL Hazards Control Flow Standard is maintained by Hazards Control Department and a copy is retained by the EMS Analyst.

The total volume of airflow volume for the sampling period is calculated by Radiation Analytical Sciences (RAS) chemists, using an average of the on-flow and off-flow in cc/min multiplied by the elapsed sampling time in minutes (normally two weeks, 20,160 minutes). The concentration of tritium in the silica gel is determined by the Radiation Analytical Sciences Laboratory. The average air tritium concentration can then be determined by dividing collected tritium (in picocuries) by the total air volume in milliliters. Average tritium air concentration is then expressed as picocuries per milliliter of air. Typical concentrations are in the range of 2×10^{-5} pCi/ml.

3. REFERENCES

1. EMP-AT-L, *Air Tritium Locations*
2. EMP-AT-S, *Air Tritium Sampling*
3. EMP-QA-NCR, *Nonconformance and Discrepancy Reporting*
4. EMP-QA-DC, *Document Retention Center*

4. DEFINITIONS

NIST: National Institute of Standards and Technology, formerly National Bureau of Standards (NBS)

Rotameter: A device used to measure airflow.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS section leader ensures that sampling and calibration procedures meet and conform to the appropriate regulatory guidance.

5.2. TAMM GOUP LEADER

The TAMM group leader is responsible for ensuring that the procedure is carried out and that adequate calibration records are maintained.

5.3. TAMM ANALYST

The TAMM Analyst is responsible for ensuring that the calibrations and flow verifications on the sampling units are performed as prescribed by this procedure.

5.4. TSG TECHNICIAN (OR TECHNOLOGIST)

It is the responsibility of the TSG technician to check and record the "off" volume of airflow each time a silica-gel tritium air flask is removed for analysis. The technician must also measure and record the "start" flow each time a new silica-gel flask is installed in the sampling unit and, if necessary, adjust the flow to ensure an exact flow of 700 cc/min at the start of the sampling period. If any sampling units are not operational or need repair or replacement, the TSG technician is responsible for these repairs or replacements. Spare parts, pumps, and replacement units are available from storage in Building 596. It is the responsibility of the TSG technician to ensure that the Gilmont rotameter is flow calibrated annually by LLNL Hazards Control Department, Industrial Hygiene (IH) Calibration Laboratory. It is the responsibility of the technician to ensure that the calibration curve is current and that it matches the correct rotameter. Hazards Control Department maintains a database of when recalibration is due, and the TSG technician and/or EMS Analyst will be notified. The TSG technician should bring the rotameter to the Hazards Control (IH) Calibration Laboratory. A calibration curve of flow rate vs. rotameter setting will be supplied to the TSG technician. Hazards Control Department will also maintain a reference copy.

6. PROCEDURES

6.1. FIELD PROCEDURES

Equipment Required:

Gilmont Rotameter with tapered glass connector (see Attachment A)
Current rotameter calibration curve (see Attachment B)
Tritium sampling logbook containing field tracking forms (see Attachment C)

6.1.1. Arrive at tritium air sampler site (see Reference 1 for locations).

6.1.2. Verify that the power is on and the unit is running. If the power is not on or the sampling unit is not running, note that fact on the Field Tracking Form (FTF). A NCR must be prepared for any defective sampler where the sample has been lost or compromised; see Reference 3 for Nonconformance and Discrepancy Reporting. A

sampling unit which is "off" upon arrival is automatically considered a "lost" sample because the technician has no way of determining the flow off. Samples are deemed acceptable if the "off" flow is within 20% of the "on" flow (however, a NCR will still need to be completed). Repair or replace the defective equipment as necessary.

6.1.3. Verify that the rotameter calibration is current by ensuring that it has been calibrated within the last 12 months by the Hazards Control IH Calibration Laboratory (see green HC tag on rotameter).

6.1.4. Remove the glass U-tube top from flask in the tritium air sampler and insert the tapered glass rotameter connector in its place.

6.1.5. Position the rotameter so it is vertical.

6.1.6. Note the rotameter indicator ball location on the rotameter scale. When reading the rotameter, use the midpoint of the ball.

6.1.7. Using the rotameter calibration curve, translate the ball reading to actual flow in cubic centimeters per minute (cc/min).

6.1.8. Record this as the "off" flow on the FTF for this location.

6.1.9. Log "off" date and time onto FTF. (A sample of a FTF is shown in Attachment C.)

6.1.10. Replace the silica-gel flask as outlined in procedure EMP-AT-S.

6.1.11. With the new silica-gel flask in place, measure the flow.

6.1.12. If "on" flow is not exactly 700 cc/min (as determined by the rotameter reading and calibration curve), adjust the pump's flow valve for a 700 cc/min flow.

Note: There are two methods available for adjusting the pump's flow. Small adjustments may be made by turning the external flow valve located on the primary intake line. Major adjustments may be made by turning the internal flow valve located inside the blue controller box.

6.1.13. Record the date and time on the FTF in the logbook. (The "on" flow is assumed because each flask is calibrated to 700 cc/min upon placement in the field).

6.2. ANNUAL ROTOMETER CALIBRATION

6.2.1. After calling to make an appointment, bring the specified rotameter to the Hazards Control Department, Industrial Hygiene Calibration Laboratory, located in Building 253.

6.2.2. HC will do a multipoint flow calibration. The calibration must be traceable to NIST standards. HC is responsible for maintaining the LLNL secondary flow to NIST traceable standards. See Attachment B for an example of a rotameter flow calibration curve from HC.

6.2.3. HC will provide a copy of the calibration curve to EMS and will also archive copies for reference.

6.2.4. EMS should replace expired calibration curves with current ones. Superseded calibration data should be filed in the EMS document retention center.

6.2.5. Anytime there is damage to the field rotameter, it should be recalibrated or replaced. If replaced, the technician should ensure that the calibration for the new rotameter is current; if not, it should be calibrated by HC.

7. DOCUMENTATION/QA RECORDS

7.1. TRITIUM SAMPLING LOGBOOK CONTAINING FIELD TRACKING FORMS

The tritium sampling logbook has Field Tracking Forms (FTF) taped inside. The logbook is maintained and archived by the EMS Environmental Technician, and provides a record of sample collection, maintenance performed on the sampling units, and flow rates for the units. Records are updated at each sample changeout, at each location (i.e., at each monitoring location every two weeks). A photocopy of the FTF should be given to the responsible EMS analyst after each silica gel run. Each logbook contains field sampling information for the year. Completed annual logbooks are retained in the EMS Document Retention Center.

7.2. CALIBRATION RECORDS

The rotameter flow calibration records are retained in the EMS Document Retention Center. Hazards Control Department, Industrial Hygiene Calibration Laboratory, also maintains a copy of these calibration records.

8. ACCEPTANCE CRITERIA

The operations described in this procedure will be considered satisfactorily completed after all the steps given in section 6 have been completed and the calibrations and verification of flow rates have been documented in the tritium sampling logbook.

9. ATTACHMENTS

- Attachment A: Gilmont Rotameter
- Attachment B: Rotameter calibration curve
- Attachment C: Sample of Field Tracking Form

ATTACHMENT A: GILMONT ROTAMETER

CALIBRATION CHART

GILMONT®
INSTRUMENTS, INC.

Flowmeter Catalog No. F1200 Hc 3044
CALIBRATION CHECK
7/21/93 w/ 8105 Dry Cal
Calibration - same
curve as electronic.

Serial No. 22501 - 22800

FLOAT PROPERTIES

Diameter = 0.125" Weight = 0.0424 GM Density = 2.53 GM/ML

AIR
ML/MIN*

*MEASURED AND FLOWING AT 1 ATM. AND 70° F

Q₂

WATER
R ML/MIN*

SCALE READING AT CENTER OF BALL

NOTE: Values of R above should be used only with compensated Inco/ry

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EMP-AT-CA
Air Tritium Calibrations

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ATTACHMENT B: ROTAMETER CALIBRATION CURVE

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ATTACHMENT C: SAMPLE OF FIELD TRACKING FORM

SILICA GEL ROUTE

Rev. 7/14/92

Date on: 12/16/93

Date off: 12/30/93

PA, HC 313

COC: 5006 LAB: RAS

range 560-840

All samples on at 700cc/min

Sample ID	Time on	Time Off	Flow Off	Wt. On	Wt. Off	Comments
L-MET-01-AT	0900	0930	700	5000.00	5050.00	
L-COW-01-AT	0940	1000	700	5000.00	5050.00	
L-VIS-01-AT	0950	1010	720	5000.00	5050.00	
L-SALV-01-AT	1000	1020	700	5000.00	5050.00	
L-CAFE-01-AT	1030	1030	710	5000.00	5050.00	
L-POOL-01-AT	1040	1040	690	5000.00	5050.00	
L-MESQ-01-AT	1050	1100	700	5000.00	5050.00	
L-B514-01-AT	1100	1115	700	5000.00	5050.00	
L-B624-01-AT	1110	1130	690	5000.00	5050.00	
L-B331-01-AT	1120	1140	700	5000.00	5050.00	
L-B292-01-AT	1130	1150	710	5000.00	5050.00	timer 10080
L-FIRE-01-AT	1145	1200	700	5000.00	5050.00	
L-VET-01-AT	1200	1215	700	5000.00	5050.00	timer 20160
L-XRDS-01-AT	1215	1230	715	5000.00	5050.00	timer 30240
L-ZON7-01-AT	1230	1300	680	5000.00	5050.00	
L-ALTA-01-AT	1300	1315	700	5000.00	5050.00	
L-LCCY-01-AT	1315	1330	700	5000.00	5050.00	
(CAFE) L-QA-01-AT	1330	1345	690	5000.00	5050.00	
L-QA-02-AT	1400	1415	700	5000.00	5050.00	

Design Change Package EMP-AT-L-001

Air Tritium Locations

Effective Date: June 14, 1994

Prepared by:

Paris Althouse

6/14/94

Paris Althouse,
Environmental Technologist, TSG

date

Approved by:

Paula Tate

6/14/94

Paula Tate,
Environmental Analyst, TMM

date

Approved by:

Lucinda M. Garcia

6/23/94

Lucinda M. Garcia,
Quality Assurance Coordinator, EMS

date

Approved by:

Kris Surano

6/20/94

Kris Surano,
Group Leader, TMM

date

Approved by:

Rebecca A. Failor

6/23/94

Rebecca A. Failor,
Section Leader, EMS

date

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1. DISCUSSION

The Livermore City Corporation yard, located 2500 Railroad Avenue, is no longer being used as an active maintenance yard. The facilities' operations and personnel have moved to a new location. The abandoned building has been boarded up and the yard entrance is locked. The air tritium sample unit at this location was vandalized twice in the past year, resulting in destroyed equipment and loss of samples.

2. PROCEDURE CHANGE

The air tritium sample unit at this location (L-LCCY) has been removed. At this time, no alternative location has been determined.

EMP-AT-L

AIR TRITIUM LOCATIONS

Prepared by: Paula Tate 1/12/94
Paula Tate
Environmental Analyst, TAMM
date

Reviewed by: Paris Althouse 1/12/94
Paris Althouse
Environmental Technologist, TSG
date

Rhonda Welsh 1/12/94
Rhonda Welsh
Environmental Technologist, TSG
date

Approved by: for RF/WLF/Voppe 1.12.94
Rebecca A. Failor
Section Leader, EMS
date

Kris Surano 1/12/94
Kris Surano
Group Leader, TAMM
date

Lucinda M. Garcia 1/13/94
Lucinda M. Garcia
Quality Assurance Coordinator, EMS
date

LLNL ENVIRONMENTAL
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1. PURPOSE

This procedure, which describes the locations of the Environmental Monitoring Section's 17 air tritium sampling locations, is to be used in conjunction with EMP-AT-S, *Air Tritium Sampling* (Reference 1).

2. DISCUSSION

Air is a primary exposure pathway for radioactive contaminants released to the atmosphere. Environmental air sampling should be conducted to evaluate potential doses to populations from inhaled or ingested radionuclides (Reference 2). The Environmental Monitoring Section (EMS) monitors tritium in air to assess potential environmental impacts from Laboratory operations. The configuration of the tritium monitoring network involves several elements: the number of sampling/monitoring sites, their geographical location, historical wind patterns, effects of topography, and access logistics. The LLNL tritium sampling network design is also guided by Reference 2, which stipulates that sampling locations should include locations of maximum predicted ground-level concentrations from stack releases, locations in the nearest community, and background locations. To address these factors, air tritium samplers are placed nearby at facility boundaries and at off-site locations, both upwind and downwind from the facility. Resources, manpower, and logistics (such as availability of AC power, access, and security) must also be considered in the selection of sampling locations.

Each sampling location is identified with alphanumeric designators in accordance with Reference 3. Attachment A is a map showing the location of the LLNL perimeter samplers, and Attachment B is a map showing the locations of the off-site, Livermore Valley samplers.

Some samples are collected on private property and some sampling location names/designators involve the use of private individuals' names. It is the policy of LLNL and EPD that the names and addresses of private parties, and directions to such sampling locations, remain in strict confidence, and this information is furnished only on a need-to-know basis. Sampling technicians who need this proprietary information to perform their sampling activities should contact the Responsible Analyst.

3. REFERENCES

1. EMP-AT-S, *Air Tritium Sampling*
2. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
3. EMP-QA-SL, *Sample Location Designators*
4. EMP-AP-L, *Air Particulate Locations*
5. EMP-QA-S, *Quality Assurance Sampling*
6. EMP-QA-SD, *Sample Tracking Documentation*

4. DEFINITIONS

None

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5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS section leader has final approval authority for the selection of all sample locations.

5.2. TAMM GROUP LEADER

The TAMM group leader assures that sampling locations meet design criteria and applicable procedures.

5.3. TAMM ENVIRONMENTAL ANALYST (AIR)

The TAMM Environmental Analyst is responsible for determining sample locations. The Analyst is also responsible for providing proprietary information to Environmental Technicians responsible for sample collection.

5.4. EMS QA COORDINATOR

The QA Coordinator is responsible for approving design changes that involve air sampling locations, assigning new sampling location designators as needed, and archiving all design changes and revisions to this procedure.

5.5. TSG ENVIRONMENTAL TECHNICIANS (OR TECHNOLOGIST)

The TSG Environmental Technicians are responsible for collecting airborne tritium samples at the locations described in this procedure.

6. PROCEDURE

Equipment Required:

None

6.1. QUALITY ASSURANCE SAMPLING

Quality Assurance for the sampling program is performed by rotating two designated sampling units through the permanent sampling locations on a bimonthly basis, thus providing duplicate samples. One QA unit is co-located alongside a permanent sample location on LLNL main site and another is placed offsite. The QA samples are sent to the laboratory as blind duplicate samples and are analyzed in the same manner as all other samples, thus allowing assessment of the integrity of both analytical and sampling techniques, and giving a measure of precision.

6.2. SAMPLING LOCATIONS

Note that 10 out of 17 air tritium samplers share locations with air particulate samplers. Air particulate sampler locations are described in detail in Reference 4.

6.3. LLNL SITE PERIMETER AIRBORNE TRITIUM SAMPLER LOCATIONS

6.3.1. MET TOWER (L-MET)

Drive west on West Gate Drive towards the West Gate. Just before you get to the guard shack, turn right onto the gravel road. Drive approximately 0.5 miles and turn right just after the Meteorological Tower fence line. Travel approximately 400 feet along this road, and the sampler is located next to the telephone pole.

6.3.2. BUILDING 292 (L-B292)

Take Avenue B to 8th Street; turn right into the south parking area of B-292. The tritium sampler is located in the grassy area south of B294 and east of the group of pine trees.

6.3.3. COWBARN (L-COW)

Driving east on the northern portion of Outer Loop Road, turn north on Avenue T and travel until the road dead-ends at 11th Street. The sampler is located in the fenced-in area across from Building 592.

6.3.4. VISITORS' CENTER (L-VIS)

Driving east on East Gate Drive go past the East Entrance Guard Station turn right into Visitors' Center parking lot, and park. The sampler is located approximately 75 feet from the parking lot, on the south side of a small arroyo that divides the parking lot from the Visitors' Center. The sampler is located at the power panel on the east side of the trailers.

6.3.5. SALVAGE YARD (L-SALV)

Driving south on South Outer Loop Road from the intersection of East Gate Drive, travel 0.2 miles to an unmarked road on the left (just before the trailer staging area). Follow this road approximately 200 feet to an unmarked gate with lock #PB222 (the key is on the key chain for the Bronco). Unlock the gate, drive through, and turn south. Follow the perimeter fence along Greenville Road until you reach another locked gate (lock #PB222). Unlock the gate and proceed along the perimeter fence until the road turns west. Follow the road to the west and continue approximately 0.2 miles. The sampler is located between the East Avenue fence and the salvage yard. It is the sample technician's responsibility to ensure all gates are locked after the samplers are changed out.

6.3.6. BUILDING 514 (L-B514)

Driving west on South Outer Loop Road, turn left on Avenue F, proceed to First Street, and turn left. Take First Street to Avenue G and turn left. (You must go this way because of one-way roads). Park on the west side of B-514, enter the building, and obtain permission to proceed to the hazardous waste storage area east of the building. The sampler is located directly behind B-514 on the east wall.

Note: Shoe covers and eye protection are required to enter this area. Upon exiting the hazardous waste storage area and before removing the shoe covers, it is necessary to check for radiation with the hand/foot monitoring equipment. Check with building personnel if you don't know how to use radiation monitoring equipment. Sign in and out on the logbook.

6.3.7. BUILDING 624 (L-B624)

Proceed south on Avenue H from South Outer Loop Road. Park in front of the hazardous waste trailer complex, T-6178. Go to the northeast corner inside the trailer. Log in and out of the hazardous waste storage area. The gate to the yard is locked, and trailer personnel must let you in. Eye protection is required. Once inside the yard, walk north. The tritium sampler is located at the southwest corner of the decommissioned incinerator control room facility (B-624).

6.3.8. SOUTH CAFETERIA (L-CAFE)

Driving south on South Gate Drive past the guard station, make a right turn on the perimeter access road right before East Avenue. Proceed approximately 300 feet to a point right behind the South Cafeteria. The sampler is located next to the East Avenue fence, on the south side of the cafeteria.

6.3.9. LLNL SWIMMING POOL (L-POOL)

Entering the LLNL south gate from East Avenue, turn left onto South Mail Road, proceed approximately 800 feet to B-318. The sampler is located in the fenced area behind B-318, to the north, between the building and the LLNL swimming pool.

6.3.10. MESQUITE (L-MESQ)

Proceed west on Mesquite Way towards Vasco Road, turn right on the road just before the Sunshine Building (B-041, LLNL Mail Services). The sampler is located inside the LLNL fence at the northwest corner of the Sunshine Building.

6.3.11. BUILDING 331 (L-B331)

Notes: Call the secretary in the Tritium Building (extension 21302 or 29872) before leaving to change the sample, so that you can be granted access through the superblock CAIN booth.

Take Avenue D from West Inner Loop, park in the B-334 lot, and proceed through the superblock CAIN booth. The tritium sampler is located across from the east wall of B-331, up against the west wall of B-332, approximately 50 feet south of the northwest corner of B-332.

6.4. OFF-SITE SAMPLING LOCATIONS

6.4.1. EAST AVENUE FIREHOUSE (L-FIRE)

From the intersection of East Avenue and Vasco Road, drive 1.15 miles west on East Avenue. Turn right on Loyola Avenue and then turn left into the back parking lot of the Fire Station. The sampler is located in the back parking lot next to a telephone pole.

6.4.2. (L-VET)

This location involves proprietary information. Sampling technicians who need this proprietary information to perform their sampling activities should contact the Responsible Analyst.

6.4.3. (L-XRDS)

This location involves proprietary information. Sampling technicians who need this proprietary information to perform their sampling activities should contact the Responsible Analyst.

6.4.4. ZONE 7 (L-ZON7)

Drive north on Greenville Road from the LLNL East Entrance. After approximately a half mile, turn right on Patterson Pass Road and proceed east 0.6 miles. Turn left into the Livermore Zone 7 Water Treatment Facility. The sampler is located on top of the clarifier, which is on the left side of the access road, before the parking area.

6.4.5. (L-ALTA)

This location involves proprietary information. Sampling technicians who need this proprietary information to perform their sampling activities should contact the Responsible Analyst.

6.4.6. ABANDONED LIVERMORE CORPORATION YARD (L-LCCY)

The abandoned Livermore City Corporation Yard is on the east end of the avenue at 2500 Railroad Avenue, behind Tri-Valley Cobbler. The yard is locked and the key (#AA10) is found on the Bronco keychain. Park outside the corp yard in spaces available. Unlock the gate and proceed into the yard. The sampler is located on the east side of the only building. It is the sample technician's responsibility to ensure the gate is locked after the sampler is changed out.

7. DOCUMENTATION/QA RECORDS

Samplers must complete Field Tracking Forms and Chain-of-Custody Record Forms when collecting air tritium samples (refer to References 1 and 6).

8. ACCEPTANCE CRITERIA

Only samples taken at official sampling locations will be used in the assessments of LLNL impacts on the environment, unless special samples are authorized in an approved sampling plan.

9. ATTACHMENTS

Attachment A: Map of LLNL on-site tritium air sampler locations

Attachment B: Map of LLNL off-site tritium air sampler locations

Attachment A: Map of LLNL on-site tritium air sampler locations

Attachment B: Map of LLNL off-site tritium air sampler locations

- Air sampling locations
- ▲ Tritium sampling locations

--- LLNL perimeter

Scale: Miles

EMP-AT-S

AIR TRITIUM SAMPLING

Prepared by:

Paula Tate 1/12/94
Paula Tate date
Environmental Analyst, TAMM

Paris P. Althouse 1/12/94
Paris Althouse date
Environmental Technologist, TSG

Reviewed by:

Donald Ramsey 1-12-94
Donald Ramsey date
Technical Coordinator, TSG

Rhonda Welsh 1-12-94
Rhonda Welsh date
Environmental Technologist, TSG

David Graves 1-12-94
David Graves date
Environmental Technologist, TSG

Approved by:

Rebecca A. Failor 1/12/94
Rebecca A. Failor date
Section Leader, EMS

Kris Surano 1/12/94
Kris Surano date
Group Leader, TAMM

Lucinda M. Garcia 1/12/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

ENVIRONMENTAL MONITORING SYSTEMS
UNCONTROLLED COPY
FOR INFORMATION ONLY

1. PURPOSE

This procedure describes the steps involved in air tritium sampling: filling silica-gel flasks used in sample collection, gathering samples for tritium analysis, completing the necessary paperwork, and preparing the samplers for the next sampling cycle. The location for all air tritium samplers is described in Reference 1, EMP-AT-L.

2. APPLICABILITY/DISCUSSION

This procedure is applicable to all individuals involved in the sampling of air tritium. Tritium represents the single largest radionuclide air emission at LLNL, and tritiated water vapor can be taken up into vegetation, food stuffs, wine, milk, etc.

Tritiated water vapor (HTO) is continuously monitored at several locations around the LLNL perimeter and off site in the Livermore Valley. Large volumes of air are passed over silica gel, and water vapor contained therein is entrained on the gel (Attachment A shows a drawing of an air tritium sampling unit). Once collected, this water is separated from the silica gel by freeze-dried vacuum distillation. Then, it is analyzed for tritium content by low-level liquid scintillation counting.

The silica gel samples at each location are collected and changed every other Thursday, a process that usually takes approximately 5 hours. At least 1 hour should be allotted to prepare the flasks [at the Radiological Analytical Sciences Section (RAS) laboratory], and approximately 30 minutes should be allotted for completing the documentation and delivering the samples. The entire process from start to finish will usually take less than 7 hours.

3. REFERENCES

1. EMP-AT-L *Air Tritium Locations*
2. EMP-QA-S *Quality Assurance Sampling*
3. EMP-AT-CA *Air Tritium Calibrations*
4. EMP-QA-SD *Sample Tracking Documentation*
5. EMP-QA-NCR *Nonconformance and Discrepancy Reporting*
6. EMP-QA-DC *Document Retention Center*

4. DEFINITIONS

Angel Hair: Spun glass that is used as a filtering material. .

Argon-Purged Box: A container (used to store silica gel) to which a vacuum is applied and then backfilled with argon gas to keep the container and contents free of moisture.

Blind Duplicate QA Samples: Samples that are submitted to RAS for analysis from a duplicate location; however, RAS does not know the location of the sample.

Channeling: The result of uneven distribution of silica gel within a flask, which causes moisture to follow a narrow, distinct path through the gel, rather than a broad, dispersed path.

Gilmont Rotameter: A flow meter, consisting of a graduated tube containing a free-floating ball, that measures the airflow rate through the sampler.

Ground Fault Interrupter (GFI): Electrical circuit breaker used to protect personnel from electrical shock. Used as part of the airborne sampling equipment in the field, the GFI isolates the sampling unit from the electrical supply so that once the unit has been tripped, it must be manually restarted.

Shaker: A motorized unit used to settle silica gel in a flask.

Silica Gel: An amorphous glassy mineral resembling rock salt, but possessing many fine pores that are capable of moisture adsorption. The silica gel used by EMS is an "indicator gel" meaning it is blue when completely dry then turns pink with the introduction of moisture.

U-Shaped Inlet Tube: The glass tube on the sampling unit through which the sample is drawn.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS section leader ensures that sampling methods meet regulatory guidance and that sampling is conducted in accordance with approved procedures.

5.2. TAMM GROUP LEADER

The TAMM group leader ensures that sampling procedures meet design criteria and that sampling is conducted in accordance with approved procedures.

5.3. TAMM ANALYST

The TAMM environmental analyst is responsible for the design, implementation, and correct operation of the tritium air monitoring network, analysis and evaluation of all monitoring results, data trending, data reporting, and documentation of air tritium results in the LLNL Annual Environmental Report.

5.4. TSG ENVIRONMENTAL TECHNICIAN (OR TECHNOLOGIST)

The TSG environmental technician is responsible for preparing the tritium air sampling silica-gel flasks, changing out the sampling flasks at all on-site and off-site field sampling locations, and returning the exposed sampling flask to the RAS laboratory for analysis. The TSG technician is also responsible for properly calibrating the flow of the samplers, documenting the flow, and recording chain-of-custody tracking information. If there are problems with the samples, or sampling network, the technician must initiate a NCR (EMP QA-NCR, Reference 5). The technician also maintains and archives the tritium sampling logbook, and provides photocopies of the Field Tracking Form (FTF) to the analyst after each sampling event.

5.5. RAS PERSONNEL

RAS personnel are responsible for purchasing and assuring necessary stock is available for filling silica-gel flasks. Stock includes: New silica gel, sampling flasks, angel hair, attachment fittings, and stoppers.

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Blowdown: Discharge of a portion of boiler water for the purpose of reducing total dissolved solids (TDS) concentration or to discharge sludge.

Condensate: Condensed water vapor resulting from the removal of latent heat from air or steam.

Filter Drains: A drain designed to evacuate condensate that builds up in the delivery lines from a boiler.

Fire Auxiliary: Sprinkler system inspection test valve.

High Volume Discharge: Discharges exceeding 5 gallons in total volume or discharged at a rate of 20 gallons per minute or greater.

Intermittent Discharge: A discharge that starts and stops at variable intervals.

Low Volume Discharge: Condensate, discharge not exceeding a total volume of 5 gallons.

Maintenance Operation Practices (MOPs): A preventative maintenance practice ensuring that equipment as a system operates efficiently thus avoiding component failure leading to a discharge.

Sump: A pit or reservoir serving as a drain or receptacle for liquids. It can be designed to serve as a footing or foundation drain.

Temperature and Pressure Valves: A safety relief valve on boilers, hot water heaters, tanks and other vessels that can open to relieve a critical temperature or pressure.

Worst Case Sampling: Worst case sampling is performed at units potentially providing the most contaminants. Potential contaminants of concern are derived from visual observation of characteristic discharge (discharge may contain a presence of color, an odor, sediment, or other character that would indicate non-potable water), mechanical age, and/or knowledge of chemical(s) used in a process or part of the materials that may affect the discharge.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS (Environmental Monitoring Section) Leader ensures that sampling methods meet regulatory guidance and that sampling is conducted according to approved procedures.

5.2. WGMG GROUP LEADER

The WGMG (Water Guidance and Monitoring Group) Leader ensures that sampling procedures meet design criteria and that sampling is conducted according to approved procedures.

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5.3. EMS ENVIRONMENTAL ANALYST

The Analyst designs appropriate sampling plans and communicates them to TSG (Technical Support Group) Technologists. The Analyst informs TSG in writing of all changes made to sampling plans. The Analyst also evaluates the resulting data, considering regulatory requirements, and designs appropriate changes in sampling plans as needed.

5.4. TSG ENVIRONMENTAL TECHNOLOGISTS

Technologists collect samples and submit samples to laboratories for analysis according to approved procedures.

6. PROCEDURE

6.1. EVALUATION PROCESS

Evaluate non-permitted, non-storm water discharges by the process outlined in steps 6.1.1-6.1.16. A flow chart of this process is given in Attachment A.

This assessment will determine the level of sampling and analysis needed based on the LLNL non-storm water discharges management controls defined in the SWPPP Best Management Practices (BMPs), BDR, and Maintenance Operation Practices (MOPs).

- 6.1.1. Locate discharge source or system. (Identification via program, Environmental Operations Group, Plant Engineering and Maintenance Division, and/or direct observation.)
- 6.1.2. Contact discharger and determine if source and/or discharge can be repaired or contained through maintenance practices. Repairs include routing the discharge to the sanitary sewer or retention tank. Routine or maintenance discharge can be contained in a carboy or similar type of container and disposed properly. If the discharge has not been characterized then sampling, analysis, and disposal must be completed.
- 6.1.3. If alternate disposal is feasible, implement new disposal option and document in the Building Drain Repair records or, for new sources, the Building Drain Management records. Alternate disposal options can include repairs such as routing the discharge to sanitary sewer, retention tank, or a maintenance practice such as containerizing the discharge in a carboy. The alternate disposal option decisions will be made jointly among facility, WGMG, and BDR team managers. Source discharge elimination decisions will be documented.
 - a. If source can be eliminated via repairs or containment, implement and document solution as in 6.1.2. If can't, proceed to 6.1.3.b.
 - b. Needs to be investigated.
- 6.1.4. If alternate disposal is not feasible, proceed with steps below.
- 6.1.5. Determine if source:
 - a. Can be repaired or eliminated. If source can be repaired or eliminated, implement and document the solution as described in 6.1.3; if it cannot be repaired or eliminated, proceed to 6.1.5.b.

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- b. Needs to be investigated. If source needs to be investigated, investigation sampling will be 1-5% of the worst case sources according to the Section for definition and will be documented in the monthly sampling plan and/or a Field Tracking Form (FTF).
- 6.1.6. Determine if source is unique.
- 6.1.7. If source is unique, proceed to 6.1.12 -6.1.16.
- 6.1.8. If source is not unique:
 - a. Determine number
 - b. Identify if all sources are operated in similar manner (maintenance)
- 6.1.9. Select "to be determined" (TBD) pieces of equipment to be sampled (if possible, should not be in same building or operated by same organization).
- 6.1.10. Number of units to be sampled will be 10% if the total number of units is greater than 100.
- 6.1.11. Number of units to be sampled will be 100% if total number of units is 10 or fewer.
(These percentages may vary depending on availability of other information to determine whether a representative source(s) can be selected with confidence.)
- 6.1.12. Identify potential internal contaminants, if any (e.g., compressor oil in condensate).
- 6.1.13. Identify MOPs or other maintenance practices, if any through appropriate maintenance shop.
- 6.1.14. Identify chemical treatments, if any.
- 6.1.15. Determine if there are any existing analytical data on the source.
- 6.1.16. Analyst and Technologist shall evaluate this information to determine if sampling is required, which parameters are to be sampled, and sampling method to be used.

6.2. POINT SOURCE SUMMARY

6.2.1. Table 1 summarizes point source systems associated with non-permitted, non-storm water discharges at the Livermore Site.

6.2.2. Source system information was compiled from non-storm water discharges identified in the following documentation:

SWPPP, BDL BDR, Site Wide Building Assessment records, NPDES Annual Storm Water Monitoring Report for the Livermore Site, Plant Engineering Maintenance records, as well as direct observations. This information is current as of the effective date of this procedure. A detailed list of LLNL's Livermore Site point source systems components and associated information is given in Attachment B.

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Table 1. Point Source Summary.

SOURCE	DISCHARGE	STATUS/MANAGEMENT CONTROL
Air Compression System	Low volume (unit dependent)	Maintenance Operation Practice. Compiling more information. Perform investigative sampling of worst cases.
Air Conditioning/ Refrigeration Systems	Condensate	Maintenance Operation Practice. Compiling more information. Perform investigative sampling of worst cases.
Boiler Systems	Low volume and high volume (unit dependent)	Maintenance Operation Practice. Representative sampling 10% of units.
Potable Water Systems	Low volume and high volume (unit dependent)	Maintenance Operation Practice. Designated in SWPPP as "little or no impact to receiving waters." Perform investigative sampling on any units of concern.
Sump Systems	High volume	Maintenance Operation Practice. Representative sampling 10% of units.
Temperature and Pressure Safety Relief Valves	Low volume and high volume (unit dependent)	Maintenance Operation Practice. Designated in SWPPP as "little or no impact to receiving waters." Perform investigative sampling on any units of concern.
Washing-Building, Grounds and Maintenance	Low volume and high volume (unit dependent)	SWPPP-BMP. Perform investigative sampling on any units of concern.
Other-See Attachment B for individual sources not listed in system summary	Low volume and high volume (unit dependent)	(Includes the following categories) No deficiencies. Repair or eliminate. BDR. SWPPP/BMP. Maintenance Operation Practice. Investigate/sample.

6.3. SAMPLING PROCEDURE

6.3.1. The WGMG Environmental Analyst and TSG Technologist responsible for point source, non-storm water discharges will develop a sampling plan and make a determination of analytes to be sampled as needed. This plan must be documented and given to the TSG Technical Coordinator as soon as possible prior to the sampling event. (An example of a non-storm water discharge sampling plan is provided in Attachment C.) The WGMG Environmental Analyst will ensure that sampling plans are translated into Field Tracking Forms (FTFs) for each sampling event. Any specific or special instructions concerning the sampling event will be documented and communicated to sampling technologists, prior to the sampling event.

6.3.2. The following sampling practices should be used when sampling non-storm water discharges. Avoiding cross-contamination is vital.

6.3.2.1. Wear disposable gloves while collecting samples and discard the gloves between sampling locations.

6.3.2.2. Take special care not to introduce any external contamination that could interfere with the quality and verifiability of the samples.

6.3.2.3. Keep the work area neat and do not place open sample bottles or caps on any surface (bottles should remain capped until used).

6.3.2.4. Do not touch the inside of sample bottles.

6.3.2.5. Before sampling any location, obtain the current Field Tracking Form (FTF) for that location from the WGMG Environmental Analyst. The FTF contains information pertinent to each location (Section 7.1). Ensure that any additional information required for sampling, such as special sample handling requirements or short holding times, is documented on the FTF before leaving for the sampling location.

6.3.3. SAMPLING CONSIDERATIONS

Special sampling considerations for specific analytes, such as rinsing bottles, air space requirements, elimination of bubbles, and field filtration, are specified in Attachment F. Contact the WGMG Environmental Analyst prior to sampling to ensure all analytes to be sampled are documented on the FTF.

6.3.4. PRESERVATION AND HOLDING TIMES

Preservation (acidification and refrigeration) requirements for specific analytes and their holding times are specified in Attachment F.

6.3.5. SAMPLE STORAGE

Samples must be kept in the possession of the sampler or stored in a secure location to ensure chain-of-custody integrity prior to transport to analytical laboratories. Secure storage locations identified for this purpose include: locked vehicle cabs, the Knack lock box at the courier drop-off point, locked offices, or locked transportainers. These secure areas help to provide an assurance of sample integrity.

6.3.6. QA SAMPLING

EMP-QA-S, *Quality Assurance Sampling* (Reference 17), describes quality assurance sampling requirements, including, duplicates, field blanks, and trip blanks. QA sampling requirements are specified on the FTF for each specific area and sampling event.

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6.3.7. SAMPLING PREPARATION

Equipment required (stored in transportainer (TR) #TY-165 at the end of 6th Street unless otherwise indicated):

Personal protective equipment: rubber boots, safety goggles, rubber gloves
Sample bottles
Tags and labels for sample bottles
Indelible marking pens (LLNL Stores Stock #s 7520-62156, -56629)
Kimwipes or equivalent
Disposable surgical-type gloves (LLNL Stores Stock #s 8415-64994, -64995)
Ice chests
Ice: B175 ice machine (ice bags from LLNL Stores # 8105-27699) (ice must be double-bagged) or blue ice in B162 Lab refrigerator
Field Tracking Form
Chain of Custody Form
pH meter
Deionized water (DI)
Field blank water
Tape measure
Chlorine residual test kit (technicians office)
Conductivity meter (technicians office)
Flashlight
Stainless steel bucket

Lab Equipment Common to All Methods (stored in EMS lab space in B162)

Lockable storage cabinets
Lockable refrigerator
Nitric acid (16M) and Sulfuric Acid (18M)
Hydrochloric Acid (12M)
Heavy rubber gloves
Safety glasses and face shield
Disposable surgical-type gloves
Kimwipes or equivalent
Adjustable pipette (5 ml capacity; Cole-Parmer Instrument Co., 7425 N. Oak Park Ave., Chicago, IL 60648-obtained through purchase order)
Chain-of-Custody Record forms

6.3.7.1. Preparation of Sample Containers

Sampling Technologists use the appropriate FTF and the sampling preservation table given to determine the type and number of bottles that are required for point source, non-storm water discharge sampling. Bottles should be collected, labeled, and acidified (if necessary) as soon as possible before sampling is to be done.

6.3.7.2. Acidification of Samples

Acidify samples in the fume hood in B162. When handling acid, always use eye protection and wear surgical gloves over heavy rubber gloves. Keep acid bottles in a pan that can contain the entire bottle's contents, in case of spillage or breakage. Use an adjustable pipette with disposable tips, or

disposable glass pipettes, when measuring acid. Keep samples requiring refrigeration next to bagged ice. Use a plastic disposable pipette tip only to acidify samples collected for metals analysis. Acidify vials "to be used for VOC sample collection and analysis" by using a glass pipette only.

6.3.7.3. Pre-Sampling Activities

Before leaving for sampling location, prepare ice chests for the locations to be sampled. Write the location identifier, client name (LLNL), sampler's initials, and sampling date in the appropriate spaces on bottles that already have laboratory labels. Prepare labels (location identifier, client name, sampler's initials, sampling date, and required analysis) and attach to the unlabeled sample bottles. Place bottles inside the ice chest along with double-bagged ice (sealed with tape). Place volatile organic sample bottles in a separate bag inside the ice chest to aid in the prevention of contamination. (The volatile organic sample containers will be used to collect aqueous samples determined for low-level analysis.) Arrange bottles in ice chest so that glass bottles do not rub against each other, thus reducing potential breakage.

6.4. SAMPLING METHODOLOGY

6.4.1. The sampling methodology will be dictated by the discharge volume provided by each point source, non-storm water discharges and will be a grab sample for either low volume or high volume discharge. Samples which are to be collected will be dictated by the discharge volume. All samples (listed in 6.4.5.1-11) will be collected for all discharges except for low volume discharges (defined in Section 3). Only indicator samples, as designated by the Analyst and denoted on the FTF, will be collected for low volume discharges.

6.4.2. Calibrate pH meter before taking into field. The pH meter will be used to obtain field pH and temperature.

6.4.3. Record calibration information on the FTF.

6.4.4. Make sure all equipment has been collected for sampling as listed in the "sampling equipment required section." Prepare to sample.

6.4.5. In preparation for sampling activities, and in order to achieve and maintain sample integrity, samples will be collected in the following order at all locations:

- 6.4.5.1. Chlorine Residual will be analyzed immediately with a portable test kit.
- 6.4.5.2. pH, conductivity, and temperature (analyzed in the field along with a 120 ml sample for conductivity; a separate sample will be collected for pH to be analyzed by the analytical laboratory).
- 6.4.5.3. Volatile Organics (EPA 502.2)
- 6.4.5.4. Total Organic Carbon
- 6.4.5.5. Oil and Grease
- 6.4.5.6. Chemical Oxygen Demand
- 6.4.5.7. Biological Oxygen Demand
- 6.4.5.8. Anions
- 6.4.5.9. Total Dissolved and Total Suspended Solids
- 6.4.5.10. Ammonia
- 6.4.5.11. Metals

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*Prior to the actual sampling event, individual facility managers, along with Plant Engineering staff, will be notified to obtain access and coordinate sampling activities within the discharge areas.

6.4.6. LOW VOLUME DISCHARGE COLLECTION

6.4.6.1. Low volume discharges are specified in the point source summary and Attachment B. If the discharge volume dictates, collect only "the minimum required volume" (specified on FTF) according to the "sample order" in Section 6.4.5.1-11. If discharge volume is insignificant to collect all samples, collect the minimum amounts for the indicator samples specified on the F.T.F. These samples are process and area specific and are determined by the analyst and documented on the FTF.

6.4.6.2. After filling, dry the outside of the sample bottles and inspect the labels for completeness; i.e., sample date, sampler's initials, sample identifier, and analysis requested. Check the sample bottles against the FTF to ensure all the bottles have been filled and are accounted for. Place the bottles properly in the ice chest to ensure their safety.

6.4.7. HIGH VOLUME DISCHARGE COLLECTION

6.4.7.1. High volume discharges are specified in the point source summary and Attachment B. Discharge rates that can exceed 20 gallons per minute will be operated by facility staff. This will be accomplished by turning the pumping equipment on then off, which will provide a discharge residual at a rate conducive to sampling. Samples will be collected from this discharge.

6.4.7.2. Collect samples according to the sample order in 6.4.5.1-11.

6.4.7.3. Handle the bottles as in 6.4.6.2.

6.4.8. SAMPLE ALLOCATION

Send all samples that are analyzed offsite to the contract laboratories the day the samples are collected or the following morning to avoid exceeding analytical hold times (see Reference 11, EMP-QA-C5).

7. DOCUMENTATION

7.1. FIELD TRACKING FORMS

FTFs must be completed during the sampling process. FTFs for point source, non-storm water discharge sampling are prepared prior to each sampling event. Copies of the most current FTFs can be obtained from the WGMG Environmental Analyst. FTFs contain information pertinent to the individual sampling location, such as: equipment type, specific discharge and collection information, as well as information specific to the sampling event. This could include information such as: samples obtained, including conductivity, pH, temperature, and the technologist's observations and comments. This information is used if needed in the evaluation process of the non-storm

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water discharge and also to fill out the Chain of Custody Form. An example of an FTF for non-storm water discharge sampling is provided in Attachment D.

7.2. CHAIN-OF-CUSTODY (COC) FORMS

Before releasing custody of samples to a laboratory for analysis, a COC must be completed as required by Reference 18. COCs may be filled out by the Analyst Assistant responsible for ground water sampling or by the sampling technologist responsible for the sampling event. Each COC must have a release number that can only be obtained from an EMS TRR (Technical Release Representative) (see Reference 12). An example of a completed COC for non-storm water discharge is given in Attachment E.

7.3. RECORDS RETENTION

FTFs, along with the COC, data hard copy, invoices, and any other field information, are QA records and are archived as described in Reference 19.

8. ACCEPTANCE CRITERIA

Samples are not acceptable if any of the criteria defined in this procedure are not met, and resampling will be necessary.

9. ATTACHMENTS

- Attachment A: Evaluation Process Flow Chart
- Attachment B: Equipment Tables
- Attachment C: Example Non-Storm Water Discharge Sampling Plan
- Attachment D: Sample Field Tracking Form
- Attachment E: Sample Chain of Custody Form
- Attachment F: Analyte Specific Sampling Requirements

ATTACHMENT A: EVALUATION PROCESS FLOW CHART

ATTACHMENT B: EQUIPMENT TABLES

BDR-Building Drain Repair Project-repair or eliminate

BMP-Best Management Practice

MOP-Maintenance Operation Practice or Procedure-maintained with no discharge to ground

NI-No Impact-identified as "little or no impact to receiving waters"-Storm Water Pollution Prevention Plan

SOURCE	DISCHARGE	NOTES / MANAGEMENT CONTROL	POLLUTANT OF CONCERN
COMPRESSED AIR SYSTEM	All discharges from this system are condensed water vapor (except humidifier)	NI- investigative sampling; representative sampling will follow, if needed	Investigate
Air compressor	Condensate	Maintenance Operation Practice/ none discharge to ground from system maintained by LLNL Plant Engineering	None
Air compressor	Intermittent	Program owned-compiling information	Oil & grease
Air dehumidifier	Investigate	Compiling information	Investigate
Air dryer	Less than 250 ml	Compiling information	Investigate
Air tank	Investigate	Compiling information	Investigate
Humidifier	Can blowdown < 10 gal per week	Compiling information	Investigate
Filter drains	No routine	Compiling information	Investigate
AIR CONDITIONER/ REFRIGERATION SYSTEMS	Condensate	NI- investigative sampling; representative sampling will follow, if needed Freon dissipates in atmosphere	Investigate
Ice makers	Condensate	NI- investigative sampling; representative sampling will follow, if needed	Investigate
Dry evaporative	Investigate	Compiling information	Investigate
Air washer unit	Investigate	Compiling information	Investigate
ASPIRATOR	No discharge	No discrepancy	None
AUTOCLAVES	Investigate	Program owned-compiling information	Investigate
BOILER SYSTEMS	Routine maintenance automatic Emergency Low and high volume	Steam Low Pressure <15 lbs. psi Steam High Pressure >15 lbs. psi Chemical addition to steam boiler make up water/Maintenance Operation Practice Blow down only on steam boilers	Representative sample of steam boiler drains
Water feed pump	No routine	Maintenance Operation Practice-maintenance	Investigate
Chemical feed	No routine	Maintenance Operation Practice-to be carboyed	None
Water filter	No routine	Maintenance Operation Practice-maintenance only	None

*Bold - Point Source System

*Non-Bold - Point Source System Components and other identified non-compliant, non-storm water discharges

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ATTACHMENT B: (CONTINUED.)

SOURCE	DISCHARGE	NOTES / MANAGEMENT CONTROL	POLLUTANT OF CONCERN
Temperature and pressure relief valves	Emergency and manual	Emergency release if vessel overpressurized Maintenance Operation Practice-manual drain during maintenance on some equipment	Investigate
Feed water (make up water)	No routine	Maintenance Operation Practice-maintenance chemical addition to steam boiler make up water	Investigate
Water tank	Blowdown	Maintenance Operation Practice-blow down during maintenance	Investigate
CATCH BASIN	No routine	SWPPP-BMP-maintained by Plant	None
CHEMICAL POTS/VATS	No routine	Maintenance Operation Practice-contents carboyed during maintenance	None
COOLING TOWER	None	Discharge to sanitary sewer	None
CLEAN OUTS	No discharge	No discrepancy	None
CONDENSERS	Investigate	Compiling information	Investigate
CRAWL SPACE PUMP discharges	No routine	Maintenance Operation Practice	None
CUP SINKS	None	Conduit	None
DISHWASHER	None	BDR-to be properly connected	None
DRUM WASHING	No routine	SWPPP-BMP-maintenance	None
DRUM TRAP	No routine	SWPPP-BMP-maintenance	None
ELEVATOR PITS	No routine	SWPPP-BMP-maintenance	None
FLOOR DRAINS	None	BDR-being repaired, eliminated, or repaired	None
FLOOR SINKS	None	BDR-being repaired or eliminated	None
ICE ON LIQUID NITROGEN TANKS	No deficiency	NI SWPPP-BMP	None
KITCHEN SINKS	No routine	BDR-to be properly connected	None
LABORATORY SINK	Being repaired or eliminated	BDR-to be properly connected	None
LAVATORY SINK	Being repaired or eliminated	BDR-to be properly connected	None
MOP SINKS	Being repaired or eliminated	BDR-to be properly connected	None
OPEN LINES	"Off normal"	Maintenance Operation Practice-maintenance	None
PIPE DRAINS	Routine	BDR-used as conduit	None
PIPE LEAKAGE	"Off normal"	Maintenance Operation Practice-maintenance	None

*Bold - Point Source System

*Non-Bold - Point Source System Components and other identified non-compliant, non-storm water discharges

ATTACHMENT B: (CONTINUED.)

SOURCE	DISCHARGE	NOTES / MANAGEMENT CONTROL	POLLUTANT OF CONCERN
POTABLE WATER SYSTEM	NI-SWPPP	NI-SWPPP (except Fire Auxilliary with current information)	None
Backflow preventers	No routine	Maintenance Operation Practice-maintenance	Investigate
Domestic shower	None	BDR-to be properly connected	None
Drinking fountain	None	NI-SWPPP	None
Emergency eyewash	Emergency	If incident-spill response	Emergency response
Emergency shower	Emergency	If incident-spill response	Emergency response
FIRE DEPARTMENT ACTIVITIES			
Deluge valve testing	Sprinkler head stays open, tested annually <50gal.	NI- investigative sampling; representative sampling will follow, if needed	Investigate
Fire apparatus pump testing	High volume	SWPPP-BMP-maintenance	None
Fire apparatus rinsing	High volume	SWPPP-BMP-maintenance rinsed in wash rack properly connected	None
Fire auxilliary (inspector test valves)	High volume	NI- investigative sampling; Representative sampling will follow, if needed	Investigate
Fire fighting training	High volume	SWPPP-BMP	None
-Wet hose drills	High volume	SWPPP-BMP	None
Fire truck washing	No routine	SWPPP-BMP	None
Fire truck pump tests	No routine	SWPPP-BMP	None
Fire hose tests	No routine	SWPPP-BMP	None
Hydrant flushing; testing	High volume	NI-SWPPP	None
Hose testing	No routine	SWPPP-BMP	None
PLANTER DRAINS	No routine	Mop-maintenance-don't overwater	None
PUMPS	No routine	40 types of pumps-compiling information Investigative sampling on units of concern	Investigate
ROOF DRAINS	Seasonal	Compiling information-area dependant	Investigate
TANKS	Investigate	45 types of tanks-compiling information Investigative sampling on units of concern	Investigate
SUMPS	No routine	Compiling information for representative sampling	Investigate
Footing drains	No routine	Investigate	Investigate
Foundation drains	No routine	Investigate	Investigate

*Bold - Point Source System

*Non-Bold - Point Source System Components and other identified non-compliant, non-storm water discharges

ATTACHMENT B: (CONTINUED.)

SOURCE	DISCHARGE	NOTES / MANAGEMENT CONTROL	POLLUTANT OF CONCERN
WASHING-BUILDING GROUNDS MAINTENANCE			
Cafeteria floor mats	Routine	SWPPP-BMP	None
Cafeteria carts	Routine	SWPPP-BMP	None
Car or floor washing	Routine	SWPPP-BMP	None
Culvert/ street flushing	Routine	SWPPP-BMP	None
Exterior building washing	Routine	SWPPP-BMP	None
Gardener & cement equipment	Routine	SWPPP-BMP	None
Hydrant flushing	Routine	SWPPP-BMP	None
Landscape irrigation	Routine	SWPPP-BMP	None
Main/line flushing	Routine	SWPPP-BMP	None
Materials which have been stored outside before bringing inside	Routine	SWPPP-BMP	None
Nitrogen tank rinsing	Routine	SWPPP-BMP	None
Painters washing brushes	Routine	SWPPP-BMP	None
Pavement washing	Routine	SWPPP-BMP	None
Pipe flushing & disinfection	Routine	SWPPP-BMP	None
Uncontaminated ground water discharges	Routine	SWPPP-BMP	None
Window washing	Routine	SWPPP-BMP	None
WASHING MACHINES	None	BDR-properly connected	None
WATER FROM UTILITY BOXES	Investigate	Secondary containment procedure	Investigate
WET SANDER	Routine	Maintenance Operation Practice- discharge contained	None

*Bold - Point Source System

*Non-Bold - Point Source System Components and other identified non-compliant, non-storm water discharges

SAMPLE PLAN AUGUST 1994

Sampling Protocol- All sampling to be in accordance with EMP-BDR-LIVERMORE.

SOURCE TO BE SAMPLED/NOTE	TYPE	DISCHARGE (POINTS TO SAMPLE)	DISCHARGE TYPE	SAMPLING TYPE	AMOUNT	ANALYTES
Air Conditioner	Roof unit	Copper discharge line	Condensate low volume	Investigative sampling (worst case)	One roof unit	Metals Trihalomethane
Back Flow Preventor	Piped to boiler make up tank	Drain line on B218 BP	High volume	Investigative sampling (worst case)	One back flow preventor	Metals Phosphates Sulfates Iron GENMIN-includes cond & pH, Fe; TSS Oil & grease
Potable Water Source						
Boiler	Steam	Blow down drain at tank bottom Blow off valve at tank top	High volume	Representative sampling	10% of total non-compliant steam boiler	Metals Phosphates Sulfates GENMIN-includes cond & pH, Fe; TSS Oil & grease
Fire Auxilliary (inspector test valve)	Deluge valve	Drain spigot	High volume	Investigative sampling (worst case)	One fire auxilliary system	Metals Oil & grease Cond & pH TDS; TSS
Sumps	Equipment room and area drainage	Discharge pipe	High volume	Representative sampling	10% of total non-compliant sumps	Area specific. Analyst will provide for each sampling unit

ATTACHMENT C NON-STORM WATER DISCHARGE SAMPLING PLAN

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ATTACHMENT D- SAMPLE FIELD TRACKING FORM

LOCATION _____ Date 5/11/94
DESIGNATOR B391 SUMP (DRY WELL) Time _____
SAMPLE _____ Started 1045
IDENTIFIER L-391D-01-OW Time _____
QA IDENTIFIER L-QA-09-OW Sampled 1110
conductivity meter# C-01 pH meter # 04

Lab	COC #
CLS	4408
GTEL	4410

measurements/observations

initials: RLW; CF

Conductivity: 1.6 mmhos pH: 8.07 Temperature: 17.5C°

Total Chlorine Residual: 0 (Kit K-2505) Flow rate: N/A

Color: Slightly Brown

Odor: odorless

Notes: Dry Well has rain water and trash inside -
plastic bag; piece of PVC pipe; water dirty

Special Instructions:

Take a depth to water measurement at this sump.

BOD-short holding time

Metals-preserve--don't filter

Wrap 502.2 samples in separate bag in ice chest

Samples	min. amt.	Lab	QA	LAB
✓ Anions (x1)	250ml	CLS		
✓ Ammonia (x)	250ml	CLS		
✓ BOD (x1)	125ml	GTEL		
✓ COD (x1)	125ml	CLS		
✓ Cond & pH (x1)	40ml	CLS		
✓ EPAS02.2 (x5)	5ml	CLS		
✓ Metals (x1)	200ml	CLS		
✓ Oil & Grease (x2)	250ml	(1) CLS	① QA-09	GTEL
✓ TDS&TSS (x2)	250ml	(1) CLS	① QA-09	GTEL
✓ TOC (x1)	250ml	GTEL		

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Chain-of-Custody Record

[illegible]

[illegible]

ATTACHMENT F: ANALYTE SPECIFIC SAMPLING REQUIREMENTS

Analyte	Typical Methods	Sampling Requirements	Acclimation and Refrigeration	Bottle Type	Comments/ EPA Footnotes
Anions Bromide Chloride Fluoride Nitrate Nitrite Phosphate Sulfate	EPA 300.0	Triple rinse bottle with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	500 ml polypropylene	48 hours hold time Footnote: c
Chemical Oxygen Demand (COD)	EPA 410	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C.	100 ml nalgene bottle, preacidified with H ₂ SO ₄ , provided by analytical laboratory.	Footnote: c, d
Chlorophyll-a		Do not rinse bottles.	Store samples in ice chest or refrigerator at 4°C.	1 L nalgene bottle provided by analytical laboratory.	6 hour hold time Wrap sample bottles in foil. Footnote: c
Cultiform bacteria		Do not rinse bottles.	Store samples in ice chest or refrigerator at 4°C.	125 ml sterilized nalgene bottle provided by analytical laboratory.	6 hour hold time Footnote: c
Drinking Water Pesticides (DWP)	EPA 608/615	Do not rinse bottles. Minimize air space, but do not overfill as overfilled bottles have been known to break.	Store samples in ice chest or refrigerator at 4°C.	6 x 1 L amber glass (Boston Rounds) provided by analytical laboratory.	Footnote: c
Fish Toxicity	EPA 600 96 hr. 1 pl. screening. 100% solution. Fat head minnow	Do not rinse carboy.	Store samples in ice chest or refrigerator at 4°C.	5 gallon carboy provided by analytical laboratory.	24 hour hold time Footnote: c

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ATTACHMENT F: (CONTINUED)

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
<u>General Minerals (GENMIN)</u> Bicarbonate Carbonate Hydroxide Total Alkalinity Aluminum Calcium Chloride Copper MBAS Nitrate Iron Magnesium Manganese Nickel pH Potassium Sodium Sulfate Conductivity TDS Hardness Zinc	EPA 310.2 EPA 310.2 EPA 310.2 EPA 310.2 EPA 200.7 EPA 200.7 EPA 300.0 EPA 200.7 EPA 425.1 EPA 300.0 EPA 200.7 EPA 200.7 EPA 200.7 EPA 200.7 EPA 150.1 EPA 200.7 EPA 200.7 EPA 300.0 EPA 120.1 EPA 160.1 EPA 130.1 EPA 200.0	Triple rinse bottles with sample matrix before filling.	Acidification and refrigeration are not required.	2 x 1 L nalgene, store-stock # 8125-24044	no footnote required
Gross Alpha/Beta	EPA 900.0	Triple rinse with sample matrix in the field.	Add HNO ₃ to achieve pH<2 after returning from field (5 ml in 1 L bottle). Refrigeration is not required.	1 L polypropylene	Filter Fil 7 samples Footnote: a
High Explosives (HE) HMX RDX TNT		Triple rinse bottles with sample matrix.	None. Refrigeration not required.	6 dram or 25 ml glass	no footnote required

ATTACHMENT F: (CONTINUED)

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Metals	Medium specific.	Filter water. Do not rinse preacidified samples. If not preacidified, triple rinse and acidify with 5ml HNO ₃ .	Refrigeration not required.	500 to 1000 ml nalgene, may be pre-acidified, provided by analytical laboratory.	Footnote: a, g
Nutrients Ammonia Nitrate Nitrite TKN	EPA 350.3 EPA 353.2 EPA 354.1 EPA 351.3	Triple rinse bottles with sample water before filling.	Upon return from field, add 10 drops H ₂ SO ₄ (to achieve pH < 2). Store samples in ice chest or refrigerator at 4°C.	1 L nalgene provided by analytical laboratory.	Footnote: c, f
Oil and Grease	EPA 413.1	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C.	1 L wide mouth amber glass bottle, preacidified with H ₂ SO ₄ to achieve pH < 2, provided by analytical laboratory.	Footnote: c, f
pH		For field measurement, calibrate meter prior to sampling. Triple rinse bottle with sample matrix in the field.	Store samples in ice chest or refrigerator at 4°C.	125 ml nalgene	pH analysis is done in the field for NPDES samples only. Lab analysis coupled with conductivity Footnote: c
Phenolics	EPA 420.1	Do not rinse bottles.	Bottles are preacidified by the analytical laboratory. Refrigeration is not required.	1 L clear glass bottles, preacidified with H ₂ SO ₄ to achieve pH < 2, provided by the analytical laboratory.	Footnote: f
Radium 226		Triple rinse with sample matrix before filling.	Add HNO ₃ to achieve pH < 2. No refrigeration required.	2 X 1000 ml polypropylene	Footnote: a

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Semivolatile Organics	EPA 625 8015	Do not rinse bottles. Minimize air space, but do not overfill as overfilled bottles tend to break.	No acidification is required. Store samples in ice chest or refrigerator at 4°C.	2 X 1 L amber glass bottles (Boston Rounds) provided by analytical laboratory	Footnote: c
Specific Conductivity	EPA 120.1	Triple rinse with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	125 ml polypropylene	No footnote required
TDS TSS	EPA 160.1 EPA 160.2	Triple rinse with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	500 ml polypropylene provided by the analytical laboratory.	Footnote: c
Total Organic Carbon (TOC)	EPA 415/9060	No air space or bubbles can be present. Form positive meniscus and cap bottles immediately after filling.	Preacidified bottles are supplied by analytical laboratory. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial, preacidified with H ₂ SO ₄ , provided by analytical laboratory	Footnote: c, d
Total Organic Halides (TOX)	9020	No air space or bubbles can be present. Form positive meniscus and cap bottles immediately after filling.	Add 12 drops H ₂ SO ₄ to achieve pH < 2 before going to the field. Store samples in ice chest or refrigerator at 4°C.	100 ml amber glass (Boston Rounds) with teflon lined cap	Footnote: c, f
Thorium	EPA 900.0	Triple rinse with sample matrix in the field.	Add HNO ₃ to achieve pH < 2 after returning from field (5 ml in 1 L bottle). Refrigeration is not required.	1 L polypropylene	Filter Pit 7 samples Footnote: a
Tritiated water (HTO)		Triple rinse with sample matrix before filling.	None. Refrigeration not required.	250 ml clear glass bottle, store stock # 8125-27804	No footnote required
Uranium		Triple rinse with sample matrix before filling.	Add HNO ₃ to achieve pH < 2. No refrigeration required.	1000 ml polypropylene	Filter Pit 7 samples Footnote: a

ATTACHMENT F: (CONTINUED.)

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ATTACHMENT F: (CONTINUED)

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments
Volatile Organic Compounds Purgeable halocarbons	EPA 601	No air space or bubbles can be present. Form positive meniscus and cap bottles immediately after filling.	Acidification is not required. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial with septa lid provided by analytical laboratory	Footnote: c
Volatile Organic Compounds Drinking Water Standards Purgeable priority pollutants Purgeable halocarbons/aromatics Purgeable aromatics "Purgeables"	EPA 502.2 EPA 524 EPA 601/602 EPA 602 EPA 624	No air space or bubbles can be present. Form positive meniscus and cap bottles immediately after filling.	Add 3 drops HCl (to achieve pH < 2) prior to going to field. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial with septa lid provided by analytical laboratory	502.2 x 5 524 x 4 601/602 x 4 602 x 2 624 x 3 Footnote: c, e, h

Footnotes

- a Acidify with 5 ml HNO₃
- b Acidify with 0.5 ml H₂SO₄
- c Refrigerate at 4° C
- d Acidify with 3 drops H₂SO₄
- e Acidify with 3 drops HCl
- f Acidify with 10 - 12 drops H₂SO₄
- g Use plastic pipette only
- h Use glass pipette only
- * Acidify only if not preacidified by the analytical laboratory

**If any analyses not listed on this table are required, please contact the EMS Analytical Laboratory contact person to obtain appropriate bottles from the analytical laboratory.

Substitution of different sized bottles of the same material (plastic or glass) is generally acceptable. If the specified bottles are not available, contact the Environmental Analyst or Analyst Assistant for guidance.

EMP-EM-S

EMERGENCY ENVIRONMENTAL SAMPLING

Prepared by:

Kris Surano 6/12/94
Kris Surano date
Group Leader, TAMM

Reviewed by:

Bill Hoppes 6/14/94
Bill Hoppes date
Group Leader, WGMG

Duane Rueppel 6/14/94 -
Duane Rueppel date
Group Leader, TSG

Brian Balke 6/14/94
Brian Balke date
Environmental Analyst, WGMG

Paula Tate 6/14/94
Paula Tate date
Environmental Analyst, TAMM

Sav Mancieri 6/14/94
Sav Mancieri date
Emergency Management Coordinator, EPD

Approved by:

Rebecca Failor 6/14/94 -
Rebecca Failor date
Section Leader, EMS

Cindy Garcia 6/14/94
Cindy Garcia date
Quality Assurance Coordinator, EMS

**LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure provides guidance for Environmental Monitoring Section (EMS) response in the event of an emergency that requires environmental sampling. It follows the established LLNL emergency reporting and dispatching protocols used for all emergencies at the Laboratory, and establishes an organization to sample incident-induced environmental contamination in an organized manner. It does not apply to sewer alarms, for which a separate procedure applies (Reference 1).

2. APPLICABILITY/DISCUSSION

In the event of an emergency, EMS will provide environmental sampling resources (personnel, equipment, and expertise) in support of the Laboratory. An incident may involve the release of radioactive/hazardous materials into the air, to the ground, or into surface or ground waters. General Laboratory objectives in response to an emergency include the determination of the nature and extent of contamination, and evaluation of the hazard to humans and the environment. Actions may be necessary to protect both Laboratory personnel and members of the public, as well as the surrounding environment, from incident-induced contamination. EMS activities support the evaluation of environmental effects. The more immediate public health and personnel safety issues are the responsibility of the Hazards Control Department.

NOTE: EMS personnel are not responsible for sampling when such activities may place them at risk of (1) loss of life or (2) detrimental health impacts. They are not authorized to proceed into contaminated areas requiring greater than OSHA Level D protection (they are not authorized to use respiratory protection in the course of these sampling activities).

EMS personnel will not necessarily respond to all incidents, but will be notified as secondary responders to an incident at the request of the Incident Commander (IC), the Environmental Duty Officer (EDO), Hazards Control ES&H Team Leaders (ES&H-TL), or the responsible ORAD ES&H Team Environmental Analyst (ES&H Team-EA). See Attachment A for the Dispatcher Call-Out List. Following this procedure, EMS personnel are to report immediately when called-out and stand by for assignments through the established chain of command. As applicable and required, they will give sampling advice, participate in formulating environmental sampling plans, and will conduct environmental sampling in accordance with this procedure. EMS analysts will be available for interpretation of the sampling data once received from analytical laboratories.

3. REFERENCES

1. EMP-SW-AR, Sewer Alarm Response
2. EMP-W-L, Water Sampling Locations
3. EMP-AP-L, Air Particulate Sampling Locations
4. EMP-S-L, Soil and Arroyo Sediment Sampling Locations
5. EMP-AT-L, Air Tritium Sampling Locations
6. EMP-QA-S, Quality Assurance Sampling
7. EMP-AP-S, Air Particulate Sampling
8. EMP-W-S, Water Sampling
9. EMP-S-S, Soil and Arroyo Sediment Sampling
10. EMP-VG-S, Vegetation and Foodstuff Sampling
11. EMP-AT-S, Air Tritium Sampling
12. EMP-QA-SD, Sample Tracking Documentation
13. EMP-EM-CA, Emergency Monitoring Equipment Calibrations
14. EMP-QA-DC, Document Retention Center

4. DEFINITIONS

Atmospheric Release Advisory Capability (ARAC): Part of the Atmospheric and Geophysical Sciences Division, predicts airborne movement of materials resulting from an incident. Uses meteorological and incident-specific data in computer dispersion models. Reports directly to the Emergency Operations Center and the Incident Commander. ARAC information is passed to EMS as necessary, through the established chain of command.

Chain of Command: Administrative system that establishes reporting and communication assignments to be used during an incident. As part of the Incident Command System, it specifies who reports to whom, so that organization and flow of information is facilitated.

Emergency Incident: In the context of environmental sampling, an event during which the release of radioactive and/or hazardous materials is suspected, has occurred, or is threatened.

Emergency Response Kits: Briefcases containing supplies for emergency environmental sampling (See Section 6, "Equipment Required," for an inventory). They are kept, fully stocked, in the transportainer next to Building 596.

EMS Monitoring Headquarters (EMS HQ): Location where EMS emergency sampling activities are planned, coordinated, and controlled. Usually the Big Sur Room (Room 1242) of Trailer 5475, this is the location where most EMS staff members are to report when called out for emergency response.

EMS Primary Contact: The first person contacted during emergency response callout (usually by the Fire Department Dispatcher.)

Environmental Duty Officer (EDO): A member of EPD who is on-call 24-hours per day for response to Laboratory emergencies. Responsible for EPD actions, notification of management, and reporting. In the absence of an ES&H Team Environmental Analyst, the EDO supports the Hazards Control ES&H Team as the EPD representative.

Environmental Monitoring Representative (EM Rep): A staff position in the EPD Satellite Operations Center that is assumed by the EMS On-Scene Representative, if the EPD SOC is activated. The EMS staff member performs the duties of the OSR, but does so from the SOC and not at the scene of the incident.

EPD Satellite Operations Center (SOC): An optional command center (T-5475, Room 1145 "Discovery Room") that, if established, is where EPD Management receives information, makes decisions, and directs EPD activities. If established, the EMS On-Scene Representative does not report to the scene of the incident, but instead reports to the SOC, and assumes the role of Environmental Monitoring Representative.

ES&H Team Environmental Analyst (ES&H Team-EA): Usually personnel from the Operations and Regulatory Affairs Division of EPD, ES&H Team Environmental Analysts are members of Hazards Control ES&H Teams, and have the responsibility on the ES&H Teams to advise and take direct action to protect or sample the environment.

Fitness for Duty: The ability to perform unimpaired in a professional capacity.

Hazards Control ES&H Team Leader (ES&H-TL): As designated leader of the Hazards Control ES&H Team, the ES&H-TL reports directly to the Incident Commander, and is reported to by the ES&H Team Environmental Analyst and/or Environmental Duty Officer.

Incident Commander (IC): Usually a Fire Department representative, this is the person who establishes the command post at the scene of an incident and directs all activities during an emergency response, including developing and implementing strategic decisions and approving and ordering the release of resources.

Lead Analyst : As designated leader of EMS Staff for the incident (usually one of the EMS Group Leaders), the Lead Analyst controls EMS activities from the EMS Monitoring Headquarters.

On-Scene Representative (OSR): A designated EMS member, usually the EMS Section Leader, who functions as the EMS representative at the scene of the incident. If the EPD SOC is established, the OSR assumes the role of EM Representative at the SOC.

5. RESPONSIBILITIES

5.1. ENVIRONMENTAL MONITORING SECTION (EMS) LEADER

Responsible for all EMS activities during the incident, the EMS Section Leader can delegate tasks, but retains responsibility for the Section's actions. In consultation with Incident Command Center personnel and EMS Analysts, the Section Leader usually determines the extent of EMS involvement in the emergency response and typically assumes the role of On-Scene Representative (or EM Rep at the EPD SOC, if established).

5.2 TECHNICAL SUPPORT GROUP LEADER

The Technical Support Group Leader is responsible for ensuring that all emergency response equipment is ready for immediate deployment to the field. This requires that all portable air samplers be properly calibrated, that all calibration data be stored in the EMS HQ, and that sufficient batteries be charged to enable EMS to place all portable air samplers in the field. It also requires that other sampling equipment (including the emergency response kits, air vapor collection equipment, and water sampling equipment), vehicles, cellular telephones and generators are available for use.

5.3. EMS PRIMARY CONTACT

The Primary Contact (the first person reached during call-out from the list shown in Attachment A) notifies the EMAD Division Leader, the EMS Section Leader, and EMS Analysts (as appropriate) that EMS is responding. In consultation with the Section Leader, and other EMS Analysts, the Primary Contact helps determine the need for additional EMS personnel, selects the location for the establishment of EMS HQ (usually The Big Sur Room in Trailer-5475, unless it is contaminated or threatened), designates emergency response roles, and directs the call-out using the list shown as Attachment B.

5.4. EMS ON-SCENE REPRESENTATIVE (OSR)/ENVIRONMENTAL MONITORING REPRESENTATIVE (EM REP)

The OSR functions as the EMS liaison to the Incident Commander upward through the established chain of command. Reporting to the ES&H Team Environmental Analyst or EDO, the OSR serves as the interface between the Incident Command Staff and EMS, provides EMS capability/status information to the Incident Command Staff, takes part in the formulation of sampling plans/strategies, relays EMS data, and provides incident-related information to EMS staff in the EMS HQ.

If the EPD SOC is established, the OSR becomes the SOC's Environmental Monitoring Representative (EM Rep). In this capacity, the EM Rep does not go to the scene of the incident, but to the EPD SOC (usually Trailer 5475, Room 1145 "Discovery Room"), and reports to the SOC Commander. The EM Rep performs all the duties described for the OSR from the SOC. In addition, the EM Rep is responsible for coordination of sampling teams with Hazards Control, the SOC, and EMS HQ. The EM Rep also establishes a communications link with ARAC through the Hazards Control SOC and is the focal point for ARAC data and interpretation. Other EM Rep duties include coordination of analytical laboratory support and provision of input to the Laboratory Emergency Management Center (EMC) on the status of environmental monitoring issues. The OSR/EM Rep should take the EPD course EP8011 "Satellite Operations Center."

5.5. EMS ANALYSTS

Some EMS Analysts are on the Dispatcher Call-Out List. They will assume the Primary Contact, OSR/EM Rep, and/or Lead Analyst roles and responsibilities, depending on assignment. In general, EMS Analysts are responsible for helping to determine the level of EMS involvement, for contacting other EMS members and EMAD management, for collaborating on environmental sampling plans, for directing sample collection and submittal, and for participation in sampling result interpretations. Analysts are responsible for keeping an up-to-date copy of the EMS Call-out List (Attachment B) at their homes to facilitate emergency response call-out. All Analysts on the Dispatcher Call-Out List must complete LLNL Course HS1610, "Operating with the Fire Department During Emergencies."

5.6. LEAD ANALYST

The Lead Analyst is responsible for coordinating EMS emergency response activities from the EMS HQ. This involves the establishment of the EMS HQ; assigning duties to other EMS staff; coordinating the formulation of sampling plans; and maintaining contact with the OSR/EM Rep, all EMS staff reporting for emergency response, and the Hazards Control Technicians supporting EMS operations. The Lead Analyst is also responsible for documenting EMS actions, and for preparation of the final incident response report. The Lead Analyst may delegate tasks, but retains local responsibility for EMS HQ operations.

5.7. EMS STAFF

All EMS Staff members must respond to support emergency-environmental sampling activities when called. They should report to the EMS HQ within 15 minutes during normal working hours and within 45 minutes during off-hours. If they cannot report within these time guidelines after being contacted, they must notify the EMS HQ as to when they can be expected to arrive, and should keep the EMS HQ apprised of their location and progress. If they are unfit for duty, they shall communicate that when contacted and should not report. Similarly, if responding would result in unattended or potentially endangered minor children, EMS members should state that situation exists and not report. EMS staff members responding will assume duties as assigned by the Lead Analyst. It is important that all reporting staff members remain accessible during the incident; therefore, all contacted staff members shall make their whereabouts known to the Lead Analyst at the EMS HQ. All staff reporting for emergency response must have completed SARA/OSHA 24-hour Hazardous Waste Operations Training and must be current with respect to annual SARA/OSHA Hazardous Waste Operations 8-hour refresher courses. They shall also have completed the EMS training for this procedure (EMP-EM-S).

5.8. FIELD SAMPLING PERSONNEL

Field sampling personnel are responsible for collecting environmental samples according to established procedures. They are to follow the emergency sampling plan, paying close attention to the location and sequence of sampling and to the established sampling procedures. They must take care not to contaminate samples; fill out all sampling documentation, including Chain-of-Custody Record Forms (COCs) completely; take detailed notes regarding sampling; and keep in close contact with EMS HQ (usually by cellular telephone.)

5.9. HAZARDS CONTROL INDUSTRIAL HYGIENIST AND HEALTH PHYSICIST

The Industrial Hygienist and Health Physicist on the Hazards Control ES&H Team must determine the safety of the environment in which EMS personnel will be traveling and sampling. Such determinations may be made based on ARAC data, Hot Spot data, or on monitoring conducted by the Hazards Control Health and Safety Technicians. Communications regarding the safety of the environment for EMS personnel should go from the Industrial Hygienist/Health Physicist to the ES&H Team Environmental Analyst to the CSR/EM Rep to the Lead Analyst at the EMS HQ.

5.10. HAZARDS CONTROL HEALTH & SAFETY TECHNICIANS

If required by the Industrial Hygienist or Health Physicist on the Hazards Control ES&H Team, Hazards Control Health and Safety Technicians are responsible for monitoring to determine the safety of the environment in which EMS personnel will be sampling. HC Techs will accompany EMS staff members to the field, if necessary, and must use radiation survey instruments and other industrial hygiene equipment to ensure that the EMS field sampling personnel are not exposed to unacceptable levels of radiation or toxic agents resulting from the incident. Environmental sampling will commence *only* after the Industrial Hygienist/Health Physicist has determined that the area is safe.

6.0 PROCEDURE

Equipment Required:

EMERGENCY RESPONSE KITS (Six each, located in the transportainer adjacent to Building 596)

- Gloves (leather) and surgical gloves (disposable)
- Flashlights with batteries (size D)
- Tape (plastic)
- Two-inch fiberglass filters/four-inch Whatman filters
- Plastic bags, glassine sample bags, rubber bands and yellow sample identification tags
- Logbook, ball-point pens, and indelible marking pens
- Trowel and shears
- Compass and area location maps
- Screwdriver, metal measuring tape, hatchet/hammer
- Kimwipes or equivalent

AIR VAPOR COLLECTION KIT

- Dry ice and alcohol; or liquid nitrogen (LN available from the Maint. Machinists or Building 196)
- Dewar with short length of aluminum tubing (located in the transportainer by Building 596)

WATER SAMPLING EQUIPMENT (Transportainer TY-165, end of Sixth St. unless otherwise noted)

- Stainless steel dip sampler (two each, in transportainer 15 yards west of Building 848 at Site 300)
- Pumps, pump controllers, and field-filtration unit (two each, Site 300, Building 848 transportainer)
- Sample vials and bottles; tags and labels for sample bottles
- Preservative materials (HCl, H₂SO₄, HNO₃)
- Personal protective equipment (rain suits, rubber boots, rubber gloves, etc., in Building 596)
- Indelible marking pens
- Kimwipes or equivalent
- Ice chests with ice (ice to be double-bagged; ice available at Building 175)

MISCELLANEOUS ITEMS

- Generators (Building 596 at LLNL; transportainer 15 yards west of Building 848 at Site 300)
- General Metal Works high-volume air samplers (Building 596)
- Portable, battery-operated air samplers (12 each; 12/24-V DC capabilities; in transportainer adjacent to Building 596)
- Automotive batteries (Building 596; Building 611 (motor pool); Building 4195 (battery shop))
- Hazardous Waste container or bag for used gloves, etc.

EMS HQ SUPPLIES (in T-5475 Big Sur Room Closet)

- Current EMS Procedures Manual (including this procedure)
- Dry erase marking pens and eraser
- Notepads, pens and other office supplies
- Telephones (2) and call-out lists; key to Room 1248, T-5475 for FAX machine access
- Street maps and copies of all monitoring network sample location maps
- Staff Status Board Function Plates

MANDATORY ITEMS

- Cellular telephone (vehicle or portable; portables in the offices of J. Sims, K. Surano, and B. Failor in Trailer 5477).
- IBM-PC Computer with air-modeling capabilities (2 located in T-5477)

DOCUMENTATION

- Chain Of Custody Record Forms (COCs) and Field Tracking Forms (FTFs)
- Field Notebooks/Notepads
- EMS HQ Incident Notebook/Notepad

6.1. CALL-OUT

Emergency response personnel requesting EMS participation (LLNL Fire Department Dispatcher, EDO, ORAD-Environmental Analysts, etc.) will call names (in order) from the Dispatcher Call-Out List (Attachment A). Once an EMS representative (the EMS Primary Contact) is contacted, the Primary Contact will take over the subsequent EMS/EMAD management and analyst call-out (See Attachment A). The EMAD Division Leader will be notified of all EMS emergency responses. The Primary Contact should receive as much information regarding the incident as possible from the person requesting EMS participation. Information regarding the nature, extent, duration, location, wind speeds/directions, and timing of the incident is important for assessing EMS personnel required for sampling and for deciding where to establish the EMS HQ.

The Primary Contact, together with EMS management and analysts, will determine the need for additional EMS personnel and will contact them accordingly (See Attachment B for a complete EMS Call-Out List). If a specific environmental medium is likely to be affected during the incident, an effort should be made to contact the EMS Environmental Analyst assigned responsibility for that medium. The Primary contact, EMS management, and analysts will also determine who will act as the OSR/EM Rep and who will act as Lead Analyst.

EMS personnel can be contacted by telephone, cellular telephone, or pager. On-site access to the LLNL Emergency Paging System is made by dialing 3-7700. The normal paging system can be accessed from on-site by dialing 3-7777. Access to the LLNL paging system from off-site can be accomplished by dialing 510-423-7705. In all cases, the system will prompt you for the pager number of the person you are trying to contact, and for the telephone number to be displayed on the person's pager.

The potential need for analytical laboratory support should be evaluated at this time. If the potential exists, Environmental Analytical Sciences (EAS) and/or Radiation Analytical Sciences (RAS) personnel should be contacted (telephone numbers are in Appendix B) and asked to stand-by to provide advice regarding analytical capabilities and possibly to analyze samples on an extreme-rush basis.

All EMS personnel are expected to be available for duty as needed. EMS personnel called out will respond within 15 minutes during on-shift hours and within 45 minutes during off-shift hours, unless otherwise directed. If they cannot report within these time guidelines after being contacted, they must notify the EMS HQ as to when they can be expected to arrive, and should keep the EMS HQ apprised of their location and progress. If they are unfit for duty, they must relate that information to the EMS HQ, and should not report to support EMS activities. Similarly, if responding would result in unattended or potentially endangered minor children, EMS members should state that situation exists and not report.

6.2. REPORTING FOR DUTY

EMS personnel should report to the Trailer 5475 Big Sur Room (Room 1242; EMS HQ) unless otherwise directed. (In the event that Trailer 5475 is in a zone of contamination, or is threatened, an alternate EMS HQ site will be chosen and established; personnel will be advised during call-out.)

The OSR must acquire a cellular telephone and will report immediately to either the scene of the incident or to the EPD SOC. In the event that the EPD SOC is activated, and no official request for environmental monitoring has been made, the OSR/EM Rep should contact other EMS personnel and ask them to stand by for possible call-out. If reporting to the scene, the OSR must find the incident command vehicle (flashing green light) and establish communication with the Incident Command Staff (through the Environmental Analyst/EDO or Hazards Control ES&H Team Leader). If reporting to the EPD SOC, the OSR will assume the

role of EM Rep and will report to the SOC Commander. The OSR/EM Rep must have a portable cellular telephone in possession and must notify EMS HQ of his/her location and cellular telephone number.

6.3. EMS MONITORING HEADQUARTERS (EMS HQ)

Upon arrival at Trailer 5475, EMS staff members must establish the EMS HQ, under the direction of the Lead Analyst, in the Big Sur Room. Anyone using the Big Sur Room must leave immediately. The Big Sur Room is served by two telephone lines (two telephone units are stored in the closet) and the numbers can be found in Attachment B. If local LLNL telephone service has been compromised, one of the portable cellular telephones must remain in the EMS HQ. The use of messengers for communication should also be considered. A FAX machine is available in Trailer 5475, Room 1248; the key to the room is in the Big Sur Room closet. Place maps on the walls; only use those pertinent to the incident. Establish the personnel status/location board on one whiteboard and prepare to update incident information on the other whiteboard. Staff members should stand by to await assignments.

6.4. CHAIN OF COMMAND AND COMMUNICATION

In accordance with LLNL emergency response protocols, the Incident Commander directs all activities during the emergency. EMS reports to the IC through an established chain of command as shown in Attachment C. The OSR, after reporting to the incident scene, must keep in close communication with both the ES&H-EA/EDO at the scene and, using a cellular telephone, the EMS HQ. Similar communications must be established from the EPD SOC, if activated.

NOTE: For the most efficient and skillful emergency response, communication between all parties involved is vital. Communication inadequacies have been identified as the major cause of problems during emergency exercises. Thus, it is of paramount importance that EMS personnel immediately establish communication with all necessary parties.

Personnel at the EMS HQ, directed by the designated Lead Analyst, must keep in close contact with the OSR/EM Rep and the Health and Safety Technicians through the Hazards Control Operational Safety Division, 2-5127. All EMS personnel sent to the field must maintain close contact with EMS HQ and must report all information necessary to keep the Incident Commander apprised, through the chain of command, of monitoring/sampling capabilities and activities. Use of the FAX machine and/or laser printers over Open Lab-Net for communication is encouraged because hard copy can be very useful. EMS personnel will stand by for instructions and should be ready to perform monitoring/sampling activities.

NOTE: ARAC data (regarding the dispersion of contamination) can help EMS Analysts formulate sampling plans and conduct dose calculations. However, ARAC reports directly to the Incident Command Staff, not through EMS. EMS HQ personnel are only authorized to receive ARAC data through the chain-of-command (generally from the EPD SOC). When requesting ARAC data, be sure to specify what types of information you desire (dose plots, surface deposition plots, air concentration plots, etc.) ARAC plots are often more useful than data quoted verbally; obtain plots via FAX, or send a messenger to obtain plots from the EPD SOC.

6.5. ASSIGNMENT OF DUTIES

The Lead Analyst will assign duties for all EMS members present. Roles can be assigned temporarily; that is, at the discretion of the Lead Analyst, assignments can be adjusted, depending on who is available at any given time. Assignments will vary depending on the incident, but at least five staff members will be required to assist the Lead Analyst in the EMS HQ.

6.5.1 EMS HQ STAFF

6.5.1.1 Communicators

Two staff members (Communicators) will be asked to answer telephones. They should make notes of all conversations. When answering a call, the Communicator shall state loudly and clearly who has called. The Lead Analyst will determine if he/she will take the call personally, if the Communicator shall reiterate all portions of the conversation aloud, or if the Communicator should keep the conversation private and take notes. The Communicators must keep the Staff Status Recorder apprised of information coming in from the field regarding personnel. The Communicators also must keep the Incident Information Recorder apprised of all information coming in regarding the incident. When instructed to telephone someone outside of the EMS HQ, the Communicators must keep the Lead Analyst apprised of progress, and must clearly enunciate when contact is made, and when instructions/requests are given or information received.

6.5.1.2 Scribe

One staff member (Scribe) will be needed to take detailed notes, including the times that events took place. It will be important to reconstruct the chronology of EMS actions when compiling the final report (see below). As much information as possible should be kept regarding roles, information received, decisions, assumptions, assignments, problems, etc.

6.5.1.3 Staff Status Recorder

The fourth staff member (Staff Status Recorder) will keep track of all EMS personnel (name, role, location, time, activity, ETA, vehicle, telephone number, pager number). The status of all EMS personnel responding to the incident will be kept current on the staff status board. Updates will be made based on information coming in over the telephone and events taking place in the EMS HQ. The Staff Status Recorder must pay close attention to the staffing assignments and deployments that are being made by the Lead Analyst, and shall request information, if needed, to complete and update the staff status board.

6.5.1.4 Incident Information Recorder

Significant events and incident information will be recorded on the whiteboard by the fifth EMS HQ staff member (Incident Information Recorder) assisting the Lead Analyst. All information coming in to the EMS HQ regarding the nature of the incident should be recorded, together with the time that the information was received. The Recorder should keep all information organized and neat, and should resist erasing information from the whiteboard.

6.5.2 EMS STAFF ASSIGNMENTS

Some staff members may be sent to the field to collect samples. Others may serve as "buddies" for samplers going to the field. EMS Environmental Analysts may be asked to stand by to help the Lead Analyst in the formulation of sampling plans. Some staff members will simply stand by and await assignment. Personnel awaiting assignments must not disturb EMS HQ operations; they shall remain quiet and available, and may be asked to leave the EMS HQ and await assignment elsewhere. If conditions permit, the courtyard adjacent to the Big Sur Room may be a good choice for personnel awaiting assignment.

The Lead Analyst should choose assignments logically. TSG technicians would likely be chosen to collect samples from the field. An Environmental Analyst would be a good candidate for a Communicator or Incident Information Recorder. If a specific medium has been identified for impact in the incident, the Environmental Analyst responsible for that medium should not be given one of the five positions listed above. That Analyst should stand by to support the Lead Analyst in a professional advisory role.

NOTE: While standing by for assignment, EMS staff must stay near the EMS HQ but must not disturb other personnel who are developing sampling plans or communicating with field personnel. The Lead Analyst may choose to restrict the numbers of personnel admitted to the EMS HQ. Furthermore, the Lead Analyst may instruct persons developing sampling plans in the EMS HQ to vacate, perform their functions nearby, and report back to the EMS HQ with their plan.

6.6. EMERGENCY SAMPLING PLAN

After the IC, in consultation with the Incident Command Staff, EPD, and EMS personnel, establishes that environmental sampling is required, sampling plans will be produced at the EMS HQ. Multiple plans may be necessary, especially if more than one environmental medium is affected and different types of samples must be collected. The sampling plans, which are necessary to minimize wasted effort, will be formulated in consultation with the IC through the OSR/EM Rep and the established chain of command. The OSR/EM Rep should report as much information about the incident to EMS HQ as possible, particularly wind speed/direction data and plume dispersion data obtained through ARAC (if appropriate).

It is impractical to design emergency sampling plans *a priori*. The type, number, frequency, and locations of sampling will be unique for each incident. Analysts must use professional judgment while preparing sampling plans, making the mental transition from routine sampling requirements to the emergency situation. In general, levels of contamination will be much higher than any measured during routine monitoring, analytical techniques may need to be adjusted, and the need to minimize the possibility of cross-contamination of samples increases. Furthermore, flexibility must be maintained to allow modifications to the plans as additional information is acquired.

Analytical laboratory personnel should be contacted for analytical method advice, sampling container information, and predicted analytical turnaround times when formulating sampling plans. The analytical laboratory personnel should also be notified of the numbers of samples that will be arriving and the estimated time of arrival. Instructions regarding the dissemination of results should also be given to analytical laboratory personnel.

The sampling plans may involve the use of existing sampling locations and monitors (see References 2 through 5), particularly in the case of air particulate sampling. However, depending on the extent and spread of contamination, portable air monitors might be required to collect samples from areas not sampled during routine surveillance monitoring.

When choosing sampling locations, analysts should use grid intersections on location maps as landmarks, if possible, so sampling locations can be easily plotted and identified. Samplers should be advised to report sampling locations in the context of prominent landmarks (for example, "100 meters west of the Vasco Road/Tesla Road intersection"). Sampling locations should be chosen to define the perimeter of the potential contamination plume. Wind speed/direction data and plume dispersion data (from ARAC) should be obtained through the OSR/EM Rep.

Air sampling requires special attention to the order in which samples are collected. Because of potential sample cross-contamination, samples from upwind locations should be collected first. These samples will give an indication of background levels to which samples from areas of contamination can be compared. Samples should be collected in the following order: (1) upwind, whenever possible, for background reference; (2) at the downwind LLNL fence line; (3) at the location of the nearest downwind resident; and (4) at several locations progressively downwind, until (based on wind data and plume dispersion model data from ARAC) significant concentrations/exposures are not expected to be detected.

Analysts should include the use of Quality Assurance/Quality Control samples when developing sampling plans (see Reference 6). Duplicate samples are of greatest importance, but trip blanks, which can provide valuable information regarding possible cross-contamination of samples, should be used. Method blanks, spikes, and standards are not as important in an emergency situation, but should be run as part of analytical laboratory quality control programs.

When each sampling plan is completed, a written copy shall be sent (via FAX, Open Lab-Net, or messenger) to the OSR/EM Rep for review by the EPD SOC Commander and/or Environmental Analyst/EDO/IC. The plan can be hand written and may be no more than a map with sampling locations indicated and notes regarding sampling procedures.

Field personnel should be briefed on all aspects of every sampling plan they will be implementing before they go to the field. Sampling should not commence until concurrence with the plan is obtained through the chain of command.

6.7. FIELD SAMPLING ACTIVITIES

NOTE: Before EMS Monitoring personnel proceed into the field, the OSR/EM Rep must request a hazard assessment from the Industrial Hygienist/Health Physicist on the Hazards Control ES&H Team. If no definitive hazard assessment can be made, EMS samplers will only proceed into the field if accompanied by a Hazards Control Health and Safety Technician who will provide a safety and radiation field — assessment using radiation instruments and other industrial hygiene instrumentation.

Once advised that it is safe to proceed, EMS personnel will perform necessary sampling and monitoring of the environment (air, water, vegetation, soil, storm sewer, surface water) to support Laboratory emergency response operations in accordance with the sampling plan. Using the "buddy system," no EMS staff members are to proceed to the field unless accompanied by another individual. The buddy can be another EMS staff member or one of the HC Technicians. The two individuals must remain together until they return to the EMS HQ.

EMS personnel in the field must verify that their cellular telephones are operational, monitor them for incoming calls, and call the EMS HQ frequently (at least once every half hour, or whenever the field personnel obtain information that should be communicated to EMS HQ).

EMS field personnel are instructed to follow the sampling plan, paying particular attention to the order in which samples are to be collected. In general, established sampling procedures are to be employed (References 7 through 11). However, some special sampling

applications may require adjustments or substitute methods. Some alternate sampling methods are presented below.

Samplers are to avoid being contaminated or tracking contamination into uncontaminated areas. Some sampling equipment may need to be disposed of as hazardous/radioactive/mixed waste. Samplers should wear disposable gloves when taking samples, discard gloves between each sampling point, and take precautions not to introduce any external contamination. Contaminated material should be disposed of into a hazardous waste container. When taking samples, the samplers must be careful not to touch filters, bags, and bottles with contaminated materials. Some physical precautions may also need to be observed. For example, to avoid hydrocarbon cross-contamination, samplers should not place generators in the same vehicle as the ice chest used to store samples. If this is not possible, samplers should place the ice chest in a sealed plastic bag. Samplers must always wear disposable gloves when handling the generators, and always place the generator downwind of the sampling location.

Samplers, or their buddies, are instructed to record all observations and activities in detail in a field notebook, paying particular attention to the times at which activities were performed or events occurred. Events that seem insignificant at the time may become critical pieces of information later, when the data are being evaluated and analyzed. All applicable sampling documentation must be completed, including FTPs and COCs. Documentation shall be filled out by EMS personnel in accordance with Reference 12.

When all samples have been collected, samplers should notify EMS HQ for instructions concerning where to take the samples for analysis. Samplers must not take samples to the analytical laboratory until instructed to do so by the Lead Analyst. In general, samples requiring nonradiological analyses (gas chromatography/mass spectrometry, inductively-coupled plasma-emission spectroscopy, atomic absorption) will be submitted to Environmental Analytical Sciences (Building 226). Radiological analyses will normally be conducted by the Radiation Analytical Sciences Laboratory in Building 151 [tritium (Room B136), gamma spectrometry (Room B114), gross alpha, gross beta (Room B130)]. However, Hazards Control laboratories may also be used, depending on the incident and the required analyses. Samplers are instructed to inform analytical personnel that data should be reported via telephone and/or FAX to the EMS HQ as soon as analyses are completed. Data, as original hard copy, shall ultimately be accompanied by appropriate documentation (COC forms) and QA/QC data.

6.8. SPECIAL EMERGENCY AIR MONITORING PROCEDURES

Battery-operated (12- or 24-V DC), portable, high-volume air particulate samplers can be used for any emergency requiring air particulate samples. The battery clips on the samplers are marked red for positive, black for negative. Field personnel must be sure to observe the polarity when using the samplers, or they might damage the units. There are several car/truck-type batteries in the transportainer at Building 596; more can be obtained at the motor pool (Building 611) or at the battery shop (Building 419 south). Whatman-41 circular filter papers are located in the transportainer at Building 596. Field personnel must record the air sampler number, the start time, end time, and beginning and ending flow rates as indicated by the rotometer on the unit. The times and rates of flow, together with calibration data (Reference 13), can be used to calculate total air volume for the sampling period. When filters are analyzed, concentrations per unit of air volume can then be calculated.

Sampling of gaseous air pollutants, particularly tritium vapor (HTO/TTO) can be accomplished quickly using freeze-out or condensation techniques. Tritium elemental gas (HT) cannot be collected using this technique. Freeze-out/condensation collects air vapor by condensing it on a short length of aluminum tubing in a portable, thermos-type, open-top dewar filled with either liquid nitrogen (LN) or dry ice and alcohol. The tubing will cool and "frost-up," thereby collecting atmospheric moisture. After the LN or alcohol evaporates, the tubing will slowly warm and the melted frost/ice will run down the tubing into the now-empty dewar.

Typically, several mL of moisture can be collected. The collected liquid should be decanted into a glass sample vial, securely capped, and double-bagged to prevent cross-contamination. The sample should then be adequately labeled and submitted promptly, with appropriate documentation, to the appropriate analytical laboratory (to be determined by the Lead Analyst).

6.9. DATA ANALYSIS

Data must be reported to the EMS HQ and ultimately to the Incident Commander through the OSR/EM Rep. EMS Analysts shall be available to provide professional interpretation of results. This includes evaluation of analytical laboratory QA/QC data; evaluation of duplicate sample results; comparison of data from contaminated areas to data obtained from background locations, as well as to data normally resulting from surveillance monitoring; and comparison of sample data to regulatory limits. If supplemental sampling is required, additional sampling plans will be developed and carried out. The use of FAX machines and Open-Labnet for transmittal of data is encouraged.

6.10. DEBRIEFING/FINAL REPORT

When the emergency incident has concluded, and EMS has been released from duty, all EMS personnel involved in the emergency response will attend a debriefing conducted at the direction of the Section Leader. The debriefing should extract all information regarding EMS response (what worked, what didn't, what happened, what decisions were made, what assumptions were used, what time things happened, who made what decisions, etc.). A final report, compiled by the Lead Analyst and OSR/EM Rep, will relate all information from the debriefing and should also include recommendations for future EMS response improvements.

6.11. READINESS AND EXERCISES

EMS personnel shall be ready to respond for emergency service at all times. Emergency monitoring equipment shall be maintained by the Technical Support Group, under the direction of the TSG Leader, in a state of readiness and shall not be used for other purposes. Calibration of portable air particulate monitors must be conducted in accordance with Reference 13.

EMS personnel will participate in all LLNL and EPD emergency response exercises and drills when requested to do so. Periodic exercises, involving only EMS personnel and scheduled at the discretion of the EMS Section Leader, are also recommended. These exercises will result in reports used to evaluate and amend EMS emergency response procedures.

7. DOCUMENTATION

All documentation associated with the EMS emergency response will be archived in accordance with Reference 14. These documents include field logbooks/FTFs used to record all pertinent information regarding sampling, COCs that have remained with associated samples and sample data at all times, notes and sampling plans prepared in the EMS HQ and those compiled by the OSR/EM Rep during the emergency incident, and the final incident report. Reports resulting from exercises and drills will also be archived in accordance with Reference 14.

8. ACCEPTANCE CRITERIA

Emergency monitoring samples will be considered unacceptable if (1) cross contamination is suspected, (2) labels are illegible, (3) sample chain-of-custody is compromised or broken, (4) documentation is incomplete, or (5) proper sampling procedures, preservatives, or storage procedures have not been followed. Data from samples not meeting acceptance criteria should not be used in the characterization of incidents and normally should not be reported to the IC.

9. ATTACHMENTS

- A. Emergency Dispatch Center Call-Out List for Environmental Monitoring
- B. EMS Emergency Environmental Monitoring Telephone Listing
- C. Chain of Command for Emergency Environmental Monitoring

Attachment A. Emergency Dispatch Center Call-Out List for Environmental Monitoring Section

Emergency Dispatch Center

Emergency Call-Out List

for

Environmental Monitoring

Call in order until one is contacted; contacted person takes over call-out

(Proprietary information)

REMARKS: Call until one is contacted. Inform them that they are EMS
Primary Contact and have responsibility to (1) take over call-out and
(2) assess need for call-out of additional EMS resources and personnel.

37700 is the on-site pager number to call for emergencies only; 37777 is the normal
pager system number and can be used.

510-423-7705 can be used from off-site to access the LLNL paging system.

REVISION 4 FINAL	EMP-EM-S Emergency Environmental Sampling	Effective date: 6/15/94 Page 17 of 20
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Attachment B. EMS Emergency Environmental Monitoring Telephone Listing

(Proprietary information)

Design Change Package EMP-GW-S-001

Ground Water Sampling

Effective Date: September 23, 1994

Prepared by:

Duke Ramsey 9/22/94
Duke Ramsey date
TSG Technical Coordinator

Approved by:

Eric Christofferson 9/22/94
Eric Christofferson date
WGMG Environmental Analyst

Lucinda M. Garcia 9/23/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Bill Hoppes 9/23/94
Bill Hoppes, date
WGMG Group Leader

for Rebecca A. Failor 9/23/94
Rebecca A. Failor date
Section Leader, EMS

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. DISCUSSION

Errors were found in the Appendix to EMP-GW-S that defines the preservation and sampling requirements for ground water. This Design Change provides the correct information.

2. PROCEDURE CHANGE

The amended table is attached. Deletions in the table are indicated by strike-through text (~~like this~~) and additions are shown in italics.

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Anions Bromide Chloride Fluoride Nitrate Nitrite Phosphate Sulfate	EPA 300.0	Triple rinse bottle with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	500 ml polypropylene	48 hours hold time Footnote: c
Chemical Oxygen Demand (COD)	EPA 410	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C.	100 ml polypropylene bottle, preacidified with H ₂ SO ₄ , provided by analytical laboratory.	Footnote: c, d*
Chlorophyll-a		Do not rinse bottles.	Store samples in ice chest or refrigerator at 4°C.	1 L polypropylene bottle provided by analytical laboratory.	6 hour hold time Light sensitive - wrap in foil. Footnote: c
Coliform bacteria		Do not rinse bottles.	Store samples in ice chest or refrigerator at 4°C.	125 ml sterilized polypropylene bottle provided by analytical laboratory.	6 hour hold time Footnote: c
Drinking Water Pesticides (DWP)	EPA 608/615	Do not rinse bottles. Minimize air space, but do not overfill as overfilled bottles have been known to break.	Store samples in ice chest or refrigerator at 4°C.	6 x 1 L amber glass (Boston Rounds) provided by analytical laboratory.	Footnote: c
Fish Toxicity	EPA 600 96 hr. 1 pt. screening. 100% solution. Fat head minnow	Do not rinse carboy.	Store samples in ice chest or refrigerator at 4°C.	5 gallon carboy provided by analytical laboratory.	24 hour hold time Footnote: c

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
General Minerals (GENMIN) Alkalinity Bicarbonate Carbonate Hydroxide Total Alkalinity Aluminum Calcium Chloride Copper MBAS (Surfactants) Nitrate Iron Magnesium Manganese Nickel pH Potassium Sodium Sulfate Conductivity TDS Hardness Zinc	EPA 310.2 EPA 200.7 EPA 200.7 EPA 300.0 EPA 200.7 EPA 425.1 EPA 300.0 EPA 200.7 EPA 200.7 EPA 200.7 EPA 200.7 EPA 150.1 EPA 200.7 EPA 200.7 EPA 300.0 EPA 120.1 EPA 160.1 EPA 130.1 EPA 200.0 EPA 200.7	Triple rinse bottles with sample matrix before filling.	Acidification is not required. Store samples in ice chest or refrigerator at 4°C.	2 x 1 L polypropylene, store-stock # 8125-24044	no footnote required
Gross Alpha/Beta	EPA 900.0	Triple rinse with sample matrix in the field.	Add HNO ₃ to achieve pH<2 after returning from field (5 ml in 1 L bottle). Refrigeration is not required. Surface water samples are not acidified.	1 L polypropylene	Filter Pit 7 samples Footnote: a
High Explosives (HE) HMX RDX TNT			None required.	40 ml clear glass vial provided by analytical laboratory	no footnote required

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Metals	Medium specific.	Filter water. Do not rinse preacidified samples. If not preacidified, triple rinse and acidify with 5 ml HNO ₃ .	Refrigeration not required.	500 to 1000 ml polypropylene, provided by analytical laboratory.	Footnote: a, g
<u>Nutrients</u> Ammonia Nitrate Nitrite TKN	EPA 350.3 EPA 353.2 EPA 354.1 EPA 351.3	Triple rinse bottles with sample water before filling.	Upon return from field, add 20 drops H ₂ SO ₄ (to achieve pH < 2). Store samples in ice chest or refrigerator at 4°C.	1 L polypropylene provided by analytical laboratory.	Footnote: c, f
Oil and Grease	EPA 413.1	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C.	1 L wide mouth amber glass bottle, preacidified with H ₂ SO ₄ to achieve pH < 2, provided by analytical laboratory.	Footnote: c, f
pH		For field measurement, calibrate meter prior to sampling. Triple rinse bottle with sample matrix in the field.	Store samples in ice chest or refrigerator at 4°C.	125 ml polypropylene	pH analysis is done in the field for NPDES samples only. Lab analysis coupled with conductivity. Footnote: c
Phenolics	EPA 420.1	Do not rinse bottles.	Bottles are preacidified by the analytical laboratory. Refrigeration is not required.	1 L clear glass bottles, preacidified with H ₂ SO ₄ to achieve pH < 2, provided by the analytical laboratory.	Footnote: f

Attachment B (continued). EMS Emergency Environmental Monitoring Telephone Listing

Supplemental Labor (obtain management approval before calling)

(Proprietary information)

RAS Laboratory (radiological analyses)

(Proprietary information)

EAS Laboratory (non-radiological analyses)

(Proprietary information)

Vehicles/Cellular Telephones/Conference Room

(Proprietary information)

Miscellaneous Numbers (Lab Extensions)

EMERGENCY

911

(Proprietary information)

Attachment B (continued). EMS Emergency Environmental Monitoring Telephone Listing

Paging System (pager number and number to display on pager entered when requested)

(Proprietary information)

Attachment C. Chain of Command for Emergency Environmental Sampling

EMP-GW-CA

GROUNDWATER EQUIPMENT CALIBRATIONS

Prepared by:

Duke Ramsey 12-3-92
Duke Ramsey
Environmental Technician, TSG
date

William G. Hoppes 12-4-92
William G. Hoppes
Group Leader, EMG
date

Reviewed by:

David Graves 12-3-92
David Graves
Environmental Technician, TSG
date

Katrina G. Fischer 12-4-92
Katrina G. Fischer
Environmental Engineer, SAIC/SMG
date

Kris Surano 12/3/92
Kris Surano
Group Leader, SMG
date

Approved by:

Rebecca A. Failor 12/3/92
Rebecca A. Failor
Section Leader, EMS
date

Kris Surano 12/3/92
Kris Surano
Group Leader, SMG
date

Lucinda M. Garcia 12/3/92
Lucinda M. Garcia
Quality Assurance Coordinator, EMS
date

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1. PURPOSE

This procedure provides guidance for calibrating the Beckman 20 and 21 pH/temperature meters currently used by the Technical Support Group (TSG) of the Environmental Monitoring Section (EMS).

2. APPLICABILITY/DISCUSSION

The EMS must collect pH and temperature readings to verify groundwater stabilization prior to collecting samples from the compliance monitoring wells. This is done to meet the requirements of various regulatory agencies (RWQCB, EPA, DOE; etc.), and thus it is essential that the Beckman combination pH/temperature meters be calibrated regularly and accurately.

Procedure EMP-GW-S, Groundwater Sampling (Reference 1), Sections 6.4.9 through 6.4.12, describes use of the pH/temperature meters in the field.

3. REFERENCES

1. EMP-GW-S, *Groundwater Sampling*.
2. Beckman Model 20/21 pH/temperature meter instructions 015-246130-b.
3. EMP-QA-NCR, Nonconformance Reports

4. DEFINITIONS

Buffer Solution: A substance capable of maintaining the relative concentrations of hydrogen and hydroxyl ions in a solution. The solution is prepared in the field with deionized (D.I.) water (see definition below) and buffer solution packets (see definition below).

Buffer solution packet: A color coded, unit-dose pillow containing the buffer powder. Buffer solution packets at pH 4.01 (red), 7.00 (yellow), and 10.00 (blue) can be ordered from the HACH Company, PO Box 389, Loveland CO 80539 (see pg. 52 of 1991-2 HACH Company catalog).

D.I. water: Deionized and charcoal filtered water, available from Building 151 (for information contact Bldg. 151 Coordinator, Vance Fowler, 2-5597).

Field Tracking Form: A form used while in the field to document sampling activities.

5. RESPONSIBILITIES

5.1. TSG GROUP LEADER

The TSG Group Leader is responsible for ensuring that the procedure is carried out; and that adequate calibration records are maintained.

5.2. EMS WATER ANALYST

The EMS Water Analyst ensures that this procedure is implemented by the environmental monitoring technicians, reviews and interprets the calibration data, and ensures that calibration data have been appropriately recorded. If the calibration is

unsuccessful, the analyst determines whether or not the equipment needs repair or service. The analyst also uses the calibration data to determine whether additional investigation is needed into the accuracy of the sampling data.

5.3. TSG TECHNICIAN

The TSG Technician performs the calibration procedure and records the calibration data. If the calibration is unsuccessful, the TSG Technician reports this fact to the EMS Water Analyst via a Nonconformance Report (Reference 3).

6. PROCEDURE

Equipment Required:

- At least one each of pH buffer solution packets at pH 4.00 (red), 7.01 (yellow), and 10.00 (blue).
- At least one liter D.I. water
- A 250 ml beaker

6.1. DAILY FIELD CALIBRATION OF THE pH/Temperature meter

6.1.1. Place the Beckman pH/temperature meter, the buffer solutions, D.I. water, and the 250 ml beaker on a relatively flat and stable working surface.

6.1.2. Triple-rinse the beaker with the D.I. water and fill with approximately 200 ml of D.I. water. This amount is arbitrary, but make sure there is sufficient volume to cover the probe.

6.1.3. Open a buffer solution packet with the pH range of the water to be sampled (usually yellow, occasionally blue; red is seldom used since groundwater in this pH range is rarely, if ever, encountered), and empty packet contents into the beaker. Agitate the mixture until the powder is dissolved.

6.1.4. Place the Beckman pH and temperature electrodes into the — prepared buffer solution. Press the clear button on the Beckman meter; this will clear the information stored from the previous calibration and will turn the meter on. Press the meter's slope button, initiating the automatic calibration sequence. For a more detailed explanation of the automatic slope and temperature calculations being performed by the pH/temperature meter, see the Beckman Instructions (Reference 2).

6.1.5 As the meter is measuring, an "eye" will flash on the LCD screen. When the "eye" stops flashing and remains steadily on, take the pH reading and compare it with the known pH of the buffer solution; the two values should be within 0.01 pH unit of each other. After calibrating, rinse the pH electrode thoroughly with D.I. water. The meter and electrode are now ready to use for sampling. Record all calibration information on the field tracking form.

6.1.6. The section entitled "Battery Replacement, Service and Troubleshooting" of the Beckman Instructions (Attachment 1) explains how to perform a check to verify the proper operation of the meter's systems. This check and verification system should be performed any time the meter fails to calibrate properly or whenever the sampler wishes to verify the correct operation of this equipment. Record all calibration information in the field notebook. Any calibration failure or other problems should be documented in a nonconformance report (Reference 3).

6.2. SEMI-ANNUAL LABORATORY TEMPERATURE PROBE CALIBRATION

During January and June of each calendar year, perform a three point calibration of the temperature probe of the pH/temperature meter against water samples, such as tap water, at the laboratory bench. Obtain reference temperatures from two thermometers, such as Stock # 6685-20086 Immersion Thermometers (-1°C to 50°C resolution to 0.1°; available from Central Supply) that agree within 0.5°C. Based upon the groundwater temperatures most likely to be encountered (5°C to 35°C), the temperature reading of the pH/temperature meter should agree with the average reading of the two thermometers to within 1°C. Calibrate against three water samples of temperatures that differ by at least 10°C, of which the middle temperature is at approximately room temperature. Record the average thermometer temperature and corresponding pH/temperature meter reading in the appropriate box in the field calibration logbook kept with the pH/temperature meter.

6.3. SERVICE AND REPAIRS

If calibration fails, or other problems occur with the pH/temperature meter, see Attachment 1, which lists two toll-free numbers that may be called for assistance and the address of the service center where the meter can be sent for repairs. Be certain to tag the meter with information that it failed calibration so that other technicians will not use it. Any calibration failures must be documented in a Nonconformance Report (Reference 3).

7. DOCUMENTATION/QA RECORDS

7.1. DAILY CALIBRATION OF THE pH/TEMPERATURE METER

Recalibrate the pH/temperature meter before each daily use (see Reference 1). Note the fact that it was calibrated, and the date, on the corresponding Field Tracking Form. Record the calibration data in the field calibration logbook kept with the pH/temperature meter.

7.2. SEMIANNUAL RECALIBRATION OF THE TEMPERATURE PROBE

Recalibrate the temperature probe semiannually before use (see Reference 1). Note the fact that it was calibrated, and the date, on the corresponding Field Tracking Form. Record the calibration data in the field calibration logbook kept with the pH/temperature meter.

8. ACCEPTANCE CRITERIA

8.1. TEMPERATURE READING OF THE pH/TEMPERATURE METER

The temperature reading of the pH/temperature meter should agree with the average of the test thermometers, to within 1°C.

8.2. pH READING OF THE pH/TEMPERATURE METER

The pH reading of the pH/temperature meter should agree with the average of the stated value of the prepared buffer solution to within 0.01 pH units.

9. ATTACHMENTS

Attachment A. Battery Replacement, Service and Troubleshooting, Beckman Instructions, 015-246130-b.

ATTACHMENT

TROUBLESHOOTING PROCEDURE

1. Disconnect electrode cable(s) from instrument. Press **ON** to turn on instrument, then press **CE** to clear. Display should show [OK, AUTO]. If not, replace batteries per BATTERY REPLACEMENT, above. If instrument is still inoperative, call Service Hot Line: 1-800-662-6217.
2. Insert one end of a paper clip into the small hole in the center of the "pH" input connector. Hold the other end of the clip to the inside barrel of the same connector as shown.

3. Press **pH**, then **7.00**. The display should lock at pH 7.00, indicating a one-point standardization.
 - a. If instrument passes test, go to Step 4.
 - b. If instrument fails test, call Service Hot Line: 1-800-662-6217.
4. Reconnect pH electrode cable to "pH" input connector. Short the input connector of the cable.

5. Press **pH** and then **7.00**. Display should lock at pH 7.00. Press **pH**, then remove paper clip. Reading should drift.
 - a. If instrument passes test, go to Step 5.
 - b. If instrument fails test, call Beckman Electrochemistry Applications:
1-800-654-8067 Outside California
714-671-4848 Within California
6. Reconnect pH electrode(s). Immerse electrode(s) in pH 4 buffer and perform one-point standardization. Then immerse electrode(s) in pH 10 buffer and take pH reading. At 25°C, the reading should be between 9.7 and 10.1 pH.
 - a. If the test is passed, the pH meter, cable, and electrode(s) are functioning properly.
 - b. If test is failed, the pH electrode(s) must be rejuvenated or replaced. The electrode rejuvenation procedure is given in the electrode instruction sheet. After rejuvenation, retest per Step 5, above.

SERVICE HOT LINE: 1-800-662-6217

APPLICATIONS HOT LINE: 1-800-654-8067 Outside California
714-671-4848 Within California

BATTERY REPLACEMENT, SERVICE AND TROUBLESHOOTING

SPECIFICATIONS

Design Change Package EMP-GW-L-001

Site 300 Water Sampling Locations

Effective Date: October 21, 1994

Prepared by:

Eric Christofferson 10/18/94
Eric Christofferson date
WGMG Environmental Analyst

Approved by:

Lucinda M Garcia 10/19/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Bill Hoppes 10/19/94
Bill Hoppes, date
WGMG Group/Leader

Rebecca A. Failor 10/19/94
Rebecca A. Failor date
Section Leader, EMS

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1. DISCUSSION

Well-01 is being destroyed in response to Tiger Team recommendations because it is screened across several water bearing zones in the lower Neroly blue sandstone. Well NC2-12D is adjacent to Well-01 and has a similar ground water tritium history to that well.

2. PROCEDURE CHANGE

Substitute well NC2-12D in section 5.8 and on figure 6 of EMP-GW-L for Well-01. The replacement well is adjacent to the old well so the map location and directions to the well do not require modification.

EMP-GW-L

SITE 300 WATER SAMPLING LOCATIONS

Prepared by:

E. Christofferson 12/21/92
Eric Christofferson date
Environmental Analyst, EMG

Duke Ramsey 12-21-92
Duke Ramsey date
Environmental Technician, TSG

Reviewed by:

Rebecca Ward 12-21-92
Rebecca Ward date
Environmental Technician, TSG

David Graves 12-21-92
David Graves date
Environmental Technician; TSG

Katrina G. Fischer 12/21/92
Katrina G. Fischer date
Environmental Engineer, SAIC/SMG

Approved by:

Rebecca Failor 12/18/92
Rebecca Failor date
Section Leader, EMS

Kris Surano 12/18/92
Kris Surano date
Group Leader, SMG

Lucinda M. Garcia 12/21/92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

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1. PURPOSE

This procedure describes groundwater and surface water sampling locations at and near Site 300. These locations include groundwater monitoring wells, compliance monitoring wells, on-site and off-site groundwater production wells, and surface water sites at Site 300 (see maps in Attachment A for sampling locations).

2. APPLICABILITY/DISCUSSION

Compliance monitoring wells at Site 300 monitor groundwater quality around inactive landfills at Site 300. The geographic scope of this procedure includes:

- Portions of the east and west firing areas. The east firing area (EFA) includes Building 801 and 802 firing tables and inactive waste disposal Pits 1, 2, 8 and 9. The west firing area (WFA) includes Building 850 and 851 firing tables and the Pit 7 Complex composed of inactive waste disposal Pits 3, 4, 5, and 7.
- Another inactive waste disposal site, Pit 6, located along the Site 300 boundary bordering Corral Hollow Road.
- The Building 817 (B-817) High Explosives (HE) process area, which uses a network of five wells to monitor the HE waste-water surface impoundment ponds.

Hereafter, the monitoring wells located in the WFA, accessible by Route 4 are called the Pit 7 Complex wells; those located in the Doali Road area, the Pit 2 wells; and those in the EFA, accessible by Route 3, the Pit 1 wells. The monitoring wells in the B-817 HE process area, accessible by Route 5, will be called the B-817 area wells; those located at the Site 300 pistol range, on Corral Hollow Road, the Pit 6 wells; and those located behind B-801, accessible by Route 3, the Pit 8 wells. Maps in Attachment A show the surface roads, locations of inactive disposal Pits, and the network of monitoring wells for each area.

Other sampling locations at Site 300 include active and inactive groundwater production wells both on and next to Site 300, and one on-site and one off-site surface water sampling location. The EMS collects some samples on private property and some of the sampling location names and designators involve the use of proprietary information. It is the policy of LLNL and EPD that the names and addresses of private parties, and directions to such sampling locations, remain In Strict Confidence and that this information only be given out on a need-to-know basis. Persons needing this proprietary information to perform their sampling activities should contact the Responsible Analyst (SMG).

3. REFERENCES

- 3.1. EMP-GW-S, *Groundwater Sampling*
- 3.2. EMP-QA-S, *Quality Assurance Sampling*

4. RESPONSIBILITIES

4.1. SECTION LEADER

The EMS Section Leader has final approval authority for the selection of all sampling locations.

4.2. SMG GROUP LEADER

The SMG Group Leader assures that sampling locations meet the sampling design criteria and applicable procedures.

4.2. SMG ANALYST

The Analyst selects sampling sites so they meet sampling design criteria and provides proprietary information to the TSG Technician as required for sampling activities.

4.3. TSG TECHNICIAN

The TSG Technician collects samples from the correct sampling location.

5. PROCEDURE

Equipment Required:

N/A

Figures 1-9 in Attachment A show groundwater and surface water sampling locations for Site 300.

5.1. PIT 1 WELLS AND LOCATIONS (FIGURE 2)

Pit 1 is located 4.1 miles inside Site 300, measured from the main gate along Route 3. Eight surveillance monitoring wells encircle this closed landfill. The wells are identified as K1-01, K1-02, K1-03, K1-04, K1-05, K1-07, K1-08, and K1-09. The wells are all visible from any position on the landfill. They have blue cylindrical metal covers rising three feet above ground. The well location identifier is clearly marked in large white numbers on the cover of each well.

5.2. PIT 2 WELLS AND LOCATIONS (FIGURE 2)

Pit 2 is located 4 miles inside Site 300, measured from the main gate, along Route 3. This landfill lies adjacent to Route 3 opposite the Doall Road connection. Four surveillance monitoring wells are found in the vicinity of Pit 2. Well K2-01 is approximately 300 feet east of the Doall Road and Route 3 connection, on the north side of Route 3. Well K2-02 is located on the left side of Route 3, 450 feet beyond the Doall Road connection, proceeding towards the advanced test accelerator (ATA). Wells K2-04S and K2-04D are located about 600 feet westward along Doall Road from its connection with Route 3. Well K2-04S is accessed through a metal plate in the road. Well K2-04D is adjacent to the south side of the road.

5.3. PIT 6 WELLS AND LOCATIONS (FIGURE 3)

Pit 6 is located adjacent to Corral Hollow Road, 3 miles west of the Site 300 main gate. Entrance to the landfill is through the Pistol Range entrance on the north

side of Corral Hollow Road. The center of the landfill is about 500 feet northwest of the Piston Range entry gate. The six surveillance monitoring wells that encircle the landfill may be seen and accessed from this position. They are, counterclockwise from north, K6-03, EP6-08, EP6-07, K6-01, EP6-09, and K6-04. Wells are clearly marked with well casing identifiers.

5.4. B-817 HE PROCESS AREA WELLS AND LOCATIONS (FIGURE 4)

HE Process Area surveillance monitoring wells are accessed from Route 5 and the parking lot for building 817. Wells W-817-03, W-817-03A, W-817-04 are located along the west shoulder of Route 5, about one-half mile from the Site 300 entrance. Well W-817-02 is located 200 feet west of well W-817-03. Well W-817-01 is located about 100 feet northeast of Building 817 and is accessed from the parking lot, which is about 0.6 mile along Route 5 from the Site 300 entrance.

5.5. PIT 7 COMPLEX WELLS AND LOCATIONS (FIGURE 5)

Pit 7 Complex surveillance monitoring wells are accessed from Route 4. The landfill complex, comprised of Pit 3, Pit 4, Pit 5 and Pit 7, is located adjacent to Route 4 and is 5.2 miles inside Site 300 from the main gate. Well K7-03 lies approximately central to this group of wells, 0.4 miles northwest along Route 4 from its connection with Doall Road. This well is located on the northeast shoulder of Route 4. Additional monitoring wells accessible on this side of Route 4 are, from northwest to southeast, NC7-25, NC7-37, NC7-26 and NC7-22. Wells accessible from this location on the opposite, southwest, side of Route 4 are, from southeast to northwest, K7-07, K7-01, K7-10, and K7-06. One additional surveillance monitoring well, NC7-47, is associated with this group, but lies over a ridge about 500 feet northwest of well K7-03 and is accessed from Route 3. Well K7-03 is located 0.25 miles along a dirt road that runs southwest off Route 3, 0.7 miles northwest from its connection with Doall Road.

5.6. PITS 8 AND 9 WELLS AND LOCATIONS (FIGURE 6)

Pit 8 surveillance monitoring well K8-01 is located 400 feet east of Building 801 which is accessed from Route 3, about 4.0 miles inside Site 300 from the main gate.

Pit 9 surveillance monitoring wells, K9-01, K9-02, K9-03, and K9-04 are clustered near bunker 845. This bunker lies 0.2 miles southwest of the connection of Linac Road with Route 3, about 3.5 miles inside Site 300 from the main gate.

5.7. QUALITY ASSURANCE LOCATIONS

QA sample locations for the compliance monitoring wells include duplicates, field blanks, and trip blanks (Reference 2). One QA sample is taken from each Pit area (Pit 1, Pit 2, Pit 6, HE Process Area, Pit 7, Pit 8 and Pit 9), one is taken from an on-site monitoring well (Section 5.8), one from an off-site monitoring well (Section 5.9) and one is taken from a surface water monitoring location (Section

5.10). Sites for QA samples are selected at random from the well locations within each Pit or group of locations.

5.8. OTHER ON-SITE MONITORING WELL LOCATIONS

Well-01 (Figure 6). Pump house, Route 3, north side of road, 0.1 miles past the entrance to B-801, or 3.7 miles along Route 3 from the main gate.

W18 (Figure 7, inset map). Pump house, north side of Route 5, 0.2 mile west of Site 300 main entrance gate.

W20 (Figure 7). Pump house, 200 feet south of a point along Route 5 that is 0.25 mile inside Site 300 from the main entrance gate.

W-7A (Figure 7, inset map). Site 300 general service area. 200 feet south of a point along Route 1 that is 0.25 mile from the main entrance gate.

NC2-11D (Figure 6) Route 3, 3.6 miles from main entrance gate, immediately past connecting road to Building 801 on northeast side of Route 3.

NC7-61 and NC7-69 (Figure 7). Adjacent to Doall Road, immediately east of its connection with Route 4, approximately 4.6 miles inside Site 300 from the main entrance gate.

NC2-07 (Figure 7). Well is on southwest shoulder of Route 1 (Linac Road), 1.2 miles southeast of the intersection of Route 1 and Route 3.

5.9. OFF-SITE MONITORING WELLS

CARNRW1, CARNRW2, CON1, CON2, CDF1, GALLO1, VIE1, VIE2, MUL1, MUL2, and STN1 wells are sampled. These wells are outside of the Site 300 boundaries. The locations of these wells are considered to be proprietary. Persons needing location information should contact the Water Analyst, or the Surveillance Monitoring Group Leader.

5.10. SURFACE WATER MONITORING LOCATIONS

GEOCRK (Figure 9). Adjacent to Corral Hollow Road, 2.1 miles east of the Site 300 main entrance. Sample(s) taken from creek on southeast side of road at the bottom of the gorge.

812CRK (Figure 9). Located 3.2 miles inside Site 300 on Route 3 to Route 1 (Linac Road). Continue 0.4 miles southeast on Route 1 to creek. Sample(s) taken from creek adjacent to southwest shoulder of Route 1.

6. DOCUMENTATION/QA RECORDS

None

7. ACCEPTANCE CRITERIA

Groundwater sampling locations are acceptable when approved by the EMS Section Leader.

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8. ATTACHMENTS

Attachment A: Maps of Site 300 Groundwater Sampling Locations.

ATTACHMENT A FIGURE 1
SITE 300 PIT LOCATIONS

Site 300 Pit locations.

ATTACHMENT A FIGURE 2
LOCATION OF MONITORING WELLS IN THE PIT 1 AND PIT 2 AREAS

Location of monitoring wells in the Pit 1 and Pit 2 Areas.

ATTACHMENT A FIGURE 3
LOCATION OF MONITORING WELLS IN THE PIT 6 AREA

ATTACHMENT A FIGURE 4
LOCATION OF MONITORING WELLS IN THE BUILDING 817 HE PROCESS AREA

Location of monitoring wells in the Building 817 HE Process Area.

ATTACHMENT A FIGURE 5
LOCATION OF MONITORING WELLS IN THE PIT 7 COMPLEX AREA

Location of monitoring wells in the Pit 7 Complex Area.

ATTACHMENT A FIGURE 6
LOCATION OF MONITORING WELLS IN THE PIT 8 AND PIT 9 AREAS

Location of monitoring wells in the Pit 8 and Pit 9 Areas.

ATTACHMENT A FIGURE 7
LOCATIONS OF SITE 300 SURVEILLANCE MONITORING INSTALLATIONS

Locations of various Site 300 surveillance monitoring installations.

ATTACHMENT A FIGURE 8
SITE 300 OFF-SITE MONITORING WELLS

Site 300 off-site monitoring wells.

ATTACHMENT A FIGURE 9
SITE 300 WATER SAMPLING LOCATIONS

REVISION 1 FINAL	EMP-GW-QR Quarterly Groundwater Report	Effective date: 01/04/93 Page 1 of 12
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EMP-GW-QR

QUARTERLY GROUNDWATER REPORT

Prepared by: Katrina G. Fischer 12-7-92
 Katrina G. Fischer date
 Environmental Engineer, SAIC/SMG

Reviewed by: Rebecca Ward 12-3-92
 Rebecca Ward date
 Environmental Technician, SMG

William G. Hoppes 12-4-92
 William G. Hoppes date
 Group Leader, EMG

Approved by: Rebecca A. Failor 12/3/92
 Rebecca A. Failor date
 Section Leader, EMS

Kris Surano 12/3/92
 Kris Surano date
 Group Leader, SMG

Lucinda M. Garcia 12/3/92
 Lucinda M. Garcia date
 Quality Assurance Coordinator, EMS

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1. PURPOSE

This procedure provides guidance in preparing the Lawrence Livermore National Laboratory (LLNL) Site 300 Groundwater Monitoring Program Quarterly Report, which is submitted to the Central Valley Regional Water Quality Control Board (CVRWQCB).

2. APPLICABILITY/DISCUSSION

Site 300 is a high-explosives (HE) testing facility located in the Altamont Hills approximately 15 miles east of LLNL's Livermore Site. Quarterly reports present the results of work performed during each quarter as part of the LLNL Site 300 Groundwater Monitoring Program. The reports fulfill requirements set forth in California Department of Health Services (DHS) [now the Department of Toxic Substances Control (DTSC)] Interim Status Document CA 2890090002 (Reference 1) and in CVRWQCB Waste Discharge Orders 80-184 (Reference 2) and 85-188 (Reference 3).

Each report is organized into the following four geographical areas as defined in References 1 through 3: Pit 1 Area, Pit 7 Complex, Building 817 (B-817) HE Process Area, and Pit 6 Area (see Reference 4). Updated information describing the four monitoring networks is presented yearly in the first quarter's report. At the Pit 1 Area, three Barcad samplers and eight routine wells are sampled. At the Pit 7 Complex, seven routine wells are sampled; one additional well, K7-07, has frequently been dry but attempts to sample are made each quarter. At the B-817 HE Process Area, four routine monitoring wells and piezometer W-817-03A are sampled. An attempt has been made each quarter to sample lysimeters underlying the HE rinse-water surface impoundments in the process area, as required by Reference 3; however, no moisture to date has been available for sample collection. At the Pit 6 Area six routine wells are sampled. Groundwater elevations are measured at each monitoring installation prior to sample collection and these data are used to interpolate contours, which are graphically presented in each year's second quarterly report (see Reference 9).

Monitoring of the indicator parameters [total organic carbon (TOC), total organic halides (TOX), pH, and specific conductance] is used as an indirect method of leak detection for the Pit 1 landfill and B-817 HE Process Area surface impoundments. Statistical tests are performed using these indicator data collected from four independent sampling events to 1) ensure independence of the samples, 2) more adequately define the variability in groundwater chemistry in the Pit 1 and B-817 HE Process Areas, and 3) be consistent with EPA guidance (Reference 5).

Some samples are collected on private property and some of the sampling location names/designators involve the use of private individuals' names. It is the policy of LLNL and EPD that the names and addresses of private parties, and directions to such sampling locations, remain in-strict-confidence and that this information only be given out on a need-to-know basis.

3. REFERENCES

1. California Department of Health Services (DHS) (1981), *Interim Status Document* Number: CA 2890090002.
2. California Regional Water Quality Control Board-Central Valley Region (1980), *Order No. 80-184, Waste Discharge Requirements for University of California Lawrence Livermore National Laboratory Site 300 and U.S. Department of Energy-San Joaquin and Alameda Counties..*
3. California Regional Water Quality Control Board-Central Valley Region (1985), *Order No. 85-188, Waste Discharge Requirements for University of California*

Lawrence Livermore National Laboratory Site 300 and U.S. Department of Energy-San Joaquin and Alameda Counties.

4. EMP-GW-L, *Groundwater Sampling Locations*
5. United States Environmental Protection Agency (1989), *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities-Interim Final Guidance*, Office of Solid Waste, Waste Management Division, Washington, D.C. (EPA/530-SW-89-026) (NTIS PB89-151047)
6. Fischer, K.G. and J. Sims (1991), LLNL Site 300 Groundwater Monitoring Program Quarterly Report, January - March 1991, Lawrence Livermore National Laboratory, Livermore, CA (UCAR-10191-91-1).
7. EMP-QA-S, *Quality Assurance Sampling*.
8. EMP-GW-S, *Groundwater Sampling*.
9. Gracely, B.W. and B. Hoppes (1991), LLNL Site 300 Groundwater Monitoring Program Quarterly Report, April - June 1991, Lawrence Livermore National Laboratory, Livermore, CA (UCAR-10191-91-2).
10. EMP-QA-NCR, *Nonconformance Report*.
11. EMP-QA-SD, *Sample Tracking Documentation*.

4. DEFINITIONS

ATA: Advanced Test Accelerator.

Barcad: A specialized water sampler designed to sample discrete areas within a saturated zone.

CABF Student's t-test: Cochran's Approximation to the Behrens-Fisher Student's t-test.

CCR: California Code of Regulations

DHS: Department of Health Services (now California EPA-DTSC).

EFA: East Firing Area.

GSA: General Site Area.

Hit: Slang term for analytical laboratory result that is at or above the limit of detection (positively detected constituent).

MCL: Maximum Contaminant Levels for drinking water, CCR Title 22 and 40CFR265, App. III.

Pit 7 Complex: Area comprised of Pits 3, 4, 5, and 7.

SAL: State Action Level—Defined by State of California regulatory agencies, it is the level of pollutants which, if exceeded, require regulatory action.

TOX: Total organic halide.

TOC: Total organic carbon.

WFA: West Firing Area.

5. RESPONSIBILITIES

This monitoring and reporting effort has typically been performed by personnel from LLNL, Brown & Caldwell Analytical (BCA), Clayton Environmental Consultants, Thermo-Analytical Incorporated/Norcal (TMA/Norcal), Science Applications International Corporation(SAIC), and Kirk-Mayer Incorporated Energy Services (KMI).

5.1. EMS SECTION LEADER

The EMS Section Leader is responsible for ensuring that the report submitted to CVRWQCB meets requirements set forth in References 1 through 3. Note that this individual has review and signatory chain responsibilities.

5.2. SMG GROUP LEADER

The SMG Group Leader is responsible for assuring that the sampling locations meet the sampling design criteria and applicable procedures (References 7 and 8). Note that this individual has review and signatory chain responsibilities.

5.3. SMG ENVIRONMENTAL ANALYST

The SMG Environmental Analyst for water is responsible for producing a report that meets requirements set forth in References 1 through 3. The Analyst supervises the work of other SMG personnel who might be assigned authorship responsibilities, approves revisions in report format and content, evaluates statistical analyses and data tables and approves their inclusion, and ensures that the LLNL review and signature chain process is completed in a timely manner so the report can be mailed to CVRWQCB before the deadline.

5.4. ENVIRONMENTAL ANALYST ASSIGNED AUTHORSHIP

Authorship of the report may be assigned to a Environmental Analyst in the SMG. Specific responsibilities may include:

- Review analytical laboratory results from Site 300 surface and groundwater samples (both from routine compliance and surveillance locations).
- Evaluate spatial and temporal trends in analyte concentration from data in cooperation with the ADD Statistician.
- Compare groundwater analyte concentrations from these data to applicable environmental regulations.
- Summarize and discuss routine compliance and surveillance monitoring results for the quarter (including graphic and trend analysis of monitoring data).
- Coordinate with other LLNL staff in preparation of data tables and statistical analyses.
- Discuss changes to monitoring networks and procedures.
- Summarize results of QA program for the quarter.

The Authoring Environmental Analyst coordinates the LLNL review and signature chain process along with coordinating with the appropriate LLNL and contractor staff on revisions to each quarterly report. This effort is to ensure that the report is completed and submitted to the CVRWQCB on schedule, and that

follow-up printing and distribution of the report is accomplished. Report copies should be maintained in the Document Retention Center.

The Authoring Environmental Analyst maintains hard-copy files for each quarterly report, including the sample tracking system, monitoring data, drafts of the quarterly reports including comments, and other miscellaneous documentation including data analysis, discrepancy reports, and QA/QC.

5.5. EMS DATA MANAGER

The EMS Data Manager coordinates with appropriate staff at the analytical laboratories to receive electronic transfers of the quarterly data to the LLNL database. The Database Manager then compiles these results into tabular format and submits them to the Authoring Environmental Analyst for inclusion into Appendix A (groundwater monitoring data), Appendix D (Quality Assurance Program), and Appendix E (Routine Groundwater Surveillance).

The EMS Data Manager is also responsible for making any necessary corrections to the database based on hardcopy results received.

5.6. SMG ENVIRONMENTAL TECHNICIAN

The SMG Environmental Technician is responsible for handling all sample tracking (Field Tracking Forms, Chain-of-Custody Record forms, laboratory analytical results).

5.7. APPLICATIONS DEVELOPMENT DEPARTMENT (ADD) STATISTICIAN

The statistical test traditionally used, the Cochran's Approximation to the Behrens Fisher (CABF) Student's t-test, is no longer consistent with EPA guidance (Reference 5). EMS will continue to perform the CABF on the indicator parameters, as specified in References 1 through 3, until either a post-closure monitoring plan can be implemented, or the Waste Discharge Orders are amended.

With the assistance of the EMS Data Manager, and in cooperation with the SMG Environmental Analyst, the ADD Statistician accesses the current quarter's data in order to perform the necessary statistics. The ADD Statistician also explains any findings of significance (in Appendix B) for specific analytes from the Pit 1 and B-817 HE Process Area. The ADD Statistician also prepares CABF Student's t-test on quarterly data from the Pit 1 and B-817 HE Process Areas (Tables F-5 through F-8), as well as the correlating Appendix F text that explains the current quarter's statistical results. This work is all reviewed and overseen by the Authoring Environmental Analyst.

5.8. TID EDITOR

The Technical Information Department (TID) Editor is responsible for editing the report for clarity, grammar, style, and consistency. The Editor interacts with the Authoring Environmental Analyst, the SMG Environmental Analyst, and with TID to assure that the document is completed in a professional and timely manner.

5.9. TID ARTIST

The TID Artist is responsible, at the direction of the TID Editor, for preparing and making revisions to the figures used in each report.

6. PROCEDURE

Equipment Required:

N/A

The following is an outline of the process used to produce the quarterly groundwater report. Groundwater monitoring data from analyses performed on samples from each geographical area are tabulated in Appendix A of each quarterly report. Appendix B is a tabulation of the updated statistical analyses performed on the Resource Conservation and Recovery Act (RCRA) indicator parameter data (TOX, TOC, pH, and specific conductance) from the current quarter's Pit 1 and B-817 HE Process Area groundwater data, along with data for the constituents arsenic and selenium from the current quarter's B-817 HE Process Area data. Appendix C describes any changes made in the groundwater monitoring program, most recently updated in the first quarterly report. Appendix D summarizes and discusses the results of the QA portion of the groundwater monitoring program. Appendix E presents a tabulation of historical and current data from the Site 300 routine groundwater surveillance program, along with a summary and discussion of the current data from the wells. CBF results will continue to be presented in Appendix F until other instructions are received from the CVRWQCB. Data in each of these appendices are subdivided by geographic area.

6.1. REVIEW AND COMPARISON OF DATA

6.1.1. LOG-IN RESULTS

As analytical results are received by the SMG Environmental Technician, they are date-stamped and forwarded to the EMS Environmental Analyst for review, comparison, and chain-of-custody signature (see Reference 11). The EMS Environmental Analyst then forwards the analytical results to the Authoring Environmental Analyst.

The Authoring Environmental Analyst reviews the constituents for which analyses have been performed against those that are required (on the SMG Environmental Technician's quarterly "Analysis Request Sheet," thus ensuring that all analyses required (in References 1 through 3) have been performed for each well. The analytical laboratory levels of detection for the analyses performed are also reviewed to ensure that the appropriate analyses is being requested relative to the most recent MCLs.

The easiest way to do this is to create a mark-up version using the previous quarterly document. This will immediately show any analyses accidentally forgotten, as well as provide a comparison of previous values with current values.

6.1.2. REVIEW DATA FOR POSITIVELY DETECTED CONSTITUENTS

Positively detected constituents must be compared against available regulatory standards (MCLs, SALs, proposed MCLs, etc.) and more importantly must be compared with previous quarters results to determine whether the recent value is within historical range or is an obvious anomaly.

All positively detected constituents must be verified with the analytical laboratories Batch QC Report, or equivalent QC data to make sure that the analytical rates of recovery (or ratios), etc., are acceptable and in accordance with Reference 7.

By entering all results alongside the previous quarter's analytical data tables (to provide comparison against former values) the Authoring Environmental Analyst can determine if the data are anomalous. These numbers can later be verified against tables prepared by the Data Manager, who accesses data received electronically from the analytical laboratory, or against manually entered data.

After reviewing the laboratory QC reports, along with comparison of data with both historical results and regulatory standards, it might be necessary to call the analytical laboratory for verification (typographical errors and incorrect transmittals have been known to occur). If the analytical laboratory is contacted, be sure to document all aspects of the call (date, time, contact person, request/discussion, etc.).

After completing the above steps, a decision can be made as to whether or not data findings warrant additional sampling or if the data must be discarded. If these situations occur, a nonconformance report may need to be filed (see Reference 10).

6.1.3. WRITE DATA SUMMARIES

The Authoring Environmental Analyst must write summaries of recent data (preferably weekly) for the SMG Environmental Analyst. These summaries should describe abnormalities (e.g., first-time detects or unusually low/high results) or results of a sensitive nature (e.g., VOC hits in drinking water wells), and should summarize the significance of each result mentioned.

Special Case: Any constituents that are positively detected in samples from Site 300 drinking water wells 18 and 20 must be brought to the immediate attention of the SMG Environmental Analyst for water, who then notifies the EMS Section Leader so that Site 300 management can be notified. This usually results in resampling the well.

6.2. WRITING THE REPORT

6.2.1. CURSORY REVIEW

As discussed in 6.1.1., create a mark-up version using the previous quarterly document. Page by page, make notes regarding any items that were mentioned in the previous report that need to be followed-up in the current report. Information to compile figures for the quarterly report must be gathered and given to the TID Editor, who will coordinate the production of figures with the TID Artist.

6.2.2. WHAT TO INCLUDE IN THE MAIN TEXT

6.2.2.1. Introduction

This portion of the report is generally very similar from quarter to quarter. The dates that the work was performed must be changed to reflect the current quarter, parties involved in the monitoring and reporting effort must be confirmed, the number of wells that were sampled from each

monitoring network must be verified, and any special sampling efforts that were conducted must be discussed. Ensure that the methods introduced for the statistical analyses portions of the quarterly monitoring are, in fact, the ones employed. The final paragraphs briefly describe the findings from the statistical analyses performed on data from the Pit 1 and B-817 HE Process Areas, respectively.

6.2.2.2. Summary

This portion of the report is used to note findings that exceeded any MCL or SAL from any of the monitoring networks. Findings that will be discussed in the appendices are not to be mentioned here (e.g., statistical analyses interpretations, quality assurance/control problems, surveillance monitoring results). Briefly summarize the findings here, as they are discussed in greater detail within the subsections of the report that are organized according to geographical area. The compilation of findings, figures, and appendices should be noted in the Summary.

6.2.2.3. Discussion of Monitoring Results

Each geographical area is a subtopic within this portion of the report (e.g., Pit 1 Area, Pit 7 Complex, B-817 HE Process Area, and Pit 6 Area). Within each subsection based on geographical area, the following elements should be presented.

- The applicable figure showing 1) the landfill/surface impoundment area; 2) the monitoring installations with upgradient locations noted; 3) the surrounding area, title, legend, and north arrow; and 4) in the second quarter only, include the water contour maps for each geographical area (these maps and water contour data are published in the first quarter iteration of Environmental Restoration Division's Site 300 Investigation Report and can be obtained from the TID Artist.
- A list of compounds analyzed from each monitoring installation and reference to the appendix in which analytical results are found.
- An explanation of the special sampling performed for selected compounds, and the application of their results in statistical methods employed (applicable only for the Pit 1 and B-817 HE Process Areas).
- Discussion of findings of interest (refer to previous quarterly reports to review comments of this nature and how they were presented in the report). This is where bulleted items from the "Summary" section are discussed in detail, along with a discussion of other positively detected constituents of interest that did not approach a MCL or SAL.
- For the first quarter only, discuss compounds analyzed and results for the Pit 1 Barcad samples. Present these results within the text, in tabular form, following the paragraph in which the findings are discussed.
- For the Pit 1 and B-817 HE Process Areas only, briefly discuss the results of the CABF Student's *t*-test and alternative statistical analyses. Reference the tables and appendix where the data can be found.

6.2.2.4. Acknowledgements

List those persons who performed or assisted in work related to the Site 300 quarterly groundwater monitoring and the production of the report.

6.2.2.5. References

List all documents (including regulatory documents) used or referenced within any portion of the report (e.g., text, appendices). However, *do not* include LLNL Draft documents or documents that have not been through the TID review and release process.

6.2.3. WHAT TO INCLUDE IN THE APPENDICES

6.2.3.1. Appendix A - Groundwater Monitoring Data

Report all analytes as received from the analytical laboratory. Table A-1 presents analytical results for the Pit 1 Area; Table A-2 presents analytical results for the Pit 7 Complex; Table A-3 presents analytical results for the B-817 HE Process Area; and Table A-4 presents analytical results for the Pit 6 Area. Note that the order in which the data from each geographical area is presented corresponds to the order in which each area is discussed in the "Discussion" section. The same format applies to Appendix D.

6.2.3.2. Appendix B - Statistical Analyses and Discussion

The material formerly discussed under "CABF Student's t-test" has been moved to Appendix F.

This appendix presents new statistical methods and discussion based on the recently amended CCR Title 23, Division 3, Chapter 15, Articles 5 and 10 regulations.

This appendix is prepared by the ADD Statistician and reviewed by the Authoring Environmental Analyst who interprets the statistical findings and prepares conclusions as to the representation of the data. These interpretations and conclusions are reviewed by the ADD Statistician who coauthors the report.

6.2.3.3. Appendix C - Programs and Methods

This appendix describes all changes made to the groundwater monitoring networks, as well as sampling and analytical procedures that have changed, since the most recently published quarterly report. In addition, a complete program description is presented with the first quarterly report of each calendar year, or after major changes to the program have been made. Please refer to Tables C-1 through C-4, Appendix C, Fischer et al. (Reference 6).

6.2.3.4. Appendix D - Quality Assurance Data and Discussion

This appendix describes the quality assurance program for each of the four geographic areas. It presents, in detail, the discussion of any discrepancies, lost samples, equipment breakdowns, or other QA problems that occurred this quarter, and how any QA problems from the previous quarter were corrected.

Also included in this section are tables compiling the QA data for each of the geographic areas.

6.2.3.5. Appendix E - Routine Groundwater Surveillance

The "Sampling Locations and Historical Data" section of Appendix E remains similar from quarter to quarter (for the first three paragraphs). Following the introduction, the analytical results for each monitoring area are summarized and highlighted under the appropriate subheading.

6.2.3.6. Appendix F - CABF Student's *t*-test Results

The subject matter formerly discussed under "CABF Student's *t*-test" (formerly Appendix B) is now presented here.

Tables F-1 and F-3 do not change from quarter to quarter, because they provide background data to which the current quarterly data is statistically compared. Tables F-2 and F-4 present the current quarterly data along with the results obtained from the CABF Student's *t*-test program run by the ADD Statistician. Tables F-5 through F-8 are also prepared by the ADD Statistician, along with the interpretation documentation at the end of Appendix F (discussion). Table F-8 is a compilation of significant and nonsignificant findings. The Authoring Environmental Analyst must coordinate the preparation of Appendix F with the Authoring ADD Statistician and must review the findings to ensure that conclusions drawn from the data are, in fact, representative.

6.2.4. SIGNATORY REQUIREMENTS

6.2.4.1. Rough Draft

After preliminary editing by the TID Editor (approximately two days), the Authoring Environmental Analyst must submit the rough draft to the SMG Environmental Analyst for review (approximately two days) prior to releasing the rough draft version to the LLNL Review Chain. This allows confirmation that the data released is consistent with EMS reporting methods. Allow approximately one week for review of the rough draft by the LLNL Review Chain. This preliminary rough draft should incorporate the Macintosh program "DocuComp" which compares the current document to the previous quarter's document, highlighting all deletions from and additions to the previous quarter's report. Concurrent with the review by the SMG Environmental Analyst, the TID Editor will perform a secondary, more comprehensive editing of the report.

The current LLNL Review Chain consists of:

EMAD Division Leader (Bill Isherwood)
EMS Acting Section Leader (Jack Sims)
ORAD Permits Analyst (David Epley)
Site 300 Facility Manager (Milt Grissom)
Site 300 Restoration Section Leader (Albert Lamarre)
SMG Group Leader (Kris Surano)
SMG Environmental Analyst (Bill Hoppes)

6.2.4.2. Final Draft

Rough draft comments are reviewed by the Authoring Environmental Analyst and, if needed, the ADD Statistician and TID Editor. These comments should be received as soon as possible from the reviewers so that the comments can be adequately addressed and incorporated into the final version. When all reviewers comments have been addressed, researched, and investigated, the Authoring Environmental Analyst must incorporate them into one copy of the rough draft and produce a final draft. Some of the reviewers may want to discuss their comments and changes; if there are any issues that can't be resolved, bring them to the attention of the SMG Environmental Analyst for resolution. As portions of the report are finalized, they should be given to

the TID Editor for final editing. Allow two days for this step if revisions are moderate, three to four days if the revisions are extensive.

When the SMG Environmental Analyst authorizes the readiness of the final draft for the LLNL Signature Chain, the draft should be given to the EMS Secretary. The Secretary will make a photocopy of the final draft and circulate it in advance to those on the LLNL Signature Chain so that they can begin their final review prior to receiving the blue folder containing the EPD Signature Sheet. By sending this advance copy, reviewers may be more likely to sign the blue signature sheet as soon as it is received.

It is acceptable to fax a copy of the blue signature sheet to the appropriate persons and to receive a fax in return with their signature on it. Allow one week for this step.

The current LLNL Signature Chain consists of the following persons, in order:

Authoring Environmental Analyst (Katrina Fischer)
SMG Environmental Analyst (Bill Hoppes)
EMS Acting Section Leader (Jack Sims)
Site 300 Restoration Section Leader (Albert Lamarre)
Site 300 Facility Manager (Milt Grissom)
EPD Legal Counsel (Jan Tulk)
EMAD Division Leader (Bill Isherwood)
EPD Department Head (Harry Galles)

Concurrently, the TID Editor will submit the document and the TID Publication Release form to the Authorized Derivative Classifier, who determines the classification. When the Classifier's signature has been obtained, the editor will submit the TID Publication Release form and three copies of the document to Publication Services for review and release. Copies are then printed by TID and sent to those on the distribution list (last page of the document).

Prior to the end of the quarter, the EMS Secretary, upon the direction of the Authoring Environmental Analyst, will submit one copy of the report to the CVRWQCB via certified mail.

7. DOCUMENTATION/QA RECORDS

The completed EPD signature sheet and TID Publication Release forms, rough draft comments received from LLNL reviewers, and the final report must be archived in the EMS Document Retention Center.

8. ACCEPTANCE CRITERIA

The QA/QC proofing of the data tables in the quarterly report is one of the acceptance criteria for the document. Other acceptance criteria include a completed TID Publication Release form and the EPD Signature Sheet completed with all of the appropriate signatures.

REVISION 1 FINAL	EMP-GW-QR Quarterly Groundwater Report	Effective date: 01/04/93 Page 12 of 12
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9. ATTACHMENTS

None.

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Radium 226	Alpha spectroscopy	Triple rinse with sample matrix before filling.	Add HNO ₃ to achieve pH < 2 immediately upon return from field. No refrigeration required.	2 X 1000 ml polypropylene	Footnote: a
Semivolatile Organics	EPA 625 8015	Do not rinse bottles. Minimize air space, but do not overfill as overfilled bottles tend to break.	No acidification is required. Store samples in ice chest or refrigerator at 4°C.	2 X 1 L amber glass bottles (Boston Rounds) provided by analytical laboratory	Footnote: c
Specific Conductivity	EPA 120.1	Triple rinse with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	125 ml polypropylene	No footnote required
TDS TSS	EPA 160.1 EPA 160.2	Triple rinse with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	500 ml polypropylene provided by the analytical laboratory.	Footnote: c
Total Organic Carbon (TOC)	EPA 415/9060	No air space or bubbles can be present. Fill completely and cap bottles immediately after filling.	Acidify bottles before sampling with 3 drops of H ₂ SO ₄ . Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial, acidified before sampling with H ₂ SO ₄ .	Footnote: c, d*
Total Organic Halides (TOX)	9020	No air space or bubbles can be present. Fill completely and cap bottles immediately after filling.	Add 12 drops H ₂ SO ₄ to achieve pH < 2 before going to the field. Store samples in ice chest or refrigerator at 4°C.	100 ml amber glass (Boston Rounds) with teflon lined cap. May be preacidified by analytical laboratory.	Footnote: c, f

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments
Thorium	EPA 900.0	Triple rinse with sample matrix in the field.	Add HNO ₃ to achieve pH < 2 after returning from field (5 ml in 1 L bottle). Refrigeration is not required.	1 L polypropylene	Filter Pit 7 samples Footnote: a
Tritiated water (HTO)			None required.	500 ml flint glass bottle with stopper provided by RAS	No footnote required
Uranium	Alpha spectroscopy	Triple rinse with sample matrix before filling.	Add HNO ₃ to achieve pH < 2. No refrigeration required.	1000 ml polypropylene	Filter Pit 7 samples Footnote: a
Volatile Organic Compounds Purgeable halocarbons	EPA 601	No air space or bubbles can be present. Fill completely and cap bottles immediately after filling.	Acidification is not required. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial with septa lid provided by analytical laboratory	Footnote: c
Volatile Organic Compounds Drinking Water Standards Purgeable priority pollutants Purgeable halocarbons/aromatics Purgeable aromatics "Purgeables"	EPA 502.2 EPA 524 EPA 601/602 EPA 602 EPA 624	No air space or bubbles can be present. Fill completely and cap bottles immediately after filling.	Add 3 drops HCl (to achieve pH < 2) prior to going to field. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial with septa lid provided by analytical laboratory	502.2 x 5 524 x 4 601/602 x 4 602 x 2 624 x 3 Footnote: c, e, h

Footnotes

a Acidify with 5 ml HNO ₃	e Acidify with 3 drops HCl
b Acidify with 0.5 ml H ₂ SO ₄	f Acidify with 10 - 12 drops H ₂ SO ₄
c Refrigerate at 4° C	g Use plastic pipette only
d Acidify with 3 drops H ₂ SO ₄	h Use glass pipette only
* Acidify only if not preacidified by the analytical laboratory	

**If any analyses not listed on this table are required, please contact the EMS Analytical Laboratory contact person to obtain appropriate bottles from the analytical laboratory.

Substitution of different sized bottles of the same material (plastic or glass) is generally acceptable. If the specified bottles are not available, contact the Environmental Analyst or Analyst Assistant for guidance.

Design Change Package EMP-GW-S-002

Ground Water Sampling

Effective Date: October 14, 1994

Prepared by:

Duke Ramsey 10.10.94
Duke Ramsey date
TSG Technical Coordinator

Approved by:

Eric Christofferson 10/11/94
Eric Christofferson date
WGMG Environmental Analyst

Lucinda M. Garcia 10/12/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Bill Hoppes 10/11/94
Bill Hoppes, date
WGMG Group Leader

Rebecca A. Failor 10/11/94
Rebecca A. Failor date
Section Leader, EMS

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1. DISCUSSION

An error was found in the Appendix to EMP-GW-S that defines the preservation and sampling requirements for ground water. This Design Change provides the correct information.

2. PROCEDURE CHANGE

The number of bottles required for EPA 601 sampling is 2. This was not specified in the original procedure. The amended table is attached.

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Anions Bromide Chloride Fluoride Nitrate Nitrite Phosphate Sulfate	EPA 300.0	Triple rinse bottle with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	500 ml polypropylene	48 hours hold time Footnote: c
Chemical Oxygen Demand (COD)	EPA 410	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C.	100 ml polypropylene bottle, preacidified with H ₂ SO ₄ , provided by analytical laboratory.	Footnote: c, d*
Chlorophyll-a		Do not rinse bottles.	Store samples in ice chest or refrigerator at 4°C.	1 L polypropylene bottle provided by analytical laboratory.	6 hour hold time Light sensitive - wrap in foil. Footnote: c
Coliform bacteria		Do not rinse bottles.	Store samples in ice chest or refrigerator at 4°C.	125 ml sterilized polypropylene bottle provided by analytical laboratory.	6 hour hold time Footnote: c
Drinking Water Pesticides (DWP)	EPA 608/615	Do not rinse bottles. Minimize air space, but do not overfill as overfilled bottles have been known to break.	Store samples in ice chest or refrigerator at 4°C.	6 x 1 L amber glass (Boston Rounds) provided by analytical laboratory.	Footnote: c
Fish Toxicity	EPA 600 96 hr. 1 pt. screening. 100% solution. Fat head minnow	Do not rinse carboy.	Store samples in ice chest or refrigerator at 4°C.	5 gallon carboy provided by analytical laboratory.	24 hour hold time Footnote: c

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
General Minerals (GENMIN) Alkalinity Bicarbonate Carbonate Hydroxide Total Alkalinity Aluminum Calcium Chloride Copper MBAS (Surfactants) Nitrate Iron Magnesium Manganese Nickel pH Potassium Sodium Sulfate Conductivity TDS Hardness Zinc	 EPA 310.2 EPA 200.7 EPA 200.7 EPA 300.0 EPA 200.7 EPA 425.1 EPA 300.0 EPA 200.7 EPA 200.7 EPA 200.7 EPA 200.7 EPA 150.1 EPA 200.7 EPA 200.7 EPA 300.0 EPA 120.1 EPA 160.1 EPA 130.1 EPA 200.0 EPA 200.7	Triple rinse bottles with sample matrix before filling.	Acidification is not required. Store samples in ice chest or refrigerator at 4°C.	2 x 1 L polypropylene, store-stock # 8125-24044	no footnote required
Gross Alpha/Beta	EPA 900.0	Triple rinse with sample matrix in the field.	Add HNO ₃ to achieve pH<2 after returning from field (5 ml in 1 L bottle). Refrigeration is not required. Surface water samples are <u>not</u> acidified.	1 L polypropylene	Filter Pit 7 samples Footnote: a
High Explosives (HE) HMX RDX TNT			None required.	40 ml clear glass vial provided by analytical laboratory	no footnote required

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Metals	Medium specific.	Filter water. Do not rinse preacidified samples. If not preacidified, triple rinse and acidify with 5 ml HNO ₃	Refrigeration not required.	500 to 1000 ml polypropylene, provided by analytical laboratory.	Footnote: a*, g
Nutrients Ammonia Nitrate Nitrite TKN	EPA 350.3 EPA 353.2 EPA 354.1 EPA 351.3	Triple rinse bottles with sample water before filling.	Upon return from field, add 20 drops H ₂ SO ₄ (to achieve pH < 2). Store samples in ice chest or refrigerator at 4°C.	1 L polypropylene provided by analytical laboratory.	Footnote: c, f
Oil and Grease	EPA 413.1	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C.	1 L wide mouth amber glass bottle, preacidified with H ₂ SO ₄ to achieve pH < 2, provided by analytical laboratory.	Footnote: c, f*
pH		For field measurement, calibrate meter prior to sampling. Triple rinse bottle with sample matrix in the field.	Store samples in ice chest or refrigerator at 4°C.	125 ml polypropylene	pH analysis is done in the field for NPDES samples only. Lab analysis coupled with conductivity Footnote: c
Phenolics	EPA 420.1	Do not rinse bottles.	Bottles are preacidified by the analytical laboratory. Refrigeration is not required.	1 L clear glass bottles, preacidified with H ₂ SO ₄ to achieve pH < 2, provided by the analytical laboratory.	Footnote: f*

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Radium 226	Alpha spectroscopy	Triple rinse with sample matrix before filling.	Add HNO ₃ to achieve pH < 2 immediately upon return from field. No refrigeration required.	2 X 1000 ml polypropylene	Footnote: a
Semivolatile Organics	EPA 625 8015	Do not rinse bottles. Minimize air space, but do not overfill as overfilled bottles tend to break.	No acidification is required. Store samples in ice chest or refrigerator at 4°C.	2 X 1 L amber glass bottles (Boston Rounds) provided by analytical laboratory	Footnote: c
Specific Conductivity	EPA 120.1	Triple rinse with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	125 ml polypropylene	No footnote required
TDS TSS	EPA 160.1 EPA 160.2	Triple rinse with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	500 ml polypropylene provided by the analytical laboratory.	Footnote: c
Total Organic Carbon (TOC)	EPA 415/9060	No air space or bubbles can be present. Fill completely and cap bottles immediately after filling.	Acidify bottles before sampling with 3 drops of H ₂ SO ₄ . Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial, acidified before sampling with H ₂ SO ₄ .	Footnote: c, d
Total Organic Halides (TOX)	9020	No air space or bubbles can be present. Fill completely and cap bottles immediately after filling.	Add 12 drops H ₂ SO ₄ to achieve pH < 2 before going to the field. Store samples in ice chest or refrigerator at 4°C.	100 ml amber glass (Boston Rounds) with teflon lined cap. May be preacidified by analytical laboratory.	Footnote: c, f

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments
Thorium	EPA 900.0	Triple rinse with sample matrix in the field.	Add HNO ₃ to achieve pH < 2 after returning from field (5 ml in 1 L bottle). Refrigeration is not required.	1 L polypropylene	Filter Pit 7 samples Footnote: a
Tritiated water (HTO)			None required.	500 ml flint glass bottle with stopper provided by RAS	No footnote required
Uranium	Alpha spectroscopy	Triple rinse with sample matrix before filling.	Add HNO ₃ to achieve pH < 2. No refrigeration required.	1000 ml polypropylene	Filter Pit 7 samples Footnote: a
Volatile Organic Compounds Purgeable halocarbons	EPA 601	No air space or bubbles can be present. Fill completely and cap bottles immediately after filling.	Acidification is not required. Store samples in ice chest or refrigerator at 4°C.	2 x 40 ml clear glass vial with septa lid provided by analytical laboratory	Footnote: c
Volatile Organic Compounds Drinking Water Standards Purgeable priority pollutants Purgeable halocarbons/aromatics Purgeable aromatics "Purgeables"	EPA 502.2 EPA 524 EPA 601/602 EPA 602 EPA 624	No air space or bubbles can be present. Fill completely and cap bottles immediately after filling.	Add 3 drops HCl (to achieve pH < 2) prior to going to field. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial with septa lid provided by analytical laboratory	502.2 x 5 524 x 4 601/602 x 4 602 x 2 624 x 3 Footnote: c, e, h

Footnotes

a Acidify with 5 ml HNO_3	e Acidify with 3 drops HCl
b Acidify with 0.5 ml H_2SO_4	f Acidify with 10 - 12 drops H_2SO_4
c Refrigerate at 4°C	g Use plastic pipette only
d Acidify with 3 drops H_2SO_4	h Use glass pipette only
* Acidify only if not preacidified by the analytical laboratory	

**If any analyses not listed on this table are required, please contact the EMS Analytical Laboratory contact person to obtain appropriate bottles from the analytical laboratory.

Substitution of different sized bottles of the same material (plastic or glass) is generally acceptable. If the specified bottles are not available, contact the Environmental Analyst or Analyst Assistant for guidance.

Design Change Package EMP-GW-S-003
Ground Water Sampling

Effective Date: January 30, 1995

Prepared by:

Becky Ward 1-27-95
Becky Ward date
WGMG Analyst Assistant

Approved by:

Eric Christofferson 1-30-95
Eric Christofferson date
WGMG Environmental Analyst

Lucinda M. Garcia 1/30/95
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Bill Hoppe 1/27/95
Bill Hoppe, date
WGMG Group Leader

for RF/Bill Hoppe 1/27/95
Rebecca A. Failor date
Section Leader, EMS

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1. DISCUSSION

EMS bottle requirements for aqueous sampling have been attached to this procedure. The table of bottle requirements has needed to be changed much more frequently than the ground water sampling procedure so it is being separated out into its own document (EMP-QA-BOT).

2. PROCEDURE CHANGE

Delete Attachment A and Design Change Packages DCP-001 and DCP-002 from EMP-GW-S. These are being replaced by a new document, EMP-QA-DOC.

EMP-GW-S

GROUND WATER SAMPLING

Prepared By:

Rebecca Ward
Rebecca Ward
Analyst Assistant, TSG/WGMG

4-21-94
date

Duke Ramsey
Duke Ramsey
Technical Coordinator, TSG

4-20-94
date

Reviewed By:

Eric Christofferson
Eric Christofferson
Environmental Analyst, WGMG

4-21-94
date

Rhonda Welsh
Rhonda Welsh
Environmental Technologist, TSG

4-21-94
date

David Graves
David Graves
Environmental Technologist, TSG

4-20-94
date

Approved by:

Rebecca Failor
Rebecca Failor
Section Leader, EMS

4-21-94
date

Bill Hoppes
Bill Hoppes
Group Leader, WGMG

4/21/94
date

Lucinda M. Garcia
Lucinda M. Garcia
Quality Assurance Coordinator, EMS

4/21/94
date

**LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes methods used by EMS to collect ground water samples at and near Site 300. The procedure is restricted to Site 300, since EMS conducts no ground water sampling at or near the Livermore Site. It also describes requirements for bottles, preservation (refrigeration or acidification), special sampling techniques (such as leaving no bubbles, minimizing headspace in bottles, or filtering samples), and other analyte specific information for all the analytes routinely sampled in water by EMS. In that capacity, this procedure serves as a reference for personnel performing all types of water sampling and prevents the redundancy that results from specifying requirements for each analyte in every media specific sampling procedure (rain, storm water runoff, central drainage basin, and other waters).

2. APPLICABILITY/DISCUSSION

This procedure specifically applies to EMS ground water sampling as required by References 1 through 4. It also provides analyte specific sampling information for all water sampling performed by EMS. Analyte specific sampling requirements are given in Section 6.2 and Attachment A; procedures common to all ground water sampling methods are described in Section 6.3; and the four methods used by EMS for ground water sampling (pumping, manual bailing, lysimeter, and barcad) are described in Sections 6.4 through 6.8. Equipment decontamination is described in Section 6.9.

Site 300 is LLNL's Experimental Test Site, located in the Altamont Hills about 15 miles east of LLNL's Livermore site. The Site 300 ground water monitoring network monitors closed landfills, the Building 817 high explosive surface impoundments, the Site 300 water supply well network, and on-site and off-site water supply wells near the site boundary. Reference 5 shows the locations of the landfills and impoundment ponds, and the monitoring-well networks currently in place. In the case of the closed landfills, historic disposal records were reviewed to determine the materials disposed of in each of these areas. These data were then used to determine analytes likely to be found. The monitoring wells for the landfills and the HE surface impoundments are sampled and analyzed quarterly. Well locations and sampling depths are based on the ground water gradient and the location of the first water-bearing zone likely to be affected by the area in question. Duddemeier et al. (Reference 6) present a site-specific geological and hydrogeological study of the Site-300 ground water network as well as monitoring-well completion data. Site 300 water supply wells are sampled monthly for a small spectrum of analytes and annually for a larger suite of analytes. Some offsite water supply wells are sampled quarterly, others annually. Water from both on- and off-site wells is analyzed for materials listed in Title 22 of the California Code of Regulation (CCR) Section 64435 as having primary or secondary MCLs.

3. REFERENCES

1. U.S. Department of Energy (1988), General Environmental Protection Program, U.S. Department of Energy, Washington, DC (DOE Order No. 5400.1).
2. California Department of Health Services (DHS) (1981), Interim Status Document Number: CA 2890090002. Effective Date: March 30, 1981. Facility: Lawrence Livermore National Laboratory Site 300, Corral Hollow Road, Alameda County, Livermore, CA 94550. Operator: Regents of the University of California, P.O. Box 808, L-520, Livermore, CA 94550.

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3. *California Regional Water Quality Control Board—Central Valley Region (1993), Order No. 93-100, Waste Discharge Requirements for University of California Lawrence Livermore National Laboratory Site 300 and U.S. Department of Energy, Landfill Pits 1 and 7—San Joaquin County, June 25, 1993.*
4. *California Regional Water Quality Control Board—Central Valley Region (1985), Order No. 85-188, Waste Discharge Requirements for University of California Lawrence Livermore National Laboratory Site 300 and U.S. Department of Energy—San Joaquin and Alameda Counties, July 9, 1985.*
5. EMP-GW-L, Ground Water Sampling Locations.
6. *Buddemeier, R. W., M. R. Ruggieri, and J. A. Oberdorfer (1987), Tritium in Ground Water at Site 300, Lawrence Livermore National Laboratory, Livermore, CA (UCID-21031).*
7. EMP-W-S, Water Sampling.
8. EMP-QA-S, Quality Assurance Sampling.
9. EMP-GW-CA, Ground Water Equipment Calibration.
10. EMP-QA-SD, Sample Tracking Documentation
11. EMP-QA-CS, Courier Service Protocol
12. EMP-QA-DC, Document Retention
13. UCRL-MA-109115 Environmental Restoration Program Standard Operating Procedures; Procedure S4.7 Treatment and disposal of well development and well purge fluids.

4. DEFINITIONS

Barcad: Device that samples water from discrete depths within a saturated zone.

Casing volume: The total volume of water standing within a well.

Casing: Material used to construct a well, usually consists of 2- to 4.5-inch inside diameter Schedule 40 or 80 PVC tubing extending from 0.5 to 3 feet above the ground surface.

D.I. water: Deionized and charcoal filtered water, available from Building 151.

Dedicated pump: A pump (submersible or bladder) permanently installed in a well.

DWAL: State Drinking Water Action Level

ERD: The Environmental Restoration Division of the Environmental Protection Department at LLNL.

Ground water: Free water existing within underground pore spaces.

Ground water elevation: Ground water elevation in reference to mean sea level.

HPLC-grade water: Commercially acquired high purity liquid chromatogram (HPLC) water that has been purged with nitrogen to remove volatile organic compounds.

Installation: The type of ground water-monitoring station that is installed in a borehole; includes wells, piezometers, barcads and lysimeters.

Lysimeter: A device designed to sample water from the unsaturated zone, it also is used between linings of a surface impoundment to detect leakage from the upper liner.

MCL: Maximum Contaminant Level

Monitoring Well: A well used to obtain ground water samples.

Piezometer: A non-pumping well normally used to measure ground water elevation, and occasionally used to obtain ground water samples.

Pump protector: A control unit that will prevent pump cavitation.

Purged water: Water that has been purged of and analyzed for volatile organics. This water is used for QA samples involving locations containing volatile organics and is supplied by the contract analytical laboratory (see HPLC water).

Saturated zone: The subsurface zone below the water table in which all pore spaces are full of water.

Submersible pump: An electric pump used to collect water samples. This pump is used only if the installation has a sufficient inside diameter (at least 3 inches) and produces sufficient water to keep the pump submerged.

Unsaturated zone: The subsurface zone above the water table in which pore spaces contain both water and air.

Well Log Book: A waterproof booklet dedicated to each installation. The date, reason for entry to the installation, depth to water, and sampler's initials are entered in the log each time the installation is visited.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The Section Leader ensures that sampling methods meet regulatory guidance and that sampling is conducted according to approved procedures.

5.2. WGMG GROUP LEADER

The Group Leader ensures that sampling procedures meet design criteria and that sampling is conducted according to approved procedures.

5.3. EMS ENVIRONMENTAL ANALYST OR ANALYST ASSISTANT

The Analyst or Analyst Assistant designs appropriate sampling plans and communicates them to TSG Technologists at least two weeks prior to the beginning of each quarter. The analyst or analyst assistant informs the TSG Technical Coordinator in writing of all changes made to sampling plans. The analyst or analyst assistant also evaluates the resulting data considering regulatory requirements, and designs appropriate changes in sampling plans.

5.4. TSG TECHNICAL COORDINATOR

The Technical Coordinator ensures that quarterly sampling plans created by the Environmental Analyst or Analyst Assistant are translated into Field Tracking Forms and ensures that sampling plans and any changes thereto are communicated to the sampling technologists.

5.5. TSG ENVIRONMENTAL TECHNOLOGISTS

The Technologists collect samples according to approved procedures.

6. PROCEDURE

Equipment Required (stored in Transportainer (TR) #TY-165 at the end of 6th St. unless otherwise indicated):

- Ice Chests
- Ice (double bagged): Bldg. 175 ice machine (ice bags from LLNL Stores # 8105-27699)
- Kimwipes or equivalent
- D.I. water in large carboy and small squeeze bottle
- HPLC-grade water (for QA samples)
- Purged water (for QA samples) stored in B162 refrigerator
- Sample bottles (see Attachment ##)
- Indelible markers and pens (LLNL Stores Stock #s 7520-62156, -56629)
- Labels (LLNL Stores Stock #7350-46221)
- Stainless steel bucket
- Disposable surgical-type gloves (LLNL Stores Stock #s 8415-64994, -64995)
- Trash bags (LLNL Stores # 8105-58929)
- Field notebook
- Appropriate Field Tracking Forms
- Chain-of-Custody Record Forms
- Two 0.45 micron cartridge filters (for metals) per installation (QED Environmental Systems Inc. 6095 Jackson Rd. Ann Arbor, MI 48106-obtained through purchase order)

Lab Equipment Common to All Methods (stored in EMS lab space in B162)

- Lockable storage cabinets
- Lockable refrigerator
- Nitric acid (16M) Sulfuric Acid (18M)
- Hydrochloric Acid (12M)
- Heavy Rubber Gloves
- Safety Glasses and Face Shield
- Disposable surgical type gloves
- Kimwipes or equivalent
- Adjustable pipette (5 ml capacity; Cole-Parmer Instrument Co., 7425 N. Oak Park Ave., Chicago, IL 60648-obtained through purchase order)
- Chain-of-Custody Record forms

Field Equipment Common to All Pump Methods

Drum of known volume (such as 30 or 55 gallon)

Beckman pH/temperature meter with instructions (see Reference 9)

Buffer solutions (pH 4, pH 7 and pH 10 see Reference 9)

Electronic water level indicator (C.J. Drilling Supply Inc. Suite 4, Roseville, CA 95678 obtain through purchase order; stored at Site 300 in TR 4265908 at Bldg. 848)

Calculator

Clean 250-ml beaker (Cole-Parmer Instrument Co.)

Field Equipment—Submersible Pump Method

Appropriate generator filled with gasoline with appropriate extension cord

Appropriate pump controller (stored at Site 300 in TR 4265908 at Bldg. 848).

In-line valve assembly for portable pumps

Field Equipment—Manual Bailing Method (stored at Site 300 in TR 4265908 at Bldg. 848)

Teflon bailer (2" sample bailer)

PVC bailer (3" purge bailer)

Electronic water level indicator (C.J. Drilling Supply Inc.)

Field filtration unit

Plastic Sheet, approximately 8 ft by 8 ft

Low phosphate detergent such as Tide

Field Equipment—Lysimeter Method (stored at Site 300 in TR 4265908 at Bldg. 848)

Manual or electrical pressure/vacuum pump with gauge

Vacuum gauge reading in kPa or centibars

Glass 6-dram vials

Field Equipment—Barcad Method

Drum of known volume (30 or 55 gallon; obtained at the Site 300 Corporation Yard)

Cartridge Filter (.045 microns; QED Environmental Systems, Inc.)

Nitrogen tanks at each installation (change out as needed; obtained from tank yard located within the Site 300 Corporation Yard)

6.1. GENERAL CONSIDERATIONS

The following sampling practices should be used when sampling surface water or ground water. Avoiding cross-contamination is vital.

6.1.1. Wear disposable gloves while collecting samples and discard the gloves between installations.

6.1.2. Take special care not to introduce any external contamination that could interfere with the quality and verifiability of the samples.

6.1.3. Keep the work area neat and don't place open sample bottles or caps on any surface (bottles should remain capped until used).

6.1.4. Do not touch the inside of sample bottles.

6.1.5. If possible, do not place generators in the same vehicle as sample ice chests. If two vehicles are not available, seal ice chests in large plastic bags.

6.1.6. Always wear disposable gloves when handling generators or any fuels, and place the generator downwind of the sampling area.

6.1.7. Keep monitoring wells secured at all times using padlocked-equipped metal protective covers at each well installation.

6.1.8. Before sampling any installation, obtain the current field tracking form for that installation (FTFs) from the TSC Technical Coordinator. The FTF

contains information pertinent to each installation (Section 7.1). Obtain any additional information required for sampling, such as containment and treatment of the water purged from the installation, from the environmental analyst before leaving for the sampling site. Section 6.9.5 describes purge-water containment methodologies for Site 300.

6.2 SAMPLING METHODOLOGY FOR GROUND WATER AND OTHER WATER

6.2.1. DETERMINATION OF ANALYTES TO BE SAMPLED (GROUND WATER)

The WGMG Environmental Analyst or Analyst Assistant responsible for ground water develops a ground water sampling plan each quarter. This plan must be documented and given to the TSG Technical Coordinator at least two weeks prior to the start of the quarter in which sampling will occur. (An example of a quarterly sampling plan is given in Attachment B.) The TSG Technical Coordinator ensures that this sampling plan is translated into Field Tracking Forms (FTFs) for the quarter and may call a meeting of all affected personnel to discuss and clarify the sampling plan prior to the start of the quarter. Any changes to the sampling plan after the quarter has begun are given, in writing, to the TSG Technical Coordinator who ensures that the appropriate changes to FTFs are made and that changes are communicated to sampling technologists.

6.2.2. PREPARATION OF SAMPLE CONTAINERS (GROUND WATER, RUNOFF, CENTRAL DRAINAGE BASIN, AND OTHER WATERS)

Sampling technologists use the appropriate FTF and the table given in Attachment A to determine the type and number of bottles that are required for water sampling. If analytes requested on the FTF do not appear in this table, the technologist should contact the responsible Analyst or Analyst Assistant. Bottles should be collected, labeled, and acidified (if necessary) as soon as possible before sampling is to be done.

6.2.3. SAMPLING CONSIDERATIONS

Special sampling considerations for specific analytes such as rinsing bottles, air space requirements, elimination of bubbles, and field filtration are specified in Appendix A. Again, if analytes requested on the FTF do not appear in this table, the technologist should contact the responsible Analyst or Analyst Assistant.

6.2.4. PRESERVATION AND HOLDING TIMES

Preservation (acidification and refrigeration) requirements for specific analytes and analytes with extremely short holding times are specified in Appendix A. Again, if analytes requested on the FTF do not appear in this table, the technologist should contact the responsible Analyst or Analyst Assistant.

63. SAMPLING PROCEDURES COMMON TO ALL GROUND WATER METHODS

63.1. QA SAMPLING

EMP-QA-S, *Quality Assurance Sampling* (Reference 8), describes quality assurance sampling requirements, including spikes, duplicates, field blanks, and trip blanks. QA sampling requirements are specified on the FTF for each specific area and sampling event.

63.2. PURGE WATER DISPOSAL

Dispose of purge water according to Reference 13.

63.2.1. Discharge purge water to ground for wells with known tritium levels below 1000 pCi/L and with all VOC concentrations below detection limits.

63.2.2. For purge water with tritium concentrations below 1000 pCi/L and detectable VOC concentrations below applicable MCLs and DWALs, discharge into 55 gallon drum and leave to evaporate.

63.2.3. For purge water with tritium concentrations above 1000 pCi/L, discharge into drums and allow to evaporate.

63.2.4. For purge water with tritium concentrations above 1000 pCi/L and VOC concentrations above an applicable MCL or DWAL, discharge into 55 gallon drum. Seal drum with lid to prevent evaporation. Purge water will be removed by ERD staff.

63.2.5. In all cases, review Reference 13 and consult with the responsible Analyst or Analyst Assistant for specific guidance.

63.3. PRE-SAMPLING ACTIVITIES

Before leaving LLNL, prepare ice chests for the installations (see definition) to be sampled. Write the location identifier, client name (LLNL), sampler's initials, and sampling date in the appropriate spaces on bottles that already have laboratory labels. Prepare labels (location identifier, client name, sampler's initials, sampling date, and required analysis) and attach to the unlabeled sample bottles. Place bottles inside the ice chest along with double-bagged ice (sealed with tape). Arrange bottles in ice chest so that glass bottles do not rub against each other, thus reducing potential breakage.

63.4. ACIDIFICATION OF SAMPLES

Acidify samples in a fume hood. If possible, the fume hood in the lab in B162 should be used. If this is not available, using the fume hood in the EMS sampling van is acceptable, however, acids may not be stored in the van and must be returned to B162 after each use. When handling acid, always use eye protection and wear surgical gloves over heavy rubber gloves. Keep acid bottles in a pan that can contain the entire bottle's contents, in case of spillage or breakage. Use an adjustable pipette with disposable tips, or disposable glass pipettes, when measuring acid. Keep samples requiring refrigeration next to bagged ice. Use a plastic disposable pipette tip only to acidify samples collected for metals analysis. Acidify vials containing samples collected for VOC analysis by using a glass pipette only.

6.3.5. SAMPLE STORAGE

Samples must be kept in the possession of the sampler or stored in a secure location to ensure chain-of-custody integrity prior to delivery to analytical laboratories. Secure storage locations include locked vehicle cabs, the Knack lock box at the courier drop off point, locked offices, or locked transportainers.

6.4. SUBMERSIBLE PUMP METHOD

6.4.1. Calibrate the pH meter before each day's use, before leaving for the field (Reference 9). Always take the pH buffer solutions into the field, in case field recalibration is necessary.

6.4.2. Measure the depth to water (DTW) with the electronic water level indicator. Lower the probe into the well until the probe contacts water (hear audible buzz and see red light on cable spool). Carefully move the probe cable up and down until the buzz is barely heard. Read DTW directly from the cable from the top edge of the blue protective cover. Using an engineering tape-measure, measure to within a hundredth of a foot. Record the DTW measurement, sampler's initials, date, and section identification (i.e., EMS) into the well logbook located at each well installation.

6.4.3. Record the DTW value in the space provided on the FTF. Subtract the DTW from that listed on the FTF for TD (total depth of the well plus protective cover height); record this result on the FTF as Wtr. Ht. (height of the water column within the well.) Transfer the value for Wtr. Ht. into the first blank in the equation on the left hand side of the FTF. Perform indicated calculations and record the result in the space provided. The result indicates the total gallons of water to purge from the well before collecting samples.

6.4.4. Attach casing riser (dedicated manifold valve assembly controlling flow and pump rate) to pump discharge tube.

6.4.5. Plug the power cord from the dedicated pump controller into an appropriately rated pump protector, and finally plug the pump protector into the generator. Use an appropriately rated extension cord to place the generator as far downwind from the well head as possible.

6.4.6. Ensure all valves on the riser and in-line valve are closed, except for the one to the discharge hose. Place the end of the discharge hose into a drum or vessel of known volume.

6.4.7. Initially, set the pump controller for 15 minutes. At this setting, when the water level in the well drops below pumping capacity, the pump controller will automatically shut the pump off. Then, in 15 minutes, the controller will automatically restart the pump. For optimum efficiency, maintain a flow rate that maximizes flow and minimizes pump down-time. This will require some experimentation for each well installation.

6.4.8. Put on gloves, start the generator, and move the breaker to the "on" position. As soon as water emerges from the discharge tube, triple-rinse the 250 ml beaker, collect a sample, and take initial pH and temperature readings. Read temperature and pH directly from the combination pH/temperature probe.

6.4.9. Record these initial values in the spaces provided on the FTF. Using the instructions provided on the FTF, calculate and record the amount of water pumped from the well and the time (estimate by amount discharged into 55 gallon drum).

6.4.11. During the well purging process, take one pH and temperature reading when one-half the casing volume has been pumped (i.e., if the casing volume is 80 gallons, take a reading when 40 gallons have been purged). Record all readings on the FTF.

6.4.12. Once the total purge volume has been achieved, take four pH and temperature readings, at two minute intervals, from newly pumped water. These readings should be within ten-percent of each other, which indicates stabilization of the aquifer and that fresh water is being pumped. If the readings are not within this range, continue purging the well until four readings (spaced two minutes apart) are within the ten-percent range. Record all readings on the FTF.

6.4.13. Obtain samples using the two valves on the well riser as appropriate (use the smaller valve for metals and volatile organic samples; take all other samples from the larger valve). Be sure to remove the purge hose from the riser and run water through these valves before sampling. Most risers are dedicated to a specific well; therefore it is only necessary to purge the valves for one minute. For wells that don't have dedicated risers, purge the valves for a minimum of five minutes. For samples requiring filtration, attach the filter cartridge to one of these valves.

6.4.14. After filling, dry the outside of the sample bottles and inspect the labels for completeness, i.e., sample date, sampler's initials, sample identifier, and analysis requested. Check the sample bottles against the FTF to ensure all the bottles have been filled and are accounted for. Place the bottles properly in the ice chest to ensure their safety.

6.5. MANUAL BAILING METHOD

6.5.1. Obtain a DTW reading as in Section 6.4.2. and record it on the FTF. Subtract the DTW from the Total Depth to get the Wtr. Ht. Calculate the DTW measurement required for the installation to be at 50% recovery (use the spaces provide on the FTF). Do not begin the second bailing until the recovered DTW is less than or equal to this number.

6.5.2. Each manually bailed installation has a dedicated rope located inside the protective blue can around each wellhead. Tie the bailer to this rope, taping the ends of the tie around the rope to ensure that the bailer does not come lose. Secure the opposite end of the rope to the protective blue can to prevent losing the rope inside the installation.

6.5.3. Slowly lower the bailer into the installation until it either becomes submerged or hits bottom. Pull the bailer up and empty by dumping from the top. Do not allow the rope to come in contact with the ground; place the rope onto a plastic sheet to prevent contamination.

6.5.4. Continue bailing until water is no longer available. Record the date and time of this first bailing on the FTF.

6.5.5. Allow the installation to recover at least 50% of the original amount of water before the second bailing. Recovery varies from location to location, and can take anywhere from a couple of hours to several days. Monitor the water level frequently enough to estimate the recovery time.

6.5.6. After the installation has recovered, perform a second bailing as in 6.5.3. Note the date and time on the FTF.

6.5.7. Sample volatile organic compounds (EPA 601, 624, TOC and TOX) within two hours of the second bailing. After obtaining these samples, allow additional well recovery time as needed to provide sufficient water for any

remaining samples (document any additional time on the FTF). Sampling must be performed with a Teflon bailer with an attachable stopcock. Obtain a bail full of water without the stopcock attached. Attach the stopcock to the bottom of the bailer and obtain the sample by opening the stopcock. Handle filled bottles as in 6.4.14.

6.5.8. Filter samples using the pump designed for field filtration. Filtration can either be done in the field, using a generator, or immediately upon returning to the lab.

6.5.9. Handle the bottles as in 6.4.14.

6.6. LYSIMETER METHOD

6.6.1. Each lysimeter has two valves that are located inside the protective cover. The set of valves for each installation is fitted with a vacuum/pressure side quick disconnect and a purge hose. Both the valves must be open (counter clockwise) prior to performing sampling activities. Connect the vacuum line from the pump to the quick disconnect valve on the Lysimeter. Place the vacuum gauge, equipped with a hose barb, into the purge hose of the second Lysimeter valve. Turn on pump and draw a vacuum on the vacuum/pressure line until the gauge indicates 60 centibars (or 60 kPa). Wait a few minutes to make sure you have a good vacuum, and, close both valves (clockwise) while they are under vacuum. Note the date, time, and vacuum pressure on the FTF.

6.6.2. The installation should remain under vacuum for two days. On the second day, insert a vacuum gauge into the purge line and open the valve. Record any residual vacuum, time, and date on the FTF.

6.6.3. Open both access lines and use the pressure line from the pump to apply pressure to the line, thereby purging the lysimeter. Fill the sample bottle, and collect any residual water in a graduated beaker. Record the time, date, and the residual sample volume on the FTF.

**NOTE: IF ANY WATER IS RECOVERED FROM THE 817
PROCESS AREA LYSIMETERS, THE EMS GROUND
WATER ANALYST MUST BE NOTIFIED IMMEDIATELY.**

6.6.4. Handle the bottles as in 6.4.14.

6.7. BARCAD METHOD

6.7.1. Each barcad has a dedicated control box that includes a two-stage regulator, manifold, and nitrogen bottle. The manifold is connected to the barcad through an access and a discharge line. New gloves should be used for sampling each barcad.

6.7.2. Use nitrogen gas to purge the barcad of water three times before sampling. Technologists should complete LLNL course HS5030 (Pressure Safety Orientation) prior to using compressed nitrogen.

6.7.3. Allow up to 20 minutes between purges (recovery time can vary from 2 to 20 minutes among installations). Note date and times of purges on FTF.

6.7.4. Begin sampling after the barcad has recovered from the third purge. Sufficient water may not be available for all sample bottles. In this case, note on the FTF which bottles were filled (if bottles were partially filled, note the approximate amount). Allow the barcad to recover for approximately two

to twenty minutes, and continue sampling. Repeat as often as necessary, and note, on the FTF, all the times and which bottles were filled.

6.7.5. If samples must be filtered, connect the filter to the discharge line (a permanently installed filter adapter is attached for this purpose).

6.7.6. Handle all bottles as in 6.4.14.

6.8. DECONTAMINATION OF EQUIPMENT

6.8.1. Clean the water-level indicators after each use and before continuing to another installation. In areas of tritium contamination (check notes on FTF), thoroughly rinse the probe with deionized water and dry it with a disposable paper towel.

6.8.2. Clean the bailers after each use and before continuing to the next installation. Thoroughly rinse the bailer with deionized water and dry it with a disposable paper towel. In areas of TCE contamination, clean bailers by washing them with a nonphosphate detergent and thoroughly rinse them with deionized water. Seal the bailer in a plastic bag after decontamination.

6.8.3. Whenever possible, dedicate equipment to each installation. Periodically replace dedicated ropes for manually bailed installations.

6.8.4. Triple-rinse all intermediate devices, such as beakers, with sample water before using.

6.8.5. Contain and discharge all purge water into dedicated drums according to 6.3.1 above and Reference 13.

6.8.6. As of the writing of this procedure, water from monitor wells EP6-09, W-817-03, W-817-03A, K7-01, K7-03, and NC7-25 contain contaminants above the MCLs. All purge water from these wells must be contained in covered drums provided at the well site. If additional wells are discovered to contain contaminants above the MCLs, the analyst will inform the sampling technologists and add purge water disposal instructions to the FTFs for those wells.

6.9. SAMPLE ALLOCATION

6.9.1. Send all samples that are analyzed offsite to the contract laboratories the day the samples are collected or the following morning to avoid exceeding analytical hold times (see Reference 11, EMP-QA-CS).

6.9.2. Submit tritium samples and radiological samples that are analyzed onsite to Radiation Analytical Sciences in B151 weekly to insure the timely acquisition of sample data.

6.9.3. Send HE samples to LLNL's Chemistry and Materials Science Department only after collecting all samples for the quarter.

7. DOCUMENTATION

7.1. FIELD TRACKING FORMS

FTFs must be completed during the sampling process. FTFs for ground water are revised at least once each quarter. Copies of the most current FTFs can be obtained from the TSG Technical Coordinator. FTFs contain information pertinent to the individual installation, such as pump type, voltage, total depth, and casing diameter as well as information specific to the sampling event such as pH,

temperature, and the technologist's observations and comments. This information is used to determine the type of equipment needed for the sampling event as well as to fill out the COC. A sample of an FTF for ground water is given as Attachment C.

7.2. CHAIN OF CUSTODY FORMS

Before releasing custody of samples to a laboratory for analysis, a COC must be completed as required by Reference 10. COCs may be filled out by the Analyst Assistant responsible for ground water or by the sampling technologist responsible for the sampling event. Each COC must have a release number that can only be obtained from an EMS TRR (see Reference 10). A sample of a completed COC for ground water is given in Attachment D.

7.3. FIELD NOTEBOOKS

Besides the information entered on the FTF, record all sampling activities in field notebooks. The notes shall include, at a minimum, locations sampled, date and time sampled, method used, identity of sampler, and any difficulties or special circumstances.

7.4. RECORDS RETENTION

FTFs, along with the COC, data hard copy, invoices, and field notebooks are QA records and are archived as described in Reference 12.

8. ACCEPTANCE CRITERIA

Samples are not acceptable if any of the criteria defined in this procedure are not met.

9. ATTACHMENTS

Attachment A: Analyte Specific Sampling Requirements
Attachment B: Sample Ground Water Sampling Plan
Attachment C: Sample Field Tracking Form
Attachment D: Sample Chain of Custody Form

Attachment A: Analyte Specific Sampling Requirements

Analyte	Typical Methods	Sampling Requirements	Acclimation and Refrigeration	Bottle Type	Comments/ FTF Footnotes
Anions Bromide Chloride Fluoride Nitrate Nitrite Phosphate Sulfate	EPA 300.0	Triple rinse bottle with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	500 ml polypropylene	48 hours hold time Footnote: c
Chemical Oxygen Demand (COD)	EPA 410	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C.	100 ml nalgene bottle, preacidified with H ₂ SO ₄ , provided by analytical laboratory.	Footnote: c, d*
Chlorophyll-a		Do not rinse bottles.	Store samples in ice chest or refrigerator at 4°C.	1 L nalgene bottle provided by analytical laboratory.	6 hour hold time Wrap sample bottles in foil. Footnote: c
Coliform bacteria		Do not rinse bottles.	Store samples in ice chest or refrigerator at 4°C.	125 ml sterilized nalgene bottle provided by analytical laboratory.	6 hour hold time Footnote: c
Drinking Water Pesticides (DWP)	EPA 608/615	Do not rinse bottles. Minimize air space, but do not overfill as overfilled bottles have been known to break.	Store samples in ice chest or refrigerator at 4°C.	6 x 1 L amber glass (Boston Rounds) provided by analytical laboratory.	Footnote: c
Fish Toxicity	EPA 600 96 hr. 1 pt. screening. 100% solution. Fat head minnow	Do not rinse kitbox.	Store samples in ice chest or refrigerator at 4°C.	5 gallon carboy provided by analytical laboratory.	24 hour hold time Footnote: c

Attachment A: Analyte Specific Sampling Requirements (cont.)

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTF Footnotes
General Minerals (GENMIN) Dicarbonate Carbonate Hydroxide Total Alkalinity Aluminum Calcium Chloride Copper MBAS Nitrate Iron Magnesium Manganese Nickel pH Potassium Sodium Sulfate Conductivity TDS Hardness Zinc	EPA 310.2 EPA 310.2 EPA 310.2 EPA 310.2 EPA 200.7 EPA 200.7 EPA 300.0 EPA 200.7 EPA 425.1 EPA 300.0 EPA 200.7 EPA 200.7 EPA 200.7 EPA 200.7 EPA 150.1 EPA 200.7 EPA 200.7 EPA 300.0 EPA 120.1 EPA 160.1 EPA 130.1 EPA 200.0	Triple rinse bottles with sample matrix before filling.	Acidification and refrigeration are not required.	2 x 1 L nalgene, store-stock # 8125-24044	no footnote required
Gross Alpha/Beta	EPA 900.0	Triple rinse with sample matrix in the field	Add HNO ₃ to achieve pH<2 after returning from field (5 ml in 1 L bottle). Refrigeration is not required.	1 L polypropylene	Filter Pit 7 samples Footnote: a
High Explosives (HE) HMX RDX TNT		Triple rinse bottles with sample matrix	None. Refrigeration not required.	6 dram or 25 ml glass	no footnote required

Attachment A: Analyte Specific Sampling Requirements (cont.)

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FIF Footnotes
Metals	Medium specific.	Filter water. Do not rinse preacidified samples. If not preacidified, triple rinse and acidify with 5ml HNO ₃ .	Refrigeration not required.	500 to 1000 ml nalgene, may be pre-acidified, provided by analytical laboratory.	Footnote: a, g
Nutrients Ammonia Nitrate Nitrite TKN	EPA 350.3 EPA 353.2 EPA 354.1 EPA 351.3	Triple rinse bottles with sample water before filling.	Upon return from field, add 10 drops H ₂ SO ₄ (to achieve pH < 2). Store samples in ice chest or refrigerator at 4°C.	1 L nalgene provided by analytical laboratory.	Footnote: c, f
Oil and Grease	EPA 413.1	Do not rinse preacidified bottles.	Store samples in ice chest or refrigerator at 4°C.	1 L wide mouth amber glass bottle, preacidified with H ₂ SO ₄ to achieve pH < 2, provided by analytical laboratory.	Footnote: c, f
pH		For field measurement, calibrate meter prior to sampling. Triple rinse bottle with sample matrix in the field.	Store samples in ice chest or refrigerator at 4°C.	125 ml nalgene	pH analysis is done in the field for NPDES samples only. Lab analysis coupled with conductivity
Phenolics	EPA 420.1	Do not rinse bottles.	Bottles are preacidified by the analytical laboratory. Refrigeration is not required.	1 L clear glass bottles, preacidified with H ₂ SO ₄ to achieve pH < 2, provided by the analytical laboratory.	Footnote: c Footnote: f
Radium 226	I	Triple rinse with sample matrix before filling.	Add HNO ₃ to achieve pH < 2. No refrigeration required.	2 X 1000 ml polypropylene	Footnote: a

Attachment A: Analyte Specific Sampling Requirements (cont.)

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments/ FTE Footnotes
Semivolatile Organics	EPA 625 8015	Do not rinse bottles. Minimize air space, but do not overfill as overfilled bottles tend to break.	No acidification is required. Store samples in ice chest or refrigerator at 4°C.	2 X 1 L amber glass bottles (Boston Rounds) provided by analytical laboratory	Footnote: c
Specific Conductivity	EPA 120.1	Triple rinse with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	125 ml polypropylene	No footnote required
TDS TSS	EPA 160.1 EPA 160.2	Triple rinse with sample matrix before filling.	Store samples in ice chest or refrigerator at 4°C.	500 ml polypropylene provided by the analytical laboratory.	Footnote: c
Total Organic Carbon (TOC)	EPA 415/9060	No air space or bubbles can be present. Form positive meniscus and cap bottles immediately after filling.	Preacidified bottles are supplied by analytical laboratory. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial, preacidified with H ₂ SO ₄ , provided by analytical laboratory	Footnote: c, d ¹
Total Organic Halides (TOX)	9020	No air space or bubbles can be present. Form positive meniscus and cap bottles immediately after filling.	Add 12 drops H ₂ SO ₄ to achieve pH < 2 before going to the field. Store samples in ice chest or refrigerator at 4°C.	100 ml amber glass (Boston Rounds) with teflon lined cap	Footnote: c, f
Thorium	EPA 900.0	Triple rinse with sample matrix in the field.	Add HNO ₃ to achieve pH < 2 after returning from field (5 ml in 1 L bottle). Refrigeration is not required.	1 L polypropylene	Filter Pit 7 samples Footnote: n
Tritiated water (HTO)		Triple rinse with sample matrix before filling.	None. Refrigeration not required.	250 ml clear glass bottle, store stock # 8125-27804	No footnote required
Uranium		Triple rinse with sample matrix before filling.	Add HNO ₃ to achieve pH < 2. No refrigeration required.	1000 ml polypropylene	Filter Pit 7 samples Footnote: a

Attachment A: Analyte Specific Sampling Requirements (cont.)

Analyte	Typical Methods	Sampling Requirements	Acidification and Refrigeration	Bottle Type	Comments
Volatile Organic Compounds Purgeable halocarbons	EPA 601	No air space or bubbles can be present. Form cap bottles immediately after filling.	Acidification is not required. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial with septa lid provided by analytical laboratory	Footnote: c
Volatile Organic Compounds Drinking Water Standards Purgeable priority pollutants Purgeable halocarbons/aromatics Purgeable aromatics "Purgeables"	EPA 502.2 EPA 524 EPA 601/602 EPA 602 EPA 624	No air space or bubbles can be present. Form positive meniscus and cap bottles immediately after filling.	Add 3 drops HCl (to achieve pH < 2) prior to going to field. Store samples in ice chest or refrigerator at 4°C.	40 ml clear glass vial with septa lid provided by analytical laboratory	502.2 x 5 524 x 4 601/602 x 4 602 x 2 624 x 3 Footnote: c, e, h

Footnotes

- a Acidify with 5 ml HNO₃
- b Acidify with 0.5 ml H₂SO₄
- c Refrigerate at 4° C
- d Acidify with 3 drops H₂SO₄
- * Acidify only if not preacidified by the analytical laboratory

- e Acidify with 3 drops HCl
- f Acidify with 10 - 12 drops H₂SO₄
- g Use plastic pipette only
- h Use glass pipette only

**If any analyses not listed on this table are required, please contact the EMS Analytical Laboratory contact person to obtain appropriate bottles from the analytical laboratory.

Substitution of different sized bottles of the same material (plastic or glass) is generally acceptable. If the specified bottles are not available, contact the Environmental Analyst or Analyst Assistant for guidance.

1994 Site 300 Sampling Plan for Pits 1 6 7 9 Barcads and HE Process Area

Numbers 1 6 7 and 9 above refer to pits to be sampled during the month indicated. (4) means four samples one week apart, are to be taken from all of the wells in the network. The single (4) exception is the HE Process Area well W B17 3A (Spring 3) where only one set of samples per quarter is taken. B stands for Barcad.

Pit 1 wells to be sampled include K1 01C 02B 03 04 05 07 08 and 09

Pit 6 wells to be sampled include K6 01 03 04 06 07 08 09

Pit 7 wells to be sampled include K7 01 03 05 09 10 NC725 25 27 and 48

Pit 9 wells to be sampled include K9 01 02 03 04

HE Process Area wells to be sampled include N B17 01 02 03 03A 0

Barcads to be sampled include K1 01A 01B 02A K2 01A 01B 02A 02B

Note: The sampling of Pits 1 and 7 in September 1994 will end the year of monthly sampling required under WDR 93 100

QA includes Trip Blanks (1/day) Field Blanks (1/spot) and Duplicates (1/pt)

EC 1994

INITIALS

Chain-of-Custody Record

Chain-of-Custody Record

Laboratory: CLS		Project Name/Analyst: BUGHG - E. CHRISTOFFERS		Number of Containers	
Sample(s) (signature): Rebecca (John J. Davis)		Date		Con-	
Sample Identifier:		Date		Containers	
Site	Location	Number	Medium		
3	K101C	01	MW	2-8-94	3
3	K102B	01	MW		3
3	K103	01	MW		3
3	K104	01	MW		3
3	K105	01	MW		3
3	K107	01	MW		3
3	K108	01	MW		3
3	K109	01	MW		3
3	QA	14	MW		3
3	QA	10	MW		3

Received		FEB 23 1994	
Release Number: 12J0299		TRR: RJW	

DISPOSITION OF COPIES (after signature)	
Original Sample (this is analyzed, after report is received)	Returned to Laboratory or Sample
Final Laboratory (this is analyzed upon receipt of sample)	Returned to Laboratory or Sample
Copy Laboratory	Returned to Laboratory or Sample
Note: Only keep for 60 days, with all data, after report is received, until report is received.	
ALL SIGNATURES MUST BE MADE ON WHITE COPY	

Environmental Monitoring Section	
Lawrence Livermore National Laboratory	
P.O. Box 808, L-821	
Livermore, CA 94551	

Form QAP-8	
Rev 5	
October 1993	

EMP-M-SCA

METEOROLOGICAL MONITORING AND EQUIPMENT
CALIBRATION

Prepared by:

Duane Rueppel 10/14/93
Duane Rueppel date
Group Leader, TSG

Paris Althouse 10/4/93
Paris Althouse date
Environmental Technologist, TSG

Reviewed by:

Frank Gouveia 7 OCT '93
Frank Gouveia date
Meteorologist, Health and Ecological
Assessment Division

Approved by:

Rebecca Faylor 10/4/93
Rebecca A. Faylor date
Section Leader, EMS

Kris Surano 10/4/93
Kris Surano date
Group Leader, Tamm

Lucinda M. Garcia 10/12/93
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes the equipment and methods used to collect meteorological data at Lawrence Livermore National Laboratory (LLNL) in compliance with the U.S. Department of Energy (DOE) Order 5400.1 (Reference 1). This procedure also describes the process used to ensure that meteorological monitoring equipment is maintained and calibrated in accordance with DOE/EH-0173T (Reference 2).

2. APPLICABILITY/DISCUSSION

The Environmental Monitoring Section (EMS) is responsible for monitoring the effects of operations conducted at the LLNL Livermore site and Site 300 on the environment and the public. Meteorological monitoring represents one aspect of EMS monitoring responsibilities. Accurate meteorological data are essential for characterizing local atmospheric dispersion conditions in order to assess the potential consequences of airborne emissions, provide environmental data to support emergency response to accidental releases, support research and engineering designs, and demonstrate compliance with federal, state, and local laws and regulations.

Meteorological monitoring equipment used by LLNL consists primarily of meteorological sensors mounted on forty meter tall towers located at the Livermore site and at Site 300. The locations of the Livermore site and Site 300 meteorological towers are shown in Attachments A and B. Attachment C is an instrument list applicable to both towers and Attachment D provides tower and sensor specifications. Attachments E and F provide data collection information for both sites. Continuous measurements of wind speed, wind direction, air temperature, relative humidity, and precipitation are taken at both sites. Barometric pressure is also taken at Site 300. Wind direction, wind speed, temperature and rainfall are required for atmospheric transport and diffusion computations to determine off-site pollutant concentrations and potential doses to the public. Barometric pressure and relative humidity are used for special studies and external requests.

The Atmospheric Release Advisory Capability (ARAC), located in T1701, provides real-time emergency assessment during radiation or toxic chemical releases. In the event of an inadvertent release of hazardous material to the atmosphere, real-time data from the meteorological towers can be read by the ARAC Center via modem. A separate, dedicated phone line also transmits meteorological data continuously to the Livermore Site System in B253, Room 1703, where air dispersion calculations can be performed. The equivalent Site System at Site 300 is located in B848.

The HANDAR meteorological sensors on the towers are calibrated, refurbished, and certified at six-month intervals as required by DOE/EH-0173T (Reference 2). Maintenance and calibration are performed by the Boise Interagency Fire Center, Bureau of Land Management (BLM) of the United States Department of the Interior.

Since March 1991, the BLM has held the maintenance contract to remove the sensors from the towers semiannually and replace them with a duplicate set that they have previously calibrated at their lab in Boise. The sensors that are removed are packaged by BLM personnel and returned to BLM in Idaho for checkout and recalibration and refurbishment as needed. All installed sensors are checked after mounting to ensure they are in working order. The microprocessor, communication lines, and site system computer are also checked to ensure that the entire system is in working order. The sensors are the property of LLNL and if the maintenance contract is terminated, the alternate set of sensors at BLM in Idaho will be returned to LLNL.

It is the responsibility of the EMS to ensure accuracy and reliability of the meteorological data collected at both the Livermore site and Site 300. This includes ensuring continuous data transmission, as well as data management and long-term data archiving. To

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meet these objectives, the requirements and schedules for specification, operation, maintenance and calibration are provided in this procedure.

3. REFERENCES

1. US. Department of Energy (1988), General Environmental Protection Program, US. Department of Energy, Washington, DC (DOE Order No. 5400.1).
2. US. Department of Energy (1991), Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, US. Department of Energy, Washington, DC (DOE/EH-0173T).
3. EMP-QA-DC, *Document Retention*
4. HANDAR Inc., Operating and Service Manual for HANDAR 540A Multiple Access Data Acquisition System (1986)
5. Baskett, R. L., Mitchell, C. S., and Foster, K.T., (1987), ARAC Site System User's Guide, Atmospheric Release Advisory Capability, Lawrence Livermore National Laboratory.
6. US. Department of Energy (1990), Radiation Protection of the Public and the Environment, US. Department of Energy, Washington, DC (DOE Order No. 5400.5).
7. Yamartino, R. J. (1984), A comparison of Several "Single-Pass" Estimators of the Standard Deviation of Wind Direction, *Journal of Climate and Applied Meteorology*. Vol. 23, pp1362-1366.
8. EMP-QA-NCR, *Nonconformance and Discrepancy Reporting*.
9. EPA-450/4-87-013, Onsite Meteorological Guidance for Regulatory Modeling Applications.
10. MIL-STD-45662.

4. DEFINITIONS

Atmospheric Release Advisory Capability (ARAC): A group at LLNL involved in air dispersion modeling, which requires meteorological data.

Data Collection Platform (DCP): The computer and data acquisition electronics directly connected to the sensors at the meteorological tower.

Sigma-Theta (σ_θ): The standard deviation of the wind direction angle. σ_θ is computed using accepted formulas (Reference 7) for single pass calculation of standard deviation in polar coordinates.

Site System: The computer in B253, Room 1707 that reads and stores data from the Livermore site meteorological tower and calculates gaussian plume dispersion. Site 300 has its own Site System, which is located in B848.

United States Department of the Interior, Bureau of Land Management (BLM), Boise Interagency Fire Center: The group responsible for calibration and routine maintenance of the meteorological tower equipment at LLNL, Site 300, Sandia, and more than 50 other DOE and DOD locations in the western states.

UTM Coordinates: Universal Transverse Mercator grid locating system.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS Section Leader ensures that sampling and calibration procedures meet and conform to the appropriate regulatory guidance.

5.2. TAMM GROUP LEADER

The Group Leader ensures that sampling and calibration procedures meet design criteria and that sampling and calibration are conducted in accordance with approved procedures.

5.3. EMS ENVIRONMENTAL ANALYST

The EMS Analyst has responsibility for determining the meteorological monitoring system specifications. The Analyst is also responsible for ensuring integrity of meteorological data, ensuring that sensors perform according to the requirements specified in References 2 and 9, and archival of meteorological data. The Analyst coordinates the LLNL meteorological monitoring program and serves as a contact point for ARAC, 'B' Division, Earth Sciences, and Hazards Control personnel performing meteorological monitoring functions.

The Environmental Analyst is also responsible for making arrangements to provide access for BLM personnel to the site computers in Building 253 at the Livermore Site and in Building 848 at Site 300 during semiannual maintenance. The Environmental Analyst must also review and approve BLM maintenance reports.

5.4. SITE SYSTEM OPERATOR

Site System Operators monitor daily operation of the site computer, report problems to the EMS Analyst and ARAC, and archive data on a monthly basis. The LLNL Livermore Site System Operator is provided by the Hazards Control Department Health and Safety Division. The Site 300 Operator is provided by 'B' Division.

5.5. EMS ENVIRONMENTAL TECHNOLOGIST

Acts as designee for EMS Analyst for BLM functions. Assumes responsibility for semiannual sensor replacement in the event of BLM contract termination.

5.6. METEOROLOGIST

The LLNL meteorologist shares the responsibilities of the EMS Environmental Analyst. In addition, the meteorologist collects the monthly archived data, reads the data into a VAX computer and a DOS computer for data manipulation, and provides annual wind and rain information for the LLNL Site Annual Environmental Report and wind files used for input into dispersion codes.

5.7. ARAC

ARAC provides more sophisticated modeling than the Site System during emergency response activities. They are responsible for Site System computer program maintenance and upgrades. ARAC also provides training in Site System operation.

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5.8. BUREAU OF LAND MANAGEMENT (BLM), BOISE INTERAGENCY FIRE CENTER

BLM is responsible, by contractual agreement, for semiannual calibration and maintenance of the meteorological tower equipment at LLNL and Site 300.

BLM is responsible for the calibration of the sensors, following the procedure detailed in the HANDAR Operating and Service Manual, Section 9, Maintenance and Calibration (Reference 4). In the manufacturing and calibration of HANDAR equipment, HANDAR and BLM use measuring and testing devices necessary to ensure that products conform to the technical requirements. These devices are calibrated at established intervals against certified standards that are traceable to the National Institute of Standards and Technology (NIST) in compliance with MIL-STD-45662 (Reference 10).

BLM personnel are responsible for notifying LLNL of their impending visit and for supplying their names and social security numbers for badging. During their visit, they shall replace all sensors and ensure that all meteorological sensors and data acquisition electronics are operating properly. Each maintenance visit will be documented in a report to the LLNL EMS Environmental Analyst.

6. PROCEDURE

Equipment Required:

Meteorological tower with sensors and DCP.

Site System DEC computer, modem, and lease line to tower.

DEC compatible disks.

No equipment is required of LLNL for calibration. BLM personnel bring all equipment and replacement parts necessary for sensor change-out and servicing.

6.1. DATA COLLECTION

The LLNL Site System computer is located in the Hazards Control Department, B253, Room 1707, and is supervised by that department. The Hazards Control Emergency Response Control Center is also located in Room 1707 so that modeling information can be immediately available during emergency response. The Site 300 Site System computer is located in B848, 50 yards east of the meteorological tower. The Site System computers at both sites operate automatically and collect data without human intervention.

A microprocessor in the HANDAR 540A Data Collection Platform (DCP), located at the base of each tower, is programmed to compile and store measurements as 15-minute averages (see Attachment D). For example, a measurement of wind speed is made every 10 seconds, and the average over the 15-minute interval is stored. The 15-minute average data are then transmitted and stored at the Site System. The DCP at the tower is capable of storing up to approximately one week's worth of data to prevent data loss during brief power outages.

A DEC 370 computer in each Site System operates automatically and contacts the DCP at its site every fifteen minutes, retrieving the data from the DCP. The data are stored on the hard disk in the DEC computer. Once per month, the data are transferred to a floppy disk for permanent archiving by the Site System operators following procedures in Reference 5.

Livermore Site and Site 300 location information is provided in Attachments E and F, respectively. The Site System operator at each site checks at least once per week to assure that the computer is still running and collecting data and archives collected

data to a floppy disk once per month. If the computer is not running or data are not being collected, an NCR must be generated and resolved according to the requirements of EMP-QA-NCR, *Nonconformance and Discrepancy Reporting*, (Reference 8).

6.2. DATA ANALYSIS

Meteorological data are archived onto floppy disk once per month by the designated Hazards Control Department and Site 300 Site System operators. These disks are retained at the site computer location. At least once per year, but typically monthly, the archived data from LLNL and Site 300 are copied onto the Environmental Protection Department microVAX computer (node name AQUA) and reviewed by the meteorologist to look for data values that might indicate a faulty sensor. The meteorologist converts sensor data into wind data files in IBM format for input into dispersion modeling codes, such as CAP88-PC, required by Reference 6.

6.3. DATA VERIFICATION

During routine checks of the meteorological data acquisition at the site computers by Site System operators, the newly acquired data are listed on the computer screen. Dashes for any parameter indicate unacceptable data. Values of zero for wind speed, values of 180 degrees ± 1 for wind direction, values of 0 to 1 for sigma-theta, or values of 431 degrees Fahrenheit for temperature for eight hours may indicate a problem with the respective sensor or cable connection. These problems are detected automatically, and a message is printed on the Site System computer. The Site System operator will notify the EMS analyst (who will submit an NCR) and the ARAC center; all three will trace the problem.

6.4. SENSOR MAINTENANCE

The EMS Analyst will perform monthly visual inspections of the tower and meteorological sensors to check for missing or damaged sensors, impaired motion, broken wires, and obstructions such as birds nests and kite string. The ARAC Center (422-9159) should be notified of any problems. An NCR will also document any problems.

In addition to the sensor calibration, the EMS Analyst is responsible for providing routine inspection and maintenance for the sensors. This work is performed semiannually by BLM. The ARAC On-Site Inspection Sheet (Attachment G) describes the parameters to be evaluated during the inspection. This form will be filled out during the semiannual visit and filed along with the calibration records at BLM offices in Boise. Copies are sent to the EMS Environmental Analyst.

6.5. EQUIPMENT REPAIR AND CALIBRATION

The HANDAR instruments are recalibrated, refurbished, and recertified by the BLM. As specified by DOE /EH-0173T (Reference 2), calibration is performed at six-month intervals and records maintained. BLM will remove the sensors from the tower and replace them with a duplicate set that has previously been calibrated and certified by BLM. The removed sensors are packaged by BLM personnel and returned to BLM in Idaho for recalibration and refurbishment to be used in the next exchange.

Near the end of March and September, BLM will request, by memo or telephone, that their personnel be admitted to the Livermore Site and Site 300 to perform calibration and preventive maintenance of the meteorological equipment. The

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request will include the dates of the visit, full names, and social security numbers of the visitors.

The Environmental Analyst in charge of the LLNL meteorological system, or designee, shall arrange for a visitor badge and an escort for BLM personnel when they visit the Site System computers at the beginning and again at the end of the maintenance procedure. The escort will meet BLM personnel at the LLNL West badge office and escort them to the Livermore Site System. Site 300 access requires no escort. Maintenance activities at the Site Systems take about 30 minutes.

BLM will follow its own detailed procedure for calibration and maintenance, outlined below. A similar procedure would be developed and followed by Technical Support Group Environmental Technologists if LLNL's contract with BLM is terminated.

6.6. TOWER CALIBRATION PROCEDURE

6.6.1. TOWER SHUTDOWN

At the Site System computer:

6.6.1.1. Notify the ARAC Center of the maintenance activity and resulting tower down-time using computer mail on the Site System.

6.6.1.2. Notify the Site System operator that semiannual maintenance is being performed.

6.6.1.3. Ensure that meteorological data archiving is current to avoid possible loss of data when tower transmission is discontinued.

6.6.1.4. Take the Data Collection Platform off-line using the computer menus on the Site System computer. During the sensor exchange, the HANDAR 540A data collection platform at the tower does not have to be turned off. The data will continue to be collected. Review the data collected during exchange and delete any bad data. The ARAC program will not need to be reloaded.

6.6.1.5. Take the Site System computer off-line using the computer menus.

6.6.1.6. The escort will then escort BLM personnel to the meteorological tower at the northwest corner of LLNL. Site 300 requires no escort. Maintenance activities may take several hours. The escort need not remain at the LLNL tower but must stay available to provide escort to the next maintenance location.

6.6.2. SENSOR REPLACEMENT

At the tower, BLM personnel will perform the following activities:

6.6.2.1. Precheck tower to ensure that all mechanical parts are in proper condition.

6.6.2.2. Check electrical power to the tower and measure all voltages specified on the checklist.

6.6.2.3. When performing sensor change-out, for safety and technical reasons, there shall be at least two technicians located at the tower. After the Site System computer is off-line, the tower crossarms may be lowered. This is done by releasing the lock on the hand crank arm and slowly lowering the crossarms. There is a wire safety line, which can be pulled if the crossarm cables get caught or snagged on the way down (do not pull on the actual cables because the cables could disconnect from the sensors).

6.6.2.4. Once the crossarms are lowered, remove the sensors by first unplugging the sensor cables and then loosening the allen screws that secure the sensor to the crossarm. The wind speed sensor and thermistor may be replaced in their proper locations simply by reconnecting the plug and then tightening the allen screws. The wind direction sensor, however, requires precise alignment.

6.6.2.5. Check wind direction sensor orientation. It must be aligned to true north so that the data received by ARAC are correct. The first step in replacing the wind direction sensor is to visually align the allen screws adjustment to due south. Then one technician, using a compass, will stand approximately 50 yards due north while the other technician, with the HANDAR 540A data platform on-line, aligns the arrow of the sensor to due north. As an option, the technician located at the tower could fine tune the adjustments while the technician with the portable phone confirms the readings with the data received from the Site System terminal by a third person.

6.6.2.6. Once all the sensors are in place, tightened, and are reading properly as indicated on the BLM portable computer diagnostic instrument, the technicians may raise the crossarms back to the proper levels of 40 meters and 10 meters.

6.6.2.7. The technicians are also required to fill out the ARAC On-Site Inspection Sheet (see Attachment G). This form must be archived according to the procedure described in Reference 3.

6.6.3. RAIN GAUGE MAINTENANCE

The only other instrument to be checked is the tipping bucket rain gauge. This requires no replacement, but should be regularly maintained and cleaned, because the bucket is prone to clogging. Removal of outer casing and cleaning of the inside mechanisms with water are all that is needed. A damaged tipping bucket rain gauge would be replaced by BLM.

6.6.4. FINAL SYSTEM CHECKOUT

After service is complete at the tower, the escort will take BLM personnel back to the LLNL Site System computer for final system checkout. At the Site System computer, reload tower program following ARAC procedures and remove any bad data that may have been collected during sensor change-out as described in Reference 5, test the tower to see that data are being acquired properly and inform ARAC that all sensors are in proper working order and that the Site System is back on-line using computer mail on the Site System.

6.7. DISCONTINUATION OF BLM CONTRACT

If BLM's calibration contract is ever discontinued, then BLM must return any spare sensors to LLNL for calibration. If an organization other than BLM is to perform the calibration of the sensors, LLNL Procurement must be contacted. Procurement will determine the appropriate paperwork and approvals required for calibration, routine servicing of equipment, and emergency repairs.

6.8. SYSTEM MALFUNCTION

If any computer malfunction is found during weekly checks, the Site System Operator must notify the EMS Analyst (who will issue an NCR) and ARAC to diagnose the problem. ARAC has frequent contact with BLM and also monitors meteorological system operation. If a computer or sensor malfunction or loss of data transfer is found, the EMS Analyst will issue a Needs Changing Report and ARAC will take the necessary steps for remedy. Needs Changing Report procedures and forms are found in EMP-QA-NCR (Reference 8). If a major problem exists, such as a bad sensor or a broken cable, ARAC will notify the BLM to obtain repairs.

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7. DOCUMENTATION/QA RECORDS

Meteorological data will be retained, stored, and archived according to the requirements of EMP-QA-DC, *Document Retention*, (Reference 3). ARAC On-Site Inspection Checklists and calibration records are maintained by BLM. A copy of ARAC On-Site Inspection Checklists and calibration records must be sent to LLNL and archived according to the requirements of EMP-QA-DC.

8. ACCEPTANCE CRITERIA

8.1. METEOROLOGICAL DATA

Meteorological data must have at a least ninety percent recovery rate on an annual basis (References 2 and 9).

8.2. CALIBRATION AND MAINTENANCE

BLM checkout procedure requires that all sensors to be calibrated and operational and that the computer and modem communication with the data collection platform is operating properly before BLM personnel leave LLNL.

Data or equipment that do not meet these criteria will be documented on a Needs Changing Report and resolved according to EMP-QA-NCR, *Nonconformance and Discrepancy Reporting* (References 8).

9. ATTACHMENTS

- Attachment A: Location of the Livermore Site Meteorological Tower
- Attachment B: Location of the Site 300 Meteorological Tower
- Attachment C: Standard HANDAR Meteorological Sensors
- Attachment D: Sensor Specifications: LLNL and Site 300 Towers
- Attachment E: HANDAR Meteorological Data Collection Information, Livermore site
- Attachment F: HANDAR Meteorological Data Collection Information, Site 300
- Attachment G: BLM Inspection Cover Letter with ARAC On-Site Inspection Sheet

Attachment A: Location of the Livermore Site Meteorological Tower

Attachment B: Location of the Site 300 Meteorological Tower

Attachment C: Standard HANDAR Tower Sensors

Sensor	Measurement	Accuracy	EPA(Reference 9)
Anemometer	Wind speed (0 to 150 mph)	$\pm 0.1\%$	$\pm(2m/s+5\%)$
Wind vane	Wind direction (standard deviation of wind direction (sigma theta) is calculated by the DCP from wind direction.)	$\pm 2^\circ$	$\pm 5^\circ$
Thermistor	Temperature (-30 to +60°C)	$\pm 0.2^\circ\text{C}$	$\pm 0.5^\circ\text{C}$
Tipping bucket	Precipitation (0.01 inches per tip)	$\pm 0.5\%$	$\pm 10\%$
Barometer	Barometric pressure (800-1100 mb)	$\pm 0.3\%$	$\pm 3\text{mb}$
Relative humidity	Relative humidity(10-90%)	$\pm 5\%$	no requirement

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Attachment D: Sensor Specifications, LLNL and Site 300 Towers

Sensor	Units	Tower Height	Sample Interval	Recorded Interval
Anemometer	m/s	10m & 40m	10 sec.	15 min.
Wind direction	deg.	10m & 40m	10 sec.	15 min.
Thermistor	°C	10m & 40 m	1 min.	15 min.
Sigma theta	deg.	10m & 40m	10 sec.	15 min.
Precipitation	inches	ground level	N/A (continuous)	15 min.
Relative humidity	%	10m	1 min.	15 min.
In addition to above, Site 300 also has the following:				
Barometric pressure	mb	10m	1 minute	15 min.

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Attachment E: HANDAR Meteorological Data Collection Information, Livermore site

1. Station: Lawrence Livermore National Laboratory, Livermore, CA
2. Longitude: 121° 42' 54" W (UTM coordinate: 613143mE on 1230 W Central Meridian)
3. Latitude: 37° 41' 36" N (UTM coordinate: 4172286mN)
4. Base elevation above sea level: 572 feet
5. Magnetic declination: 17° East
6. Equipment manufacturer: HANDAR, Inc.
1188 Bordeaux Dr., Sunnyvale, CA 94089 (408) 734-9640
7. Number (and heights) of sensors: three sensors per crossarm at levels of 10 meters and 40 meters above ground level.
8. Site System location, phone number, and contact: LLNL, Building 253, Room 1707, (510) 423-3475, Dave Trombino 423-2648, or Mark Grubbs 422-1846.

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Attachment F: HANDAR Meteorological Data Collection Information: Site 300

1. Station: Site 300, San Joaquin County, CA
2. Longitude: 121°, 31' 30" (UTM coordinates: 630120mE on 1230 W Central Meridian)
3. Latitude: 37°, 39' 13" (UTM coordinates: 4168107mN)
4. Base elevation above sea level: 1,220 feet
5. Magnetic declination: 17° East
6. Equipment manufacturer: HANDAR, Inc.
1188 Bordeaux Dr., Sunnyvale, CA 94089 (408) 734-9640
7. Number (and heights) of sensors: three sensors per crossarm at levels of 10 meters and 40 meters above ground level.
8. Site System location, phone number, and contact: LLNL Site 300, Weather Station, Building 848, John Kleiber or Mike Barnett, 423-5395.

Attachment G: BLM Inspection Cover Letter and ARAC On-Site Inspection Sheet

ON REPLY REFER TO

9209 (211)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Boise Interagency Fire Center
3905 Vista Avenue
Boise, Idaho 83705-5392

OCT 21 1992

Mr. Duane Ruppel
Lawrence Livermore National Laboratory
LLNL, L-255
P.O. Box 808
Livermore, CA 94550

Dear Mr. Ruppel:

On October 14, 1992, Daniel Boss and Denise Buske of the Remote Automatic Weather Station (RAWS) Field Support Group, visited the Atmospheric Release Advisory Capability (ARAC) tower LLNLLIVE to perform calibration and preventive maintenance. The wind speed, wind direction, relative humidity, and air temperature sensors were all replaced. The tipping bucket count remains at 00.08 inches.

The site was also inspected for structural strength, mechanical wear and tear, system alignments, and operational accuracy. The ARAC system is currently operating within LLNL/Interagency standards.

Attached is a copy of the ARAC on-site inspection sheets for your records. If you have any questions, please contact either Bob McCormick or Phil Sielaff at (208) 389-2726. Thank you for your continued support of the Interagency RAWS program.

Sincerely,

Roger L. Trimble
Director, BIFC

Attachment

cc: Jon Welch, ARAC Meteorological Tower Coordinator

Attachment G: BLM Inspection Cover Letter and ARAC On-Site Inspection Sheet (cont.)

Date 15 Oct 92

SITE Site 300T

TOWER LOCATION LLNL; Livermore, CA

AT THE P.C.

1. Display tower status to verify tower metadata is current.
2. List metadata to printer for hard copy of current data.

LAST Data (Pre-Maintenance)

CH 1		CH 21
CH 11		CH 22
CH 12	see Print out	CH 23
CH 13		CH 24
CH 14		CH 25
CH 16		CH 26
CH 18		CH 28

3. Send mail message to ARAC/LLNL co/ Pat Ellis or Jon Welch notifying of work to begin.
4. Take Tower Offline.
5. Check Lease Line Modem Voltage with Carrier light on modem
.450 VAC (Should be .3 to .45 VAC)
6. Inspect all telephone line connections/surge protectors, and ground connections for tower.
7. Type of modem DF02 DF112 ✓

AT THE TOWER

List Last Data, put DCP in Program Mode, and Save Program

Last Data (Pre-maintenance)

Ch 1 13.9	
Ch 11 5.5	Ch 21 5.2
Ch 12 7.5	Ch 22 7.7
Ch 13 25.1	Ch 23 25.7
Ch 14 6.6	Ch 24 7.8
Ch 16 11.6	Ch 26 12.2
Ch 18 27.6	Ch 28

CH4 - 00.13
CH6 - 1017.9

Attachment G: BLM Inspection Cover Letter and ARAC On-Site Inspection Sheet (cont)

1. TOWER PRE-CHECK - BEFORE CLIMBING
(circle one)

- ☒ Y ☐ N All tower sections bolted together?
- ☒ Y ☐ N/A ☐ N Guys and anchors secure, straight, proper tension?
- ☒ Y ☐ N/A ☐ N Safety wire installed?
- ☒ Y ☒ N Tower true vertically? Use level.
- ☒ Y ☐ N Base bolted to concrete base or roof at 4 corners?
- ☒ Y ☐ N Tilt hinge secured with 2 bolts?
- ☒ Y ☐ N Base condition good--no cracks, flaws, etc.?
- ☒ Y ☐ N Cable clamps, turnbuckles, base bolts, other hardware not excessively rusted and in good condition?
- ☒ Y ☐ N Ground rod in place, connected to lightning rod?
- ☒ Y ☐ N/A ☐ N Cables tie-strapped to tower?
- ☒ Y ☐ N All sensor brackets secure?
- ☒ Y ☐ N All brackets secure?
- ☒ Y ☐ N/A ☐ N Guy wires "flagged" for safety, if required?
- ☒ Y ☐ N Extra fuses left?
- ☒ Y ☐ N All rubber-sealed surface siliconed?
- ☒ Y ☐ N Dielectric applied
- ☒ Y ☐ N External DC ckt fuse okay?
- ☒ Y ☐ N Battery DC ckt fuse okay?
- ☒ Y ☐ N Microprocessor ckt fuse okay?
- ☒ Y ☐ N All boards seated securely, bracket in place?
- ☒ Y ☐ N All internal ribbon connectors secure?
- ☒ Y ☐ N External DC power supply connectors (2) secure?
- ☒ Y ☐ N External modem connectors (2) secure?
- ☒ Y ☐ N External met sensor connector secure?
- ☒ Y ☒ N Any stripped threads on cover bolts/brackets?
- ☒ Y ☐ N Metboard for lowest tower level in card slot 4? Upper Level Card Slot 6?

2. TOWER AC/DC POWER CHECK

- 11.6 VDC 540 battery reading from program set.
- 51.4 VDC Dial-in phone line voltage across 540 dial-in modem internal connector.
- .44 VAC Lease Line Voltage (at modem internal connection)

Attachment G: BLM Inspection Cover Letter and ARAC On-Site Inspection Sheet (cont.)

<u>116.6</u>	VAC	110 Volts AC hot to neutral
<u>117.2</u>	VAC	110 Volts AC hot to ground
<u>.94</u>	VAC	Volts neutral to ground (should be close to zero)
<u>20.5</u>	VDC	540 power supply battery charger output (should be 14V DC).
<u>13.46</u>	VDC	540 power supply operating DC output voltage (should be ~ 12V DC).
<u>17.0</u>	VDC	Solar panel output. Connector pin A = +, B or C = -, (should be ~ 14-16V DC).
<u>440</u>	IDC	From solar panel, varies 0-2500 ma. depending on incident sunlight.
<u>13.81</u>	VDC	540 external voltage
<u>13.81</u>	VDC	540 battery voltage
<u>13.38</u>	VDC	540 microprocessor voltage
<u>13.71</u>	<u>12.69</u>	Battery Load Test
<u>13.79</u>	VDC	540 Regulator

Inspect and Check Surge Suppressors

3. CLIMB TOWER AND CHANGE OUT SENSORS.

OCT 92

	Level 1	Level 2
W/S sensor	SN# 1051	1230
Cup size	1 3/4	1 3/4
Torque watch readings	4.01	4.01
Freq/Vol	.626	.626
W/D Sensor	SN# 1044	318
Torque watch readings	.26	.44
Air Temp sensor	SN# 1188 (RWAT)	574
540	SN# 969	
Firmware Rev.	1.8	
Power Supply	145	
Mag Dec	16	
Latitude	37:29:11 N	
Elev ABMSL	1280	
Tower Elev ABGL	75	
WS/WD Sensor Height above tower base	35	70
Temp Sensor Height above tower base	35	70

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Attachment G: BLM Inspection Cover Letter and ARAC On-Site Inspection Sheet (cont.)

ARAC SITE SYSTEM WIND VANE
ORIENTATION CHECKLIST

OCT-92

1. Determine the declination for the tower location using the information supplied by LLNL ✓

2. Calculate the compass settings for TRUE SOUTH and NORTH:

(Circle one)

TRUE SOUTH compass setting = 180 deg MINUS EASTERLY declination
OR

TRUE SOUTH compass setting = 180 deg PLUS WESTERLY declination

TRUE SOUTH compass setting = 180 - E OR + W 16 deg decl. =
164 deg.

TRUE NORTH compass setting = 360 deg MINUS EASTERLY declination
OR

TRUE NORTH compass setting = 360 deg PLUS WESTERLY declination

TRUE NORTH compass setting = 360 - E OR + W 16 deg decl. =
344 deg.

CHECK FACTORY SETTING TO TRUE SOUTH

3.. N/A Climb the tower and mount wind vane in crossarm. Do not tighten the Crossarm Mount. Set Screw at the base of the vane's post. Leave the South Lock Pin in place.

4. ✓ Connect wind sensor cable at the sensor and to the data collection platform (DCP)

5. ✓ If not already done, Reload program into DCP. If a program exists in the DCP, put it in the Program Mode ("?" command on a terminal) and select the wind direction channel CH 13/23 ("M" command on a terminal, enter 13 and return).

6. ✓ Do a "FORCED SCAN" ("S" on a terminal) while still in the Program Mode and read the current wind direction. It should be 180 deg + or - 2 deg REGARDLESS OF THE VANE'S POSITION in the crossarm. (The lock pin locks the vane to a 180 degree wind direction).

Wind direction reading = 179 deg (should be 180 deg)

If the reading is not near 180 deg and you are reading the wind direction channel, the vane will have to be returned to handar to be reset.

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Attachment G: BLM Inspection Cover Letter and ARAC On-Site Inspection Sheet (cont.)

7. N/A The person on the ground walks 50-100 ft NORTH or SOUTH of the tower. The ground person sights along the shaft of the vane while he is also sighting down his compass with the above TRUE NORTH/SOUTH compass setting. Once the tower and ground-based persons agree that the vane is oriented in line with the TRUE NORTH/SOUTH compass sighting, then the tower person secures the two set screws in crossarm mounting bracketed to lock the vane's alignment bushing in place. Resite the vane to check that tightening the crossarm set screws has not rotated the vane post slightly.
8. ☒ Remove the Lock Pin.
9. WITH PROGRAM SET STILL IN PROGRAM MODE MAKE ALL CHECKS OF ALL SENSOR READINGS.

HANDAR SENSOR CHECKLIST

Vane Orientation

(fill in number)

110 deg Declination degrees for this geographic area.

(circle one)

- ☒ N Wind direction sensor arrowhead oriented TRUE south
(account for declination)?

179 deg Reading for Wind direction with PIN IN PLACE (Channel 13/23)

179 deg Reading for wind direction with sensor oriented TRUE south.

90 deg Reading for wind direction with sensor oriented TRUE east.

272 deg Reading for wind direction with sensor oriented TRUE west.

001 deg Reading for wind direction with sensor oriented TRUE north.

Wind Direction

- ☒ N Reading of wind direction seem reasonable for ambient conditions?

Anemometer Output

1.3 m/sec Reading for wind speed. (CH 11/21)

- ☒ N Does wind speed seem reasonable for ambient conditions?

1.7 m/sec Reading for wind gust (Channel 12/22)

- ☒ N Does wind gust reading seem reasonable for ambient conditions?

SIGMA WILL NOT GIVE OUT INSTANTANEOUS READINGS CHANNEL 14/24.

Temperature Output

20.2 deg C Reading for temperature (Channel 16/26).

Attachment G: BLM Inspection Cover Letter and ARAC On-Site Inspection Sheet (cont.)

☒ Y N Does temperature reading seem reasonable for ambient conditions?

Verify all weather parameters with belt weather kit

☒ Y N Solar Panel Aimed South and secure? Clean?

Disconnect program set

Turn DCP off

Wait - 5-10 sec.

Turn DCP on

Secure Cover and make final check of everything

Return to PC

AT P.C. (After Maintenance)

1. Reload Tower program from ARAC Software. Choose Tower Operations, then choose Reload tower program. If a multiple tower site, select station_id as needed.
2. After tower reload is successful, then check tower program via terminal emulation to verify WS constants correct and/or all channels programmed. Make changes as needed.
3. Recheck lease line voltage with carrier Light On Modem 150VAC
4. Reload ARAC Software
 - a. If tower program changed, then Save tower program in ARAC software. Choose Tower Operations, then choose Save tower program. Magic key to save tower tower program is F-5 or call ARAC for assistance.
5. After metadata collection on PC starts up again, list metadata to printer..(Approx 1/2 hour after DCP is put in run mode)

RAWSDData (After-maintenance)

Ch 1	
Ch 11	Ch 21
Ch 12	Ch 22
Ch 13	Ch 23
Ch 14	Ch 24
Ch 16	Ch 26
Ch 18	Ch 28

Print inop

6. Send mail to ARAC/LLNL Attn: Pat Ellis or Jon Welch of completed work. Please note if program changed or any problems. ARAC should check dial in line after tower rehab complete.
7. If HELP needed call Pat Ellis, Jon Welch or Ron Baskett at ARAC 415/422-9159.
8. Brief POC on Operations Done.

EMP-QA-A

ANALYTICAL LABORATORY AUDITING

Prepared by:

Barbara C. Fields 12/4/92
Barbara C. Fields date
Environmental Analyst, EMS

Reviewed by:

Kris Surano 12/3/92
Kris Surano date
Group Leader, SMG

Rebecca Ward 12-3-92
Rebecca Ward date
Environmental Technician, EMS

Approved by:

Rebecca A. Failor 12/3/92
Rebecca A. Failor date
Section Leader, EMS

Lucinda M. Garcia 12/3/92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Concurrence by:

Larry Pendexter 12/9/92
Larry Pendexter date
Quality Assurance Manager, EPD

LLNL ENVIRONMENTAL
MONITORING SECTION
UNCONTROLLED COPY
FOR INFORMATION ONLY

1. PURPOSE

This procedure details the methods for conducting audits and inspections of laboratories that perform analytical services for the Environmental Monitoring Section (EMS).

2. DISCUSSION

The Environmental Monitoring Section (EMS) audits analytical laboratories to verify that analyses performed for EMS comply with applicable DOE and EMS requirements (References 1 and 2). References 3 and 4 provide additional guidance for this procedure.

EMS audits serve as quality assurance checks that validate analytical procedures and resulting data. The audit may also serve to improve laboratory performance by assessing whether necessary quality control systems and management practices are in place and are functioning adequately.

The laboratories perform analyses on samples collected both on and off the Lawrence Livermore National Laboratory (LLNL) main site and Site 300 from a variety of environmental media. Analyses performed include organic and inorganic chemical analyses as well as radiochemical analyses.

All laboratory audits conducted by EMS must assess sample log-in and sample processing procedures, personnel training, data validation and reporting, instrument calibrations, and quality control documentation. Laboratories should be audited annually. Each audit shall be followed by a written audit report. A follow-up visit may be necessary to verify that audit findings have been addressed before the audit can be considered complete.

3. REFERENCES

1. EQVG Quality Assurance Plan (UCAR-10203)
2. DOE Orders 5700.6C
3. Environmental Protection Department QAMP, Revision 2; December 31, 1991
4. LLNL QA Guide M-078-QG-3, June 1990
5. EMP-QA-DC, Document Retention Center

4. DEFINITIONS

Action Plan: Proposed actions by the auditee to address audit findings. The plan should include specific discussions of each finding and a proposed timetable for action implementation.

Audit: A periodic, systematic, documented review of a facility's operation and practices to ensure that procedural, technical, contractual, and environmental requirements are met. It is a planned and documented activity performed to determine by investigation, examination, or evaluation of objective evidence the adequacy of and compliance with procedures, instructions, and other applicable documents, and the effectiveness of implementations.

Auditee: The analytical laboratory being audited.

Audit Report: The official record of an audit, written by the lead auditor, with input from the audit team.

Audit Team: A group of auditors who are selected by the lead auditor that have knowledge and expertise in the analytical services that are being audited. Preferably individuals who have had formal training in the conduction of audits.

Exit meeting: The close-out meeting which provides immediate feedback of the audit team's conclusions to the auditee.

Follow-up-visit: The visit made by the lead auditor after evaluation and verification of the auditee's action plan to ensure that all findings discovered during the audit are corrected by the auditee.

Findings: Observations that require corrective actions.

Lead Auditor: Auditor who communicates directly with the auditee to assure that there is a clear and mutual understanding of the audit assignment.

5. RESPONSIBILITIES

5.1. LEAD AUDITOR

The Lead Auditor is responsible for contacting the laboratory to be audited by telephone, setting up the audit schedule, and writing a follow-up letter to confirm the arrangements. The Lead Auditor must select the audit team, conduct a pre-audit meeting, and compile an audit checklist. The lead auditor also is responsible for for conducting the audit, directing the audit team, writing the audit report (which includes findings and recommendations), determining that corrective actions are completed by the audited laboratory, and for filing the final report with the EMS QA Coordinator.

5.2. AUDIT TEAM

The Audit Team is responsible for conducting the audit, in accordance with this procedure, under the direction of the Lead Auditor.

5.3. EMS QA COORDINATOR

The EMS QA Coordinator is responsible for reviewing the audit report and final report and for ensuring that the reports are archived in the Document Retention Center in accordance with Reference 5.

6. PROCEDURE

Equipment Required:

None

6.1. AUDIT PREPARATION PHASE

Review the laboratory's existing procurement contract for audit limitations or authorization to ensure that the audit is conducted within the legal framework of the contract. It may be necessary to contact LLNL Procurement/Legal personnel for a copy of the contract and for interpretation of its conditions.

Contact the Auditee's QA Manager or Customer Support Services Representative by telephone to schedule the date and time of the audit. The telephone call must be followed by a formal letter of confirmation. In the event the Auditee can not be reached by telephone, a letter must be sent notifying him/her that an audit is being scheduled. The confirmation letter should state the authorization for the audit, the purpose of the audit, and identify the areas that

will be reviewed, such as organic and inorganic chemistry, radiochemistry, training, sample tracking, and calibrations.

Compile a detailed audit checklist that is specific for the analytical laboratory being audited (See Attachment A for a sample audit checklist).

If more than one person will conduct the audit, a lead auditor must be designated by the EMS QA Coordinator before contacting the laboratory. The lead auditor serves as the communication/organizational focal point for the audit team. The lead auditor is responsible for carrying out the audit successfully and assuring that a timely audit report is written. The lead auditor should communicate directly with the auditee to assure a clear mutual understanding of the audit procedure, including the audit's purpose, date, and time requirements.

The audit team shall meet before visiting the Auditee to discuss the audit agenda, assignment of responsibilities, regulatory research, audit checklist refinement, and updates. This meeting should take place no more than one week before the audit.

6.2. GENERAL AUDIT GUIDANCE

On the day of the audit, be on time, show identification, and make introductions.

Conduct a pre-audit conference with the auditee and the entire audit team to discuss the scheduled events, such as permits/file reviews, inspections, and interviews. During the pre-audit conference, the lead auditor should introduce the audit team members and briefly describe their individual responsibilities. Any known problems or existing concerns should be mentioned at the conference. The status of findings from previous audits should be reviewed.

Normally, there is a negative reaction associated with any audit, regardless of the conditions. Therefore, auditors should conduct audits in a professional manner, being careful not to intimidate the auditee. Make the auditee feel comfortable with the auditor's presence to encourage cooperation.

Know what is contained in the audit checklist, but do not become dominated by it so that effective communication is hampered. Auditors should take notes throughout the audit. Auditors must be able to reconstruct what was observed, where it was observed, who was involved, and to what requirements the observations relate. The audit's conclusions must stem from the auditors' observations.

Review important documents first (e. g., permits, resumes, training records, standard operating procedures (SOPs), Quality Assurance (QA) manuals, corrective action procedures, etc.). Obtain and retain a copy of documents if necessary.

When interviewing, ask open-ended questions. Avoid too many yes-or-no questions. Interview all key personnel one on one, preferably in their work-place. Make the interviewee a part of the audit process, not the object of it.

Avoid questions that can be evaluated better by a physical inspection or by a documentation review during a later stage of the audit.

Avoid auditor reactions that make the interviewee uncomfortable when findings are identified. Emphasize that the audit is not a personal inquisition.

6.3. INSPECTION OF THE LABORATORY

See Attachment A for a sample audit checklist. Neither the guidance presented here nor Attachment A should be considered all-inclusive. The audit team can use this information to develop the audit check-list, but must prepare an individual checklist for each audit (i.e., a radiological laboratory will require a different audit checklist than that of metals or organic laboratory).

Inspect the laboratory carefully to ensure that:

6.3.1. The laboratory is secure and that access by visitors is limited and supervised by laboratory staff.

6.3.2. A written protocol exists for sample receipts; observe if that protocol is followed.

6.3.3. There is a designated sample custodian.

6.3.4. The sample custodian's procedures and responsibilities are documented.

6.3.5. There is a permanent, bound logbook where records of samples received are maintained; determine that the minimum entries per sample are made (i.e., date received, client name, sample matrix, sample date, and laboratory order number).

6.3.6. All calibration data is being documented.

6.3.7. All standards are NIST-traceable.

6.3.8. Steps are taken to minimize cross-contamination.

6.3.9. Laboratory has adequate work space for each analyst.

6.3.10. Instruments are calibrated; observe if calibration is documented.

6.3.11. Samples are stored properly in adequate spaces.

6.3.12. There is a secured area for long-term sample storage.

6.3.13. Safety is practiced.

- Chemicals stored properly
- Eyewashes are available to work stations
- Work station cleared.

6.3.14. Hazardous waste disposal practices are adequate.

- Waste from samples disposed of properly.
- Hazardous waste manifest from waste hauler.
- Insured waste hauler.
- Completed hazardous waste labels, including start date, are on the hazardous waste containers.

6.3.15. Reagents and standards are stored properly.

6.3.16. General housekeeping is adequate.

Auditors should review the following:

- Control charts.
- Sample receipt, log-in, tracking, and chain of custody practices.
- QA/QC data and evaluate results.
- Written QA Plan.
- Training records.
- QA self-assessment activities.
- Written analytical procedures.
- All steps in applicable analytical processes.
- Corrective action procedures.

6.4. EXIT MEETING

At the conclusion of the laboratory inspection/review, the audit team should meet privately to discuss findings and prepare for the exit meeting. The lead auditor conducts the exit meeting with the auditee and the audit team present.

During the exit meeting, the audit team provides immediate feedback to the auditee regarding the team's findings. The auditor can convey general impressions about the audit, comment on what worked well, or discuss any problems.

Additionally, this meeting provides a final opportunity for the auditee to contribute information. Any problem that was not reconciled during the audit can be addressed. The exit meeting should include a discussion of the corrective action schedule. The lead auditor informs the auditee of the date when the written audit report will be provided and asks the auditee to prepare an action plan within 30 days of receipt of the audit report.

The exit meeting is a vital part of the audit process. The exit meeting provides the opportunity to inform the facility staff of significant findings and to resolve any audit team misunderstandings. Positive feedback should be presented to the auditee as appropriate. The meeting must be conducted so that it provides a solid basis for the written audit report.

The exit meeting includes:

- Acknowledgement of analytical laboratory staff assistance.
- An overall statement of performance.
- Activities, findings, and conclusions that include
 - What the audit team saw.
 - What the audit team found.
 - What the findings mean.

Audit team members may individually present their findings during the exit meeting.

6.5. AUDIT REPORT

The audit report is the key document in the audit process; it documents the audit team findings and presents the compliance status of the facility. In addition to findings, the audit report contains analyses, agreements, suggested corrective actions, and a time frame within which corrective action plan should be completed. This report is a support document that assists the auditee to attain and maintain compliance. It should contain both positive and negative findings, but should hold no surprises. All potential findings should have been addressed verbally at the exit meeting.

A cover letter from the EMS QA Coordinator and lead auditor must accompany the audit report. The report must include the purpose of the audit, introductory information, general audit activities, specific activities and findings, a summary of findings, a synopsis of the exit meeting, conclusions, and recommendations.

The text should be clear and concise, and should avoid conjecture (conclusions deduced by guess work). There should be at least one piece of evidence for each finding.

Distribution of the report should be limited to the audit team members, the EMS QA Coordinator, the EPD QA Manager, the EMS Section Leader, the auditee, and the EMS files.

The audit team leader is responsible for assigning writing duties to the audit team, establishing a schedule, and compiling the audit report. Audit team members should write those sections of the report that relate to the areas they reviewed during the audit.

Before the report is sent to the audited laboratory, the signature chain must include the lead auditor, the EMS QA Coordinator, the EMS Section Leader, LLNL Procurement staff, and LLNL Legal Counsel for review.

6.6. ACTION PLAN

Within 30 days of the audit, the auditee must respond in writing to EMS with a plan of action that includes a specific response to each finding and a schedule for implementation of corrective actions.

The lead auditor reviews the response from the auditee and provides written comments to the EMS QA Coordinator, who recommends acceptance or rejection of the response and plan.

Within 30 days following the acceptance of the action plan, the lead auditor may need to conduct a follow-up visit to the auditee and complete a follow-up report to verify that all findings were addressed.

7. DOCUMENTATION/QA RECORDS

Records must be kept of the following items.

- Auditor training.
- Phone calls for audit notification.
- Letter of scheduled audit confirmation.
- Audit checklist and notes.
- Audit reports with proper signatures.
- The auditee's action plan.
- Documentation of follow-up visit.

8. ACCEPTANCE CRITERIA

Audits are deemed closed/acceptable when the following steps are completed.

- The audit has been scheduled and conducted according to this procedure.
- A written report has been prepared, reviewed, and signed by proper signatories.
- A written response to the audit report has been prepared by the auditee. This response must identify a plan of action for all findings and state a time frame within which all corrective actions will be completed.
- The lead auditor has reviewed the auditee's response and action plan and has provided written comments to the EMS QA Coordinator, who recommends (in writing) acceptance of the action plan.
- If necessary, a follow-up visit has verified that the laboratory has implemented its action plan so that all audit findings were addressed adequately.
- A letter has been sent to the auditee verifying that the audit has been successfully completed.

9. ATTACHMENTS

Attachment A: Sample Audit Checklist

Attachment A: SAMPLE AUDIT CHECKLIST

A general audit checklist should be comprehensive, covering all areas of specific laboratory performance. The audit checklist is not generated to be fault-finding, but to identify those areas that be should improved.

The following audit checklist demonstrates the kinds of questions that can be asked of any laboratory performing chemical analysis. Questions should be open-ended as much as possible to obtain information from the auditee and to generate participation.

**SAMPLE QUALITY ASSURANCE AUDIT
LABORATORY CHECKLIST**

<u>GENERAL LABORATORY SECTION</u>	<u>Y/No</u>	<u>Documented</u>
1. Is the access to laboratory secure and visitors limited and supervised by lab staff?	_____	_____
2. Are training records kept for all employees?	_____	_____
3. Is the training done in-house?	_____	_____
4. Is a training plan available?	_____	_____
5. Are resumes of laboratory employees available?	_____	_____
6. Is a written QA plan available?	_____	_____
7. Are QA procedures documented and available to analysts?	_____	_____
8. Are in-house analytical procedures properly authorized, used, and documented?	_____	_____
9. Are written procedures available to employees?	_____	_____
10. Does the sample log-in/tracking system allow for easy tracing of sample's progress, and assure that all requested analysis are performed?	_____	_____
11. Are volatile chemicals stored properly?	_____	_____
12. Are corrosive chemicals stored properly?	_____	_____
13. Are acids stored in cabinets designated for acids?	_____	_____
14. Are solvents stored in cabinets approved for storage of flammable materials?	_____	_____
15. Is the general laboratory work area kept orderly and clean, with trash in cans, storage containers clearly labeled, benches clear, and unused samples stored?	_____	_____

16. Does the laboratory appear to have adequate work space for each analyst?

17. Are analytical balances located away from areas subject to drafts or rapid temperature changes?

18. Are balances calibrated by certified technicians annually?

19. Are balances routinely checked with certified weights, and results recorded in a bound notebook?

20. Are reagents and calibration standards stored properly?

21. Is conductivity of distilled demineralized water routinely checked and recorded?

22. Can laboratory document that deionized and organic-free water is free of mineral or organic substance?

23. Are steps taken to minimize cross contamination in areas provided for trace-level analysis?

24. Is chemical waste disposed of properly, acids and bases neutralized, hazardous waste segregated, etc.?

25. Is hazardous waste labeled properly, stored under appropriate conditions, and disposed of correctly?

26. Are oven temperatures recorded daily?

27. Are permanently bound notebooks used for data?

28. Are methods referenced in each analytical notebook?

29. Are QC limits available in each analytical notebook?

30. Are notebooks numbered serially?

31. Are notebooks maintained in a legible manner?

32. Is only permanent, water-resistant ink used to record entries in notebook?

33. Are notebook corrections made as a single strike-through, with date and initial?

34. Are primary analytical documents (chromatograms, printouts, etc.) clearly cross-referenced in bound notebooks?

35. Do supervisors periodically review notebooks and sign them to verify review? _____

The following is sample checklist for a specific laboratory (Radiochemical Laboratory) The auditor will make up a specific checklist as appropriate for the audit along with a general audit checklist

RADIOCHEMICAL ANALYSIS

Yes/No

Documented

1. Is there a certified Health Physicist on staff? _____
2. Are radiochemical employees cross-trained in the laboratory and is the cross-training documented? _____
3. Are in-house analytical procedures properly authorized used, and documented? _____
4. Are written procedures available to employees? _____
5. Does sample log-in/tracking system allow for easy tracing of sample's progress and assure that all requested analysis are performed? _____
6. Are samples scanned for activity levels upon receipt to laboratory? _____
7. Are low level activity samples stored separately from medium and high level activity samples? _____
8. Is there a procedure available for checking /approving of the data before it is reported? _____
9. Are instrument detection limits consistent with DOE Orders? _____
10. Are calculations checked by a second person? _____
11. Is there a procedure to document corrective action taken? _____
12. Are modification of procedures properly documented? _____
13. Are records kept in a bound notebook of instrument calibration, dates and detection limits? _____
14. Are calibration of instruments performed using NIST standards, and at a frequency appropriate to the stability of instruments involved? _____

15. Are calibration curves and data calculations documented?	_____	_____
16. Are manufacturer's operation manual available to employees?	_____	_____
17. Are maintenance service contract in place?	_____	_____
18. What are the minimum detection limits of counting instruments (gross alpha, gross beta, and tritium)?	_____	_____
19. Are good laboratory practices in place, including housekeeping and cleanliness?	_____	_____
20. Are fume hoods, counter tops, and floors kept clean to prevent cross-contamination?	_____	_____
21. Are spiked tracers used to determine sample recoveries?	_____	_____
22. Are analytical grade reagents or better used for analysis	_____	_____
23. Are reagents properly stored?	_____	_____
24. Are freshly made reagents dated and initialed?	_____	_____
25. Is laboratory safety observed?	_____	_____
26. Is laboratory hazardous waste generated from the analyses of samples received from LLNL?	_____	_____
27. Is waste labeled, stored and disposed of properly (in accordance with CCR, TITLE 22)	_____	_____
28. Is there a written procedure regarding to decontamination of glassware?	_____	_____
29. Are all records kept in a bound notebook?	_____	_____
30. Do notebooks contain all pertinent information: sample size, final volume, spikes, duplicates, reagents used, date made, date open, lot?	_____	_____
31. Does Lab participate in ESML and DOE EML program?	_____	_____

EMP-QA-AER

Site Annual Environmental Report

Prepared by:

Gretchen Gallegos 9/21/93
Gretchen Gallegos Date:
SAER Project Leader

Reviewed by:

Bill Hoppes 9/23/94
Bill Hoppes Date:
Group Leader, WGMG

Kris Surano 9/21/93
Kris Surano Date:
Group Leader, TAMM

Rebecca Failor 9/21/93
Rebecca Failor Date:
Section Leader, EMS

Approved by:

Rebecca Failor 9/21/93
Rebecca Failor Date:
Section Leader, EMS

Lucinda Garcia 9/21/93
Lucinda Garcia Date:
Quality Assurance Coordinator, EMS

**LLNL ENVIRONMENTAL
MONITORING SECTION
UNCONTROLLED COPY
FOR INFORMATION ONLY**

1. PURPOSE

This procedure describes requirements for the Site Annual Environmental Report (SAER). Guidance for the content of this report is contained in DOE Order 5400.1 (Ref. 1) and addenda; it is a general report of environmental effluent and surveillance monitoring data and of environmental compliance activities for the calendar year. Attachment A contains the sections of 5400.1 relevant to the SAER. This procedure provides a method for compiling the data and text so the report can be completed on a timely basis while maintaining the highest standards of quality.

2. APPLICABILITY/DISCUSSION

Every DOE site is required by DOE Order 5400.1 to complete an annual report containing environmental monitoring data and environmental program compliance information. The contents of all such reports are further summarized by DOE to enable evaluation of the impact of DOE operations on a nationwide basis.

The purpose of the report is to provide detailed information about environmental effluent and surveillance monitoring, to provide detailed descriptions of environmental compliance activities, to provide radiation dose estimates for surrounding populations, to summarize all significant environmental activities in one report, and to provide analyses of environmental trends. It is a comprehensive document that involves the effort of a large number of people throughout the Environmental Protection Department (EPD), and requires a high level of cooperation and timely submission of material.

The document has a wide readership that includes scientists, politicians, lawyers, regulators, and interested members of the public. Reaching all of these readers at their level of understanding presents a challenge not faced in most scientific writing. Timely completion of the document also presents a significant challenge because of the breadth of material covered and the delayed receipt of analytical data. The final draft of the SAER should be submitted to DOE as soon as reasonably possible so the DOE and the public have timely information about the environmental issues surrounding LLNL operations.

This procedure applies to all personnel responsible for writing or reviewing any section or sections of the SAER. This includes all environmental analysts within the EMS and personnel in EPD who are assigned to write about compliance, or other subjects, for inclusion in the SAER.

3. REFERENCES

1. DOE Order 5400.1.
2. Metric Conversion Action of 1979, 15 U.S.C. 205a *et seq.*
3. Presidential Executive Order 12770, *Metric Usage in Federal Government Programs*, July 25, 1991.
4. DOE Order 5900.2.
5. EMP-QA-DM, *Data Management*
6. EMP-QA-DC, *Document Retention*.

4. DEFINITIONS

DOE Headquarters: The Office of Environmental Health, Environmental Compliance Division, which is the organization within DOE responsible for review of all SAERs and production of a nationwide report on DOE environmental impacts.

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DOE-SF: The Department of Energy-SF Francisco Field Office; DOE-SF employees work at either the Oakland office or at the LLNL site office.

Formal Comment Version: The draft of the SAER that is reviewed internally and by DOE-SF. It is not to be confused with the final draft SAER, which is to be submitted to DOE-SF when the document is ready to be printed.

Site Annual Environmental Report: The SAER is a report required by DOE Order 5400.1 for all DOE sites. It is to cover environmental program information; environmental radiological program information, including radioactivity monitoring results and calculation of potential doses to the public; environmental nonradiological program information; environmental compliance information; and quality assurance. The document must also include references and a distribution list. DOE-SF and DOE Headquarters often will issue memoranda that provide further guidance for the preparation of this document.

5. RESPONSIBILITIES

5.1. EPD DEPARTMENT HEAD

The Department Head is responsible for reviewing and commenting on the formal comment version of the SAER to assure that all activities within EPD have been presented accurately. The Department Head also reviews the final draft of the SAER as part of the signature-chain process, and signs the certification of the data's validity.

5.2. EPD DIVISION LEADERS

The Division Leaders of Operations & Regulatory Affairs Division (ORAD), Environmental Restoration Division (ERD), and Hazardous Waste Management Division (HWM) are responsible for assigning appropriate personnel to write the sections of the SAER pertaining to environmental compliance, environmental restoration, and hazardous waste management. The Division Leader of the Environmental Monitoring and Analysis Division (EMAD) and the Division Leaders of the other divisions are responsible for reviewing and commenting on the formal comment version of the SAER; this review may be delegated to other members of the division. The EMAD Division Leader also reviews the final draft of the SAER as part of the signature-chain process, and signs the certification of the data's validity.

5.3. EMS SECTION LEADER

The EMS Section Leader is responsible for the timely and accurate production of the SAER. If a requirement for additional personnel to produce the SAER is perceived, the EMS Section Leader should be made aware of the need. Other responsibilities include directing the inclusion of appropriate material in the Executive Summary, setting the tone and style of the report, and establishing priorities for the Environmental Analysts when conflicting duties interfere with the timely production of the SAER. The Section Leader is responsible for reviewing and commenting on the formal comment version, for reviewing the final draft of the SAER as part of the signature-chain process, and for signing the certification of the data's validity.

5.4. TAMM GROUP LEADER

The TAMM Group Leader is the line manager directly responsible for the production of the SAER. The SAER Project leader will interact frequently (daily, if necessary) with the TAMM Group Leader to resolve workload distribution and other issues. The TAMM Group Leader is responsible for reviewing and commenting on the formal comment version, for reviewing the final draft of the SAER as part of the signature-chain process, and for signing the certification of the data's validity.

5.5. EMS ENVIRONMENTAL ANALYSTS

The EMS Environmental Analysts are responsible for writing the sections in the SAER concerning the environmental media for which they are analysts, e.g., the analyst responsible for air monitoring will write the sections on air monitoring. The analysts are also responsible for proofing the drafts for their media, including the drafts of the data tables and the figures. In addition, they are responsible for proof-reading the QC checking of the data in the final draft against the original (hard copy) data; for providing input to the quality assurance chapter and the summary chapters; and for reading and proofing other sections, as assigned under the direction of the QA Coordinator. The timely submission of well-considered data and text for the SAER is an important consideration for the Environmental Analysts' performance appraisals.

5.6. EMS QUALITY ASSURANCE COORDINATOR

The EMS Quality Assurance Coordinator is responsible for coordinating the QC checking of the data tables in the SAER against original, hard copy data. The QA Coordinator is also responsible for coordinating the writing of the quality assurance chapter(s) of the report, with input from individual analysts, as appropriate.

5.7. ORAD, ERD, EMAD, AND HWM PERSONNEL

Designated ORAD, ERD, EMAD, and HWM personnel (chosen by their division leaders) are responsible for writing the sections in the SAER on environmental regulatory compliance issues and permitting, environmental restoration activities, environmental risk assessment activities, and hazardous waste management activities. These personnel are also responsible for proofing the drafts of the SAER for their sections, including the drafts of tables or figures.

5.8. SAER PROJECT LEADER

The SAER Project Leader is responsible for the production of the introductory, summary, and nontechnical appended material for the SAER. The SAER Project Leader will monitor the production schedule for the document, advise the TAMM Group Leader and EMS Section Leader of delays, keep a written record of the submission of data and text (see Attachment B), and evaluate the document for overall content and consistency. The SAER Project Leader is also responsible for interacting, on a daily basis if necessary, with the Technical Information Department (TID), including editors, designers, artists, compositors, proofers, and printers, to assure that the document is completed in a professional and timely

manner. The SAER Project Leader will also interact with DOE-SF personnel to acquire the most recent guidance on the content and format of the SAER.

5.9. TID EDITOR

The TID Editor is responsible for editing the SAER for clarity, grammar, style, and consistency. The Editor has first-line responsibility for interacting with the individual analysts and with TID, including designers, artists, compositors, proofers, and printers, to assure that the document is completed in a professional and timely manner.

5.10. PUBLIC INFORMATION OFFICER

The Public Information Officer is responsible for reviewing the Executive Summary of the document and providing comments and for preparing a news release about the SAER.

6. PROCEDURE

Equipment Required:

N/A

The schedule for completing the SAER that is described below (see Tables 1 and 2) is based on the assumption that all data will be available by April 1 and that all reviewers will complete their reviews on a timely basis. All responsible parties should make every effort to keep the document on schedule; nonetheless, there may be delays in the receipt of data or in the resolution of reviewers comments that may cause the document to be late.

6.1. MONITORING DATA

The tabulation of the effluent and surveillance monitoring data for publication is the most labor-intensive aspect of preparing the SAER. Many thousands of results are presented in tabular form each year. To spread this work over the year, if possible, the data should be reviewed by the Environmental Analysts and processed by the Data Management personnel throughout the year, as the data are received.

Data are presented in the SAER in Systeme Internationale (SI) units; i.e., sieverts (Sv) are used for dose and becquerels (Bq) are used for radioactivity. The units are followed in text by their conventional units (rem and curies). The use of SI units is required by federal law, (Refs. 2 to 4).

6.1.1. Each analyst should review all available data as soon as possible after receipt. After the data are determined to be valid and are suitably processed, they should be submitted to the Data Manager (Ref. 5). The Environmental Analysts will request draft tables from the Data Manager on or about April 1. Environmental Analysts must advise the SAER Project Leader if all hardcopy reports of the data are not available at this time.

6.1.2. Within two weeks from the receipt of the data, the Environmental Analysts will have noted any errors in the data and provided information to the Data Manager about the errors so they can be corrected in the database (see Ref. 5).

[illegible]

Table 2. Plan for preparing the SAER—TID and Review tasks; shading indicates the milestone for the item.

Task	June			July			August			September			October		
TID Responsibilities															
Document delivered to TID															
Prepare cover															
Prepare maps															
Edit document															
Authors review															
Correction cycle															
Complete formal comment version															
Review/Correction Cycle															
Internal and DOE-SF review															
Correction cycle, layout, final proof															
Submit final draft SAER to DOE; EPD & TID Blue sheet															
Vend to Printer															
Distribute															

6.1.3. In the last two weeks of May, the data in all tables and the figures will be subjected to extensive quality assurance proofing, which will be coordinated by the QA Coordinator. This step will include the proofing of the tables against original (hard copy) data by personnel in the EMS who are not responsible for the analysis of that type of data. For example, the air analyst may proof sewage tables or water tables, but not air tables.

6.2 MAPS OF SAMPLING LOCATIONS

In March, the Environmental Analysts should review the maps in the previous SAER to determine if there have been any changes, additions, or deletions of sampling locations. Minor changes may be noted on a photocopy of the previous SAER and submitted to the SAER Project Leader, who will in turn submit them to TID personnel for correction. Copies of any revisions also should be submitted to the EMS QA Coordinator, who will use them in preparing the QA chapter of the SAER.

NOTE: Changes in sampling locations will be reflected in the text as well as the figures. Be sure to make appropriate changes in the text.

6.3. CHAPTERS PERTAINING TO MONITORING

In March, the Environmental Analysts should review the previous SAER to determine if there should be any changes or additions to the introductory material and the methods discussions presented at the beginning of the chapters on each media. In addition, the Analysts should review the format of their tables and determine what changes are necessary.

In April, the discussion and environmental impact sections should be revised. There may be some data that are not yet available. Nonetheless, the major revision of the chapters should occur at this time, and any changes necessitated by later data will be incorporated as those results become available. In addition, the Environmental Analysts should review the information about their media that is contained in the general introduction to the document and make appropriate changes. Minor changes may be noted on a photocopy of the previous SAER and submitted to the SAER Project Leader. Major changes can be submitted in handwritten form or in Microsoft Word on disk. It is appropriate to provide references in these discussions. However, *do not* include LLNL Draft documents or documents that have not been through the TID review and release process. These documents should not be referred to because they are not complete, and reference to them may make them prematurely subject to Freedom of Information Act requests.

6.4. SECTIONS NOT PERTAINING TO MONITORING

The sections concerning compliance with environmental laws and regulations, existing permits, and hazardous waste management will generally be prepared by individuals outside the EMS, i.e., by people assigned from ORAD, ERD, and HWM. The authors for these sections should be identified at the beginning of March; the individuals responsible for writing these sections will be assigned by the Division Leaders of the other EPD divisions. Each Division will assign an appropriate member of their management to review material to be submitted for the SAER before it is actually submitted. By the end of March, the first draft of these sections should be submitted to the SAER Project Leader, who will monitor the completion of the work and provide drafts to appropriate reviewers. The Draft Compliance Summary chapter is due on April 15 and is provided to DOE-SF, which forwards it to DOE Headquarters.

It is appropriate to provide references in these discussions; however, *do not* include LLNL Draft documents or documents that have not been through the TID review and release procedure. These documents should not be referred to because they are not complete and reference to them may make them prematurely subject to Freedom of Information Act requests.

6.5. EXECUTIVE SUMMARY AND PROGRAM SUMMARIES

In April, the SAER Project Leader, the TAMM Group Leader, the EMS Section Leader, and the TID Editor will create the Executive Summary. The EMS Section Leader, Analysts, and the Public Affairs Office will review the summary for accuracy and overall content.

6.6. LIST OF EPD PUBLICATIONS (APPENDIX)

In April (or before), the SAER Project Leader will contact the TID Publications Specialist who supports EPD. This Publications Specialist retains copies of all TID blue sheets for EPD for the calendar year. The SAER Project leader will obtain these copies and have the list of EPD publications for the year created. The format shall follow the reference list format, except the year is omitted (because they are all the same year).

6.7. QUALITY ASSURANCE

In April, the Analysts will provide QA data to the QA Coordinator for incorporation into the QA chapter. In May, the QA Coordinator will write the new QA chapter and submit it, either in handwritten form or in Microsoft Word on disk, to the SAER Project Leader.

6.8. COVER DESIGN

Design of the cover will begin in June. The cover should be ready for the formal comment version of the SAER (Section 6.9, below). Any design elements that should be retained from previous SAER covers should be noted. The SAER Project Leader, TID Editor, the TAMM Group Leader, and the EMS Section Leader should supply general instructions for the content of the cover and request sketches. When developed design is accepted, the artist will be authorized to complete the design. The final cover selection will be reviewed and approved by the TAMM Group Leader, the EMS Section Leader, and the SAER Project Leader.

6.9. EDIT, PRELIMINARY LAYOUT, AND COPYPROOF

Editing, preliminary layout, and copyproofing of the SAER is an ongoing process as material is submitted. Nonetheless, the SAER Project Leader, Editor, and Designer need time to review the document as a whole and make whatever editorial and artistic changes are necessary. These changes, including review by the appropriate analysts and responsible parties, should be completed by July 15. When this step is completed, a formal comment version of the SAER will be available for review. No new material should be introduced by Analysts after this version is completed.

6.10. INTERNAL AND DOE-SF REVIEW

Each section of the formal comment version of the SAER should be closely proofread by its author(s). This is the last opportunity for any changes by authors, and these changes should not be substantial. (Substantial changes will force a new layout of the document, a very time-consuming and expensive process.) The SAER is subject to review by many persons at LLNL, including authors; all of the Division Leaders in EPD; the Department Head of EPD; the LLNL Environment, Safety, and Health Working Group; and the Plant Operations Associate Director. DOE-SF will also conduct a review of the formal comment version; reviewers include the Director of the Livermore Operations Division of DOE-SF, and appropriate DOE-SF Branch Chiefs. Reviewers will be provided with a copy of the document, and a comment review form (Attachment C), but generally will mark their comments on the document.

Concurrent review by all these individuals should be completed by the end of July. The analysts and other authors must sign an approval form to acknowledge that they have reviewed their portion of the document and that it is correct to the best of their knowledge (Attachment D).

The SAER Project Leader makes sure that the copies are distributed, contacts the reviewers to determine how the review is progressing, and provides review comment forms and approval forms.

6.11. CORRECTION CYCLE AND FINAL LAYOUT

The SAER Project Leader will notify the authors of changes suggested during the internal and DOE-SF review. All suggested changes will be resolved, and reviewers will be notified. The correction cycle to implement these changes and to accomplish the final layout should be performed by the Editor and TID personnel on an expedited basis. The SAER Project Leader and Editor will proof the changes to assure that they are properly incorporated.

6.12. FINAL REVIEW OF THE FINAL DRAFT SAER

When the SAER Project Leader and Editor sign the approval form (Attachment E) for the final draft SAER, 20 photocopies of the document will be made and 5 submitted to DOE-SF by August 15. (A copy of a transmittal letter to DOE is presented in Attachment F.) At this time, the document should also be sent through TID for review and release and through EPD for its Blue Sheet release and certification of data.

6.13. CERTIFICATION OF DATA

The data contained in the report must be certified as to their validity, accuracy, and completeness. This certification must be accomplished in a document signed by the EMS Section Leader, the EMS QA Coordinator, the EMAD Division Leader, the EPD Department Head, and the Associate Director for Plant Operations. A sample of this certification document is presented in Attachment G.

6.14. PRINTING

Any changes required by DOE should be made as soon as possible. Generally, the changes will be implemented by TID personnel. The SAER Project Leader and Editor will proof these changes, and will sign the approval form that all changes have been correctly placed. Printing, including production of color separations, negatives, and plates normally will take at least six weeks. A color authorization memo may be necessary before printing; the need for this should be determined by TID personnel.

7. DOCUMENTATION/QA RECORDS

The completion of the steps in this procedure will be noted by the SAER Project Leader in a checklist. This checklist is similar in overall structure to Tables 1 and 2 and is appended here as Attachment B. The documentation of the QA/QC proofing of the data tables, and all author approval forms, will be maintained by the QA Coordinator in conformance with EMP-QA-DC, *Document Retention Center* (Ref. 6).

8. ACCEPTANCE CRITERIA

The QA/QC proofing of the data tables in the SAER is one of the acceptance criteria for the document, as is the certification of data validity. Other acceptance criteria include signed text approval forms from all authors, the signed approval forms by the SAER Project Leader and Editor for correction cycles, the EPD signature chain approval, and the LLNL Director's approval.

9. ATTACHMENTS

- Attachment A: Sections of DOE Order 5400.1 Pertaining to SAER
- Attachment B: SAER checklist
- Attachment C: Sample Annual Environmental Report Review Comment Form
- Attachment D: Sample Author Approval Form
- Attachment E: Sample SAER Project Leader/Editor Approval Form
- Attachment F: Sample Draft SAER Transmittal Letter
- Attachment G: Certification of SAER

Attachment A: Sections of DOE Order 5400.1 pertaining to SAER

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11-9-83

Attachment II-1
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SUGGESTED CONTENT AND FORMAT FOR ANNUAL SITE ENVIRONMENTAL REPORTS

Content and format for the Annual Site Environmental Report is provided below; guidelines and examples are included to illustrate the quality and kind of information required. The report should be of the high quality typical of DOE and contractor technical and public reports. The cover should be of appropriate quality and appearance, and the text printed and professionally edited. Where possible, pages illustrating figures, maps, etc. should be 8 1/2" x 11".

1. COVER PAGE. The cover page should include the site name, facility, reporting period, reporting organization, address, and document number. The report should be titled "(Name) Site Environmental Report for Calendar Year 19--".
2. TITLE PAGE. Same as for 1 above.
3. TABLE OF CONTENTS. The Table of Contents should list sections, locations of figures, texts, appendices, references, etc., in the document.
4. INTRODUCTION. The introduction should include a brief description of the site, its mission, the nature of its primary operations, and activities. A general discussion of environmental features and land and water use, including pertinent demographic information, should be included in this section.
5. SUMMARY. The summary should provide evaluation and interpretation of the information included in each of the sections (items 6-9 which follow) contained in the report; the meaning of these data should be explained in the context of applicable environmental standards and requirements. The summary should be written in a manner understandable to the general public. Explanations, as appropriate, should be included for unusual events or releases. A discussion of abnormal occurrences which resulted from or could have impact upon either the program activity or the site, should be included. Population dose estimates and the dose to the maximum exposed individual (where appropriate) should be included. The total quantity of radioactivity by radionuclide released as airborne and liquid effluents should be included, along with descriptive information on nonradioactive effluents.
6. COMPLIANCE SUMMARY. This section should review the facility's compliance record. Specific instances of noncompliance should be discussed and a description of corrective actions should be included.

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7. **ENVIRONMENTAL PROGRAM INFORMATION.** This section should provide a summary of all of a site's environmental activities performed to comply with laws and regulations, to enhance environmental quality, and to improve understanding of the effects of environmental pollutants from site operations. Items to be included are:
 - a. A summary of environmental monitoring performed. This should be a brief description of the types of monitoring performed; which regulations require it; number of stations, frequency, and parameters measured; to whom data are reported; and a summary of results compared to applicable standards. This summary should address programs for both radioactive and nonradioactive monitoring.
 - b. A listing of environmental permits issued to the site by Federal, state and local regulatory agencies. Include the type of permit, by whom issued, and the expiration date.
 - c. A listing of draft and final EISs and EAs completed during the year that pertain to site activities.
 - d. A summary of significant environmental activities at the site. This could include activities to meet permit or EIS requirements, new procedures implemented to comply with regulations, pollution abatement projects, and special studies of the fate and effect of pollutants from the site.
8. **ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION.** This section should provide an accurate description of the environmental radiological monitoring program conducted at each facility. For facilities that do not need to monitor for radioactivity in the environment, a "Not Applicable" response is sufficient.
 - a. **Radioactive Effluent Data.** Effluent data for radionuclides should be summarized. The nuclides of concern and the total number of curies in airborne and liquid effluents released to the offsite environment should be included in the portion of the report dealing with air and water monitoring, respectively. In instances where liquid effluents released to different receiving streams result in separate routes of potential exposure, the radioactivity discharged to each receiving stream should be identified. For purposes of reporting radiological effluent data, gross radioactivity measurements are unacceptable, unless specified by applicable federal, state, or local regulations.
 - b. **Environmental Sampling for Radioactivity.** Include a brief description of each of the media sampled as part of the monitoring program or as part of a special study. The type and frequency of sampling and the methods of analysis should be presented. Individual data points are not required, but tables, graphs, or text which clearly and accurately present the overall monitoring results should be provided. A map

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showing the location of monitoring stations and sampling points also should be included. As a general rule, data should be presented for radioactivity in media for which there are applicable standards or other meaningful bases for interpreting the results. Interpretation should be made, where appropriate, of how the environmental levels (resulting from site operations) compare to relevant parameters such as background radioactivity, and applicable effluent or environmental standards.

- c. Reporting Potential Dose to the Public. The Environmental Report should contain an assessment of the potential radiation exposure to the public which could have resulted from site operations during the calendar year. The assessment should be as accurate and realistic as possible. The modeling and calculation methodology used in the dose assessment should be included or referenced. A comparison of results with applicable standards and relevant parameters (e.g., natural and manmade sources of exposure) also should be included.
- d. Reporting Units. The following units should be used in reporting radiological data:
 - (1) Air. uCi/ml (for tritium, report in pCi/ml; for uranium and thorium, also include pg/ml).
 - (2) Sediment. uCi/g or pCi/g dry weight. Specify sample depth and method of obtaining dry weight. For uranium and thorium, also include ug/g dry or wet weight, where possible. For tritium, the concentration may be expressed in uCi/ml of moisture content in unit volume of wet samples.
 - (3) Food and Vegetation. uCi/g or pCi/g dry weight. Specify percent moisture and method of obtaining dry weight. For tritium, the concentration may be expressed in uCi/ml of moisture content in unit volume of wet samples.
 - (4) Milk. uCi/ml.
 - (5) Penetrating Radiation. mrem/yr.
 - (6) Soil. Three possible reporting units:
 - (a) uCi/m2 (or pCi/m2). Specify sample depth or profile depth. For tritium, the concentration may be expressed in uCi/ml of soil moisture;

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- (b) uCi/g (or pCi/g) dry weight. Specify sample depth and method of obtaining dry weight;
- (c) For uranium and thorium, also include ug/g dry or wet weight.

(7) Water. uCi/ml.

9. ENVIRONMENTAL, NON-RADIOLOGICAL, PROGRAM INFORMATION. This section should provide an accurate description of the environmental non-radiological monitoring program conducted at each facility. For facilities that do not need to monitor non-radiological pollution, a "Not Applicable" response is sufficient.

- a. Effluent Data. Effluent monitoring data should be summarized. Pollutants of concern and discharge volumes in airborne and liquid effluents released to the environment should be included in the portion of the report dealing with air and water monitoring, respectively.
- b. Environmental Sampling for Non-Radiological Pollution. Include a brief description of each of the media sampled as part of the monitoring program or as part of a special study. The type and frequency of sampling and the methods of analysis should be presented. Individual data points are not required, but tables, graphs, or text which clearly and accurately present the overall monitoring results should be provided. A map showing the location of monitoring stations and sampling points also should be included.

As a general rule, data should be presented for which there are applicable standards or other meaningful bases for interpreting the results. Interpretation should be made, where appropriate, of how the environmental levels (resulting from site operations) compare to relevant parameters such as background levels, and applicable effluent or environmental standards.

- c. Reporting Units. In reporting non-radiological data, units should agree with those specified by the analytical methods. Where applicable, reporting units should agree with the units specified on permits issued under regulatory programs.
10. GROUNDWATER PROTECTION. The groundwater protection program should be summarized, including a review of the monitoring program that describes the number of wells, sampling method, sampling frequency, analyses performed and a summary of results. There also should be a summary of the hydrogeology of the site, major aquifers, movement of groundwater, potential sources of groundwater pollution, and uses of groundwater in the vicinity of the site.

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11. QUALITY ASSURANCE. A quality assurance section should summarize the measures taken to ensure the quality of monitoring data. The overall program, including sampling, analysis, and data management, should be described for both radioactive and nonradioactive effluent and environmental monitoring. A summary of results from participation in interlaboratory cross-check programs should be included, listing site results and expected results.
12. REFERENCES. A section should list applicable references and other documents cited in the body of the report.
13. DISTRIBUTION LIST. A standard distribution list of those persons or organizations receiving copies of the report should be included.

Attachment B

SAER Checklist

Task	March	April	May	June	July	August	Sept	Oct
All data available Air Sewage Water Soil Vegetation Radiation Dose Assessment Meteorology Noise								
Draft tables proofed and corrections submitted Air Sewage Water Soil Vegetation Radiation Dose Assessment Meteorology Noise								
Quality assurance proofing of tables Air Sewage Water Soil Vegetation Radiation Dose Assessment Meteorology Noise								
Review previous SAER sampling locations: Submit changes Air Sewage Water Soil Vegetation Radiation Dose Assessment Meteorology Noise								

SAER Checklist (continued)								
Task	March	April	May	June	July	August	Sept	Oct
Review previous SAER chapter introduction, procedures, discussion, impacts. Submit changes Air Sewage Water Soil Vegetation Radiation Dose Assessment Noise								
Draft compliance and permitting sections								
Draft executive summary & pro- gram summaries								
Draft quality assurance chapter(s)								
Cover design sketches final design								
Cover review and approval								
Color authorization, if necessary								
Edit and layout								
Internal and DOE-SF review Air Sewage Water Soil Vegetation Radiation Dose Assessment Noise								
Correction cycle and final layout								
Submit to DOE for final draft review, EPD & TID Blue sheets								

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Attachment C

Sample Annual Environmental Report Review Comment Form

Annual Environmental Report Review Comments

Page _____ of _____

Review for:				
Reviewer Information:				
Name		Directorate:	Telephone	Date Reviewed
Page #	Line #	Chapter #	Comment	Response

Attachment D
Sample Author Approval Form

I certify that the chapter(s) of the 199_ SAER that I authored, including text and data tables, accurately represent the data and monitoring processes for 199_. This information is true, accurate, and complete to the best of my knowledge.

Environmental Analyst for Sewage Monitoring

Date

Environmental Analyst for Radiation Monitoring

Date

Environmental Analyst for Water Monitoring

Date

Environmental Analyst for Air Monitoring

Date

Environmental Analyst for Radiation Monitoring

Date

Environmental Analyst for Dose Assessment

Date

Environmental Analyst for Soil Monitoring and
Vegetation and Foodstuffs Monitoring

Date

EMS Section Leader

Date

EMS Quality Assurance Coordinator

Date

Attachment E
Sample SAER Project Leader/Editor Approval Form

I certify that all of the corrections required by the authors, internal reviewers, and DOE-SF for the 199_ SAER have been accurately implemented. This information is true, accurate, and complete to the best of my knowledge.

SAER Project Leader

Date

TID Editor

Date

Attachment F
Sample Draft SAER Transmittal Letter

September 17, 199_

_____, Director
Laboratory Operations Division
U.S. Department of Energy
San Francisco Field Office
1333 Broadway
Oakland, CA 94612

SUBJECT: Final Draft 1992 Annual Environmental Report of LLNL

Dear Mr. _____

Enclosed please find five (5) copies of the final draft Lawrence Livermore National Laboratory 199_ Annual Environmental Report and a signed statement certifying the validity of the monitoring data.

If you have technical questions, please call *TAMM Group Leader* at ext. 2-____, otherwise, please call me.

Sincerely,

Associate Director
Plant Operations
Lawrence Livermore National Laboratory

Enclosures

cc: M. Cornell, DOE-SF
H. Galles, LLNL, L-192
B. Isherwood, LLNL, L-621
J. Sims, LLNL, L-621

Attachment G
Sample SAER Certification

**Certification of Validity of
199_ Annual Environmental Report Monitoring Data**

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. The information submitted is true, accurate, and complete to the best of my knowledge and belief.

Quality Assurance Coordinator
Environmental Monitoring Section
Environmental Protection Department
Lawrence Livermore National Laboratory

Date

Section Leader
Environmental Monitoring Section
Environmental Protection Department
Lawrence Livermore National Laboratory

Date

Division Leader
Environmental Monitoring and Analysis Division
Environmental Protection Department
Lawrence Livermore National Laboratory

Date

Department Head
Environmental Protection Department
Lawrence Livermore National Laboratory

Date

Associate Director
Plant Operations
Lawrence Livermore National Laboratory

Date

EMP-QA-AR

ANALYTICAL REQUIREMENTS

Prepared by:

Gretchen Gallegos 12/4/92
Gretchen Gallegos
Acting Group Leader, IMG
date

Reviewed by:

Brian Balke 12/3/92
Brian Balke
Environmental Analyst, EMG
date

Paula Tate 12/3/92
Paula Tate
Environmental Analyst, SMG
date

William Hoppes 12/4/92
William Hoppes
Group Leader, EMG
date

Barbara Fields 12/4/92
Barbara Fields
Environmental Analyst, SMG
date

Duane Rueppel 12/3/92
Duane Rueppel
Group Leader, TSG
date

Kris Surano 12/3/92
Kris Surano
Group Leader, SMG
date

Rebecca Ward 12-3-92
Rebecca Ward
Environmental Technician, TSG
date

Approved by:

Rebecca A. Failor 12/3/92
Rebecca A. Failor
Section Leader, EMS
date

Lucinda M. Garcia 12/3/92
Lucinda M. Garcia
Quality Assurance Coordinator, EMS
date

Concurrence:

Larry Pendexter 12/9/92
Larry Pendexter
Quality Assurance Manager, EPD
date

LLNL ENVIRONMENTAL
MONITORING SECTION
UNCONTROLLED COPY
FOR INFORMATION ONLY

1. PURPOSE

This procedure states the analytical requirements for all analytical laboratories providing analysis of Environmental Monitoring Section (EMS) samples. It provides a consistent format for producing and reporting analytical results that will enable members of the EMS to analyze data in a thorough and professional manner. All environmental samples analyzed for the EMS must follow this guidance unless specifically exempted in writing by either the Surveillance Monitoring Group (SMG) Group Leader or the Effluent Monitoring Group (EMG) Group Leader.

2. APPLICABILITY/DISCUSSION

This procedure applies to all contract and LLNL analytical laboratories that provide analytical services for the EMS. The analytical laboratories must have the capability to perform detailed analytical procedures using EPA, ASTM, and other standard methods (Refs. 1-3), specified by EMS, that can be used to determine accurately and precisely the widely varying concentrations of chemical and radioactive constituents in diverse environmental media.

The analytical techniques applied to the samples of the various media must be capable of providing meaningful data. At a minimum, the analytical technique must be sufficiently sensitive to demonstrate regulatory compliance; in many instances, the analytical techniques are prescribed by law. However, not all media sampling is set by regulation. In some cases, to achieve the goals of its monitoring program, the EMS must go beyond regulatory requirements and use other techniques or, if necessary, develop new ones to provide data sufficient to support the assessment of LLNL operations.

Environmental samples are collected at or near the LLNL Livermore Site, in the Livermore Valley, at Site 300 (near Tracy, CA), and in other nearby areas as determined by EMS Environmental Analysts. Laboratory analyses normally are performed Monday through Friday, during normal working hours. However, the analytical laboratory must be capable of providing service 24 hours per day, if required, including Saturdays, Sundays, and holidays.

3. REFERENCES

1. U.S. EPA Test Methods for Evaluating Solids and Water, Physical/Chemical Methods, Document No. SW 846.
2. U.S. EPA Regulations for Test Procedures for the Analysis of Pollutants, 40 CFR 136.
3. U.S. EPA Methods for the Determination of Organic Compounds in Drinking Water, Document No. EPA-600/4-88/039.
4. EMP-QA-SD, *Sample Tracking Documentation*
5. EMP-QA-DC, *Document Retention Center*
6. EMP-QA-DM, *Data Management*
7. EMP-QA-NCR, *Nonconformance Reports*

4. DEFINITIONS

Analytical laboratory: A contract or LLNL laboratory that analyzes environmental media samples for the EMS. Primary analytical laboratories are those laboratories performing more than 75% of analyses for a particular analyte from a particular media.

ASTM: American Society for Testing and Materials.

REVISION 1 FINAL	EMP-QA-AR Analytical Requirements	Effective date: 01/04/93 Page 3 of 23
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Method Detection Limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero.

QA Record: A completed document that furnishes evidence of the quality of items and/or quality-affecting activities.

Reporting Detection Limit (RDL): The method detection limit for the analyses of a particular sample; the RDL is affected by sample size, sample dilution, sample digestion, or other techniques necessary to prepare a sample for a specific analytical technique.

Rush Analyses: Analyses that must be performed as quickly as possible and for which LLNL pays additional compensation to the analytical laboratory.

STLC: Soluble Threshold Limit Concentration (extraction in water).

TICH: Total Identifiable Chlorinated Hydrocarbons.

TTLC: Total Threshold Limit Concentration (typically, a complete dissolution in acid).

TCLP: Toxicity Characteristic Leaching Procedure, an EPA-designated leaching procedure for solids.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS Section Leader is responsible for reviewing and approving all contracts and agreements for analytical services.

5.2. EMS GROUP LEADERS

The Group Leaders are responsible for reviewing and approving all contracts and agreements for analytical services for their groups.

5.3. EMS QUALITY ASSURANCE COORDINATOR

The EMS QA Coordinator is responsible for reviewing and approving all contracts and agreements for analytical services to assure that the requirements for quality assurance are met.

5.4. ENVIRONMENTAL ANALYSTS

The Environmental Analysts are responsible for reviewing and approving all contracts and agreements for analytical services to assure that the analytical requirements for their environmental media are met.

5.5. ANALYTICAL LABORATORY

The analytical laboratory is responsible for providing analyses consistent with the requirements of this procedure.

6. PROCEDURE

Equipment Required:

N/A

6.1. GENERAL QUALIFICATION REQUIREMENTS FOR ANALYTICAL LABORATORIES

All analytical laboratories must be certified by the State of California and must have carefully documented and acceptable analytical and QA/QC plans and procedures. The analytical laboratories must agree to comply with EMS QA plans and procedures, including, but not limited to, chain-of-custody procedures, specified analytical procedures, specified detection limits, data reporting, turn-around times, electronic data transmittal, discrepancy reporting, audits, and corrective action. For the media and analytes specified by LLNL, all analytical laboratories must participate in mutually acceptable, nationally recognized cross-check programs (such as the DOE Quality Assessment Program conducted by the Environmental Measurements Laboratory in New York, NY; the EPA Radioactivity Laboratory Intercomparison Studies Program conducted by the EPA Monitoring Services Laboratory in Las Vegas, NV; and the EPA Water Pollution Performance Evaluation Study conducted by the EPA Monitoring Support Laboratory, Cincinnati, OH).

The analytical laboratory must have qualified, trained and experienced laboratory technicians who are capable of performing the requisite analyses, and qualified, trained and experienced chemists to oversee these activities and ensure acceptable QA/QC practices.

The analytical laboratories must provide EPA-approved sample containers with appropriate sample preservation material included. Samples in analytical laboratory custody must be kept in an appropriate sample storage facility. Written sample-handling and custodial procedures, following criteria acceptable to the State of California, must be maintained.

Analytical laboratories must be familiar with and must follow appropriate materials handling and personnel safety precautions for materials of unknown identity and concentration. Some analyses will involve unknown materials in samples. The analytical laboratories are also responsible for proper disposal of samples following analysis, in accordance with appropriate state and federal guidelines governing the disposal of hazardous waste.

The analytical laboratories must be able to accept and process emergency or rush samples, potentially during off-hours, with turnaround times limited to those specified in analytical and quality assurance procedures.

6.2. TECHNICAL REQUIREMENTS FOR ANALYTICAL LABORATORIES

6.2.1. NONRADIOLOGICAL ANALYSES

Analytical laboratories conducting nonradiological analyses must be capable of performing the following analyses (or their equivalents) as appropriate and requested by LLNL staff:

Organic compounds—EPA Methods 502.1, 502.2, 524.1, 524.2, 525.1, 601, 602, 608, 624, 625, 5020, 8010, 8015, 8020, 8030, 8080, 8240, 8250, 8270.

Metals—EPA 6010/7000 and 200 series; and California Assessment Manual (CAM) metals.

Cyanides—EPA 335/9010 series.

Oil and grease—EPA 413 series.

Toxicity test—Aquatic 96-hour LC₅₀ toxicity test.

Water quality characterization analyses—CCR Title 22 (sections 66699 subpart b and c, 66700, 66702 and 66708), 40 CFR section 261.31 subpart c, and in TICH and STLTC/TTLTC/TCLP extraction procedures.

6.2.2. RADIOLOGICAL ANALYSES

Analytical laboratories providing radioanalytical services must be capable of performing gross alpha and gross beta analyses with EPA method 9310; tritium analyses; gamma spectrometry; and isotopic uranium, radium, plutonium, americium, and beryllium-7 analyses.

6.2.3. QA/QC ANALYSES

Analytical laboratories performing QA/QC support must be able to perform the same battery of analyses (radiological/nonradiological) as the primary analytical laboratories on approximately 10% of the routine samples collected. In addition, the QA/QC analytical laboratories must be capable of providing LLNL representatives with blanks and a range of analytical standards (matrix spikes) that can be submitted to the various analytical laboratories as "blind" QC samples at LLNL discretion. Such standards must be produced according to LLNL specifications and must be traceable to NIST standards.

6.3. SPECIFIC LIMITS OF SENSITIVITIES

The required limits of sensitivities for the analyses conducted on environmental samples vary by media and by analyte. These are presented in tabular form below.

6.3.1. SEWER SAMPLE LIMITS OF SENSITIVITIES

Table 1. Limit of sensitivity and accuracy for compliance monitoring of radiation discharges to the LLNL sanitary sewer.

Analyte	Limit of Sensitivity [$\mu\text{Ci/mL}$]	Accuracy [$\pm 2\sigma\%$]	DOE DCG [$\mu\text{Ci/mL}$]
³ H	0.27×10^{-6}	5	$10,000 \times 10^{-6}$
alpha	5.5×10^{-9}	70	N/A
beta	9.4×10^{-9}	30	N/A
¹³⁷ Cs	10×10^{-12}	20	15×10^{-6}
²³⁹ Pu	0.2×10^{-12}	20	15×10^{-6}

Table 2. Weekly metals analysis.

Metal	EPA Method	Sensitivity [mg/L]	Permit Limit [mg/L]
Aluminum	200.7	0.01	N/A
Arsenic	200.7	0.002	0.06
Beryllium	200.7	0.0001	N/A
Cadmium	200.7	0.0003	0.14
Chromium	200.7	0.0005	0.62
Copper	200.7	0.001	1.0
Iron	200.7	0.005	N/A
Lead	200.7	0.0017	0.20
Mercury	245.1	0.0001	0.01
Nickel	200.7	0.0005	0.61
Silver	200.7	0.0002	0.2
Zinc	200.7	0.005	3.00

6.3.2. WATER SAMPLE LIMITS OF SENSITIVITIES

Table 3. Limits of sensitivities for water.

Analyte	Size of aliquot	Sensitivity	Counting time
Gross alpha	N/A	1.65 pCi/L	100 min
Gross beta	N/A	1.65 pCi	100 min
Uranium	1 L	0.05 pCi/L	1000 min
²²⁶ Ra	40 mL	0.1 pCi/L	50 min
⁹⁰ Sr	1 L	0.08 pCi/L	100 min
³ H	10 mL	200-250 pCi/L	100 min

Table 4. Method detection limits for halogenated volatile organic compounds in water samples (EPA 601).

Analyte	Detection Limit (µg/L)
Chloromethane	0.08
Bromomethane	1.18
Dichlorodifluoromethane	1.81
Vinyl chloride	0.18
Chloroethane	0.52
Methylene chloride	0.25
Trichlorofluoromethane	not determined (nd)
1,1-Dichloroethene	0.13
1,1-Dichloroethane	0.07
trans-1,2-Dichloroethene	0.10
Chloroform	0.05
1,2-Dichloroethane	0.03
1,1,1-Trichloroethane	0.03
Carbon tetrachloride	0.12
Bromodichloroethane	0.10
1,2-Dichloropropane	0.04

Table 4. (Continued)

Analyte	Detection Limit (µg/L)
cis-1,3-Dichloropropene	0.34
Trichloroethene	0.12
Dibromochloromethane	0.09
1,2,2-Trichloroethane	0.02
trans-1,3-Dichloropropene	0.20
2-Chloroethylvinyl ether	0.13
Bromoform	0.20
1,1,2,2-Tetrachloroethane	0.03
Tetrachloroethene	0.03
Chlorobenzene	0.25
1,3-Dichlorobenzene	0.32
1,2-Dichlorobenzene	0.15
1,4-Dichlorobenzene	0.24

Table 5. Method detection limits for halogenated volatile organic compounds in water samples (EPA 624).

Analyte	Detection Limit (µg/L)
Chloromethane	nd
Bromomethane	nd
Vinyl chloride	nd
Chloroethane	nd
Methylene chloride	2.8
Trichlorofluoromethane	nd
1,1-Dichloroethene	2.8
1,1-Dichloroethane	4.7
trans-1,2-Dichloroethene	1.6
Chloroform	1.6
1,2-Dichloroethane	2.8
1,1,1-Trichloroethane	3.8
Carbon tetrachloride	2.8
Bromodichloroethane	2.2
1,2-Dichloropropane	6.0
cis-1,3-Dichloropropene	5.0
Trichloroethene	1.9
Benzene	4.4
Dibromochloromethane	3.1
1,2,2-Trichloroethane	5.0
trans-1,3-Dichloropropene	nd
2-Chloroethylvinyl ether	nd
Bromoform	4.7
1,1,2,2-Tetrachloroethane	6.9
Tetrachloroethene	4.1
Toluene	6.0
Chlorobenzene	6.0
Ethyl benzene	7.2

Table 5. (Continued)

Analyte	Detection Limit (µg/L)
1,3-Dichlorobenzene	nd
1,2-Dichlorobenzene	nd
1,4-Dichlorobenzene	nd

Table 6. Method detection limits for pesticides and PCBs in water samples (EPA 608).

Analyte	Detection limit (µg/L)
BHC, alpha isomer	0.003
BHC, gamma isomer (Lindane)	0.004
BHC, beta isomer	0.006
Heptachlor	0.003
BHC, delta isomer	0.009
Aldrin	0.004
Heptachlor epoxide	0.083
Endosulfan I	0.014
4,4'-DDE	0.004
Dieldrin	0.002
Endrin	0.006
4,4'-DDD	0.011
Endosulfan II	0.004
4,4'-DDT	0.012
Endrin aldehyde	0.023
Endosulfan sulfate	0.066
Chlordane	0.014
Toxaphene	0.24
PCB 1016	nd
PCB 1221	nd
PCB 1232	nd
PCB 1242	0.065
PCB 1248	nd
PCB 1254	nd
PCB 1260	nd

Table 7. Method detection limits for volatile organic compounds in water samples (EPA 602).

Analyte	Detection Limit (µg/L)
Benzene	0.2
Toluene	0.2
Ethylenebenzene	0.2
Chlorobenzene	0.2
1,4-Dichlorobenzene	0.3
1,3-Dichlorobenzene	0.4
1,2-Dichlorobenzene	0.4

Table 8. Method detection limits for halogenated volatile organic compounds in drinking water samples (EPA 502.1).

Analyte	Detection Limit (µg/L)
Bromodichloroethane	0.003
Bromoform	0.05
Carbon tetrachloride	0.003
Chlorobenzene	0.005
Chloroethane	0.008
2-Chloroethylethyl ether	0.02
Chloromethane	0.01
Dibromochloromethane	0.008
1,2-Dibromoethane	0.04
1,1-Dichloroethane	0.003
1,2-Dichloroethane	0.002
1,1-Dichloroethene	0.003
1,2-Dichloroethene	0.002
1,1,2,2-Tetrachloroethane	0.01
Tetrachloroethene	0.001
1,1,1-Trichloroethane	0.003
1,1,2-Trichloroethane	0.007
Trichloroethene	0.001
Vinyl chloride	0.01

Table 9. Method detection limits for halogenated volatile organic compounds in drinking water samples (EPA 502.2).

Analyte	Detection Limit (µg/L)			
	Column 1		Column 2	
	PD	ECD	PD	ECD
Benzene	0.01	-	0.01	-
Bromobenzene	0.01	0.03	0.04	0.14
Bromochloromethane	-	0.01	-	0.01
Bromodichloromethane	-	0.02	-	0.10
Bromoform	-	1.6	-	0.09

Table 9. (Continued)

Analyte	Detection Limit ($\mu\text{g/L}$)			
	Column 1		Column 2	
	PD	ECD	PD	ECD
Bromomethane	—	1.1	—	0.19
n-Butylbenzene	0.02	—	0.03	—
sec-Butylbenzene	0.02	—	0.03	—
tert-Butylbenzene	0.06	—	0.06	—
Carbon tetrachloride	—	0.01	—	0.02
Chlorobenzene	0.01	0.01	0.02	N.D.
Chloroethane	—	0.1	—	0.13
Chloroform	—	0.02	—	0.01
Chloromethane	—	0.03	—	0.10
2-Chlorotoluene	N.D.	0.01	0.03	0.04
4-Chlorotoluene	0.02	0.01	0.02	0.07
1,2-Dibromo-3-chloropropane	—	3.0	—	0.20
Dibromochloromethane	—	0.3	—	0.05
1,2-Dibromoethane	—	0.8	—	0.17
Dibromomethane	—	2.2	—	0.10
1,2-Dichlorobenzene	0.05	0.02	0.03	0.04
1,3-Dichlorobenzene	0.02	0.02	0.02	0.07
1,4-Dichlorobenzene	0.01	0.01	0.03	0.04
Dichlorodifluoromethane	—	0.05	—	0.29
1,1-Dichloroethane	—	0.07	—	0.03
1,2-Dichloroethane	—	0.03	—	0.03
1,1-Dichloroethene	N.D.	0.07	0.10	0.04
cis-1,2-Dichloroethene	0.02	0.01	0.03	0.05
trans-1,2-Dichloroethene	0.05	0.06	0.03	0.05
1,2-Dichloropropane	—	0.01	—	0.03
1,3-Dichloropropane	—	0.03	—	0.02
2,2-Dichloropropane	—	0.05	—	N.D.
1,1-Dichloropropane	0.02	0.02	0.05	0.02
cis-1,3-Dichloropropene	N.D.	N.D.	0.06	0.08
trans-1,3-Dichloropropene	N.D.	N.D.	0.06	0.10
Ethylbenzene	0.01	—	0.04	—
Hexachlorobutadiene	0.06	0.02	0.09	0.05
Isopropylbenzene	0.05	—	0.02	—
p-Isopropyltoluene	0.01	—	0.02	—
Methylene chloride	—	0.02	—	0.01
Naphthalene	0.06	—	0.02	—
n-Propylbenzene	0.01	—	0.03	—
Styrene	0.01	—	0.1	—
1,1,1,2-Tetrachloroethane	—	0.01	—	N.D.
1,1,2,2-Tetrachloroethane	—	0.01	—	0.02
Tetrachloroethene	0.05	0.04	0.04	0.02
Toluene	0.01	—	0.02	—

Table 9. (Continued)

Analyte	Detection Limit (µg/L)			
	Column 1		Column 2	
	PD	ECD	PD	ECD
1,2,3-Trichlorobenzene	N.D.	0.03	0.05	0.06
1,2,4-Trichlorobenzene	0.02	0.03	0.06	0.08
1,1,1-Trichloroethane	-	0.03	-	0.01
1,1,2-Trichloroethane	-	N.D.	-	0.04
Trichloroethene	0.02	0.01	0.03	0.06
Trichlorofluoromethane	-	0.03	-	0.34
1,2,3-Trichloropropane	-	0.4	-	0.02
1,2,4-Trichloropropane	0.05	-	0.02	-
1,3,5-Trimethylbenzene	0.01	-	0.03	-
Vinyl chloride	0.02	0.04	0.01	0.18
o-xylene	0.02	-	0.02	-
m-xylene	0.01	-	0.02	-
p-xylene	0.01	-	0.02	-

Note: PD is an abbreviation for Photoionization Detector, ECD is an abbreviation for Electrolytic Conductivity Detector, "-" are place when the detector did not respond, and N.D. stands for not determined.

Table 10. Method detection limits for purgeable organic compounds in water samples (EPA 524.1).

Analyte	Detection Limit (µg/L)
Benzene	0.1
Bromobenzene	0.1
Bromodichloroethane	0.5
Bromoform	0.7
Carbon tetrachloride	0.3
Chlorobenzene	0.1
Chloroethane	0.2
Dibromochloromethane	0.4
1,2-Dibromo-3-chloropropane	2
1,2-Dibromoethane	0.4
Dibromomethane	0.3
1,2-Dichlorobenzene	1
1,4-Dichlorobenzene	2
Dichlorofluoromethane	0.3
1,1-Dichloroethane	0.2
1,2-Dichloroethane	0.2
1,1-Dichloroethene	0.2
trans-1,2-Dichloroethene	0.2
1,2-Dichloropropane	0.2
1,3-Dichloropropane	0.1
Methylene chloride	1

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Table 10. (Continued)

Analyte	Detection Limit (µg/L)
Styrene	0.2
1,1,2,2-Tetrachloroethane	0.4
Tetrachloroethene	0.3
Toluene	0.1
1,1,1-Trichloroethane	0.3
Trichloroethene	0.4
Trichlorofluoroethane	0.2
Vinyl chloride	0.3
o-xylene	0.2
p-xylene	0.3

Table 11. Method detection limits for purgeable organic compounds in water samples (EPA 524.2).

Analyte	Detection Limit (µg/L)
Benzene	0.04
Bromobenzene	0.03
Bromochloromethane	0.04
Bromodichloromethane	0.08
Bromoform	0.12
Bromomethane	0.11
n-Butylbenzene	0.11
sec-Butylbenzene	0.13
tert-Butylbenzene	0.14
Carbon tetrachloride	0.21
Chlorobenzene	0.04
Chloroethane	0.10
Chloroform	0.03
Chloromethane	0.13
2-Chlorotoluene	0.04
4-Chlorotoluene	0.05
Dibromochloromethane	0.05
1,2-Dibromo-3-chloropropane	0.26
1,2-Dibromoethane	0.06
Dibromomethane	0.24
1,2-Dichlorobenzene	0.03
1,3-Dichlorobenzene	0.12
1,4-Dichlorobenzene	0.03
Dichlorodifluoromethane	0.10
1,1-Dichloroethane	0.04
1,2-Dichloroethane	0.06
1,1-Dichloroethene	0.12
cis-1,2-Dichloroethene	0.12
trans-1,2-Dichloroethene	0.06
1,2-Dichloropropane	0.04
1,3-Dichloropropane	0.04

Table 11. (Continued)

Analyte	Detection Limit (µg/L)
2,2-Dichloropropane	0.35
1,1-Dichloropropane	0.10
Ethylbenzene	0.06
Hexachlorobutadiene	0.11
Isopropylbenzene	0.15
4-Isopropyltoluene	0.12
Methylene chloride	0.03
Naphthalene	0.04
n-Propylbenzene	0.04
Styrene	0.04
1,1,1,2-Tetrachloroethane	0.05
1,1,2,2-Tetrachloroethane	0.04
Tetrachloroethene	0.14
Toluene	0.11
1,2,3-Trichlorobenzene	0.03
1,2,4-Trichlorobenzene	0.04
1,1,1-Trichloroethane	0.08
1,1,2-Trichloroethane	0.10
Trichloroethene	0.19
Trichlorofluoromethane	0.08
1,2,3-Trichloropropane	0.32
1,2,4-Trichloropropane	0.13
1,3,5-Trimethylbenzene	0.05
Vinyl chloride	0.17
o-xylene	0.11
m-xylene	0.05
p-xylene	0.13

Table 12. Method detection limits for pesticides and PCBs in water (EPA 525.1; generally measured at 0.2 µg/L, those with asterisks measured at 2 µg/L).

Analyte	Detection limit (µg/L)	
	Ion Trap	Magnetic Sector
Perylene-D12	0.1	0.2
Acenaphthylene	0.1	0.1
Aldrin	0.1	0.1
Anthracene	0.04	0.1
Atrazine	0.1	0.3
Benz[a]anthracene	0.04	0.2
Benz[b]fluoranthene and	0.2	0.3
Benz[k]fluoranthene		
Benzo[a]pyrene	0.04	0.1
Benzo[g,h,i]perylene	0.1	0.1
Butylbenzenephthalate	0.3	0.5
Chlordane components	0.2	0.1
alpha-chlordane	0.1	0.3

Table 12. (Continued)

Analyte	Detection limit (µg/L)	
	Ion Trap	Magnetic Sector
gamma-chlordane	0.3	0.1
trans nonaclor	0.1	0.1
Chrysene	0.04	0.3
Dibenz[a,h]anthracene	0.1	0.1
Di-n-butylphthalate	0.3	4
2,3-Dichlorobiphenyl	0.1	0.2
Diethylphthalate	0.8	0.6
Di(2-ethylhexyl)phthalate	0.6	0.8
Di(2-ethylhexyl)adipate	0.6	0.5
Dimethylphthalate	0.04	0.3
Endrin	0.5	1
Flourene	0.2	0.1
Heptachlor	0.04	0.2
Heptachlor expoxide	0.2	0.3
2,2',3,3',4,4',5-Heptachlorobiphenyl	0.1	0.04
Hexachlorobenzene	0.1	0.2
2,2',4,4',5,6'-Heptachlorobiphenyl	0.1	0.1
Hexachlorocyclopentadiene	0.03	0.1
Indeno[1,2,3,c,d]pyrene	0.1	0.02
Lindane	0.1	0.1
Methoxychlor	0.04	0.3
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	0.2	0.1
2,2',3',4,6-Pentachlorobiphenyl	0.1	0.1
Pentachlorophenol	0.3	3
Phenanthrene	0.01	0.2
Pyrene	0.02	0.1
Simazine	0.2	0.2
2,2',4,4'-Tetrachlorobiphenyl	0.1	0.1
Toxaphene	15*	9*
2,4,5-Trichlorobiphenyl	0.06	0.12
Arachlor		1.0

Table 13. Reporting detection limits for chemical and physical analyses of water samples (in mg/L unless otherwise noted).

Analyte	Detection limit (mg/L)
Ammonia nitrogen (as N)	0.02
Arsenic	0.002
Cadmium	0.0005
Carbonate alk (as CaCO ₃)	1
Chloride	1
Chromium	0.005
Copper	0.05

Table 13. (Continued)

Analyte	Detection limit (mg/L)
Total dissolved solids (TDS)	10
Fluoride	0.1
Iron	0.1
Manganese	0.05
Mercury	0.0005
Nickel	0.1
Nitrate (as N)	0.1
Nitrate (as NO ₃)	0.4
Nitrate plus nitrite (as NO ₃)	0.4
Low level phenolics	0.005
Total suspended solids (TSS)	1
Selenium	0.002
Silver	0.0005
Sodium	5
Sulfate	1
Total Kjeldahl nitrogen	0.5
Vanadium	0.05
Quadruplicate TOC	0.5
Quadruplicate TOX	0.02
Quadruplicate beryllium	0.0005
Quadruplicate lead	0.002
Quadruplicate barium	0.05
Conductivity	1 µmhos/cm

Table 14. Reporting detection limits for volatile organic compound analyses of drinking water samples (EPA 502.2; in µg/L unless otherwise noted).

Analyte	Detection limit (µg/L)
Benzene	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromodichloromethane	0.5
Bromoform	0.5
Bromomethane	0.5
n-Butylbenzene	0.5
sec-Butylbenzene	0.5
tert-Butylbenzene	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
Chloroethane	0.5
Chloroform	0.5
Chloromethane	0.5
2-Chlorotoluene	0.5
4-Chlorotoluene	0.5
Dibromochloromethane	0.5
1,2-Dibromo-3-chloropropane	0.5

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Table 14. (Continued)

Analyte	Detection limit (µg/L)
1,2-Dibromoethane	0.5
1,2-Dichlorobenzene	0.5
1,3-Dichlorobenzene	0.5
1,4-Dichlorobenzene	0.5
Dichlorodifluoromethane	0.5
1,1-Dichloroethane	0.5
1,2-Dichloroethane	0.5
1,1-Dichloroethene	0.5
trans-1,2-Dichloroethene	0.5
cis-1,2-Dichloroethene	0.5
1,2-Dichloroethene (total)	0.5
1,2-Dichloropropane	0.5
1,3-Dichloropropane	0.5
2,2-Dichloropropane	0.5
1,1-Dichloropropene	0.5
Ethylbenzene	0.5
cis-1,3-Dichloropropene	0.5
trans-1,3-Dichloropropene	0.5
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
para-Isopropyltoluene	0.5
Methylene chloride	0.5
Naphthalene	0.5
n-Propylbenzene	0.5
1,1,2,2-Tetrachloroethane	0.5
1,1,1,2-Tetrachloroethane	0.5
Tetrachloroethene	0.5
Toluene	0.5
1,2,3-Trichlorobenzene	0.5
1,2,4-Trichlorobenzene	0.5
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethene	0.5
Trichlorofluoromethane	0.5
Freon 113	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	0.5
1,3,5-Trimethylbenzene	0.5
Vinyl Chloride	0.5
o-Xylene and Styrene	0.5
p,m-Xylenes	0.5
Surrogate: Bromofluorobenzene	LCL:60 UCL:132

6.3.3. SOIL AND SEDIMENT SAMPLE LIMITS OF SENSITIVITIES

Table 15. Limits of sensitivities for radionuclides in soil and sediment samples.

Isotope	Detection limit
Plutonium-239	0.0001 pCi/g
Tritium	120 pCi/L
Potassium-40	1.0 pCi/g
Cesium-137	0.03 pCi/g
Radium-226	0.2 pCi/g
Radium-228	0.05 pCi/g
Thorium-232	0.2 pCi/g
Uranium-235	0.2 pCi/g
Uranium-238	0.5 µg/g
Americium-241	0.02 pCi/g

Table 16. Method detection limits for pesticides and PCBs in soils and sediments (EPA 8080).

Analyte	Detection limit (mg/kg)
Aldrin	0.002
Chlordane	0.01
DDD	0.002
DDE	0.002
DDT	0.007
Dieldrin	0.002
Endosulfan I	0.002
Endosulfan II	0.002
Endosulfan sulfate	0.007
Endrin	0.007
Endrin aldehyde	0.007
Heptachlor epoxide	0.002
Heptachlor	0.002
Methoxychlor	0.01
Aroclor 1016	0.01
Aroclor 1221	0.01
Aroclor 1232	0.01
Aroclor 1242	0.01
Aroclor 1248	0.01
Aroclor 1254	0.01
Aroclor 1260	0.01
Aroclor 1262	0.01
Toxaphene	0.07
BHC, alpha isomer	0.002
BHC, beta isomer	0.002
BHC, delta isomer	0.002
BHC, gamma isomer (Lindane)	0.002

Table 17. Method detection limits for halogenated volatile organic compounds in soils and sediments (EPA 8010).

Analyte	Detection Limit (mg/kg)
1,1,1-Trichloroethane	0.0002
1,1,2,2-Tetrachloroethane	0.0002
1,2,2-Trichloroethane	0.0002
1,1-Dichloroethane	0.0002
1,1-Dichloroethene	0.0002
1,2-Dichloroethane	0.0002
1,2-Dichlorobenzene	0.0002
1,2-Dichloroethene (Total)	0.0002
1,2-Dichloropropane	0.0002
1,3-Dichlorobenzene	0.0002
1,4-Dichlorobenzene	0.0002
2-Chloroethylvinylether	0.0002
Bromodichloroethane	0.0002
Bromomethane	0.0002
Bromoform	0.0002
Chlorobenzene	0.0002
Carbon tetrachloride	0.0002
Chloroethane	0.0002
Chloroform	0.0002
Dibromochloromethane	0.0002
Dichlorodifluoromethane	0.0002
Freon 113	0.0002
Methylene chloride	0.0002
Trichloroethene	0.0002
Trichlorofluoromethane	0.0002
Tetrachloroethene	0.0002
Vinyl chloride	0.0002
cis-1,2-Dichloroethene	0.0002
cis-1,3-Dichloropropene	0.0002
trans-1,2-Dichloroethene	0.0002
trans-1,3-Dichloropropene	0.0002

Table 18. Method detection limits for aromatic volatile organic compounds in soils and sediments (EPA 8020).

Analyte	Detection Limit (mg/kg)
1,2-Dichlorobenzene	0.002
1,3-Dichlorobenzene	0.002
1,4-Dichlorobenzene	0.002
Benzene	0.001
Chlorobenzene	0.001
Ethylbenzene	0.002
Toluene	0.002
Total Xylene Isomers	0.002

Table 19. Method detection limits for soils and sediments samples for metals (EPA 6010, unless indicated otherwise).

Analyte	Detection Limit (mg/L)
Arsenic (EPA 7060)	0.002
Selenium (EPA 7740)	0.002
Silver	0.05
Barium	0.05
Beryllium	0.01
Beryllium (EPA 7090)	0.04
Cadmium	0.05
Cobalt	0.05
Chromium	0.05
Copper	0.05
Molybdenum	0.2
Nickel	0.1
Lead	0.2
Antimony	0.2
Thallium	0.2
Vanadium	0.05
Zinc	0.05
Mercury (EPA 7470)	0.0005

6.3.4. AIR SAMPLE LIMITS OF SENSITIVITIES

Table 20. Method detection limits for metals.

Analyte	Sensitivity
Beryllium	0.04 µg/L
Lead	1.0 µg/L

Table 21. Limits of sensitivities for radiological air samples.

Analyte	Nominal aliquot size, liters of air volume	Sensitivity
Gross alpha	4×10^6	$1 \times 10^{-16} \mu\text{Ci/mL}$
Gross beta	4×10^6	$5 \times 10^{-16} \mu\text{Ci/mL}$
Plutonium	4×10^6	$1 \times 10^{-19} \mu\text{Ci/mL}$
Uranium	4×10^6	$5 \times 10^{-15} \mu\text{g/mL}$
Gamma-emitting nuclides	4×10^6	typically $1 \times 10^{-17} \mu\text{Ci/mL}$
Tritium	1.4×10^4	$1 \times 10^{-12} \mu\text{Ci/mL}$

6.3.5. VEGETATION AND FOODSTUFF SAMPLING LIMITS OF SENSITIVITIES

Table 22. Limits of sensitivities for vegetation and foodstuff.

Sample type	Isotope	Detection limit
Vegetation	Tritium	120.0 pCi/L
Milk	Tritium	120.0 pCi/L
	Potassium-40	0.5 pCi/L
	Cesium-137	0.150 pCi/L
Wine	Tritium	20.0 pCi/L
Honey	Tritium	50.0 pCi/L

6.3.6. ENVIRONMENTAL RADIATION SAMPLING LIMITS OF SENSITIVITIES

Table 23. Limits of sensitivities for radiation sampling.

Analyte	Sensitivity
TLDs	10 mR
Track-etch detectors	0.5 mR

6.4. QUALITY CONTROL AND AUDIT REQUIREMENTS

The analytical laboratory QC protocols must include a minimum of 10% duplicate sampling (lab splits), 10% blanks, 10% spikes, and 10% analytical standards. The results of QC analyses must be transmitted to the designated EMS representative and must be acceptable to designated LLNL personnel. The analytical laboratory and its personnel must be accessible to LLNL personnel for a preaward audit and routine annual audits of all analytical laboratory activities related to LLNL samples. The scope of the audits will include, but are not limited to, analytical instrumentation and calibration; receiving, tracking, and storage of

samples; QA/QC procedures; documentation; sample preparation methods; analytical methods; personnel training; and data validation and reporting.

LLNL will provide qualified and knowledgeable personnel, such as hydrogeologists, engineers, chemists, health physicists, environmental scientists, or geologists, who are either contractors or LLNL employees, to review work and performance. The analytical laboratory must be responsive to QA/QC questions. Noncompliance with the approved methods and procedures will be cause for an LLNL representative to interrupt or suspend the work (Reference 7).

6.5. DELIVERY OF RESULTS

Written analytical reports, with accompanying chain-of-custody documentation and QA/QC data, are to be received by the designated EMS representative within no more than 30 days (and preferably 21 days) of routine sample submittal. Preliminary results of any rush analyses are to be reported verbally, by FAX, or electronically to the designated EMS representative immediately at the completion of the analyses. Depending on the need and required analysis, a 24 to 96 hour verbal/FAX response on rush analyses will be required. The preliminary results are to be followed within five working days by a written analytical report with complete QC/QA data and chain-of-custody documentation (see Ref. 4).

Failure of the analytical laboratory to deliver analytical results within the specified times will delay our interpretation of the data, delay the progress of investigations, and may have compliance implications that could seriously erode our credibility with the regulatory community. If the analytical laboratory exceeds a method-specific sample holding time, loses or destroys a sample, fails to complete all the requested analyses, or fails to complete required documentation, the analytical laboratory will be required to pay for resampling and subsequent reanalyses for that sample. In addition, the analytical laboratory will provide a letter of explanation to LLNL that is suitable for submittal to regulatory agencies.

6.5.1. CONTENTS OF WRITTEN REPORTS

Written analytical reports are to include the following data, as applicable:

- Analytical result and associated error.
- Units and significant digits for the analytical result.
- Detection limit.
- LLNL sample number or sample identifier.
- Sample collection date.
- Date the analytical laboratory received the sample.
- Date of sample analysis.
- Requested analysis method number.
- Analytical chemist's ID.
- Date of sample digestion.
- Sample dilution values.
- Analytical laboratory's sample log number.
- Sample description.
- Chain-of-custody form number.

Written analytical reports are also to include the following QA/QC data (for each analyte):

- Laboratory Control Standards (LCS) data: batch number, method number, date of analysis, instrument ID number, analyst's ID number
- Matrix QC Precision (Lab Split/Duplicate Sample) data: batch number, method number, date of analysis, instrument ID number, analyst's ID number
- Matrix QC Accuracy (Spike) data: batch number, method number, date of analysis, instrument ID number, analyst's ID number
- Method Blank data: batch number, method number, date of analysis, instrument ID number, analyst's ID number
- Reporting Detection Limit (RDL)
- Method Detection Limit (MDL)

The analytical laboratory must provide the designated LLNL representative with the control limits or acceptance criteria used for LCS, matrix QC precision and accuracy, method blanks, and RDL data used to determine acceptance. If the control limits are unacceptable to the LLNL representative, the analytical laboratory will use contract RDL limits based on EPA or Contract Laboratory Program recommendations. All analyses will be reported in units specified by the EMS Environmental Analyst. Reporting of results as "less than the limit of sensitivity" is not acceptable; actual instrument values must be reported, even if the value is less than the limit of sensitivity or less than zero.

6.5.2. ELECTRONIC TRANSMISSION

Electronic transmission of sample results is required, in addition to written records. Electronic data transfers will be checked against written data reports by LLNL personnel. Electronic data transfer must follow established LLNL protocols. The analytical laboratory must also have the capability to FAX data on an as-needed basis.

6.6. SAMPLE RETENTION

Samples will be retained for a minimum of 30 days following the delivery of the written analytical report.

7. DOCUMENTATION/QA RECORDS

The completed and signed Chain-of-Custody form (COC; see Ref. 4) with a hard copy of the results comprises the required documentation of analytical results. Incomplete or unsigned COCs are not acceptable. Upon receipt of acceptable analytical reports, the Document Manager will file the hard copy of the reports in accordance with Ref. 5. Similarly, upon receipt of acceptable electronic data transfers, the Document Manager will update the EMS database in accordance with Ref. 6.

8. ACCEPTANCE CRITERIA

All written analytical results must be accompanied by applicable QA/QC results and sample custody documentation (including signed LLNL Chain-of-Custody forms), and must follow EMS reporting protocols. Written data reports, together with related QA/QC data and sample custody documentation, will be the only official data records. Receipt of

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such data reports and associated material is the only means for authorizing payment for the services of the analytical laboratories. Preliminary results, received verbally, by FAX, or electronically transferred, and including written reports without required QA/QC data or sample custody documentation, will not be sufficient for payment to be authorized.

LLNL, at its discretion, will perform checks of electronically downloaded data against official written data transmittals. If the data in these two forms of reporting are not identical, the results cannot be accepted and payment for analytical services involved will not be authorized. Such a discrepancy, and any other analytical service occurrences that are not in compliance with the instruction of this procedure, will result in the issuance of a Nonconformance Report (Reference 7).

9. ATTACHMENTS

N/A

EMP-QA-CD

CHANGES IN DESIGN

Prepared by:

Lucinda M Garcia 9/10/92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Reviewed by:

Kris Surano 8/25/92
Kris Surano date
Group Leader, SMG

Gretchen Gallegos 8/18/92
Gretchen Gallegos date
Acting Group Leader, IMG

Rebecca A. Failor 9/17/92
Rebecca A. Failor date
Section Leader, EMS

Approved by:

Rebecca A. Failor 9/17/92
Rebecca A. Failor date
Section Leader, EMS

Lucinda M Garcia 9/10/92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Concurrence:

Larry Pendexter 10/5/92
Larry Pendexter date
Quality Assurance Manager, EPD

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure provides a method for implementing minor changes to existing procedures. Because the review cycle required for this process is shorter than that required for creating a new procedure or making a complete revision of an existing procedure, it allows minor changes to be made relatively easily.

2. APPLICABILITY/DISCUSSION

The Environmental Monitoring Section (EMS) uses procedures to define exactly how activities are to be performed. These procedures must be updated as changes in methods, sampling locations, sampling frequencies, and other adjustments become necessary. This "Changes in Design" procedure describes the method for implementing minor changes to existing procedures and is the only alternative to complete revision of a procedure. It provides a mechanism by which changes get adequate review, are distributed to, and incorporated by all parties who need to be apprised of the change, and by which documentation of the process is accomplished. This procedure is not intended to be used for creating new procedures or making major changes to existing procedures. All Design Changes made using this procedure must be incorporated into a complete procedure revision within one year of the issuance of the first Design Change or after three Design Changes to a procedure have been made, whichever comes first.

3. REFERENCES

1. EPD QAMP *Quality Assurance Management Plan*
2. EPD QAP 5.2 *Development of Operational Procedures and Instructions*
3. EPD QAP 6.1 *Document Control*
4. EMP-QA-DC, *Document Retention Center*
5. EMP-QA-PW, *Procedure Writing*

4. DEFINITIONS

Controlled Copy: A numbered copy of an EMS controlled document that is sent to a designated copy holder with an Acknowledgment Form which must be signed and returned. If the document has been revised, any superseded or obsolete portions of the document must also be returned.

Controlled Document: A document that specifies quality requirements or prescribes activities affecting quality and whose preparation, issue, and change are subject to control.

Design Change Package: The document necessary to implement a Design Change without a complete procedure revision; it includes a title/signature page, the statement of change in design, location maps, if any, and an updated Procedures Manual Table of Contents.

Document Control: The act of assuring that controlled documents are reviewed for adequacy, approved for release by authorized personnel, and distributed to and used at the location where the prescribed activity is performed.

Information Copy: An unnumbered copy of an EMS controlled document that is given to an authorized individual on a one-time basis for informational purposes.

Procedures Manual Table of Contents: The table of contents located at the front of the EMS Procedures Manual. It must be updated and replaced every time a procedure or Design Change Package is

distributed. It includes all procedure names, revision numbers, and effective dates, as well as a list of all Design Changes and their effective dates.

Proprietary Information: Information pertaining to private individuals' names, addresses, property, or telephone numbers. Information of this nature must be held in strict confidence and divulged only on a need-to-know basis.

QA Record: Any document that can be used for quality assurance purposes to verify that a procedure or operation has been performed properly.

Reference Copy: A numbered copy of an EMS controlled document that is sent to a designated copy holder for reference use only. Designated Reference copy holders sign and return the accompanying Acknowledgment Form to certify that they have received the document, understand that they are not authorized to perform the work described in that document, and will not attempt to do so without receiving the appropriate training and certification.

Responsible Party: The person responsible for all aspects of the preparation of a procedure or a Design Change Package. The Responsible Party may author the document or may delegate the authorship. This role is typically filled by an Environmental Analyst, but can be filled by the Data Manager or other EMS personnel as assigned by management.

Revision Number: The revision number refers to a complete update of a procedure. New procedures are designated Revision 0.

Sanctioned Copy: A numbered copy of an EMS document that is sent to a designated copy holder along with an Acknowledgment Form. Sanctioned copy holders sign and return the Acknowledgment Form to certify that they have read and understood the document, that they are authorized to perform the procedures described therein, and that they will follow the procedure in future operations.

5. RESPONSIBILITIES

5.1 EMS SECTION LEADER

The EMS Section Leader is responsible for the review and approval of all Design Change Packages.

5.2. EMS GROUP LEADERS

EMS Group Leaders are responsible for the review and approval of all Design Change Packages written by members of their groups pertaining to subject matter under the domain of the Group Leader.

5.3. EMS ENVIRONMENTAL ANALYSTS

The EMS Environmental Analysts are responsible for ascertaining the need for changes to procedures relating to the environmental media to which they have been assigned. The analysts are the Responsible Parties who must prepare, or direct the preparation of, the Design Change Packages for their respective environmental media.

5.4. EMS QUALITY ASSURANCE COORDINATOR

The QA Coordinator, with the Responsible Party, determines if a proposed change can be handled with a Design Change Package, or if it must be implemented through a complete procedure revision. The QA Coordinator reviews and approves all Design Change Packages, assigns an effective date, and produces an updated EMS Procedures Manual Table of Contents as described in Reference 5 whenever a procedure or Design Change Package is distributed. The QA Coordinator also ensures that all Design Change Packages are incorporated into subsequent procedural revisions.

The QA Coordinator is responsible for the distribution of Design Change Packages to persons having Sanctioned or Reference copies of the EMS Procedures Manual and for archiving original Design Change Packages and signed Acknowledgment Forms (References 4 and 5).

The EMS Quality Assurance Coordinator is responsible for preparing, or directing the preparation of, all Design Change Packages for procedures pertaining to Quality Assurance issues.

5.5. EMS STAFF

All EMS staff members are responsible for informing the QA Coordinator and/or the Responsible Party when they discover EMS procedures that require revision. Sanctioned and Reference copy holders are responsible for signing and returning Acknowledgment Forms in a timely manner and for keeping their Procedures Manuals up to date in a manner consistent with the requirements of Reference 5 and this procedure.

6. PROCEDURE

Equipment Required:

N/A

6.1. NEED FOR DESIGN CHANGE

Before preparing a Design Change Package, the Responsible Party must first determine whether the proposed changes can be made using a Design Change or if a revised EMS procedure is required. The Responsible Party must discuss the problem with the QA Coordinator and determine the best method for implementing the required modifications. If a new or revised procedure is required, the method described in Reference 5 must be followed. If minor modifications to an existing procedure are required, a Design Change Package may be created according to this procedure if any existing Design Change Packages for the procedure are less than one year old and if less than three Design Change Packages have been created for it.

6.2. DESIGN CHANGE TITLE PAGE

The format for the title page of the Design Change is illustrated in Attachment A. The Design Change title page contains the words "Design Change Package", followed by the name and number of the procedure to be changed, both centered at the top of the page, followed by the effective date. The effective date assigned by the QA Coordinator should be at least 10 days following the date on which the Design Change Package will be sent to holders of Sanctioned or Reference copies of the EMS Procedures Manual. The names/titles/affiliations of the preparer and the reviewers of the package must be listed on the title page.

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The header of the title page must follow the format shown below. The procedure designator for a design package is "DCP/EMP-XX-X", where EMP-XX-X is the procedure designator for the procedure being modified.

DCP/EMP-AP-5 Air Particulate Sampling	Effective date: 9/24/92 Page 5 of 20
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There must be a footer, in 7-point type, indicating the date and time the procedure was printed. The automatic update utility for date and time must be used, and the footer must appear as shown below:

Printed December 2, 1992: 10:21 AM

6.3. STATEMENT OF CHANGE IN DESIGN

The statement of the change in design must always contain two parts: (1) Discussion and (2) Procedure (or Location) Change. The Discussion must clearly state the justification for the change. Often, only a few sentences will be needed. The Procedure Change section must describe the revised way to perform the procedure and list actions that are no longer required. If possible, the changed sections of the original procedure should be called out. If the Design Change affects sampling locations, a map showing the location changes must be attached and the new location(s) clearly described; directions to the site(s) must also be given. The use of proprietary information must, as always, be avoided (Reference 5). The header and footer of the design-change statement should use the same format as the title page and begin with "Page 2 of x." An example of a statement of Design Change is presented in Attachment B.

6.4. REVIEW OF THE DESIGN CHANGE PACKAGE

Design Change Packages are reviewed and approved by the QA Coordinator, the EMS Section Leader, and the appropriate EMS Group Leader. The Responsible Party must obtain approval signatures from all reviewers. All signatories must sign the original Design Change Package.

6.5. REVISED EMS PROCEDURES MANUAL TABLE OF CONTENTS

The QA Coordinator must produce a revised Table of Contents for the EMS Procedures Manual as part of the Design Change Package. A sample Table of Contents is available in Reference 5.

6.6. DISTRIBUTION OF THE DESIGN CHANGE PACKAGE

After all reviewer signatures have been obtained, the Responsible Party gives the Design Change Package to the QA Coordinator. The QA Coordinator makes copies of the Design Change Package on colored paper. The first Design Change affecting a procedure is to be printed on pink paper. If a second Design Change is required prior to a formal procedure revision, it is to be printed on canary (light yellow) paper. If a third Design Change is required prior to a formal procedure revision, it is to be printed on green paper. The use of colored pages will facilitate the recognition and review of Design Changes once the pages are placed in the Procedures Manuals.

The QA Coordinator distributes the Design Change Packages to all persons having Sanctioned or Reference copies of the affected procedure. An updated Procedures Manual Table of Contents (Reference 5) must be part of the Design Change Package. The Design Change Package is also accompanied by a Sanctioned or Reference Copy Acknowledgment Form.

(Attachments C and D), which must be signed by the recipients and returned to the QA Coordinator.

The Sanctioned Copy Acknowledgment Form serves as a certification that the recipient has read the Design Change Package, understands it, and will follow its directions. Sanctioned copy holders must therefore read the package and incorporate all changes when performing assigned operations.

The Reference copy holder signs the Acknowledgment Form to acknowledge receipt of the Design Change Package. The Reference Copy Acknowledgment Form is also a certification that the Reference copy holder is not authorized to perform the work outlined in the Design Change Package and will not attempt to do so until requisite training and certification has been completed.

6.7. INCORPORATION OF THE DESIGN CHANGE INTO REVISED PROCEDURE

Any procedure that has been the subject of a Design Change Package must be officially revised within one calendar year of the release of the Design Change Package. Procedures affected by more than one Design Change Package must be revised within one calendar year of the release of the first Design Change Package. In addition, no procedure will be allowed to have more than three Design Changes made without a complete procedure revision. That is, if a procedure has had three Design Change Packages released, the need for a fourth Design Change Package will require a complete procedure revision, even if one year has not yet passed since the release of the first Design Change Package. The QA Coordinator will be responsible for informing the Responsible Party when a complete procedure revision is due and for ensuring that required revisions are completed.

The QA Coordinator will notify the Responsible Party if a procedure that is being revised is affected by any current Design Changes which therefore must be incorporated into the revised procedure. The QA Coordinator will review all revised procedures to verify that appropriate Design Changes have been incorporated.

7. DOCUMENTATION/QA RECORDS

7.1. TITLE PAGE WITH SIGNATORIES/ ORIGINAL DESIGN CHANGE PACKAGE

An example of a title page is given in Attachment A: Example of a Design Change Title Page. The Analyst responsible for the Design Change Package must ensure that the title page is properly prepared, attached to the final package, and signed by the appropriate signatories. The original, signed title sheet will be archived, with the original final copy of the package, by the QA Coordinator in a manner consistent with the requirements of Reference 4.

7.2. SANCTIONED COPY ACKNOWLEDGMENT FORM

An example of the Sanctioned Copy Acknowledgment Form is presented in Attachment C. Signed copies of these forms will be obtained from each holder for each Sanctioned Copy and maintained in a file by the QA Coordinator in a manner consistent with the requirements of Reference 4.

7.3. REFERENCE COPY ACKNOWLEDGMENT FORM

An example of the Reference Copy Acknowledgment Form is presented in Attachment D. Signed copies of these forms will be obtained from each holder for each Reference Copy and maintained in a file by the QA Coordinator in a manner consistent with the requirements of Reference 4.

8. ACCEPTANCE CRITERIA

A Design Change Package will be considered satisfactorily completed after all signatures have been obtained on the Design Change title page, the originals have been archived and all signed Acknowledgment Forms have been returned to the QA Coordinator.

9. ATTACHMENTS

- Attachment A. Example of a Design Change Title Page
- Attachment B. Example of a Statement of Design Change
- Attachment C. Sample Sanctioned Document Acknowledgment Form
- Attachment D. Sample Reference Document Acknowledgment Form

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Attachment A. Example of a Design Change Title Page

DCP/EMP-AP-L Air Particulate Sampling Locations	Effective date: April 10, 1992 Page 1 of 2
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Design Change Package

**Air Particulate Sampling Locations
EMP-AP-L**

Effective Date: 10 April 1992

Prepared by: _____
Paula Tate, Environmental Analyst, SMG date

Approved by: _____
Lucinda M. Garcia, Quality Assurance Coordinator, EMS date

Approved by: _____
Kris Surano, Group Leader, SMG date

Approved by: _____
Rebecca A. Failor, Section Leader, EMS date

Attachment B. Example of a Statement of Design Change

1. DISCUSSION

Elevated levels of airborne plutonium have been measured for several years by the high-volume (hi-vol) air samplers located around the southeastern LLNL main site perimeter.

The hypothesized source of this elevated airborne plutonium is soil re-suspension from historical solar evaporator waste handling operations in this area during the 1960s and 1970s. The 1990 DOE Tiger Team Inspection requested that additional hi-vol air samplers be installed in this area to characterize better the source term and distribution of the wind-blown plutonium soil re-suspension.

2. PROCEDURE CHANGE

Two additional on-site hi-vol air units will be added to the current site perimeter network of six samplers. No additional units will be added to the off-site network of seven hi-vol air samplers.

The location designator for the air sampler located to the southeast of the UNCLE Credit Union Building, adjacent to Greenville Road, is L-CRED.

The location designator for the air sampler located near the historical solar evaporator pits, in the vicinity of Building 531, is L-B531.

Samplers will be operated at a flow rate of 400 L/min., continuously, 24 hours a day, 7 days a week. Whatman-41, 8-inch x 11-inch filter paper will be used and changed-out weekly as part of the routine air sampling network sampling program. Filters will be analyzed for plutonium concentrations. Results will be reported with other routine network filter analysis data.

No other changes to the air particulate monitoring network will be made.

Location Map

ATTACHMENT C: SAMPLE SANCTIONED DOCUMENT ACKNOWLEDGMENT FORM

Environmental Monitoring Section

SANCTIONED DOCUMENT RECEIPT ACKNOWLEDGMENT FORM

I have received sanctioned copy number _____ of EMS Design Change Package number DCP/EMP-XX-XX, Procedure Name, Rev. ##. I have read and understood this Design Change Package and will follow it from this point on. I have incorporated this Design Change Package into my EMS Procedures Manual by inserting it at the front of the procedure which it affects and I have replaced the Table of Contents with the version I received along with this Design Change Package.

Signature

Date

RETURN TO CINDY GARCIA, EMS QA COORDINATOR, L-255

ATTACHMENT D: SAMPLE REFERENCE DOCUMENT ACKNOWLEDGMENT FORM

Environmental Monitoring Section

REFERENCE DOCUMENT RECEIPT ACKNOWLEDGMENT FORM

I have received reference copy number _____ of EMS Design Change Package number DCP/EMP-XX-XX, Procedure Name, Rev. ##. I have incorporated this Design Change Package into my EMS Procedures Manual by inserting it at the front of the procedure which it affects and I have replaced the Table of Contents with the version I received along with this Design Change Package.

Signature

Date

RETURN TO CINDY GARCIA, EMS QA COORDINATOR, L-255

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EMP-QA-CS

COURIER SERVICE PROTOCOL

Prepared by: Paris E. Althouse 12-3-92
Paris Althouse date
Environmental Technician, TSG

Reviewed by: Duke Ramsey 12-3-92
Duke Ramsey date
Environmental Technician, TSG

Rebecca Ward 12-3-92
Rebecca Ward date
Environmental Technician, SMG

David Graves 12-3-92
David Graves date
Environmental Technician, TSG

Approved by: Rebecca A. Failor 12/3/92
Rebecca A. Failor date
Section Leader, EMS

Duane Rueppel 12/3/92
Duane Rueppel date
Group Leader, TSG

Lucinda M Garcia 12-3-92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Concurrence: Larry Pendexter 12/9/92
Larry Pendexter date
Quality Assurance Manager, EPD

**LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure outlines the current protocol for using a contracted courier service to deliver environmental samples to off-site analytical laboratories. It also outlines the requirements necessary to maintain the integrity of environmental samples collected by the EMS.

2. APPLICABILITY/DISCUSSION

The Environmental Protection Department's contract for courier service is with Priority Express, 324 Lang Rd., Burlingame, CA 94010. EPD's contact there is Ed Sliger, Sales Manager, (415) 438-6611.

EMS collects samples from various media in and around the Livermore Valley, and from the explosive test site located between Livermore and Tracy (Site 300). These samples are needed to support environmental monitoring activities required by local, state, and federal agencies. The integrity of these samples is, therefore, very important and strict guidelines must be followed to ensure this integrity. Many of these samples have a maximum holding time of 24 hours, so delivery must be expedited.

3. REFERENCES

1. Procedure EMP-W-S, *Water Sampling*
2. Procedure EMP-QA-SD, *Sample Tracking Documentation*

4. DEFINITIONS

Chain of Custody Record form (COC): A document used to track samples from the sample collector to the sample courier and from the courier to the analytical laboratory, as well as to track sample data from the analytical laboratory to the data analyst, from the data analyst to the data manager, and from the data manager to the archivist for data archiving. It contains important sample information, including the name of the laboratory that will analyze the samples, sample identifiers, the identity of the sampler, the identity and telephone number of the EMS analyst who is responsible for the sample/data and to whom the data are to be sent, the EMS mailing address, the date on which a sample was collected, a unique COC number (embossed on the form), the analyses to be performed, and signatures that document custodianship of the samples as they change hands. The COC document is a six-part, color-coded form. A copy is available for each custodian as samples change hands and signatures are acquired.

Sound condition: Free from breakage, contaminants, or any other type of damage that could affect the accuracy of analytical results.

Maximum holding time: The maximum period of time allowed between sample collection and extraction of the sample for analysis. Maximum holding time varies between methods of analyses.

5. RESPONSIBILITIES

5.1. ENVIRONMENTAL TECHNICIAN

The technician is responsible for delivering the samples, on time, to the courier location. The samples must be properly preserved, if preservation is

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required (Reference 1), in sound condition, and listed correctly on a COC. The technician is responsible for relinquishing the sample to the courier after proper documentation of the COC (Reference 2) has been confirmed by both the courier and the technician.

5.2. CONTRACT COURIER

The courier must be at the sample pickup location at the predetermined time, must deliver the samples to the appropriate analytical laboratory (the same day), and must ensure that the COC is not compromised. This is accomplished by ensuring that the necessary signatures appear on the COC. The samples must be in sound condition when the courier relinquishes them to the laboratory. The courier must return the correct (pink) copy of the COC and the empty ice chests to the technician at an agreed-upon location.

6. PROCEDURE

Equipment Required: Ice chests Ice, double bagged Chain of Custody Record form
--

6.1. PRESERVING AND PACKING SAMPLES

Once the samples have been obtained, it is the responsibility of the technician to properly preserve each sample, whether it be acidification or merely by keeping the samples cold (Reference 1). If samples do not need to be preserved or kept cold, the technician should place them in a box and tape the box so the samples can not be removed or tampered with. All samples going to the same analytical laboratory may be packed together; however, overweighted containers should be avoided. Glass bottles should be securely packed to avoid any possible breakage. Glass bottles and samples needing to be kept cold should be packed in ice chests with the (double bagged) ice packed tightly as to avoid movement during transport. The ice chests should not yet be taped closed. All containers should be labeled with the date, as well as the name of the analytical laboratory to which they shall be delivered.

6.2. COURIER PICKUP POINT

The courier pickup point is on Third Street, off Avenue H, between the ERD trailer and a storage tent. The pickup times are between 0900 and 0915, and between 1615 and 1630. The courier is required to be at the pickup point during these times; however, if traffic is heavy, it may be necessary for technicians to wait longer.

6.3. TRANSFER OF SAMPLES TO COURIER

Upon the arrival of the courier at the pickup point, the technician and courier must verify that all samples listed on the COC are accounted for and in sound condition. The technician then signs the COC in the box labeled *Relinquished by*, fills in the time and date, and must ensure that the courier signs in the box labeled *Received by*. The technician removes the last copy (goldenrod) and returns it to the analyst per Reference 2 and gives the remainder of the COC forms to the

courier along with the samples. The ice chests should then be taped closed. The courier places all samples in the delivery truck and delivers them to the proper analytical laboratory. The following analytical laboratories are currently used by EMS:

Clayton Environmental Consultants, 1252 Quarry Lane, Pleasanton,
CA (510) 425-2600

Brown & Caldwell Analytical Laboratory, 1255 Powell St.,
Emeryville, CA (510) 428-2300

TMA/Norcal, 2030 Wright Ave., Richmond, CA (510) 235-2633

6.4. RETURN OF COC

Once the samples have been received by the proper analytical laboratory, the courier returns the signed pink copy of the COC to the technician. A mailbox for this purpose is located at the pickup point. All other copies of the COC will be returned via mail after the analytical data is released (Reference 2).

6.5. BACKUP COURIERS

If the courier is missed, or if emergency sampling must be performed on a holiday or weekend, the samples may be delivered directly to the analytical laboratory by an EMS technician. If the courier is missed during regular LLNL hours, an emergency backup courier is available through shipping (Building 411). The same procedure must be followed in this event.

7. DOCUMENTATION

The COC must be filled out correctly and completely, and must accompany the samples/results from the time of sample delivery to the time the data are received (Reference 2).

8. ACCEPTANCE CRITERIA

Samples will not be deemed acceptable if the proper preservative measures have not been followed, if the COC has been broken or compromised, if proper documentation has not been followed, or if the bottles have been broken or otherwise been compromised.

9. ATTACHMENTS

None.

EMP-QA-D / DATA ANALYSIS

Prepared by:

Donald J. MacQueen 9/24/93
Donald MacQueen date
Statistician, Computing Applications Organization

Reviewed by:

Gretchen Gallegos 9/24/93
Gretchen Gallegos date
Environmental Analyst, TAMM

Brian Balke 9/24/93
Brian Balke date
Environmental Analyst, WGMG

Paula Tate 9/24/93
Paula Tate date
Environmental Analyst, TAMM

Eric Christofferson 9/24/93
Eric Christofferson date
Environmental Analyst, WGMG

Robert L. Berger 9/24/93
Bob Berger date
Environmental Analyst, TAMM

Barbara C. Fields 9/24/93
Barbara Fields date
Environmental Analyst, TAMM

Approved by:

Rebecca A. Failor 9/24/93
Rebecca A. Failor date
Section Leader, EMS

Kris Surano 9/27/93
Kris Surano date
Group Leader, TAMM

Bill Hoppes 9/24/93
Bill Hoppes date
Group Leader, WGMG

Duane Rueppel 9/24/93
Duane Rueppel date
Group Leader, TSG

Lucinda M. Garcia 9/27/93
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

**LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure provides statistical guidance for Environmental Analysts in the Environmental Monitoring Section (EMS). It ensures that all EMS statistical analyses are done in a consistent manner, and in some cases, establishes minimum requirements for valid statistical analysis. Typical statistical activities include summarizing a dataset, estimating population parameters, testing for differences between populations, comparison of data with regulatory standards, and evaluating trends.

2. APPLICABILITY/DISCUSSION

Although this procedure applies to all statistical analyses reported by the EMS, it does not establish a proper statistical method for each and every type of data collected by the Section. Instead, it outlines the types of analyses an Environmental Analyst may find appropriate. Formal statistical tests generally require assumptions about the underlying population in order to be valid. This procedure defines the steps to ensure such tests are valid. Some analyses, such as calculating summary statistics when some samples are below an analytical detection limit, can be done in many different ways. In such situations, this procedure ensures that all EMS statistical analyses are done appropriately.

3. REFERENCES

1. U.S. DOE, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE EH-0173T, 1991.
2. EMP-QA-S, *Quality Assurance Sampling*.
3. Gilbert, R.O., *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, 1987.
4. Helsel, D.R., and Cohn, T.A., *Estimation of Descriptive Statistics for Multiply Censored Water Quality Data*, Water Resources Research 24-12, 1988.
5. U.S. EPA, U.S. Environmental Protection Agency, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities—Interim Final Guidance*, Office of Solid Waste, Waste Management Division, Washington, D.C., EPA/510-SW-89-026; NTIS PB89-151047, 1989.
6. U.S. EPA, U.S. Environmental Protection Agency, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities—Addendum to Interim Final Guidance*, Office of Solid Waste, Waste Management Division, Washington, D.C., EPA/510-SW-89-026; Draft, July 1992.
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9. Chambers, J.M., et al., *Graphical Methods for Data Analysis*, Wadsworth International Group, Belmont, CA, 1983.
10. Hahn, G.J., and Meeker, W.Q., *Statistical Intervals—A Guide for Practitioners*, John Wiley & Sons, New York, 1991.
11. Draper, N.R., and Smith, H., *Applied Regression Analysis, Second Edition*, John Wiley & Sons, New York, 1981.
12. Isaaks, E.H., and Srivastava, R.M., *An Introduction to Applied Geostatistics*, Oxford University Press, 1989.
13. EMP-QA-NCR, *Nonconformance Reports*.

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14. EMP-QA-DM, *Data Management*.
15. EMP-QA-DC, *Document Retention*.

4. DEFINITIONS

Alternative hypothesis—The opposite of the null hypothesis. For example, if the null hypothesis is $H_0: \mu_1 = \mu_2$, then the alternative hypothesis is $H_a: \mu_1 \neq \mu_2$. See *Null hypothesis*.

Analysis of variance (ANOVA)—A statistical method for comparing two or more populations. See *Hypothesis test*.

Autocorrelation—The correlation of a variable with itself at earlier times. For instance, the measured values of a variable that has seasonal cycles would be positively correlated with the values measured one year earlier. See *Correlation*.

Binomial distribution—A distribution that may be used to model events that either do or do not occur (for example, whether or not a concentration is above a detection limit). See *Distribution*.

Central tendency—A phrase used to indicate that distributions and datasets have centers. For symmetric distributions, the location of the center is intuitively obvious; for asymmetric distributions, it is not so obvious. Various measures are used to give a numeric value to the center of a distribution or dataset. When used in the context of summary statistics for datasets, the generic term is "central tendency." The three most commonly used measures of central tendency are the mean, median, and mode.

Coefficient of skewness—A measure of skewness of a dataset or distribution. See Section 1.1.3 of Reference 6 for the formula.

Coefficient of variation (COV)—The standard deviation divided by the mean. A measure of variability. For the lognormal distribution, a measure of skewness.

Control chart—A statistical method for tracking changes in a variable over time.

Correlation—The degree to which two or more variables vary together.

Coverage—A property of statistical intervals. The coverage of an interval is the percentage of calculated intervals that actually include the true value of the parameter they are intended to estimate.

Dataset—A collection of measurements from environmental samples. In the field of statistics, the usual term would be "sample," but this document uses "dataset" to avoid confusion with environmental usage of the word "sample."

Detection limit—An upper bound for the concentration (or other measurement) of a compound in a sample. Values below the detection limit are not reported as specific values, but as less than the detection limit. In statistical terminology, such values are said to be "censored."

Distribution—A measure of the relative frequency of occurrence of different ranges of values of a variable for a population or dataset. The most commonly used distributions in environmental applications are the normal and lognormal distributions. Other distributions that occasionally arise are the binomial, Poisson, Weibull, gamma, and beta distributions. Mathematical definitions of these distributions are given in Chapter 12 of Reference 2.

Gamma distribution—One of several asymmetric distributions that may be used to model environmental variables. See *Distribution*.

Geometric mean—The mean of the logs of a set of numbers, transformed back to the original units. A measure of central tendency.

Geometric standard deviation—The standard deviation of the logs of a set of numbers, transformed back to the original units. A measure of variability.

Hypothesis test—A procedure that uses a dataset to make a decision about a population. Examples of decisions include (1) whether the analyte concentrations in a population are in compliance with regulations, (2) where to dispose of a tank of waste, and (3) whether a population parameter exceeds a specified value.

Interquartile range (IQR)—The difference between the 75th and 25th percentiles of a dataset or population. A measure of variability.

Interval estimate—An estimate of a population parameter, consisting of a range of values. See *Point estimate* and *Statistical interval*.

Location—A generic term for the parameter of a distribution that locates the distribution within the range of possible values for the variable. Changing the value of the location parameter shifts the distribution up or down, but does not change its variability.

Lognormal distribution—A commonly used asymmetric distribution that may be used to model environmental variables. See *Distribution*.

Mean—The arithmetic average of a set of numbers. A measure of central tendency.

Median absolute deviation from the median (MAD)—The median of the absolute deviations of the data from the median of the data. A measure of variability.

Median—The middle value in a dataset, or 50th percentile of a population. A measure of central tendency.

Model—A mathematical representation of a population. Two types of model are often used in environmental applications. One is a probability model for the distribution of the population (e.g., normal, lognormal). The other is a model for relationships between different variables (e.g., concentration and time, or concentration and geographical location).

Mode—The value or range of values in a distribution that occur most frequently.

Non-parametric—A statistical method that does not require the assumption of a particular distribution is said to be non-parametric. See *Parametric*.

Normal distribution—A symmetric, bell-shaped distribution used to model environmental variables. See *Distribution*.

Null hypothesis—The hypothesis that is tested by a hypothesis test. A commonly used hypothesis is $H_0: \mu_1 = \mu_2$, where μ_1 and μ_2 are parameters representing the means of two possibly different populations.

Outlier—An unusually large or unusually small value in a dataset.

Parameter—A constant, usually of unknown value, that specifies a model. For example, if the normal distribution is the model for a population, then the mean and variance are the parameters; they specify one particular normal distribution from among many possible normal distributions.

Parametric—A statistical method that requires the assumption of a particular distribution is said to be parametric. See *Non-parametric*.

Point estimate—An estimate of a population parameter consisting of a single value. See *Interval estimate* and *Statistical interval*.

Poisson distribution—A distribution that is used to model radioactive decay. See *Distribution*.

Population—A larger set of data about which a dataset is intended to provide information.

Power ($1-\beta$)—A property of statistical tests. When the null hypothesis is in fact false, the power of a test is the probability that the null hypothesis will be rejected. In environmental applications, power usually indicates the ability of a test to detect contamination. Power is also known as the probability of *not* making a Type II (false negative or failure to detect) error.

Prediction interval—A statistical interval used to predict the value of specific future samples. See *Statistical interval*.

Regression—A statistical method for modeling the relationship between two or more variables.

Residual—The difference between an observed value and the value predicted for it by a model.

Robust—A statistical method is robust when it is little affected by outliers or departures from the assumptions upon which it is based. In particular, the power and significance level of a robust statistical test are relatively unaffected.

Significance level (α)—A property of statistical tests. When the null hypothesis is in fact true, the significance level is the probability of rejecting the null hypothesis (also known as a Type I error, or false positive).

Skewness—The degree to which a distribution is asymmetric.

Spatial correlation—The degree to which values measured at a particular location are correlated with values measured at other locations (at the same time). See *Correlation*.

Standard deviation—The square root of the variance. A measure of variability.

Standard error—The standard deviation of the mean of a dataset.

Statistical interval—A range of values, calculated from a dataset, that is likely to contain the true value of a population parameter of interest. Confidence, prediction, and tolerance intervals are types of statistical interval.

Statistical test—A synonym for hypothesis test. See *Hypothesis test*.

t-test—A statistical method for comparing the means of two populations. See *Hypothesis test*.

Time series—A dataset collected at regular time intervals.

Tolerance interval—A statistical interval used to predict a percentile of a future sample. See *Statistical interval*.

Variable—A quantity or measure used in a statistical analysis. Examples include the concentration of a particular chemical, sample date, and geographical location.

Variability—The degree to which values of a variable vary. High variability corresponds to low homogeneity, and vice versa.

Variance—The sum of the squared deviations from the mean, divided by the sample size minus one. A measure of variability.

Weibull distribution—One of several asymmetric distributions that may be used to model environmental variables. See *Distribution*.

5. RESPONSIBILITIES

5.1. SECTION LEADER

The Section Leader is responsible for ensuring that this procedure meets relevant regulatory requirements.

5.2. GROUP LEADERS

The Group Leaders are responsible for ensuring that their group members follow this procedure.

5.3. ENVIRONMENTAL ANALYSTS

Environmental Analysts are responsible for reviewing the data for their media and applying appropriate statistical methods for reporting results. The Environmental Analysts are also responsible for designing sampling plans and their associated statistical methods.

5.4. STATISTICAL ANALYST

The Statistical Analyst is responsible for advising and assisting Environmental Analysts with designing sampling plans and determining, applying, and interpreting appropriate statistical methods.

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6. PROCEDURE

6.1. VARIABILITY OF ENVIRONMENTAL DATA

The sources of variability in environmental data can be divided into the following three types: (1) spatial—variations that are a function of geographical location, (2) temporal—changes over time, or (3) natural random variation.

Spatial and temporal variability may be natural, or due to LLNL activities, or both. Statistical analyses attempt to distinguish between natural variation and variation due to LLNL activities.

6.2. PURPOSE AND APPLICABILITY

Before proceeding with a statistical analysis, the Analyst must first determine the purpose of the analysis and the applicability of the data. These should be clearly stated in both the sampling plan and final report.

Examples of purposes include: (1) determining whether the concentration of an analyte is changing over time at a particular location, (2) determining whether analyte concentrations are the same at two or more locations, (3) summarizing a dataset, (4) estimating population parameters, and (5) comparison with regulatory standards.

The applicability of a dataset to the purpose of an analysis is determined by two factors: (1) whether or not the dataset is representative of the population of interest, and (2) whether or not the dataset was collected in a manner appropriate for the purpose.

A dataset is representative when the important properties of the population are accurately reflected in the dataset. For example, samples collected for the purpose of characterizing the extent of a contaminant plume would not be representative of the whole region surrounding and including the plume.

The appropriateness of a dataset depends on the type of variability expected to be present. For example, data collected at irregular or infrequent time intervals are not appropriate for the purpose of determining whether seasonal cycles are present.

The statistical method used must be appropriate to the purpose of the analysis and the type of variation expected to be present. Sampling plans and reports should clearly state why a statistical method is appropriate.

6.3. OUTLINE OF STATISTICAL METHODS

Statistical methods are broadly grouped into two categories: descriptive (§6.3.1) and inferential (§6.3.2). Graphical methods are discussed in §6.5.

Descriptive statistics convey information about a dataset, and are presented without intention of conveying information about any population the dataset may represent.

Inferential statistics are statements about properties of a population, based on properties of the dataset. Inferential statistics may be further grouped into two categories: estimation (§6.3.2.1) and testing (§6.3.2.2). Estimates are statements about the value of a population parameter, such as the mean. Tests are formal procedures for using datasets to make decisions about populations, such as whether or not a trend is present, or whether or not two populations have the same mean.

All reporting of statistical analyses should clearly state whether the analysis is descriptive or inferential. For example, a statement such as "the average tritium in surface soil at Site 300 this quarter was..." is somewhat ambiguous, because it takes a fact about the dataset and states it as if it were a fact about the population. Better choices would be, "the mean tritium activity in surface soil samples collected at Site 300 was..." (descriptive), or "our estimate of the mean tritium activity in surface soil at Site 300 was..." (inferential). The latter example assumes that the dataset is representative of Site 300 as a whole.

6.3.1. DESCRIPTIVE STATISTICS

Descriptive statistics summarize a dataset. Basic descriptive statistics include measures of central tendency (mean, median, geometric mean, or mode) and variability [standard deviation, geometric standard deviation, coefficient of variation (COV), interquartile range (IQR), or median absolute deviation from the median (MAD)].

Additional descriptions of a dataset may include correlation coefficients or regression results. In fact, any number calculated from the dataset may be used as a descriptive statistic if it provides useful information about the dataset.

Graphics can be useful for describing a dataset; see §6.5.

6.3.2. INFERENCE STATISTICS

The purpose of inferential statistics is to infer or estimate properties of a population from a dataset. The validity of inferences is based on the representativeness of the dataset. Inferential statistics include formal statistical tests, and point and interval estimates of population parameters.

6.3.2.1. Estimation

Sample statistics are used to estimate population parameters. The parameters of interest will depend on the purpose of the analysis. Parameters likely to be of interest include the mean and standard deviation, correlation and regression coefficients, and differences between population means or medians.

It is recommended that interval estimates (usually confidence intervals) be reported in addition to point estimates.

6.3.2.2. Testing

Statistical tests are used when a specific action (for example, issuing an Occurrence Report) either will or will not be taken, and the decision is based on the value of a population parameter compared to a standard. In this context, the purpose of statistical methodology is to control the risk of making an incorrect decision.

Testing is also employed when it is necessary to make a formal decision about the nature of a population (for example, the presence of a time trend), or about potential differences between populations (i.e., different locations). In this case the purpose of statistical methodology is to determine whether observed results could reasonably be due to natural random variation.

6.3.2.3. Interpretation of inferential statistics

6.3.2.3.1. Point estimates

A clear statement to the effect that the reported value is an estimate of a population value, and that no upper and lower bounds are implied, is sufficient.

6.3.2.3.2. Interval estimates

Any particular 95% confidence interval may or may not include the parameter being estimated, and it is unknown whether or not it does. In the long run, however, approximately 95% of all confidence intervals constructed by a given method will contain the population parameter; such confidence intervals are said to have 95% coverage. This property is loosely described by a statement such as "we are 95% confident that this interval contains the population mean." It is recommended that reports not use statements of this type. Instead, simply state that the calculated values are a 95% confidence interval. Formulas for confidence intervals are given in Reference 3, Chapters 11 and 13; Reference 5, Section 6; Reference 7, Volume II, Chapter 9; and Reference 10, Chapters 4-7.

6.3.2.3.3. Hypothesis tests

Statistical tests require care in interpretation. Formally, the two possible outcomes of any statistical test are: "Reject the hypothesis," and "Fail to reject the hypothesis."

Rejection of a hypothesis does not prove that the hypothesis is false. Rejection of a hypothesis occurs when the values in a dataset are shown to be highly unlikely if the hypothesis is true. If this is the case, then the hypothesis is not credible, and is therefore rejected.

Failure to reject the hypothesis does not prove, or imply, that the hypothesis is true. Failure to reject a hypothesis indicates only that the evidence provided by the data was insufficient to reject the hypothesis.

For example, suppose a hypothetical regulation requires statistical evidence at the 5% significance level that a population mean is greater than 100 mg/L, in order to trigger a reporting requirement. The statistical interpretation of such a regulation would be to establish the null hypothesis $H_0: \mu \leq 100$ and make the report if the data result in the rejection of the null hypothesis. If the dataset mean turns out to be 102 mg/L, with a standard error of 4 mg/L, then the null hypothesis would not be rejected, and the reporting requirement would not be triggered. However, this result does not prove that the population mean is less than 100 mg/L. It merely indicates that the result of 102 mg/L was not sufficiently above the regulatory limit to provide statistical evidence that the population mean is above 100 mg/L. Given the above standard error, a dataset mean of 102 mg/L could reasonably have come from a population with a mean of 99 mg/L.

6.3.3. MINIMUM STANDARDS

The EMS standard for statistical analyses is that the methods used be appropriate to the purpose of the environmental analysis and be statistically valid. The latter requirement implies, for example, that datasets used for analysis of variance should be checked for the appropriate statistical assumptions.

In the absence of specific regulatory guidance, the EMS standard probability levels for inferential methods will be 95% coverage for confidence intervals and a 5% significance level for statistical tests. Analysis may select

other values for coverage or significance level, provided there is justification. Significance levels between 5% and 10% may be considered advisory and indicate that further investigation may be warranted.

6.3.4 . SELECTION OF METHODS

The following table lists some of the types of analyses encountered in EMS activities, with suggested statistical methods for each. Many of the methods have both parametric and non-parametric versions; these are not called out separately in the table.

Type of analysis	Suggested methods
Compare locations	ANOVA, tolerance intervals, <i>t</i> -tests
Compare time periods	ANOVA
Compare both time and location	ANOVA or regression
Simple time trends	Regression
Complex time trends, cycles	Time series methods, including autocorrelation function
Compare with regulatory limit	<i>t</i> -test, confidence interval, tolerance interval
Compare a location with its own history	ANOVA, control chart
Evaluate spatial distribution	Kriging and other spatial interpolation methods
Evaluate spatial correlation	Scatterplot matrix

6.3.5. SAMPLING DESIGN

A full treatment of statistical sampling design is beyond the scope of this procedure. However, a brief discussion of two major aspects of sampling design, sample location and dataset size, is provided. Reference 3 (Chapters 2-10) and Reference 7 (Volume II, Chapter 9) contain good discussions of sampling design.

In some cases, the purpose of the analysis may dictate both the dataset size and the sample locations—for example, daily monitoring of effluent streams.

6.3.5.1. Sample location

Methods for a statistically based selection of sample locations include simple random sampling, stratified random sampling, and systematic sampling. Statistically based sampling is used to ensure that the samples collected are representative of the population being studied.

6.3.5.1.1. General considerations

Effective sampling design is based on the kind and scale of variation present in the population. When nothing is known about these, simple random sampling is the preferred method.

Different kinds of variation include trends, cycles, and hot spots. The scale of variation refers to the distances over which significant

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variation occurs. For example, there could be substantial variation over very short distances. In contrast, there could be only small variation over small distances, but large variation over large distances.

6.3.5.1.2. Simple random sampling

A simple random sample is one in which each element of the population is equally likely to be selected, and the selection of one element does not affect the selection of another.

6.3.5.1.3. Other sampling methods

If there are known (or perhaps strongly suspected) trends or patterns of contamination, then other designs that take into account the patterns may give more accurate estimates. See Reference 3, Chapter 3; and Reference 7, Volume II, Chapter 9.

6.3.5.1.4. Non-statistically based sampling

The above discussion of sampling methods is not intended to preclude basing sampling decisions on other criteria. For example, an air sampler could be placed at a high-risk location, as determined by population dose modeling.

When random sampling is not possible, a dataset may be considered representative if the selection of sampling locations is independent of the spatial variability in the population.

6.3.5.2. Dataset size

The sizes of statistical intervals decrease as the dataset size increases, and the power of statistical tests to detect departures from the null hypothesis increases with dataset size. These factors indicate that large datasets are desirable.

However, a distinction between statistical significance and practical or environmental significance must be made. With a sufficiently large dataset size, any difference between datasets, no matter how small, may be found to be statistically significant. As a result, it is possible to have statistically significant differences that are of no environmental significance.

One approach to dealing with this is to base dataset size on pre-specified decisions about the degree of accuracy and level of confidence one wishes to achieve.

6.3.5.2.1. Sample size determination

Reference 3, Chapters 4, 5, 8, and 10; and Reference 10, Chapters 8, 9, and 10, contain methods for determining appropriate sample sizes.

6.3.5.2.2. Decisions based on a single sample

Unless the population being sampled is highly homogeneous, statistical tests using a single sample result should be avoided. For example, a procedure that uses a single concentration measurement compared to a regulatory limit to determine compliance status may have many false positives or false negatives (Reference 1), especially when the population sampled has a mean close to the regulatory limit.

6.4. SPECIAL CONSIDERATIONS

The following factors can affect the choice of method and should be considered before proceeding with an analysis.

6.4.1. STATISTICAL ASSUMPTIONS

Many statistical methods, including small sample confidence intervals and tests of significance in analysis of variance and regression, assume that the data, or the residuals from the model, are (1) from a normal distribution, (2) have a common variance, and (3) are independent. Failure of one or more of these assumptions will result in the method not having the stated significance level or confidence interval coverage. Unless the standard method is known to be robust, this indicates the use of an alternate method—see the remainder of this section, and §6.4.2.

Of these three assumptions, the one most critical to valid statistical analysis is the assumption that the samples in the dataset are independent.

6.4.1.1. Distribution assumptions

The first step for many analyses is to identify the distribution of the dataset. According to the EPA, "EPA's experience with environmental concentration data, and ground-water data in particular, suggests that a Lognormal distribution is generally more appropriate as a default statistical model than the Normal distribution..." (Reference 6, Section 1.1). Other distributions that may occasionally be appropriate include the binomial, Poisson, and Weibull distributions. The Weibull distribution has sometimes been found to model concentrations of radiological elements in soil.

The best initial evaluation of the distribution of a dataset is a probability plot (also called a quantile plot in some statistical software). The following features should be looked for.

- i) An approximately continuous straight line indicates that the data are homogeneous and from a distribution of the same type as the probability plot.
- ii) Severe discontinuities indicate that different subsets of the dataset, coming from different populations, are involved. When such conditions occur, the dataset should be re-examined and the identifiable subsets analyzed separately.
- iii) Curvilinearity in the plot indicates that the dataset comes from a distribution other than that of the probability plot. In particular, in a normal probability plot this indicates that a data transformation is required before methods based on the normal distribution may be used.

6.4.1.1.1. Transformation to normality

If data transformation is indicated, the log transformation $y = \log(x)$ should be tried first. Another transformation often suggested in the statistical literature (Reference 9, Section 6.7) is the Box-Cox power transformation: $y = x^\lambda$ ($\lambda \neq 0$). This is an iterative procedure in which different values of λ between +1 and -1 are tried until, hopefully, a value is found that straightens the probability plot or causes the transformed data to pass a test for normality.

6.4.1.1.2. Tests for normality.

The recommended test for normality is the Shapiro-Wilk test (Reference 3, Sections 12.3.1 and 12.3.2; and Reference 6, Sections 1.1.4 and 1.1.5). This test estimates the mean and standard deviation from the data. If the mean and standard deviation are obtained from another source, such as background data from a different location, then the Kolmogorov-Smirnov test is appropriate. The χ^2 test is not recommended because it is less sensitive than the recommended methods to departures from normality in extremes of the distribution (Reference 6, Section 1.1.4).

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For very large samples, even small departures from normality will be statistically significant. For very small sample sizes, the tests have little power to detect departures from normality.

Therefore, for very small samples, the normal or lognormal distribution may be assumed. For very large samples, if a histogram shows the data as reasonably symmetric and bell shaped, or a normal probability plot is approximately straight, the normal distribution may be assumed. For intermediate sample sizes, a formal test of normality should be performed. Precise definitions of very small and very large are not possible; suggested values are <10 for very small and >50 for very large.

If the dataset indicates that the population has a non-normal distribution, see §6.4.2.

6.4.1.2. Constant variance assumption

The recommended method for testing the assumption of constant variance is Levene's test (Reference 6, Sec. 1.2.2).

t-tests and one-way analysis of variance have versions that are appropriate when the groups being compared have unequal variances. If the variance is approximately proportional to the magnitude of the measured values, a log transformation should be tried. For other types of problems, the Statistical Analyst should be consulted.

6.4.1.3. Independence assumption

If the samples within a dataset are correlated, either spatially or temporally, see §6.4.3. A good visual method for checking spatial correlation is to use a scatterplot matrix. Temporal autocorrelation may be visually obvious in some cases, such as seasonal cycles.

6.4.1.4. Robust methods

Some standard methods, including regression and analysis of variance methods, are robust against departures from normality and equality of variance. For such methods, only large departures from normality indicate that an alternative statistical method must be used. The issue of deciding whether or not to use an alternative method is complicated by the issue of sample size; see §6.4.1.1.2.

6.4.2. NON-NORMAL DISTRIBUTIONS

When a dataset indicates that the population has a non-normal distribution, the following adjustments should be made.

6.4.2.1. Data can be transformed to the normal distribution

If a transformation that normalizes the data is found, the following considerations apply.

6.4.2.1.1. Means and confidence intervals for the mean

If the data are lognormal, the methods given in Reference 3, Sections 13.1.1 and 13.2, should be used if point or interval estimates for the arithmetic mean are required. The geometric mean and standard deviation are valid measures of central tendency and variability for the lognormal distribution. For other transformations, §6.4.2.2.1 applies (using the non-transformed data).

6.4.2.1.2. Statistical tests

Analysis of variance, regression, control charts, and confidence intervals used to test against a regulatory limit should be done using the transformed data (against the transformed regulatory limit, if applicable).

6.4.2.2. Data cannot be transformed to the normal distribution

If no transformation that normalizes the data can be found, the following considerations apply.

6.4.2.2.1. Confidence intervals for the mean

If the dataset size is sufficiently large, the ordinary confidence limit for the mean may be used. "Sufficiently large" cannot be defined in advance for every dataset; the greater the departure from normality, the larger the required dataset size. However, as a rough guideline, the dataset size should be at least 30, and at least 50 for highly skewed populations.

If the dataset size is not sufficiently large, the median should be used rather than the mean. Confidence intervals for quantiles, including the median, are given in Reference 3, Section 11.10.

6.4.2.2.2. Statistical tests

Analysis of variance and regression should be done using non-parametric methods. Prediction and tolerance intervals may not be used.

6.4.3. LACK OF INDEPENDENCE

Lack of independence is a serious problem for analysis of variance and regression methods. Data collected at regular time intervals at a single location should be evaluated for autocorrelation (also known as serial correlation). If sufficient data are available, they should also be evaluated for seasonal cycles. Data should also be inspected for spatial correlation.

6.4.3.1. Autocorrelation

If autocorrelation is present, then corrections must be made to the standard deviation and statistics derived from it, such as confidence intervals. See Reference 3 (Equations 4.18, 4.21, 11.18, and 11.20) for formulas to correct for autocorrelation, and Reference 11, Section 3.9, for methods for testing for autocorrelation. For other types of analyses, the Statistical Analyst should be consulted.

6.4.3.2. Seasonal Variation

If a seasonal cycle is present, the dataset should be corrected for seasonality before continuing with other analyses (see Reference 5, Section 7.2; and Reference 3, Chapter 17).

6.4.3.3. Spatial correlation

If spatial correlation is present, then corrections must be made to the standard deviation and statistics derived from it, such as confidence limits. See Reference 3, Section 4.5, and Reference 12. For other types of analyses, the Statistical Analyst should be consulted.

6.4.4. NON-DETECTIONS

No single method of dealing with non-detects is appropriate for all datasets and all purposes. Three approaches for the calculation of summary

statistics have been identified. These are: (1) for the Sitewide Annual Environmental Report (SAER), (2) based on current guidance from the U.S. EPA (References 6 and 8), and (3) situations not covered by (1) or (2).

The first approach, for the SAER, is designed to be as simple as possible, so that summary statistics may be reproduced by a non-technical reader, without the use of any specialized statistical software. This approach also assumes that an upper bound for a dataset summary statistic is an adequate summary of the data. This approach does not provide estimates of the population mean when there are non-detections.

The second approach is designed to produce an estimate of the population mean when there are some non-detections, and the percentage of non-detections is not too great.

The third approach includes methods for estimating a population mean when there is a substantial proportion of non-detections.

Before proceeding with any of these approaches, the detection limits should be evaluated.

6.4.4.1. Detection limits

Evaluate the detection limits. If any samples have detection limits that are unusually high, they may be omitted from the analysis. "Unusually high" is difficult to rigorously define. The basic guideline to use is that if the detection limit is so high that the sample result provides essentially no information, then the value should not be used in statistical analyses.

Common reasons for unusually high detection limits include sample matrix dilution and obsolete analytical methods. Other cases will be up to the professional judgement of the Analyst. Detection limits several orders of magnitude larger than the largest positively detected sample in the dataset are likely candidates for exclusion from statistical analysis.

An example in which non-detects would not be excluded would be a recently collected dataset in which some samples were analyzed by method A, with a method detection limit of 0.05 mg/L, and other samples were analyzed by method B, with a detection limit of 0.002 mg/L. Samples diluted so that their detection limits were raised to 10 mg/L would be omitted from the statistical analysis.

6.4.4.2. Sitewide Annual Environmental Report

6.4.4.2.1. No non-detections

If there are no non-detections, use the mean and standard deviation.

6.4.4.2.2. Some non-detections

If there are fewer than 50% non-detections, calculate the median, substituting the detection limits as the value for the non-detections. If any of the detection limits are greater than the median, place a 'less than' sign (<) before the value. If the values of the detection limits relative to the positive detections permit (see example in §6.4.4.3.5), it may be possible to calculate the MAD or IQR, and a confidence interval for the median. In some cases, there will be no estimate of variability.

If there are 50% or more non-detections, calculate the median using the detection limits and place a 'less than' sign (<) before the value. In this case, there is no estimate of variability.

6.4.4.2.3. Interpretation

Medians calculated according to §6.4.4.2.1 that have a 'less than' sign are upper bounds for the dataset median. They are not upper bounds for the population median. Care should be taken that the latter interpretation is not implied when the results are discussed in a report.

6.4.4.2.4. Radiological results

Guidance for radiological analyses in Reference 1 states that values below the detection limit, including negative values, should be used in the calculation of means and standard deviations.

6.4.4.3. Current EPA guidance

References 6 and 9 indicate that the appropriate summary statistics are determined by the percentage of non-detections and the degree of skewness of the dataset.

6.4.4.3.1. 15% or fewer non-detects, not highly skewed

Substitute half the detection limit for each non-detect, and proceed as if all the data had been positive detections. That is, evaluate the distribution (normal, lognormal, or other) and calculate the appropriate measures of central tendency and variability. As a rule of thumb, a dataset will be considered "highly skewed" if its coefficient of skewness is greater than 2.5.

6.4.4.3.2. More than 15%, less than 50% non-detects, not highly skewed

Use the median as the measure of central tendency. If the values of the detection limits relative to the positive detections permit (see example in §6.4.4.3.5), it may be possible to calculate the MAD or IQR, and a confidence interval for the median. In some cases there will be no estimate of variability.

6.4.4.3.3. Highly skewed, any percentage of non-detects less than 50%

See 6.4.4.3.2.

6.4.4.3.4. 50% or more non-detects

Calculate an upper bound for the dataset mean using the detection limit for all non-detects. Clearly indicate that the result is an upper bound for the dataset mean, but that due to sampling variability, it is *not* an upper bound for the population mean. Do not report an estimate of the standard deviation.

6.4.4.3.5. Example

The following numbers are chosen to illustrate the fact that the median absolute deviation may or may not be calculable, depending on what the non-detect levels are. In other words, the choice of method cannot be based solely on how many non-detects there are. This example does not cover all possible combinations of detection limits and positive detections, but indicates the kind of calculation necessary to determine whether the MAD can be calculated.

The number of non-detects is the same in both cases: 4 out of 12, or 33%, so §6.4.4.3.2 is applicable. In both cases, the median is 6.5.

Low non-detect levels			High non-detect levels		
Data	Absolute Deviations	Sorted Absolute Deviations	Data	Absolute Deviations	Sorted Absolute Deviations
<1	>5.5	.5	<4	>1.5	.5
<1	>5.5	.5	<4	>1.5	.5
<1	>5.5	1.5	<4	>1.5	1.5
<1	>5.5	1.5	<4	>1.5	1.5
5	1.5	2.5	5	1.5	>1.5
6	.5	3.5	6	.5	>1.5
7	.5	4.5	7	.5	>1.5
8	1.5	5.5	8	1.5	>1.5
9	2.5	>5.5	9	2.5	2.5
10	3.5	>5.5	10	3.5	3.5
11	4.5	>5.5	11	4.5	4.5
12	5.5	>5.5	12	5.5	5.5
Median	—	Median	Median	—	Median
6.5	—	4	6.5	—	?

In the first case, that of low non-detect levels, the sorted absolute deviations from the median are such that the middle two deviations are known. Therefore, the median absolute deviation is estimable. In the second case, the non-detects fall right in the middle of the sorted deviations. Since it is not known how much greater than 1.5 they are, the middle two deviations' values are unknown.

6.4.4.4. Other methods

A variety of alternate methods for estimating population parameters in the presence of non-detections have been developed. Some of these methods are applicable when there are more than 15% non-detects, yet an estimate of the mean rather than the median is required. Others are applicable when it is reasonable to assume that non-detections are truly zeros. See Reference 4 for an overview of some of these methods.

6.4.4.5. Trends

The Mann-Kendall non-parametric test for trends (Reference 3, Chapter 16) may be used when a formal test for a trend is necessary for a dataset with non-detects.

6.4.4.6. Analysis of variance

Non-parametric analysis of variance (analysis of variance based on ranks) may be used when non-detects are present, provided that in each cell of the ANOVA model fewer than 50% of the samples are non-detects.

6.4.5. OUTLIERS

A visual inspection of a scatterplot, histogram, or probability plot will generally identify possible outliers. However, plots with a linear axis may be misleading—what appears to be an outlier may actually be a high value from a lognormal distribution. The U.S. EPA (Reference 6, Section 6.2) recommends that outlier tests be run on the logarithms of the dataset instead of the original values,

and that formal testing for outliers should only be done "if an observation seems particularly high (by orders of magnitude) compared to the rest of the data set."

The presence of one or more outliers indicates one of the following conditions:

- (1) An error has occurred, perhaps during sample collection, laboratory analysis, or data transcription.
- (2) The dataset actually comes from more than one distinct population, or perhaps from a population that is changing over time.
- (3) An inexplicable anomaly has occurred.

Formal tests for outliers are described in Reference 3, Chapter 15; and Reference 5, Section 8.2.

Regulatory requirements for the treatment of outliers vary, depending on the regulation and regulatory agency. In the absence of specific regulatory requirements, the EMS standard for the treatment of outliers given in §6.4.5.1 should be followed. For comparison, guidance from the U.S. EPA and the U.S. DOE is summarized in §6.4.5.2.

6.4.5.1. EMS Standard for outliers

If it can be shown that an error has occurred, then the error should be corrected. If the error cannot be corrected then the erroneous value must be excluded from any statistical analyses. Such errors should be documented in Nonconformance Reports (NCRs) and resolved according to EMP-QA-NCR (Reference 13).

If the Analyst is able to identify the different populations involved (for example, different geographic location), or the reason for changes over time (e.g., seasonal cycles), then the selected analysis should be changed to reflect the new information. If the Analyst decides to proceed with the original analysis despite the presence of different populations, then the outliers may not be omitted.

Apparent outliers may only be classified as anomalous if a formal test for outliers identifies them as such and no explanation for them has been found. In this case, the Analyst has the option of (1) including the anomalous value in the analysis; (2) presenting two analyses, one with the anomalous values, and one without; or (3) using a robust statistical method.

The use of a robust method is appropriate when the Analyst has determined that the data analysis should not be heavily influenced by the outliers; this is a matter of professional judgement. The median and IQR or MAD may be substituted for the mean and standard deviation. Non-parametric analysis of variance may be substituted for parametric analysis of variance. Mann-Kendall regression (Reference 3, Chapter 16) may be substituted for ordinary regression.

6.4.5.2. EPA and doe Guidance for outliers

Guidance from the U.S. EPA for ground water monitoring (Reference 6) states that if a test designates an observation as a statistical outlier, and a plausible and documentable reason cannot be found, "the sample should be treated as a true but extreme value, not to be excluded from further analysis."

Guidance from the U.S. DOE for radiological effluent monitoring (Reference 1) states that when outliers are not attributable to errors in the data, "...estimators and statistical tests *should* be computed with and without

the outliers..." If the results differ substantially, then both results should be reported.

6.5. GRAPHICAL METHODS

The use of graphical methods for the display of data is highly recommended. Graphics should be clear and simple, while conveying the essential information in the dataset. The main point of a graphic should be apparent at first glance. See Reference 9.

6.5.1. UNIVARIATE DATA

Useful graphical displays for univariate data include histograms, density traces, box plots, probability plots (also known as quantile plots), and symmetry plots.

6.5.2. MULTIVARIATE DATA

Useful graphical displays for multivariate data include scatterplots, box plots, quantile-quantile plots, and multiple density traces. Scatterplot smoothing is recommended for displaying non-linear trends in a dataset. When appropriate, error bars should be included; there are several types of error bars possible, including standard deviations, standard errors, and range. The choice is a matter of professional judgement.

6.6. MISCELLANEOUS TOPICS

6.6.1. SIGNIFICANT DIGITS

The number of significant digits in reported summary statistics and parameter estimates should reflect the precision of the dataset on which they are based. The number of significant digits in reported intermediate calculations, such as analysis of variance tables and test statistics, should be such that the reader can accurately reproduce the calculations presented.

6.6.2. DATA QUALITY

The Analyst should review and validate data prior to performing statistical analyses. See EMP-QA-DM (Reference 14).

7. DOCUMENTATION/QA RECORDS

Statistical analyses that are formally reported are subject to the requirements of this section.

7.1. STATISTICAL ANALYSIS PACKAGE

A statistical analysis package documents a statistical analysis. It provides sufficient information, such that the analysis can later be reproduced by the original Analyst, other analysts, or authorized outside parties (such as auditors). Documentation must therefore include the dataset used and information about (1) where the data can be found or how it can be obtained from the database; (2) the statistical method used (including information about which variables in the dataset were used for which part of the analysis — e.g., in regression, note both the dependent and independent variables); and (3) the results, including any results that are normally

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part of the statistical analysis but were not included in the final report. It is good practice to identify the software used to perform the analyses and to retain electronic copies of files used in the analyses. It is not likely that a published report will include all such documentation, but such documentation should be available to interested authorized parties.

7.2. QA RECORDS

Statistical analysis packages are QA Records and should be maintained according to the requirements of EMP-QA-DC (Reference 15).

8. ACCEPTANCE CRITERIA

The analysts involved in performing a statistical analysis are responsible for determining which sections of this procedure (EMP-QA-D) are applicable. An analysis is deemed acceptable when the documentation described in §7 contains evidence that procedures described herein have been followed. Only those statistical analyses that are formally reported are subject to this acceptance criteria.

Statistical analyses that do not meet the requirements of this procedure should be documented in a Nonconformance Report and resolved according to the procedure described in EMP-QA-NCR (Reference 13).

EMP-QA-DM
DATA MANAGEMENT

Prepared by:

Gretchen Gallegos 12/3/92
Gretchen Gallegos date
Acting Group Leader, IMG

Reviewed by:

Nina L. Hankla 12/3/92
Nina Hankla date
Data Manager, IMG

Kris Surano 12/3/92
Kris Surano date
Group Leader, SMG

Brian Balke 12/3/92
Brian Balke date
Environmental Analyst, EMG

Bill Hoppes 12.4.92
Bill Hoppes date
Group Leader, EMG

Paula Tate 12/5/92
Paula Tate date
Environmental Analyst, SMG

Duane Rueppel 12/3/92
Duane Rueppel date
Group Leader, TSG

Barbara C. Fields date
Barbara Fields
Environmental Analyst, SMG

Approved by:

Rebecca A. Failor 12/3/92
Rebecca A. Failor date
Section Leader, EMS

Lucinda M. Garcia 12/3/92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

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MONITORING SECTION
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1. PURPOSE

This procedure describes methods used to manage all data received by the Environmental Monitoring Section (EMS). It provides a step-by-step discussion involving all aspects of data management, including sample planning; collection and submittal of samples taken; receipt, review, analysis, and comparison of data hard copy to electronic data transfer of results; placement of the EMS data into the database; and electronic and hard-copy data storage. This procedure is independent of the computer platform chosen for data management activities. The techniques used for interaction with the current system are discussed in Reference 1.

2. APPLICABILITY/DISCUSSION

Significant time, energy, and financial resources are expended to collect and analyze environmental effluent and surveillance monitoring samples. EMS data are the documented evidence of all monitoring activity and are used to assess LLNL's impact on the environment and demonstrate compliance with regulations, laws, and orders promulgated by local, regional, state, and federal agencies.

Data management ensures conversion of the monitoring effort into final data summaries, analyses, and presentations. EMS data result from samples of a variety of environmental media. Data generated by EMS include results from analytical laboratories, field-instrument calibration data, and results from the on-line sewer monitoring system. Flow charts and the calibrations are maintained in field logs. All other samples are sent to analytical laboratories for analysis. Data from analytical laboratories are always received as data hard copy with the signed Chain-of-Custody (COC) form. Often the data hard copy are accompanied by electronic data downloads.

EMS data are stored in an INGRES database on a VAX 6310 computer. Hard-copy results, the official data form, are sent to the responsible EMS Analyst for review and analysis (Reference 2). The analysts deliver data to the EMS Data Manager for inclusion into the EMS database (Reference 1) and systematic data package filing by medium (Reference 3).

The review, EMS and INGRES formatting, and verification of electronically transferred data sets to EPD/EMS specifications are discussed briefly in this procedure; Reference 1 discusses data storage in the INGRES database, methods for accessing data for reports, and the performance of Quality Assurance tasks.

3. REFERENCES

1. *INGRES Database User's Manual*
2. *EMP-QA-D, Data Analysis*
3. *EMP-QA-DC, Document Retention*
4. *EMP-QA-SD, Sample Tracking Documentation*
5. *EMP-QA-AER, Site Annual Environmental Report*
6. *EMP-QA-NCR, Nonconformance Reports*
7. *EMP-QA-I, Invoice Processing*
8. *EMP-GW-QR, Quarterly Groundwater Report*

4. DEFINITIONS

ASCII—*American Standard Code for Information Interchange*: A standard for defining codes for information exchange between equipment produced by different manufacturers.

Database: A database is any collection of information that is organized so that it can be used efficiently. The information in the EMS sample analysis database is organized in the form of records. Each record contains all of the information about a sample in the database.

COC: Chain-of-Custody Record Form, defined in EMP-QA-SD as a document used to track samples from the sample collector to the sample courier and from the courier to the analytical laboratory, as well as tracking the data from the analytical laboratory to the environmental analyst, from the environmental analyst to the data manager, and from the data manager to the archivist for storage. It contains important sample information, including the name of the laboratory that is to analyze the samples, sample identifiers, the identity of the sampler, the identity and the telephone number of the EMS analyst who is responsible for the sample/data and to whom the data are to be sent, the EMS mailing address, the date the sample was collected, a unique COC number (embossed on the form), the analysis to be performed, and the signatures that document custodianship of the samples as they change hands. The COC document is a six-part color-coded form. A copy is available for each custodian as samples change hands and signatures are acquired.

Field Tracking Form (FTF): A form used to document sample collection and log sampling information. It contains sample identifiers, as well as information pertinent to unspecified, or blind, QA samples. Analysts are only to decode laboratory QA sample results using the information contained on the FTF.

Work Tables: Tables in INGRES that allow the user to work with data so they can be placed in an acceptable format that can be entered into the database, i.e., the Global Tables. A Work Table consists of three tables: a Sample Table, which contains the basic field structure that is used by INGRES and the Global Tables; an Analysis Table, which contains the numbers or actual results of the lab analysis; and the QA Analysis Table, which contains information used by the database to maintain the Global Tables' integrity.

5. RESPONSIBILITIES

5.1. DATA MANAGER

The Data Manager works with EMS analysts to implement data management activities on a media-specific basis. At the request of individual analysts, the Data Manager may track sample acquisition, monitor FTF's and COCs (Reference 4), accept data hard copy for a specific medium, and file data hard copy and COCs prior to archiving. The individual analyst retains authority and responsibility for activities regarding the specific medium, including delegated data management duties.

The Data Manager is responsible for all electronic data transfers. The Data Manager is responsible for communicating electronic data transfer specifications to analytical laboratories, ensuring transfers are done correctly and in a timely manner, checking all data against the hard copy from the analytical laboratory, and appending the data to the database. The Data Manager is responsible for quality control checks of the data in the database.

The Data Manager is also responsible for preparing data tables for the analysts on a monthly basis; these reports serve as status reports to the analysts and provide the analysts an early opportunity to check that the data have been entered properly and that the values are correct.

The Data Manager also acts as a contact point for communicating data access capabilities to the EMS and acts as an interface for computational support in selecting and installing user friendly data manipulation capabilities created or purchased by computational support personnel.

5.2. TECHNICAL INFORMATION ASSISTANT

Under the general direction of the Data Manager, the Technical Information Assistant is responsible for manual data entry and careful data management record keeping. The

Technical Information Assistant is responsible for keeping records of each sample entered into the database, and maintaining an organized filing system for data hard copy and data entry processes. Electronic data transfers can be processed by the Technical Information Assistant under the supervision of the Data Manager.

5.3. ARCHIVIST

The Archivist is responsible for filing the documents in the Document Retention Center. This includes assigning an archive number and updating the Document Retention Center database.

5.4. ENVIRONMENTAL ANALYSTS

The EMS Environmental Analysts are responsible for creating media-specific monitoring plans, tracking sample acquisition, receiving and reviewing data hard copy, analyzing the data, and generating reports. EMS analysts can delegate data entry and filing tasks at their discretion. However, all analysts are ultimately responsible for ensuring that the data reported by the analytical labs is accurate, and that the data is entered into the database correctly. The EMS Environmental Analysts also provide QA/QC for results in the database and provide the ultimate authority in establishing consistency in units and resolving problems involving reported data.

5.5. IMG GROUP LEADER

The Information Management Group Leader is responsible for ensuring that data management activities are conducted in accordance with this procedure, and there are sufficient data management personnel and resources to perform the required activities.

5.6. EMS QA COORDINATOR

The EMS QA Coordinator is responsible for maintaining a checklist for validation of report tables against data hard copy, and for ensuring that proper QA procedures are followed in data management activities.

6. PROCEDURE

Data management occurs continuously through EMS monitoring activities. It begins with the Environmental Monitoring Plan (EMP), continues through sampling, to data review and analysis, and concludes with final data and documentation archiving. EMS monitoring activities are presented in a flow chart in Figure 1.

Equipment Required:

VAX 6310 Computer
Computer terminal that will emulate VT100
Database software (INGRES)

6.1. EMS SAMPLING PLAN

Data management begins with an annual sampling plan written by the responsible Environmental Analyst that specifies a sampling strategy for a particular medium. The plan includes the purpose of the sampling, the locations to be sampled, the methods for collecting

samples, the actual number of samples to be taken, the frequency of the sampling effort, the analytical methods to be employed, and the sampling analytes. The plan can reference existing EMS procedures. The sampling plan must include considerations of the time necessary for analysis; seasonal conditions; field technician availability; the true representativeness of the samples; and local, state, and federal agency sampling requirements.

The Data Manager must be aware of each analyst's sampling plan. New sampling locations must be added to the database, and the frequency of the sampling effort must be monitored to allot time for data receipt, subsequent data entry/data verification, and report generation.

6.2. SAMPLING

As the samples are taken in the field, the responsible analyst tracks the sampling activities. The responsible analyst develops and implements a system for tracking the sampling activities for the medium of responsibility. Samples are usually collected by EMS Environmental Field Technologists, with the analyst tracking the field activities either by accompanying the field technicians during the sampling effort, or by reviewing the submitted FIFs and COCs (Reference 4).

6.3. SAMPLES SENT TO LABORATORY

The COC accompanies all samples, regardless of medium, when they are sent to analytical laboratories for analysis (Reference 4). The responsible analysts must keep track of the status of the samples to ensure that they are analyzed in a timely manner. This is particularly true for any samples that have holding times. The responsible analyst should review COC forms so the appropriate analyses are requested, and that prompt delivery of the samples to the analytical laboratory is assured. The Data Manager must also monitor the COC progress for a medium's sampling plan and keep in contact with the analytical laboratory to schedule electronic downloads and communicate transfer file specifications.

6.4. ANALYSIS OF SAMPLES

6.4.1. The responsible analyst makes sure that problems with any analysis are resolved in a timely manner, e.g., re-sampling and submitting samples to replace any samples that may have been lost. Frequent communication with analytical laboratory customer service representatives or laboratory managers is encouraged.

6.4.2. The Data Manager tracks sampling progress to the extent necessary to ensure the laboratories' compliance with sampling schedules as they may affect electronic data transfers. Prior to completion of analysis, the Data Manager or his representative contacts each analytical laboratory to prepare for electronic downloads. The Data Manager must schedule electronic downloads and communicate transfer specifications at least 30 days in advance of a download so that the analytical laboratory has time to prepare the data in the appropriate format. Problems are resolved to the specifications of the analyst, who must be informed and consulted about all pertinent issues pertaining to a medium.

6.5. ANALYTICAL RESULTS SENT TO EMS

6.5.1. Most sample analytical data should be received in 4-6 weeks following the submittal of samples to the analytical laboratory. The Data Manager notifies the analyst when a scheduled data transfer is late. If data are not available in a timely manner, the responsible analyst should contact the QA Coordinator and the analytical laboratory. A phone call can resolve most issues. If the problem can be resolved to the satisfaction of the

QA Coordinator and the responsible analyst in an informal manner, no written notification need be sent and the Procurement Department need not be contacted. If the root cause of the problem cannot be resolved, the Procurement Department contact should be notified and a Nonconformance Report should be initiated.

6.5.2. Hard-copy results are received directly by the responsible analyst, usually by mail (Reference 4). Sometimes the data are sent by fax. Fax copies, however, are not the official hard copy. All official data must be accompanied by the original signed COC. If the COC has not been signed by every party, a nonconformance report must be filed with the QA Coordinator. All electronic data transfers must be verified against the official data record. An electronic data transfer is not official until it has been verified against the official data hard copy.

6.5.3. After the COCs and official hard-copy results are delivered from the analytical laboratory to the responsible analyst, the data must be reconciled with the FTF's and other COC copies (Reference 4). Data hard copy are temporarily stored by the responsible analyst with the corresponding FTF, COC, and invoice according to their individually developed systems until a data/COC/FTF/invoice package is completed and all data are verified. Data should then be copied and stored in the responsible analyst's office. The analyst must then provide the Data Manager with the original data hard copy/COC/FTF/invoice package as soon as possible. The Data Manager uses the material to verify any related electronic data transfer that has been entered into the EPD/EMS database, or oversees the manual entry into the database.

6.5.4. Whenever possible, electronic downloads of EMS data should arrive simultaneously with the data hard copy/COC package. Electronically transferred data are processed within an established organizational structure that contains a variety of checks and balances (Reference 1).

6.6. ANALYST'S REVIEW OF RESULTS

6.6.1. The data are reviewed immediately following receipt by the responsible analyst. Initial review may be cursory, to determine whether the required analyses have been performed, and to ascertain any unusual values, or to flag items that require immediate response and reporting. Any anomalous data are brought to the attention of the analytical laboratory. If there is a situation that does not comply with EMS procedures, a Nonconformance Report must be filed with the QA Coordinator (Reference 6). If erroneous data have been entered into the database, the Data Manager must be informed of the problem and steps must be taken to correct the database. Changes to the EMS portion of the database cannot be made on the basis of verbal information; they must be substantiated by hard copy. The responsible analyst must provide the official result to the Data Manager once the nonconformance problem has been resolved by the responsible analyst. Unusual data results must be verified or reanalyzed by the analytical laboratory within 30 days, which is the established laboratory holding time for samples.

6.6.2. The data must be checked, by the responsible analyst or designated party, against the COC to assure that EMS received the requested analytical results prior to authorization of payment for invoices (Reference 7). QA samples for the EMS are submitted to analytical laboratories as blind samples. Prior to entry into the database the results must be decoded using the FTF (Reference 4).

6.7. DATABASE UPDATED

EMS can receive data electronically on the VAX 6310 computer or the data can be manually entered into the database from laboratory hard-copy output. The data results are organized and prepared for input to the database under the direction of the Data Manager, using methods detailed in Reference 1. If necessary, the Technical Information Assistant manually enters the data after the hard-copy results are reviewed by the analysts.

Figure 1. Flow Chart of EMS Activities

6.8. DATA SECURITY

The security of the database is assured by limiting access to it, and providing tape back-up and code that checks the database for consistency. The Environmental Analysts have "read only" privileges, and are not able to change data by direct access to the database. The Data Manager and Senior Technical Information Assistant are the *only* individuals authorized to make any changes in the EMS data. Typically the Data Manager will fix errors in the EMS database, whether they occurred during an electronic download or manual data entry. The Data Manager is responsible for resolving the situation which caused an error to occur, or informing parties of the error and how to resolve the problem. The entire database for EPD is routinely backed-up on magnetic tape to maintain database integrity.

Data archiving procedures are detailed in Reference 3.

6.9. REPORTS GENERATED FROM DATABASE

6.9.1. Data management helps ensure conversion of monitoring efforts into final data summaries, analyses, and presentations. Currently, all the data in the Quarterly Groundwater Monitoring Report and most of the data for the Annual Environmental Report (AER) are generated from the INGRES database (see References 5 and 8).

6.9.2. The Data Manager also prepares data tables for the analysts on a monthly basis or as requested; these reports serve as status reports to the analysts and provide the analysts an early opportunity to check that the data have been entered properly and that the values are correct.

6.9.3. Upon request by the Environmental Analysts, reports are sometimes downloaded to Macintosh files in Excel or Microsoft Word format. These data files can be generated by the analysts or Data Manager, depending on the nature of the problem and the actual needs of the analyst.

7. DOCUMENTATION/QA RECORDS

The sample plans, all data and associated documents, and each FTF/COC/data result/invoice package are QA records. A checklist is kept by the QA Coordinator and responsible party for validation of report tables against data hard copy. This is a quality control step in the production of reports such as the AER.

8. ACCEPTANCE CRITERIA

Once the data hard copy complies with the requirements in Reference 4 and is stored in the appropriate format, the data hard copy is deemed acceptable. Once the data have been groomed and the Work Table format meets the Global Table criteria, the data must be validated against the official data record (hard copy). A computer-generated code examines data for blank log number, duplicate log number in the Global Table, duplicate log number in the Work Table, no matching analysis data, invalid location identification, invalid date sampled, invalid sample type, invalid project identification, no requester name, and no lab name, prior to entry into the EPD database. Data management personnel generate an edit report and validate data contained in the sample and analysis tables against data hard copy prior to data validation. If the criteria for the data are met, the data entered to the database will be acceptable.

9. ATTACHMENTS

Attachment A: Electronic Transfer of Data into the Database.

ATTACHMENT A: ELECTRONIC TRANSFER OF DATA INTO DATABASE

Data files are delivered via phone modem and are stored in directories on the system disk drive. (The electronic download data are always accompanied by data hard copy.) The directories can be thought of as a mail box that organizes files in a way that is easy to access and control. Files from BC Analytical are delivered via a phone modem and placed in the directory [bclab]. Files from TMA-Norcal are delivered to the directory [tinalab]. The directory is set up for each company and for each individual receiving the data files. Each directory is protected from unauthorized access. The staff person within EMS who can control access to the directories is the Database Manager. In the Environmental Protection Department, a company or individual can gain entry only to the specific directory assigned to the company or individual, or through granted access privilege. The established series of checks and balances gives maximum protection to the area where the data will ultimately reside, which in this case is the INGRES Global Tables. The example given will illustrate sewer data results and accompanying information stored with a sewer sample.

Work Tables allow the user to work with data so they can be placed in an acceptable format to be entered into the database, i.e., the Global Tables. It has the same form and constraints as the Global Tables, but is only temporary and is destroyed upon data transfer into the Global Tables. A Work Table consists of three tables: Sample Table, which contains the basic field structure that is used by INGRES and the Global Tables; Analysis Table, which contains the numbers or actual results of the lab analysis; and the QA Analysis Table, which contains information used by the database to maintain the Global Tables' integrity.

WORK SAMPLE TABLE			
log_no: LSB0190-01	loc_id: B-196	sampled: 1/1/90 norm_year: 1990 _qtr: 1 _month: 1	
type: RTN	depth: 0.0	doc_ctrl_no:	
project: LEMG		lab: LLNL 222	
requester: Jack Sims		lab_loc_id: 093-19	
footnote:		entered: 02/13/90	updater: GMD
note: Sewer RAD sample			
Append(Do) Help(Help) End(PF3)			

The fields that must be filled in the Sample and Analysis Tables correspond to the predesigned forms generated to record sampling information. Each field must be filled prior to exiting that specific entry, while grooming the table. This assures all fields accurate entry. There are associated tables maintained by the Data Managers and/or the Database Management Team. Once the tables have been groomed, an edit check is performed. The edit check is a list of all data entered for a particular data set. The edit check is verified against data hard copy. Once the data have been verified, the Sample and Analysis Work Tables are appended to the Global Tables. (Hand-entering this data into the database requires the creation of the Sample Table and subsequent loading of the Analysis Table prior to database entry.)

ANALYSIS TABLE

(Scientific Notation)

log_no: L580190-01

TAB TWICE

seq: 0

parameter: 8800

Enter parameter number for Tritium

description: Tritium

req_analys: RAD

anal_method:

los_ind: <

result: 3.3000E01

Enter RESULT for Tritium

error: 0.0000E+00

error_type:

units: pCi/L

los_value: 2.7500E02

Enter LOS_VALUE for Tritium

calcd_value: 0.0000E+00

entered: 2/13/90

updater: GMD

extracted:

analyzed:

Append(DO) Help(Help) Quit(PF4)

Press <DO> KEY

Append #3 will appear on screen

Global Tables are a collection of tables that contain specific types of data; they are the ultimate repository for monitoring data. There are 18 Global Tables: HT_OBSERVED WELL, WELLSCREEN, HYDRAULIC TEST, WELL, BOREHOLE/SPRING, GW ELEVATION, GW INSTRUMENT, LITHOLOGIC, PARAMETER, ANALYSIS, ANALYSISQA, LOCATION, NON-GW LOCATION, SAMPLE, PROJECT, OUTSIDE LAB, STATDESC, and STATRECS. Each Table contains specific fields. For example, fields for the LOCATION TABLE are ID, Type, Updater, Date entered. Fields for the PARAMETER TABLE are: Code, Description, Sequence, Entry Date. Fields for the SAMPLE TABLE are: Log #, Location ID, Sample Date, Normalized Year, Normalized Quarter, Normalized Month, Type, Depth, Project ID, Footnote, Note, Lab, Requester, Lab Location, Duplicate/Spike, Entry Date, Updater, Document Control #. Fields for the ANALYSIS TABLE are: Log #, Parameter ID, Requested Analysis, Analysis Method, Limit of Sensitivity Indicator, Result, Limit of Sensitivity Value, Calculated Value, Error, Error Type, Units, Date Extracted, Date Analyzed, Entry Date, Updater, Sequence, Flag_code.

The Global Tables have a specific inter-related design. Each Table is connected to the other tables via a connecting, or same field, such as the Location Identifier Field (loc_id), or Date Sampled (sampled), or Log Number (log_no). For example, the Sample Table is linked to the Analysis Table by log_no, but the Analysis Table is linked to the Parameter Table by the Parameter Code Field (code). The Sample Table is linked to the Location Table by the Location Identifier Field (loc_id). A table such as the Location Table contains all locations referenced by the Sample Table, and a location may not be entered into the location identifier field in the Sample Table unless it exists in the Location Table. The Parameter Table consists of a list of analytes, each with a corresponding number and alpha description. If a parameter is not contained in the Parameter Table, the parameter number code may not

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be entered into the parameter field of the Analysis Table. Each Table, or information grouping contained in the Global Tables, in turn, controls the integrity of data entry into the database.

EMP-QA-I

INVOICE PROCESSING

Prepared by:

Rebecca Ward 12-3-92
Rebecca Ward date
Environmental Technologist, SMG

Reviewed by:

Nina Hankla 12-3-92
Nina Hankla date
Data Manager, IMG

Paris E. Althouse 12-3-92
Paris Althouse date
Environmental Technologist, TSG

Wilda Martin 12-3-92
Wilda Martin date
Resource Manager, EMAD

Approved by:

Rebecca A. Failor 12/3/92
Rebecca A. Failor date
Section Leader, EMS

Cindy Garcia 12/3/92
Cindy Garcia date
Quality Assurance Coordinator, EMS

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REVISION 1 FINAL	EMP-QA-I Invoice Processing	Effective date: 01/04/93 Page 2 of 6
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1. PURPOSE

This procedure provides guidance for reviewing, verifying, and processing invoices issued to the Environmental Monitoring Section (EMS) within the Environmental Monitoring and Analysis Division (EMAD). It provides general guidance for situations resulting from the procurement of goods, but it must be strictly followed when processing invoices pertaining to the receipt of analytical services. (See Reference 1 for service criteria and the list of contract laboratories presently used.) Guidance also can be obtained by contacting LLNL Procurement Department personnel (3-2375). Official procedural changes by the Procurement Department may result in design changes to this document (Reference 2).

2. APPLICABILITY/DISCUSSION

This procedure applies to all personnel who review, verify, and process invoices resulting from the procurement of analytical services. Invoices are issued to the Technical Representative(s) of the group.

3. REFERENCES

1. EMP-QA-AR, *Analytical Requirements*
2. EMP-QA-CD, *Changes in Design*
3. EMP-QA-SL, *Sample Location Designators*
4. EMP-QA-DC, *Document Retention*
5. EMP-QA-SD, *Sample Tracking Documentation*

4. DEFINITIONS

Analytical Services: Chemical and/or radiological analyses of environmental samples and the subsequent data reporting.

Technical Representative (TR): As defined by the Procurement Office, the individual selected to receive and process invoices. This is the same individual who first receives the data reports to which the specific invoices correspond.

Invoice Action Form (IAF): This form is issued by the Procurement Department and is attached to the invoice (which is previously issued by a contract laboratory). The IAF includes information such as the invoice number; the purchase order number; the identities of the Technical Representative(s), the Resource Manager, and the contact person in the Procurement Department; and instructions for reviewing the invoice. (See Attachment A).

Invoice: An itemized list of goods shipped or services rendered, stating quantities, prices, fees, shipping charges, etc. (See attachment B).

5. RESPONSIBILITIES

5.1. SECTION LEADER

The EMS Section Leader is ultimately responsible for assuring that invoices are processed, as prescribed, in a timely manner by appropriate personnel.

5.2. TECHNICAL REPRESENTATIVE(S)

The EMS Technical Representatives are responsible for reviewing, verifying, and processing all invoices issued to the group by the Procurement Department Contract Administration. Presently, the responsibility for invoice review has been assigned to EMS personnel according to the type of media being sampled.

5.3. EMAD RESOURCE MANAGER

The EMAD Resource Manager is responsible for further processing of the invoice which includes such activities as; verifying the TR's signature, checking for proper account number, posting the invoice in the appropriate ledger, signing the invoice, and forwarding the invoice for payment to either the Accounting Office or to the LLNL Procurement Department.

5.4. IMG DATA MANAGER

The IMG Data Manager is responsible for filing the completed data package, which includes the invoice(s), the original data report, and the Chain-of-Custody Record Form (COC).

6. PROCEDURE

Equipment Required:

Rubber date stamp.
Black ball-point pen.
Invoice(s) that need to be processed.

Upon receipt of the invoice package from the Procurement Department, the EMS TR should perform the following sequence of tasks:

- 6.1. Date the package with the rubber stamp.
- 6.2. Verify that the IAF correctly identifies with the attached invoice(s) and that it is inclusive. That is, check to see that the invoice numbers on the invoice(s) are the same as those listed on the IAF, and that all are accounted for.
- 6.3. Verify that the Purchase Order (P.O.) number listed on the IAF identifies with the Client P.O. number on the invoice(s). (If the numbers do not agree, the invoice may belong to another program or department.)
- 6.4. Review each item listed under ITEM SAMPLE IDENTIFICATION. Each item should be recognizable as an EMS sample designator (see Reference 3).
- 6.5. Once satisfied that all items invoiced are the responsibility of EMS, verify receipt of the services listed by applying at least one of the following methods:
 - 6.5.1. Compare the itemized invoice against a check-off list inclusive of all analytical results received to-date, or
 - 6.5.2. Compare the itemized invoice against the actual hard copy of the analytical results.

6.6. When satisfied that all items have been appropriately invoiced, sign in the designated box on the IAF, and include in the signature box the EMS account number that supports the services received.

6.7. Attach a photocopy of the corresponding COC form, which must include all necessary signatures (see Reference 5).

6.8. If a photocopy of the invoice is not included with the invoice package, make sure a copy is made prior to forwarding the package on to the EMAD Resource Manager.

6.9. Forward the package to the EMAD Resource Manager via LLNL mail or hand deliver the package. It is important to complete steps 6.1. through 6.9. within five working days.

6.10. File the photocopy of the processed invoice with the corresponding original data report/COC package.

6.11. Relinquish the completed data package to the Data Manager for archiving (as prescribed in EMP-QA-DC).

Questions pertaining to any step in the procedure, or problems related to processing the package should be addressed quickly. If the EMAD Resource Manager is unavailable or unable to respond to a problem, contact the Procurement Department, Subcontract Administrator Support Section, for guidance.

7. DOCUMENTATION

Although there is no prescribed method for documenting the time that invoice processing activities have occurred, it is highly recommended that the TR record such activities in a logbook. The TR's personal work logbook would serve as an appropriate place for this activity, provided it is properly maintained and up-to-date.

8. ACCEPTANCE CRITERIA

N/A

9. ATTACHMENTS

Attachment A: Sample Invoice Action Form
Attachment B: Sample Invoice

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FINAL

EMP-QA-I
Invoice Processing

Effective date: 01/04/93
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ATTACHMENT A:

Procurement Department
Contract Administration

Invoice Action Form

11/20/92 13:17
Livermore Laboratory
R2055

Received

To: REBECCA WARD L- 255 NOV 23 1992 Date: 11/20/92
Technical Representative

From: Procurement Dept, Subcontracts L- 650

Subject: Approval for Payment of Invoice # E48902 1190.00
Purchase Order # H111600
Subcontractor: BC ANALYTICAL
Does this Invoice contain Property ?

Please review the attached invoice and determine whether the labor and material charges are consistent with your understanding of the work the Subcontractor performed during the period billed. If you conclude the charges are acceptable, please sign the certification block on the invoice. Call the undersigned if you are holding the invoice pending problem resolution.

Please return the invoice within five (5) days to: Wilda Martin

S. MEYER FREAD L- 650 Ext: 33061

Thank you.

Comments:

To: J. ADAMS Subcontract Administrator Date: _____
Ext: 32375

Date Expires :	03/31/93	*****
Subcontract Amt:	7030000.00	* Does this Invoice *
Cum-to-Date :	6032156.35	* Contain Property ? *
Balance :	997843.65	* *****

Please Note:

131 Days till Expiration.

Request Payment Approval

85 % of Contract has been expended.

Change Order in progress ?

Comments:

Return to: S. MEYER FREAD
Subcontract Administrator Support Section

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FINAL

EMP-QA-I
Invoice Processing

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ATTACHMENT B:

B C Analytical

801 WESTERN AVENUE - GLENDALE, CA 91201
(610) 307-4727 FAX (610) 307-4707

CONTRACTS
MANAGEMENT GROUP

Rec'd
1992 NOV 11 A 4 11

INVOICE

CONTROL NO. 1343-00

CLIENT PO. NO. H111600

REQ. NO: 1321

PROJECT NO: 2351

INVOICE NO: E48902

Ms. Annette Hoyle
UC Lawrence Livermore National Lab
P.O. Box 5012, Mailstop L-650
Livermore, California 94550

Received

NOV 23 1992

INVOICE DATE: 05 NOV 1992

TERMS: Net 30 Days

EMG

LOG NO: E92-10-326

INVOICE

ITEM	SAMPLE IDENTIFICATION	ANALYSIS	TYPE	PRICE + RUSH	* QTY *	AMOUNT
1	1-3-K703-01-MV	Beryllium	GV	15.00	7	105.00
	2-3-K701-01-MV	Lead		15.00		105.00
	3-3-NC725-01-MV	Barium		15.00		105.00
	4-3-0A-52-MV	Manganese		15.00		105.00
	5-3-0A-74-MV	Digestion Charge		10.00		70.00
	6-3-NC747-01-MV	Digestion Charge				
	7-3-K710-01-MV	EPA Method 601		100.00		700.00

TOTAL

\$1,190.00

THIS IS TO CERTIFY THAT THE MATERIALS
AND/OR SERVICES STATED ON THIS INVOICE
WERE RECEIVED OR RENDERED IN ACCORDANCE
WITH THE PURCHASE ORDER OR SUB CONTRACT.

BY

Rebecca Ward
3293-10

REPORTED TO: Ms. Rebecca Ward
BCA CONTACT: Rich Bauer
BCA PHONE: (510) 428-2300

CUSTOMER PHONE: 510/423-0513

For Proper Credit,
please show INVOICE Number
on your remittance

Remit to: BC Analytical
801 Western Avenue
Glendale, California 91201

PAYMENT IS DUE WITHIN 30 DAYS AFTER DATE OF INVOICE. INTEREST ON THE UNPAID BALANCE WILL ACCRUE BEGINNING WITH THE FIRST DAY AT THE RATE OF 1.5 PERCENT PER MONTH OR THE MAXIMUM INTEREST RATE PERMITTED BY LAW, WHICHEVER IS LESSER.

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EMP-QA-NCR
NONCONFORMANCE AND DISCREPANCY REPORTING

Prepared by: Lucinda M Garcia 6/28/94
Lucinda M. Garcia date
QA Coordinator, EMS

Reviewed by: Bill Hoppes 6/28/94
Bill Hoppes date
Group Leader, WGMG

Duane Rueppel 6/28/94
Duane Rueppel date
Group Leader, TSG

Kris Surano 6/28/94
Kris Surano date
Group Leader, Tamm

Approved by: Rebecca A. Failor 6/28/94
Rebecca A. Failor date
Section Leader, EMS

Lucinda M Garcia 7/29/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Concurrence: Jack Sims 7/28/94
Jack Sims date
QA Coordinator, EMAD

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MONITORING SECTION
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1. PURPOSE

This procedure defines the responsibilities, requirements, and methods used by EMS for identifying, evaluating, controlling, resolving, and reporting quality-affecting items and activities that do not conform to specified EMS requirements. It defines the use of Needs Changing Reports (NCRs) and EMAD Nonconformance Reports to document the identification and resolution of EMS quality-affecting activities that do not meet specified requirements.

2. APPLICABILITY/DISCUSSION

In order to achieve ongoing improvement in EMS quality-affecting activities, conditions that do not conform to requirements specified in plans, procedures, contracts, or interface documents, or which cast doubt on the quality of environmental monitoring data, should be identified, controlled, and corrected (References 1, 2, and 3). In addition, items and processes requiring improvement should be submitted to the attention of Management. NCRs are Quality Assurance tools used to help EMS improve quality by notifying Section Management and the QA Coordinator of areas needing improvement, and by documenting the evaluation process, actions taken when quality-affecting activities do not meet specified requirements, or the reasons a decision not to take action was made.

This procedure applies to all EMS quality-affecting activities (Reference 2), with the exception of self-assessment corrective action plans, sewer alarm response activities, items listed on DefTrack, and data errors discovered during the Site Annual Environmental Report QC check. These activities are covered in References 4, 5, 6, and 7, respectively. All other EMS quality-affecting activities that do not conform to specified requirements must be documented in NCRs. When an NCR is related to costly (>\$10,000) or high-risk items, or when resolution will require a lot of resources (money, time, equipment, people, or space), an EMAD Nonconformance Report will be written and the NCR will not be closed without approval from the EMAD QA Coordinator. Copies of all EMAD Nonconformance Reports will be forwarded to the EPD QA Manager. Items and activities that are not EMS quality-affecting (Reference 2) do not require the completion of NCRs.

Typical issues that might be discovered by EMS personnel that would require the preparation of NCRs include, but are not limited to, lost samples, incorrect sampling method, broken sample containers, equipment malfunctions, interruption of utility services, human error in sampling, sampling delay, samples taken at locations other than those specified in EMS Procedures, problems with sample documentation (such as broken Chain of Custody), samples lost or contaminated by an analytical laboratory, samples not analyzed within specified holding times, incorrect sampling method used, incorrect calculations, transmission errors in electronic downloads, typographical errors in data reports, missing or incomplete data, incorrect units in data reports, Quality Control (QC) data out of bounds or missing, incorrect detection limits, and failure by an analytical laboratory to follow agreed upon protocol. This list is not intended to be comprehensive, but to serve as an aid in identifying the types of problems that should be documented in NCRs.

The NCR process is designed to document situations where quality-affecting activities do not conform to specified requirements, ensure that appropriate solutions are implemented, and ultimately, reduce the number and magnitude of problems and their impact on the Section. All EMS personnel are responsible for and authorized to initiate NCRs. Personnel may participate in NCR investigations and corrective action and remediation activities, as assigned by the Section QA Coordinator, in concurrence with either the appropriate Group Leader or the Section Leader.

The status of EMS NCRs will be reported to the Section Leader, the EMS Group Leaders, the EMAD QA Coordinator, and the EPD QA Manager. NCRs are considered QA records and will be maintained according to the requirements of Reference 8.

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3. REFERENCES

1. EPD Quality Assurance Management Plan
2. EMS Quality Assurance Plan
3. EPD QIP-15.1, Nonconformance and Corrective Action Reporting
4. EMP-QA-SA, Self Assessments
5. EMP-SW-AR, Sewer Alarm Response
6. EPD Self Assessment Implementation Guidelines
7. EMP-QA-AER, Site Annual Environmental Report
8. EMP-QA-DC, Document Retention

4. DEFINITIONS

DefTrack: The LLNL Environmental Safety and Health (ES&H) Deficiency Tracking System. DefTrack is administered by the Assurance Review Office (ARO). DefTrack provides a logical, convenient mechanism for finding, tracking, verifying, and assessing deficiencies found during ES&H compliance inspections mandated by the Plant Operations Directorate and Environmental Protection Department Self-Assessment Programs. DefTrack was created in 4th Dimension relational database software and runs on Macintosh computers.

EMS Quality-Affecting Activity: An item or activity that meets the criteria for an EMS quality-affecting activity as defined in Section 1.4 of the EMS Quality Assurance Plan (Reference 2).

NCR Log: A database containing information regarding EMS NCRs. A printout showing the information included in the EMS NCR Log is included as Attachment C.

Needs Changing Report (NCR): The document used to report EMS quality-affecting activities that do not conform to specified requirements or that cast doubt on the quality of environmental monitoring data or reports. NCRs document evaluation and resolution and identify the assignment of EMAD Nonconformance Reports, when necessary.

Responsible Party: The EMS staff member assigned by the QA Coordinator to be responsible for the analysis, resolution, implementation, and documentation of a particular NCR or EMAD Nonconformance Report.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The Section Leader has overall responsibility for ensuring that EMS quality-affecting activities that do not conform to specified requirements or that cast doubt on the quality of environmental monitoring data or reports are identified, corrected, and managed in such a way that they will not recur. The Section Leader ensures that this procedure is adequate to meet the needs of the Section and that it is fully implemented. The Section Leader is also responsible for ensuring that all personnel are adequately trained in the philosophy and tools required to be successful in identifying, documenting, and resolving problems related to EMS quality-affecting activities. The Section Leader reviews NCR summary reports at least quarterly and participates in the resolution of NCRs and EMAD Nonconformance Reports as required. In

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addition, the Section Leader is responsible for allocating sufficient resources to ensure that this procedure can be implemented as written.

5.2. GROUP LEADERS

Group Leaders are responsible for ensuring that members of their groups understand and comply with the requirements of this procedure. Group Leaders may recommend the initiation of EMAD Nonconformance Reports. If Group Leaders feel that the responsibility for resolving an NCR was assigned to a member of their group inappropriately, they are responsible for informing the QA Coordinator and determining a mutually acceptable assignment of responsibility. Group Leaders also review periodic NCR summary reports.

5.3. EMS QUALITY ASSURANCE COORDINATOR

The EMS Quality Assurance Coordinator manages the NCR system. The EMS QA Coordinator is responsible for reviewing all NCRs, assigning responsibility for correcting EMS quality-affecting activities that do not conform to specified requirements or that cast doubt on the quality of environmental monitoring data or reports, ensuring that responsible parties work towards resolving NCRs, approving the closure of all completed NCRs, maintaining the NCR log, assigning NCR numbers, maintaining files of open and closed NCRs, and reporting NCR summaries to management in quarterly and annual reports. In addition, the EMS QA Coordinator is responsible for determining the need for EMAD Nonconformance Reports, preparing EMAD Nonconformance Reports, and working with the EMAD QA Coordinator to resolve EMAD Nonconformance Reports related to EMS. Finally, the EMS QA Coordinator is responsible for ensuring EMS personnel are adequately trained to identify, document, and resolve problems using the methods described herein.

The EMS QA Coordinator may delegate NCR log-in and tracking duties, but retains ultimate responsibility for their accomplishment.

5.4. ALL EMS PERSONNEL

All EMS personnel are responsible for identifying EMS quality-affecting activities that do not conform to specified requirements, documenting them in NCRs, and delivering NCRs to the QA Coordinator for processing. When assigned by the QA Coordinator, Section personnel are responsible for determining and documenting the disposition of NCRs. When Section personnel feel they have been assigned responsibility for resolving an NCR inappropriately, they are responsible for informing their Group Leader.

5.5. NON-EMS PERSONNEL

Personnel outside EMS performing quality-affecting activities for EMS (such as analytical laboratory personnel) who identify areas where EMS is not conforming to specified requirements may file EMS NCRs. Non-EMS personnel needing to write EMS NCRs should contact the EMS QA Coordinator.

5.6. EMAD QA COORDINATOR

The EMAD QA Coordinator reviews NCR summary reports and may, upon request, review closed EMS NCRs. The EMAD QA Coordinator manages the EMAD Nonconformance Report system and informs the EPD QA Manager of the status of EMS NCRs.

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6. PROCEDURE

Equipment Required:
NCR Form (Attachment A)
EMAD Nonconformance Report Form (Attachment B)

6.1. INITIATION OF NCR

Whenever an EMS staff member discovers an item or activity that does not meet specified EMS requirements, that person must document the condition on an EMS NCR Form (Attachment A). Staff members should make notes at the time and scene of the occurrence, where appropriate, to provide the most complete description of the problem.

If it is possible and safe to do so, the person discovering the problem should correct it immediately. (An example would be plugging in the electrical cord of an air sampler that was discovered unplugged.) However, an NCR must be completed even if the problem is resolved in the field.

As soon as possible after identifying the need for an NCR, the person making the discovery should complete the top part of an EMS NCR Form including "Problem Identified by:" and the date. The box representing the type of problem (Sampling, Analytical Lab, Training, or Other) should be checked and any additional information required (type of sampling, name of lab or description of "other") should be filled in. A description of the problem observed and any immediate action taken to correct it should be entered under "Description of Problem and Action Taken". Applicable EMS procedures, plans, or other documents should be referenced as Applicable Requirements. Any supporting information, such as copies of data reports from analytical laboratories, that could help define the problem more completely should be stapled to the NCR form.

If an NCR is not resolved immediately upon discovery, any affected items should be identified by marking, tagging, or other viable means and, if possible, segregated to prevent inadvertent use before the problem is corrected.

6.2. LOG-IN

After the top of the NCR form has been filled out, the author should deliver it to the EMS QA Coordinator. The EMS QA Coordinator will review the NCR, determine if all necessary information has been given and, if necessary, obtain further explanation from the author. The EMS QA Coordinator will then determine whether an EMAD Nonconformance Report is required. EMAD Nonconformance Reports are required when the subject of the NCR is costly (>\$10000), a high-risk item, or indicative of a trend (such as particular samples being damaged each time they are collected or repeatedly receiving erroneous data from an analytical laboratory). The EMS QA Coordinator will initiate an EMAD Nonconformance Report if one is required (see Section 6.8.) If not, the NCR will continue to be processed.

The EMS QA Coordinator will assign an NCR number to the new NCR, sign the NCR, and enter it in the NCR log. EMS NCR numbers are formatted "NCR-YY-XXX" where YY is the calendar year, and XXX is the sequential NCR number for that year. A copy of the NCR is filed in the EMS "Open-NCR" binder, and the original is submitted to the person responsible for resolving it.

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6.3. ASSIGNMENT OF RESPONSIBILITY

The QA Coordinator will identify the best person within the Section to be the responsible party for the NCR. The responsible party must determine the disposition of the NCR, decide what (if any) additional action should be taken and who is responsible for taking that action, ensure that the recommended action is completed, and finally, ensure that the problem has been resolved. In general, the responsible party will be the Environmental Analyst or Analyst Assistant responsible for the affected medium, but responsibility for resolving NCRs may also be assigned to Environmental Technologists, the Data Manager, the QA Coordinator, the Section Leader, or any other EMS personnel with demonstrated competence in the field related to the condition described in the NCR. The appropriate Group Leader or the Section Leader may overrule assignments made by the QA Coordinator. When this happens, the Group Leader or Section Leader must inform the QA Coordinator and determine a mutually acceptable responsible party.

6.4. RESOLUTION

The responsible party reviews the NCR and determines its disposition. If an EMAD Nonconformance Report has not been assigned and the responsible party feels that an EMAD Nonconformance Report is indicated, he or she should contact the QA Coordinator. When an EMAD Nonconformance Report has been assigned, the disposition of the NCR will be linked to the EMAD Nonconformance Report. Final disposition of the NCR cannot be determined until the EMAD Nonconformance Report has been completed and approved (see Section 6.7).

Possible dispositions for EMS NCRs include Use as Is, Problem Resolved in Field, Resample, Contact Analytical Laboratory, Training, and Other. The responsible party should check off the appropriate disposition when it has been determined.

If, based on information given in the top part of the NCR form, it is apparent that the problem was resolved in the field, and the responsible party is satisfied that the action taken was adequate to resolve the problem, it is only necessary to check that box, sign the NCR form, and return it to the QA Coordinator.

If the responsible party determines that "Use as Is" is the appropriate disposition, a justification is required. This justification should include the rationale for determining that the item or action is acceptable in this particular case and, if possible, the underlying (root) cause. If modification of EMS procedures or plans is required based on this NCR, the name of the plan or procedure to be modified and a summary of the modifications required should be included in the justification. The justification must be approved by the QA Coordinator before the NCR is accepted and closed.

Any of the other possible dispositions require that some action be taken. Actions to be taken to resolve NCRs without EMAD Nonconformance Reports assigned to them should be relatively short-term (e.g., contact analytical lab for corrected data, take another sample, recalibrate equipment, etc.). If the action required to resolve the NCR is resource intensive or is related to a high risk or costly (>\$10,000) item or activity, the QA Coordinator should be contacted and an EMAD Nonconformance Report may be initiated.

The responsible party must decide the action to be taken, then ensure that it is completed and that it adequately addressed the issue described in the NCR. The responsible party must also document what was done and when in the Justification section of the NCR form.

6.5. VERIFICATION, ACCEPTANCE, AND CLOSURE

After determining the appropriate disposition and completing and documenting any actions taken to resolve the NCR, the responsible party should submit it to the QA

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Coordinator. The QA Coordinator will review the NCR, determine whether the disposition and action taken or justification are acceptable, and discuss any outstanding questions with the responsible party. The QA Coordinator may verify that any actions described were completed as stated and that the problem was resolved before approving the NCR.

After the QA Coordinator is satisfied that the completed NCR is acceptable, both the QA Coordinator and the responsible party sign and date the NCR, thereby closing it. In cases where an EMAD Nonconformance Report was assigned, the EMAD Nonconformance Report must be closed before the NCR can be closed. After an NCR has been signed off as being closed, the QA Coordinator will close it in the log and file the completed NCR form in the "Closed NCR" binder.

6.6. CONDITIONS THAT ARE CORRECTED IN THE FIELD

When the condition requiring an NCR condition is corrected in the field, the person who discovered and corrected it should still complete an NCR form. The action taken to correct the problem should be described in the Justification or Explanation section of the form. The form should be submitted to the QA Coordinator who, together with appropriate EMS staff members, will verify that no further action is required. The QA Coordinator will approve the resolution of the NCR, send an informational copy to the appropriate Environmental Analyst, and close it immediately. The QA Coordinator will ensure that the NCR is logged in, assigned an NCR number, and archived as described in Sections 6.2 and 6.5 of this procedure.

6.7. NCRS THAT ARE RELATED TO ONGOING NCR OR EMAD NONCONFORMANCE REPORTS

If the QA Coordinator determines that a new NCR is directly related to an in-progress NCR or EMAD Nonconformance Report, the resulting NCR will be assigned to the person responsible for that NCR or EMAD Nonconformance Report. The new NCR will only be resolved when the ongoing NCR or EMAD Nonconformance Report is closed. EMAD management will be periodically informed when new NCRs related to open EMAD Nonconformance Reports are filed.

6.8. INITIATION OF EMAD NONCONFORMANCE REPORT

When the need for an EMAD Nonconformance Report is identified, the responsible person will inform the QA Coordinator. If the QA Coordinator concurs that an EMAD Nonconformance Report is appropriate, the top part of an EMAD Nonconformance form (Attachment B) will be completed by the responsible party or the QA Coordinator. The QA Coordinator will deliver the EMAD Nonconformance Report to the EMAD QA Coordinator who will determine and assign responsibility for resolving it and ensure that it is resolved.

6.9. REPORTS TO MANAGEMENT

The QA Coordinator will prepare a quarterly report for the EMS Section Leader, the EMS Group Leaders, and the EMAD QA Coordinator summarizing NCR activity during the quarter, highlighting successes, and pointing out persistent and particularly difficult problems. Management will review this report and provide feedback to the QA Coordinator as required. NCRs and EMAD Nonconformance Reports will also be summarized in the annual EMS Quality Assurance Report to Management (Reference 2) and the Site Annual Environmental Report

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(SAER, Reference 7). Copies of all EMS NCR summary reports will be forwarded to the EPD QA Manager for review.

7. DOCUMENTATION/QA RECORDS

All NCRs shall be maintained as QA records. Any documentation generated in support of the closure of an NCR should become part of the NCR. In the case where a controlled document (such as an EMS procedure) is generated or revised in response to an NCR, it does not need to be attached, but the new revision generated should be clearly referenced on the NCR. Two binders are kept by the QA Coordinator: one containing open NCRs, and the other containing closed NCRs. NCRs are kept in numerical sequence within each binder. After the SAER is published, the NCRs for that year may be filed in the Document Retention Center as described in Reference 8. Copies of EMS NCRs will be made available to the EMAD QA Coordinator or the EPD QA Manager upon request.

8. ATTACHMENTS

Attachment A: NCR Form

Attachment B: EMAD Nonconformance Report Form

Attachment C: NCR Log Database Fields

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**Attachment A
NCR FORM**

ENVIRONMENTAL MONITORING SECTION

NCR# _____

Problem identified by: _____

Date: _____

Type of Problem

- ☐ Sampling (which type) _____
- ☐ Analytical Lab (which lab) _____
- ☐ Training _____
- ☐ Other _____

Description of Problem and Action Taken:

Applicable Requirements (reference EMS procedures, plans, or documents if possible):

Assigned to: _____

QA Coordinator: _____ **date:** _____

Disposition:

- ☐ Use As Is ☐ Problem Resolved in Field ☐ Resample
- ☐ Contact Analytical Laboratory ☐ Training ☐ Other

Justification:

EMAD NCR Required: ☐ No ☐ Yes: NCR # _____

Approved by: _____ **date:** _____

responsible party: _____ **date:** _____

QA Coordinator: _____ **date:** _____

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**ATTACHMENT B:
EMAD NONCONFORMANCE REPORT FORM**

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ATTACHMENT A

ENVIRONMENTAL PROTECTION DEPARTMENT NONCONFORMANCE AND CORRECTIVE ACTION REPORT			
SECTION I NONCONFORMANCE			
1. Date:	2. Item Name:	3. Equipment I.D. Number	4. NCAR No: (MPS) -
5. Item Supplier:	6. Responsible Division:	7. Location:	
8. Description of Nonconformance: 			
9. Preparer: (Print and sign)		Date:	10. Responsible Supervisor
SECTION II NONCONFORMANCE ANALYSIS			
11. Disposition: ☐ Accept* ☐ Reject ☐ Repair* ☐ Rework *Justification Required 			
12. Corrective Action: 			
12a. Remedial action taken: 			
12b. Underlying Cause: 			
12c. Compliance Code: 			
12d. Preventive: 			
13. Responsible Individual: (Supervisor or designee)		Date:	
SECTION III APPROVALS			
14. QAIC Concurrence:		Date:	
15. Responsible Supervisor Approval:		Date:	

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**ATTACHMENT C:
NCR LOG DATABASE FIELDS**

1994 NCRs

NCR Number _____

NCR date _____

Problem Identified by _____

Type of Problem _____

Description of problem _____

Applicable requirements _____

Assigned to _____

Date assigned _____

Disposition _____

Justification _____

EMAD NCR required _____

Completion date _____

Comments _____

EMP-QA-P

PROCUREMENT PRACTICES

Prepared by:

Gretchen Gallegos
Gretchen Gallegos
Acting Group Leader, IMG

12/9/92
date

Reviewed by:

Kris Surano
Kris Surano
Group Leader, SMG

12/9/92
date

Wilda Martin
Wilda Martin
Resource Manager, EMAD

12-9-92
date

Approved by:

Rebecca A. Failor
Rebecca A. Failor
Section Leader, EMS

12/9/92
date

Lucinda M. Garcia
Lucinda M. Garcia
Quality Assurance Coordinator, EMS

12/9/92
date

Concurrence:

Larry Pendexter
Larry Pendexter
Quality Assurance Manager, EPD

12/9/92
date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes specific areas to be considered during the procurement process for items and services affecting quality for the Environmental Monitoring Section (EMS), including assessment of proposed contractors' QA plans, QA performance, ability to do the work, and cost. It also states the requirements and responsibilities for control of procurement documents associated with the purchase of items or services for the EMS. This procedure shall be used in conjunction with LLNL Procurement Department policies and procedures and is not intended to replace, contradict, or interfere with those requirements or with the requirements of References 1 and 2.

2. APPLICABILITY/DISCUSSION

LLNL has a large Procurement Department, which is generally responsible for the procurement of items and services. The EMS, through its Division Leader, provides the information necessary for Procurement to acquire the quality-affecting items and services needed by the group. For the purposes of this procedure, "procurement" means the requisitioning of items and services that are purchased by the LLNL Procurement Department and does not include direct purchases, such as purchases made with petty cash.

3. REFERENCES

1. DOE Order 5700.6B
2. ANSI/ASME NQA-1-1986
3. Environmental Protection Department Quality Assurance Management Plan
4. EMP-QA-A, Quality Assurance Audits
5. EMP-QA-DC, Document Retention Center

4. DEFINITIONS

None

5. RESPONSIBILITIES

5.1. EPD QUALITY ASSURANCE MANAGER

The EPD Quality Assurance Manager is responsible for monitoring the procurement process to verify that applicable procurement documents and procurement actions include appropriate QA requirements, as stated in Reference 3. The QA Manager is also responsible for approving contractor/vendor qualification and reviewing contractual documents for inclusion of appropriate QA provisions. The QA Manager may delegate these responsibilities, but the QA Manager retains ultimate responsibility.

5.2. DIVISION LEADER

The Division Leader is responsible for assuring that procurement documents include the appropriate technical, regulatory, LLNL Procurement Department, and QA requirements applicable to the item or service being procured, including receipt inspection and acceptance. The Division Leader is also responsible for initiating and maintaining a Procurement Document Package containing a copy of all documentation for the procurement. These responsibilities may be delegated, but the Division Leader remains ultimately responsible for the task. The Division

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Leader is responsible for the approval of all procurement documents prior to submittal to the LLNL Procurement Department. This approval may be delegated to the Section Leader, a Group Leader, or other EMS personnel with account-number signature authority.

5.3. EMS GROUP LEADERS

The EMS Group Leaders are responsible for determining what items and services the groups need, and for the timely submittal of procurement requests.

5.4. EMS ENVIRONMENTAL ANALYSTS

The EMS Environmental Analysts are responsible for advising their Group Leader of items or services needed; they are responsible for keeping informed about new analytical methods and new vendors of items and services. They are also responsible for advising their Group Leader of any deficiencies in the performance of ongoing service contracts or defects in items procured. In addition, the Environmental Analysts are responsible for assessing the ability of proposed contractors to do the work required in a service contract.

5.5. EMS QUALITY ASSURANCE COORDINATOR

The EMS Quality Assurance Coordinator is responsible for assessing proposed contractors' QA plans and their past QA performance.

6. PROCEDURE

Equipment Required:

N/A

6.1. LLNL PROCUREMENT DEPARTMENT

The LLNL Procurement Department initiates all formal procurement actions and is responsible for the compliance of these actions with federal law and regulations and DOE Orders (References 1 and 2). This procedure does not attempt to describe or control LLNL Procurement Department practices; rather, it addresses those considerations that must be brought to the attention of the Procurement Department during the procurement process.

6.2. INITIATION OF PROCUREMENT DOCUMENT PACKAGES

The procurement cycle begins when the need for an item or service has been identified and the decision has been made to purchase from a qualified subcontractor or vendor. The appropriate procurement requirements are then developed. Minimum QA requirements for services and items are listed in sections 6.2.1 and 6.2.2.

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6.2.1. PROCUREMENT CRITERIA FOR CONTRACT SERVICES

6.2.1.1. Quality Assurance Plan

To be an acceptable candidate, any subcontractor or vendor of environmental monitoring services must have a written Quality Assurance plan. The plan must address, at a minimum, the following elements:

Organization	Control of Nonconformances
Procedures and Instructions	Identification of Items
Document Control	Training
Inspections/Audits	Test Control
Special Processes	QA Records and Corrective Action
Handling, Storage, and Shipping	Control of Measuring and Test Equipment

6.2.1.2. Quality Assurance Performance

The past quality assurance performance of candidate subcontractors or vendors must be evaluated. One method for evaluation is to audit the candidate before awarding the procurement contract, following procedure EMP-QA-A, Quality Assurance Audits (Reference 4). Another method is to review the results of any independent QA audit against the requirements of EMP-QA-A. Whatever the method of determining past QA performance, it must consist of more than just the representations of the candidate subcontractor or vendor.

6.2.1.3. Quality Assurance Audits

As a condition of the procurement contract, any subcontractor or vendor of services must submit to periodic quality assurance audit by the EMS or other appropriate organizations within LLNL.

6.2.1.4. Subcontractor/Vendor Ability to Perform Work

The ability of any proposed subcontractor or vendor to perform the work must be evaluated. This evaluation should include the analytical devices used by the subcontractor or vendor and their sensitivity, accuracy, and precision. In addition, the ability of the subcontractor or vendor to handle the expected volume of work should be evaluated. Other criteria specific to the media being analyzed also should be specifically listed.

6.2.1.5. Cost

The costs of services should be evaluated when considering proposals submitted by subcontractors or vendors. Very low bids should be examined closely to make sure that all terms in the procurement package are addressed.

6.2.2. PROCUREMENT CRITERIA FOR ITEMS

6.2.2.1. Item Utility

Any item being purchased for EMS must be capable of performing the work for which it is intended. For analytical devices, this should be evaluated and/or specified in terms of sensitivity, accuracy, and precision. In addition, the ability of the item to handle the expected volume of work should be evaluated. Other criteria specific to the media being analyzed should also be specifically listed.

6.2.2.2. Cost

The cost of all items should be evaluated. Very low bids should be examined closely to be sure that all terms in the procurement package are addressed.

6.3. REVIEW OF PROCUREMENT DOCUMENT PACKAGES

The Division Leader is responsible for assuring that procurement documents are reviewed and, if necessary, revised. The review ensures that documents transmitted to subcontractors or vendors include provisions that services and associated deliverables will meet specified requirements. Reviews shall also verify that procurement documents include applicable regulatory requirements.

The QA Manager assures, through audits and surveillance, that procurement documents have been reviewed and that appropriate changes have been made.

6.4. APPROVAL OF PROCUREMENT DOCUMENTS

After an appropriate review, the Division Leader is responsible for the approval of all procurement documents prior to submittal to the LLNL Procurement Department. This approval may be delegated to the Section Leader, a Group Leader, or other EMS personnel with account-number signature authority.

6.5. PROCUREMENT DOCUMENT CHANGES

Changes to procurement documents shall be subjected to the same review and approval process that is required for the preparation of the original document.

7. DOCUMENTATION/QA RECORDS

Quality-affecting procurement documents shall be initiated by the Division Leader and controlled to ensure that the procurement cycle has been implemented effectively. Procurement records shall include all appropriate documentation, including all documentation submitted to or received from the LLNL Procurement Department. A list of all current, major contracts or procurements shall be kept in the Document Retention Center. A list of all major pending procurement packages shall also be kept in the Document Retention Center (Reference 5).

8. ACCEPTANCE CRITERIA

This procedure shall be completed when services and items have been received and accepted and appropriate procurement documentation filed. The criteria for methods used for acceptance of items and services shall be identified in appropriate written procedures and contracts.

9. ATTACHMENTS

N/A

EMP-QA-PW
PROCEDURE WRITING

Prepared by: Lucinda M Garcia 9/10/92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Reviewed by: Gretchen Gallegos 8/18/92
Gretchen Gallegos date
Acting Group Leader, IMG

Kris Surano 8/25/92
Kris Surano date
Group Leader, SMG

Rebecca A. Failor 9/14/92
Rebecca A. Failor date
Section Leader, EMS

Approved by: Rebecca A. Failor 9/17/92
Rebecca A. Failor date
Section Leader, EMS

Lucinda M Garcia 9/10/92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Concurrence: Larry Pendexter 10/5/92
Larry Pendexter date
Quality Assurance Manager, EPD

LLNL ENVIRONMENTAL
MONITORING SECTION
UNCONTROLLED COPY
FOR INFORMATION ONLY

1. PURPOSE

This procedure, prepared in conformance with Reference 1, provides guidance for the preparation of procedures used by the Environmental Monitoring Section (EMS) in the performance of its duties. It provides a consistent format for producing quality documents that will enable members of the EMS to perform assigned tasks in a thorough and professional manner. All procedures produced by the EMS must follow this guidance and should be in the same format as this procedure.

2. APPLICABILITY/DISCUSSION

This procedure applies to all personnel engaged in writing procedures within the EMS. Well organized, clearly written procedures are essential to define exactly how an activity is to be performed. Procedures should include the purpose, rationale/logic, methods to be employed, any special personnel or material requirements, sequence of operations, means of data collection, methods to record and report the data, and methods to determine and document that the procedure has been correctly completed.

3. REFERENCES

1. EPD Procedure QIP-5.2, *Development of Operational Procedures and Instructions*
2. EMP-QA-CD, *Changes in Design*
3. EMS Training Plan (in preparation)
4. EPD QAMP, *Environmental Protection Department Quality Assurance Management Plan*
5. EMP-QA-DC, *Document Retention Center*
6. Microsoft Word 5.0 User's Guide

4. DEFINITIONS

Controlled Copy: A numbered copy of an EMS controlled document that is sent to a designated copy holder along with an Acknowledgment Form, which is signed and returned along with superseded or obsolete versions of the document.

Controlled Document: A document that specifies quality requirements or prescribes activities affecting quality and whose preparation, issue and change are subject to control.

Design Change Package: The document necessary to implement a Design Change without a complete procedure revision; it includes a title/signature page, the statement of change of design, any location maps, and an updated Procedures Manual Table of Contents.

Document Control: The act of assuring that controlled documents are reviewed for adequacy, approved for release by authorized personnel, and distributed to and used at the location where the prescribed activity is performed.

Draft Number: The draft number refers to the number of the draft for any given revision.

Esoteric: Something that is understood by, or meant for, only the select few who have special knowledge or interest.

Information Copy: An unnumbered copy of an EMS controlled document that is supplied on a one-time basis for informational purposes.

Procedures Manual Table of Contents: The table of contents located at the front of the EMS Procedures Manual. It must be updated and replaced every time a new or revised procedure or a Design Change Package is distributed. It includes all procedure names, revision numbers, and effective dates, as well as a list of all Design Changes and their effective dates (see Attachment E for Sample Table of Contents.).

Proprietary Information: Information pertaining to private individuals names, addresses, property, or telephone numbers. Information of this nature must be held in strict confidence and divulged only on a need-to-know basis.

QA Record: Any document that can be used for quality assurance purposes to verify that a procedure or operation has been performed properly.

Reference Copy: A numbered copy of an EMS controlled document that is sent to a designated copy holder along with an Acknowledgment Form. Designated holders of reference copies must sign and return the Acknowledgment Form to certify that they have received a document and that they understand that they are not authorized to perform the work described in that document and will not attempt to do so without receiving the appropriate training and certification.

Responsible Party: The person responsible for all aspects of the preparation of a procedure or a Design Change Package. The Responsible Party may author the document, or may delegate the authorship. This role is typically filled by an Environmental Analyst, but can be filled by the Data Manager or other EMS personnel as assigned by management.

Revision Number: The revision number refers to a complete update of a procedure. New procedures are designated Revision 0.

Sanctioned Copy: A numbered copy of an EMS document that is sent to a designated copy holder along with an Acknowledgment Form. Sanctioned copy holders sign and return the Acknowledgment Form to certify that they have read and understood a document, that they are authorized to perform the procedures described therein and that they will follow the procedure in future operations.

5. RESPONSIBILITIES

5.1. SECTION LEADER

The EMS Section Leader is responsible for reviewing and approving all procedures, instructions, and revisions issued at the EMS level, and has ultimate authority on all EMS procedures.

5.2. GROUP LEADER

EMS group leaders are responsible for reviewing and approving all procedures, instructions and revisions that deal with activities controlled by their group. Group Leaders may also serve as authors or technical reviewers, as required.

5.3. QUALITY ASSURANCE COORDINATOR

The QA Coordinator assigns a Responsible Party for the preparation or revision of each procedure, assigns technical reviewers, reviews all EMS procedures for QA merit, archives the

Final Draft (including original title sheet and Procedure Production Checklist), defines and maintains lists of sanctioned and reference copy holders, maintains and distributes the EMS Procedures Manual Table of Contents, and issues sanctioned, reference and information copies of EMS procedures. The QA Coordinator is responsible for coordinating all changes to EMS procedures, for ensuring that Design Changes are incorporated into revised documents as required, and for ensuring that procedures are reviewed and revised as required by Reference 2.

5.4. RESPONSIBLE PARTY

The person responsible for all aspects of the preparation of a procedure or a revision to a procedure normally will be an EMS Environmental Analyst. Authorship of the procedure may be delegated, but the overall responsibility remains with the Responsible Party. If authorship is delegated, both the author and the Responsible Party will be listed under the "prepared by:" section of the procedure title page.

5.5. TECHNICAL REVIEWERS

Technical reviewers are responsible for the critical technical review of Draft 1 of each procedure. One of the reviewers for each procedure should be an individual who will use the procedure in the future to perform an assigned task.

5.6. TECHNICAL EDITOR

The Technical Editor assigned to the EMS is responsible for reviewing Draft 2 of each procedure for grammar, spelling, format, logic, clear and concise language, and sentence structure.

5.7. SANCTIONED COPY HOLDER

Sanctioned copy holders are responsible for maintaining current revisions of sanctioned copies of the EMS procedures assigned to them. As the personnel required to perform the work defined in EMS procedures, sanctioned copy holders shall sign an Acknowledgment Form for each sanctioned copy they receive certifying that they have read and understood the procedure and will follow its directions in all future work. Sanctioned copy holders shall return, in a timely manner, the Acknowledgment Form and any superseded or obsolete copies of procedures to the Quality Assurance Coordinator.

5.8. REFERENCE COPY HOLDER

Reference copy holders are responsible for maintaining current revisions of reference copies of the EMS procedures assigned to them. Reference copy holders shall sign an Acknowledgment Form for each reference copy they receive certifying that they have received the procedure, and that they understand that they are not authorized to perform the work defined in the procedure and will not attempt to do so without completing the required training and certification processes as defined in Reference 3. Reference copy holders shall return, in a timely manner, the Acknowledgment Form and any superseded or obsolete copies of procedures to the Quality Assurance Coordinator.

5.9. EPD QA MANAGER

The EPD QA Manager shall review and concur with all EMS operational procedures that implement the EPD QAMP (Reference 4). The EMS QA Coordinator is responsible for

informing the EPD QA manager of all new EMS procedures and for maintaining a list of procedures that require concurrence. The EPD QA Manager is responsible for informing the EMS QA Coordinator when EPD QA concurrence is required.

6. PROCEDURE

Equipment Required:

N/A

6.1. INITIATING A PROCEDURE

The first step towards initiating a new or revised procedure is to establish the need for that document. When a potential need is identified, it should be brought to the attention of the QA Coordinator, who will designate a Responsible Party. If the QA Coordinator and the Responsible Party determine that the requisite changes can be implemented through a Design Change, as defined in Reference 2, then a Design Change Package will be created. If, however, the QA Coordinator and the Responsible Party agree that a new procedure or revision is required based on the complexity of the required changes or the need for procedure revision as defined in Reference 2, the QA Coordinator will prepare a Procedure Production Checklist (Attachment B) and the Responsible Party will collect all pertinent information (old revisions, previous drafts, manuals, maps, photos, etc.) and obtain the procedure code and revision number from the QA Coordinator. Actual authorship of the procedure may be delegated, if desired, but responsibility for distribution of drafts and for coordination of development of the procedure, as well as the ultimate responsibility for its preparation, remains with the Responsible Party.

6.2. WRITING THE PROCEDURE

The author prepares Draft 1 of the procedure, including a title page with preparation and approval information, using the format outlined in Attachment A, Format of Procedures. A header and a footer must be included on each page as shown in Attachment A. The automatic update utility for both date and time must be used in the footer. The revision number refers to a complete update (see Reference 1); new procedures are designated "Revision 0". The draft number represents the number of times that a revision has been redrafted. Each draft number is used for a particular part of the procedure review process. Draft 1 is used for technical review, Draft 2 is for editorial review, Draft 3 is for QA review, and Draft 4 is for management review. The effective date shown in the header is the date on which the designated revision of the procedure becomes effective and must be followed. For all drafts of a procedure except the Final Draft, the word "future" should be typed in as the effective date.

All procedures must have the following sections. If a particular section does not apply to a procedure, put N/A under the heading.

1. **Purpose:** Briefly state the objective of the procedure. One or two sentences should be sufficient.
2. **Applicability/Discussion:** Clearly describe the applicability and identify the range and extent of the procedure. Provide background information, i.e., state why the operation is done, briefly explain why the sampling network exists, why samples from these locations are appropriate, detail how new locations are chosen, relate the procedure to QA requirements, etc. Put the procedure in the context of EMS activities and environmental monitoring plans.
3. **References:** List references called out in the body of the procedure. References should either be resources for additional information or documents from which information in the procedure was directly drawn. Give enough information so that a reader can find the reference easily. Include other related procedures, the EMS QA Plan, manufacturer's user manuals, DOE orders, EPA Guidance, etc.
4. **Definitions:** Assume nothing other than that the reader is not familiar with esoteric terms. Define terms that are specific to the procedure under this heading, and it will not be necessary to define them in the body of the procedure.
5. **Responsibilities:** Identify the titles and major responsibilities of the individuals or organizations responsible for implementing the requirements of the procedure.
6. **Procedure:** This is the main body of the document. List all equipment necessary to complete the operation and where these items can be found. Enclose the list in a box at the beginning of this section (see Attachment A). Give a clear, concise, step-by-step description of how the operation is to be completed. Include everything that is important to produce results of acceptable quality. Direct the procedure toward Sanctioned Copy Holders who are expected to have the appropriate basic skill and qualifications (as defined in Reference 3) to do the tasks described. Do not assume pretraining in the exact operations specified in the procedure. EMS procedures are used as training tools for new employees as well as reference documents for employees who are already authorized to perform the actions described therein. Refer to other documents, and cite photos, diagrams, and attachments as appropriate. Include troubleshooting information to help the reader deal with problems that might arise in the operation. Detail the selection criteria for sampling sub-locations; the actual sample collection techniques; decontamination procedures; guidelines for sample preservation, labeling, and disposition; holding times; and guidance for completing documentation, etc. Give detailed directions concerning sampling locations, and provide guidance for creating new sampling locations and assigning their designators, as appropriate. When sampling locations are on private property, the individual's names, addresses, and directions to these locations are considered proprietary information and must not be divulged in procedures. This information must be maintained separately by the responsible Environmental Analyst and must remain in strict confidence, divulged only on a need-to-know basis.
7. **Documentation/QA Records:** List any forms that must be filled out and give instructions for their completion, disposition, the length and method of form storage, and any data transmission information. List any QA records that will be generated or completed as a result of implementing the procedure.
8. **Acceptance Criteria:** Provide qualitative or quantitative criteria for determining if the operation has been satisfactorily completed. Give steps to follow if a problem is encountered.
9. **Attachments:** Any other information necessary to perform the work defined in a procedure should be included in the attachments. Examples of items which might be included as attachments to sampling procedures include flow charts, photos, and selected documentation from equipment manuals. Attachments to location procedures might include maps, directions to the locations (except for proprietary information), Field Tracking Forms, and photos. Some other possible attachments are blank forms (calibration forms, Chain-of-Custody Record forms, etc.), data tables (such as call-out lists and location designator tables), tables of analytes and their detection limits and computer code listings.

After the procedure is written, the author must spell-check and carefully review the document, including the header and title page, for completeness and accuracy. The author must then make copies of the procedure (including title page) and distribute copies simultaneously to each technical reviewer and one to the QA Coordinator for filing. All technical reviewers will review Draft 1 of the procedure at the same time.

The author and the Responsible Party must then sign and date the Procedure Production Checklist to certify that Draft 1 has been distributed for technical review (example is given in Attachment B Procedure Production Checklist). The checklists are kept by the EMS Quality Assurance Coordinator.

6.3. REVIEW PROCESS

6.3.1. DRAFT 1 —TECHNICAL REVIEW

Normally, technical reviewers must critically review Draft 1 for technical merit within one week of receipt. In extraordinary circumstances, this deadline may be abbreviated at the discretion of the QA Coordinator. The procedure must be explicit and complete, yet concise, readable and understandable. The author and reviewers should direct the procedure toward Sanctioned Copy Holders who are expected to have the appropriate basic skill and qualifications (as defined in Reference 3) to do the tasks but lack familiarity with the specific operations described. Do not assume pretraining in the exact operations specified in the procedure. EMS procedures are used as training tools for new employees as well as reference documents for employees who are already authorized to perform the actions described therein.

If only minor changes are required, the reviewers return the procedure, with comments, to the author, and sign and date the Procedure Production Checklist, certifying the technical quality of the procedure. Note that the draft title sheet of the procedure is not signed. This will occur only at the final signatory stage (see section 6.4.2.).

If major changes are required, the reviewer returns the draft to the author, requests that a subsequent Draft 1 (Draft 1a, Draft 1b, etc.) be written and notes the request for a new draft along with the date requested on the Procedure Production Checklist. The author prepares the revised draft, gives one copy to the reviewer and one copy to the QA Coordinator for filing. A copy of the reviewer's comments should be given to the QA Coordinator and the original comments should be returned to the reviewer with the revised draft. Reviewers are responsible for ensuring that their comments are incorporated or addressed.

When the draft has been revised to the reviewer's satisfaction, the reviewer returns the procedure, with comments, to the author, and signs and dates the Procedure Production Checklist, certifying the technical quality of the procedure.

After each stage of the review process, the author must incorporate revisions promptly and prepare the subsequent draft, using great care to ensure that the proper draft number is reflected in the header and the date and time printed are shown in the footer.

After all reviewers have signed the Procedure Production Checklist and all comments have been incorporated or addressed, the author produces Draft 2, delivers it to the editor for editorial review, delivers a copy to the QA Coordinator for filing, and signs and dates the Procedure Production Checklist on the appropriate line.

Note: The author must make sure that the header of the procedure is updated to read "Draft 2."

6.3.2. DRAFT 2 —EDITORIAL REVIEW

The editor edits Draft 2 for grammar, spelling, format, logic, and sentence structure to ensure that the procedure is clear and concise. Editing normally should be accomplished within one week of the receipt of Draft 2. If the revisions are minor, the editor produces Draft 3 and sends an electronic copy to the author and signs and dates the Procedure Production Checklist. If major changes are required, the editor works with the author to produce a version which is acceptable to both parties. When the draft has been revised to the editor's satisfaction, the editor produces Draft 3 and sends an electronic copy to the author and signs and dates the Procedure Production Checklist.

The author gives a copy of Draft 3 to the QA Coordinator for review, and signs and dates the Procedure Production Checklist.

Note: The author must make sure that the header of the procedure is updated to read "Draft 3."

6.3.3. DRAFT 3 — QA REVIEW

The QA Coordinator reviews Draft 3 for QA merit, ensures that all applicable Design Change packages have been incorporated into the revised document, and provides additional technical review. QA review normally should be completed within one week of the receipt of Draft 3. If changes are minor, the QA Coordinator returns the draft, with comments, to the author and signs and dates the Procedure Production Checklist. If major changes are required, the QA Coordinator returns the draft to the author, requests that a subsequent Draft 3 (Draft 3a, Draft 3b, etc.) be written and notes the request for a new draft along with the date requested on the Procedure Production Checklist. The author prepares the revised draft and returns it to the QA Coordinator. When an acceptable version of Draft 3 has been produced, the QA Coordinator returns the procedure, with comments, to the author, and signs and dates the Procedure Production Checklist.

The author produces Draft 4 (only after the QA Coordinator has signed off on Draft 3), gives copies of the draft to the EMS Section Leader and the appropriate Group Leader (if necessary) for review, signs and dates the Procedure Production Checklist, and gives a copy to the QA Coordinator for filing.

Note: The author must make sure that the header of the procedure is updated to read "Draft 4."

6.3.4. DRAFT 4 — EMS MANAGEMENT REVIEW

The EMS Section Leader and the appropriate Group Leader review Draft 4 and, if no major changes are required, return the draft with comments to the author and sign and date the Procedure Production Checklist. Management review normally should be completed within one week of the receipt of Draft 4. If changes are minor, the Section Leader or Group Leader returns the draft, with comments, to the author and signs and dates the Procedure Production Checklist. If major changes are required, the Section Leader or Group Leader returns the draft to the author, requests that a subsequent Draft 4 (Draft 4a, Draft 4b, etc.) be written and notes the request for a new draft along with the date requested on the Procedure Production Checklist. The author prepares the revised draft, gives one copy to the Section Leader or Group Leader who requested the revision and one copy to the QA Coordinator for filing. A copy of the Section Leader's or Group Leader's comments should be given to the QA Coordinator and the original comments should be returned with the revised draft. When an acceptable Draft 4 has been produced, the Section Leader and Group Leader return the procedure, with comments, to the author, and sign and date the Procedure Production Checklist.

6.4. FINAL DRAFT

6.4.1. AUTHOR/RESPONSIBLE PARTY

After the Section Leader and Group Leader have signed off on Draft 4, the author produces the Final Draft (complete with title page that contains the list of signatories) and routes it to all signatories. Before producing the Final Draft, the author must obtain the effective date for the procedure from the QA Coordinator and enter it into the procedure header. The footer must also be deleted at this time.

<p>Note: The author must make sure that the header of the procedure is updated to read "FINAL" and show the correct effective date, obtained from the QA Coordinator. The author must also make sure the footer has been deleted before printing the final version of the procedure.</p>

6.4.2. SIGNATORIES

Individuals listed on the title page as signatories review the Final Draft and sign and date the signature page only if the procedure is acceptable. Final review and signoff normally should be completed within one week of the receipt of the Final Draft. Signatories are cautioned not to assume that the Final Draft is the same as the last version they reviewed. They must again certify the technical quality of the procedure. If the procedure is not acceptable, signatories should consult with the QA Coordinator, who will arrange for resolution of any unanswered questions. All signatures and dates, including that of the EPD QA Manager when required, must be made on the same sheet. After all signatures and dates have been entered, the Final Draft (including title page with signatures) should be returned to the Responsible Party.

6.4.3. RESPONSIBLE PARTY

After all signatures and dates have been obtained, the Responsible Party gives the Final Draft, electronic copy, and the signed title page to the QA Coordinator, and signs and dates the Procedure Production Checklist.

6.4.4. QA COORDINATOR

The QA Coordinator makes copies of the procedure, archives the original copy and signature page, updates the table of contents for the EMS Procedures Manual, and -- distributes copies of the procedure and table of contents, along with the appropriate Acknowledgment Forms, to all holders of sanctioned and reference copies of the procedure. The QA Coordinator maintains lists of all sanctioned and reference copy holders for each EMS procedure; ensures that all Acknowledgment Forms are signed and returned, along with any superseded or obsolete versions of the procedures; and maintains files of signed Acknowledgment Forms. The QA Coordinator may dispose of previous drafts once the Final Draft is received, but must maintain copies of all superseded and obsolete Procedures and Design Changes as required by Reference 5.

6.4.5. SANCTIONED COPY HOLDER

The sanctioned copy holder signs the Sanctioned Copy Acknowledgment Form to acknowledge receipt of the new procedure or procedure update, and returns the form and the copy of the outdated procedure (if applicable) to the QA Coordinator.

The Sanctioned Copy Acknowledgment Form serves as certification that the recipient has read the procedure, understands it, and will follow its directions in future operations, so sanctioned copy holders must read the procedure, note any changes, and

follow its directions. When performing assigned operations, EMS staff should continually evaluate written procedures to determine if changes or updates are needed. Suggestions for updating or altering procedures should be brought to the attention of the QA Coordinator, who is responsible for coordinating Design Change Packages (see Reference 2) and revisions to procedures.

6.4.6. REFERENCE COPY HOLDER

The reference copy holder signs the Reference Copy Acknowledgment Form to acknowledge receipt of the new procedure or procedure update, and returns the form and a copy of the outdated procedure (if applicable) to the QA Coordinator. The Acknowledgment Form is also a certification that the reference copy holder understands that he/she is not authorized to perform the work outlined in the procedure and will not attempt to do so until requisite training and certification has been completed.

6.4.7. MANAGEMENT

The EMS Section Leader and Group Leaders are responsible for determining when it is appropriate for members of their staff to receive sanctioned or reference copies of particular EMS procedures and for communicating this information to the QA Coordinator. When an employee completes the required training for a particular procedure and becomes certified to do the work described in that procedure, management is responsible for providing that information to the QA Coordinator so that person's name can be added to the sanctioned copy distribution list for that procedure.

DOCUMENTATION/QA RECORDS

7.1. SIGNED TITLE PAGE/ FINAL COPY OF PROCEDURE

An example of a title page is given in Attachment A: Format of Procedures. Each individual assigned as Responsible Party for a procedure must ensure that the title page is properly prepared, is attached to the Final Draft of the procedure, and is signed and dated by the appropriate signatories. The QA Coordinator will archive the original signed title sheet, along with the original final copy of the procedure, in a manner consistent with the requirements of Reference 5.

7.2. PROCEDURE PRODUCTION CHECKLIST

A sample Procedure Production Checklist is presented in Attachment B. The actual checklist for each procedure being prepared is located in a binder in the office of the QA Coordinator. Each individual involved in the production or review of procedures is responsible for signing and dating the Procedure Production Checklist at the appropriate time as stated in this procedure. The original signed Procedure Production Checklist for each procedure will be archived by the QA Coordinator in a manner consistent with the requirements of Reference 5.

7.3. SANCTIONED COPY ACKNOWLEDGMENT FORM

A sample Sanctioned Copy Acknowledgment form is presented in Attachment C. Signed copies of these forms will be obtained from each sanctioned copy holder for each sanctioned copy they receive. The QA Coordinator must file these forms in a manner consistent with the requirements of Reference 5.

7.4. REFERENCE COPY ACKNOWLEDGMENT FORM

An example of the Reference Copy Acknowledgment Form is presented in Attachment D. Signed copies of these forms will be obtained from each reference copy holder for each reference copy they receive. The QA Coordinator must file these forms in a manner consistent with the requirements of Reference 5.

8. ACCEPTANCE CRITERIA

Production of a procedure will be considered satisfactorily completed after all signatures have been obtained on both the Procedure Production Checklist and the procedure title page, the originals have been archived, distribution of the procedure has been made and all Acknowledgment Forms have been signed and returned to the QA Coordinator along with any outdated or obsolete versions of the procedure.

9. ATTACHMENTS

- Attachment A: Format of Procedures
- Attachment B: Procedure Production Checklist
- Attachment C: Sanctioned Copy Acknowledgment Form
- Attachment D: Reference Copy Acknowledgment Form
- Attachment E: Sample Procedures Manual Table of Contents

ATTACHMENT A: FORMAT OF PROCEDURES

EMS Procedures are formatted using a modified outline in which the nine sections defined on page 6 serve as first order headings. The format of this procedure serves as an example of correct EMS procedure formatting. Levels of headings are numbered following a regular outline format, e.g.,

1. FIRST ORDER HEADINGS

1.1. SECOND ORDER HEADINGS

1.1.1. THIRD ORDER HEADINGS

1.1.1.1. Fourth Order Headings

1.1.1.1.1. Fifth Order Headings

1.1.2. THIRD ORDER HEADINGS

1.1.2.1. Fourth Order Headings

1.1.2.1.1. Fifth Order Headings

1.2. SECOND ORDER HEADINGS

1.2.1. THIRD ORDER HEADINGS

1.2.1.1. Fourth Order Headings

1.2.1.1.1. Fifth Order Headings

1.2.2. THIRD ORDER HEADINGS

1.2.2.1. Fourth Order Headings

1.2.2.1.1. Fifth Order Headings

It is not necessary for all third, fourth, and fifth order material to have headings. The document margins should be one inch on all sides. Text should be in 10-point Palatino type on 12-point leading, and paragraphs of text should not be separated by a return.

Two exceptions to the outline format are the "References" and the "Definitions" headings. The references are listed by number directly below the heading. The definitions are also listed directly below the heading; they are put in alphabetical order, the terms that are being defined are put in italics, and a return is used between each definition. For example:

3. REFERENCES

1. EMP-W-S, Water Sampling
2. EMP-W-L, Water Sampling Locations

4. DEFINITIONS

Chain-of-Custody Record (COC): A document used to track samples from the sample collector to the sample courier and from the courier to the analytical laboratory, ... etc.

Field Tracking Form (FTF): A form used to document sample collection and log sampling information. It contains sample identifiers, as well as information ... etc.

Only five orders of headings are authorized. If a procedure has more than five, the outline should be reorganized. If more than five orders of headings appear absolutely necessary, consult the

QA Coordinator for authorization for such levels. Samples of the formatting for the five levels of headings and associated text are provided below.

1. FIRST ORDER HEADINGS

The first order heading should be Palatino 10 point, bold, caps. It should be placed flush against the left margin and separated from the following text by 11 points (this is done automatically when Microsoft Word styles are applied). The first order text should be Palatino 10 point, with all text placed flush against the left margin and the first line indented 1/2 inch. The text should be separated from the next heading by a return.

1.1. SECOND ORDER HEADINGS

The second order heading should be Palatino 10 point, bold, caps. It is identical to the first order heading, except it is indented 1/2 inch. It should be separated from the following text by 11 points (this is done automatically when Microsoft Word styles are applied). The second order text is identical to the first order text except that it is indented 1/2 inch from the left margin and the first line is indented an additional 1/2 inch. The text should be separated from the next heading by a return.

1.1.1. THIRD ORDER HEADINGS

The third order heading should be Palatino 10 point, bold, caps. It is indented 3/4 inch. The third order text is Palatino 10 point, with all text indented 3/4 inch from the left margin and the first line indented an additional 1/2 inch. The text should be separated from the next heading by a return.

1.1.1.1. Fourth Order Headings

The fourth order heading should be Palatino 10 point and bold. It is indented one inch. The fourth order text is Palatino 10 point, with all text indented 1 inch from the left margin and the first line indented an additional 1/2 inch. The text should *not* be separated from the next heading by a return if the following heading is fourth or fifth order.

1.1.1.1.1. Fifth Order Headings

The fifth order heading should be Palatino 10 point and bold. It is indented 1 1/4 inch. The fifth order text is Palatino 10 point, with all text indented 1 1/4 inch from the left margin and the first line indented an additional 1/2 inch. The text should *not* be separated from the next heading by a return, if the following heading is fourth or fifth order.

There is also a specific format for examples, notes, and the equipment list at the beginning of section 6. This format includes placement of the text in a box, preceded by the word "Example", "Note", or "Equipment Required" in bold, (see below). (To avoid confusion, the box style has not been used for all the examples in this attachment.)

Example: Palatino 10 point in a box indented 1 1/2 inch from the left margin and 1/2 inch from the right margin. Sample text sample text sample text sample text sample text sample text sample text sample text.

REVISION 1 FINAL	EMP-QA-PW Procedure Writing	Effective date: 10/6/92 Page 14 of 20
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The header is to contain specific information, including the Revision number, the procedure designator, the effective date, the draft number, the procedure title, and the page number in the following format, all in 10-point type. Note that the left margin is *not* indented.

REVISION 1 FINAL	EMP-QA-XX Sample Title Block	Effective date: 9/1/92 Page 14 of 20
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A footer is used for Drafts 1, 2, 3 and 4. The footer is to contain the word "Printed" followed by the date and time in Palatino 7 point. The automatic update utility for date and time should be used.

Printed December 2, 1992 11:51 AM

The footer must be deleted prior to printing the final version of the procedure.

Microsoft Word glossary entries for both headers and footers are available from the EMS QA Coordinator, who will QuickMail them or supply a disk as needed. Place the glossary-entry file in the Word 5.0 folder on your hard disk, and follow the instructions on page 259 of the Microsoft Word 5.0 User's Guide (Reference 6) to open it. Instructions for inserting a glossary entry into a document are on page 253 of Reference 6.

To enter a dynamic page number (a number that automatically changes as the number of pages changes) for the total number of pages in the header, scroll to the last page of the document and choose Repaginate Now from the Tools menu. Place the cursor at the very end of the document, press "return" three or four times, then choose Glossary from the Edit menu, and select Page Number from the dialog box. Click on "insert", and a page number will appear alongside the cursor. Select the page number and copy it. Then go to the header, place the cursor at the end of "Page 7 of" and space twice. Select Paste Special from the Edit menu, and Paste Link the number as a picture after the two spaces. Then return to the bottom of the last page and format the original page number as hidden text. The page number in the header will change as pages are added or deleted from the document; however, not until the document is closed and reopened. This limitation occurs because the document is linked to itself and the link does not get updated until the document is closed.

There are two styles for the title page information. The title of the procedure is in Palatino 14 point, bold, caps, underlined, and centered; The preparation and approval information is in Palatino 12 point, Indent: Left 0 in, tab stops: 0.5 inches, 2.125 inches, and 5.5 inches right flush. These are illustrated below.

EMP-QA-??
SAMPLE TITLE

Prepared by:

Paula Tate	date
Environmental Analyst, EMS	

Reviewed by:

Kris Surano	date
Group Leader, SMG	

Duke Ramsey	date
Environmental Technician, TSG	

REVISION 1 FINAL	EMP-QA-PW Procedure Writing	Effective date: 10/6/92 Page 15 of 20
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There are no set formats for tables. They should be in 10 point type and placed 1/2 inch from the margin, unless they are too wide to fit within a 6-inch column.

There are no set formats for Attachments either, but they should use the same headers and footers as the rest of the procedure. The Attachment number and title should be centered directly beneath the header using 10 point Palatino bold caps. Attachments should be page-numbered consecutively with the procedure.

REVISION 1 FINAL	EMP-GW-S Groundwater Sampling	Effective date: 9/1/92 Page 15 of 20
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ATTACHMENT B: EXAMPLE OF COMPLETED CHAIN-OF-CUSTODY RECORD FORM

The formats described above have been incorporated into "styles" in Microsoft Word. These styles are available on disk for incorporation into new or modified procedures. To place these styles from the format document into the procedure being written or modified, first open the procedure, select Style in the Format menu, and go to the File menu to open the format document, i.e., the document from which the styles are to be copied. Word will automatically copy the styles from the format document into the procedure. Then close the Style dialog box.

After the styles are copied into the document, they should be appropriately applied to the contents of the document. This can be done through the ruler style selection box or through the format menu.

The styles and their attributes are:

1st Order Heading

Normal + Bold, Caps, Indent: Left 0 in., Space After 11 pt

1st Order Text

Normal + Indent: Left 0 in First 0.5 in.

2nd Order Heading

Normal + Bold Caps, Space After 11 pt

2nd Order Text

Normal+ Indent: First 0.5 in.

3rd Order Heading

Normal + Bold Caps, Indent Left 0.75 in

3rd Order Text

Normal + Indent Left 0.75 in First 0.5 in

4th Order Heading

Normal + Bold, Indent Left 1 in

4th Order Text

Normal - Indent Left 1 in First 0.5 in, Tab stops 1.25 in

5th Order Heading

Normal + Bold, Indent: Left 1.25 in.

5th Order Text

Normal + Indent: Left 1.25 in. First 0.5 in., Tab stops: 1.5 in.

Box

Normal + Indent: Left 1.5 in. Right 0.5 in. Border: Top Bottom Left Right (single)

Definitions

Normal + Indent: Left 0 in.

Procedure Title

Normal + Font: 14 pt, Bold Underline, Caps, Centered

Normal

Font: Palatino 10 pt, Indent: 0.5 in. Flush left, Line Spacing: Exactly 12 pt

Reference List

Normal + Indent: Left 0 in.: Tab stops 1 in.

Title page information

Normal + Font 12 pt, Indent: Left 0 pt, Tab stops: 0.5 in.; 2.125 in.; 5.5 in. Right Flush

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ATTACHMENT B: SAMPLE PRODUCTION CHECKLIST

PROCEDURE PRODUCTION CHECKLIST

NUMBER 17

PROCEDURE #: EMP-AT-CA
Responsible Party: Paula Tate

TITLE: Air Tritium Calibrations
Revision: 1

Signature

Date

Draft 1

Paula Tate

Reviewer 1

Paris Althouse

Reviewer 2

Kris Surano

Reviewer 3

Rebecca Ward

Draft 2

Paula Tate

Editor

Sam Hunter

Draft 3

Paula Tate

QA Review

Cindy Garcia

Draft 4

Paula Tate

Group Leader

Kris Surano

Section Leader

Becky Failor

Final Draft

Paula Tate

Signatures

Paula Tate

Distribution

Cindy Garcia

REVISION 1
FINAL

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Procedure Writing

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ATTACHMENT C SAMPLE SANCTIONED DOCUMENT ACKNOWLEDGMENT FORM

Environmental Monitoring Section
SANCTIONED DOCUMENT RECEIPT
ACKNOWLEDGMENT FORM

I have received sanctioned copy number _____ of EMS procedure EMP-XX-XX, Procedure Name, Rev. ##. I have read and understood this revision and will follow it from this point on. I have incorporated this procedure into my EMS Procedures Manual and I am returning any revisions of this procedure that are superseded by this new version along with this form.

Signature

Date

RETURN TO CINDY GARCIA, EMS QA COORDINATOR, L-255

REVISION 1
FINAL

EMP-QA-PW
Procedure Writing

Effective date: 10/6/92
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ATTACHMENT D: SAMPLE REFERENCE DOCUMENT ACKNOWLEDGMENT FORM

Environmental Monitoring Section

REFERENCE DOCUMENT RECEIPT
ACKNOWLEDGMENT FORM

I have received reference copy number _____ of EMS procedure EMP-XX-XX, Procedure Name, Rev. ##. I have incorporated this procedure into my EMS Procedures Manual and I am returning any revisions of this procedure that are superseded by this new version along with this form. I understand that I am not authorized to do the work defined in this procedure at this time and I will not attempt to do so without completing all required training and certification processes.

Signature

Date

RETURN TO CINDY GARCIA, EMS QA COORDINATOR, L-255

Attachment E: Environmental Monitoring Section
Sample Procedures Manual Table of Contents
Effective Date: 09/01/92

NO.	Procedure	TITLE	Rev.	Effective
1	EMP-EM-S	Emergency Environmental Sampling	0	09/01/92
2	EMP-EM-CA	Emergency Monitoring Equipment Calibration	0	09/01/92
3	EMP-W-L	Water Sampling Locations	0	10/04/92
4	EMP-W-S	Water Sampling	0	08/11/93
5	EMP-GW-L	Groundwater Sampling Locations	0	08/01/92
	EMP-GW-L	EMP-GW-L Design Change # 1		09/04/92
	EMP-GW-L	EMP-GW-L Design Change # 2		11/25/92
6	EMP-GW-S	Groundwater Sampling	0	08/04/92
7	EMP-GW-CA	Groundwater Equipment Calibrations	0	07/17/92
8	EMP-RA-S	Rain Sampling	0	09/01/92
9	EMP-RA-L	Rain Sampling Locations	1	08/14/92
	EMP-RA-L	EMP-RA-L Design Change # 1		09/25/92
	EMP-RA-L	EMP-RA-L Design Change #2		11/18/92
	EMP-RA-L	EMP-RA-L Design Change #3		12/28/92
10	EMP-RO-S	Storm-water Runoff Sampling	0	09/01/92
11	EMP-RO-L	Storm-water Runoff Locations	0	10/12/93
12	EMP-AP-L	Air Particulate Locations	1	11/01/92
13	EMP-AP-S	Air Particulate Sampling	1	11/01/92
14	EMP-AP-CA	Air Particulate Sampler Calibration	0	09/01/92
	EMP-AP-CA	EMP-AP-CA Design Change # 1		11/15/92
15	EMP-AT-L	Air Tritium Locations	1	09/01/92

EMP-QA-SD
SAMPLE TRACKING DOCUMENTATION

Prepared by:

Lucinda M Garcia 6/28/94
Lucinda M. Garcia date
QA Coordinator, EMS

Lucinda M Garcia for RW 6/28/94
Rebecca Ward date
Environmental Technologist, TSG

Reviewed by:

W H Hoppes 6/28/94
William Hoppes date
Group Leader, WGMG

Duane Rueppel 6/28/94
Duane Rueppel date
Group Leader, TSG

Kris Surano 6/28/94
Kris Surano date
Group Leader, TMM

Approved by:

Rebecca A. Failor 6/28/94
Rebecca A. Failor date
Section Leader, EMS

Lucinda M Garcia 6/28/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Concurrence:

Jack Sims 7/28/94
Jack Sims date
QA Coordinator, EMAD

1. PURPOSE

This procedure describes requirements for the use of the Environmental Monitoring Section (EMS) Field Tracking Forms (FTF), Chain-of-Custody (COC) Record Forms, and Data Packages. The procedure applies to both routine monitoring and special studies, unless specifically stated otherwise in the scope of work for a special study.

2. APPLICABILITY/DISCUSSION

The scientific validity, acceptability, and legal defensibility of data from EMS's efforts depend on careful recordkeeping and the tracking of environmental samples. Samples, and subsequent data, that do not have proper documentation are suspect and cannot be used in the assessment of LLNL impacts on the environment. Proper recordkeeping and chain-of-custody practices must, therefore, be followed at all times.

Field Tracking Forms (FTFs) for the various environmental media sampled by EMS are used by field personnel to document sample collection, record pertinent sampling information, and track conditions that might affect the integrity of the sample. FTFs often contain information that is critical to the eventual analysis of data. An example of an FTF is included as Attachment A.

The Chain-of-Custody (COC) Record Form is used to document sample custodianship during the many steps in the handling and analysis of each sample, including the delivery of the sample from the Sampling Technologist to the sample Courier, the delivery from the Courier to the analytical laboratory for analysis, the data transfer from the analytical laboratory to the appropriate Analyst, and the data transfer from the Analyst to the Data Manager for input to the EMS database and storage in the EMS Document Retention Center. The form is a legal document that contains vital information about the samples, including, but not limited to, identification/labeling of the sample (the sample identifier), the collection date, the Sampling Technologist's identity, requested analyses that are to be performed on the samples by the analytical laboratory, and the release number that must be obtained for any analyses performed by laboratories outside of LLNL. Whenever a sample is submitted for analysis, a COC must be generated. The form must remain with the sample at all times until analyses are complete, and then must remain with data hardcopy. An example of a COC is included as Attachment B.

3. REFERENCES

1. EMP-QA-SL, Sample Location Designators
2. EMP-QA-S, Quality Assurance Sampling
3. *Certification for the TRR on Blanket Service Agreements*
4. EMP-QA-CS, Courier Service Protocol
5. EMP-QA-DC, Document Retention
6. EMP-QA-SA, Quality Assurance Assessments
7. EMP-QA-NCR, Nonconformance and Discrepancy Reporting
8. EMP-QA-DM, Data Management

4. DEFINITIONS

Chain-of-Custody (COC) Record Form: A document used to track samples as they progress from the sample collector (Sampling Technologist) to the sample Courier and from the Courier to the analytical laboratory, as well as to track sample data from the analytical laboratory to the Analyst, from the Analyst to the Data Manager, and from the Data Manager to the Archivist for data archiving. It contains important sample information, including the name of the laboratory that will analyze the

samples, sample identifiers, the identity of the individual who collected the sample, the identity and telephone number of the EMS Analyst who is responsible for the sample and resultant data and to whom the data are to be sent, the EMS mailing address, the date on which the sample was collected, a unique COC number (printed on the upper right corner of the form), a release number for analyses to be performed by off-site laboratories, the analyses to be performed, and signatures that document custodianship of the samples as they change hands. The COC is a five-part, color-coded form. A copy is available for each custodian as samples change hands and signatures are acquired (goldenrod-Sampling Technologist; pink-Courier; canary-analytical laboratory; green-Analyst; white-original, archived in Document Retention Center).

Field Tracking Form (FTF): A form used to document sample collection information. It contains sample identifiers, as well as information pertinent to unspecified, or blind, Quality Control samples. Analysts can only decode laboratory QC sample results with information contained on the FTF.

Example: A QC sample that is a duplicate of L-FCC-01-VG will be listed as L-QA-01-VG on the COC and shown as L-FCC-D1-VG on the FTF. The routine sample, L-FCC-01-VG, also appears on the FTF and may also be listed on the same COC.

Location Designator: The two-field code that specifies the sampling location from which an environmental sample was obtained. It is composed of a site code (L- for Livermore, 3- for Site 300, C- for California, etc.) and a location code (MET for the Meteorological Tower, CAFE for the South Cafeteria, etc.; see Reference 1).

PARIS: LLNL Procurement Department's Purchasing, Accounting, and Receiving Information System.

PARIS Electronic Release System: A system in which the Technical Release Representative enters release information into the PARIS computer system at the time an order is placed with a vendor. The information is used for certification of services, payment, and historical data such as usage.

QC Sample: A sample that is submitted unidentified to the analytical laboratory and is used to provide quality assurance/quality control for the sampling and analytical effort. QC samples can be duplicates, blanks (equipment, trip, or field), spikes, or standards. When submitted to the laboratory, the "blind" location code is "QA" and the various QC samples are assigned sequential replicate numbers (L-QA-01-xx, L-QA-02-xx, L-QA-03-xx, etc.) without any other identification appearing on the COC concerning those samples. Actual identification of QC samples is only found on the FTF. See EMP-QA-S (Reference 2) for descriptions of QC samples and their use.

Sample Custody: To have physical possession or control of a sample. Control includes having the sample in one's view, secured (locked up) so that no one can tamper with it, or kept in a secured area that is restricted to authorized personnel.

Sample Identifier: The four-field code that identifies a sample to an analytical laboratory. It is made up of the location designator (two fields), a sample number, and a media code (see Reference 1). In the case of QC samples, the sample identifier is temporary when the sample is submitted to the laboratory; it is decoded with information provided on the FTF by the responsible Analyst when the data are received, and it is assigned a permanent identifier as appropriate before data are given to the Data Manager.

Shipping Report for Nonhazardous Samples: A report that is sent to the LLNL Traffic Office to inform them of the destination, commodity, number of packages, and estimated total weight of samples using courier services provided by analytical laboratories.

TRR: Technical Release Representative.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The Section Leader is responsible for ensuring that EMS sample tracking documentation meets all regulatory, DOE, and LLNL requirements and that this procedure is followed for all EMS environmental samples.

5.2. GROUP LEADER

EMS Group Leaders are responsible for ensuring that members of their groups comply with the requirements of this procedure for all EMS environmental samples collected and analyzed.

5.3. EMS SAMPLING TECHNOLOGISTS

EMS technologists who collect environmental samples from any medium must complete FTFs according to media sampling, media location, quality assurance sampling, sample designator, and documentation procedures (see Section 6, below). All required information must be recorded on the FTFs (Section 6.1). COCs must also be completed for all samples (Section 6.2.1). Technologists must complete the COC form, including the Release Number, and sign it before relinquishing samples to the Courier. (COCs must be reviewed by the TRR and the TRR must assign a Release Number to the COC.) Technologists are responsible for delivering the goldenrod copy of the COC (with Sampling Technologist and Courier signatures), together with the FTF, to the responsible Environmental Analyst.

5.4. TECHNICAL RELEASE REPRESENTATIVE (TRR)

The TRR has sole authority in EMS for "promising and releasing" funds for the purpose of environmental sample analysis. The TRR must be certified as prescribed in Reference 3. The TRR assigns a release number to each set of samples sent for analysis and writes it on the appropriate COC. The TRR reviews invoices for accuracy, reconciles COCs to invoices, and verifies by signature that receivables match analyses requested and that the costs of analyses are consistent with contracted prices. The TRR communicates activities with LLNL Accounts Payable using PARIS and records all releases on an Excel spreadsheet. The TRR may be asked to provide formal or informal reports to the EMAD Resource Manager.

5.5. COURIER

The Courier must sign the COC when receiving samples from a Sampling Technologist and must maintain custody of the samples until they are relinquished to an analytical laboratory representative. The Courier is responsible for promptly delivering the samples to the analytical laboratory, and for obtaining the signature of authorized analytical laboratory personnel upon transfer of custodianship (Reference 4).

5.6. ANALYTICAL LABORATORY PERSONNEL

Analytical laboratory personnel must sign the COC when receiving samples from the Courier. The laboratory must return the pink copy of the COC (with both Courier and analytical laboratory personnel signatures) to the responsible Environmental Analyst. The

laboratory is responsible for keeping track of the samples while in its custody, using a system acceptable to EMS. After analysis is complete, laboratory personnel will sign the COC form, keep the canary copy, and return the original and the green copy along with the data to the responsible Environmental Analyst.

5.7. EMS ENVIRONMENTAL ANALYST OR ANALYST ASSISTANT

The Environmental Analyst or Analyst Assistant assigned responsibility for a given environmental medium assembles into a data package the original FTF and COC, the original hard-copy data report from the analytical laboratory, and where necessary, the invoice. The Analyst or Analyst Assistant decodes QC sample information on the COC using information from the FTF and assigns permanent sample identifiers to QC samples. The Analyst or Analyst Assistant will supply decoded QC sample information to the analytical laboratory upon request.

5.8. EMS DATA MANAGER

The Data Manager ensures that all data are entered into the EMS Monitoring Database either by hand-entry or by electronic download from the analytical laboratory. The Data Manager stores data packages until the first quarter following the issuance of the Site Annual Environmental Report (SAER) for the year in which the data were generated, at which point they are transferred to the Document Retention Center as described in EMP-QA-DC (Reference 5).

5.9. EMS QA COORDINATOR

The QA Coordinator ensures that data packages are transferred from the Data Manager to the Document Retention Center, according to Reference 5. The QA Coordinator also performs QA assessments of the document tracking process as required by EMP-QA-SA (Reference 6).

6. PROCEDURE

6.1. FIELD TRACKING FORMS (FTF; ATTACHMENT A)

Field Tracking Forms are predesigned forms or notebooks used to record sampling information in the field. All field notes should be entered on FTFs.

6.1.1. MANDATORY INFORMATION

6.1.1.1. Sample Identifiers

All samples must have individual sample identifiers (defined in Section 4). Sample identifiers must be unique on a given FTF (and associated COC). Acceptable sample location designators and media codes are defined in EMS location procedures (EMP-XX-L, where XX is a code representing the medium being sampled).

Note: Temporary, nonspecific sample identifiers will be assigned to all submitted QC samples. Detailed information regarding the actual nature of all QC samples must be recorded on the FTF only (see definition of QC sample, Section 4). QC samples should be submitted "blind" to analytical laboratories. That is, the laboratories should not know in advance if the QC samples are blanks, spikes, standards, or duplicates, and in the case of duplicates, the laboratory should not know which routine sample is being duplicated. Information regarding sample content can be provided if necessary to prevent laboratory contamination, but under no circumstances should any QC samples be specifically identified on the COC until after the data have been reviewed and accepted. The FTF, then, becomes a critical document in the sampling effort, because it will be needed to decode the QC data when they are received from the laboratory.

After analytical data are received, the responsible Environmental Analyst must reconcile the data and assign appropriate permanent sample identifiers to QC data. This information is written on both the analytical report and COC. If an analytical laboratory requests QC decode information, the Analyst or Analyst Assistant will send them a copy of the COC.

Location designators for non-QC samples will usually be preprinted on all FTFs. Sample identifiers will be assigned to samples as they are taken in the field and will be recorded on both the FTFs and COCs.

Sample identifiers must follow the format defined in EMP-QA-SL (Reference 1), must be approved by the Data Manager and the QA Coordinator, and must be described in EMS Sample Location procedures.

Example: A QC sample identifier from a duplicate sample will be decoded into a permanent sample identifier using its true sampling location designator, and the replicate number will be "Dx," where x is the number of the sample duplicated. For example, a duplicate air filter from location L-MET will be submitted to the laboratory as L-QA-01-AF, and will later be decoded into L-MET-D1-AF.

Example: A similar process will be used for field blanks. A QC sample that is a field blank prepared at location L-CDB and submitted as L-QA-02-RA will be decoded as L-CDB-F1-RA.

Example: For trip blanks, the "QA" in the B field will remain as part of the permanent sample identifier. The C field in the permanent sample identifier will be "T1" (see Reference 1).

6.1.1.2 Sampling Date

Each individual sample must have an associated sampling date. The date must appear on both the FTF and COC.

6.1.1.3 Analyte(s) or Names of the Analyses To Be Performed

All analytes/analyses must be listed on the FTF for each sample. Usually, all samples listed on an FTF receive the same analyses, but this is not always the case. If all samples receive the same analyses, the analyses need only be mentioned once on the FTF. Otherwise, the analytes/analyses must be specified for each individual sample. Furthermore, Sampling Technologists should be aware that the analytes/analyses

required for any given sample from any given sample location may change from sampling event to sampling event. Before sampling, Sampling Technologists must consult the FTF to ensure that the sample will be appropriately collected for all requested analyses.

6.1.1.4. Sampling Technologist Identification

The Sampling Technologist collecting each individual sample must initial or sign each FTF or COC so that any questions regarding the sampling or samples can be addressed later.

6.1.1.5. COC Numbers and Names of Laboratories on FTFs

Because samples are often processed for different analytes by different laboratories, and each laboratory receives its own COC, the information from a given FTF may be related to several COCs. Therefore, it is imperative that all the COC numbers related to a particular sample be identified on the corresponding FTF, along with the names of the laboratories themselves.

Example: An arroyo sediment sample (with a sample identifier of L-ASW-01-AS) may be sent to one laboratory for organic analyses and to another for radiological analyses. There is only one FTF, but the sample identifier appears on two COCs, one going to the first laboratory and the other to the second. All associated COC numbers and the laboratory to which each COC is sent must be recorded on the FTF.

6.1.2. SUPPLEMENTAL INFORMATION

Along with the mandatory information, each FTF should contain the following information, as appropriate. Guidance as to inclusion of this information can be found in the individual sampling procedures and on the FTFs for each medium.

6.1.2.1. Time Sample Was Taken

For some samples, it is important that the time of sampling be recorded. A 24-hour (military time) format should be used (5:40 PM is recorded as 1740).

Example: A sample collected at 2:45 PM on July 12 should be recorded with a sampling time of "1445."

6.1.2.2. Flows and Flow Rates

Flows and flow rates of sampling equipment are often important, and sometimes critical, to the analysis of the data. Record them accurately if they are required, being sure to include appropriate units.

6.1.2.3. Equipment Specifications

Record all equipment-related information, such as air calibration unit number or pH meter number, required by sampling procedures or FTFs.

6.1.2.4. Pertinent Analytical Data

Physical measurements associated with the sampling (pH, conductivity, temperature, etc.) must be recorded if required by sampling procedures or FTFs.

6.1.2.5. Distance and Direction from the Permanent Marker

For some media, such as soil and vegetation, it is important to record the exact location from which a sample was taken. If this is required by the sampling procedure, the Sampling Technologist should estimate as accurately as possible the distance and direction from the permanent marker to the location where the sample was collected.

6.1.2.6. Comments

Sampling Technologists' comments can often be very important. Sampling Technologists should make comments regarding the sampling and any unusual, questionable, or noteworthy events that may have occurred during sampling.

Note: Sampling Technologists are encouraged to make detailed notes regarding the entire sampling procedure on the FTF or in sampling logbooks.

6.1.2.7. Quality-Affecting Activities that Do Not Conform to Requirements

If any quality-affecting activities that do not conform to EMS requirements are discovered during sampling, the Sampling Technologist should correct the problem in the field, if possible and safe to do so, and complete an NCR according to the requirements of EMP-QA-NCR (Reference 7). It is important to document the problem and any corrective actions taken as soon as possible so that they can be described accurately.

6.1.3. COMPLETION OF COC

After sampling, the Sampling Technologist should use the data from the FTF to fill out the COC.

6.1.4. DISPOSITION OF FTF COPIES

After the COC is filled out, the original FTF must be given to the responsible Analyst. Photocopies may be filed by Sampling Technologists for their own records. Photocopies of FTFs bound in logbooks should be sent to the Analyst.

6.2. CHAIN-OF-CUSTODY (COC) RECORD FORM

The COC is a five-part form. Sampling Technologists should use an appropriate pen and press hard enough to make impressions on all copies when filling out the form. Standard ball-point pens used with moderate pressure on the form when it is placed directly on a hard surface seem to work best. Be sure to check the bottom copy of the COC to make sure all the information entered on the top sheet has transferred legibly to the bottom sheet.

Note: All signatures and original information must be entered on the white (top) copy of the COC. No other copies of the COC should contain original information. The use of photocopies of COCs should be minimized.

COCs are sequentially numbered, so Sampling Technologists should attempt to obtain and use the forms in order. If a COC is voided, Sampling Technologists must write "VOID" in large letters across the face of the form. A ledger of voided COCs is maintained by the EMS Sampling Technologists.

6.2.1. SAMPLING TECHNOLOGIST

Note: The Sampling Technologist is responsible for the security and integrity of the samples and their documentation from the time that the samples are collected until custodianship is transferred to the Courier or analytical laboratory. The information required in Sections 6.2.1.1 through 6.2.1.11 is mandatory and must be included on the COC.

6.2.1.1. Name of Analytical Laboratory

The name of the laboratory where the samples are being sent for analysis must be clearly indicated.

6.2.1.2. Project Name and Responsible EMS Analyst

The project name will usually be "EMS" for normal monitoring. If the sample is for a special project, specify the project name. Include the name of the EMS Analyst who is responsible for the samples and the data. The laboratory should send the data reports to this person. Include the Analyst's L-code and telephone number.

6.2.1.3. Sampling Technologist's Signature

6.2.1.4. Sample Identifiers

Each sample must have a sample identifier that is unique to the particular COC (see 6.1.1.1.).

6.2.1.5. Description of Sample Group

All samples on a COC should be related. Media or generalized locations are not to be mixed. For example, Site 300 samples should use separate COCs from Livermore Valley samples, and each different ground water monitoring complex should have its own COC. Related samples should be kept together so that a generalized description of the total sample group can be made.

Example: "1991 4th quarter Livermore Valley vegetation samples" or
"1991 Annual Site 300 soil samples."

6.2.1.6. Sample Date for Each Sample,

It is critical that individual collection dates be specified because samples collected on different dates are occasionally grouped on a COC.

6.2.1.7. Number of Sample Containers for Each Sample

Samples very often require several (sometimes dissimilar) containers. The total number of containers for each sample should be written on the COC.

6.2.1.8. Requested Analyses

All requested analyses should be listed in the diagonal columns at the top of the COC. A check mark must be placed in the column under every analysis required for each sample. Pay particular attention to the description of the analysis; that description is used by analytical laboratories to determine how to process the samples. Additional information regarding the analysis can be written in the "Remarks" column at the right of the form. An individual sample will be listed once on the FIF, but may appear on several COCs because a separate COC is required for each laboratory.

6.2.1.9. Remarks

Sampling Technologists are encouraged to use the remarks section on the COC to note any special requirements or other information that could be useful to EMS or the analytical laboratory.

6.2.1.10. Release Number

For samples that will be analyzed by laboratories outside LLNL, the Sampling Technologist must verify that a Release Number has been assigned to the sample set and recorded in the proper box on the COC. Release Numbers can only be assigned and recorded on the COC by authorized TRRs. The authorized TRR assigning the Release Number should initial the appropriate box on the COC.

6.2.1.11. Multiple COCs Accompanying One Sample

When more than ten analyses are requested for an individual sample (an unlikely occurrence), more than one COC may be submitted to the same laboratory for the same set of samples. When this occurs, indicate the page number and total number of pages (page 1 of 2, for example) at the top of the COC forms.

6.2.1.12. Sample Verification

The Sampling Technologist should verify that all samples relinquished to the Courier are listed on the COC and make sure that all containers are present and are properly labeled.

6.2.1.13. COC Signature

The Sampling Technologist must sign and date the "Relinquished by Sampling Technologist" box on the COC form. This signature must match the one at the top of the COC form (see 6.2.1.3).

6.2.1.14. Delivery to Couriers or Shipping Department

When samples are to be sent off-site for analysis, EMS Sampling Technologists will usually deliver samples to laboratory couriers or the LLNL Shipping Department in person. The Sampling Technologist should ensure that the courier signs the "Received by Courier at LLNL" box on each COC before relinquishing the samples.

6.2.1.15. Goldenrod Copy

The Sampling Technologist should remove the goldenrod copy of the COC and give it to the EMS Analyst listed in the "Project Name/Analyst" box.

6.2.1.16. Shipping Report for Nonhazardous Samples (Courier Service)

The Sampling Technologist should complete an EMS Nonhazardous Environmental Sample Shipping Report for samples transported to an off-site analytical laboratory using a laboratory-provided courier service. A sample EMS Shipping Report is shown in Attachment C. If more than one container is being shipped to a particular laboratory, it is not necessary to use more than one shipping report; information from all containers being shipped to that laboratory should be summarized on one report. Completed shipping reports should be mailed to the LLNL Traffic Office at L-516.

6.2.1.17. Shipping Airbill for Nonhazardous Samples (No Courier Service)

The Sampling Technologist must complete a Federal Express Airbill for each sample shipping container sent to an offsite analytical laboratory that is not picked up by a laboratory-provided courier. The airbill should be filled out as shown in Attachment D. Directions for completing the form are given on the form itself. The Technologist must weigh each shipping container and attach the Airbill to it — each shipping container must have its own airbill attached. Weighing and shipping of samples are conducted at Building 411 Shipping.

6.2.1.18. Shipping of Hazardous Samples

EMS environmental samples are generally considered nonhazardous. If circumstances arise under which EMS must send hazardous samples off-site for analysis, special arrangements must be made through the LLNL Shipping Department.

6.2.2. COURIER

6.2.2.1. Sample Verification and Acceptance

The Courier must check to make sure the sample set is listed on the COC and that sample containers are in acceptable condition. The courier should verify that all sample containers listed for each sample are present, and that labeling is correct, then sign the "Received by Courier at LLNL" to indicate acceptance of custody of the samples.

Note: The Courier is responsible for the security and integrity of the samples and the documentation while the samples are in Courier custody.

6.2.2.2. Sample Delivery

The Courier will deliver samples immediately to the analytical laboratory indicated on the COC and relinquish them to an authorized laboratory representative.

6.2.2.3. Custody Transfer

Upon delivery, the Courier will sign and date the "Relinquished by Courier to Lab:" box on the COC and make sure the laboratory representative signs the "Received at Laboratory:" box.

6.2.3. ANALYTICAL LABORATORY

6.2.3.1. Sample Verification and Acceptance of Custody

An authorized laboratory representative must check to make sure all samples received are listed on the COC, that the numbers of sample containers listed for each sample are present, that labeling is correct, and that the condition of the sample containers is acceptable. If all these criteria are met, the Laboratory representative should sign the "Received at Laboratory:" box on the COC to indicate the laboratory's acceptance of custody. If there are any problems with any of the samples, the laboratory representative should immediately contact the Analyst listed in the "Project Name/Analyst" box on the COC or the person designated by the EMS Section Leader as the official contact person for that laboratory.

6.2.3.2. Disposition of Form

After signing the COC, the laboratory representative should mail the pink copy to the EMS Analyst listed in the "Project Name/Analyst" box on the COC.

6.2.3.3. Sample Tracking

The laboratory is required to track samples until all analyses are complete and EMS has accepted the analytical data. An internal tracking system can be used, but is subject to EMS approval.

Note: While the samples are in laboratory custody, the laboratory is responsible for the security and integrity of the samples and their documentation.

6.2.3.4. Sample Processing

Laboratory personnel should complete the requested analyses according to acceptable written procedures. If questions regarding the samples or their disposition arise, laboratory personnel should contact the EMS Analyst listed in the "Project Name/Analyst" box on the COC.

6.2.3.5. Data Verification

When data are ready for hard-copy transmittal to EMS, laboratory personnel should verify that completed data sets are available for all samples, attach the COC to the data, and sign and date the "Data Relinquished from Lab:" box on the COC.

Note: It is imperative for sample data identification that the sampling date, sample identifier, and related COC number be included with all data. The laboratory must either provide a separate data report with every COC or specify the sample identifier, COC number, and sampling date for each sample on a data report.

6.2.3.6. Sample Archiving

The laboratory is required to save the samples for 30 days after data reports are issued. It is important that the samples not be discarded until data are accepted because questionable data may require re-analysis of samples. This should occur within

one month after receipt of data and will be performed in conjunction with invoice validation and authorization for payment of services.

6.2.3.7. Data Transmittal

After signing the COC, the Analytical Laboratory Representative should remove and retain the Canary copy and send the data and accompanying COC to the EMS Analyst listed on the "Project Name" box. Data sent without the COC will be considered preliminary; similarly, the COC shall not be sent until all data regarding that set of samples are available.

Send the entire data package for the samples listed on a COC to the Analyst with the signed-off COC attached, even if preliminary reports have been sent previously. EMS will only accept COC forms with complete data sets attached.

6.2.3.8. Disposition of Form

The EMS Analyst will sign the COC after data are received and reviewed. If the laboratory so requests, the Analyst will provide decoding information for any QC samples listed on the COC.

6.2.4. EMS ENVIRONMENTAL ANALYST

6.2.4.1. Data Verification

Upon receipt of the data package, the Analyst should check that all data for samples listed on the COC have been received in a single data package and verify that the sampling date and COC numbers have been included for each sample. If any data are missing or documentation is incomplete, the analyst should complete an NCR according to the procedure defined in Reference 7.

6.2.4.2. Data Acceptance

After verification and review of the data are complete, the Analyst should sign the "Data Received by Analyst" box on the COC.

6.2.4.3. Assignment of Permanent Sample Identifiers

Using information on the Field Tracking Forms, the Analyst should decode QC sample identifiers, assign permanent EMS sample identifiers to the QC data as appropriate, and enter the decoded QC sample information on both the COC and data reports. The Analyst should also provide this information to the Laboratory if it has been requested.

6.2.4.4. Relinquishment of Data to Data Manager

After accepting the data, the analyst will attach the original FTF to the COC, the hard-copy data report, and the analytical laboratory invoice (where appropriate) to form a data package. By the end of each quarter, the analyst will deliver completed data packages to the Data Manager, and sign and date the "Data Relinquished by Analyst" box on the COC. The analyst should make sure that the Data Manager signs the "Data Received By Data Manager" box.

6.2.5. EMS DATA MANAGER

6.2.5.1. Data Verification and Acceptance

Upon receipt of data package, the Data Manager should check that all data for samples listed on the COC are included and sign the "Data received by Data Manager" box on the COC.

6.2.5.2. Placement of Data in the Database

The Data Manager will ensure that all data are entered into the EMS database according to the requirements of EMP-QA-DM (Reference 8). This may involve hand-entry or verification of electronically downloaded data. The hard copy and

attached COC constitute the official data record. Electronic data transfers must be considered secondary transfers of information. Data-entry personnel are required to make careful checks of electronic data against the hard copy data report attached to the original COC.

6.2.5.3. Relinquishment of Data to Document Retention Center

Original data will be relinquished to the Document Retention Center by the Data Manager once each year during the quarter following the publication of the Site Annual Environmental Report (SAER) for the previous year. For example, if the 1992 SAER is published in November of 1993, the data should be transferred to the Document Retention Center during the first quarter of calendar year 1994. Procedures to be used for transferring and archiving data in the Document Retention Center are defined in EMP-QA-DC, *Document Retention* (Reference 5).

6.2.6. QA COORDINATOR

The EMS QA Coordinator will ensure that all data packages are transferred to the EMS Document Retention Center and entered into the Document Retention database as required by EMP-QA-DC, *Document Retention* (Reference 5).

7. DOCUMENTATION/QA RECORDS

Completed data packages including COCs, hard-copy data reports, FTFs, and invoices (where appropriate) are considered QA records and must be archived according to the requirements of EMP-QA-DC, *Document Retention* (Reference 5).

8. ACCEPTANCE CRITERIA

To be considered acceptable, all EMS environmental sampling data must be accompanied by properly completed COCs and FTFs. Data that are not acceptable cannot be used in EMS assessments of LLNL environmental impacts, unless exempted by the EMS QA Coordinator and the Section Leader. Any deviation from this procedure or break in the chain of custody is cause for the issuance of an NCR (Reference 7) and is subject to corrective action.

9. ATTACHMENTS

Attachment A: Sample Field Tracking Form

Attachment B: Sample Chain-of-Custody Record Form

Attachment C: Sample EMS Nonhazardous Environmental Sample Shipping Report

Attachment D: Sample Federal Express Airbills

ATTACHMENT A: SAMPLE FIELD TRACKING FORM

MONTHLY-4Q93 DECEMBER

FIELD TRACKING FORM EMP-GW-S-01

LOCATION DESIGNATOR: K2-01

SAMPLE IDENTIFIER: 3-K701-01-MW

pH meter# 01

Date: 12-28-93

Time Started 1050

Time Sampled 1110

Casing ID: 325

Pump type: 115x Standard

T.D.: 44.80

92.50 x 18.75 = 8.07 x 3 24.22

D.T.W.: 26.05

231

Wtr. Ht.: 18.75

COC#:	4616	Lab:	15
	4012		CLS

DO NOT RINSE ANY GLASS BOTTLES EXCEPT TRITIUM AND H.E. VIALS

FIELD TREATMENTS

Filtered Samples

✓ Metals +
(As, Cd, Co, Cu, Ni, Zn)

pH	Temp.	Gal.	Time
7.6	19.1°	0	1050
7.15	19.9°	12	1056
7.13	19.6°	24	1102
7.05	20.6°	26	1104
7.04	20.6°	28	1106
7.07	20.6°	30	1108

Untreated Samples

✓ Thorium 228, 232
✓ 226 Ra (2L)
✓ H.E.

LABORATORY TREATMENTS

See LABORATORY TREATMENTS sheet
for definition of footnotes.

COMMENTS: Had to lift unit up to reassemble
cellar into well. But Duke and I precame!

INITIALS DR, JS

4012

[illegible]

ATTACHMENT C:

SAMPLE EMS NONHAZARDOUS ENVIRONMENTAL SAMPLE SHIPPING REPORT

Environmental Monitoring Section

NON-HAZARDOUS ENVIRONMENTAL SAMPLE

SHIPPING REPORT

Date: 2-17-94

Destination:
(check one)

- ☒ California Laboratory Services (CLS), Ranch Cordova, CA 95742
☐ International Technology Corporation (IT), St. Louis, MO 63045
☐ GTEL Environmental, Concord, CA 94520
☐ Fruit Grower's Laboratory, Santa Paula, CA 93061
☐ Other _____
(Please specify) (Zip Code)

These laboratories provide courier service for samples

Contact:
(check one)

- ☒ Becky Ward 2-3792 ☐ Paris Althouse 2-3001

Commodity:
(check all that apply)

- ☒ Aqueous Environmental Samples
☐ Soil Environmental Samples
☐ Sewer Environmental Samples
☐ Air Particulate Environmental Samples
☐ Other _____

Number of Packages:
(example: 1 ice chest)

1 ice chest

Estimated Total Weight:
(include units)

43 lbs

Report Prepared by:

Debra Ramsey
Signature

Please Mail to the Traffic Office at L-516

SENDER'S COPY
DROP OFF YOUR PACKAGE AND SAVE

printed June 29, 1974

SENDER'S COPY
DROP OFF YOUR PACKAGE AND SAVE

[illegible]

Design Change Package EMP-QA-SL-001

Sample Location Designators

Effective Date: December 27, 1994

Prepared by:

Nina L Hankla

12/19/94

Nina Hankla
Data Manager, EMS

date

Approved by:

Lucinda M Garcia

12/19/94

Lucinda Garcia
Quality Assurance Coordinator, EMS

date

Approved by:

Duane Rueppel

12-19-94

Duane Rueppel
Group Leader, TSG

date

Approved by:

Rebecca Failor

12/19/94

Rebecca Failor
Section Leader, EMS

date

LLNL ENVIRONMENTAL
MONITORING SECTION
UNCONTROLLED COPY
FOR INFORMATION ONLY

Statement of Change in Design

1. DISCUSSION

QA samples are to be submitted to the laboratories with "blind" location codes. Previously, "QA" was used in the location code for QA samples. This immediately signified the lab that the sample was probably a duplicate, blank, or spike.

2. PROCEDURE CHANGE

When developing an identifier for a QA sample, such as a duplicate, the analyst should create a location code that does not correspond with an actual location. This code should follow the naming convention for the corresponding area or network but must not identify an existing location. The location code "QA" should be avoided.

This new identifier will be used each time a sample of that QA type is taken for that area. These "fake" names are to be used on EMS sample tracking documentation so the laboratory will not know the actual location or type of the QA sample. The QA name will be decoded to the actual sampling location before the data is entered into the EPDDATA database.

For example, the locations on the Livermore Valley other waters network, follow the convention "L-xxxx-OW". The duplicate is now "L-LABS-OW." "LABS" does not refer to any existing location and should never be used to identify a new location. Even though the actual location where the duplicate is taken will vary with each sampling event, the duplicate identifier is always "L-LABS-OW."

EMP-OA-SL

SAMPLE LOCATION DESIGNATORS

Prepared by: Nina L Hankla 10/13/94
 Nina Hankla date
 Data Manager, EMS

Reviewed by: Duane Rueppel 10/13/94
 Duane Rueppel date
 Group Leader, TSG

Kris Sufano 10/17/94
 Kris Sufano date
 Group Leader, Tamm

Bill Hoppes 10/17/94
 Bill Hoppes date
 Group Leader, WGMG

Approved by: Rebecca A. Failor 10/17/94
 Rebecca A. Failor date
 Section Leader, EMS

Lucinda M. Garcia 10/17/94
 Lucinda M. Garcia date
 Quality Assurance Coordinator, EMS

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 MONITORING SECTION
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REVISION 1 Final	EMP-QA-SL Sample Location Designators	Effective date: 11/1/94 Page 2 of 6
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1. PURPOSE

This procedure explains the sampling location designator notation used by EMS and provides guidance for naming new sampling locations. This procedure also lists acceptable codes for the media sampled by EMS. It is intended that all EMS and affiliated personnel will use these sample location designators exclusively in the production of sample identifiers (Reference 1), in data reports, and in the EMS monitoring database. Data in the database using previous designators shall be reviewed and updated with current sample designators, as appropriate.

2. DISCUSSION

The designators stated in this procedure shall be used exclusively for routine sampling and for special studies unless the sampling plan indicates otherwise. Any deviations from this procedure must be approved by the EMS Data Manager. As new routine sampling locations are added, design change packages or revised procedures specific to the monitoring activity will be issued (in accordance with References 11 and 12) and will contain new sample location designators.

Some sampling location names/designators involve the use of brand names or private individuals' names or residences. It is the policy of LLNL and EPD that brand names and the names and residences of private parties remain for official use only and this information only be given out on a need-to-know basis. Samplers needing this proprietary information to perform their sampling activities should contact the Responsible Analyst.

3. REFERENCES

1. EMP-QA-SD, *Sample Tracking Documentation*
2. EMP-AP-L, *Air Particulate Sampling Locations*
3. EMP-AT-L, *Air Tritium Sampling Locations*
4. EMP-S-L, *Soil and Arroyo Sediment Sampling Locations*
5. EMP-VG-L, *Vegetation and Foodstuff Sampling Locations*
6. EMP-W-L, *Water Sampling Locations*
7. EMP-GW-L, *Ground Water Sampling Locations*
8. EMP-RA-L, *Rain Sampling Locations*
9. EMP-RO-L, *Runoff Sampling Locations*
10. EMP-R-L, *Radiation Monitoring Locations*
11. EMP-QA-CD, *Changes in Design*
12. EMP-QA-PW, *Procedure Writing*
13. EMP-QA-S, *Quality Assurance Sampling*

4. DEFINITIONS

Sampling Location: Any designated area from which samples are collected in support of the Environmental Monitoring Section's monitoring effort.

Sample Location Designator: The two-field code that specifies the sampling location from which an environmental sample was obtained. A site code (L for Livermore, 3 for Site 300, C for California, etc.) and a location code (PATT for Patterson Pass, ALTA for Altamont, etc.) comprise this designator.

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Sample Identifier: The four-field code that identifies an individual sample to an analytical laboratory. It is made up of the sample location designator (two fields), a sample number, and a media/location type code (L-ALTA-01-RA, for example).

Media/Location Type Code: A two-letter field of the sample identifier; it identifies the sample matrix or specific location type, such as HY for honey, RA for rain, MW for monitoring well, etc.

QA Sample: A sample that is submitted unidentified to the analytical laboratory and is used to provide quality assurance/quality control for the sampling/analytical effort. QA samples can be duplicates, blanks (equipment, trip, or field), spikes, or standards. When a sample is submitted to the laboratory, the "blind" location code is "QA" and the various QA samples are assigned sequential replicate numbers (L-QA-01-xx, L-QA-02-xx, L-QA-03-xx, etc.) without any other identification appearing on the COC with respect to those samples. Refer to Procedure EMP-QA-S (Reference 13) for descriptions of QA samples and their use.

5. RESPONSIBILITIES

5.1. EMS ENVIRONMENTAL ANALYSTS/ANALYST ASSISTANTS

Environmental Analysts, or Analyst Assistants, assigned responsibility for a particular sampling network must propose new location designators when new locations are required. The Analyst must also assess the suitability of existing sample location designators and make suggestions regarding name changes. The Analyst should discuss potential additions/changes with the QA Coordinator and the Data Manager and is responsible for preparing design change packages justifying the renaming or addition of sampling locations. The Analyst is also responsible for providing proprietary information to Technicians responsible for the collection of samples, regarding sample brand names and sampling location designators, on an in-strict-confidence/need-to-know basis.

5.2. EMS DATA MANAGER

The EMS Data Manager is responsible for implementation of this procedure in the development of sample location designators. Only the Data Manager can officially determine sample location designators. The Data Manager must keep lists of acceptable sample location designators. The Data Manager must discuss potential new location designators with Environmental Analysts and the QA Coordinator and must review design change packages when new locations are instituted or old locations are renamed. The EMS Data Manager is responsible for ensuring that data in the EMS monitoring database be identifiable using the current sample location designators. Historical data must be updated with new location designators as soon as the design change package is released. All historical data from a sample location can only be accessed in data reports if accurate sample location designators are used. For purposes of tracing naming-convention evolution, the Data Manager keeps a Historical List of Sample Identifiers.

5.3. QA COORDINATOR

The EMS QA Coordinator is responsible for reviewing and approving design change packages when new locations are instituted or old locations are renamed, seeing that all staff members receive updated information regarding sample location

designators, and ensuring all staff members are using the current designators exclusively.

6. PROCEDURES

Equipment Required:
N/A

6.1. ASSIGNING SAMPLE LOCATION DESIGNATORS

Only the Data Manager MAY officially assign sample location designators. The Data Manager also assigns new media codes. Any proposed new sampling locations must be referenced in a design change package or procedure revision and should contain sample location designators that have been approved by both the QA Coordinator and the Data Manager. The Data Manager will ensure that the proposed designators meet the requirements stated below and will incorporate the new information into the next revision of this procedure. The Data Manager is responsible for making changes to sample location designators in the monitoring database and for ensuring that all locations in the database are correct and current.

6.2. ALPHANUMERIC FIELDS OF LOCATION DESIGNATORS

Location designators have two fields in the form A-BBBB or A-QA, where A is the general descriptor of the site, usually L for Livermore Valley and 3 for Site 300. For vegetation, foodstuffs, and radiation monitoring, the general location field may contain a C for California (other than Livermore or Site 300), an F for France, a G for Germany, an I for Italy, or a U for other USA locations. Similar "A" fields should be used for other media when sampling takes place outside of the Livermore Valley or the Site 300 area. The BBBB field is used to denote specific locations within a general area. It is a three to seven character alphanumeric descriptor of the sampling location (such as ALTA for Altamont, COW for cow barn, etc.). For wine, the BBBB field may represent wine regions of California, France, Italy, or Germany; identify another state in the United States; or identify the Livermore Valley as the location (LIV). For honey and non-Livermore Valley vegetation samples, the BBBB field represents the city/county from WHICH the sample was collected (C-TUR for Turlock, C-FRES for Fresno). For onsite monitoring locations, building numbers are often used (L-B438, L-B196, etc.).

Note: Location designators always appear as upper-case characters. Care should be taken to eliminate or disguise personal names from the location designators to ensure the privacy of participants in the monitoring effort.

6.3. RADIATION AND GROUND WATER SAMPLE LOCATION DESIGNATORS

TLD, neutron dosimeter, and ground water sample designators cannot conform strictly to this system. Many ground water locations are originated by the Environmental Restoration Division (ERD), and when EMS takes over the monitoring of these locations, the ERD names are maintained for consistency. TLD and neutron dosimeter sample location designators are less descriptive due to the quantity of sites and network changes. The ground water and environmental radiation media maintain their own historical sample location designator systems (References 7 and 10).

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6.4. QA SAMPLE LOCATION DESIGNATORS

For designating and tracking QA samples, refer to References 1 and 13, procedures that explain how to record QA samples on Field Tracking Forms and Chain of Custody Record Forms and how to decode blind QA sample identifiers.

7. DOCUMENTATION/QA RECORDS

Design change packages and procedure revisions are the mechanism by which new sample location designators are added or names of sampling locations are changed (see References 11 and 12). Design-Change Packages and procedure revisions are QA records. Occasionally, completely new procedures may list new sample locations and their designators. References 2 through 10 contain the official listings of accepted designators, but they can be amended with Design-Change Packages or procedure revisions. In accordance with References 11 and 12, recipients of the Design-Change Package or revised procedure that lists new sample location designators will be required to sign receipts that will also become QA records.

8. ACCEPTANCE CRITERIA

All samples must be identified with acceptable location designators as part of their sample identifier code. Samples using unofficial location designators will not be acceptable for use in EMS monitoring activities. Sample location designators must follow the guidance presented in this procedure, unless exempted by the QA Coordinator and Data Manager based on reasons provided by individual analysts. New location designators shall not be used unless accepted by the Data Manager and the QA Coordinator and released in Design-Change Packages or revisions of this and other sampling location procedures to all sanctioned EMS personnel.

9. ATTACHMENTS

Attachment A: Acceptable EMS Media/Location Type Codes

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ATTACHMENT A: ACCEPTABLE EMS MEDIA/LOCATION TYPE CODES

<u>TYPE</u>	<u>MEDIUM</u>	<u>CODE</u>
Air	Air Particulate (Air Filter)	AF
	Air Tritium	AT
Building Drain Investigation, Repair, or Maintenance	Building Drain	BD
Vegetation and Foodstuff	Honey	HY
	Goat Milk	ML
	Cow Milk	CM
	Wine	WI
	Vegetation	VG
Soil	Soil	SO
	Arroyo Sediments	AS
Sewage	Sewage	SW
Radiation	Thermoluminescent Dosimeters (TLD)	TD
	Neutron Dosimeters	NT
Routine Water	Storm Water Runoff	RO
	Rain	RA
	Cooling Tower Water	TW
	Surface and Other Water	OW
Ground Water	Monitoring Well	MW
	Barcad	BC
	Piezometer	PZ
	Lysimeter	LY
Sludge	Liquid Sludge	SL
	Solid Sludge	SS

EMP-R-CA

RADIATION MONITORING CALIBRATION

Prepared by:

Barbara C. Fields 5/3/93
Barbara C. Fields date
Environmental Analyst, TAMM

Reviewed by:

Duane Rueppel for 5/3/93
Paris Althouse date
Environmental Technician, TSG

David Graves 5-3-93
David Graves date
Environmental Technician, TSG

Duane Rueppel 5/3/93
Duane Rueppel date
Group Leader, TSG

Approved by:

Rebecca Failor 5/3/93
Rebecca Failor date
Section Leader, EMS

Cindy Garcia 5/3/93
Cindy Garcia date
Quality Assurance Coordinator, EMS

Kris Surano 5/3/93
Kris Surano date
Group Leader, TAMM

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1. PURPOSE

This procedure describes the methods and responsibilities for the calibration of environmental thermoluminescent dosimeters (TLDs) and neutron dosimeters used to measure direct radiation levels at the LLNL boundary and in the surrounding areas.

2. APPLICABILITY/DISCUSSION

Quality control of the radiation monitoring program is evaluated by charting the performance of dosimeters exposed to Cs-137 photons and bare Cf-252 neutron sources. The LLNL Hazards Control Radiation Dosimetry Group calibrates TLDs and neutron dosimeters for the Environmental Monitoring Section. All dosimeters are calibrated to NIST-traceable standards.

Six TLDs are exposed to prescribed radiation levels for calibration purposes midway through each quarter and are read at the end of the quarter by the Radiation Dosimetry Group. Six blank (unexposed) TLDs are similarly read at the end of the quarter. The calibration numbers are entered into the Hazards Control Radiation Dosimetry Group database and a calibration curve is generated. The curve is used to determine the exposure of TLDs collected from the field to environmental radiation. In addition, eight TLDs (six irradiated and 2 blanks) with known exposures are submitted as blind QC samples to verify accuracy.

Neutron dosimeters (rem-meters) are tested during the neutron-reading cycle by exposing two of the rem-meters to a calibrated neutron source and determining the dose. See Reference 6 for a description of neutron dosimeters.

Both TLD and neutron calibration dosimeter readings are transmitted to the Hazards Control QA Manager and are forwarded to the responsible TAMM analyst. The average value must be within $\pm 20\%$ of the "true" value or within 5 mR for TLDs or 5 mrem for neutrons, whichever is greater (See Reference 7). If any dosimeter results fail to meet these criteria, the processing system will be reevaluated. Evaluation and the corrective action taken will be documented in a Nonconformance Report by the responsible TAMM analyst (Reference 9).

3. REFERENCES

1. DOE Order 5480.5 DOE Accreditation Program for Personnel Dosimeters
2. DOE Order 5480.4 Mandatory ES&H Standards (Policy) Requirements
3. DOE Order 1324.2A/AV-1 Radiological Control for Calibration Maintenance Equipment and Tools
4. DOE Order 5400.6C Calibration and Maintenance of Monitoring and Data Collection Equipment
5. Hazards Control Progress Report "Calibration of Anderson-Braun Rem-Meters with Track-Etch Detectors," UCRL 5007-76-1, Aug. 1976.
6. EMP-R-S *External Radiation Monitoring*
7. Hazards Control QC Procedure 8-4-1
8. EMP-R-L *Radiation Monitoring Locations*
9. EMP-QA-NCR *Nonconformance Reports*
10. EMP-QA-DC *Document Retention*

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4. DEFINITIONS

Hazards Control Radiation Dosimetry: Group within Hazards Control Department that is responsible for processing radiation dosimeters for field deployment.

Lead Pig: A box fabricated from lead which is used to shield TLDs from external ionizing radiation (located on the north side of B-151).

Millirem (mrem): One-thousandth of a rem.

Milliroentgen (mR): One-thousandth of a roentgen, which is a unit of exposure equal to 2.58×10^4 coulombs per kilogram of air.

Rem: The product of the absorbed dose in rads times the quality factor, distribution factor, and any other necessary modifying factors.

Rem-meter: An instrument for measuring effective dose equivalent of neutron radiation.

Spark Counter (Detector): An instrument that determines the total number of tracks created in the polycarbonate plastic track-etch detector caused by neutron radiation. The number of tracks is proportional to the neutron dose.

Thermoluminescent Dosimeter (TLD): A device that is used to measure external ionizing radiation.

5. RESPONSIBILITY

5.1 EMS SECTION LEADER

The EMS Section Leader ensures that all calibration standards meet and conform to the appropriate regulatory guidance.

5.2 TAMM GROUP LEADER

The Group Leader assures that calibration procedures meet design criteria and that calibration is conducted in accordance with approved procedures.

5.3 TAMM ANALYST

The Terrestrial and Atmospheric Monitoring and Modeling Analyst is responsible for ensuring that TLDs are calibrated as described herein, the resulting data are correct and within the acceptable range, neutron rem-meters are functioning properly and are properly calibrated, and calibration data are properly archived. The Analyst is also responsible for issuing non-conformance reports if calibration/QC checks are unacceptable.

5.4 TSG ENVIRONMENTAL TECHNICIAN

The TSG Environmental Technician is responsible for completing Radiation Request forms, delivering dosimeters for exposure, picking them up when they have been exposed, and replacing them in the lead pig. The technician must also complete a Radiation Request form for exposures of neutron rem-meters.

5.5 HAZARDS CONTROL RADIATION DOSIMETRY GROUP LEADER

The Hazards Control Radiation Dosimetry Group Leader ensures that calibration personnel perform calibrations and maintain calibration records according to the requirements of applicable procedures.

5.6 HAZARDS CONTROL CALIBRATION PERSONNEL

Hazards Control calibration personnel calibrate TLDs and neutron dosimeters and maintain calibration records according to the requirements of applicable procedures.

6. PROCEDURE

6.1 THERMOLUMINESCENT DOSIMETERS

At the beginning of each quarter, when TLDs for deployment to the field are being requested from Hazards Control, twenty (20) calibration and blind QC TLDs are included in the request, as described in Reference 7. These TLDs are stored in a lead pig so that they will be subjected temperature cycling similar to that of the field units. At mid-quarter, these TLDs are removed from the pig, irradiated as required and then returned to the pig for storage until the end of the quarter. The table below describes the type, number, submittal times, and exposure times for TLDs.

TYPE	NUMBER	SUBMITTAL	EXPOSURE	LEAD PIG
Site Perimeter	16	Quarterly	-	-
Livermore Valley	49	Quarterly	-	-
SITE 300	20	Quarterly	-	-
Special Study	11	Quarterly	-	-
Duplicates	14	Quarterly	-	-
Trip Blanks	4	Quarterly	-	-
Calib. Controls	12	Quarterly	Mid-Qtr.	Quarterly
Blind QC	8	Quarterly	Mid-Qtr.	Quarterly

At mid-quarter, the twelve calibration control TLDs are sent to the Hazards Control Radiation Dosimetry Group. Six of the TLDs are irradiated to specified levels, and six are not exposed to radiation. After irradiation, all the calibration control dosimeters are placed in a zip-lock plastic bag and returned to the lead pig for storage until the beginning of the following quarter, when they are picked up for use as the control standards for that monitoring cycle. Also at mid-quarter, the eight blind QC TLDs are sent to the Hazards Control Radiation Dosimetry Group. Six of the blind QC TLDs are irradiated to specified levels and two are not exposed to radiation. After irradiation, all the blind QC dosimeters are placed in a zip-lock plastic bag and returned to the lead

pig for storage until the beginning of the following quarter, when they are picked up by the TSG technician and read by the Radiation Dosimetry Group in accordance with References 1, 2, 3, and 4.

The steps involved in the calibration process are described below.

Equipment Required:
Lead Pig (north side of Building 151)
20 TLDs (stored in lead pig)

6.1.1. At mid-quarter, the TSG technician completes an Irradiation Request Form (see Attachment A) for all dosimeters that require exposure. Information that must be put on this form includes the date of the request, the date the TLDs are needed, the requester's name, the quarter of the request (for example "Second Quarter 1992 Environmental TLD Cal."), the numbers of TLDs in each requested exposure range (the requested exposures should be listed under "Additional Information," not in the table). Hazards Control personnel will complete the form.

6.1.2. At mid-quarter the TSG technician must pick up TLDs from the lead pig (placed there at the beginning of the quarter in accordance with Reference 6) and deliver them to the Hazards Control Radiation Dosimetry Group with the completed Irradiation Request Form requesting:

- 6 TLDs with 50 to 100 mR exposure
- 6 TLDs with 0 mR exposure (unexposed)

6.1.3. Additionally, a request for irradiation of the blind QC samples listed below must be submitted to the Hazards Control Radiation Dosimetry Group. Exposures will range within the doses stated below:

- 3 TLDs with 15-50 mR exposure
- 3 TLDs with 50-100 mR exposure
- 2 TLDs with 0 mR exposure (unexposed)

6.1.4. In accordance with Hazards Control Quality Control Procedure 8-13-1A, the Radiation Dosimetry Group irradiates dosimeters to NIST-traceable standards, as required by References 1, 2, and 3.

6.1.5. The Hazards Control Radiation Dosimetry Group informs the TSG technician when the irradiated TLDs are ready for pick-up.

6.1.6. The TSG technician picks up the 12 calibration control TLDs and the eight blind QC TLDs and returns them to their respective labeled zip-lock bags in the lead pig for storage until the beginning of the next quarter, when they will be used as the standards and QC checks for the reading of the field TLDs.

6.2. NEUTRON DOSIMETERS

6.2.1. The TAMM Analyst must telephone the Counting Lab of the Hazards Control Radiation Dosimetry Group (2-5234) one week before the delivery date to inform them the rem-meters are being delivered for counting and QC checks.

6.2.2. The TAMM Analyst also must telephone the Standards and Calibration Lab of the Hazards Control Radiation Dosimetry Group (3-2648) one week before the rem-meter delivery date and inform them that two rem-meters are being delivered for irradiation to support QC checks. The two rem-meters to be tested are selected at random from the field units.

6.2.3. The TSG technician must submit a completed Irradiation Request Form requesting exposure by the Standards and Calibration Laboratory for all rem-meters that require testing. The completed Irradiation Request Form must include the requester's name, the quarter of the request (for example "2nd Quarter 1990 neutron rem-meter test"), the date of the request, the date the neutron rem-meters are needed, the source (PuBe and Cf-252), and the approximate dose (usually 10-50 mrem). The source type and dose range should be listed in the "additional information" section; all other information will be completed by Hazards Control personnel.

Note: It is important to notify the Hazards Control Laboratories personnel one week before delivery date that rem-meters are being delivered. This allows preparation time for the Hazards Control Personnel.

6.2.4. The quality control check for two of the modified rem-meters is carried out by replacing the ^{235}U foil in the meters and exposing them to known neutron levels in accordance with Hazards Control QC Procedure 8-3-1A.

6.2.5. After exposure, the modified neutron rem-meters are taken to the Counting Laboratory to be spark-counted and read. This QC check should yield the same dose as that calculated from the exposure ($\pm 20\%$ or 5 mrem, whichever is greater).

6.2.6. After counting, the Counting Laboratory technician replaces the ^{235}U foils with new foils so the rem-meters may be returned to the field and contacts the TSG technician. This process takes place as quickly as possible so that all rem-meters can be returned to their sites within the same day by the TSG technician.

6.2.7. The Counting Laboratory then completes the analyses and returns the results to the TAMM Analyst along with the data from the field units and the corresponding COC form (see Reference 6).

7. DOCUMENTATION/QA RECORDS

Irradiation Request Forms and calibration data provided by the Hazards Control Radiation Dosimetry Group will be stored according to the requirements of Reference 10.

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8. ACCEPTANCE CRITERIA

The following criteria must be satisfied to fulfill the requirements of this procedure:

- TLDs are calibrated to NIST-traceable sources.
- Neutron rem-meters have quality control checks and are calibrated to NIST-traceable sources.
- The QC value must agree within 20% of the "true" value or within five (5) mR for TLDs and five (5) mrem for neutron rem-meters, whichever is greater.

9. ATTACHMENTS

Attachment A: Irradiation Request Form for Calibration Control TLDs

Attachment B: Irradiation Request Form for Blind QC TLDs

Attachment C: Irradiation Request Form for Neutron Rem-meter QA check

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Attachment A: Irradiation Request Form for Calibration Control TLDs

Personnel Dosimetry/Calibration & Standards Laboratory
IRRADIATION REQUEST FORM

DATE: _____ (to be completed by Calib Lab Tech)

Requester: DAVID GRAVES

Quarter Requested: 3rd Quarter 1993

Date Requested: 2-13-93 Date needed: 2/1/93 Rush: _____

Phantom: Y N Moderator: _____

Badge holder with cover: Y N

Additional Instructions: 6 TLDs with 50-100 mR ¹³⁷Cs exposure
6 TLDs with 0 mR exposure

Source type Identification #	Dist. (cm)	Exposure (list units)	Time (min)	Notes/TLD ID #	Beam Monitor

Beam Monitor: Type _____ ID (L) _____ (R) _____

Technician completing work: _____

Attachment B: Irradiation Request Form for Blind QC TLDs

Personnel Dosimetry/Calibration & Standards Laboratory
IRRADIATION REQUEST FORM

DATE: _____ (to be completed by Calib Lab Tech)

Requester: DAVID GRAVES

Quarter Requested: 2ND QTR 1993

Date Requested: 3/2/93 Date needed: Feb 4/1/93 Rush: _____

Phantom: Y N Moderator: _____

Badge holder with cover: Y N

Additional Instructions: BLIND QC TLDs

3 TLDs with 15-30 mR exposure, 3 TLDs with
50-100 mR exposure AND 2 TLDs with 0 exposure

Source type Identification #	Dist. (cm)	Exposure (list units)	Time (min)	Notes/TLD ID #	Beam Monitor

Beam Monitor: Type _____ ID (L) _____ (R) _____

Technician completing work: _____

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Attachment C: Irradiation Request Form for Neutron QA Check

Personnel Dosimetry/Calibration & Standards Laboratory
IRRADIATION REQUEST FORM

DATE: _____ (to be completed by Calib Lab Tech)

Requester: DAVID GRAVES

Quarter Requested: 2nd QTR 1993

Date Requested: 3/21/93 Date needed: 4/1/93 Rush: _____

Phantom: Y N Moderator: _____

Badge holder with cover: Y N

Additional Instructions: QUALITY CONTROL CHECKS ON NEUTRON

REM-METERS. EXPOSE 1 REM-METER TO 10-50

MR PV BE - EXPOSE 1 REM-METER TO 10-50 MR²⁹ CT

Source type Identification #	Dist. (cm)	Exposure (list units)	Time (min)	Notes/TLD ID #	Beam Monitor

Beam Monitor: Type _____ ID (L) _____ (R) _____

Technician completing work: _____

RADIOLOGICAL DOSE ASSESSMENT

Prepared by:

Robert J. Harrach 11/10/93
Robert J. Harrach date
Physicist, TAMM

Reviewed by:

Rebecca A. Failor 11/10/93
Rebecca A. Failor date
Section Leader, EMS
Kris Surano 11/10/93
Kris Surano date
Group Leader, Tamm
Bob Berger 11/10/93
Bob Berger date
Environmental Analyst, TAMM
Brian Balke 11/10/93
Brian Balke date
Environmental Analyst, WGMG
Bill Hoppes 11/10/93
Bill Hoppes date
Group Leader, WGMG
Duane Rueppel 11/10/93
Duane Rueppel date
Group Leader, TSG
Barbara Fields 11/10/93
Barbara Fields, date
Environmental Analyst, TAMM
Gretchen Gallegos 11/10/93
Gretchen Gallegos, date
Environmental Analyst, TAMM
Paula Tate 11/10/93
Paula Tate, date
Environmental Analyst, TAMM

Approved by:

Rebecca A. Failor 11/10/93
Rebecca A. Failor date
Section Leader, EMS
Kris Surano 11/10/93
Kris Surano date
Group Leader, TAMM
Lucinda M. Garcia 11/10/93
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

**LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes the methods used to determine potential radiological doses to individuals and populations from releases of radionuclides by Lawrence Livermore National Laboratory (LLNL). These methods apply to routine operations involving chronic, as opposed to acute, releases of radionuclides to the environment. This procedure is not intended for assessing consequences from abnormal occurrences (e.g., accidents involving major acute releases), because the models incorporated in the procedure use annual-averaged integrated data, and not one-time accidental release data.

2. DISCUSSION

The release of radionuclides and the resultant radiological impact to the public from operations at LLNL is regulated by both the Department of Energy (DOE) and the Environmental Protection Agency (EPA).

DOE environmental radiation protection standards, provided under the authority of the Atomic Energy Act of 1954, as amended, and the DOE Organization Act of 1977, as amended, are defined in DOE order 5400.5, *Radiation Protection of the Public and the Environment* (Reference 1). The standards for controlling exposures to the public from operations at DOE facilities which are incorporated in this order are based on recommendations by the International Commission on Radiation Protection and Measurements (Reference 2). The radiological impact to the public is assessed in accordance with DOE Order 5400.1 (Reference 3), DOE/EH-0173T (Reference 4), DOE Order 5480.5 (Reference 5), and DOE Order 5480.1, Chapter 1 (Reference 6).

Radionuclide emissions to the atmosphere from DOE facilities are further regulated by the EPA, under the authority of Section 112 of the Clean Air Act, as amended (Reference 7). Subpart H of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) under 40 CFR Part 61, sets standards for public exposure to airborne radioactive materials (other than radon) released by DOE facilities; radon is regulated by Subparts Q and T. NESHAPs implements the dosimetry system recommended by the International Commission on Radiological Protection in its Publication 26 (Reference 8).

The primary DOE radiation standards for protection of the public are 100 millirem per year (mrem/y) effective dose equivalent (EDE) for prolonged exposure of a maximally exposed individual in an uncontrolled area, and 500 mrem/y EDE for occasional exposure of this individual. (EDEs and other technical terms are defined in Sec. 4 of this procedure.) These limits pertain to the sum of the EDE from external radiation and the committed 50-y EDE from radioactive materials ingested or inhaled during a particular year that may remain in the body for many years. The EPA's radiation dose standard, which only applies to air emissions, limits the whole-body EDE to members of the public from DOE activities to 10 mrem/y. EPA regulations specify not only the allowed levels, but also specify the approved methods by which airborne emissions and their impacts must be evaluated.

LLNL relies on a combination of physical measurements and computer modeling to determine the public exposure to radionuclides released in LLNL operations. Because the EPA and DOE radiation protection standards are very low compared to levels of natural exposure to radioactivity in the environment (principally those due to cosmic rays, radioactive materials in soil and rock, radon gas in the air we breathe, and naturally-occurring radionuclides we ingest through food and drink), it is difficult to prove compliance with the standards by measuring the effects of dispersal of the radioactivity in the atmosphere. The EPA has therefore developed computer codes that implement its approved dosimetry model, and the EPA mandates that these codes be used to calculate potential doses to the public for compliance demonstrations. Our primary calculational tool for estimating dose and risk is the EPA computer code CAP88-PC (Reference 9).

Radionuclides that enter the environment via transport in air can cause human health effects principally through internal exposures from inhalation of air and ingestion of foodstuffs and drinking water, and by external exposures through irradiation from a contaminated ground surface and

immersion in contaminated air. The CAP88-PC code evaluates these four principal pathways in arriving at the EDEs. The radionuclide database in CAP88-PC includes dose rate conversion factors for 265 different radionuclides, and the code describes six radioactive decay chains (four simple and two complex ones). More details of CAP88-PC are provided below in Sec. 6.2.

An alternative approach to deriving effective dose equivalents using the built-in dosimetry model in CAP88-PC or other EPA-mandated code is to explicitly calculate doses using mathematical formulas from, e.g., the Nuclear Regulatory Commission's Regulatory Guide 1.109 (Reference 10), which incorporates dose conversion factors consistent with those in the International Commission on Radiation Protection's document ICRP 30 (Reference 11). This approach has been used historically at LLNL (preceding the availability of CAP88-PC), and continues to be used, to evaluate annual doses to the public inferred from sampling of local environmental media (air, water, vegetation, milk, honey, and wine). This methodology is described in Sec. 6.2.3.

When applying CAP88-PC or other computer models to assess probable off-site impacts, we distinguish three categories of estimated releases of radioactivity to the environment:

- Releases directly measured using environmental dosimeters (thermoluminescent dosimeters and neutron detectors) in and around the site and at selected points on the LLNL perimeter;
- Releases estimated by computer modeling that incorporates measured source emission data obtained from continuous sampling of the source and/or surveillance measurements;
- Releases estimated by computer modeling based on assumed "unabated" source emissions inferred from radionuclide inventories, i.e., taking no account of radiation emission control or abatement devices (such as filters), and assuming fractional release factors (i.e., factors specifying the fraction of the annual inventory that potentially could be released) of 1×10^{-2} , 1×10^{-3} , and 1×10^{-6} for sealed gases, liquids or powders, and solids, respectively, in accordance with 40 CFR part 61, Appendices D and E (Reference 7).

For each of these categories, three potential doses are emphasized: (1) The maximum dose at the site boundary, or maximum "fenceline" dose, due to emissions from each facility at a site, (2) the dose to the so-called "site-wide maximally exposed individual" (SW-MEI) member of the public, combining the effects of all facilities at a site, and (3) the collective dose to the populations residing within an 80 km (50-mile) radius of the two LLNL sites, adding up the products of individual doses received times the number of people receiving them.

The radiological dose assessment is reported each year in the LLNL Site Annual Environmental Report, in the NESHAPs Annual Report, and (for the past two years) in NESHAPs quarterly reports. A broader discussion of the subjects addressed in this procedure is presented in the Site Annual Environmental Reports for 1971-1992; see, e.g., Reference 12.

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19. EMP-QA-D, *Data Analysis*.
20. EMP-QA-S, *Quality Assurance Sampling*.
21. EMP-QA-R, *Reporting and Review Requirements*.
22. EMP-W-S, *Water Sampling*.
23. EMP-GW-S, *Groundwater Sampling*.
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4. DEFINITIONS

Absorbed Dose: The amount of energy imparted to matter by ionizing radiation per unit mass of irradiated material. The absorbed dose is expressed in units of rad or gray. (1 rad = 0.01 gray).

Committed Dose Equivalent: The predicted total dose equivalent to a tissue or organ over a 50-year period after an intake of a radionuclide into the body. It does not include contributions from external dose. Committed dose equivalent is expressed in units of rem (or sievert).

Committed Effective Dose Equivalent: The sum of the committed dose equivalents to various tissues in the body, each multiplied by an appropriate weighting factor representing the relative vulnerability of different parts of the body to radiation. Committed effective dose equivalent is expressed in units of rem or sievert (100 rem equals one sievert).

Collective Dose Equivalent and Collective Effective Dose Equivalent: The sums of the dose equivalents or effective dose equivalents to all individuals in an exposed population within 80 km (50 miles) of the radiation source. These are evaluated by multiplying the dose received by an individual at each location by the number of individuals receiving that dose, and summing over all such products for locations within 80 km of the source. They are expressed in units of person-rem or person-sievert. The collective EDE is also referred to as the "population dose."

Deep Dose Equivalent: The dose equivalent at a depth of one centimeter in tissue from external (penetrating) radiation.

Dose Equivalent: The product of absorbed dose in rad (or gray) in tissue, a quality factor representing the relative damage caused to living tissue by different kinds of radiation, and perhaps other modifying factors representing the distribution of radiation, etc. Dose equivalent is expressed in units of rem or sievert (1 rem = 0.01 sievert).

Effective Dose Equivalent: The summation of the products of the dose equivalent and weighting factor for each tissue. The *weighting factor* is the decimal fraction of the risk arising from irradiation of a selected tissue to the total risk when the whole body is irradiated uniformly to the same dose equivalent. These factors permit dose equivalents from nonuniform exposure of the body to be expressed in terms of an effective dose equivalent that is numerically equal to the dose from a uniform exposure of the whole body that entails the same risk as the internal exposure (Reference 11). For purposes of this Procedure, the effective dose equivalent includes the committed effective dose equivalent from internal deposition of radionuclides and the effective dose equivalent due to penetrating radiation from sources external to the body and is expressed in units of rem (or sievert).

Gray: The SI unit of measure for absorbed dose; the quantity of energy imparted by ionizing radiation to a unit mass of matter, such as tissue. One gray equals 100 rads, or one joule per kilogram.

Maximally Exposed Individual: The maximally exposed individual is a hypothetical member of the public who, over an entire year, continuously receives the maximum dose (summed over all pathways) from a given release point or set of release points.

Quality Factor: The factor by which the absorbed dose is multiplied to obtain a quantity that expresses (on a common scale for all ionizing radiation) the biological damage to exposed persons. Quality factor is used because some types of radiation, such as alpha particles, are biologically more damaging than others. Quality factors for alpha, beta, and gamma radiation are in the ratio 20:1:1.

Rad: See Gray

Rem: See Sievert

Sievert: The SI unit of dose equivalent. This is the product of the absorbed dose (gray), quality factor (Q), distribution factor, and other necessary modifying factors. One sievert equals 100 rem.

Site-Wide Maximally Exposed Individual (SW-MEI): The site-wide maximally exposed individual is defined as the hypothetical member of the public who receives, at a given location, the greatest LLNL-induced effective dose equivalent (EDE) from all radionuclide release points at a site. This individual is assumed to continuously reside at a facility accessible to the public that is most highly exposed to the emissions from release points throughout the site. Generally, this implies that the facility is located both near to and in the prevailing wind direction from the principal radionuclide release points for the site. At the Livermore site, the SW-MEI is located at the U.N.C.L.E. Credit Union, about 10 m outside the controlled eastern perimeter of the site. This location lies 948 m east-northeast from the principal radionuclide source, the Tritium Facility (Building 331). At Site 300, the SW-MEI is located in an experimental area termed "Bunker 2," operated by Physics International. Bunker 2 lies about 300 m outside the east-central boundary of Site 300, a distance of 2.38 km southeast of the firing table associated with Building 801, which is the principal radionuclide source at Site 300.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS Section Leader is responsible for reviewing and approving all compliance evaluation/demonstration activities concerning the measurement, modeling, and reporting of radiological doses to the public arising from LLNL operations.

5.2. GROUP LEADERS

The EMS Group Leaders are responsible for directing and coordinating the activities of the environmental analysts, and are responsible for reviewing and approving all compliance activities concerning the measurement, modeling, and reporting of LLNL's radiological doses to the public via all pathways: air, land, and water. The Terrestrial and Atmospheric Monitoring and Modeling (TAMM) Group Leader has responsibility for compliance demonstrations/evaluations regarding radionuclide emissions and calculated doses via the air and land (soils, sediments, vegetation) pathways. The Group Leader of the Water Guidance and Monitoring Group (WGMG) has responsibility for determining possible radioactive releases and calculated doses from LLNL via the water pathway, by measurements of on-site surface water, tap water, storm water runoff, sewer line discharges, and underground water both off-site and at Site 300.

5.3. EMS ENVIRONMENTAL ANALYSTS

The EMS environmental analysts are responsible for planning and conducting measurements in environmental media (gathering data from continuous sampling and environmental surveillance activities); performing data analysis, reduction, and assessment; obtaining data on radionuclide inventories and stack release parameters; modeling releases of radionuclides to the environment and assessing doses and risks to the public; reporting the results; and archiving the data and results in the EMS Documentation Retention Center. The analysts are responsible for communicating effectively with facility managers and personnel from Hazards Control, Hazardous Waste Management Division, and other LLNL organizations that interface with EMS on the assessment of LLNL's radiological doses to the public. The analysts are responsible for identifying the need for upgrades in the methods of data acquisition and modeling, and

planning and implementing these upgrades. The analysts are also responsible for QC checking the data, the inventories, the calculations, and the reports.

6. PROCEDURE

6.1. MONITORING THE EXTERNAL FENCE-LINE DOSE

The fence-line dose rate is a measure of the maximum external dose at locations of nearest uncontrolled public access. Dose rates from external penetrating radiations (primarily gamma rays and neutrons) are measured using environmental dosimeters [thermoluminescent dosimeters (TLDs) and neutron detectors]. External dose rates are measured at 16 locations at the LLNL perimeter and at 49 off-site locations, 13 Site-300 perimeter locations and 3 off-site locations (Reference 13). The TLDs measure environmental radiation exposure rates in milliroentgens (mR). These exposure rates are converted to dose equivalent units (mrem) to compare with existing dose standards.

Environmental neutron dose rate measurements using U-235 track-etch detectors are also made at eight locations on the LLNL site perimeter. A detailed description of the detector and the spark-counting procedure can be found in Reference 14. The environmental dosimeters measure dose rates from all external radiation sources, including cosmic radiation, naturally occurring radioactivity in the environment, fallout from nuclear weapons testing, and any contribution from LLNL operations. Hence, these doses are not solely attributable to LLNL and in most instances are a measure of regional background levels. This is determined by comparing the perimeter measurements with those made at off-site (Livermore Valley) locations. Moreover, LLNL location measurements are made at points of maximum exposure and assume an occupancy of 24 hours per day, 365 days per year. These estimates of received dose are conservative (high), since no member of the public remains at any of these locations for extended periods of time.

6.2. DETERMINING DOSE FROM INHALATION/IMMERSION, INGESTION, AND GROUND IRRADIATION PATHWAYS

The amount of radioactivity released to the environment from LLNL operations is usually too low to be definitively determined above background levels, as noted in Section 2. Therefore we rely on calculations based on environmental transport models and exposure pathway models, in particular using EPA-mandated computer codes that embody the EPA's approved dosimetry model, to assess potential doses resulting from LLNL's radionuclide effluent emissions. Doses from the four pathways of (1) intake by inhalation, (2) intake by ingestion, (3) external irradiation by contaminated ground surface, and (4) external dose from immersion in contaminated air are calculated at and beyond the perimeters of the Livermore site and Site 300 to determine the maximum dose delivered to a member of the public, the dose to the site-wide maximally exposed individual member of the public, and the collective dose to the exposed population within 80 km of the two sites.

Since the issuance of the CAP88-PC code in April of 1992, it has been the preferred EPA model for use at LLNL in compliance calculations. Use of the Continuous-Point-Source (CPS) code (Reference 15), in particular, has been discontinued.

6.2.1. CAP88-PC CODE METHOD

The CAP88-PC code (Reference 9) is a set of computer programs, databases, and associated utility programs for estimating dose and risk from radionuclide emissions to air. It was developed under an Interagency Agreement between the DOE and the EPA to provide the capability to compute dose and risk to both maximally exposed individuals and

collective populations. The differences between CAP88-PC and earlier similar codes (e.g., AIRDOS) is discussed in Appendix E of Reference 9.

CAP88-PC uses a modified Gaussian plume equation to estimate the average dispersion of radionuclides released from up to six sources (elevated stacks or uniform area sources; all six sources are modeled as if located at the same point). Plume rise can be driven either by momentum or buoyancy. Flat terrain is assumed; variation in radionuclide concentrations due to complex terrain cannot be modeled by CAP88-PC. Assessments are done for a circular grid with a radius of 80 km or less around a facility, allowing up to 20 user-selected radial distances. Concentrations and doses are sector-averaged for each element of area in the sixteen 22.5-degree compass sectors; each area element is bounded above and below by arcs with radii from the set of user-selected distances, and on its sides by radial line segments separating the sectors. The mathematical models and explicit equations used in CAP88-PC are described in Chapter 8 of Reference 9, under the major headings "Environmental Transport," and "Dose and Risk Estimates."

The CAP88-PC code accommodates meteorological data, i.e., sensor-determined data files specifying the frequencies of occurrence for different wind speeds and wind directions, and numbers specifying the annually-averaged precipitation, temperature, and average height of the atmospheric inversion layer. The atmospheric transport of radioactive materials released to the atmosphere from LLNL is a sensitive function of meteorological conditions. Meteorological measurements (wind speed, direction, and fluctuation in direction) are measured continuously at two meteorological towers, one at the LLNL site and the other at Site 300. The code also accepts population data files (specifying the distribution of population as a function of distance and direction out to a radial distance of 80 km). CAP88-PC computes results for each of seven Pasquill-Gifford atmospheric stability categories. The code thus computes, in a single run, dose rates in sixteen 22.5-degree compass sectors for up to 20 radial distances extending as far as 80 km from the radionuclide release point, for each of seven Pasquill-Gifford atmospheric stability categories. Only the run producing the highest maximum dose is output to the user, without identifying which particular case it is.

The program computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area (using the Nuclear Regulatory Commission Regulatory Guide 1.109 terrestrial food chain models, Reference 10). Up to 36 radionuclides can be included in a single run, chosen from a total library of 265 radionuclides. Two complex (the U-238 and Th-232 chains) and four simple (the Cs-137, Ba-140, Mo-99, and Pb-210 chains) radioactive decay chains are available on CAP88-PC.

Dose and risk are estimated by combining the inhalation and ingestion intake rates, and the air and ground surface concentrations with dose and risk conversion factors in ICRP Publication 26 (Reference 8). The dose received by an individual via the inhalation, ingestion, and air immersion pathways is expressible in the form $D = K (E \times DF) / P$, where D is the individual dose rate in mrem/y, E is the "exposure" in person-pCi/cm³, DF is the "dose rate conversion factor" in (mrem/y)/(nCi/m³), P is the number of exposed people or "exposed population", and K is a proportionality constant, equal to 10³ for the stated units. This same formula describes the dose received due to ground surface exposure, but the units "per cm³" and "per m³" are replaced by "per cm²" and "per m²", and the proportionality constant becomes $K = 10$. Dose and risk can be tabulated as a function of radionuclide, pathway, spatial location, and body organ. The frequency distribution of risk is tabulated, showing the number of people at various levels of risk on a logarithmic scale from one in ten to one in ten million. Dose and risk estimates from CAP88-PC are applicable only to low-level chronic exposures, since the health effects and dosimetric data it uses are based on low-level chronic intakes. The code is not suitable for modeling either short-term or high-level radionuclide intakes.

Inputs to CAP88-PC: In order to model atmospheric dispersion and estimate public radiation dose with CAP88-PC, site-specific data for a variety of parameters are required. These data define the emission source, the meteorological conditions, the local agricultural characteristics and land use, and the distribution of population surrounding the site. Required data inputs to CAP88-PC are described in Chapter 4 of Reference 9.

(1) **Source:** The most essential feature characterizing a source is the release rate (number of curies per year, or Ci/y) for each radionuclide. Generally, this information is provided by inventory data on file in the EMS Documentation Retention Center (DRC); alternatively, it can be obtained from facility health physicists or Hazards Control. Other aspects of source characterization depend on the type of release—from a stack or an extended area, of a routine or fugitive nature. For a stack emission, additional necessary information includes the height and diameter of the stack and the amount of plume rise (determined, e.g., by the volumetric flow rate or temperature of gas in the stack). This data can be obtained from stack monitoring records or estimated from facility operating parameters on file in the EMS DRC. When preparing the title and information page for a CAP88-PC run, the user should cite sources from which the code input was derived, giving, e.g., the name of the health physicist or other person that provided the radionuclide inventory, the location of the inventory (building, room number, glovebox number, etc.), the blower, vent, and stack numbers, etc. Data residing in the EMS DRC may be accessed with the help of the Documentation Center Archivist. Note: Unusual releases may require special measurements and calculations to characterize the source. An example is the fugitive emissions from Building 292 in 1992, in which leakage from an underground tank resulted in the release of tritium to the atmosphere via soil evaporation and uptake and transpiration by plants.

(2) **Meteorology:** Meteorological data are collected from on-site meteorological towers at the Livermore site and Site 300. Wind speed and direction are sampled every few seconds, temperature every minute, and all are averaged into quarter hour increments, time-tagged and computer-recorded (Reference 16). The LLNL meteorological data are provided to the air effluent analyst by the TAMM Group Meteorologist. The data reside on a DOS computer diskette and are converted into a CAP88-PC input wind file by the meteorologist in accordance with EPA guidelines, as described in the meteorological monitoring procedure (Reference 16). Section 4.3.3, Chapter 7, and Appendix B in the CAP88-PC User's Manual (Reference 9) describe the meteorological data and its conversion for use with that code.

(3) **Agriculture:** Local agricultural characteristics and land use are model-default parameters established by the EPA, and the particular designation influences the ingestion dose received by the local population. The Livermore site and Site 300 are most accurately characterized as "urban" areas, with regard to CAP88-PC modeling of consumption of food grown in the assessment area. The most conservative choice is to characterize the two LLNL sites as "local" with regard to food consumption, meaning that the population exposed to radionuclide releases from LLNL consumes only locally grown food, maximally contaminated by those releases. Agricultural data inputs for CAP88-PC are described in Section 4.3.5 and Appendix C of Reference 9.

(4) **Population:** Population distributions centered on the two LLNL sites are compiled from 1990 census data and used as input to the model calculations of person-rem doses for all persons living within an 80-km radius of LLNL. The preparation and installation of population files for use with CAP88-PC is described in Appendix F of Reference 9.

CAP88-PC output: The output of CAP88-PC is presented in the form of seven "reports," any or all of which can be printed out by the user. These are described in Section 6.2 of the User's Manual (Reference 9). In brief summary, the "Synopsis Report" is a composite of the most essential information generated by the code's assessment. The "General Data" report contains the input data and other general data related to

radionuclide-dependent variables, agriculture, etc. The "Weather Data" report contains tables showing the frequencies of occurrence of different wind speeds and directions and contains information on stability classes. The "Dose and Risk Conversion Factors" report contains dose conversion factors for the ingestion, inhalation, air immersion, and ground-surface irradiation pathways and information on health risk, years of life lost, etc. The "Dose and Risk Equivalent Summary" report contains the summaries of calculated exposures and risks, broken down by organ, pathway, radionuclide, and cancer. The "Concentration Tables" report presents the radionuclide concentration tables generated by the modified version of AIRDOS that is a subroutine in CAP88-PC. Finally, the "Chi/Q Table" report gives χ/Q values (i.e., ratios of the radionuclide concentration in air $\chi[\text{Ci}/\text{m}^3]$ to the source release rate $Q[\text{Ci}/\text{s}]$) for each radionuclide in the assessment.

Only a small subset of this output information is included in our compliance demonstration reports to the EPA. Specifically, we include the cover page of either the General Data report or Dose and Risk Conversion Factors report, identifying the model run by name, type, date, etc.; page 2 of the Synopsis Report, giving radionuclide release data and annual-average temperature, precipitation, and atmospheric lid height data for the site; page 3 of the Synopsis Report giving source information (e.g., stack height, diameter, and specific momentum), agricultural data (fraction of food produced in the assessment area, etc.), and specifying the radial distances to be used in the assessment of maximum individual dose; and pages 5 (and 6, if needed) of the Dose and Risk Equivalent Summary report, showing tables of the individual EDE rate (mrem/y) for all radionuclides and all pathways, in all 16 sector directions for each distance selected. An example of the CAP88-PC output is given in Section 9 below.

6.2.1.1. Prerequisites to Running the CAP88-PC code

Regarding availability, the CAP88-PC computer code is installed on the DOS computers in the offices of two TAMM Group environmental scientists. (To run the code, the computer must have at least 3.5 Mbytes free and must possess a math coprocessor and at least 500 kbytes of free RAM.) Copies of the User's Manual (Reference 9) and program diskette are also available in these offices.

Prerequisite knowledge for effectively using CAP88-PC includes familiarity with personal computers and DOS (in particular, familiarity with simple DOS commands such as DIR, CD, and COPY), some understanding of the physics modeled in the code dealing with phenomena such as plume rise, dispersion of windborne material, specific activity of radionuclides, etc., and some understanding of the dosimetry model and risk assessment methodology used in the code. The User's Manual states that CAP88-PC is intended for use by health physicists experienced in dose assessment, and provides on pages 1-4 a list of seven articles for recommended background reading.

6.2.1.2 Running CAP88-PC for a Simple Scenario

There is no substitute for familiarity with the 150-page User's Manual for running CAP88-PC. However, we briefly describe a code-use scenario of a particularly simple type, in which CAP88-PC is run by a nonexpert or infrequent user for a simple stack or area release problem in order to estimate the maximum fence-line dose.

In this example, we assume that the Compaq DeskPro 50m DOS computer with CAP88-PC installed on its hard disk is to be used. The instructions are the same for the IBM Personal System/2 Model 70 486, except for the need to "Exit Windows" at the start of the run on the Compaq computer.

Step-by-step instructions:

Switch on the computer, monitor, and printer. Use the mouse to pull down the File Menu and select the Exit Windows option. The prompt C:\> should appear on the screen. Type CD\CAP88PC, and press the Enter key. Then type CAP88PC and press Enter. A page of information appears on the screen; press Enter to move on.

The Main Menu page appears. Use the up- and down-Arrow keys to highlight different choices in the list. For someone not familiar with the code, the simplest path is to select the option "Modify Dataset" and press Enter. A page of names of previous model runs appears; by pressing the Page Down key, other pages of stored model runs can be viewed. Use the Arrow keys to select one of the names (especially one involving the same Building identifier and emission year as the run at hand, if possible) and press Enter.

The "Facility Information" page appears. Using the Arrow keys to position the cursor, type over any input data you want to change. Press the Page Down key to go to the next input data page.

The "Run Information" page appears. One can select a "Population" or "Individual" type run by striking the space bar; assume the quantity of interest is a dose to an individual member of the public, in which case Individual is selected. Similarly, use the spacebar to select a stack or area type of source. Then use the Arrow keys to move the cursor to the locations where source information is specified, e.g., on stack height, stack diameter, plume rise type, and speed or buoyancy of plume rise, etc. (If necessary, consult the Screen Interface features described in Chapter 3 of the manual for more details.)

Press the Page Down key to go to the next page, which is the Agricultural Data page. Quite likely all the choices are suitable for the problem at hand, so press Enter to go to the next page, which is the Radionuclide List. Use the Arrow keys to scan the radionuclides already in the list. Any you do not want can be deleted by hitting the Delete key when that radionuclide is highlighted. Press the spacebar to access new choices, which appear in a box on the screen. Scan this database by holding down the up- or down-Arrow keys; stop on each radionuclide desired, and press Enter to add it to your list.

Press Page Down to go to the next page, which is the Release Data page. For each of the radionuclides you have selected, input an annual release rate in Ci/y.

Press Page Down to go to the Size & Class Data page. Accept what is there unless you know a good reason to put in something different. Striking the Page Down key once more returns you to the Facility Information page, where you started.

Press the ESC (Escape) key to exit the preparation stage. Select the "Save Changes" option by pressing Enter when it is highlighted. Then press the down-Arrow to choose the option to "Save Under a New Dataset Name." Type in a new name and press Enter.

The Main Menu page appears. Use the Arrow key to select the Execute option. Press Enter. The page of model run names appears; find the name of yours by scanning with the Arrow keys (you may have to hit the Page Down key a couple of times to find it). Press Enter once it is highlighted. Wait for the completion of execution, usually a matter of a few seconds on the very fast Compaq DeskPro 50m computer.

Press the ESC key to return to the Main Menu and select the Print Results option. Again you are presented with the page of names of stored model runs. Select yours and press Enter. A page of output choices appears. In succession, hit the Spacebar, down-Arrow, Spacebar, down-Arrow, down-Arrow, Spacebar, and G keys. In this sequence, the Synopsis Report, General Data, and Dose and Risk Equivalent Summaries are printed out, while the Weather Data, Dose and Risk Conversion Factors, Concentration Tables, and Chi/Q Tables are not printed out.

6.2.1.3. Caveat on reporting of maximum dose rate

The Synopsis Report prominently displays the EDE in (mrem/y) experienced by the "maximally exposed individual," and the location of that individual (considering only the distances specified in the model run and the sixteen sector directions to the north, north-northwest, northwest, etc., centered at the source). Generally this maximum EDE displayed in the Synopsis Report, and other CAP88-PC output reports as well, refers to a point *inside* the LLNL site boundary, rather than a point at or beyond the boundary where a member of the public could reside, because the code returns dose-rate values for all directions for each distance. In the case of Building 251, for example, the closest fenceline distance is 658 m to the west, but since the prevailing winds at the Livermore site blow towards the east and northeast, the highest dose at 658 m is found to occur due east of B251, well inside the site boundary. This dose is not one we report, since it does not apply to any member of the public. The actual maximum fenceline dose in this case is found to occur at a distance of 734 m to the south-southwest, and is almost equaled by the fenceline value at 1,224 m to the east.

Evaluating the maximum fenceline dose and dose to the SW-MEI: The actual maximum fenceline dose can be found in the Dose and Risk Conversion Factors output, in a table labeled "Individual Effective Dose Equivalent Rate (mrem/y) (All Radionuclides and Pathways)," provided that the user inputs an appropriate set of distances. The rows in this table represent the 16 compass directions and the columns the radial distances from source to receptor selected by the user. When the distance to the fenceline in all 16 directions is inputted, the fenceline dose in each direction appears in the table, and the largest of these is the dose to the maximally exposed individual member of the public (assuming the doses monotonically fall with increasing distance beyond the fenceline, as is nearly always the case). Similarly, if the distance from the release point to the location of the designated site-wide maximally exposed individual is included in the set of user-selected distances, then the table entry at the appropriate distance in the appropriate direction is the dose rate for the SW-MEI. It is our practice to manually circle or otherwise mark the entries in this table that correspond to fenceline dose rates and the dose received by the SW-MEI. Maps showing the fenceline distances from each facility at the Livermore site and Site 300 are on file in the EMS DRC.

6.2.1.4. Assessment Assumptions Regarding Tritium

Tritium H-3 emissions account for the major dose from LLNL operations. Tritium exists in two major chemical forms: tritium oxide or vapor (HTO) and elemental molecular tritium (HT). The HTO that enters the body is distributed throughout the entire body and eliminated at the same rate as body water. Only a very small fraction of HT is retained. The effective dose equivalent from exposure to elemental tritium in air is more than four orders of magnitude lower than an equal exposure from tritium oxide (Reference 8). Thus, HTO concentration is the major contributor to the tritium dose, which is reflected in the input to the model. CAP88-PC assumes HTO is meant whenever an inventory of H-3 is input to the code.

6.2.1.5. Caveats on Source-Term Specification in CAP88-PC

The specification of radionuclide releases in CAP88-PC has two steps, first to select the particular radionuclides and then to specify their rates of release in curies-per-year (Ci/y).

(1) Caveat on radioactive decay chains and secular equilibrium: CAP88-PC uses only the radionuclides selected by the user, at most augmented (in the case of the six radioactive decay chains mentioned above) by those decay products that "grow in" on time scales comparable to the source-to-receptor transit time of the plume. In

particular, the code does not add other radionuclides that would be expected to be present in long-term secular equilibrium due to radioactive decay chains operating over many years. A prime example is U-238, which decays very slowly to U-234. A mass-based inventory containing U-238 might neglect to explicitly mention the tiny amount (smaller than the U-238 mass by a factor of about 20,000) of U-234 also present, but the specific activity of U-234 is approximately 20,000-times greater, so the two isotopes produce equal release rates expressed in Ci/y. To get the correct release rate, the user generally should input equal curie-per-year values for U-238 and U-234, unless there is specific information that the quantity of U-234 is negligible.

(2) Caveat on dose conversion rates: In the present version of CAP88-PC, a few of the 265 radionuclides in its database have zeroes for their dose conversion factors, e.g., Eu-155. These radionuclides are thus effectively not in the database until this deficiency is removed in a subsequent version of the code. The analyst should check the code output to make sure all radionuclides included in a model run have non-zero dose conversion factors.

6.2.3. ENVIRONMENTAL MEASUREMENTS METHOD

The potential doses from ingestion of locally produced foodstuff and surface water are estimated by environmental sampling (References 17-27) and computer modeling techniques, and are reported annually in LLNL's Site Annual Environmental Report. The dose assessment concerns each of the significant agricultural products of the Livermore Valley. These include milk, wine, honey, and general vegetation, and in particular the forage-cow-milk pathway for tritium in vegetation.

Doses are also calculated for drinking water at each of the eight Livermore Valley and thirteen Site 300 water sampling locations. None of these locations is a primary source of drinking water. However, to provide an upper-bound estimate of dose, it is assumed that a hypothetical person at each location uses that water as a primary source for drinking, consuming two liters per day.

The dose estimations that follow are based on the methods and models presented in the Nuclear Regulatory Commission Regulatory Guide 1.109 (Reference 10). LLNL's first use of these relations is described by Lindeken, et al., in Reference 28 and Silver, et al., in Reference 29. Data on consumption-rates, etc., required for evaluation of parameters in the equations is provided in References 10 and 30.

Annual Dose from Potable Water

Based on the assumption that all water sampled is available as drinking water, the annual whole-body dose for tritium in mrem/y can be calculated using the following equation:

$$D_{\text{whole body}}(\text{mrem/y}) = C_w \times U_w \times D_w \quad (\text{F-1})$$

where

C_w = concentration of tritium in water (pCi/L)

U_w = water consumption rate (L/y) = 730 L/y for maximally exposed individual

D_w = dose factor (mrem/pCi)

= 6.3×10^{-8} mrem/pCi for tritium for the whole-body ingestion pathway for an adult

$D_{\text{whole body}}$ = effective dose equivalent (mrem/y) from ingestion of 730 L of potable water with tritium concentration C_w .

A relation of the form (F-1) is used in the following subsection to estimate the annual dose from tritium in milk (directly consumed), meat, and leafy vegetables. Similarly, the dose from ingestion of wine and honey is expressed in this form, with appropriate consumption-rate factors and measured concentrations. The milk consumption rate, for example, is estimated at 310 L/y in Appendix 1 of Reference 10. The consumption rate for honey is reported in the U.S.D.A. food consumption survey of 1977-78 (Reference 30) to be 0.51 kg/y per person, or about 0.36 L/y. In the absence of consumption data on locally produced wine, we employ the conservative (high dose) assumption that the intake rate for wine is the same as that for water. The resultant dose is expected to be several times too high for wine, but well below levels of health concern.

Annual Dose from Forage-Cow-Milk Pathway for Tritium in Vegetation

Based on the assumption that all feed for the cattle was pasture grass, the effective dose equivalent per $\mu\text{Ci/mL}$ of tritiated water (HTO) for the maximally exposed individual can be calculated using the following equation:

$$D_{\text{whole body(mrem/y)}} = D_{\text{veg}} + D_{\text{meat}} + D_{\text{milk}} \quad (\text{F-2})$$

where

D_{veg} = mrem/y dose from ingestion of vegetables

D_{meat} = mrem/y dose from ingestion of meat

D_{milk} = mrem/y dose from ingestion of milk

Vegetation:

$$D_{\text{veg(leafy)}} = U_{\text{veg}} \times C_{\text{veg}} \times D_{\text{HTO}} \quad (\text{F-2a})$$

where

U_{veg} = intake rate (kg/y): 64 kg/y for maximally exposed individual

C_{veg} = concentration (pCi/kg): $10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}} \times (C_{\text{veg}} [\mu\text{Ci/mL measured}])$

D_{HTO} = dose factor (mrem/pCi): 6.3×10^{-8} mrem/pCi for H-3 for the adult whole-body ingestion pathway

Thus,

$$D_{\text{veg(mrem/y)}} = (0.40 \times 10^4) \times (C_{\text{veg}} [\mu\text{Ci/mL measured}])$$

Meat:

$$D_{\text{meat(mrem/y)}} = U_{\text{meat}} \times C_{\text{meat}} \times D_{\text{HTO}} \quad (\text{F-2b})$$

where

U_{meat} = intake rate (kg/y): 110 kg/y for maximally exposed individual

D_{HTO} = dose factor (mrem/pCi): 6.3×10^{-8} mrem/pCi for H-3 for the adult whole-body ingestion pathway

$C_{\text{meat}} = (F_f) \times (Q_f) \times (C_{\text{veg}}) \times (e^{-\lambda_f t_f})$

D_{HTO} = dose factor (mrem/pCi): 6.3×10^{-8} mrem/pCi for H-3 for the adult whole-body ingestion pathway

F_f = fraction of daily intake of nuclide per kg of animal/fish (pCi/kg in meat per pCi/d ingested by the animal) (d/kg): 1.2×10^{-2} d/kg

Q_f = amount of feed consumed (kg/d): 50 kg/d

C_{veg} = concentration (pCi/kg): $10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}} \times (C_{veg} [\mu\text{Ci/mL measured}])$

λ_i = radiological decay constant (d⁻¹): 1.5×10^{-4} d⁻¹

t_s = time between slaughter to consumption (d): 20 d

$$C_{meat} = (1.2 \times 10^{-2} \text{ d/kg}) \times (50 \text{ kg/d}) \times (C_{veg} [\mu\text{Ci/mL}]) \times (10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}}) \times (\exp[-1.5 \times 10^{-4} \times 20])$$

$$= 0.6 \times 10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}} \times (C_{veg} [\mu\text{Ci/mL measured}])$$

Thus,

$$D_{meat}(\text{mrem/y}) = (110 \text{ kg/y}) \times (0.6 \times 10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}} \times C_{veg} [\mu\text{Ci/mL measured}]) \times (6.3 \times 10^{-8} \text{ mrem/pCi})$$

$$= (0.41 \times 10^4) \times (C_{veg} [\mu\text{Ci/mL measured}])$$

Milk:

$$D_{milk}(\text{mrem/y}) = U_{milk} \times C_{milk} \times D_{HTO} \quad (\text{E-2c})$$

where

U_{milk} = intake rate (L/y): 310 L/y for maximally exposed individual

D_{HTO} = dose factor (mrem/pCi): 6.3×10^{-8} mrem/pCi for H-3 for the adult whole-body ingestion pathway

$C_{milk} = (F_m) \times (Q_f) \times (C_{veg}) \times (e^{-\lambda_i t_f})$

F_m = fraction of daily intake of nuclide per liter of milk (pCi/L in milk per pCi/d ingested by the animal) (d/L): 1.0×10^{-2} d/L

Q_f = amount of feed consumed by the animal (kg/d): 50 kg/d

C_{veg} = concentration (pCi/kg): $10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}} \times (C_{veg} [\mu\text{Ci/mL measured}])$

λ_i = radiological decay constant (d⁻¹): 1.5×10^{-4} d⁻¹

t_f = time from milking to milk consumption (d): 2 d

$$C_{milk} = (1.0 \times 10^{-2} \text{ d/L}) \times (50 \text{ kg/d}) \times (C_{veg} [\mu\text{Ci/mL}]) \times (10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}}) \times (\exp[-1.5 \times 10^{-4} \times 2])$$

$$= (0.5 \times 10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}}) \times (C_{veg} [\mu\text{Ci/mL measured}])$$

Thus,

$$D_{milk}(\text{mrem/y}) = (310 \text{ L/y}) \times (0.5 \times 10^9 \frac{\text{pCi/kg}}{\mu\text{Ci/mL}} \times [C_{veg} [\mu\text{Ci/mL measured}]] \times (6.3 \times 10^{-8} \text{ mrem/pCi}) = (0.97 \times 10^4) \times (C_{veg} [\mu\text{Ci/mL measured}])$$

Whole Body:

$$D_{\text{whole body (mrem/y)}} = [0.40 \times 10^4] \times [C_{\text{veg}} (\mu\text{Ci/mL measured})] \\ + ([0.41 \times 10^4] \times [C_{\text{veg}} (\mu\text{Ci/mL measured})]) \\ + ([0.97 \times 10^4] \times [C_{\text{veg}} (\mu\text{Ci/mL measured})]).$$

Thus,

$$D_{\text{whole body (mrem/y)}} = ([1.78 \times 10^4] \times [C_{\text{veg}} (\mu\text{Ci/mL measured})]).$$

Inhalation/Immersion Dose

Doses due to inhalation of and immersion in radionuclide-contaminated air can be estimated in an analogous way to the preceding treatment of ingestion doses. The starting point is to evaluate the radionuclide concentration in air, $\chi(\text{Ci/m}^3)$ at the location of interest. χ can be directly measured, or calculated using a Gaussian dispersion air transport model. In the latter approach, the calculated quantity is the atmospheric dispersion parameter, χ/Q , which is the product of the radionuclide concentration in air $\chi(\text{Ci/m}^3)$ at all locations of interest and the source release rate $Q(\text{Ci/s})$.

For inhalation dose, once χ or the product $(\chi/Q) \times (Q)$ is evaluated, it is multiplied by the inhalation rate of a human to obtain the number of curies of radioactive material inhaled by the human body. Dose and dose-rate conversion factors provided by the DOE (Reference 31), which are consistent with those specified in ICRP 30 (Reference 11), are used to relate the intake of radioactive material into the body to dose commitment. These dose factors provide estimates of 50-year dose from a chronic one-year intake of radioactivity.

The inhalation dose is expressible as

$$D_{\text{whole body (mrem/y)}} = U_{\text{inhalation}} \times C_{\text{radionuclide}} \times D_{\text{radionuclide}} \quad (\text{F-3})$$

where

$$U_{\text{inhalation}} = \text{air intake rate (L/y): } 8,400 \text{ m}^3/\text{y for an adult}$$

$$D_{\text{radionuclide}} = \text{dose conversion factor (mrem/pCi) for the radionuclide of interest. For HTO this factor is } 1.5 \times 6.4 \times 10^{-8} \text{ mrem/pCi} = 9.6 \times 10^{-8} \text{ mrem/pCi for the adult whole-body ingestion pathway, where the factor 1.5 accounts for absorption through the skin; for other radionuclides, see Table 2.1 in Reference 32.}$$

$$C_{\text{radionuclide}} = (F) \times (\chi/Q) \times (Q) = \text{radionuclide concentration at the receptor (pCi/m}^3\text{)}$$

$$F = \frac{1 \times 10^{12} \text{ pCi/Ci}}{3.15 \times 10^7 \text{ s/y}} = 3.17 \times 10^4 \text{ (pCi/Ci)/(s/y)}$$

$$Q = \text{radionuclide release rate (Ci/y)}$$

$$\chi/Q = \text{diffusion parameter (s/m}^3\text{); calculated}$$

Thus,

$$D_{\text{whole body (mrem/y)}} = (3.17 \times 10^4 \text{ [pCi/Ci]/[s/y]}) \times (\chi/Q)(\text{s/m}^3) \times (Q(\text{Ci/y})) \\ \times (8.4 \times 10^3 \text{ m}^3/\text{y}) \times D_{\text{radionuclide}}(\text{mrem/pCi}).$$

The immersion dose is similarly expressible as

$$D_{\text{whole body}}(\text{mrem/y}) = C_{\text{radionuclide}} \times (DRF) \quad (\text{F-4})$$

where

$$C_{\text{radionuclide}} = (F) \times (\chi/Q) \times (Q) = \text{radionuclide concentration at the receptor (pCi/m}^3\text{)}$$

$$F = \frac{1 \times 10^{12} \text{ pCi/Ci}}{3.15 \times 10^7 \text{ s/y}} = 3.17 \times 10^4 (\text{pCi/Ci})/(\text{s/y})$$

$$Q = \text{radionuclide release rate (Ci/y)}$$

$$\chi/Q = \text{diffusion parameter (s/m}^3\text{); calculated}$$

and

$$DRF = \text{the external dose-equivalent rate factor per unit radionuclide concentration (mrem/y)/(pCi/m}^3\text{). For elemental H-3 this factor is } 3.9 \times 10^{-8} (\text{mrem/y})/(\text{pCi/m}^3\text{); for other radionuclides see Table 2.3 in Reference 32.}$$

6.3. DOSE TO THE SITE-WIDE MAXIMALLY EXPOSED INDIVIDUAL

The dose to the site-wide maximally exposed individual member of the public, or SW-MEI, as defined in Section 4, represents the maximum credible dose to a hypothetical member of the general public from all release points at a given site. It includes contributions from all potential exposure pathways and is derived using the most conservative but realistic exposure data and assumptions. This hypothetical person is assumed to reside at the point of highest ground-level radionuclide air concentration continuously for 24 hours per day, 365 days per year. During this occupancy period, a portion of this person's diet consists of locally produced foodstuffs and drinking water containing the highest measured radionuclide concentration. Thus, this is not a dose actually received by any individual and should be viewed as a health conservative estimate (i.e., overestimate) of the highest possible dose to any member of the public.

The EPA's CAP88-PC code is used to evaluate this dose, carrying out separate calculations for the Livermore site and Site 300. The procedure is as described in detail in Section 6.2 above (especially Subsection 6.2.1.3): The 20 user-selected distances at which the individual dose rate is calculated must include the distance from the facility to the location of the SW-MEI. In the CAP88-PC runs for each release point (or set of release points at a given facility), the value in the direction of the SW-MEI, at the appropriate distance, is circled or otherwise noted. Adding together these values from runs for each release point gives the total dose-rate for the SW-MEI.

The dose-rate due to each release point i is the a sum of contributions from each of the exposure pathways treated by CAP88-PC, as described in Section 6.2, so the dose-rate to the SW-MEI can be expressed as

$$\text{Dose(SW-MEI)} = \sum_i^N (D_i(\text{External}) + D_i(\text{Inhalation}) + D_i(\text{Ingestion})),$$

where N is the total number of release points at the site; for the Livermore site N is about 200.

6.4. ANNUAL POPULATION DOSE

The population dose, expressed in person-rem or person-sievert, is the collective EDE for the population residing within 80 km of a site. Data for the populations within this range of the Livermore site and Site 300 have been obtained from the Alameda County, CA, Planning Department and placed on file in the EMS Documentation Retention Center. Population files for use with CAP88-PC have been prepared and installed in accordance with Appendix F in Reference 9; see, e.g., the files named LIV90.POP and S300R90.POP in the directory of the Compaq DeskPro 50m computer.

As constructed, the population grid has circular symmetry centered on the site, with sixteen "spokes" spaced 22.5 degrees apart, marking the sector edges, and a set of concentric circles with radii corresponding to the distances from site-center selected by the analyst. A spacing that adequately represents the population clusters is coarse-grained compared to the distances typically used in code runs to determine individual, as opposed to collective, doses. To calculate the population dose, the products of dose rate and population for each sector segment (*i*) within 80 km of LLNL are summed over all directions (*n*), where a sector segment is bounded on its sides by the radial lines separating adjacent sectors, and above and below by arcs with radii of adjacent concentric circles. Population dose, or collective EDE, values are determined in person-rem by CAP88-PC.

The source used in the CAP88-PC run to evaluate the population dose is a combination of all principal radionuclides released during the year with their corresponding cumulative curie-per-year values. This combined-sources treatment is necessary, since CAP88-PC handles only six sources in a single run. If necessary, several population dose calculations can be made, with each using a subset of the cumulative releases, and the total population dose obtained by summing the person-rem values from all runs.

The CAP88-PC result for the collective EDE takes into account, for each radionuclide, all four of the exposure pathways discussed above in Section 6.2: air inhalation/immersion, ingestion, and ground irradiation. For the inhalation pathway, which is generally most important for LLNL emissions, this calculation takes the explicit form

$$\text{Dose (person-rem/y)} = (F) \times \sum_r^M \left\{ \sum_i^N ([\chi/Q]_i P_i)_r \times Q_r \times U \times D_r \right\} \quad (F-5)$$

where

$$F = \frac{1 \times 10^{12} \text{ pCi/Ci}}{3.15 \times 10^7 \text{ s/y}} = 3.17 \times 10^4 (\text{pCi/Ci})/(\text{s/y})$$

$\sum_i^N ([\chi/Q]_i P_i)_r$ = Summation, for each of *M* radionuclides designated by index *r*, of the products of $[\chi/Q]_i$ for sector segment *i* and the population (*P_i*) in that sector segment, for all *N* sector segments, in person-s/m³

Q_r = release rate of radionuclide *r*, Ci/y

U = inhalation rate of average adult individual: 8400 m³/y.

D_r = dose factor for radionuclide *r*, rem/pCi.

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7. DOCUMENTATION/QA RECORDS

Measurements and calculations on radionuclide emissions for each year are presented in the LLNL Site Annual Environmental Report, in the NESHAPs Annual Report, and (over the past two years) in NESHAPs Quarterly Reports. Original copies of the model runs and other calculations and supporting data are archived in the EMS Documentation Retention Center, according to the requirements of Reference 33.

8. ACCEPTANCE CRITERIA

For the results of the radiological dose assessment to be considered acceptable, approved models and correct model input parameters must be used. The CAP88-PC model used by LLNL to calculate off-site radiological dose impact to the public is a DOE and EPA developed and approved model that is widely used in government and industry. Acceptance criteria for the concentration values of various radionuclides in the environmental media are governed by the EMS QA/QC for sample collection and analysis. The QA/QC of this environmental sampling data and analysis is discussed in detail in EMS procedures (References 13, 16 through 27, and 33). When the EMS Section Leader and the responsible Environmental Analysts have verified that the data resulting from the monitoring program are correct, and the requirements of this procedure have been fulfilled, the radiological dose assessment will be accepted.

9. ATTACHMENT

Illustrative output of a CAP88-PC code run, describing cumulative emission of HTO from two stacks of Building 331 for 1992.

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C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

GENERAL DATA

Non-Radon Individual Assessment

Apr 29, 1993 12:49 am

Facility: LLNL

Address: 7000 East Ave.

City: Livermore

State: CA

Zip: 94550

Source Category: B331 (tritium bldg.) Stacks 1&2, 1992

Source Type: Stack

Emission Year: 1992

Comments: Report prepared by Bob Harrach, EKA0, X22348, L621
Using 1992 windfile, precipitation, & inventory.

Dataset Name: B331 Stks1&2 92

Dataset Date: Apr 29, 1993 12:49 am

Wind File: \\NDFILES\LLNL92.WND

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SYNOPSIS

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RADIONUCLIDE EMISSIONS DURING THE YEAR 1992

Nuclide	Class	Size	Source	Source	TOTAL
			#1	#2	
			Ci/y	Ci/y	Ci/y
H-3	*	0.00	5.1E+01	4.9E+01	1.0E+02

Inventory data supplied by TAMM
Group Environmental Analyst

SITE INFORMATION

Temperature: 16 degrees C
Precipitation: 37 cm/y
Mixing Height: 750 m

Apr 29, 1993 12:49 am

SYNOPSIS

Page 3

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	30.00	30.00
Diameter (m):	1.22	1.22
Plume Rise		
Momentum (m/s):	7.50E+00	1.05E+01
(Exit Velocity)		

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	1.000	1.000	1.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

288	407	441	572	899	948	970	986	1063	1270
1336	1384	1445							

Apr 29, 1993 12:49 am

SUMMARY

Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	9.15E-02
BREAST	9.15E-02
R MAR	9.11E-02
LUNGS	9.21E-02
THYROID	9.12E-02
ENDOST	7.23E-02
RMNDR	1.16E-01
EFFEC	9.82E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	8.49E-02
INHALATION	1.33E-02
AIR IMMERSION	0.00E+00
GROUND SURFACE	0.00E+00
INTERNAL	9.82E-02
EXTERNAL	0.00E+00
TOTAL	9.82E-02

Apr 29, 1993 12:49 am

SUMMARY
Page 5

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE ($\mu\text{rem/y}$)
(All Radionuclides and Pathways)

Distance (m)

Direction 288 407 441 572 899 948 970

N	8.8E-03	1.2E-02	1.4E-02	1.8E-02	2.2E-02	2.2E-02	2.1E-02
NNW	5.4E-03	6.5E-03	6.7E-03	7.4E-03	7.7E-03	7.7E-03	7.7E-03
NW	6.5E-03	4.6E-03	4.4E-03	4.3E-03	5.9E-03	6.1E-03	6.1E-03
NNW	6.5E-03	4.5E-03	4.3E-03	4.5E-03	6.6E-03	6.8E-03	<u>6.9E-03</u>
W	9.9E-03	6.6E-03	6.0E-03	4.8E-03	<u>5.6E-03</u>	5.8E-03	5.8E-03
WSW	1.4E-02	9.3E-03	8.6E-03	7.2E-03	7.3E-03	7.3E-03	7.4E-03
SW	3.2E-02	2.8E-02	2.7E-02	<u>2.4E-02</u>	1.8E-02	1.7E-02	1.7E-02
SSW	<u>3.0E-02</u>	2.7E-02	<u>2.6E-02</u>	2.3E-02	1.6E-02	1.5E-02	1.5E-02
S	2.8E-02	<u>2.2E-02</u>	2.0E-02	1.5E-02	8.6E-03	8.0E-03	7.8E-03
SSE	2.0E-02	1.4E-02	<u>1.2E-02</u>	8.6E-03	4.9E-03	4.6E-03	4.4E-03
SE	1.9E-02	1.3E-02	1.1E-02	<u>7.8E-03</u>	4.1E-03	3.8E-03	3.6E-03
ESE	2.5E-02	1.7E-02	1.6E-02	1.2E-02	7.0E-03	6.5E-03	6.3E-03
E	7.4E-02	6.4E-02	6.1E-02	5.0E-02	3.1E-02	2.9E-02	2.8E-02
ENE	9.8E-02	8.1E-02	7.7E-02	6.2E-02	3.9E-02	<u>3.7E-02</u>	3.6E-02
NE	5.3E-02	6.3E-02	6.5E-02	6.5E-02	5.2E-02	5.0E-02	4.9E-02
NNE	1.9E-02	3.2E-02	3.5E-02	4.2E-02	4.4E-02	4.3E-02	4.2E-02

Underlined entries are
fence line dose rates

EDE @
Swimming
Pool

EDE@SW-MEI
(UNCLE Credit
Union, B6575)

Distance (m)

Direction 986 1063 1270 1336 1384 1445

N	2.1E-02	2.1E-02	1.8E-02	<u>1.8E-02</u>	1.7E-02	1.7E-02
NNW	7.6E-03	7.4E-03	6.8E-03	<u>6.6E-03</u>	6.4E-03	<u>6.3E-03</u>
NW	6.2E-03	6.2E-03	<u>6.1E-03</u>	6.1E-03	6.0E-03	5.9E-03
NNW	7.0E-03	7.1E-03	7.0E-03	6.9E-03	6.8E-03	6.8E-03
W	5.9E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	5.9E-03
WSW	<u>7.4E-03</u>	7.2E-03	6.8E-03	6.7E-03	6.6E-03	6.5E-03
SW	1.6E-02	1.5E-02	1.3E-02	1.2E-02	1.2E-02	1.1E-02
SSW	1.5E-02	1.4E-02	1.1E-02	1.1E-02	1.0E-02	9.6E-03
S	7.6E-03	6.9E-03	5.4E-03	5.0E-03	4.8E-03	4.5E-03
SSE	4.4E-03	4.0E-03	3.1E-03	3.0E-03	2.8E-03	2.7E-03
SE	3.6E-03	3.2E-03	2.5E-03	2.3E-03	2.2E-03	2.1E-03
ESE	6.2E-03	<u>5.6E-03</u>	4.5E-03	4.2E-03	4.0E-03	3.7E-03
E	<u>2.7E-02</u>	2.5E-02	1.9E-02	1.8E-02	1.7E-02	1.6E-02
ENE	3.5E-02	<u>3.2E-02</u>	2.6E-02	2.4E-02	<u>2.3E-02</u>	2.1E-02
NE	4.8E-02	4.5E-02	3.7E-02	3.5E-02	<u>3.4E-02</u>	3.2E-02
NNE	4.2E-02	4.0E-02	3.4E-02	3.3E-02	3.2E-02	<u>3.0E-02</u>

Max EDE@LINL
boundary fence line

RADIATION MONITORING LOCATIONS

EMP-R-L

Prepared by:

Barbara C. Fields 12/8/93
Barbara C. Fields date

Environmental Analyst, TAMM

Reviewed by:

Paris Althouse 12-7-93
Paris Althouse date
Environmental Technologist, TSG

David Graves 12-6-93
David Graves date
Environmental Technologist, TSG

Duke Ramsey 12-6-93
Duke Ramsey date
Environmental Technologist, TSG

Rhonda S. Welsh 12-6-93
Rhonda Welsh date
Environmental Technologist, TSG

Approved by:

Rebecca Failor 12/8/93
Rebecca Failor date
Section Leader, EMS

Kris Surano 12/8/93
Kris Surano date
Group Leader, TAMM

Cindy Garcia 12/13/93
Cindy Garcia date
Quality Assurance Coordinator, EMS

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MONITORING SECTION
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1. PURPOSE

This procedure describes gamma thermoluminescent dosimeter (TLDs) and neutron rem-meter locations at the LLNL site perimeter, Livermore Valley, and Site 300. Some TLD location directions are not provided because they contain proprietary information. The Analyst will provide proprietary information to the TSG technologists on a need-to-know basis.

2. APPLICABILITY/DISCUSSION

EMS conducts direct radiation monitors at 16 Livermore site-perimeter locations and 49 Livermore Valley locations, as well as 20 on and off-site locations at Site 300.

Each EMS sampling location is identified with an alphanumeric designator as described in Reference 1. Sample designators with an "L" prefix (such as L-01-TD) represent LLNL perimeter TLDs; sample designators with a "V" prefix represent the Livermore Valley TLDs; sample designators with a "3" prefix represent Site 300 TLDs; and sample designators with a "P" prefix represent LLNL site perimeter neutron rem meter locations. Each sample is taken according to Reference 2.

Some samples are taken on private property and some sampling locations involve the use of private individual names. It is the policy of LLNL and the Environmental Protection Department (EPD) that names and addresses of private parties and directions to such sampling locations remain in strict confidence. Such information will be provided on a need-to know-basis.

EMS participates in the State of California Agreement in Principle Sampling Program (AIP) conducted by the California Department of Health Services (DHS). The AIP allows the DHS to co-monitor at several LLNL site perimeter, Livermore Valley, and Site 300 locations. DHS clearly identifies their TLDs, and these may not be disturbed by TSG technologists.

Additionally, EMS measures neutron radiation dose levels at eight LLNL perimeter locations. LLNL selected the neutron-monitoring locations to measure exposures from LLNL neutron operations.

3. REFERENCES

1. EMP-QA-SL, Sample Location Designators
2. EMP-R-S, External Radiation Monitoring
3. EMP-QA-DC, Document Retention
4. EMP-QA-NCR, Nonconformance and Discrepancy Reporting

4. DEFINITIONS

COC, Chain of Custody Forms

EMS, Environmental Monitoring Section

FTF, Field Tracking Forms

TAMM, Terrestrial Atmospheric Monitoring and Modeling Group

Thermoluminescent Dosimeter (TLD): A device used to measure external penetrating gamma radiation.

TSG, Technical Support Group

Neutron dosimeter(rem-meter) : A device used to measure neutron radiation.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS Section Leader has final approval authority for selection of all sampling locations.

5.2. TAMM GROUP LEADER

The TAMM Group Leader ensures that sampling locations meet the sampling design criteria and applicable procedures.

5.3. EMS ANALYST

The Environmental Analyst responsible for this monitoring network will determine the monitoring locations. The Analyst must periodically review the sampling network locations to ensure they are technically suitable in the context and goals of the EMS goals and mission. The Analyst is responsible for assessing the need to sample newly discovered areas of known or suspected contamination. If a TLD is consistently lost at a particular location, the placement of a TLD at that location should be discontinued, and the Analyst must select a suitable site for monitoring. The responsible Analyst may discontinue any unsuitable locations and submit a revised procedure with suitable locations. Annually, the EMS Analyst must select randomly duplicate quality control TLD locations (see Attachment A) to conduct QC checks alongside routine TLD locations. The duplicate TLD location will vary by location quarterly. The EMS Analyst must ensure that the TSG technologist distributes the duplicate TLDs as described in Reference 2. The Analyst is responsible for evaluating the need for and reviewing or approving TLD and neutron location design changes. The Analyst must update the procedure, and communicate the changes to the TSG staff members as needed. The Analyst is responsible for providing proprietary information on the FTF to the technologist responsible for collecting the samples.

5.4. EMS QA COORDINATOR

The Quality Assurance Coordinator is responsible for keeping lists of all present and past sampling locations and their designators and archiving all revisions for this procedure as described in References 3 and 4.

5.5. TSG TECHNOLOGIST

The TSG technologists are responsible for collecting TLD and neutron dosimeters, using the method described in EMP-R-S. They must complete appropriate and current FTF and COC Forms, make notes regarding any discrepancy that may occur, complete an NCR report (as stated in Reference 4) and communicate that information to the responsible Analyst. Technologists are also responsible for providing the Analyst with recommendations regarding the sampling locations.

6. PROCEDURE

6.1 QUALITY CONTROL

Duplicate sampling locations are used as QC checks. The responsible Analyst will provide the TSG technologists with a list of duplicate sample locations annually. The Analyst generates a list of random numbers to select duplicate TLD sampling locations, which vary quarterly. A sample list of duplicate TLD locations is shown in Attachment A. The TSG technologists must ensure that all duplicate TLD sampling location numbers are written in the appropriate spaces on the Field Tracking Form (see Attachment B, C, and D). Three neutron rem meters are selected at random each quarter and exposed to a known quantity of radiation to serve as quality control checks. The quality control checks are performed in the laboratory. The Hazard Control technologist conducting the spark counting technique chooses the rem-meters at random for QC checks.

TLD locations may be found by following the directions provided below:

6.2 PERIMETER TLD LOCATIONS

L-13-TD	Along the LLNL site perimeter at the intersection of Avenue A and Mesquite Way on west fence (diagonally across from A-4 parking lot).
L-01-TD	On the LLNL west perimeter fence (which runs parallel to Ave. A) 20 yd. north of MW 458 (aligned with the west side of B-151, Nuclear Chemistry)
L-02-TD	On the first power pole north of Westgate Drive, leading to B-196.
L-03-TD	Continue north from L-02-TD on dirt road. TLD is on the fence west of the Butler Bldg. 5250.
L-04-TD	On dirt road that leads directly north to Bldg. 196, TLD is on the west side of the fence across from Bldg. 196 (behind the Eucalyptus tree).
L-05-TD	Continue east from L-04-TD on dirt road, the TLD is on north perimeter fence at right angle to B-195.
L-06-TD	Continue going east from L-05-TD on the dirt road, the TLD is on the north perimeter fence, next to grade just past power pole.
L-07-TD	On north perimeter fence (aligned with B-431 and parking lot C-10).
L-10-TD	At the intersection of Eleventh St. and Avenue T. Near Air Monitoring Location L-COW on caged fence.
L-11-TD	B-212 inside fence on East Avenue by bus stop (right above the neutron Rem-meter).

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- L-12-TD Directly East of L-11-TD right above neutron Rem-meter.
- L-14-TD 0.1 mi north on Vasco Road from East Ave on the east side of perimeter fence, near walking bridge and just past the bus stop.
- L-15-TD Heading north on Vasco Road on east side at second gate entrance, TLD is next to "NO TRESPASSING SIGN."
- L-16-TD Heading north on Vasco Road on gate (near Oakland Fence Company sign) next to the light pole. TLD on gate used to enter L-WPDC (air sampling location).
- L-47-TD Return to Greenville. Heading south on Greenville Road. TLD is on east perimeter fence just south of the East gate entrance. TLD is on the fence closest to L-VIS sample location near "Air Monitoring Sign."
- L-50-TD South on Greenville, Credit Union/Visitor Center entrance on south side of the fence.
- L-52-TD TLD is on the east perimeter fence on Greenville across from TLD L-51-TD.
- L-56-TD At the intersection of Greenville Rd and East Avenue at the corner perimeter fence SE corner.

6.3 VALLEY TLD LOCATIONS

- V-17-TD Heading north on Vasco Road, turn left on Brisa, take immediate left continue south to Railroad. TLD is on metal post near the MCI sign.
- V-18-TD Heading north on Vasco Road at second Railroad crossing north of Brisa Rd. TLD is on the east side of the road on a bar wrapped around RR warning light.
- V-19-TD At the intersection of Vasco Road and Preston Road/S. Front on the north side on the cyclone fence.
- V-20-TD Turn north onto South Front Road—on the fence on the north side of the road directly across the street from the Livermore Disposal driveway.
- V-21-TD On South Front Road on the fence across from the trailer park. On the north side of road in fence area thick with Oleander bushes.
- V-22-TD On South Front Road, on the north side of road on fence across street from Bell underground cable warning sign and two manholes.

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- V-23-TD On South Front Road north side of road on the west side of fence by the Bell warning sign and the 580 Freeway off ramp.
- V-24-TD Follow South Front road toward Greenville Road and turn north. TLD is on the fence just south of the highway overpass on the east side of Greenville Rd.
- V-27-TD Turn around on Greenville road heading south. Just past railroad tracks and the divider in the road. TLD is on the east side of the street at triangle support on barbed wire fence across from the telephone pole.
- V-28-TD Heading south on Greenville Road near 35 mph sign across from block building, on the right side of the road.
- V-29-TD Heading south on Greenville, south of railroad overpass on the east side of the road on the fence.
- V-30-TD Heading south on Greenville on the left side of the road on the fence in front of the house (near the Pomegranate tree).
- V-31-TD Left from Greenville on Patterson Pass Road. East 0.3 miles. TLD is on the south side on fence before the guardrail.
- V-32-TD Heading east on Patterson Pass Road, on the south side of the road across from Zone 7 water plant entrance.
- V-33-TD At the intersection of Patterson Pass Road and Flynn Road on south side of the road on the fence.
- V-34-TD Heading east on Patterson Pass on north side of the road just past curve by the big almond tree (room to turn around here).
- V-35-TD Heading west on Patterson Pass Road. Turn right at Flynn Road on right side by gate at 9290 Flynn Road. In turnout, on fence in front of power pole.
- V-36-TD Continue up Flynn Road on right side. Due east of farm, about 300 yards. Just past road marker 18.3.
- V-37-TD Continue on Flynn top of the hill south side of the road due east of old water tank.
- V-38-TD Continue up Flynn to summit. TLD is on the south side of fence by telephone pole.
- V-70-TD On Flynn Road at the main entrance to US Wind Power's cyclone fence.

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- V-71-TD Continue up Flynn, just short of freeway, and make left on "Not a through street." At top of hill, dead end. TLD is on vertical post on the fence gate.
- V-72-TD Continue on Flynn, over freeway, take Carroll Road downhill. Left side of road nearest point to freeway.
- V-73-TD Heading west on Altamont Pass Road to Goecken Road go up right side about 200 yards. TLD is on 8200 Altamont sign.
- V-41-TD TLD at junction of Patterson Pass Road and Greenville on the south east side of the fence.
- L-42-TD NE corner of LLNL at Greenville and Patterson Pass on Laboratory perimeter fence (same location as L-NEP for soil and air sampling).
- V-43-TD On east side of Greenville across from the last baseball field closest to LLNL Davis Campus "no parking sign."
- V-44-TD South on Greenville turn east on Lupin Way—500 ft. up on south side of the road. On the fence entrance nearest the pump equipment.
- V-45-TD Continue east on Lupin on the north side, the TLD is on the fence just south of the entrance to 8626 Lupin Way.
- V-46-TD Continue up Lupin at canal crossing on the north side of the fence.
- V-51-TD Continue south to 2456 Greenville Rd., TLD is on barbed-wire fence just south of the white wooden gate entrance.
- V-55-TD At the junction of Greenville and East Avenue, on north side of the fence corner. TLD is on the corner of the white wooden fence.
- V-57-TD South on Greenville from East Avenue. TLD is located by aqueduct gate on right side of the fence. (Same as L-AQUE location).
- V-58-TD South on Greenville near wooden gate on the west side.
- V-59-TD At the intersection of Tesla Road and Greenville on Tesla south west side. TLD is attached to a telephone support wire.
- V-60-TD West on Tesla on canal fence on the northwest side of the fence.
- V-61-TD West on Tesla across from concrete abutment. TLD is on the south side of the road on a barbed wire fence.

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- V-62-TD At the intersection at Vasco and Tesla on north side of Tesla on the corner of the fence.
- V-63-TD Turn north on Vasco on east side at 2700 Vasco. TLD is next to and just north of entrance gate.
- V-66-TD North on Vasco at 2480 Vasco north of house—TLD is on the fence.
- V-67-TD North on Vasco just south of the intersection of Vasco and East Avenue. TLD is on the cyclone fence entrance gate by fence marker #563.
- V-68-TD Turn east on East Avenue on right opposite Building 111.
- V-69-TD Heading east on East Avenue opposite to and just east of the main gate on Sandia fence near gate #503.
- V-74-TD This location involves proprietary information. Samplers requiring directions to this location should contact the Environmental Analyst
- V-75-TD Behind the East Avenue Fire Station on air sampler handle. (Same as L-FIRE air sampling location).
- V-76-TD Northern most end of Railroad Ave., downtown Livermore behind Kenny's Shoes. TLD is on the fence just west of the locked entrance to the abandoned Livermore Corp. yard by air sampler (Same as L-LCCY air sampling location).
- V-77-TD Take First Street to Trevarno Road, Right to end of Trevarno before RR crossing on right side of chain link fence east of the garage.

6.4 SITE 300 TLD LOCATIONS.

- 3-78-TD Site 300 GSA area; on the north side of Site 300 entrance drive attached to air monitor (same as air sampling location 3-GOLF).
- 3-81-TD Site 300 entrance drive Route 1 to 834A. TLD is behind B-834A on first security fence (not perimeter fence), north of 834A gate.
- 3-82-TD Site 300 entrance Route 3 to Linac Rd. East on Linac Rd. to B812 Drive. North to Tank 5. Follow Ridge fire trail to the east perimeter fence. South along the fence to sign "144". TLD is next to old wooden gate.
- 3-83-TD From location 3-82-TD north along east perimeter on boundary fence. TLD is on top of second hill before reaching NE corner of the Site, by the "No Trespass" sign.

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- 3-84-TD From location 3-83-TD follow east fence line to north perimeter fence at intersection of north/south fire trail and perimeter fire trail.
- 3-85-TD Follow north perimeter fence, TLD is west of location 3-83-TD, at the intersection of second north/south fire trails, near old wooden gate.
- 3-86-TD Follow north perimeter fence at power station. TLD is on the fence 8 feet west of the power pole. Alternate route: Site 300 entrance drive to Route 3. Follow Route 3 to the end at the north power station.
- 3-87-TD From location 3-86-TD, follow the north perimeter fence to west perimeter fence, south along west perimeter fence to the east/west fire trail intersection. TLD is on the west perimeter fence.
- 3-88-TD South boundary of Site, next to pistol range gate; accessible via Corral Hollow Road.
- 3-89-TD South boundary of Site, near metal gate 101, across from Carnegie Memorial Marker; accessible via Corral Hollow Road.
- 3-90-TD Off site on Tesla Rd., west of Site 300. Located near entrance of Dwakowic Ranch, 16900 Tesla; TLD is on the north side of the road.
- 3-91-TD Site 300 South Perimeter on Corral Hollow Road; east of Carnegie Ranger Station on north side of road, between signs on fence.
- 3-92-TD Off site at Tracy Airport. Take Corral Hollow Road toward Tracy and follow signs to Airport (turn south on Tracy Blvd.). TLD is on Airport boundary fence, between signs.
- 3-93-TD Off site at Tracy Fire Department near air sampler. TLD is on conduit at the far side of the roof.
- 3-94-TD 17023 Tesla, Southeast corner of fence at back of property, approximately 4/10 mile from gate at bottom of hill.
- 3-95-TD On private property on the east fence line, approximately 2/10 mile from lower gate (private property).
- 3-96-TD At the bottom of the hill (on private property) on right side of gate (same private property as above).
- 3-97-TD From location 3-98-TD, follow trail 0.9 mile from 3-98-TD (1.8 mile from gate) to the left, TLD is on the yellow delineator past marker MPB 8 (private property).

- 3-98-TD From location 3-99-TD, follow the trail 0.9 mi. from gate. TLD is on the fence to the left (private property).
- 3-99-TD East of Patterson Rd. from Greenville Rd. to U. S. Wind power gate #9 (south side of Patterson Rd.). TLD to the right of gate behind sign posts, approximately 2 meters above ground.

6.5 NEUTRON REM-METER LOCATION

Neutron rem-meter may be found by driving to the following locations:

- P-01-NT Approximately 100 feet north of the stop sign on the west side near the intersection at Third Street and Avenue A.
- P-02-NT 0.2 miles going north of West Gate Drive on the access road to Bldg. 196, 100 feet west of Bldg. 196 at the fence line.
- P-03-NT Inside south perimeter fence south of Bldg. 212 near the east end alongside East Ave.
- P-04-NT Continue 0.3 mile on access road north of Bldg. 298 at the perimeter fence line.
- P-05-NT Inside south perimeter fence south of Bldg. 212 on the west end alongside East Avenue.
- P-06-NT Take Outer Loop Rd. south from Bldg. 691 and go 0.5 mile, rem-meter is on the left inner perimeter fence, surrounded by trees.
- P-07-NT Continue on Outer Loop Road for 0.2 mile, rem-meter is on left side at perimeter fence west of T-6475.
- P-08-NT 40 feet due south of T-5104 inside south perimeter fence alongside East Avenue.

Maps depicting TLD and neutron sampling locations at LLNL site perimeter, Livermore Valley, and Site 300 are provided in attachments E, F, and G.

7. DOCUMENTATION/QA RECORDS

COCs must accompany all data, along with the Field Tracking Form, at the completion of sample collection.

Data Management personnel must retain and archive all data.

8. ACCEPTANCE CRITERIA

TLDs and neutron sampling locations are acceptable when approved by the QA Coordinator, TAMM Group Leader, and EMS Section Leader.

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9. ATTACHMENTS

Attachment A: Randomly Selected Duplicate locations.

Attachment B: Sample LLNL Perimeter TLD FTF

Attachment C: Sample Site 300 TLD FTF

Attachment D: Sample Neutron FTF

Attachment E: Map depicting LLNL site perimeter TLD and Neutron Dosimeter Locations

Attachment F: Map depicting Livermore Valley TLD Locations

Attachment G: Map depicting Site 300 TLD Locations

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**Attachment A:
Example of Randomly Selected Duplicate TLD Locations for a Given Year**

FIRST QUARTER

<u>PERIMETER</u>	<u>LIVERMORE VALLEY</u>	<u>SITE-300</u>
L-06-TD	V-14-TD	3-91-TD
L-11-TD	V-23-TD	3-89-TD
L-42-TD	V-27-TD	
L-47-TD	V-31-TD	
L-52-TD	V-44-TD	
L-56-TD	V-51-TD	

SECOND QUARTER

<u>PERIMETER</u>	<u>LIVERMORE VALLEY</u>	<u>SITE-300</u>
L-01-TD	V-17-TD	3-78-TD
L-03-TD	V-21-TD	3-92-TD
L-04-TD	V-24-TD	
L-07-TD	V-37-TD	
L-12-TD	V-46-TD	
L-50-TD	V-63-TD	

THIRD QUARTER

<u>PERIMETER</u>	<u>LIVERMORE VALLEY</u>	<u>SITE-300</u>
L-05-TD	V-18-TD	3-86-TD
L-06-TD	V-22-TD	3-99-TD
L-10-TD	V-30-TD	
L-13-TD	V-55-TD	
L-50-TD	V-66-TD	
L-56-TD	V-74-TD	

FOURTH QUARTER

<u>PERIMETER</u>	<u>LIVERMORE VALLEY</u>	<u>SITE-300</u>
L-02-TD	V-35-TD	3-84-TD
L-04-TD	V-43-TD	3-91-TD
L-11-TD	V-51-TD	
L-42-TD	V-63-TD	
L-52-TD	V-70-TD	
L-54-TD	V-76-TD	

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**Attachment B: Sample LLNL Perimeter TLD FTF
PERIMETER TLD DATA SHEET
LLNL AND LIVERMORE VALLEY**

Date of TLD Change: _____

Collector's Initials: _____

TLD Tray Locations

Tray 1 01-50

Tray 2 51 - 77

(plus transit controls)

Codes: (blank) = TLD Packet OK

M = TLD Packet Missing (lost sample)

G = TLD Packet on the Ground (unopened)

O = TLD Packet OPEN on ground (lost sample)

Location Identifier	ID# + Code	Mileage Between Stops	Slot #	Description of TLD Location
L-13-TD			Tray 1 13	Intersection of Avenue A and Mesquite Way on west fence (diagonally across from A-4 parking lot). Proceed North to L-01-TD.
L-01-TD			01	On west perimeter fence which runs parallel to Ave A. 20 yd. north of MW458 (aligned with west side of B151, Nuclear Chem.).
L-02-TD		0.3	02	On the first power pole North of West gate Drive on dirt road leading to B-196.
L-03-TD		0.18	03	Continue north from L-02-TD along dirt road. TLD is on the fence west of Butler Bldg. 5-250.
L-04-TD		0.03	04	On the dirt road which leads directly north to B196. TLD is on west side fence across from B-196 (behind the Eucalyptus tree).
L-05-TD		0.1	05	Continue east on dirt road. TLD is on North perimeter fence at right angle to B-195.
L-06-TD		0.1	06	On North perimeter fence, next to grade just past power pole.
L-07-TD		0.35	07	On North perimeter fence (aligned with B-431 and parking lot C-10).
L-10-TD		0.25	10	Intersection of Eleventh Street and Ave T. Near air monitoring location L-COW on caged fence.
L-11-TD		1.50	11	B-212 inside fence on East Avenue by bus stop (directly above neutron dosimeter).
L-12-TD		0.0	12	Directly East of #11—right above Neutron Dosimeter.
L-14-TD		0.55	14	0.1 mi N on Vasco Road from East Ave on the east side of perimeter fence, Near walking bridge and just past bus stop.
L-15-TD		0.4	15	North on Vasco Road on east side at second gate entrance, TLD next to "No Trespassing" sign.

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Location Identifier	ID# + Code	Mileage Between Stops	Slot #	Description of TLD Location
L-16-TD		0.35	16	North on Vasco Road on gate (near Oakland fence company sign) next to light pole. TLD on gate used to enter L-WPDC location.
V-17-TD		0.65	17	North on Vasco Road, turn left on Brisa take immediate left continue South to RR tracks. TLD is on small metal post near the MCI sign. Return to Vasco Rd for location #18.
V-18-TD		0.35	18	Heading north on Vasco Road at Railroad crossing north of Brisa Rd. TLD on east side of the road on a bar wrapped around RR warning lights.
V-19-TD		0.35	19	Intersection of Vasco Road and Preston Road/ S. Front Rd on the North side on the cyclone fence.
V-20-TD		0.2	20	Turn on North onto S. Front Road—on the fence north side of the road directly across the street from Livermore Disposal driveway.
V-21-TD		0.35	21	S Front Road on fence across the street from the trailer park. N side of road in fence area thick with Oleander bushes.
V-22-TD		0.5	22	S. Front Road north side of road on fence across street from Bell underground cable warning sign and two manholes.
V-23-TD		0.25	23	On S. Front Road north side of road on west side of fence by Bell warning sign and the Highway 580 off ramp.
V-24-TD		0.25	24	Follow S. Front Rd towards Greenville Rd, turn north. TLD is on fence just south of highway overpass on east side of Greenville Rd.
V-27-TD		0.4	27	Turn around on Greenville Rd heading south. Just past RR tracks and divider in the road. TLD is on east side of street at triangle support on barbed wire fence across from telephone pole.
V-28-TD		0.3	28	South on Greenville Road near 35 mph sign across from block bldg., west side of the road.
V-29-TD		0.3	29	Heading south on Greenville, south of RR overpass on the east side of the road on fence.
V-30-TD		0.2	30	South on Greenville on the east side of the road on the fence in front of the only house (near Pomegranate tree).
V-31-TD		0.55	31	Left from Greenville onto Patterson Pass Road. East 0.3 miles. South side on fence before the guardrail.

Location Identifier	ID# + Code	Mileage Between Stops	Slot #	Description of TLD Location
V-32-TD		0.55	32	Heading East on Patterson Pass Road, south side of road across from Zone 7 Water Treatment Plant main entrance.
V-33-TD		0.50	33	Intersection of Patterson Pass Road and Flynn Road south side of the road on fence.
V-34-TD		0.4	34	Heading east on Patterson Pass on north side of the road just past curve by the big Almond tree (room to turn around here).
V-35-TD		0.7	35	Heading west on Patterson Pass Rd. Turn right at Flynn Road on right side of fence by gate at 9290 Flynn Road. In turnout, on fence in front of power pole.
V-36-TD		0.25	36	Continue Up Flynn Road on right side. Due East of farm, about 300 yards. Just past road marker 18.3.
V-37-TD		0.4	37	Continue on Flynn top of the hill left side of the road due east of old water tank.
V-38-TD		0.5	38	Continue up Flynn to summit. Right side of fence by telephone pole.
V-70-TD		1.0	Tray 2 20	On Flynn Rd at main entrance to US Wind Power. TLD is on north east side of cyclone fence on gate entrance.
V-71-TD		1.0	21	Continue up Flynn, just short of freeway. Make left on "Not a through street." At top of hill, dead-end on vertical post on fence gate.
V-72-TD		0.9	22	Continue on Flynn, over freeway, take Carroll Road downhill. Left side of road nearest point to freeway.
V-73-TD		1.35	23	Heading west on Altamont Pass Road to Goecken Road go up. TLD is on right side about 200 yards on 8200 Altamont sign.
V-41-TD		3.0	Tray 1 41	TLD at intersection of Patterson Pass Road and Greenville on the southeast side of fence.
L-42-TD		0.1	42	NE corner of LLNL at Greenville and Patterson Pass on Lab perimeter fence (same location as L-NEP).
V-43-TD		0.4	43	On east side of Greenville across from the baseball field closest to LLNL Davis campus near the "no parking sign".
V-44-TD		0.2	44	South on Greenville turn east on Lupin Way—500 ft. up on south side of road. On the fence entrance nearest to pump equipment.

Location Identifier	ID# + Code	Mileage Between Stops	Slot #	Description of TLD Location
V-45-TD		0.3	45	Continue east on Lupin on the north side. TLD on fence just south of entrance to 8626 Lupin Way.
V-46-TD		0.5	46	Continue east on Lupin at canal crossing on north side of fence.
L-47-TD		1.0	47	Return to Greenville. Heading south on Greenville Rd, TLD is on E perimeter fence just south of East gate entrance. TLD is on fence closest to L-VIS sample location near "Air Monitoring Station" sign.
L-50-TD		0.1	50	South on Greenville, TLD is on fence entrance to Credit Union/Visitor Center on south side of fence.
V-51-TD		0.1	Tray 2 01	Continue south to 2546 Greenville Rd. TLD is on barbed wire fence just south of white wooden gate entrance.
L-52-TD		0.0	02	TLD is on east perimeter fence on Greenville Rd directly across from TLD L-51-TD.
V-55-TD		0.3	05	Jct. Greenville and East Avenue, on north side at fence corner. TLD is on the corner of the white wooden fence in front of house at.
L-56-TD		0.0	06	Intersection of Greenville Rd and East Ave at the corner of the SE perimeter fence.
V-57-TD		0.1	07	South on Greenville from East Avenue, TLD is located by aqueduct gate on right side of fence (same as L-AQUE location).
V-58-TD		0.5	08	South on Greenville near old wooden gate on the west side.
V-59-TD		0.4	09	Intersection of Tesla Road and Greenville on Tesla south west side. TLD is attached to telephone support wire.
V-60-TD			10	West on Tesla on canal fence on the northwest side.
V-61-TD		0.4	11	West on Tesla across the street from concrete abutment. TLD is on the south side of the road on a barbed wire fence.
V-62-TD		0.3	12	Intersection of Vasco and Tesla on north side of Tesla on the corner of the fence.
V-63-TD		0.3	13	Turn north on Vasco on east side at 2700 Vasco. Next just north of entrance.
V-66-TD		0.3	16	North on Vasco at 2480 Vasco north of house—on the fence under pine tree.

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Location Identifier	ID# + Code	Mileage Between Stops	Slot #	Description of TLD Location
V-67-TD		0.4	17	North on Vasco just south of intersection of Vasco and East Avenue. TLD is on cyclone gate entrance by fence marker #563.
V-68-TD		0.3	18	Turn east on East Avenue on south fence opposite Building 111.
V-69-TD		0.35	19	Heading east on East Avenue opposite to and just east of our main gate on Sandia fence near gate marker #503.
V-74-TD		1.8	Tray 2 24	This location involves proprietary information. Samplers requiring directions to this location should contact the Environmental Analyst
V-75-TD		1.0	25	Behind East Avenue Fire Station on air sampler handle. (Same as L-FIRE location).
V-76-TD			26	Northern most end of Railroad Ave, downtown Livermore behind Kinney's Shoes. TLD is on fence just west of locked entrance to the abandoned Livermore City Corp. yard. (Same as L-LCCY location).
V-77-TD			27	First Street north to Trevarno Road. End of Trevarno before RR crossing. TLD is on the corner of chain link fence, east of garage.

DUPLICATES

ID#	LOCATION	TLD#	SLOT#	TRAY#
L-QA01-TD				
L-QA02-TD				
L-QA03-TD				
L-QA04-TD				
L-QA05-TD				
L-QA06-TD				
L-QA07-TD				
L-QA08-TD				
L-QA09-TD				
L-QA10-TD				
L-QA11-TD				
L-QA12-TD				

TRANSIT CONTROLS

ID#	TLD#	SLOT#	TRAY#
L-QA13-TD			
L-QA14-TD			
L-QA15-TD			
L-QA16-TD			
L-QA17-TD			
L-QA18-TD			
L-QA19-TD			

Attachment C: Sample Site 300 FTF
PERIMETER TLD DATA SHEET
SITE 300

Date TLD changed: _____

Tray #: _____

Sampler's Initials: _____

Codes: Blank = TLD packet OK
 M = TLD packet missing (lost sample)
 G = TLD packet on the ground unopened
 O = TLD packet on the ground opened (assume wet, lost sample)

Location Identifier	ID # + Code	Slot #	Description of Location
3-78-TD		1	Site 300 GSA area. North side of S300 entrance drive attached to air monitor location 3-GOLF.
		2	Empty
		3	Empty
3-81-TD		4	S300 entrance drive Route 1 to B-834A. TLD is behind B-834A on security fence (not perimeter fence) north of B-834A gate.
3-82-TD		5	S300 entrance drive Route 3 to Linac Rd East on Linac Rd to B812 Drive. North to Tank-5. Follow Ridge fire trail to east perimeter fence. South along fence to sign "144" next to old wooden gate.
3-83-TD		6	From Location 3-82-TD north along east perimeter boundary fence. TLD is on top of second hill before reaching NE corner of the Site by the "No Trespass" sign.
3-84-TD		7	From Location 3-83-TD follow east fence line to north perimeter fence. Go west to the intersection of north/south fire trail and perimeter fire trail.
3-85-TD		8	Follow north perimeter fence, TLD is west of location 3-83-TD, at intersection of second north/south fire trail, near old wooden gate.
3-86-TD		9	Follow north perimeter fence to north power station. TLD is on fence 8 ft west of power pole. Alternate Route: S300 entrance drive to Route 3. Follow Route 3 to its end at the north power station.
3-87-TD		10	From Location 3-86-TD, follow north perimeter fence to west perimeter fence, south along west perimeter fence to east/west fire trail intersection. TLD is on west perimeter fence.
3-88-TD		11	South boundary of Site, next to pistol range gate; accessible via Corral Hollow Road.
3-89-TD		12	South boundary of Site, near metal gate 101, across from Carnegie Memorial Marker; accessible via Corral Hollow Road.

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Location Identifier	ID # + Code	Slot #	Description of Location
3-90-TD		13	Off site on Tesla Rd., west of Site 300. Located near entrance of Dwakowic Ranch, 16900 Tesla; north side of the road.
3-91-TD		14	Site 300 South Perimeter on Corral Hollow Road; east of Carnegie Ranger Station on north side of road, between signs on fence.
3-92-TD		15	Off site at Tracy Airport. Take Corral Hollow Road toward Tracy and follow signs to Airport (turn south on Tracy Blvd.) TLD is on Airport entrance boundary fence, between signs.
3-93-TD		16	Off site at Tracy Fire Department near air sampler. TLD is on conduit at the far side of the roof.
3-94-TD		17	17023 Tesla. Southeast corner of fence at back of property, approximately 4/10 mile from gate at bottom of hill.
3-95-TD		18	East fence line, approximately 2/10 mile from lower gate.
3-96-TD		19	At the bottom of hill (on private property) on the right side of gate.
3-97-TD		20	From location 3-98-TD, follow trail 0.9 mile from loc. 3-98-TD (1.8 mi from location 99 gate), to left, TLD is on the yellow delineator past marker MPB 8.
3-98-TD		21	From location 3-99-TD, follow trail 0.9 mi. from gate on left of fence.
3-99-TD		22	East on Patterson Pass Rd from Greenville Rd to U.S. Wind power Gate #9 (south side of Patterson Pass Rd). TLD is right of gate behind sign posts, approximately 2 meters above ground.

	ID	TLD #	Slot #	Tray #	Location
<u>Duplicates</u>	3-QA01-TD	_____	_____	_____	_____
	3-QA02-TD	_____	_____	_____	_____
<u>Transit Controls</u>	3-QA03-TD	_____	_____	_____	_____
	3-QA04-TD	_____	_____	_____	_____
	3-QA05-TD	_____	_____	_____	_____

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Attachment D: Sample Neutron FTF

FIELD TRACKING FORM Perimeter Neutron Dosimeters

ID	DATE REMOVED	DATE INSTALLED	TECH INITIALS	DESCRIPTION OF NEUTRON LOCATION
P-01-NT				Approximately 100 feet north of the stop on the west side near the intersection at Third Street and Avenue A.
P-02-NT				0.2 miles going north of West gate Drive on the access road to Bldg. 196, 100 feet west of Bldg. 196 at the fence line.
P-03-NT				Inside South Perimeter fence south of Bldg. 212 near the east end alongside East AVE.
P-04-NT				Continue 0.3 mile on access Rd. north of Bldg. 298 at the perimeter fence line.
P-05-NT				Inside South Perimeter fence south of Bldg. 212 on the west end alongside East Avenue.
P-06-NT				Take Outer Loop Rd south from Bldg. 691 and go 0.5 mile, rem-meter is on the left inner perimeter fence, surrounded by trees.
P-07-NT				Continue on Outer Loop Road for 0.2 mile, rem-meter is on left side at perimeter fence west of T-6475.
P-08-NT				40 feet due south of T-5104 inside South perimeter fence alongside East Avenue.

Date Irradiated

P-QC01-NT	Ci	Standards and Calibration Lab Bldg. 255
P-QC02-NT	PuBe	Standards and Calibration Lab Bldg. 255

Notify Joanne Westernmark 25234 or Bldg. page 28253. Deliver Neutron Dosimeters and irradiation req. to Joanne in B253 Room 1722 A.

NOTE: One day minimum advance notification is required to Joanne Westernmark and Dave Trombino for dosimeter processing.

Attachment E:
Map depicting LLNL site perimeter TLD and Neutron Dosimeter Locations

Attachment F:
Map depicting Livermore Valley TLD Locations

Attachment G:
Map depicting Site 300 TLD Locations

EMP-R-S

EXTERNAL RADIATION MONITORING

Prepared by:

Barbara C. Fields 3/16/93
Barbara C. Fields
Environmental Analyst, TAMM

Reviewed by:

Duane Rueppel 3/17/93
Duane Rueppel
Group Leader, TSG

Paris E. Althouse 3-17-93
Paris Althouse
Environmental Technician, TSG

David Graves 3-22-93
David Graves
Environmental Technician, TSG

Approved by:

Rebecca Failor 3/16/93
Rebecca Failor
Section Leader, EMS

Cindy Garcia 4/21/93
Cindy Garcia
Quality Assurance Coordinator, EMS

Kris Surajo
Kris Surajo
Group Leader, TAMM

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes the steps taken by the Environmental Monitoring Section (EMS) to perform direct radiation monitoring. EMS measures environmental gamma radiation quarterly at 16 perimeter locations at Lawrence Livermore National Laboratory (LLNL), at 49 off-site Livermore Valley locations, and at 20 Site-300, Tracy, and surrounding ranch locations. Neutron radiation measurements are made at eight locations on the LLNL site perimeter.

2. APPLICABILITY/DISCUSSION

External ionizing radiation, which cannot be measured by collection of material on filters nor chemically trapped, is measured using radiation dosimeters. The dosimeters provide a measure of the total amount of external ionizing radiation—both natural background radiation and any radiation that has man-made origins—at a particular location.

EMS direct radiation monitoring is carried out to assess the potential radiation dose to the public that could result from LLNL operations. This monitoring uses thermoluminescent dosimeters (TLDs) to detect gamma radiation and ²³⁵U track-etch detectors (modified neutron rem-meters) for neutron radiation measurements. Radiation monitoring is carried out in accordance with References 1, 2, 3, 6, 7, 8, 9, 10, 11, and 12. Quality assurance and data verification are also carried out in accordance with Reference 5 and 16.

2.1 TLD MONITORING

EMS measures external ionizing gamma radiation with TLDs quarterly in order to assess the environmental impact of LLNL's operations and determine levels of background ionizing radiation. Each TLD is heat-sealed in a 3-1/2 in. x 2-1/4 in. (8.9 cm x 5.7 cm), 4.5-mm-thick foil pouch for protection against light and moisture.

TLDs (Panasonic Model UD-814AS1) contain three elements of activated calcium sulfate (CaSO₄) and one element of lithium borate (Li₂B₄O₇). Impurities in the TLD crystals form low temperature trapping sites for electrons excited to higher energy states when the TLD receives gamma radiation exposure. The electrons remain in a high energy state at normal ambient temperatures. In the analytical laboratory, the Hazards Control Radiation Dosimetry Group heats the TLD in a three-phase process. When the TLD is heated, the electrons are released from the trapping sites, drop to lower energy states and photons are emitted. The photons are measured with a photomultiplier tube and the light intensity is proportional to the original absorbed dose of radiation (See References 15 and 16 for more details). After the TLD is read, it is heated and read again. The reading should be near zero, indicating that all the stored energy in the trap has been measured. This process, referred to as annealing, verifies that the TLD is again ready for field deployment.

NOTE: The California Department of Health Services (DHS) co-monitors six of the TLD perimeter sites at LLNL. The DHS TLDs are clearly identified as DHS property, and should not be disturbed by EMS technicians.

2.2. NEUTRON MONITORING

Measurements of environmental neutron radiation dose levels at the LLNL site perimeter are made with ^{235}U track-etch detectors encased in modified neutron rem-meter moderators in accordance with References 4, 5, 6, 7, 9, 11 and 12. The modified neutron rem-meters are removed quarterly from the eight locations around the Laboratory and are taken to the Hazards Control Radiation Dosimetry Group for processing. Neutron dosimeters are collected, processed, and returned to their respective sites within the same day.

The modified neutron rem-meter consists of a vapor-plated, 0.11 μCi , ^{235}U foil and a 25-mm-diameter disk of 8-micron-thick polycarbonate film encircled in a cylindrical polyethylene moderator. The products from neutron-induced fission in the foil produce damage tracks in the polycarbonate film. These tracks are counted by the spark technique. A detailed description of the detector and the spark-counting procedure have been previously published in Reference 4.

3. REFERENCES

1. Hazards Control QC Procedure 6-2-1-2, *Reading to Anneal Dosimeters*
2. Hazards Control QC Procedure 6-2-1-4, *Reading Test/Miscellaneous Dosimeters*
3. Hazards Control QC Procedure 8-2-2, *Environmental Data Analysis*
4. Hazards Control Progress Report "Track-Etch Neutron Dosimeters," UCRL 50007-76-1, August 1971.
5. EMP-QA-S, *Quality Assurance Sampling*
6. EMP-QA-SD, *Sampling Tracking Documentation*
7. EMP-R-CA, *Radiation Calibration Procedure*
8. EMP-R-L, *Radiation Location Procedure*
9. Hazards Control QC Program Description 7-4-1-4, *Environmental Dosimetry Dose Analysis*
10. DOE Order 5400.1, General Environmental Protection, parts 7a and 7b
11. 40 CFR PART 61, Federal Clean Air Act
12. California Radiation Control Regulations, California Code of Regulation, Title 17, Health; State of California Department of Health Services
13. EMP-QA-NCR *Nonconformance Reports*
14. EMP-QA-DC *Document Retention*
15. Radiation Safety Technician Training Course, National Technical Information Service, U.S. Dept. of Commerce, May 1972, pp. 227-228.
16. Hazards Control QC Procedure 8-4-1, *Environmental Dosimeter Processing Quality Assurance Testing*
17. Hazards Control QC Procedure 8-S, *Environmental Dosimeter Measurements*

4. DEFINITIONS

Absorbed Dose: The quantity of energy deposited by radiation in a given amount of material.

Annealed Dosimeter: A dosimeter that has been heated to remove residual electrons trapped in elevated energy states caused by previous exposure to ionizing radiation.

Controls (Blanks): TLDs that are used to determine exposure to ionizing radiation other than that resulting from the source being measured.

Calibration Controls (Standards): TLDs that are irradiated by the Hazards Control Radiation Dosimetry Group in exposures of 50 to 100 millirem. This information is used to calculate the exposure of environmental TLDs.

Duplicates: Duplicate samples that are taken to estimate the precision of sampling and analyses.

Lead Pig: A box fabricated from lead which is used to shield TLDs from external ionizing radiation (located on the north side of Building 151).

Modified Neutron Rem-meter: A device used to measure neutrons in mrem. The modified neutron rem-meter consists of a vapor-plated, 0.11- μ Ci, ^{235}U foil and a 25-mm-diameter disk of 8-micron-thick polycarbonate encircled in a cylindrical polyethylene moderator.

Nonconformance Report: A report used to describe non conforming conditions and document evaluation and resolution, as well as verification and acceptance of corrective actions.

Quality Factor: The factor by which the absorbed dose (rad) is multiplied to obtain a quantity that expresses biological damage to exposed persons.

Quality Control (QC) TLDs: TLDs that have been irradiated to specified levels and are submitted as blind samples to the analytical laboratory. Results of their analyses are compared to the known irradiation levels to evaluate analytical laboratory accuracy.

Radiation Dosimetry Group: The group within the Hazards Control (HC) Department that is responsible for processing radiation dosimeters for field deployment.

Reading Magazine: A tray used to assemble TLDs for reading.

Rem: The product of the absorbed dose in rad times the quality factor, distribution factor and any other necessary modifying factors.

Thermoluminescent Dosimeter (TLD): A device that is used to measure external ionizing gamma radiation.

Transit Controls (Trip Blanks): TLDs that are carried by the technicians, while they are deploying other TLDs in the field, to monitor exposure during deployment.

5. RESPONSIBILITIES

5.1 EMS SECTION LEADER

The EMS Section Leader ensures that sampling procedures meet and conform to the appropriate regulatory guidance.

5.2 TAMM GROUP LEADER

The Group Leader assures that sampling procedures meet design criteria and that sampling is conducted in accordance with approved procedures.

5.3. TAMM ANALYST

The TAMM analyst responsible for the external radiation monitoring network will determine the monitoring locations and periodically review them for technical suitability in the context and goals of EMS. The analyst is responsible for assessing the need to monitor newly discovered areas of known or suspected LLNL-induced radiation exposure and assessing the need for using improved methods and state of the art technology. The analyst is responsible for providing proprietary information to the technician responsible for collecting samples, submitting design change packages regarding network sampling locations, updating the sampling procedure, and communicating changes to other EMS staff members as needed. Once each year, the analyst must assign duplicate locations for each of the next four quarters and provide that information to the TSG Group Leader who will forward it to the technicians. The analyst and/or technicians must contact the Hazards Control Radiation Dosimetry Group at least one week in advance of rem-meters drop off. The analyst must evaluate the data, sign Chain of Custody (COC) Record Forms, note any data disparity on Nonconformance Reports, and report the data in the Site Annual Environmental Report.

5.4 EMS QA COORDINATOR

The Quality Assurance Coordinator is responsible for keeping lists of all present and past sampling locations and their designators, evaluating the need for and reviewing/approving TLD and neutron location design changes, and archiving all design changes and revisions to this procedure as described in Reference 5.

5.5 TSG TECHNICIAN

TSG technicians are responsible for collecting TLD and neutron samples, using the methods described in this procedure. The TSG technician will contact the Hazards Control Radiation Dosimetry Group one week prior to TLD field deployment to coordinate pick-up and delivery. They must complete the appropriate Field Tracking Forms (FTFs), Radiation Request Forms, the Environmental Dosimeter Exchange Form (Attachment A), and the COCs, make notes regarding any actions or situations observed that are not in compliance with this procedure, and complete Nonconformance Reports to communicate that information to the responsible analyst. Technicians are also responsible for providing the analyst with recommendations regarding sample collection.

5.6 HAZARDS CONTROL RADIATION DOSIMETRY GROUP

The Hazards Control Radiation Dosimetry Group is responsible for issuing the requested number of TLDs. This group is responsible for reading the dosimeters and annealing TLDs to remove residual readings. The group also provides results of TLD and rem-meter results along with signed COCs on a quarterly basis and should archive all pertinent data.

6. PROCEDURE

Equipment Required:

Sample pouches (Special Order Kapak Co.)
Plastic sealing unit (Transportainer Bldg. 596)
TLDs (Hazards Control, Almond Avenue)
Reading magazines (Hazards Control, Almond Avenue)
Plastic ties (Transportainer Bldg. 596)
Metal eyelet press (Transportainer Bldg. 596)
Labels (TID)
Marking pen (Sharpie, black) (Transportainer Bldg. 596)
FIT (obtain from Responsible Analyst)
HC Radiation Dosimetry Group Irradiation Request Form
(Transportainer Bldg. 596)
Environmental Dosimeter Exchange Form (Bldg. 1680, Room 1043)

6.1 TLD PROCEDURES

A week prior to the beginning of a quarter, the TSG technician makes a request to the Hazards Control Radiation Dosimetry Group for calibration, QC, trip blank, and replacement TLDs (including duplicates). TSG technicians store the calibration and QC TLDs in a lead pig during the first half of the quarter (Reference 7.) At mid-quarter, the TSG technician requests the Hazards Control Radiation Dosimetry Group to irradiate the calibration and QC TLDs to specific exposures, and once irradiation is complete, replaces them in the lead pig for the remainder of the quarter. These TLDs are used as calibrated controls and blind QC checks for the following quarter's field TLDs.

The TSG technician collects TLDs from the field every quarter and submits them to the Hazards Control Radiation Dosimetry Group on Almond Avenue, Pod F to be read. The TSG technician replaces the collected TLDs with new TLDs to prevent interruption of the monitoring process. The monitoring cycle also includes placing duplicate TLDs in randomly pre-selected sites (which are different each quarter), use of trip blanks (transit controls) during the TLD run, and ensuring that calibration control and blind QC TLDs are available at each quarterly reading. The TSG technician places twelve duplicate samples in the field equally divided between the site perimeter and the Livermore Valley, and places two duplicate samples in the field at Site 300. Duplicate sample locations are determined by the TMM Analyst on an annual basis (Reference 8).

6.1.1. A week before TLD field distribution, the responsible analyst verifies the request for TLDs from the Hazards Control Radiation Dosimetry Group has been made. The number of TLDs required is equal to the number of locations plus 38 extra dosimeters which are used as calibration controls, trip blanks, duplicates, and blind quality controls.

6.1.2. At the beginning of each quarter, the TSG Environmental Technician completes the following tasks:

6.1.2.1. Picks up TLDs from the Hazards Control Radiation Dosimetry Group. Twelve (12) TLDs to be used for calibration purposes must be placed in a labeled zip-lock bag in the lead pig located on the north side of Building 151. These TLDs will be left in the lead pig until mid-quarter when they will be irradiated and returned to the lead pig. Eight (8) additional TLDs to be used as QC checks are placed in a separate zip-lock bag in the lead pig for mid-quarter irradiation and storage (Reference 7.)

6.1.2.2. Removes the calibration and QC TLDs placed in the lead pig during the previous quarter and puts them in the reading magazine (these stay at the work station until the TLD field collection is completed). The calibration control and blind QC TLDs are replaced in the lead pig by the calibration and QC TLDs described in step 6.1.2.1.

6.1.2.3. Takes the remaining TLDs (field replacements, duplicates, and transit controls) to the work station, inserts each TLD into a sample pouch, and seals each pouch with the plastic sealing unit.

6.1.2.4. Uses the metal eyelet press to place an eyelet at each end of the pouch, as shown in Figure 1, and installs an LLNL identification label on each pouch.

Figure 1. Placement of metal eyelet

6.1.2.5. Takes enough TLDs to cover monitoring sites and duplicates along the route, plus one transit control TLD for the LLNL site perimeter, two transit control TLDs for the Livermore Valley route, and one transit control TLD for the Site 300 route. The transit control TLDs must be left in the vehicle until the route is completed. The TSG technician then drives to the first location listed on the FTF, and completes the following activities:

6.1.2.5.1. Using the marking pen, writes the location ID and the quarter being sampled on the back of the replacement TLD pouch that is to be used at that location. For example, #01-4Q92 for Dosimeter Location One for the fourth quarter of 1992.

6.1.2.5.2. Removes the old TLD and installs the new one, with the LLNL label clearly visible, using the plastic ties through the eyelet to fasten the pouch securely.

Note: Be sure there are no obstructions (i.e., shielding) between the TLD and any facility. If the old TLD is missing, open, damaged, or on the ground, make proper note of it on the FTF for that location and initiate a non-conformance report after returning to the work station.

6.1.2.5.3. Opens the old pouch and removes the TLD.

6.1.2.5.4. Writes the TLD ID number next to TLD location number on the FTF and the Environmental Dosimeter Exchange Form as well as duplicate TLD locations where applicable.

6.1.2.5.5. Puts the old TLD in the proper reading magazine, in the slot (as listed on the FTF) for that location.

6.1.2.6. Goes to the next location listed on the FTF and repeats steps 6.1.2.5.1 through 6.1.2.5.5.

6.1.2.7. When all TLDs have been collected from the field, the TSG technician takes them back to the work station and carries out the following:

6.1.2.7.1. Completes the COC using information from the FTF.

6.1.2.7.2. Delivers the field TLDs to the Hazards Control Radiation Dosimetry Group, along with calibration controls, transit controls, blind QC samples for the quarter being analyzed, the Environmental Dosimeter Exchange Form, and the COC.

6.1.2.7.3. Ensures that the COC is signed by the Radiation Dosimetry Group staff receiving the TLDs, retrieves the goldenrod and pink copies of the COC, and gives them to the Environmental Analyst.

6.2 ENVIRONMENTAL NEUTRON DOSIMETER PROCEDURE

Neutron dosimeters are collected quarterly from eight locations around the Laboratory and given to Hazards Control Radiation Dosimetry Group, Building 253, Room 1722A, who remove the disk assemblies and immediately replace them with new disk assemblies. Two of the eight rem-meters are used for QC checks as described in Reference 7. The dosimeters are taken back to their sites within the same day.

Quality control for the modified neutron rem-meters is carried out by exposing two of the rem-meters to a known calibrated neutron dose ranging from 5-20 mR PuBe and ^{252}Cf respectively. A neutron Irradiation Request Form must be completed and submitted to the Hazards Control Radiation Dosimetry Group for the above services as described in Reference 7.

6.2.1. The EMS Analyst contacts the Hazards Control Radiation Dosimetry Group by telephone (Extension 2-5234 or the Building Pager, 2-8253) one week in advance of the scheduled change-out for neutron dosimeters to ensure that neutron dosimeters can be processed. The Analyst notifies the TSG technicians accordingly.

6.2.2. The TSG technician picks up the rem-meters from the field and delivers them to the Hazards Control Radiation Dosimetry Group.

6.2.3. The technician collecting the neutron dosimeters must complete the Irradiation Request Form, FTF, and COC. The COC must be signed by the Hazards Control personnel receiving the neutron dosimeters, and must be attached to the FTF when it is returned to the analyst. The analyst must approve and sign the COC upon receipt of the completed data analyses.

6.2.4. The date and time that the neutron dosimeters were collected in the field must be recorded, as well as the date and time they are returned to the field. These data are recorded on the FTF.

6.2.5. Twenty polycarbonate disks are prepared in advance by Hazards Control personnel for the rem-meter moderators. Ten are used for controls, two are used for calibration, and eight are used for sampling.

6.2.6. After the disk assemblies have been exchanged, Hazards Control personnel notify the TSG technician. The TSG technician picks up the neutron dosimeters and replaces them at their pre-assigned locations.

7. DOCUMENTATION/QA RECORDS

The COC and the FTF must be completed and attached to all pertinent data concerning the TLDs and neutron dosimeters and stored as described in Reference 14.

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8. ACCEPTANCE CRITERIA

TLDs and neutron dosimeter data are deemed acceptable when:

- TLDs are loaded into reading magazines correctly.
- TLDs have been annealed to remove any residual radiation-induced reading.
- All pertinent data concerning dosimeters are recorded on the FTF and the COC.
- Nonconformance Reports are completed for lost or damaged TLDs and rem-meters.
- Dosimeters have been calibrated to NIST-traceable sources.
- Quality control checks have been performed for neutron rem-meters and TLDs.
- Data are received, validated, and attached to the COC and FTF.

9. ATTACHMENTS

A. Environmental Dosimeter Exchange Form

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ATTACHMENT A: ENVIRONMENTAL DOSIMETER EXCHANGE FORM

DATE _____

TLD START DATE _____
TLD EXCHANGE _____

ENVIRONMENTAL DOSIMETER EXCHANGE

SLOT #	FIELD LOCATION	TRAY #	DOSIMETER #	FOR COMMENT	QUARTER 19	SLOT #	FIELD LOCATION	DOSIMETER #	COMMENT
1.						26.			
2.						27.			
3.						28.			
4.						29.			
5.						30.			
6.						31.			
7.						32.			
8.						33.			
9.						34.			
10.						35.			
11.						36.			
12.						37.			
13.						38.			
14.						39.			
15.						40.			
16.						41.			
17.						42.			
18.						43.			
19.						44.			
20.						45.			
21.						46.			
22.						47.			
23.						48.			
24.						49.			
25.						50.			

Design Change Package EMP-RA-L-001

Rain Sampling Locations

Effective Date: October 17, 1994

Prepared by:

Eric Christofferson 10/12/94
Eric Christofferson date
WGMG Environmental Analyst

Approved by:

Lucinda M Garcia 10/12/94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

Bill Hoppes 10/12/94
Bill Hoppes, date
WGMG Group Leader

Rebecca A. Failor 10/12/94
Rebecca A. Failor date
Section Leader, EMS

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1. DISCUSSION

A computer plot of air tritium distribution based on air tritium sampling and a recent study of LLNL wind direction during rain events revealed a gap in EMS rain sampling coverage close-in to the southwest part of the Livermore Site. At least one more sampling location is needed in that quadrant, closer than the old rain monitoring stations, BVA and VINE. Placing a rain sampling bucket next to the existing air tritium sampling station at location L-VET, off Vasco Road, is recommended for reasons of location, air-rain comparison, logistics, and security. This should be completed before the first rain sampled in rain year 1994-1995.

2. PROCEDURE CHANGE

Add the following location to EMP-RA-L:

6.13. (L-VET)

The rain sampler is located next to the air tritium sampler at location L-VET. This location involves proprietary information. Sampling technologists who need this proprietary information to perform their sampling activities should contact the Responsible Analyst.

EMP-RA-L

RAIN SAMPLING LOCATIONS

Prepared by:

Eric Christoffersen 12/22/93
Eric Christoffersen date
Environmental Analyst, WGMG

Reviewed by:

Rebecca Ward 12/22/93
Rebecca Ward date
Environmental Technologist, TSG

Duke Ramsey 12/28/93
Duke Ramsey date
Technical Coordinator, TSG

Rhonda Welsh 12/16/93
Rhonda Welsh date
Environmental Technologist, TSG

Approved by:

Rebecca A. Failor 12/31/93
Rebecca A. Failor date
Section Leader, EMS

Bill Hoppes 12/22/93
Bill Hoppes date
Group Leader, WGMG

Lucinda M. Garcia 12/29/93
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

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1. PURPOSE

This procedure contains locations used to collect rain samples in the Livermore Valley.

2. APPLICABILITY/DISCUSSION

The Environmental Monitoring Section (EMS) samples rain in the Livermore Valley, in accordance with Reference 1, to assess possible environmental impacts of Lawrence Livermore National Laboratory (LLNL) operations.

Rainfall is collected at seven on-site and four off-site locations in the Livermore Valley. There are two categories of sampling locations: those sufficiently removed from LLNL to be unaffected by laboratory operations (background), and those in areas that could be impacted by LLNL operations.

Some samples are collected on private property. It is the policy of LLNL and EPD that the names and addresses of private parties, and directions to these sampling locations, remain in strict confidence. Individuals who need this proprietary information to perform their sampling activities should contact the responsible Analyst.

3. REFERENCES

1. EMP-RA-S, *Rain Sampling*
2. EMP-QA-SL, *Sample Location Designators*
3. EMP-QA-SD, *Sample Tracking Documentation*

4. DEFINITIONS

Field Tracking Form (FTF): A form used in the field to document sampling activities.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS Section Leader has final approval authority for the selection of all sampling locations.

5.2. WGMG GROUP LEADER

The Water Guidance and Monitoring Group Leader (WGMG) ensures that sampling locations meet applicable design criteria and procedures.

5.3. WGMG ENVIRONMENTAL ANALYST

The WGMG Environmental Analyst determines the locations where rain samples are collected. The Analyst also provides proprietary information concerning sampling locations, on a confidential, strict need-to-know basis, to TSG Environmental Technologists responsible for collecting the samples.

5.4. TSG ENVIRONMENTAL TECHNOLOGIST

The Technical Support Group (TSG) Environmental Technologist ensures that the samples are collected at the proper locations and in accordance with Reference 1. The Technologist also selects one location for each sampling event where a duplicate sample will be collected.

6. PROCEDURE

Equipment Required:

None

The following is a list of the eleven Livermore Valley rain sampling location designators with descriptions for finding each one. Attachment A is a sample Field Tracking Form used for Livermore main-site and Livermore valley rain sampling. Attachment B is a map showing the location of on-site and off-site rain sampling locations in the Livermore Valley.

6.1. L-COW

Cow barn—Located on LLNL north perimeter, opposite the cow barn. From North Outer Loop Rd., turn north onto Ave. "T" and travel to its end at 11th Street. The rain collection bucket and rain gauge are attached to the permanent soil sampling marker adjacent to the fenced air sampler nearby.

6.2. L-ZON7

Zone 7—Drive north on Greenville Rd. from the LLNL East Gate. Turn right on Patterson Pass Rd., proceed east 0.6 miles, and turn left into the Livermore Zone 7 Water Treatment Facility. The rain collection bucket and rain gauge are located behind the chain-link fence on the left side of the driveway entrance.

6.3. L-MET

LLNL Meteorological Tower—Proceed west on West Gate Drive toward the West Gate. Just before the guard shack, turn right onto the gravel road. Drive 0.5 miles and turn right immediately beyond the Meteorological Tower fence. Travel 400 feet along this road until you find the rain collection bucket and rain gauge next to a telephone pole.

6.4. L-SLST

Proprietary information—contact the responsible WGMG Environmental Analyst for directions to this sampling location.

6.5. L-B343

Building 343—in the green area, between B343 and B341. The rain collection bucket and rain gauge are attached to barrier post on the south side of B343, near the security fence.

6.6. L-AQUE

Aqueduct—east of SNLL. Exit LLNL from the East Gate and turn right (south) onto Greenville Road. The sampling location is approximately 0.1 mi south of the intersection of Greenville Road and East Avenue, on the right side of Greenville Road at the California Aqueduct access road gate. Turn in and stop before gate. Walk 30 feet along fence to right (north) to find rain collection bucket (there is no rain gauge at this location).

6.7. L-VIS

LLNL Visitors Center—Driving east on East Gate Drive, go past the East Entrance guard station and turn right into the Visitors Center parking lot, and park. The rain collection bucket and rain gauge are located inside the fence behind building T6501, near the air sampler, approximately 75 feet from the parking lot, across a small arroyo that divides the parking lot from the Visitors Center.

6.8. L-SALV

Salvage— Driving south on South Outer Loop Road from the intersection of East Gate Drive, travel 0.2 miles to an unmarked road on the left (just before the trailer staging area). Follow this road approximately 200 feet to an unmarked gate with lock #PB222 (the key is on the key chain for the Bronco). Unlock the gate, drive through and turn south. Follow the perimeter fence along Greenville Road until you reach another locked gate (lock #PB222). Unlock the gate and proceed along the perimeter fence until the road turns west. Follow the road to the west and continue approximately 0.2 miles. The rain collection bucket and rain gauge are located between the East Avenue fence and the salvage yard.

6.9. L-B291

Building 291—The rain collection bucket and rain gauge are behind B291 (north side), attached to a fence post that is adjacent to the B291 east parking area.

6.10. L-CDB

Central Drainage Basin— From South Inner Loop Rd., turn into parking lot D-5. Drive to the north end of the parking lot. The rain collection bucket and rain gauge are adjacent to the lake inlet.

6.11. L-ESAN

East of SNLL — Turn left on East Ave. from the LLNL South Gate. Turn right into the SNLL east entrance. Follow the perimeter road south. The sampling location is near the mid-point of the SNLL east perimeter fence. Locate a large oak adjacent to the perimeter road there. From that location, the rain collection bucket can be seen near the fence. The rain collection bucket and rain gauge are about 200 feet beyond the end of the archery range.

6.12. L-QA

Quality Assurance duplicate sample taken from the same collection bucket as one of the routine samples. The location for duplicate sampling is selected randomly (and

REVISION 1 FINAL	EMP-RA-L Rain Sampling Locations	Effective date: 1/3/94 Page 5 of 7
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according to availability of sufficient rain) by the sampling technologist during each sampling event.

7. DOCUMENTATION/QA RECORDS

Documentation and QA records requirements for rain sampling are defined in Reference 1.

8. ACCEPTANCE CRITERIA

Locations for collecting rain samples will be considered acceptable when they have been approved by the EMS Section Leader. Only samples taken at official sampling locations will be used in the assessment of LLNL impacts on the environment, unless special samples are authorized in an approved sampling plan.

9. ATTACHMENTS

Attachment A: Field tracking form used for rain sampling in the Livermore Valley
Attachment B: Map showing rain sampling locations in the Livermore Valley

Livermore Valley Rain Gauges - LLNL On-Site and Off-Site Locations

Date and ~Time Storm Ended 11/11/93 2010

1. COW-D1-RA = LOA-07-RA

L-COW	COWBARN - 80 Yards due east of S.E. corner of Building 6952	26
L-ZON7	ZONE 7 - on left side of entrance gate	
L-MGT	MET TOWER - Near air sampler	
L-SLT	Proprietary Information - contact Environmental Analyst	
L-VIS	VISITORS CENTER - Near EMC Air Sampler	
L-B343	BUILDING 343 - Behind building 343 in green area (SE)	
L-AQUE	AQUEDUCT - At same location as vegetation location on Greenville Rd.	
L-SALV	SALVAGE - Near Air Sampler at East & Greenville near Salvage Yard	
L-B291	BUILDING 291 - Behind B-291 attached to vertical pipes	
L-COB	CENTRAL DRAINAGE BASIN - North of 551W near Pond	
L-ESAN	EAST OF SANDIA - On Greenville Rd. approx 100yds from L-AQUE inside gate marked GAS MAIN	

Attachment B: Map of Livermore Valley Rain Sampling Locations

Design Change Package EMP-RA-S-001

Rain Sampling

Effective Date: November 21, 1994

Prepared by:

Eric Christofferson

11/17/94

Eric Christofferson
WGMG Environmental Analyst

date

Approved by:

Lucinda M Garcia

11/17/94

Lucinda M. Garcia
Quality Assurance Coordinator, EMS

date

Bill Hoppes

11/17/94

Bill Hoppes,
WGMG Group Leader

date

Rebecca A. Failor

11/17/94

Rebecca A. Failor
Section Leader, EMS

date

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1. DISCUSSION

The bottles required for tritium sampling have been changed as requested by the analytical laboratory (RAS).

2. PROCEDURE CHANGE

In the "Equipment Required" box directly under the heading "6. PROCEDURE", change

"250-ml rain-collection bottles (stored in the BMS sampling transportainer); LLNL Stores #8125-27804 (QOR PAC 250 ml)"

to:

500 ml flint glass bottle with stopper provided by RAS

EMP-RA-S

RAIN SAMPLING

Prepared by:

Eric Christofferson 12/22/93
Eric Christofferson date

Environmental Analyst, WGMG

Reviewed by:

Rebecca Ward 12-22-93
Rebecca Ward date

Environmental Technologist, TSG

Duke Ramsey 12/28/93
Duke Ramsey date

Technical Coordinator, TSG

Rhonda Welsh 12-28-93
Rhonda Welsh date

Environmental Technologist, TSG

Approved by:

Rebecca A. Failor 12/23/93
Rebecca A. Failor date

Section Leader, EMS

Bill Hoppes 12/23/93
Bill Hoppes date

Group Leader, WGMG

Lucinda M. Garcia 12-23-93
Lucinda M. Garcia date

QA Coordinator, EMS

LLNL ENVIRONMENTAL
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1. PURPOSE

This procedure describes methods for measuring rainfall amounts, collecting rain samples, and submitting them to an analytical laboratory for tritium analysis.

2. APPLICABILITY/DISCUSSION

This procedure is applicable to all personnel performing rain sampling. It describes good sampling technique, which involves clean, uncontaminated equipment; careful handling to prevent cross-contamination; and careful checking, documenting, and tracking of samples from collection point to the analytical laboratory.

Rainwater monitoring is called for in DOE Order 5400.1 which states, "Representative meteorological data are required at DOE facilities to support environmental monitoring activities. This information is essential to characterize atmospheric transport and diffusion conditions in the vicinity of the DOE facility and to represent other meteorological conditions (e.g., precipitation, temperature, and atmospheric moisture) which are important to environmental surveillance activities such as air quality and radiation monitoring."

3. REFERENCES

1. EMP-RO-S, Storm Water Runoff Sampling
2. EMP-RA-L, Rain Sampling Locations
3. EMP-QA-S, Quality Assurance Sampling
4. EMP-QA-SD, Sample Tracking Documentation
5. EMP-QA-DC, Document Retention
6. EMP-QA-NCR, Nonconformance and Discrepancy Reporting

4. DEFINITION

Chain-of-Custody Record Form (COC): The form used to track the custody of samples from collection through analysis, it also is used to track the data received from the analytical laboratory.

Rain: Rainwater that is collected directly as it falls from the sky, before it strikes the ground or other objects that might be a source of contamination.

Rain event: Rainfall sufficient to produce the 100 ml needed in the collectors for a sample (usually at least 0.20 inches).

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The Environmental Monitoring Section Leader (EMS) ensures that sampling methods meet regulatory guidance and that sampling is conducted in accordance with approved procedures.

5.2. WGMG GROUP LEADER

The Water Guidance and Monitoring Group Leader (WGMG) ensures that sampling procedures meet design criteria and that sampling is conducted in accordance with approved procedures.

5.3. WGMG ENVIRONMENTAL ANALYST

The WGMG Environmental Analyst for water designs the sampling network and sampling scheme to ensure representative samples from the Livermore site and off site areas. The Analyst ensures that the network of rain collectors are installed and remain in place (occasionally collectors are stolen and must be replaced). The Analyst also ensures that rainwater samples are collected by the sampling technologists as scheduled and are submitted to the appropriate analytical laboratories for analysis.

5.4. TSG TECHNICAL COORDINATOR

The TSG Technical Coordinator schedules and assigns sampling Technologists to ensure that samples are collected according to the requirements of this procedure.

5.5. TSG ENVIRONMENTAL TECHNOLOGIST

The Technologist is responsible for following proper decontamination procedures, reading rain gauges, and collecting samples and delivering them to the appropriate analytical laboratory in accordance with this procedure.

6. PROCEDURE

Equipment Required:

Stainless-steel 13-quart buckets for rain collection; from LLNL Stores #7960-30343 (keep two, as spares).

Plastic rain collection gauges (two, as spares); order from:

Environmental Instruments
2170 Commerce Ave, Unit S
Concord, CA 94520

Chain-of-Custody Record Forms (COC)

Field Tracking Forms (FTF)

Kimwipes or equivalent

250-ml rain-collection bottles (stored in the EMS sampling transportainer); LLNL Stores #8125-27804 (QOR PAC 250 ml)

6.1. COLLECTION EVENTS AND LOCATIONS

Samples are collected for the same storm events as those sampled for storm water runoff, according to the schedule given in Reference 1. Rain gauges are read and sample buckets are emptied each time there is at least a 12-hour break between rain storms.

Rainwater is collected in rain gauges and/or stainless-steel collection buckets at each sampling location specified in Reference 2.

6.2. PREVENTING CONTAMINATION

Technologists should ensure that they do not use any equipment that has been contaminated with tritium and should use caution to eliminate any potential sample or equipment cross-contamination. Personnel performing sampling or analysis should not wear tritiated wristwatches or watches containing any radioactive material. If there is any question concerning potential contamination of the equipment or vehicle, the Technologist should contact the responsible Analyst.

Prior to the start of each rainy season, Technologists should clean all rain gauges and rain collection buckets by rinsing them with deionized water and drying them with Kimwipes or equivalent. All bugs and debris should be removed from the buckets at this time and each time the buckets are emptied.

6.3. READING RAIN GAUGES AND EMPTYING BUCKETS

This procedure should be followed every time there is at least a 12-hour break between rain storms except when rain is to be sampled according to the requirements of section 6.4 of this procedure.

- 6.3.1. Drive to sampling location.
- 6.3.2. Enter date and approximate time that the storm started and ended on the FTF. This information is estimated by the Technologist in the field. More accurate information is obtained by the WGMG Environmental Analyst from rainfall and wind data collected every 15 minutes at the LLNL Meteorological Tower.
- 6.3.3. Put on fresh disposable sampling gloves.
- 6.3.4. Read the rain gauge reading. If enough rain fell that it spilled over the top of the rain gauge and into the outer housing (over one inch of rainfall), the sampler should decant the water from the inside cylinder of the gauge into the collection bucket then pour the spillover into the inside cylinder to determine the amount of rainfall over one inch. The rain gauge reading will be this value plus one inch (1") for the original contents of the inside-cylinder.
- 6.3.5. Dispose of water from the gauge on the ground.
- 6.3.6. Replace the inside cylinder of the rain gauge into its housing.
- 6.3.7. Dispose of water in the collector bucket on the ground.
- 6.3.8. Wipe the collector bucket clean with a Kimwipe or equivalent wipe.
- 6.3.9. Replace collector bucket and ensure that it is straight.
- 6.3.10. Return to vehicle, remove and discard gloves and Kimwipes and record rain gauge reading on the FTF.
- 6.3.11. Drive to next location and repeat.

6.4. READING RAIN GAUGES AND SAMPLING RAIN

This procedure should be followed each time NPDES runoff sampling is performed, according to the schedule in Reference 2.

- 6.4.1. Prior to leaving for sampling, prepare one label for each sampling location. Labels should follow the example given in Attachment A.
- 6.4.2. Collect one sample bottle for each location to be sampled.
- 6.4.3. Drive to sampling location.
- 6.4.4. Enter date and approximate time that the storm started and ended on the FTF. This information is estimated by the Technologist in the field. More accurate information is obtained by the WGMG Environmental Analyst from rainfall and wind data collected every 15 minutes at the LLNL Meteorological Tower.
- 6.4.5. Put proper label on the bottle.
- 6.4.6. Enter the date and time sampled and the sampler initials on the FTF.
- 6.4.7. Put on fresh disposable sampling gloves
- 6.4.8. Read the rain gauge reading. If enough rain fell that it spilled over the top of the rain gauge and into the outer housing (over one inch of rainfall), the sampler should decant the water from the inside cylinder of the gauge into the collection bucket then pour the spillover into the inside cylinder to determine the amount of rainfall over one inch. The rain gauge reading will be this value plus one inch (1") for the original contents of the inside cylinder.
- 6.4.9. Decant the water from the rain gauge into the collector bucket and agitate to mix.
- 6.4.10. Replace the inside cylinder of the rain gauge into its housing.
- 6.4.11. Pour a small amount of water from the collector bucket into the sample collection bottle. Place the lid on top of the bottle, shake to rinse, and empty contents onto the ground.
- 6.4.12. Repeat step 6.4.11 two more times (triple rinse) if sufficient water is available.
- 6.4.13. Pour water from collector bucket into the sample bottle. Fill the bottle completely and put the cap on. Try to avoid putting any bugs or debris that may be present in the sample collector bucket into the sample bottle.
- 6.4.14. The absolute minimum sample size for analysis is 25 ml. A minimum of 100 ml is considered optimum. If less than this amount is available at any location during a scheduled rain sampling event, make a note on the FTF that no sample was taken and complete an NCR according to the requirements of Reference 6. The rain gauge reading should be recorded whether or not there is sufficient rain available for analysis.
- 6.4.15. Dispose of any excess water in the collector bucket on the ground.
- 6.4.16. Wipe the collector bucket clean with a Kimwipe or equivalent wiper.
- 6.4.17. Replace collector bucket and ensure that it is straight.
- 6.4.18. Return to vehicle, remove and discard gloves and Kimwipes and record rain gauge reading on the FTF.
- 6.4.19. Drive to next location and repeat steps 6.4.5 through 6.4.17.

6.5. QUALITY ASSURANCE SAMPLING

Quality assurance duplicate samples for rain are taken at one randomly determined location for each sampling event as described in Reference 2. This location

is submitted "blind" to the analytical laboratory and decoded on the FTF as required by References 3 and 4.

6.6. POST SAMPLING ACTIVITIES

- 6.6.1. After sampling is complete, verify that all samples listed on the FTF have been collected. Fill out a COC as illustrated in Attachment B. Results should be sent to the WGMG Environmental Analyst responsible for rain monitoring.
- 6.6.2. Take the samples and the COC to the sample drop off location (located in Building 151).
- 6.6.3. Fill out an RAS Request for Tritium Analysis form. A sample Tritium Analysis form is shown in Attachment C.
- 6.6.4. Ensure that a representative of the laboratory signs the COC in the correct box to acknowledge receipt of samples.

7. DOCUMENTATION/QA RECORDS

FTFs and COCs must be completed according to the requirements of Reference 4. The COC also tracks the delivery of the data from the analytical laboratory to the EMS. All COCs and FTFs must be archived with the corresponding data in the EMS Document Retention Center in accordance with Reference 5.

8. ACCEPTANCE CRITERIA

All requirements of this procedure must be met, including the documentation required in Section 7, before samples will be considered acceptable. At least 25 and preferably 100 ml of rain must be collected for a valid analytical sample. If any of these are not met, an NCR should be completed according to the requirements of Reference 6.

9. ATTACHMENTS

Attachment A: Example of Label for Rain Samples

Attachment B: Sample Chain-of-Custody for Rain Samples

Attachment C: Sample Request for Tritium Analysis for Rain Samples

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Attachment A: Example of Label for Rain Samples

11-11-93

L-COW-01-RA

Tritium RLW

Laboratory: *LAIS*

Chain-of-Custody Record

2971

Project Name/Analyst:
*WJGME / Eric Christoffersen*Sampler(s): (signature)
Rhonda G. Welsh

Sample Identifier

site - location - num - media

Date

Number of Containers

Analyses Requested

Sample Group Description
*Rainwater - Valley*Logbook ID No:
NOV. 93

REMARKS

L - COW - 01 - RA

L - ZON7 - 01 - RA

L - MET - 01 - RA

L - SLST - 01 - RA

L - VIS - 01 - RA

L - B343 - 01 - RA

L - AQUE - 01 - RA

L - SALV - 01 - RA

L - B291 - 01 - RA

L - CDB - 01 - RA

L - ESAN - 01 - RA

L - QA - 27 - RA

L - QA - 39 - RA

-

-

Relinquished by Sampler:

Date/Time
11/11/93 1510

Received by Courier:

Date/Time

Relinquished by Analyst:

Date/Time

Relinquished for archiving by Data Manager:

Date/Time

Relinquished for archiving by Archivist:

Date/Time

Archived By:

Date/Time

Archive Number:

ALL SIGNATURES TO BE MADE ON WHITE COPY

DISPOSITION OF COPIES (after signatures)

Goldenrod: Sampler (return to Analyst; other copies to Courier w/samples)

Pink: Courier (return to Analyst; other copies to Laboratory w/samples)

Canary: Laboratory (send with data and other copies to Analyst; returned to Laboratory for their files by Analyst after data receipt and signature)

Green: Analyst (keep for files; all other copies to Data Manager w/data)

Blue: Data Manager (keep for files; while to Archivist w/data)

White: Archivist (archive white w/data; send photocopies of completed white to Analyst and QA Coordinator)

Environmental Monitoring Group
Lawrence Livermore National Laboratory
P.O. Box 808, L-255
Livermore, CA 94551Form OAP-8-1
Rev. 4
Jan. 1991REVISION 2
FINALEMAP-RA-S
Rain SamplingEffective date: 1/3/94
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Attachment B: Sample Chain of Custody for Rain Samples

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FINAL

EMP-RA-S
Rain Sampling

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Attachment C: Sample Request for Tritium Analysis for Rain Samples

University of California
Lawrence Livermore
National Laboratory

SAMPLE NUMBER _____

TRITIUM REQUEST AND WORK SHEET

DATE: 11/11/93 SUBMITTED BY: Rhonda Welsh
ORIGINATOR'S NO.: L-COW-01-RA ARGON PROTECTED ☐ YES ☐ NO
DESCRIPTION: Rainwater SOURCE: _____
SPECIAL INFO: _____

DISTILLATION: DATE _____ STATION _____ COMMENTS _____

ENRICHMENT: CELL _____ V_0 _____ ENRICH _____ NaOH LOT _____ & VOL _____

START _____ END _____ β = _____ POSITION _____

VAC. DIST.: DATE _____ BULB NO. _____ WATER _____ G WATER _____ ML

ALIQ. FACTOR _____ G/ML COMMENTS _____

GAS CONV. DATE _____ TRAP _____ FURNACE _____ RUN _____ VOL _____

GPC DATE _____ AM/PM COUNTER _____ V_x _____ V_y _____ RT = _____

TEMP (C°) _____

P_{SAM} _____

P_{PRO} _____ 38.0

P_{SAM} + P_{PRO} _____

P_{TOTAL} _____ 150.0

PIPET: DATE _____ A = _____ ML B = _____ ML POSITION _____

SET # _____

SAMPLE NUMBER

EMP-RO-L
STORM-WATER RUNOFF LOCATIONS

Prepared by:

William G. Hoppes 12/4/92
William G. Hoppes
Group Leader, EMG date

Reviewed by:

Duke Ramsey 12-4-92
Duke Ramsey
Environmental Technician, TSG date

David Graves 12-4-92
David Graves
Environmental Technician, TSG date

Paris Althouse 12-4-92
Paris Althouse
Environmental Technician, TSG date

Approved by:

Rebecca A. Failor 12/7/92
Rebecca A. Failor
Section Leader, EMS date

Kris Surano 12/3/92
Kris Surano
Group Leader, SMG date

Lucinda M. Garcia 12/4/92
Lucinda M. Garcia
Quality Assurance Coordinator, EMS date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes the locations for collecting storm-water runoff samples at and in the vicinity of the Livermore site.

2. DISCUSSION

The Surveillance Monitoring Group (SMG) of the Environmental Monitoring Section (EMS) monitors storm-water influent and effluent from Lawrence Livermore National Laboratory (LLNL) and the collective effluent from Sandia National Laboratories, Livermore (SNLL) to assess potential environmental impacts from laboratory operations (Ref. 1). EMS monitors storm water at ten locations (see Attachment A). These locations were chosen to monitor the collective effluent from SNLL, the influent to LLNL, effluent from various facility operations, and the collective effluent from LLNL.

The arroyos and ditches at LLNL generally drain from the south to the north. Of the ten storm-water sampling locations at LLNL, six were selected to characterize storm water entering (influent) or leaving (effluent) LLNL. Two arroyos cross the Livermore site. Locations designated GRNE and ALPW are used to characterize the influent and effluent, respectively, of the Arroyo de las Positas. Locations ASS2 and ASW are used to characterize the influent and effluent, respectively, of the Arroyo Seco. Location ALPE characterizes influent from an unnamed drainage at the LLNL entrance at Greenville Road and Lupin Way. Location ASS2 also is used to characterize the SNLL contribution to storm water entering LLNL. The remaining effluent sampling location is CDB, at the central drainage basin. This basin, which normally has no outflow other than loss by evaporation, collects storm-water flow from a large portion of the Livermore site.

The remaining four locations were selected to allow better definition of sources of storm-water flow originating near certain key areas within the Livermore site. Location 4THA is used to sample flow from the plutonium and tritium facilities; location 438E is used to sample storm water from the shops area and the Hazardous Waste Management facility. Location ALPN is used to monitor the outflow channel from the central drainage basin. This channel is used only during severe rainstorms, when storm water overflows from the central drainage basin into Arroyo de las Positas. Major construction to place an impervious liner beneath the Central Drainage Basin is ongoing at the time this procedure is being drafted. During this construction period flow into ALPN only occurs when rainwater that has collected into the Central Drainage Basin is pumped out. This usually occurs several days after the storm has occurred. Location WPDC characterized flow in the ditch that drains the western edge of LLNL and joins the north side drain at Location ALPW.

3. REFERENCES

1. EMP-RO-S, Storm-water Runoff Sampling

4. DEFINITIONS

None

5. RESPONSIBILITIES

5.1. SURVEILLANCE MONITORING GROUP LEADER

The Group Leader has final approval authority for the selection of all sampling locations.

5.2. SMG ENVIRONMENTAL ANALYST

The Environmental Analyst is responsible for selecting appropriate sampling sites to meet the sampling design criteria.

5.3. TSG ENVIRONMENTAL TECHNICIAN

The Environmental Technician is responsible for ensuring that the samples are collected from the correct sampling locations, and for properly completing Field Tracking Forms (FTFs) while sampling. A sample FTF is included as Attachment B.

6. PROCEDURE

Equipment Required:

N/A

The following is a list of the sampling locations, which are identified by a fencepost or drainpipe that is painted red and white and has a 2 x 3" aluminum tag affixed with the location ID.

- L-ALPE Arroyo Las Positas East—Used to sample influent to LLNL, the sampling location is just inside the East Gate entrance. Park in the Visitor Center parking lot and sample from the south side of Eastgate Drive at upstream side of culvert.
- L-CDB Central Drainage Basin—Located near the southwestern corner of the basin at the upstream side of the culvert that lies under the pedestrian walkway.
- L-ALPW Arroyo Los Positas West—At the northwest boundary; used to sample effluent from LLNL. Follow Avenue A north, turn left on Westgate Drive, turn right at the first dirt road, which parallels the fence line, and then drive alongside the fence to the arroyo. Collect the sample where the two discharges converge, just north of Building 196.
- L-ASW Arroyo Seco West—Used to sample effluent from the southwest corner of LLNL and effluent from SNLL's west parking lot. Heading south on Vasco Road, stop approximately 100 yd before reaching the intersection of Vasco Road and East Avenue. Sampling location is below a small pedestrian bridge on east side of Vasco Road.
- L-4THA Arroyo Seco—Drive to intersection of Avenue A and Fourth Street. Take the sample where drain pipes converge in the ditch to the west of the intersection.
- L-B438 East side of Building 438—From Southgate Drive, turn east on South Outer Loop Road. Take first left into parking lot E-3. Proceed north towards B438. Sample is taken at the drainpipe in the ditch, directly across from the stairs.
- L-ASS2 Arroyo Seco South 2—Used to characterize SNLL influent to LLNL. Enter the SNLL main gate, identify yourself to the guard, and follow the main entrance road. At the first stop sign, follow the road that veers to the right and, as soon as possible, turn right again and follow the dirt road along the west side of the arroyo. Park about 75 yd south of East Avenue. Sample is collected where runoff comes out of the drain pipe and converges with the upstream flow (75 yd south of East Ave.)

This location is very slippery when rain is falling; thus at least two other technicians must be present when samples are collected at this location.

- L-ALPN Arroyo Los Positas North—Proceed on north Outer Loop Road to Avenue T and turn north. Drive to the end of this road, turn left onto Eleventh Street, and drive approximately 200 ft. Sampling location is adjacent to T5902.
- L-GRNE Greenville Road—This location, at the northeast corner of LLNL, is used to characterize influent to LLNL. Drive north on Avenue T, turn east (right) and follow Eleventh St. until it becomes a dirt road at the east perimeter fence. Proceed north along the fence about 50 yd. Collect the sample from the concrete spillway on the west side of drain pipe.
- L-WPDC West Perimeter Drainage Channel— Exit LLNL on Westgate Drive, turn right onto Vasco Rd., and drive approximately 0.2 mile to the access gate in the perimeter fence. The key to the lock on the gate is located in B-1680, Room 1043. Drive through the gate to the West Perimeter Drainage Channel. Approximately 0.1 mile to the north you'll find the beginning of the concrete channel, which is where you should collect the sample.
- L-QA The location for this sample should be chosen at random from the above sampling locations.

7. DOCUMENTATION/QA RECORDS

- 7.1 During collection of the samples, Field Tracking Forms shall be completed. The information from these forms will be used to complete the Chain-of-Custody form (QAP-8-1). The Field Tracking Forms will be archived in the Document Retention Center on a periodic basis.
- 7.2 Field notebooks shall be used to note all sampling activities. The notes shall include, at a minimum, the locations sampled, date and time sampled, identity of persons collecting samples, and any difficulties or special circumstances.

8. ACCEPTANCE CRITERIA

- 8.1 Samples will not be deemed acceptable if the proper procedures have not been followed.
- 8.1 Samples will not be deemed acceptable if the proper preservative measures have not been followed.
- 8.2 Samples will not be deemed acceptable if the chain of custody has been broken or compromised.
- 8.3 Samples will not be deemed acceptable if the documentation has been properly completed.
- 8.4 Samples will not be deemed acceptable if the bottles are not properly labeled, dated, and initialed by the sample collector.

9. ATTACHMENTS

- Attachment A. Map of storm-water runoff sampling locations, LLNL and vicinity
- Attachment B. Field Tracking Form for storm-water sampling

Storm-water runoff sampling locations, Livermore site and vicinity.

FIELD TRACKING FORM: SURFACE WATER SAMPLING - EMP-W-S-01

REVISION 2 FINAL	EMP-RO-L Storm-water Runoff Locations	Effective date: 01/04/93 Page 7 of 7
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Attachment B (Continued). Field Tracking Form for storm-water sampling (back side)

<u>Location Descriptions</u>	<u>Method of Analysis and Bottles</u>	<u>Preservative</u>
L-ALPE Arroyo Las Positas - E of LNL Greenville entrance	EPA 624 x2: 40ml-septum top-refrigerate	HCL
L-CD8 Central Drainage Basin	EPA 625 x2: 1000ml-Amber-Refrigerate	none
L-ALPW Arroyo Las Positas-NW boundary north of B196	DWP x4: 1000ml-Amber-Refrigerate	none
L-CRNE Greenville Rd. Northeast corner of LNL	Oil & Grease: 1000ml-Amber-Refrigerate	H2SO4
L-ASS2 Arroyo Seco - Sardinia Inlet to LNL across from B113, south side of East Ave.	C.O.D.: 1000ml-Amber-Refrigerate	H2SO4
L-4THA On site at the intersecto of 4th and A	Alpha/Beta: 1000ml Poly-Rinse	HNO3
L-B438 East of B-438 across from stairs.	Metals: 1000ml-rinse-filter-refrigerate	H2SO4
L-ALPN Arroyo Las Positas - N at Cowburn	TOC x4: 40ml-septum top-refrigerate	H2SO4
L-ASIW Vesco Rd - SW	NUTRIENTS: 500ml-refrigerate	none
L-WPDC Northwest area of the Lab buffer area - Patterson Pass road Buffer Key Needed	ANIONS: 500ml-rinse-refrigerate	none
	H.T.O.: 500ml-ground glass stopper	none

REVISION 2
FINAL

EMP-RO-L
Storm-water Runoff Locations

Effective date: 01/04/93
Page 6 of 7

Attachment B. Field Tracking Form for storm-water sampling.

FIELD TRACKING FORM: STORMWATER SAMPLING - EMP-W-S-01

ID	DATE	TIME	INITIALS	COMMENTS:
L-ALPE-01-RO				
L-CDB-01-RO				
L-ALPW-01-RO				
L-GRNE-01-RO				
L-ASS2-01-RO				
L-ATHA-01-RO				
L-BAG8-01-RO				
L-ALPN-01-RO				
L-ASW-01-RO				
L-WPDC-01-RO				Buffer key needed
L-QA-____-RO				____-D1-RO
L-QA-____-RO				____-F1-RO (Field Blank)
L-QA-____-RO			N/A	L-QA-T1-RO (Trip Blank)

C.O.C.	LAB

Design Change Package EMP-RO-S-001

Storm Water Runoff Sampling

Effective Date: June 8, 1994

Prepared by: Erich Brandstetter 6/8/94
Erich Brandstetter
Environmental Analyst
date

Approved by: Lucinda M. Garcia 6/8/94
Lucinda M. Garcia,
Quality Assurance Coordinator, EMS
date

Approved by: Bill Hoppes 6/8/94
Bill Hoppes,
WGMG Group Leader
date

Approved by: Rebecca A. Failor 6/8/94
Rebecca A. Failor,
Section Leader, EMS
date

1. DISCUSSION

Section B of the General Industrial Activity Permit states that samples should be obtained within the first half-hour of flow. If the flow ceases within the first hour of discharge, however, the runoff is not considered to be a "significant storm water discharge," and samples are not required. Furthermore, the General Permit specifies that "If collection of the grab sample during the first 30 minutes is impracticable, the grab sample can be taken as soon as practicable thereafter, and the discharger shall explain in the annual monitoring report why the grab sample could not be taken in the first 30 minutes." Given the manpower resources available for storm water monitoring, and the distance between sampling locations, it is understood that obtaining samples within the first half hour of flow at all locations is, in fact, impracticable. It is nevertheless important that not only the time of sampling be recorded, but also an estimate of the time that flow began. In the event that flow ceases within an hour, this should also be documented.

2. PROCEDURE CHANGE

The wet season observation form is modified to add recording of flow start time and (if flow stops prior to one hour) flow stop time.

NPDES WET SEASON OBSERVATION FORM

Storm Water Monitoring Program
Record of Observation

IDENTIFY ANY: SUSPENDED MATERIALS, FLOATING OBJECTS,
OIL & GREASE, TURBIDITY, DISCOLORATIONS, ODOR OR ANY UNNATURAL SUBSTANCE.
DESCRIBE SURROUNDING AREA

Date:

Time:

Name of Observer:

Location:

Floating or Suspended Materials Present:

☐

yes

☐

no

Kind of Material:

Amounts:

Oil and Grease:

Comments:

☐

yes

☐

no

Discolorations:

Description:

☐

yes

☐

no

Odor:

Description:

☐

yes

☐

no

Turbidity:

Measurements:

Temperature: _____

pH: _____

(Optional) Water Flow rate: _____

Flow start time: _____

Flow stop time: _____ (* record flow stop time if flow stops prior to one hour)

Other Comments: _____

EMP-RO-S

STORM WATER RUNOFF SAMPLING

Prepared by: Rhonda J. Welsh 5-16-94
Rhonda Welsh date
Environmental Technologist, TSG

Reviewed by: Duke Ramsey 5-16-94
Duke Ramsey date
Environmental Technologist, TSG

Eric Christofferson 5-16-94
Eric Christofferson date
Environmental Analyst, WGMG

Karen Folks 5-18-94
Karen Folks date
Environmental Analyst, WGMG

Approved by: Rebecca A. Failor 5-18-94
Rebecca A. Failor date
Section Leader, EMS

William G. Hoppes 5-18-94
William G. Hoppes date
Group Leader, WGMG

Lucinda M. Garcia 5-27-94
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes the requirements and methods for collecting storm water runoff samples at the Livermore site and Site 300 to meet the requirements of the Laboratory's California General Industrial Activity Storm water Permit (Reference 1, Section B) and the monitoring requirements of DOE Order 5400.1 (Reference 2).

2. DISCUSSION

The Federal Clean Water Act [Section 402(p)] requires industries to obtain National Pollutant Discharge Elimination System (NPDES) permits for discharges of storm water associated with industrial activity to navigable waters of the United States. Storm water discharges associated with industrial activity at LLNL are covered by the California General Industrial Activity Storm water Permit. Section B of this permit includes requirements for a comprehensive storm water monitoring and sampling program. This permit requires that storm water runoff samples be collected and analyzed from two storm events that produce significant storm water discharge during each wet season (October through April). The sampling events preferably include the first storm of the season. Monitoring required by Section 13b of the General Permit is not required to be performed during severely adverse climatic conditions or more than two hours after the end of scheduled facility operating hours. Compliance (NPDES) storm water monitoring is required at both the Livermore main site and at Site 300.

Storm water runoff and other surface water monitoring at the Livermore site are also required by DOE Order 5400.1, which states, "Environmental surveillance shall be conducted to monitor the effects, if any, of DOE activities on on-site and off-site environmental and natural resources." DOE-mandated monitoring is performed every other month during the rainy season, not to exceed four storms per year. Two of the storms monitored to meet DOE requirements will be combined with the two storms sampled to meet the requirements of the General Permit.

Sampling and analysis requirements for the Livermore site are defined in Attachment A of this procedure. Sampling and analysis requirements for Site 300 are defined in Attachment B. Rain samples are taken concurrently with storm water samples as specified in these attachments and Reference 10.

This procedure specifically applies to collecting storm water runoff samples and does not apply to other process water discharge sampling, to ground water sampling mandated by the California Regional Water Quality Control Board (RWQCB), or to the ground water sampling procedures outlined in EMP-GW-S.

NOTE: Because sampling occurs during rainstorms, the sampler must be aware of hazards, such as wet rocks, slippery muddy slopes, limited visibility, and rushing water. It is recommended that this sampling be done by a team of at least two qualified persons who have met the specific training and experience requirements for the position or tasks.

5. RESPONSIBILITIES

5.1 EMS SECTION LEADER

The EMS Section Leader ensures that sampling methods meet regulatory guidance and that sampling is conducted according to approved procedures.

5.2 WGMG GROUP LEADER

The Group Leader checks that ensuring that sampling methods conform to regulatory requirements and that sampling is conducted according to approved procedures. The Group Leader also assigns responsibility for the runoff network to an Environmental Analyst.

5.3 WGMG ENVIRONMENTAL ANALYST

The Environmental Analyst is responsible for designing appropriate sampling methods and communicating them to technologists, evaluating the resulting data considering regulatory requirements, and designing changes in sampling methods where appropriate. These tasks may be delegated to the WGMG Analyst Assistant, as appropriate.

5.4 TSG TECHNOLOGIST

The technologist is responsible for collecting samples according to approved procedures.

6.2. STORM WATER RUNOFF SAMPLING

6.2.1. PRE-SAMPLING ACTIVITIES

Bottles and labels should be prepared before sampling.

Requirements for preparation of bottles are given in Reference 3. The list of analytes to be sampled for each sampling event are given in Attachments A and B. Bottles and labels are usually prepared at the end of the quarter before the quarter in which storm water runoff sampling will occur and placed in sampling kits, ready to be taken into the field. Sampling kits contain sampling equipment, blank forms, and bottles prepared for each sampling location.

6.2.2. STANDARD EMS FIELD SAMPLING PROTOCOL

6.2.2.1. Wear disposable gloves when collecting samples, and discard gloves between locations.

6.2.2.2. Take special precautions to not introduce any external contamination or cross-contamination into samples. This includes keeping the work area clean, not placing open sample bottles or caps on any surface (vials and bottles should remain capped until used), and not touching the inside of sample bottles.

6.2.2.3. Do not place generators in the same vehicle as the sample bottles, if at all possible.

6.2.2.4. If a second vehicle is not available for the generator, place the ice chests containing samples in large plastic bags.

6.2.2.5. Wear disposable gloves when handling generators.

6.2.2.6. Place generator downwind of the sampling area when possible.

6.2.2.7. Calibrate the pH meter in the transportainer according to the procedure described in EMP-GW-CA (Reference 4), before going to the field. Record calibration information on the FTF.

6.2.2.8. In general, the sampling order should be volatile organics (EPA 624 and 625), TOC and TOX when required, followed by all other analytes with metals being sampled last.

6.2.2.9. Sampling is performed either by dip sampling or by grab sampling. The method to be used depends upon access, water flow, and other conditions and usually must be determined by the technologist at the time of sampling.

6.2.3. PROCEDURE FOR DIP SAMPLING

6.2.3.1. Triple rinse the stainless-steel bucket and handle with the water to be sampled.

6.2.3.2. Dip or submerge the bucket into the water to be collected and withdraw in a smooth motion. Avoid sampling near the edge of surface water bodies to minimize the collection of sediment that may be present in the sample matrix.

6.2.3.3. Sample vials for volatile organics must be filled immediately. Do not use the field filtration unit to fill these vials.

6.2.3.4. Samples for metals must be filtered. Collect the sample in the stainless-steel bucket, then pour into the container attached to the field filtration unit to filter these samples. Triple rinse the bucket and rinse or flush the filtration unit with the water to be sampled before collecting samples.

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requirements and the procedure to be followed for shipping samples off-site for analysis are defined in References 6 and 9.

6.6. WET SEASON OBSERVATION

6.6.1. During the wet season (October through April), visual observations of all storm water discharge locations defined in EMP-RO-L (Reference 7) should be taken during the first hour of one storm event per month that produces significant discharge (continuous flow for at least one hour) during daylight hours. This should occur monthly and coincide with sampling events when applicable. These observations should identify the presence of discoloration, floating and suspended materials, oil and grease, turbidity, odor, and any other unnatural substances.

6.6.2. Record all observations, locations observed, time, date, time storm started, name of observer, and comments containing any additional observations that might indicate contamination of the storm water runoff on the Wet Season Observation Form. A sample Wet Season Observation form is given in Attachment J.

6.6.3. If discoloration, excessive debris, oil sheen, odor, or other indications of contamination of the storm water runoff are present, contact the responsible Environmental Analyst immediately so that the problem can be investigated and appropriate corrective action can be initiated, if required, to avoid an off-site discharge.

6.7. DRY SEASON OBSERVATION

6.7.1. During the dry season (May through September), conduct two visual observations and/or test for the presence of non-storm water discharges at all storm water discharge locations specified in EMP-RO-L (Reference 7). If any such discharges are identified, the sampler should contact the responsible Environmental Analyst and be prepared to take samples if the Analyst requests them. Dye tests, TV line surveys, and/or analysis and validation of accurate piping schematics are some of the tests that may be requested.

6.7.2. Identify and document the presence of stains, sludge, odor, and any other unnatural substances.

6.7.3. Record all observations, description of method used, type of observation (usually visual), locations observed, time, date, name of observer, and applicable test results on the Dry Season Observation Form. A Sample Dry Season Observation Form is given in Attachment K.

7. DOCUMENTATION/QA RECORDS

All documentation and records related to storm water runoff sampling must meet the requirements of EMP-QA-SD (Reference 5) and EMP-QA-DC (Reference 9).

7.1. FIELD TRACKING FORM (FTF)

The FTF must be completed while samples are being collected. The sampler must enter the date and time of each sample, their initials, any comments of interest concerning the sample, the location of the QA duplicate, and the corresponding COCs and the labs the samples were sent to in the spaces provided. For compliance samples, the pH reading must also be recorded. Examples of completed FTFs are included in Attachments C and D.

ATTACHMENT A: SAMPLING SCHEDULE AND ANALYTES

LIVERMORE MAIN SITE STORM WATER

First Event Compliance and Surveillance	Second Event Surveillance Only	Third Event Surveillance Only	Fourth Event Compliance and Surveillance	Notes
Anions	Anions	Anions	Anions	
COD	COD	COD	COD	
DWP	DWP	DWP	DWP	
EPA 624	EPA 624	EPA 624	EPA 624	
EPA 625	EPA 625	EPA 625	EPA 625	
GENMIN			GENMIN	Request TSS on COC (conductivity and pH are included in the GENMIN analysis)
Gross Alpha	Gross Alpha	Gross Alpha	Gross Alpha	
Gross Beta	Gross Beta	Gross Beta	Gross Beta	
Metals	Metals	Metals	Metals	
Oil and Grease	Oil and Grease	Oil and Grease	Oil and Grease	
pH			pH	Take pH in the field
TOC	TOC	TOC	TOC	
Tritium	Tritium	Tritium	Tritium	

Compliance Sampling

First Event should be the first storm of the wet season in which there is significant discharge (continuous flow for at least one hour). Fourth event should preferably be the final storm of the wet season in which there is significant discharge. If samples have been obtained and flow ceases before one hour of significant discharge, samples should be discarded. Compliance sampling can take place during or up to two hours after scheduled facility operating hours (8 am to 5 pm, Monday through Friday, excluding holidays). Wet weather observations are to occur simultaneously with compliance sampling events and monthly when no sampling occurs, as long as there is continuous flow for at least one hour prior to the observation. Dry weather observations are required twice during the dry season (May through September) at all discharge points designated in EMP-RO-L (Reference 7).

Surveillance Sampling

Surveillance sampling is to be done every other month, not to exceed four storms per year. The first and last compliance sampling events are coordinated with compliance sampling.

Rain Sampling

Rain sampling at the Livermore site is to be done concurrently with each storm water sampling event (both compliance and surveillance). See EMP-RA-S (Reference 10).

ATTACHMENT C: SAMPLE FIELD TRACKING FORM FOR LIVERMORE SITE

NPDES/SURVEILLANCE FIELD TRACKING FORM: STORMWATER SAMPLING - EMP-W-S-02 REVISION 10/25/93

ID	DATE	TIME	INITIALS	COMMENTS:
L-ALPE-01-RO	11-10-93	0950	RLW	HIGH FLOW
L-ALPO-01-RO	11-10-93	1015	RLW	LOW FLOW
L-ASS2-01-RO	11-10-93	1040	RLW	GOOD FLOW
L-ASW-01-RO	11-10-93	1033	RLW	MEDIUM FLOW
L-COU-01-RO	11-10-93	1050	RLW	LOW FLOW
L-GRE-01-RO	11-10-93	1055	RLW	LOW FLOW
L-WPDC-01-RO	11-10-93	0930	RLW	HIGH FLOW
L-QA-12-RO	11-10-93	0942	RLW	L-REC-01-RO
L-QA-1-RO				L-1-01-RO

C.O.C.	LAB
2970	CLS

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ATTACHMENT D: SAMPLE FIELD TRACKING FORM FOR SITE 300

IO	DATE	pH	TIME	INITIALS	COMMENTS:
3-NLIN-01-RO	2/7/94	7.35	1627	RLW	~ 3 gpm flow - water clear
3-N829-01-RO	—	—	—	—	no flow no sample
3-N883-01-RO	2/7/94	7.05	1730	RLW	~ 3 gpm flow water clear
3-NPT6-01-RO	2/7/94	7.02	1821	RLW	no flow puddled water only
3-NSTN-01-RO	2/7/94	7.65	1710	RLW	High silt load gpm ~ 2
3-NPT7-01-RO	2/7/94	7.25	1600	RLW	water slightly brown ~ 2 gpm
3-QA-29-RO	2/7/94	7.00	1825	RLW	taken @ 3 NPT6

Tritium

Alpha/Beta

Spec. cond., pH; TOC; HE (3-N829 only)

Uranium

TOX

Total Suspended Solids

C.O.C.	LAB
4049	CUS
4050	GTEL

pH Meter # 09 Calibration 4.0 = 4.08

7.0 = 6.95

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ATTACHMENT E: SAMPLE LABELS FOR LIVERMORE SITE AND SITE 300

California Laboratory Services

SAMPLE I.D. GENMIN	
LOCATION L-ALPO-01-RO	
PROJECT LLNL	
SAMPLED BY RLW	
DATE 2/7/94	TIME
PRESERVATIVES -	

3249 Fitzgerald Road, Rancho Cordova, CA 95742 • (916) 638-7301

California Laboratory Services

SAMPLE I.D. METALS	
LOCATION L-ALPO-01-RO	
PROJECT LLNL	
SAMPLED BY RLW	
DATE 2/7/94	TIME
PRESERVATIVES HNO₃	

3249 Fitzgerald Road, Rancho Cordova, CA 95742 • (916) 638-7301

LIVERMORE SITE

California Laboratory Services

SAMPLE I.D. TOX	
LOCATION 3-N883-01-RO	
PROJECT LLNL	
SAMPLED BY RLW	
DATE 2/7/94	TIME
PRESERVATIVES H₂SO₄	

3249 Fitzgerald Road, Rancho Cordova, CA 95742 • (916) 638-7301

California Laboratory Services

SAMPLE I.D. COND: pH	
LOCATION 3-N883-01-RO	
PROJECT LLNL	
SAMPLED BY RLW	
DATE 2/7/94	TIME
PRESERVATIVES -	

3249 Fitzgerald Road, Rancho Cordova, CA 95742 • (916) 638-7301

SITE 300

REVISION 2
FINAL

EMP-RO-S
Storm Water Runoff Sampling

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ATTACHMENT F: SAMPLE CHAIN-OF-CUSTODY FORM FOR LIVERMORE SITE
(COMPLIANCE ONLY)

M3704
page 1 of 1
4035

Chain-of-Custody Record

Laboratory: <u>CLS</u>		Project Name/Analyst: <u>Storm Water</u>		Sample Group Description	
Sampler: (signature) <u>Debra Ramsey</u>		Logbook ID No:		REMARKS	
Site	Location	Sample Identifier	Number of Containers	Analysis Requested	Remarks
L-ALPE	01-RO	1-24-94	16	As requested by EPA 200.7, Be by EPA 200.7, (best GFAA R.L.); Cd by EPA 200.7, Pb by EPA 200.7, Hg by EPA 200.7, Ag by EPA 200.7	(a) include: SO ₄ , Cl, CO ₃ , HCO ₃ , F
L-ASS2	01-RO		16		
L-ASW	01-RO		16		(b) EPA 608/615
L-CDB	01-RO		16		
L-GRVE	01-RO		16		(c) include T.S.S. with GEMMIN
L-WPDC	01-RO		16		
L-RA	06-RO		16		
L-ASW	01-RO		16		

Relinquished by Sampler:	Date/Time	Received by Courier at LML:
<u>Lawrence W. Paley</u>	1-25-94 1536	<u>[Signature]</u> 7-20
Relinquished by Courier to Lab:	Date/Time	Received at Laboratory:
<u>[Signature]</u> 7-20	1-24-94 1830	<u>[Signature]</u> 1-24-94 1830
Relinquished from Lab:	Date/Time	Date received by Analyst:
<u>Don M. Damm</u>	2/9/94 1413	<u>[Signature]</u>
Relinquished by Analyst:	Date/Time	Date received by Data Manager:
<u>[Signature]</u>	3/1/94	<u>Maria A. Handala</u>

Release Number: 1250280 TRR: T.R.R.

DISPOSITION OF COPIES (after signatures)
 Certified Sampler (signature) to analyst; other copies to courier or sampler;
 Public Laboratory (signature) to analyst upon receipt of samples; other copies to Laboratory or sampler;
 Client Analyst (signature) to Data Manager; other copies to analyst;
 Data Manager (signature) to Data Manager; other copies to analyst;
ALL SIGNATURES MUST BE MADE ON WHITE COPY

Environmental Monitoring Section
 Lawrence Livermore National Laboratory
 P.O. Box 808, L-621
 Livermore, CA 94551

Form OAP-8
 Rev. 5
 October 1993

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ATTACHMENT I: SAMPLE TRITIUM REQUEST AND WORK SHEET

University of California
Lawrence Livermore
National Laboratory

SAMPLE NUMBER _____

TRITIUM REQUEST AND WORK SHEET

DATE: 11-10-93 SUBMITTED BY: Rhonda Welsh

ORIGINATOR'S NO.: L-ALPE-01-20 ARGON PROTECTED: ☐ YES ☐ NO

DESCRIPTION: STORMWATER SOURCE: _____

SPECIAL INFO: _____

DISTILLATION: DATE _____ STATION _____ COMMENTS _____

ENRICHMENT: CELL _____ V_0 _____ ENRICH _____ NaOH LOT _____ & VOL _____

START _____ END _____ β = _____ POSITION _____

VAC. DIST.: DATE _____ BULB NO. _____ WATER _____ G WATER _____ ML

ALIQ. FACTOR _____ G/ML COMMENTS _____

GAS CONV.: DATE _____ TRAP _____ FURNACE _____ RUN _____ VOL _____

GPC DATE _____ AM/PM COUNTER _____ V_x _____ V_y _____ RT = _____

TEMP (C°) _____

P_{SAM} _____

P_{PRO} _____ 38.0

$P_{SAM} + P_{PRO}$ _____

P_{TOTAL} _____ 150.0

PIPET: DATE _____ A = _____ ML B = _____ ML POSITION _____

SET # _____

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ATTACHMENT K: SAMPLE DRY SEASON OBSERVATION FORM

NPDES DRY SEASON OBSERVATION FORM

Storm Water Monitoring Program
Testing for Non-Storm Water Discharge

IDENTIFY ANY: STAINS, SLUDGES, DISCOLORATION'S, ODORS OR ANY UNNATURAL SUBSTANCE. DESCRIBE SURROUNDING AREA	
Location: 3-NLIN-01-R0	
Surrounding Area: Clear of any unnatural substance and/or debris	
Date: 7/15/93	Time: 1401
Name of Tester(s): Rhonda L. Welsh	
Method(s) used: Visual Observation	
Test results:	
☒	No non-storm water discharge found.
☐	Non-storm water discharge found.
☐	Corrective Action taken.
Description of non-storm water discharge and any corrective action taken:	

EMP-RT-AL
RETENTION TANK ANALYSIS LIST UPDATE

Prepared by:

Shari Brigdon 10/22/93
Shari Brigdon date
WGMG Responsible Person

Reviewed by:

Joy Hirabayashi 11-1-93
Joy Hirabayashi date
Group Leader, EOG

Approved by:

Rebecca A. Failor 11/3/93
Rebecca A. Failor date
Section Leader, EMS

Bill Hoppes 11/1/93
Bill Hoppes date
Group Leader, WGMG

Lucinda M. Garcia 11/3/93
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

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REVISION 1 FINAL	EMP-RT-AL Retention Tank Analysis List Update	Effective date: 11/1/93 Page 2 of 16
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1. PURPOSE

This procedure provides Environmental Monitoring Section (EMS) personnel with the approved method for updating the Retention Tank Analysis List (RTAL) as part of the overall process of controlling releases to the sanitary sewer system. Appendix A includes an example of an RTAL. Figure 1 shows the steps to be followed in completing this procedure.

2. APPLICABILITY/DISCUSSION

This procedure applies to the distribution of the current issue of the RTAL, along with a cover letter requesting review and update, consolidation and incorporation of changes to the RTAL, maintenance of a historical file and record of changes to the RTAL, and distribution of copies of the updated RTAL.

3. REFERENCES

1. *Retention Tank Analysis List* (See an example attached as Appendix A.)
2. Grandfield, C. H. *Guidelines for Discharges to the Sanitary-Sewer System*, Lawrence Livermore National Laboratory, EPD, UCAR 10235, August 1989.
3. *Guidelines for Design and Operation of Retention Tank Systems*, Lawrence Livermore National Laboratory, EPD, 1990.
4. EMP-RT-RA, *Retention Tank Release Authorization*.
5. EMP-QA-DC, *Document Retention*.

4. DEFINITIONS

Retention tank: A tank used to contain wastewater that may contain constituents that exceed applicable sanitary sewer discharge limits.

Retention-tank system: Wastewater storage tanks, ancillary equipment, and containment system.

Retention Tank Analysis List (RTAL): A list of retention tanks showing constituents requiring analysis to determine whether or not wastewater can be discharged to the sanitary sewer system.

5. RESPONSIBILITIES

5.1 EMS SECTION LEADER

The EMS Section Leader approves this procedure for use and ensures that it complies with pertinent regulations and LLNL policies and procedures.

5.2 WATER GUIDANCE AND MONITORING GROUP (WGMG) GROUP LEADER:

The WGMG Group Leader ensures that this procedure complies with pertinent regulations and LLNL policy and procedures, maintains a file that identifies the WGMG personnel who are trained and authorized to perform this operation, ensures that the work described in this procedure is performed by individuals sanctioned for this procedure, and reviews the forms and activities of this procedure to ensure that the operations are properly controlled and completed.

5.3 ENVIRONMENTAL OPERATIONS GROUP (EOG) LEADER

The EOG Group Leader reviews this procedure to verify consistency with the procedures of EOG.

5.4 EMS QA COORDINATOR:

The EMS QA Coordinator ensures that this procedure conforms to EMS and EMAD Quality Assurance requirements.

5.5 WGMG RESPONSIBLE PERSON (WGMG RP)

The WGMG RP develops, reviews, and performs the tasks described in this procedure. The WGMG Group Leader may be assigned other trained and sanctioned WGMG personnel in the absence of the WGMG RP.

5.7 ENVIRONMENTAL OPERATIONS GROUP ENVIRONMENTAL ANALYSTS (EOG EA)

Environmental Operations Group Environmental Analysts (EOG EAs) are responsible for reviewing building operations using the criteria list shown in Appendix C and submitting corrections to the RTAL as necessary.

5.8 TANK RESPONSIBLE PERSON (TANK RP)

The Tank Responsible Person (TANK RP) is responsible for arranging sample collection and, after appropriate notification, release to sanitary sewer. This employee is normally a Hazardous Waste Management (HWM) field technician but may be a Health and Safety (H&S) technician or other individual who has been designated as responsible for the tank.

6. PROCEDURE

6.1 RETENTION TANK ANALYSIS LIST UPDATE

6.1.1. To update the RTAL, the WGMG RP must perform the following required operations:

6.1.1.1. Approximately three weeks before the end of the each calendar quarter, send copies of the RTAL to the EOG Group Leader, with a cover letter requesting review and update of the RTAL (The EOG Group Leader will distribute these copies to each analyst in the group. Analyst's responses will be returned to the WGMG RP via the Group Leader). The cover letter should state the purpose of the request and include the date that the responses must be returned to the WGMG RP. The EAs should be given five to eight working days to complete their revisions and changes to the RTAL.

6.1.1.2. The cover letter should also include for update, a current distribution list (sample in Appendix B) for those receiving the RTAL. The cover letter must also make clear to the EAs that they must return the RTAL even if they do not have any changes to make.

6.1.1.3. Send informational copies of the RTAL and quarterly update cover letter to the WGMG and EO Group Leaders.

6.1.1.4. EOG EAs review the RTAL, with the programs they support, for their respective areas of responsibility in accord with Appendix C.

6.1.1.5. EOG EAs return the RTAL, signed and dated, to the WGMG RP with all changes noted. Mid-quarter and one-time changes to the RTAL should be made by memo as directed in Section 6.2 and 6.3. EOG EAs who do not make any changes to the RTAL must

still return it to the WGMG RP, dated and signed, with a note indicating that no changes are required.

6.1.1.6. If the allotted time for returning the revisions to the RTAL has passed, the WGMG RP should contact the EOG Group Leader and request the necessary response.

6.1.2. After receiving all RTALs, the WGMG RP must combine and incorporate all changes and revisions from the EOG EAs. Changes must be highlighted (boldface type) to distinguish them from the unchanged portions of the RTAL. In subsequent issues, the highlighted changes will be incorporated as permanent changes (boldface removed). The date on the revised RTAL must also be changed to reflect the most recent revision.

6.1.3. The WGMG RP will then arrange for copying and distribution of the updated RTAL with a cover letter explaining the purpose. The following groups and individuals should always be on the distribution list:

1. Operations & Regulatory Affairs Division (ORAD) Personnel
 - a. - EOG - all
 - b. - TACG - all
 - c. - PRAG - 1 copy
2. Environmental Monitoring & Analysis Division (EMAD) Personnel
 - a. - WGMG - all
 - b. - TSG - 2 copies
 - c. - Environmental Analytical Sciences (EAS) Section - 5 copies
 - d. - Radiation Analytical Sciences Section (RAS) - 1 copy
3. ES & H Team Leaders - one copy each
4. Hazardous Waste Management (HWM) Personnel
 - a. - Field Technician Supervisor and Field Technicians
 - b. - B514 Supervisor
 - c. - B612 Supervisor
 - d. - Requisition Tracking Office - 2 copies
 - e. - Process Engineer
 - f. - Operations - 2 copies
 - g. - Operation Control
5. Laboratory Counsel - 1 copy
6. Plant Engineering
7. Project manager, FY92 line item tank upgrade project

6.2. MID-QUARTER AND ONE-TIME CHANGES TO THE RTAL

Occasionally, EAs may submit long-term changes of constituents and tank status for the RTAL mid-quarter. The EA initiating the changes must immediately notify the TANK RP in writing and send a copy of the request to the WGMG RP. The WGMG RP must then write and distribute a memo informing those on the distribution list (see Section 6.1.4 above and Appendix B) of these changes to the RTAL and indicating that the changes will be incorporated into the next quarterly update of the RTAL. These necessary incidental changes to the RTAL do not replace the regular quarterly update.

One-time changes need not be reflected in the RTAL, but must be documented in a memorandum from the EA requesting the change with a copy to the WGMG RP, who will retain the memorandum with that RTAL documentation.

6.3. CHANGES TO STANDARD OPERATING PROCEDURE

If difficulty is experienced in following this procedure and the problem can not be resolved, the WGMG Group Leader should be contacted. If the changes require revision of this procedure, the EMS QA Coordinator should be notified.

7. DOCUMENTATION/QA RECORDS

Superseded RTALs, comments from EAs and Group Leaders, mid-quarter and one-time changes, as well as RTAL distribution lists are considered QA records and should be retained according to the requirements of Reference 5, EMP-QA-DC.

8. ACCEPTANCE CRITERIA

RTAL updates will not be valid unless all requirements defined in this procedure have been met.

9. ATTACHMENTS

Appendix A: Sample Retention Tank Analysis List (RTAL)

Appendix B: Sample RTAL Distribution List

Appendix C: Environmental Operations Group Procedures for Determining RTAL Constituents and Status Changes

Appendix D: Flow Chart of Procedures for Retention Tank Analysis Quarterly Update

Appendix A
Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Noncategorical

Building	Tank ID No.	Required Analyses	Required Containers
113	P2A1-east P2A2-west (profiled tanks)	Cu, Cr, Ni, Zn, Ag, 8010, pH.	2-A, 1-B
151	R1U1-west R1U2-east	Alpha, beta, H ³ , gamma, Cu, Cr, Ni, Zn, Pb, Cd, pH.	1-B, 1-C
175	R1A1, out-of-service R2A1	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Pb, pH.	1-B, 1-C
177	R1A1 R1A2 R2A1 R2A2	Alpha, beta, H ³ , gamma, CAM metals (TTL), 8010/8020, pH.	2-A, 2-C
190	shielding tank	Alpha, beta, H ³ , gamma, pH.	1-C
191	R1A1-west R1A2-east	Cu, Cr, Ni, Zn, Pb, Hg, pH.	1-C
194	*R1A1-east, out-of-service *R1A2-west, out-of-service	Alpha, beta, H ³ , pH.	1-C *collects rain water
212	R1A1	Alpha, beta, H ³ , pH.	1-C
222	R1A1 R1A2 R1A3 R1A4	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Hg, 8010, pH.	2-A, 2-C
226	R1A1-west R1A2-east	Alpha, beta, H ³ , pH, Cu, Cr, Ni, Zn, Ag, Pb, Cd, Be, 8010.	2-A, 1-B, 1-C

- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;

D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Appendix A (cont.)
Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Noncategorical Tanks (cont'd)

Building	Tank ID No.	Required Analyses	Required Containers
231	R1A1-west R1A2-east	Alpha, beta, H ³ , Be, Cu, Cr, Ni, Zn, 8010, pH.	2-A, 1-B, 1-C
235	R1U1, sump R1O1-north R1O2-south	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Be, Hg, pH.	2-C
241	R1A1 R1A2	Alpha, beta, H ³ , CAM metals(TTLC) including As, Se, Hg, Oil(ppm), 8010, pH.	2-A, 2-C, 1-E
251	R1A1-north R1A2-south R2U1-NW	Alpha, beta, H ³ , gamma, Cu, Cr, Ni, Zn, Pb, pH.	1-B, 1-C
253	R1A1-west R1A2-east	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Be, Hg, pH.	2-C
281	R1U1-east, out-of-service R1U2-west, out-of-service	Alpha, beta, H ³ , gamma, pH, Cu, Cr, Ni, Zn.	1-B, 1-C
291	Cooling tower	Cu, Cr, Ni, Pb, Zn, pH.	1-B
292	R1U1, out-of-service	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, Ti, 8010, oil-ppm, pH.	2-A, 1-B, 1-C, 1-E
298	R1A1	Alpha, beta, H ³ , Cu, Ag, Be, Hg, Pb, 8010, oil-ppm, pH.	2-A, 2-C, 1-E
321C	R1O1-north R1O2-south R1U1-sump	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Pb, Be, 8010, pH.	2-A, 1-B, 1-C
325	Cooling tower	Cu, Cr, Ni, Pb, Zn, pH.	1-B
332	R1U1-north R1U2-south	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Ag, pH.	1-B, 1-C

- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Appendix A (cont.)
Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Noncategorical Tanks (cont'd)

Building	Tank ID No.	Required Analyses	Required Containers
365	R1A1-east R1A2-west	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, 8010, pH.	2-A, 1-B, 1-C
377	R1U2-east, out-of-service R1U1-west, out-of-service	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, 8010, pH.	2-A, 1-B, 1-C
418	Paint booth No. 1 Paint booth No. 2	Cu, Cr, Ni, Zn, Ag, Pb, Cd, Hg, pH, 8010/8020.	2-A, 1-C
423	shielding tank-not in use	pH, CAM metals, 8010/8010, oil-ppm	2A, 1C, 1E
431	To be determined	Cu, Cr, Ni, Pb, Zn, pH, 8010, PCB, oil-ppm.	2-A, 1-B, 3-E,
435	Cooling tower	Cu, Cr, Ni, Zn, pH.	1-B
490	R3U1, profiled R4U1, profiled	Cu, Cr, Ni, Zn, Pb, 8010, oil- ppm, pH.	2-A, 1-B, 1-E
	R1U3, sump R1U1-south, sump	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, oil-ppm, pH.	1-B, 1-C, 1-E
	R1U2-mid R2U1-north	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, oil-ppm, pH.	1-B, 1-C, 1-E
491	R1U1	Cu, Cr, Ni, Zn, pH, Flash Point	1-C
	R2A1 R2A2	Alpha, beta, H ³ , CAM metals (TTLC), 8010/8020, pH.	2-A, 2-C
492	R1U1, sump R1A1,	Cu, Cr, Ni, Pb, Zn, 8010, pH, oil-ppm, Flash Point.	2-A, 1-C, 1-E

- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;

D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

REVISION 1 FINAL	EMP-RT-AL Retention Tank Analysis List Update	Effective date: 11/1/93 Page 9 of 16
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Appendix A (cont.)
Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Noncategorical Tanks (cont'd)

Building	Tank ID No.	Required Analyses	Required Containers
514	R5A1-north R5A2-north mid R5A3-south mid R5A4-south R5A5-east R5A6-west R5O1	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Be, pH, 8010/8020, oil-ppm. Add CN to all PTS samples. For Categorical wastes, substitute 624/625 for 8010/8020.	2-A, 1-B, 1-C, 1-E 1-C 2-A, 1-B, 1-C, 3-E
	R4A1-DO1 R4A2-DO2	*Alpha, beta, H ³ , pH	1-C *If more analyses are needed, contact EAS for proper containers
	R6A1-DO3	*Alpha, beta, H ³ , pH	1-C *If more analyses are needed, contact EAS for proper containers
612	R1A1, out-of-service	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, pH, oil-ppm.	1-B, 1-C, 1-E
663	R1A1-north R1A2-south	Cu, Cr, Ni, Zn, Be, pH.	1-B

- Bold letters designate tanks that have had changes made.
- **Deleted** designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Appendix A (cont.)
Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Categorical Tanks

Building	Tank ID No.	Required Analyses	Required Containers
131	R1A1-east R1A2-west R1U2	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Ag, Pb, Cd, As, CN, F, pH, 624/625.	2-A, 3-C, 2-E
141	R2O1 (TLW 3) R2O2 (TLW 4) R1O1 (TLW 5) R1O2 (TLW 6) R3O1 (TLW 1) R3O2 (TLW 2) (Profiled except for pH)	Cu, Cr, Ni, Zn, Pb, Cd, Ag, CN, 624/625, pH. This process now uses a TTU from Erickson Environmental pH-only	2-A, 2-C, 2-E
	R4A1-east, R4A2-west (semicond. tanks)	Cu, Cr, Ni, Zn, Pb, Cd, Ag, CN, pH, 624/625.	2-A, 1-C, 2-E
153	R1O1 R1O2	Cu, Cr, Ni, Zn, Ag, Pb, Cd, As, CN, F, pH, 624/625.	2-A, 2-B, 2-C, 2-E
161	R1A1, out-of-service	Cu, Ce, Er, Hg, Pb, CN, pH, 8010. Substitute 624/625 for 8010 and add Cr, Zn, Ni, Ag, Cd if this waste is to go to sewer.	2-A, 2-C, (2-E)
322	R2O1-north R2O2-south	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Pb, Cd, Ag, CN, pH, 624/625. Take duplicate and send in for CAM metals (do not hold up tank discharge for CAM results).	2-A, 2-C, (2-C for CAM metals) (2-E)

- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Appendix A (cont.)
Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Site 300 Retention Tanks

Building	Tank ID No.	Required Analyses	Required Containers
801	R2A1 R2A2	pH, alpha, beta, H ³ , 8010/8020, oil-ppm.	2-A, 1-C, 1-E
	R3O1*	Cu, Cr, Ag, Cd, pH.	1-B
817*	R1A1	8010/8020, HMX, TATB.	3-A
819	P1A1-P1A5	Cu, Cr, Ni, Pb, Zn, Hg, pH, 8010/8020, oil-ppm.	2-A, 1-C, 1-E
823*	R1U1	Cu, Cr, Cd, Ag, pH.	1-B
826*	NEW	8010/8020, TATB, HMX, DMSO, acetone.	3-A
825*	NEW	8010/8020, TATB, HMX, DMSO, acetone.	3-A
827C*	R1A1	8010/8020, TATB, HMX, DMSO, acetone.	3-A
827E*	NEW		
828*	R1A1 R2A2	TATB, HMX, 8010/8020.	3-A
843	P1A1 P1A2	pH, Cu, Cr, Ni, Zn, 8010/8020, oil-ppm.	2-A, 1-B, 1-E
	P2A1	H ³ , pH, Cu, Cr, Ni, Zn, 8010/8020, oil-ppm.	2-A, 2-B, 1-E
851*	R1A1,	Cu, Cr, Ag, Cd, pH.	1-B
865	R1A1-NW R1A2-mid R1A3-SE	Cu, Cr, Ni, Zn, Ag, Pb, Cd, Oil- ppm, 8010/8020.	2-A, 1-B, 1-E
872	P2A1-west, P2A2-east	Cu, Cr, Ni, Zn, Hg, Cd, Ag, Pb, pH, 8010/8020.	2-A, 1-C

* These tanks discharge into surface impoundments.

- ~~Online~~ letters designate Categorical Tanks. These tanks must meet more strict (federal) pretreatment discharge limits to be discharged to the sanitary sewer.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Appendix A (cont.)
Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Site 300 Retention Tanks (cont'd)

Building	Tank ID No.	Required Analyses	Required Containers
875	P2A1-west P2A2-east	Cu, Cr, Ni, Zn, Cd, Ag, Pb, CN, pH, 624/625.	2-A, 1-C, (2-E)
879	R1A1-SW R1A2-NE	Cu, Cr, Ni, Pb, Zn, pH, 8010/8020, oil-ppm.	2-A, 1-B, 1-E

- * These tanks discharge into surface impoundments.
- * ~~Outline~~ letters designate Categorical Tanks. These tanks must meet more strict (federal) pretreatment discharge limits to be discharged to the sanitary sewer.
- * Normality needs to be done on all tanks with a pH of <5 or >10.
- * Bold letters designate tanks that have had changes made.
- * ~~Bold~~ designates deletions that have been made.
- * "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- * () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- * When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- * Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Appendix B
Sample of RTAL Distribution List

Distribution:

Environmental Monitoring and Analysis Division

Environmental Monitoring Section-Becky Failor (L-629)
Water Guidance and Monitoring-Bill Hoppes (L-629)
Shari Brigdon (L-629)
Karen Folks (L-629)
Al Grayson (L-629)
Rob Vellinger (L-629)
Technical Support Group-Duane Rueppel (L-629)
Kim Stanford (L-629)
Environmental Analytical Sciences Section-Price Russ (L-310)
Supervisor-Dave Silberman (L-311)
Darrell Pugh (L-310)
Roz Swansiger (L-310)
Sampling Team Supervisor-Susan Gagner (L-311)
Radiation Analytical Sciences Section-Howard Hall (L-233)

Operations & Regulatory Affairs Division

Environmental Operations Group-Joy Hirabayashi (L-633)
Blair Barnett (L-633)
Mo Bissani (L-633)
Dawn Chase (L-633)
Terry Chukwueke (L-633)
Michelle Corcoran (L-633)
Tony Gabrielli (L-633)
Richard Michalik (L-633)
Willie Montemayor (L-633)
Dennis Peifer (L-633)
Stan Terusaki (L-633)
Joe Woods (L-633)
Tank Assessment & Guidance Group-Sabre Coleman (L-633)
Bruce Campbell (L-633)
David Castro (L-633)
Dave Graser (L-633)
Marion Heaton (L-633)
Rick Henry (L-633)
Bill Schwartz (L-633)
Permits Group-Steve Cerruti (L-627)

Hazardous Waste Management Division

Field Support-Supervisor-Jayne Tonowski (L-620)
-Field Techs(10)
B514 Supervisor-Scott Kidd (L-618)
Rob Tageson (L-620)
B612 Supervisor-Wendell Kelley (L-620)
Process Engineer-John Bowers (L-620)
Req. Tracking Office-Chris Carlson(2) (L-620)
Procedures Office (L-620)
Operations-Jean Maltby (L-620)
Operations Control Group-Rod Hollister (L-620)

Appendix B (cont.)
Sample of RTAL Distribution List

Hazards Control

Safety Team Leaders (7) (L-383)

Laboratory Counsel

KathrynRauhut (L-701)

Plant Engineering

Erik Brown (L-654)

Appendix C
Environmental Operations Group Procedures to Determine RTAL Constituents
and Status Changes

The following procedures are used by the Environmental Operations Group Environmental Analysts to establish the constituents and permanent changes in tank status to be listed on the Retention Tank Analysis List (RTAL):

1. Review, with program personnel, the processes within the building that could discharge to the retention system and subsequently to the sanitary sewer system.
2. Review the waste streams within the building.
3. Review suspected contaminants within the waste streams.
4. Review potential pathways of disposal for the waste streams; i.e., release to sanitary sewer or treat as hazardous waste.
5. Review hazardous materials handled in the building.
6. Review waste streams with generators at the point sources.
7. Identify potential categorical processes within the building.
8. Identify permanent changes (additions and removals) of retention tank systems.

Before establishing the analysis criteria for the RTAL, the EOG EA makes revisions by repeating one or more of the above steps as necessary. These activities are required when the EOG EA is informed by the LLNL programs of permanent changes to tanks or of process changes or other events that may alter the characteristics of the wastewater in retention tanks. Such information is acquired by the EOG EA from ES&H team meetings, program meetings, plant engineering job validations meetings, building inspections, and from other sources.

Appendix D. Flow Chart of Procedures for Retention Tank Analysis Quarterly Update

Design Change Package EMP-RT-RA-001

Retention Tank Release Authorization

Effective Date: March 8, 1994

Prepared by:

Shari Brigdon 3/7/94
Shari Brigdon, date
WGMG Responsible Person

Approved by:

Lucinda M Garcia 3/7/94
Lucinda M. Garcia, date
Quality Assurance Coordinator, EMS

Approved by:

Bill Hoppes 3/7/94
Bill Hoppes, date
WGMG Group Leader

Approved by:

Rebecca A. Failor 3/7/94
Rebecca A. Failor, date
Section Leader, EMS

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MONITORING SECTION
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1. DISCUSSION

An error was found in Table 2 of EMP-RT-RA. Units for gross alpha/gross beta were given as mCi/1000 L. These units should have been μ Ci/1000 L.

2. PROCEDURE CHANGE

Replace Table 2 on page 14 of Revision 2 of EMP-RT-RA with the following:

Table 2. LLNL's internal discharge limits for radioisotopes in wastewaters (from *Guidelines for Discharges to the Sanitary-Sewer System*).

Parameter	Individual discharges	Total daily limit for site
Gross alpha	0.3 μ Ci/1000 L	5.0 μ Ci
Gross beta	3.0 μ Ci/1000 L	50.0 μ Ci
Tritium	5.0 mCi/1000 L	100.0 mCi
Gamma ^a		

^a There is no gross gamma limit; isotope-specific limits apply. A list of isotopic limits is available from the WGMG RP.

EMP-RT-RA

RETENTION TANK RELEASE AUTHORIZATION

Prepared by:

Shari Brigdon 10/20/93
Shari Brigdon date
WGMG Responsible Person

Reviewed by:

Allen Grayson 10-20-93
Allen Grayson date
WGMG Analyst

Joy Hirabayashi 11-1-93
Joy Hirabayashi date
Group Leader, EOG

Approved by:

Bill Hoppes 11/1/93
Bill Hoppes date
Group Leader, WGMG

Rebecca A. Failor 11/3/93
Rebecca A. Failor date
Section Leader, EMS

Lucinda M. Garcia 11/3/93
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

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MONITORING SECTION
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1. PURPOSE

This procedure provides Water Guidance & Monitoring Group (WGMG) personnel in the Environmental Monitoring Section (EMS) with the approved method for authorizing the release of retention tank contents to the sanitary sewer system. Figure 1, Flow Chart of Procedures for Retention Tank Release Authorization, shows the steps to be followed in the procedures for retention tank release authorization. Two figures in Appendix A, adapted from Figures F-1 and F-2, Appendix F, in *Guidelines for Discharges to the Sanitary-Sewer System* (UCAR-10235, August 1989), highlight the activities of the WGMG Responsible Person (WGMG RP) in completing the retention tank release authorization procedures for Site 300 and the Livermore site respectively.

2. SCOPE

This procedure addresses the following activities:

- Gathering sample analysis data.
- Reviewing data to determine if tank contents are within the acceptable discharge limits.
- Filling out the Retention System Disposition Record (RSDR).
- Distributing the RSDR and sample data.
- Logging in the results and filing the completed RSDR.

3. REFERENCES

1. EMP-RT-AL, *Retention Tank Analysis List Quarterly Update*
2. HWM 504, *Retention Tank Pumpouts*
3. EMP-QA-DC, *Document Retention*
4. EMP-QA-NCR, *Nonconformance Reporting*
5. *Guidelines for Discharges to the Sanitary-Sewer System*, EPD, Grandfield, C. H., UCAR-10235, Lawrence Livermore National Laboratory, Livermore, CA, August 1989
6. *Guidelines for Design and Operation of Retention Tank Systems*, EPD, UCRL-AR-103976, Lawrence Livermore National Laboratory, Livermore, CA, June 1993
7. *Waste Accumulation Area (WAA) Contingency Plans*, EPD, Chase and Felicitas, UCRL-AR-110233, Lawrence Livermore National Laboratory, Livermore, CA, July 1993
8. *Spill Prevention Control and Countermeasures (SPCC) Plan for the Livermore Site*, EPD, ORAD, UCRL-MA-105699 Rev. 0; and *Spill Prevention Control and Countermeasures (SPCC) Plan for Site 300*, EPD, ORAD, UCRL-MA-105700 Rev. 0
9. *RCRA Part B Permit Application for Hazardous Waste Treatment and Storage Facility, Livermore Site*, EPD, UCAR-10275-93, Lawrence Livermore National Laboratory, Livermore, CA, April 1993
10. *Quality Assurance Plan for the Sewer Diversion Facility*, PE QA Plan M-078-30.8.2, Rev. 0

4. DEFINITIONS

Environmental Analytical Sciences (EAS) Lab: The on-site analytical laboratory used for non-radiological analysis of waste samples.

Holding time: The period of time during which a sample may be stored after collection and preservation without significantly affecting the accuracy of the analysis. Holding times vary by analysis. Many holding times have been defined by regulatory agencies.

Radiation Analytical Sciences (RAS) Lab: The on-site analytical laboratory used for radiological analysis of waste samples.

Release to sewer: The means by which the contents of the tanks of the retention-tank system are sent to the sanitary sewer system.

Retention System Disposition Record (RSDR): A four-part form used to document the final disposition of wastewater.

Retention tank: A tank used to contain wastewater that may contain constituents that exceed applicable sanitary sewer discharge limits.

Retention-tank system: Wastewater storage tank(s), ancillary equipment, and containment system.

Sewer Diversion Facility (SDF): A tank system at the northwest corner of the Livermore site used to redirect, hold, and release sewage that has been diverted for retention because of possible off-normal constituents and conditions above the City of Livermore permit limits. Treatment of nonhazardous levels of constituents may also be done. Hazardous concentrations will only be treated if properly permitted.

5. RESPONSIBILITIES

5.1 EMS SECTION LEADER

The EMS Section Leader approves this procedure for use and ensures that it complies with pertinent regulations and LLNL policies and procedures.

5.2 WGMG GROUP LEADER

The WGMG Group Leader ensures that this procedure complies with pertinent regulations and LLNL policies and procedures, ensures that the work described in this procedure is performed by trained and sanctioned individuals, and maintains a file that identifies WGMG and EMS personnel who are trained and sanctioned to perform this operation. The Group Leader also reviews the forms and activities to ensure that the operation will be properly controlled and completed and performs periodic assessments to ensure this procedure is followed and to identify problems.

5.3 EMS QUALITY ASSURANCE COORDINATOR

The QA Coordinator works with the WGMG RP to ensure this procedure conforms to EMS and EMAD standards for procedures. The QA Coordinator also maintains a file of current and superseded procedures and ensures that the procedure is revised as required.

5.4 WGMG RESPONSIBLE PERSON (WGMG RP)

The WGMG RP develops, reviews, and performs the tasks of this procedure. The WGMG Group Leader may assign other trained and sanctioned WGMG or EMS personnel in the absence of the WGMG RP.

5.6 TANK RESPONSIBLE PERSON (TANK RP)

The TANK RP is responsible for sample collection and either releasing tank contents to sanitary sewer or transferring contents to HWM for proper disposal. This employee is normally a Hazardous Waste Management (HWM) field technician but may be a Health and Safety (H&S) technician or other individual who has been designated as responsible for the tank. The TANK RP's name and phone number will be usually be listed on the EAS Waste Analysis Request Form in the "HWM Field Tech," "Send results to," or "generator" spaces.

In the case of the SDF, the Tank RP is the Plant Engineering (PE) Manager for Mechanical Utilities or designee for release to the sanitary sewer. A WGMG analyst/Technical Support Group (TSG) technician is responsible for sampling.

5.7 ENVIRONMENTAL OPERATIONS GROUP ENVIRONMENTAL ANALYST (EOG EA)

The EOG EA is responsible for working with LLNL programs to determine temporary or permanent changes to the Retention Tank Analysis List (RTAL) (see Reference 1, EMS-RT-AL).

Note: Reference or Sanctioned copies of this procedure can be obtained from the EMS QA Coordinator. Suggestions for revisions or any questions regarding the procedure can be directed to either the WGMG RP or the EMS QA Coordinator.

6. PROCEDURE

Equipment/Supplies - Located in the WGMG RP office

Blank RSDR forms (WGMG RP maintains a supply, reorders from TID when necessary)
Date Received Stamp
Categorical and Noncategorical stamps
Current internal discharge limits, permit limits, RTAL, DOE diversion criteria for radionuclides, etc., located in the Discharge Approval
References binder (Maintained by the WGMG RP)

6.1 PRE-OPERATIONAL ACTIVITIES

After the tank is sampled and the analyses completed, as requested by the Tank RP according to the requirements of the RTAL, the WGMG RP must gather together and date stamp pertinent, signed analytical data from all applicable sources (see examples below).

Environmental-Analytical Sciences (EAS) Laboratory—Bldg 226.

Radiation-Analytical Sciences (RAS) Laboratory—Bldg 151—data reported by EAS Laboratory.

ITAS Lab—Missouri—brought to WGMG RP by the Tank RP.

John Reynolds (C&MS) rain water analysis—brought to WGMG RP by the Tank RP.

6.2 RETENTION TANK RELEASE AUTHORIZATION OPERATIONS

To complete the retention tank release authorization procedure, the WGMG RP must perform the following required operations:

6.2.1. COMPARE ANALYTICAL REPORT(S) AGAINST RTAL

See Appendix B for a sample RTAL. If all the required analyses have not been requested, contact the HWM Operations Control Group or the Tank RP to determine the reasons for the inconsistency. Contact the EOG EA assigned to the Program area where the tank resides to determine if the inconsistency results from changes in the latest RTAL. To determine the appropriate EOG EA, contact the EOG secretary. The EOG EA, in conjunction with LLNL Programs and the WGMG RP, may make a decision, based upon the type of

waste being generated, to waive, permanently delete, or add an analysis. If a decision to waive is not given, call the laboratory performing the analysis and request them to complete the required analysis. If the laboratory does not have sufficient sample, or if the allowable holding time has been exceeded, have the Tank RP arrange for the collection and submittal of additional sample for analysis. The WGMG RP completing the retention tank release authorization procedure must receive written verification from the EOG EA if there is a decision to delete an analysis from the RTAL, whether the deletion is permanent or only for a particular instance.

6.2.2. CHECK TANK VOLUMES AGAINST THE DATABASE

The tank volume (in liters) should be included in the analytical report (To convert gallons to liters, multiply the number of gallons by 3.785). The volume reported should only match with volume listed in the Wastewater And Tank Systems (WATS) Database when the tank is full. The WGMG RP must verify volumes that don't compare reasonably with those on the Tank Database, as well as volumes that appear abnormal, with the Tank RP. If an incorrect volume has been given, call the Radiation Analytical Sciences Section (RAS) Lab Supervisor to give them the correct volume and ask for a corrected copy of the data. An incorrect volume will also affect the pH adjustment data computed by the EAS Laboratory. If this is the case, inform the EAS Lab Supervisor and ask for a corrected pH adjustment calculation. If time is of the essence, the WGMG RP may correct the calculations for the purpose of completing the RSDR, but should still contact the appropriate lab(s) and request a corrected report for the file.

6.2.3. COMPARE RADIOACTIVITY LEVELS

Compare radioactivity levels from the RAS to the EAS rad screening test results. If there is a significant difference, especially when either reported level is close to the limit for release to sanitary sewer, the RAS should be contacted to reconcile the difference.

6.2.4. COMPARE ANALYTICAL REPORTS TO ACCEPTABLE DISCHARGE LIMITS

Compare results listed on analytical reports against the acceptable discharge limits presented in Tables 1 and 2 (and Table 3 for SDF). Determine whether categorical or noncategorical limits apply using the RTAL. Categorical tanks are listed separately for the Livermore site and indicated by special outlined text font on the list of retention tanks at Site 300.

6.2.5. FILL OUT THE RETENTION SYSTEM DISPOSITION RECORD (RSDR)

Follow the instructions attached to the RSDR (Appendix C). Be sure to list the original tank number as well as the current container number when waste has been transferred from its original container. Double-check the data, comparing the results against the given detection limits. Occasionally, the analytical laboratories make errors, i.e., reported results will be less than the detection limit, or the detection limit may be above the discharge limit. Stamp each page of the RSDR with the label CATEGORICAL WASTE or NONCATEGORICAL WASTE, as applicable. (The stamps are kept by the WGMG RP.) If the tank contents can be released to the sanitary sewer, notify the HWM Operations Control Group (HWM OCG) or the Tank RP by telephone, ask if they want to pick up the RSDR or have it mailed (note the preference on the RSDR), and complete the steps in Section 6.2.6. If the tank contents cannot be released to the sanitary sewer, notify the HWM OCG or the Tank RP as described above. The HWM OCG will arrange for proper handling of the tank contents, according to Reference 2.

6.2.6. RECORD-KEEPING AND DISTRIBUTION OF RSDR

The WGMG RP completes the following steps to maintain accurate records and track the RSDR:

6.2.6.1. Photocopy all results of the sample analyses for distribution. Attach the original results to the goldenrod copy of the RSDR. These are retained and filed by the WGMG RP.

6.2.6.2. Attach a photocopy of the analytical report to the original (white) and remaining copies of the RSDR, notify the HWM OCG or the Tank RP that the RSDR is available for pick up, then place the RSDR in the mail if so instructed per section 6.2.5. In the case of the SDF, contact the Plant Engineering Operations Coordinator (shift foreman) on Ext 29762 to pick up the RSDR. If additional copies of the RSDR are requested, the requester(s) should be listed on the form and the photocopies should be marked "Information only."

6.2.6.3. Keep and update the distribution list for those receiving copies of the analytical reports and RSDRs on a regular basis. (One-time or short-term special requests need not be documented, but extra copies should be marked "Information only.")

6.2.6.4. Log the analytical information in the Retention Tank Log, retained by the WGMG RP.

6.2.6.5. Hold the goldenrod copy of the RSDR until the white copy (circulating copy) is returned with the required signature(s). When the white copy has been returned, attach it to the goldenrod copy. If, after 2 weeks, the white copy has not been returned, notify the HWM OCG or the Tank RP in order to expedite the signature process. If the white copy is returned incomplete, try to obtain the missing information from the HWM OCG or the Tank RP. If it is not possible to make the correction based on verbal communication (i.e., missing signature), photocopy the original and return it to the appropriate individual, requesting that the missing information be provided and the form returned to you. The photocopy may be discarded when the original is returned completed.

Do not file the form until all items have been completed correctly, or a determination is made that the form cannot be completed. If the form cannot be completed, or some discrepancy is identified, note these facts on the RSDR.

6.2.6.6. Record final release information from the white copy of the RSDR, such as final pH and/or discharge date, in the Retention Tank Log.

6.2.6.7. File the completed RSDR and the analytical results together in the Retention Tank Sample Results file, maintained by the WGMG RP or the EMS Document Retention Center, for five years.

6.2.7. SPECIAL CONSIDERATIONS—RAIN WATER

Rainwater samples from berms at HWM facilities have a special approval procedure (Reference, see Appendix D). After containing collected rain water from berms at HWM facilities, HWM must collect representative samples, arrange for analysis, and submit the analytical results to the WGMG RP to confirm that the rainwater is acceptable for release to sewer. Releases of rainwater from berms surrounding retention and storage tanks, drum storage areas, etc., other than those releases discussed above, are not covered by Appendix D.

Releases of rainwater from secondary containment other than from HWM facilities that does not meet the criteria for discharge to the storm sewer/ground must be containerized and characterized prior to final disposition. (See References 6, 7, 8, and 9 for criteria for discharges to storm sewer/ground.)

6.2.8. SPECIAL CONSIDERATIONS—SEWER DIVERSION FACILITY (SDF)

Figure 2 is a flow chart showing the steps to be followed in the procedure for retention tank release authorization when dealing with the SDF. When the WGMG Sewer

Monitoring Analyst (WGMG SMA) has verified that diversions made to the SDF contain constituents at levels above LLNL's Wastewater Discharge Permit limits (see Table 3), samples of the tank contents are taken by the WGMG SMA analyst or TSG technician for each tank containing diverted sewage. The constituents to be analyzed will be determined by WGMG SMA based on information obtained from the Bldg 196 monitoring station equipment and will be unique for each diversion. Reference is also made to the "Quality Assurance Plan for the Sewer Diversion Facility," PE QA Plan M-078-30.8.2, Rev. 0, (Reference 10) and Appendices B, C, and D (operation diagrams 1, 2, and 3) of that document (Appendix F).

This procedure, starting with Section 6.1, will be followed by the WGMG RP, with the special considerations noted above. If analytical results show the constituent concentrations to be at or below LLNL's Wastewater Discharge Permit limits, the WGMG RP notifies the Plant Engineering Operations Coordinator (shift foreman) on Ext 29762 verbally, followed by an RSDR, that there are no constraints on the time or rate of discharge. [Concentrations above Permit limits but at or below LLNL Internal Discharge limits (Tables 1 and 2) follow the same discharge constraints as other retention tanks (8 a.m. to 4 p.m., Mon-Fri of normal work week).]

When diversions to the SDF contain constituent concentrations above LLNL internal discharge limits, the WGMG RP may contact the Livermore Water Reclamation Plant (LWRP) at 373-5230 to determine if they will permit discharge of the material. If approved by the LWRP, the WGMG RP notifies PE verbally and by RSDR of the approval and any constraints imposed by the LWRP (e.g., flow rate, time of day of release; see Figure 3 for an example of a RSDR with constraints). If not approved by the LWRP, the WGMG RP verbally, and by RSDR, notifies PE to contact HWM for other treatment or disposal options.

6.2.9 SPECIAL CONSIDERATIONS—NON-RSDR RELEASES

Note that non-RSDR releases require special procedures and handling. These special procedures are documented by memoranda from the EOG EA for the concerned facility to the person responsible for the releases. (For current examples of these memos, see the WGMG RP.) Special release approvals must be verified annually by the EOG EA upon notification by the WGMG RP that review is due. A copy of each relevant memorandum is filed by the WGMG RP for audit purposes. They are then reviewed by the WGMG Group Leader as part of the annual review of this procedure.

6.3. CONTINGENCIES

6.3.1 CHANGES TO STANDARD OPERATING PROCEDURE

If difficulty is experienced in following this procedure and the problem can not be resolved, the WGMG Group Leader should be contacted. If the changes require revision of this procedure, the EMS QA Coordinator should be notified.

7. DOCUMENTATION/QA RECORDS

Quality assurance records created by the implementation of this procedure are collected, stored, and maintained by EMS according to the requirements of Reference 1. Quality assurance records include the following:

- The RTAL and comments by the EAs and Group Leaders
- Retention Tank Logbooks
- Original signed RSDR with analytical report attached
- Non-RSDR release memoranda

8. ACCEPTANCE CRITERIA

Release of retention tanks to the sanitary sewer will not be authorized unless all requirements defined in this procedure have been met. Release attempts which do not meet the requirements of this procedure will be documented on an NCR and resolved according to the procedure defined in Reference 2.

9. ATTACHMENTS

Figure 1:	Flow chart of procedures for retention tank release authorization (non-SDF)
Figure 2:	Flow chart of procedures for retention tank release authorization (SDF)
Figure 3:	Example of an RSDR with constraints
Table 1:	LLNL's internal discharge limits for nonradioactive parameters in waste waters from noncategorical and categorical processes
Table 2:	LLNL's internal discharge limits for radioisotopes in waste waters
Table 3:	City of Livermore's discharge limitations
Appendix A:	Livermore Site and Site 300 retention system release procedures
Appendix B:	Sample Retention Tank Analysis List (RTAL)
Appendix C:	Copy of RSDR with instructions
Appendix D:	Special approval procedures - HWM berm water
Appendix E:	Rain water analytical test
Appendix F:	Sewer Diversion Facility operations

Figure 1. Flow Chart of Procedures for Retention Tank Release Authorization (non-SDF)(sheet 1 of 2).

Figure 1. Flow Chart of Procedures for Retention Tank Release Authorization (non-SDF) (sheet 2 of 2).

Figure 2. Flow Chart of Procedures for Retention Tank Release Authorization (SDF) (sheet 1 of 1).

Figure 3. Example of an RSDR with constraints.

Retention System Disposition Record

(I) System Description

(a) Building Number: 193 (b) Date sampled: 7/28/93

(c) System Component (Include specific identification as necessary):

☒ Tank: 193-R101 ☐ Cooling Tower ☐ Other _____

☐ Tanker/Portable #: _____ ☐ Paint Booth

☐ Drum: _____ ☐ Carboy _____

(d) Lab Name/Sample ID #: HC 9309999 Requisition #: _____

Lab Name/Sample ID #: EAS 9309998 Volume (L): 11.355

Authorization Record of CATEGORICAL WASTE

(II) EPD—EMAD

(a) ☐ OK to release to sanitary sewer
☐ OK to release to sanitary sewer on H adjustment to 5-10 Add: _____
☐ May not be released to sanitary sewer due to high _____
☐ Not to be used to determine release information only
☐ Other _____

(b) ☐ Results placed in bucket and labeled PEOC
☐ Results mailed to _____

Comments: _____

Name (print) CHARL BRIDGON Signature _____ Date 8/1/93

(III) Tank Responsible Person (Tank RP) Requisition #: _____

(a) ☐ Released to sanitary sewer on _____ with pH of _____
Date/Time

(b) ☐ Transferred by Tank RP to container # _____ on _____
Date

(c) ☐ No action by Tank RP; HWM assumed responsibility for contents.

Comments: _____

Name (print) _____ Signature _____ Date _____

(IV) EPD—HWM

(a) ☐ Assumed possession of wastewater on _____ as Requisition # _____
Date/Time

(b) Ultimate Disposition

☐ Retained for treatment

☐ Released to sanitary sewer on _____ with pH of _____
Date/Time

☐ To sewer access # _____

☐ To be shipped off-site for treatment, disposal, or recycling.

Comments: _____

Name (print) _____ Signature _____ Date _____

Table 1. LLNL's internal discharge limits for nonradioactive parameters in wastewaters from noncategorical and categorical processes, in milligrams per liter (mg/L) (from *Guidelines for Discharges to the Sanitary-Sewer System*).

Parameter	Noncategorical limits ^a	Categorical limits ^b	
		Metal finishing	Electronic components
Beryllium (Be)	0.74		
Copper (Cu)	10	2.07	
Chromium (Cr)	4.9	1.0	
Mercury (Hg)	0.05		
Nickel (Ni)	5	2.38	
Zinc (Zn)	15	1.48	
Silver (Ag)	1	0.24	
Lead (Pb)	4.9	0.43	
Cadmium (Cd)	0.9	0.26	
Cyanide (CN) ^c	5	0.65	
pH	5-10	5-10	5-10
TTO ^d		2.13	1.37
VHS ^e	4.57		
TICH ^f	0.10		
Oil and grease	500		
PCBS ^g	0.05		

^a These standards have been established to meet the City of Livermore's requirements at the Bldg. 196 outfall.

^b These standards are specified by the Environmental Protection Agency (EPA). By regulation, the EPA or City of Livermore limit is used, whichever is lower. Noncategorical limits apply where no standard is specified.

^c Limits apply to CN discharges other than CN salts. CN salts are classified by the State of California as "extremely hazardous waste" and cannot be discharged to sewer.

^d Total toxic organics. Applies to categorical processes only. Appendix C (in the Guidelines document) lists the materials that comprise TTO.

^e Volatile halogenated solvents, the term used at LLNL to designate EPA Methods 601/8010. Appendix C (in the Guidelines document) lists the compounds analyzed as VHS for wastewater being evaluated for possible release to the sewer. A less comprehensive list is used for other forms of waste.

^f Total identifiable chlorinated hydrocarbons (pesticides). Appendix C (in the Guidelines document) lists the materials that comprise TICH.

^g Polychlorinated biphenyls.

Table 2. LLNL's internal discharge limits for radioisotopes in wastewaters (from *Guidelines for Discharges to the Sanitary-Sewer System*).

Parameter	Individual discharges	Total daily limit for site
Gross alpha	0.3 mCi/1000 L	5.0 mCi
Gross beta	3.0 mCi/1000 L	50.0 mCi
Tritium	5.0 mCi/1000 L	100.0 mCi
Gamma ^a		

^a There is no gross gamma limit; isotope-specific limits apply. A list of isotopic limits is available from the WGMG RP.

Table 3. City of Livermore's Discharge Limitations^a

No person shall discharge wastewater containing in excess of:

0.06	mg/L	arsenic
0.14	mg/L	cadmium
1.0	mg/L	copper
0.62	mg/L	chromium (total)
0.20	mg/L	lead
0.01	mg/L	mercury
0.61	mg/L	nickel
0.20	mg/L	silver
3.00	mg/L	zinc
0.04	mg/L	cyanide
1.0	mg/L	total toxic organics

^a From Sections 13.32.060 and 13.32.100 of the Livermore Municipal Code. The range of pH is 5 to 10.

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Appendix A

Figures F-1 and F-2 from *Guidelines for Discharges to the Sanitary-Sewer System*. These figures have been adapted to highlight the activities of the WCMG RP in completing the retention tank release authorization procedures.

Figure F-1. Site 300 Retention-System Release Procedure

1. The wastewater may require analysis for constituents not included on the first analytical request form if the new container or tanker was previously used for other constituents of concern and has not been thoroughly cleaned.

2. Put the analytical lab sample number and HW Disposal Requisition form number for the first sample somewhere on the analytical request form for the second sample. A second RSDR is not required.

3. In general, if both samples are less than the limit, it remains permissible to sewer. Resample if one is less and one is greater than the limit.

4. Subsequent tracking of wastewater available through HWM requisition system.

Figure F-2. Livermore Site Retention-System Release Procedure

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Appendix B

Sample Retention Tank Analysis List

Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Noncategorical

Building	Tank ID No.	Required Analyses	Required Containers
113	P2A1-east P2A2-west (profiled tanks)	Cu, Cr, Ni, Zn, Ag, 8010, pH.	2-A, 1-B
151	R1U1-west R1U2-east	Alpha, beta, H ³ , gamma, Cu, Cr, Ni, Zn, Pb, Cd, pH.	1-B, 1-C
175	R1A1, out-of-service R2A1	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Pb, pH.	1-B, 1-C
177	R1A1 R1A2 R2A1 R2A2	Alpha, beta, H ³ , gamma, CAM metals (TTLC), 8010/8020, pH.	2-A, 2-C
190	shielding tank	Alpha, beta, H ³ , gamma, pH.	1-C
191	R1A1-west R1A2-east	Cu, Cr, Ni, Zn, Pb, Hg, pH.	1-C
194	*R1A1-east, out-of-service *R1A2-west, out-of-service	Alpha, beta, H ³ , pH.	1-C *collects rain water
212	R1A1	Alpha, beta, H ³ , pH.	1-C
222	R1A1 R1A2 R1A3 R1A4	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Hg, 8010, pH.	2-A, 2-C
226	R1A1-west R1A2-east	Alpha, beta, H ³ , pH, Cu, Cr, Ni, Zn, Ag, Pb, Cd, Be, 8010	2-A, 1-B, 1-C

- Bold letters designate tanks that have had changes made.
- **bold** designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;

D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Noncategorical Tanks (cont'd)

Building	Tank ID No.	Required Analyses	Required Containers
231	R1A1-west R1A2-east	Alpha, beta, H ³ , Be, Cu, Cr, Ni, Zn, 8010, pH.	2-A, 1-B, 1-C
235	R1U1, sump R1O1-north R1O2-south	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Be, Hg, pH.	2-C
241	R1A1 R1A2	Alpha, beta, H ³ , CAM metals(TTLC) including As, Se, Hg, Oil(ppm), 8010, pH.	2-A, 2-C, 1-E
251	R1A1-north R1A2-south R2U1-NW	Alpha, beta, H ³ , gamma, Cu, Cr, Ni, Zn, Pb, pH.	1-B, 1-C
253	R1A1-west R1A2-east	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Be, Hg, pH.	2-C
281	R1U1-east, out-of-service R1U2-west, out-of-service	Alpha, beta, H ³ , gamma, pH, Cu, Cr, Ni, Zn.	1-B, 1-C
291	Cooling tower	Cu, Cr, Ni, Pb, Zn, pH.	1-B
292	R1U1, out-of-service	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, Ti, 8010, oil-ppm, pH.	2-A, 1-B, 1-C, 1-E
298	R1A1	Alpha, beta, H ³ , Cu, Ag, Be, Hg, Pb, 8010, oil-ppm, pH.	2-A, 2-C, 1-E
321C	R1O1-north R1O2-south R1U1-sump	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Pb, Be, 8010, pH.	2-A, 1-B, 1-C
325	Cooling tower	Cu, Cr, Ni, Pb, Zn, pH.	1-B
332	R1U1-north R1U2-south	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Ag, pH.	1-B, 1-C

- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Noncategorical Tanks (cont'd)

Building	Tank ID No.	Required Analyses	Required Containers
365	R1A1-east R1A2-west	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, 8010, pH.	2-A, 1-B, 1-C
377	R1U2-east, out-of-service R1U1-west, out-of-service	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, 8010, pH.	2-A, 1-B, 1-C
418	Paint booth No. 1 Paint booth No. 2	Cu, Cr, Ni, Zn, Ag, Pb, Cd, Hg, pH, 8010/8020.	2-A, 1-C
423	shielding tank-not in use	pH, CAM metals, 8010/8010, oil-ppm	2A, 1C, 1E
431	To be determined	Cu, Cr, Ni, Pb, Zn, pH, 8010, PCB, oil-ppm.	2-A, 1-B, 3-E,
435	Cooling tower	Cu, Cr, Ni, Zn, pH.	1-B
490	R3U1, profiled R4U1, profiled	Cu, Cr, Ni, Zn, Pb, 8010, oil- ppm, pH.	2-A, 1-B, 1-E
	R1U3, sump R1U1-south, sump	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, oil-ppm, pH.	1-B, 1-C, 1-E
	R1U2-mid R2U1-north	Alpha, beta, H ³ , Cu, Cr, Ni, Pb, Zn, oil-ppm, pH.	1-B, 1-C, 1-E
491	R1U1	Cu, Cr, Ni, Zn, pH, Flash Point	1-C
	R2A1 R2A2	Alpha, beta, H ³ , CAM metals (TTL), 8010/8020, pH.	2-A, 2-C
492	R1U1, sump R1A1,	Cu, Cr, Ni, Pb, Zn, 8010, pH, oil-ppm, Flash Point.	2-A, 1-C, 1-E

- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Noncategorical Tanks (cont'd)

Building	Tank ID No.	Required Analyses	Required Containers
514	R5A1-north R5A2-north mid R5A3-south mid R5A4-south R5A5-east R5A6-west R5O1	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Be, pH, 8010/8020, oil-ppm. Add CN to all PTS samples. For Categorical wastes, substitute 624/625 for 8010/8020.	2-A, 1-B, 1-C, 1-E 1-C 2-A, 1-B, 1-C, 3-E
	R4A1-DO1 R4A2-DO2	*Alpha, beta, H ³ , pH	1-C *If more analyses are needed, contact EAS for proper containers
	R6A1-DO3	*Alpha, beta, H ³ , pH	1-C *If more analyses are needed, contact EAS for proper containers
612	R1A1, out-of-service	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, pH, oil-ppm.	1-B, 1-C, 1-E
663	R1A1-north R1A2-south	Cu, Cr, Ni, Zn, Be, pH.	1-B

- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Categorical Tanks

Building	Tank ID No.	Required Analyses	Required Containers
131	R1A1-east R1A2-west R1U2	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Ag, Pb, Cd, As, CN, F, pH, 624/625.	2-A, 3-C, 2-E
141	R2O1 (TLW 3) R2O2 (TLW 4) R1O1 (TLW 5) R1O2 (TLW 6) R3O1 (TLW 1) R3O2 (TLW 2) (Profiled except for pH)	Cu, Cr, Ni, Zn, Pb, Cd, Ag, CN, 624/625, pH. This process now uses a TTU from Erickson Environmental pH only	2-A, 2-C, 2-E
	R4A1-east, R4A2-west (semicond. tanks)	Cu, Cr, Ni, Zn, Pb, Cd, Ag, CN, pH, 624/625.	2-A, 1-C, 2-E
153	R1O1 R1O2	Cu, Cr, Ni, Zn, Ag, Pb, Cd, As, CN, F, pH, 624/625.	2-A, 2-B, 2-C, 2-E
161	R1A1, out-of-service	Cu, Ce, Er, Hg, Pb, CN, pH, 8010. Substitute 624/625 for 8010 and add Cr, Zn, Ni, Ag, Cd if this waste is to go to sewer.	2-A, 2-C, (2-E)
322	R2O1-north R2O2-south	Alpha, beta, H ³ , Cu, Cr, Ni, Zn, Pb, Cd, Ag, CN, pH, 624/625. Take duplicate and send in for CAM metals (do not hold up tank discharge for CAM results).	2-A, 2-C, (2-C for CAM metals) (2-E)

- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;
D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Site 300 Retention Tanks

Building	Tank ID No.	Required Analyses	Required Containers
801	R2A1	pH, alpha, beta, H ³ , 8010/8020, oil-ppm.	2-A, 1-C, 1-E
	R2A2		
	R3O1*	Cu, Cr, Ag, Cd, pH.	1-B
817*	R1A1	8010/8020, HMX, TATB.	3-A
819	P1A1-P1A5	Cu, Cr, Ni, Pb, Zn, Hg, pH, 8010/8020, oil-ppm.	2-A, 1-C, 1-E
823*	R1U1	Cu, Cr, Cd, Ag, pH.	1-B
826*	NEW	8010/8020, TATB, HMX, DMSO, acetone.	3-A
825*	NEW	8010/8020, TATB, HMX, DMSO, acetone.	3-A
827C* 827E*	R1A1 NEW	8010/8020, TATB, HMX, DMSO, acetone.	3-A
828*	R1A1 R2A2	TATB, HMX, 8010/8020.	3-A
843	P1A1	pH, Cu, Cr, Ni, Zn, 8010/8020, oil-ppm.	2-A, 1-B, 1-E
	P1A2		
	P2A1	H ³ , pH, Cu, Cr, Ni, Zn, 8010/8020, oil-ppm.	2-A, 2-B, 1-E
851*	R1A1,	Cu, Cr, Ag, Cd, pH.	1-B
865	R1A1-NW R1A2-mid R1A3-SE	Cu, Cr, Ni, Zn, Ag, Pb, Cd, Oil- ppm, 8010/8020.	2-A, 1-B, 1-E
872	P2A1-west, P2A2-east	Cu, Cr, Ni, Zn, Hg, Cd, Ag, Pb, pH, 8010/8020.	2-A, 1-C

* These tanks discharge into surface impoundments.

- **Onfile** letters designate Categorical Tanks. These tanks must meet more strict (federal) pretreatment discharge limits to be discharged to the sanitary sewer.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- **Bold** letters designate tanks that have had changes made.
- **Bold** designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;

D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Sample Retention Tank Analysis List (RTAL)
(Revised July 1993)

Site 300 Retention Tanks (cont'd)

Building	Tank ID No.	Required Analyses	Required Containers
875	P2A1-west P2A2-east	Cu, Cr, Ni, Zn, Cd, Ag, Pb, CN, pH, 624/625.	2-A, 1-C, (2-E)
879	R1A1-SW R1A2-NE	Cu, Cr, Ni, Pb, Zn, pH, 8010/8020, oil-ppm.	2-A, 1-B, 1-E

* These tanks discharge into surface impoundments.

- ~~Outline~~ letters designate Categorical Tanks. These tanks must meet more strict (federal) pretreatment discharge limits to be discharged to the sanitary sewer.
- Normality needs to be done on all tanks with a pH of <5 or >10.
- Bold letters designate tanks that have had changes made.
- ~~Bold~~ designates deletions that have been made.
- "Profiled" means this waste stream has been profiled and does not need an RSDR before pick-up by HWM.
- () These samples/bottles are needed only if the waste is to be discharged to the sanitary sewer.
- When requesting additional analyses not on this list, contact the EAS Lab to see if more sample is needed.
- Gamma analysis must be done whenever the gross alpha or beta exceeds the limit of sensitivity.

A = VOA bottle, stock #8125-69385; B = 125-mL poly bottle, #8125-67704; C = 250-mL poly bottle, #8125-42043;

D = 500-mL poly bottle, #8125-42045; E = 500-mL glass bottle, #8125-27773.

Appendix C: Copy of RSDR with Instructions

Instructions

Retention System Disposition Record Form

This document summarizes the procedure for completing the Retention System Disposition Record (RSDR).

Section I. System Description

- This section is to be completed by the Environmental Monitoring & Analysis Division (EMAD) personnel who are authorized to approve releases of retention-tank contents to sewer.
- In part (c), additional descriptions of containers must be included to the right of the checked component (Examples: ATS 54 T11, Tanker 2, etc.)

Authorization Record

Section II. EPD—EMAD

- EMAD personnel complete parts (a) and (b); verify that analytical results are either within appropriate release limits or exceed these limits; and notify the appropriate technician that the results are available.
- EMAD retains the goldenrod copy of this form. After disposition of the container contents, the original form (white) is returned to the Water Guidance & Monitoring Group Responsible Person (WGMG RP), L-621, where it must be matched to and filed with the retained copy.

Section III. Tank Responsible Person (Tank RP)

- If the material is released to the sewer, the Tank Responsible Person (Tank RP), places a check mark by part (a), provides the date, time, and pH of the release; signs and dates the form; returns the white copy to the WGMG RP, L-621; and retains the pink copy.
- If the material is transferred to another container, but is not immediately removed or discharged, the Tank RP places a check by part (b), fills in the container number, date of transfer, and the requisition number, and signs and dates the form. After retaining the pink copy, the RSDR is attached to the requisition and together they are submitted to the HWM Operations Control Group.
- If the material is neither transferred to a container for temporary storage at the building nor discharged to the sewer, but is removed by HWM personnel, the Tank RP checks the blank beside part (c), signs and dates the form, and submits it to HWM with the contents of the tank. The Tank RP also includes the waste requisition number.

Section IV. EPD—HWM

- If the material cannot go to the sewer, HWM personnel assume possession of the contents and complete part (a).
- After determining the appropriate disposition of the material, HWM personnel check the appropriate line in part (b); record the pH, time, and date if the material is released to the sewer; record any comments; sign and date the form; and return the white copy to the WGMG RP, L-621. HWM personnel retain the canary copy.

Appendix C: Copy of RSDR with Instructions (cont.)

Retention System Disposition Record

(I) System Description

(a) Building Number: _____ (b) Date sampled: _____

(c) System Component (Include specific identification as necessary):

___ Tank: _____ Cooling Tower ___ Other _____

___ Tanker/Portable #: _____ Paint Booth _____

___ Drum: _____ Carboy _____

(d) Lab Name/Sample ID #: _____ Requisition #: _____

Lab Name/Sample ID #: _____ Volume (L): _____

Authorization Record

(II) EPD—EMAD

- (a) ☐ OK to release to sanitary sewer
☐ OK to release to sanitary sewer with pH adjustment to 5-10
☐ May not be released to sanitary sewer due to pH
☐ Not to be used to determine release information only
☐ Other _____

(b) Results placed in pickup box per _____
 Results mailed to _____

Comments _____

Name (print) _____

Signature _____

Date _____

(III) Tank Responsible Person (Tank RP)

Requisition #: _____

(a) ___ Released to sanitary sewer on _____ with pH of _____
Date/Time

(b) ___ Transferred by Tank RP to container # _____ on _____
Date

(c) ___ No action by Tank RP; HWM assumed responsibility for contents.

Comments _____

Name (print) _____ Signature _____ Date _____

(IV) EPD—HWM

(a) ___ Assumed possession of wastewater on _____ as Requisition # _____
Date/Time

(b) Ultimate Disposition

___ Retained for treatment

___ Released to sanitary sewer on _____ with pH of _____
Date/Time

___ To sewer access # _____

___ To be shipped off-site for treatment, disposal, or recycling.

Comments _____

Name (print) _____ Signature _____ Date _____

REVISION 2 Final	EMP-RT-RA Retention Tank Release Authorization	Effective date: 11/1/93 Page 28 of 36
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Appendix D

Special Approval Procedures

Memorandum from R. Michalik to N. Riley, dated February 13, 1991, EO:90-937/D13C/bld

633

2-5010

February 13, 1991

TO: Neil Riley, L-620
HWM Operations Manager

FROM: Richard Michalik, Environmental Analyst
Environmental Operations Group

SUBJECT: Analytical Requirements for HWM Berm Water

On December 5, a meeting with Judy Steenhoven, Steve Cerruti, Charlene Grandfield, Scott Kidd and myself was held to discuss which analytical test methods must be performed on the water collected in the secondary containment basins in the HWM facilities. The discussion centered on regulatory and Part B Permit application requirements stated in a letter from Steve Cerruti to yourself dated November 29. In the letter, Steve informed you that the following methods could be used to classify the collected berm water as non-hazardous or hazardous:

1. Testing the waste to determine if any hazardous constituents are contained or the waste exhibits a hazardous characteristic. Only analytical test methods approved by the DHS and EPA can be used to analyze the waste.
2. Apply generator's knowledge of the chemicals and process used to produce the waste to state that the waste is non-hazardous. This procedure can only be used when the generator's knowledge can totally assure that no hazardous constituents are contained or hazardous characteristics exhibited by the waste.

In his letter, Steve also points out that HWM must try to comply with all of the provisions specified in the Part B Permit application. Based on these requirements, we decided HWM could not use generator's knowledge to classify the berm water collected from the first rainstorm as non-hazardous. The reason for this decision was no one could guarantee there was no residue of hazardous waste in the containment basin or on the containers in storage which would contaminate the berm water. HWM will have to analyze the berm water from the first storm to prove it is non-hazardous. Once it is proven the collected berm water from the first rainstorm is non-hazardous, HWM can use generator's knowledge to classify the berm water from the following storms as non-hazardous.

The first rain storm of the season is defined as the storm or storms from which the collected berm water significantly reduces HWM's berm water storage capacity (i.e., less than 50% of HWM's storage capacity remaining). The berm water from this first rain storm must be considered potentially contaminated with hazardous constituents. The following procedures are to be used by HWM to manage the berm water:

1. The berm will be sampled and analyzed using approved DHS and EPA analytical test methods. HWM's "Waste Analysis Plan" contained in the Part B Permit application

specifies the analytical test methods to be performed on the various waste streams generated at the Laboratory. The analytical test methods required for sewerable materials are specified on page 14 or in Table V-C-6 of HWM's Waste Analysis Plan.

2. If the results of these analyses show the berm water is non-hazardous and sewerable, the collected berm water can be discharged to the sanitary sewer following standard procedures. The analytical results will also prove there is no residue of hazardous waste in the containment basins or on the waste containers in the storage units which would contaminate the berm water.
3. If the analyses show the berm water meets the definition of a hazardous waste, it must be disposed according to hazardous waste procedures. The berm water collected from the next storm must be handled according to the above mention procedures.

After the berm water from the first rain storm has been shown to be non-hazardous, HWM can use generator knowledge to classify any newly collected berm water as non-hazardous. The following procedures are to be used to handle the berm water from subsequent storms:

1. During the daily operations of the HWM facility, the HWM Techs working in each storage unit will visually inspect the unit for any evidence of a spill. The HWM Techs receiving new waste containers into the yard will inspect the containers to verify there is no residue on the outside of the container. If residue is present on a container, the residue will be removed prior to placing the container into a storage unit. These inspections need to be documented in some type of log book and should include a statement on whether or not any evidence of a spill was discovered, date, name of Tech and any clean up work performed.

If a spill occurs in a storage area, the affected area will be decontaminated using appropriate procedures and swipe samples will be taken in the affected area to verify there are no residual hazardous constituents. The results of the swipe samples must be attached to the daily review log book to document that the spill was satisfactorily cleaned up. If the analytical results indicate a residue of hazardous constituents is present, the spill area must be decontaminated again or the water collected in the storage unit from the next storm must be analyzed by the DHS/EPA approved test methods.

Note: Swipe samples will be analyzed for all hazardous constituents contained in the waste.

2. The berm water from the subsequent storms will be analyzed using the analytical test methods acceptable to the Livermore Water Reclamation Plant (LWRP). The LWRP has indicated the methods are "equivalent" to EPA methods, although not necessarily approved by the EPA as acceptable.

A summary of the analytical test methods approved by the DHS/EPA and LWRP is attached. If for any reason HWM personnel can not guarantee, through the daily walkthroughs, the containment basins or waste containers are not contaminated with a hazardous waste residue, the collected berm water must be analyzed using analytical test methods approved by the DHS and EPA.

The samples of the berm water which are to be analyzed using DHS/EPA approved test methods are to be submitted to the Environmental Analytical Science (EAS) laboratory. All other berm water

samples are submitted to John Reynolds or his representative, in Building 412 Room 1113. John Reynolds must be paged at #2055 prior to delivering samples. Examples of how the EAS laboratory's "Waste Analysis Request Form" needs to be completed are attached. If you have any questions, please call me at 2-5010.

Attachment

cc: Steve Cerruti, L-255
Charlene Grandfield, L-633
Joy Hirabayashi, L-633
Wendell Kelley, L-620
Scott Kidd, L-620
Charlie Patterson, L-620
Price Rass, L-310
John Reynolds, L-524
Judy Steenhoven, L-255

EO:90-937/D13C/bld

Appendix E: Rain Water Analytical Test

The following are the required analytical tests that must be performed on the berm water that will be discharged to the sanitary sewer.

DHS/EPA Approved

(These test are taken from HWM "Waste Analysis Plan")

pH

Total Toxic Organic: EPA Method 624 and 625

Cam TTLC Metals

Flashpoint

Cyanide

Oil and Grease: EPA Method 503

Total Dissolved Solids (TDS)

Radioactivity: Gross Alpha, Gross Beta, Tritium

Sample requirements: 2-40 ml VOA viles, 2-250 ml plastic bottles, 1-500 ml amber glass bottle.

LWRP Approved

pH

Dissolved Metals

VHS by head space G.C. analytical procedure equivalent to the EPA Method 601 and 602 procedures

Radioactivity by EAS laboratory radioactivity scan procedures

Sample requirements: 2-40 ml VOA viles, 1-250 ml plastic bottle

Appendix F: Sewer Diversion Facility Operation Diagrams

SEWER DIVERSION FACILITY

QA PLAN

APPENDIX B: OPERATION DIAGRAM 1:
Environmental Monitoring Group

Revision of this appendix: 0 Issued: [Signature] Date: 3-13-91
Facility Manager

(Use in conjunction with appendixes C, D, and E.)

Appendix F: Sewer Diversion Facility Operation Diagrams (cont.)

QA PLAN

SEWER DIVERSION FACILITY

APPENDIX C: OPERATION DIAGRAM 2:
Wastewater and Tank Systems Group

Revision of this appendix: 0

Issued:

[Signature]
Facility Manager

Date: 3-13-91

(Use in conjunction with appendices B, D, and E.)

I — same as C but does not involve PE since work has been removed from that facility

J — same as C but both PE & HYM must be notified

Appendix F: Sewer Diversion Facility Operation Diagrams (cont.)

SEWER DIVERSION FACILITY

QA PLAN

APPENDIX D: OPERATION DIAGRAM 3:
Hazardous Waste Management

Revision of this appendix: 0 Issued: RTA Date: 3-13-91
Facility Manager

(Use in conjunction with appendixes B, C, and E.)

Appendix F: Sewer Diversion Facility Operation Diagrams (cont.)

QA PLAN

SEWER DIVERSION FACILITY

APPENDIX E: OPERATION DIAGRAM 4:
PE Maintenance Mechanics Shop

Revision of this appendix: 0 Issued: [Signature] Date: 3-13-91
Facility Manager

(Use in conjunction with appendices B, C, and D.)

EMP-S-L

SOIL & ARROYO SEDIMENT SAMPLING LOCATIONS

Prepared by:

Kris Surano
Kris Surano
Environmental Analyst, SMG

12/3/92
date

Reviewed by:

Paris Althouse
Paris Althouse
Environmental Technician, TSG

date

David Graves
David Graves
Environmental Technician, TSG

12-4-92
date

Rebecca Ward
Rebecca Ward
Environmental Technician, TSG

12-4-92
date

Duke Ramsey
Duke Ramsey
Environmental Technician, TSG

12-4-92
date

Approved by:

Rebecca A. Failor
Rebecca A. Failor
Section Leader, EMS

12/7/92
date

Kris Surano
Kris Surano
Group Leader, SMG

12/3/92
date

Lucinda M. Garcia
Lucinda M. Garcia
Quality Assurance Coordinator, EMS

12/8/92
date

LLNL ENVIRONMENTAL
MONITORING SECTION
UNCONTROLLED COPY
FOR INFORMATION ONLY

1. PURPOSE

This procedure describes, and gives directions to, soil sampling locations at LLNL, in the Livermore Valley, at Site 300, and arroyo sediment sampling locations at and around LLNL. It also provides a description of Field Tracking Forms to be used in soil/arroyo sediment sampling activities.

2. APPLICABILITY/DISCUSSION

Soil is an integrating medium that can contain pollutants originally released directly to the ground, to the air, or through liquid effluents. Reference 1, on which much of EMS monitoring is based, states that "Periodic sampling and analysis of indicator materials, such as soil ... should be performed to determine if there is measurable long-term buildup of radionuclides in the terrestrial environment." Since 1972, surface soil sampling in the vicinity of LLNL and Site 300 has been part of a continuing LLNL monitoring program designed to measure any changes in environmental levels of radioactivity and to evaluate any increase in radioactivity that might have resulted from LLNL operations.

Prior to 1988, soil samples were collected at sites selected at random from Livermore Valley locations previously sampled in a 1971-1972 study that was conducted to determine background concentrations of radionuclides in area soils. In 1988, Livermore Valley surveillance soil sampling locations were chosen to coincide with air sampling locations or to give coverage to areas of special concern, including areas of known past contamination. The use of constant sampling locations allows for better trending of data and closer monitoring of areas of concern; such is the case regarding Site 300 soil sampling activities. At Site 300, sampling locations have not changed significantly since their inception. The sampling locations were originally chosen because of their proximity to firing tables. Given that Site 300 encompasses such a large geographic area, sampling near areas of potential contamination for surveillance purposes should be satisfactory. All soil sampling, regardless of location, is conducted according to Reference 2.

According to Reference 1, "The sampling of sedimentary material from streams or ponds can provide an indication of the accumulation of undissolved radionuclides in the aquatic environment. The accumulation of radioactive materials in sediment can lead to exposure of humans through ingestion of aquatic species, through sediment resuspension into drinking water supplies, or as an external radiation source..." Sediments also have the potential to concentrate nonradioactive constituents present in storm water runoff. Sediment sampling, followed by radiological and chemical analyses, helps EMS determine if significant buildups of pollutants have occurred.

Since 1988, sediment samples have been collected from selected arroyos and other drainages at and around LLNL, using methods detailed in Reference 2. For the most part, locations coincide with selected storm water sampling locations. Analyses have been conducted on both radioactive and nonradioactive constituents of sediment samples every year since the inception of sediment monitoring.

Changes/additions to the soil/arroyo sediment monitoring networks since 1988 are evidence of an EMS goal to more adequately monitor the soils and sediments potentially affected by LLNL operations. Pursuant to Reference 1, soil sampling locations have been located near air monitoring locations, include areas thought to represent background concentrations (geologically similar, but distant locations unlikely to be affected by LLNL operations), and involve areas of known contamination (such as LWRP soils containing plutonium from a 1967 accidental release to sewer). The soil environment completely surrounding the LLNL perimeter is adequately monitored, including areas in prominent downwind directions off-site and in upwind background locations.

The number and location of sediment sampling locations has also been re-evaluated and increased since 1988. Locations where runoff has not occurred for two consecutive years, those that were inaccessible, or those that were considered misplaced in terms of what they were to represent have been abandoned. Other locations have been added as the drainage patterns at LLNL have been more

REVISION 1 FINAL	EMP-S-L Soil & Arroyo Sediment Sampling Locations	Effective date: 01/04/93 Page 3 of 19
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accurately identified. Sediments from 11 major LLNL drainages are now sampled. The sediment sampling locations coincide with storm water runoff sampling locations, so results from the sampling of these two related media can be compared (Reference 3).

Some samples are collected on private property and some sampling location names/designators involve the use of private individuals' names. It is the policy of LLNL and EPD that the names and addresses of private parties, and directions to such sampling locations, remain in strict confidence and this information only be given out on a need-to-know basis. Samplers needing this proprietary information to perform their sampling activities should contact the Responsible Analyst.

3. REFERENCES

1. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
2. EMP-S-S, *Soil and Arroyo Sampling*
3. EMP-RO-L, *Storm Water Runoff Sampling Locations*
4. EMP-QA-CD, *Design Change Packages*
5. EMP-QA-SL, *Sample Location Designators*
6. EMP-QA-SD, *Sample Tracking Documentation*
7. EMP-HS-300, *Site 300 Health and Safety Work Procedure*
8. EMP-W-DB, *Water Sampling-Central Drainage Basin*

4. DEFINITIONS

Arroyo: A deep gully cut by an intermittent stream.

Sediment: Finely divided solid material that settles to the bottom of a liquid.

Soil: The top layer of earth, suitable for the growth of plants.

Soil sample: An aliquot of surface soil collected to a depth of 5 cm because surface deposition from the air is the primary pathway for potential soil contamination.

Sediment sample: An aliquot of arroyo sediment taken with a split-spoon sampler driven into the sediment to a depth of 2 ft.

5. RESPONSIBILITIES

5.1. EMS ENVIRONMENTAL ANALYST (SOILS)

The Environmental Analyst assigned responsibility for the soil and sediment monitoring networks will decide where samples are to be collected. The Analyst must periodically review the network sampling locations to ensure they are technically suitable in the context of EMS goals and missions. Furthermore, the Analyst is responsible for assessing the need to sample newly discovered areas of known or suspected contamination. The Analyst is responsible for submitting design changes regarding the network sampling locations, keeping this procedure updated, and communicating changes to other EMS staff members as needed. The Analyst is also responsible for providing proprietary information, to Technicians' responsible for the collection of samples, regarding sampling locations on an in-strict-confidence/need-to-know basis.

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5.2. EMS QUALITY ASSURANCE COORDINATOR

The Quality Assurance Coordinator is responsible for keeping lists of all present and past sampling locations and their designators (Reference 5), evaluating the need for and reviewing/approving soil sampling location design changes, assigning new soil sampling location designators as needed, and for archiving all design changes and revisions of this procedure.

5.3. EMS TECHNICIANS

The EMS Technicians are responsible for collecting soil and sediment samples, using methods detailed in Reference 2, at locations described in this procedure. They shall fill out appropriate and current Field Tracking Forms, making notes regarding the direction and distance from the permanent soil/sediment sampling location marker to the location where the samples actually were collected. Technicians are also responsible for providing the Analyst with recommendations regarding the suitability of sampling locations and their permanent markers, and for providing detailed descriptions of, and directions to, the sampling locations.

6. PROCEDURE

Equipment Required:

None

6.1. SAMPLING LOCATION SELECTION

Choices of soil sampling locations made by the Environmental Analyst shall be based on the following criteria in accordance with Reference 1: (1) proximity to LLNL and the potential for being affected by LLNL operations, (2) background locations with geologically similar substrates as those near LLNL, but unlikely to be affected by LLNL operations, (3) areas of known or suspected LLNL-induced contamination. For areas of known or suspected contamination, sampling locations should be selected to delimit the extent of the contamination and to track the contamination from year to year. The Analyst shall avoid selecting frequently tilled or disturbed areas, or locations near buildings or other obstructions. Sampling locations should also be chosen to avoid areas with unusual wind or precipitation influences. Practical considerations may also temper selection of sampling locations. The use of private property is discouraged. Government installations (federal, state, city, regional) are usually very cooperative in providing areas for sampling as long as pertinent parties are asked/notified. Other considerations should include access during inclement weather, and personnel safety in vehicle operation/parking or sample collection.

6.2. LIVERMORE VALLEY SOIL LOCATIONS

EMS technicians should proceed to the following locations (shown on the map in Attachment A) when requested to collect Livermore Valley and LLNL surface soil samples. Each location is identified by name with a permanent location marker, which is a metal tag attached to a single red and white fence post or to a piece of rebar driven into the ground.

6.2.1. Mesquite (L-MESQ): Proceed west on Mesquite Way towards Vasco Rd., turn right on the road just before the "Sunshine Building" (B-041, LLNL mail services/west badge office). Go to the northwest end of the perimeter fence to the permanent location marker, which is next to the air sampler.

6.2.2. Sandia Tank (L-TANK): Drive from Southgate Drive across East Ave. to the entrance of Sandia National Laboratory, Livermore (SNLL). Identify yourself to the guard, and follow the main road to the right past the parking area and up the hill to the gate at the base of the water towers. Open the EMS lock on the gate and continue (on foot) south towards the southeast corner of the fence. The permanent location marker is next to the high-volume air sampler.

6.2.3. Zone 7 (L-ZON7): Drive north on Greenville Rd. from the LLNL East Gate. Turn right on Patterson Pass Rd, proceed east approximately 0.6 miles, and turn left into the Livermore Zone 7 Water Treatment Facility. The permanent location marker is below the air sampler, which is located on top of the clarifier and to the left side of the driveway before the parking area.

6.2.4. (L-PATT): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.5. FCC Station (L-FCC): The Federal Communications Commission (FCC) Station is on Lorraine Street. From Vasco Rd. proceed west on Dalton Rd. to its end, turn right on Ames Rd. and proceed to its end. Turn left on Raymond Rd. and then left on Lorraine Street. The FCC Station is located on the right hand side of the road, and the permanent location marker is a red and white stake just inside the gate to the left of the driveway.

6.2.6. VA Hospital (L-HOSP): From the intersection of Wetmore Ave. and State Highway 84, proceed southeast on Wetmore Ave. to its end. Turn right onto Arroyo Rd. and follow it about 2.3 miles, following the road signs to the VA Hospital. (Alternate Route: From the intersection of 4th and L Streets in Livermore, proceed south on L Street (which becomes Arroyo Rd.) for about 3.1 miles to the entrance of the hospital.) Turn right to enter the hospital grounds and proceed up the hill on Sycamore Rd. (to the right) toward the old incinerator and fire station. The permanent location marker is on the right side of the incinerator building next to the air sampler.

6.2.7. Met Tower (L-MET): Drive west on West Gate Drive towards the West Gate. Just before you get to the guard shack, turn right onto the gravel road. Travel approximately 400 ft along this road to the met tower. The soil sampling location and permanent marker are next to the telephone pole and high-volume air sampler.

6.2.8. Visitors' Center (L-VIS): Drive east on East Gate Drive. Go past the East Gate guard shack, turn into the Visitors' Center parking lot, and park. The soil sampling location and permanent marker (with rain bucket attached) are located approximately 10 yards east of the air sampler. You must cross a small arroyo that divides the parking lot from the Visitors' Center.

6.2.9. Cowbarn (L-COW): This location is on the LLNL north perimeter, opposite the cow barn. Driving on North Outer Loop Rd., turn north onto Ave. "T" and travel until the road dead ends at 11th Street. The soil sampling location is by the fenced-in area around the air sampler near that intersection. A rain sampling bucket is attached to the permanent soil sampling location marker.

6.2.10. Salvage Yard (L-SALV): This sampling location is near the southeast corner of LLNL along the fence behind the salvage yard. Driving south on Greenville Rd., turn right on East Ave., drive approximately 0.2 miles and enter the gate marked Contract Badge Office and Escorts (gate P61551). To the immediate right after you enter is another gate. Go to the Escort office to have them unlock the gate. Drive through the gate and

proceed approximately 1/10 of a mile. The permanent marker is on the right side of the road near the air sampler.

6.2.11. South Cafeteria (L-CAFE): Drive south on Southgate Drive past the guard station and turn right onto the access road just past the South Badge Office and before East Ave. Proceed approximately 300 ft to the permanent marker, which is located near the fence and next to the air sampler behind the South Cafeteria. The sample may be obtained outside the fence line on East Ave. if it cannot be obtained inside the fence line.

6.2.12. (L-ALTA): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.13. (L-RRCH): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.14. (L-ERCH): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.15. N.E. Perimeter (L-NEP): From LLNL's East Gate, proceed north on Greenville Rd. to the end of the LLNL east perimeter fence. The samples should be taken from the area where the new perimeter fence meets the old perimeter fence (new fence is black, old fence is grey). The permanent location marker is at the junction of the two fences.

6.2.16. Livermore Water Reclamation Plant (L-WRP1, L-WRP2, L-WRP3, L-WRP4, L-WRP5, L-WRP6): Proceed west on I-580 to the Airway Blvd exit, proceed south on Airway Blvd. until it ends and turn left. Proceed 0.7 miles to Kitty Hawk and turn right. Go approximately 0.2 miles to the gate on the right, which is between the Livermore Airport runway and the LWRP fence. The gate will probably be locked; pick up a key to the gate from personnel in the office of LWRP. All the LWRP soil sampling locations are permanently marked by red and white fence posts that are driven into the ground next to the LWRP boundary fence.

L-WRP1 is located north of LWRP, 125 yards west of the gate entrance at the corner of two LWRP boundary fences. L-WRP2 is also located to the north of LWRP, 125 yards further west of L-WRP1 (250 yards west of the entrance gate). L-WRP3 is located at the northwest corner of the LWRP boundary fence, 125 yards further west of L-WRP2 (375 yards west of the entrance gate). L-WRP4 is located west of the LWRP boundary, 125 yards south of the northwest corner of the LWRP boundary fence. L-WRP5 is also located to the west of LWRP, 125 yards to the south of L-WRP4 (250 yards south of the northwest corner). L-WRP6 is also located west of LWRP, 125 yards south of L-WRP5 (375 yards south of the northwest corner of the LWRP boundary fence).

On the north side of LWRP (L-WRP1 through L-WRP3) take samples approximately 30 ft north of the permanent markers, perpendicular to the fence, using the four corners-plus center sampling technique described in Reference 2. On the west side of LWRP (L-WRP4 through L-WRP6), take samples approximately 10 ft from the fence using the five-sample-in-a-line technique described in Reference 2. Be sure to record pertinent location information on the FTP, using the permanent location marker as the point of reference.

6.3. LIVERMORE VALLEY SOILS FIELD TRACKING FORM

Soil samplers are instructed to complete soils Field Tracking Forms (see Attachment B) when conducting soil sampling activities, in accordance with References 2 and 6. Of special note is the request for information regarding the proximity of the sampling location to the

permanent marker. Samplers are instructed to estimate carefully the distance and compass direction from the permanent marker to the actual collection location, and to record this on the Field Tracking Form. Samplers must also record dates and times of sampling, provide their initials for each sample, cross-reference COC numbers (Reference 6), and provide QA sample information.

6.4. ARROYO SEDIMENT SAMPLING LOCATIONS

EMS technicians should proceed to the following locations (shown on the map in Attachment C) when requested to collect arroyo sediment samples. All sampling locations are identified by a permanent location marker, which is often a drainage pipe or culvert and may not be easy to identify in the field. Samplers should point out these locations to new employees during training.

6.4.1. Arroyo Las Positas East (L-ALPE): This location represents the influent of this arroyo to LLNL. The sampling location is in the drainage channel on the south side of Eastgate Drive, just west of Greenville Rd. The permanent marker is a red and white stake driven into the ground at the edge of the culvert.

6.4.2. Greenville Rd./Northeast Perimeter(L-GRNE): Drive on North Outer Loop to "T" Street, turn north, drive to the end of the road (11th Street). Turn right, drive east to the end of the road, and turn left. The sampling location, marked by a red and white stake driven into the ground at the edge of the culvert, is in the ditch on the left side of the road.

6.4.3. Central Drainage Basin/LLNL Lake (L-CDB): The Central Drainage Basin is east of the Central Cafeteria and north of B-551W. From South Inner Loop Rd., turn into parking lot D-5. Drive to the north end of the parking lot and collect the sample from the edge of the inlet on the south side of the lake. The edge of the metal culvert is the permanent location marker.

6.4.4. Central Drainage Basin 2/Middle of LLNL Lake (L-CDB2): The Central Drainage Basin is east of the Central Cafeteria and north of B-551W. This sample is to be collected from the bottom of the Lake, near its center. The sampling must be conducted from a boat, using specialized sampling equipment (refer to References 2 and 8).

6.4.5. Arroyo Las Positas West (L-ALPW): This sampling location provides sediment from the effluent of this arroyo from LLNL. The sample is collected at the northwest corner of LLNL, near B-196, outside the fence, off the edge of the dam. Exit LLNL on Westgate Drive and turn right onto Vasco Rd. Drive approximately 0.2 miles to the access gate in the perimeter fence (the key to the lock is kept in B-151, Room 140G). Drive through the gate, across the field to the fence, and proceed north along the fence until you come to the drainage ditch. The stake next to the dam is the permanent marker.

6.4.6. Arroyo Seco South 2 (L-ASS2): This location represents Sandia effluent/LLNL influent in Arroyo Seco. The location is accessed near the Sandia West Gate entrance off East Ave. (Tell the security officer what you are going to do.) Drive 0.1 miles to the stop sign, cross the bridge, proceed about 0.1 miles to the dirt road that parallels the drainage ditch, and then about 0.1 miles to area of access. Walk down the embankment into the ditch and then walk towards East Ave. Take samples as close as possible to the steel grate (toward LLNL), where the drainage ditch goes under East Ave. The steel grate is the permanent location marker.

6.4.7. Arroyo Seco West (L-ASW): This location represents sediments in this arroyo's effluent from LLNL. The sample is collect beneath the bridge on Vasco Rd. where the Arroyo passes underneath. The face of the concrete overpass is the permanent location marker. Sample upstream (to the east) of the overpass.

6.4.8. Building 438 (L-B438): From South Outer Loop Rd., turn onto Ave. "H," proceed approximately 100 yards to 3rd St. and turn left. Drive approximately 600 ft to the access road on the left, which parallels the drainage ditch. Go to the end of the ditch. The edge of the drainage pipe serves as the permanent location marker.

6.4.9. West Perimeter Drainage Channel (L-WPDC): Exit LLNL on Westgate Drive, turn right onto Vasco Rd., and drive approximately 0.2 mile to the access gate in the perimeter fence. The key to the lock on the gate is located in B-1680, Room 1043. Drive through the gate to the West Perimeter Drainage Channel. The permanent marker is approximately 0.1 mile to the north, where the concrete channel begins.

6.4.10. Arroyo Las Positas North (L-ALPN): Proceed on North Outer Loop Rd. to "T" St., turn north. Drive to the end of the road and turn left onto 11th St., and proceed approximately 200 ft. The sampling location, marked by the edge of the spillway, is on the right side of the road. Samples should be collected from the edge of the concrete spillway.

6.4.11. 4th and A Streets (L-4THA): Drive on Ave. A to 4th St. The permanent location marker, a red and white stake at the edge of the drainage pipe, is in the ditch on the west side of Ave. A near the intersection. Determine the distance and direction from the stake to the actual sampling location and record this data on the Field Tracking Form.

6.5. ARROYO SEDIMENT FIELD TRACKING FORM

In accordance with References 2 and 6, samplers are instructed to complete arroyo sediment Field Tracking Forms (see Attachment D) when collecting sediment samples. Samplers are instructed to estimate carefully the distance and direction from the permanent location marker to the actual sampling location and to record it on the Field Tracking Form. Samplers must also record the date of sampling, provide their initials for each sample, cross-reference COC numbers (Reference 6), record sampling depths, and provide QA sample information.

6.6. SITE 300 SOIL SAMPLING LOCATIONS

EMS technicians should proceed to the following locations (shown on the map in Attachment E) when requested to collect Site 300 surface soil samples. Site 300 access and safety procedures must be strictly followed (Reference 7). All sampling locations are identified by a permanent location marker, which is a metal tag attached to a fence post, a wooden stake, or a piece of rebar driven into the ground.

NOTE: Watch and listen for rattlesnakes when walking in tall grass.

6.6.1. Golf Course (3-GOLF): This sampling location is located west of the Site 300 Cafeteria, near the putting green. Travelling from LLNL to Site-300 on Corral Hollow Rd., enter the gate marked 107 (first gate into parking lot). Take samples from narrow strip between the fence and the road. The permanent location marker is a red and white stake next to the first fence post.

6.6.2. West of 834 (3-834W): Enter the Main Gate at Site 300 from Corral Hollow Rd., go past the Guard Post and proceed to Route 2. Follow Route 2 approximately 1.3 miles to Route 1, turn left and travel approximately 0.3 mile to the entrance of Building 834.

NOTE: You must obtain permission from the personnel in Building 834A before you sample soil behind Building 834M.

Sign in with Building 834A personnel upon entry and sign out upon departure. Drive towards the fence, turn right and follow the road to Building 834M. The sampling location, marked by a red and white stake, is on the right side of the road, approximately 40 ft past 834M and approximately 20 ft off the right side of the road between Building 834M and Well W834M2.

6.6.3. North of 812 (3-812N): This sampling location is located behind Bunker 812. From the intersection of Route 2 and Route 3, drive up the hill on Route 3 approximately 3 miles to Route 1, turn right, and travel approximately 0.3 mile to Bunker 812 (follow the sign). Proceed to the left of Bunker 812B, go to Bunker 812A through the gate to the right, and follow the road to the hill. Take samples from the side of the hill to the right, approximately 30 ft from the road and 10 ft to the left of the rock out-cropping. A red and white stake is the permanent location marker.

6.6.4. East of 801 (3-801E): This location was previously described as northeast of air sampler 10 (old air sampling location 040-10). Travel Route 1 about 0.2 mile to the sign that is marked "Tank 5." Make a very sharp left hand turn, and go to the top of the hill. Proceeding along the fire trail to the right, travel approximately 0.6 mile to the "T" in the road and turn right. This road will bring you around in front of the air sampler. Take samples in the proximity of the permanent marker, which is near the power pole.

6.6.5. North of 801 (3-801N): Travelling from the intersection of Route 3 and Route 1, proceed approximately 0.4 mile north on Route 3 to the entrance of Building 801 (the FXR). Enter the driveway and drive to Bunker 801A.

NOTE: You must obtain permission from personnel in Building 801A before going behind the berm.

After you sign in, they will give you a key. Drive back to Route 3 and turn right. Then take the first right, continue, and take another right. Drive up this road to the fire trail on the right, and then drive up the fire trail approximately 0.2 mile to where the road splits. Take the right fork, proceed approximately 0.1 mile, and stop just as the road starts to go downhill. To the right, approximately 30 ft away, is a barbed-wire fence. The permanent marker, a red and white stake, is in a line-of-sight with the fence post (one post to the left of a "Radiation Area" caution sign) and the stack on Bunker 801. After you collect the sample, you must go back to Bunker 801A to sign out and return the key.

6.6.6. West of 801 (3-801W): Approximately 0.4 mile northwest of the intersection of Route 3 and Route 1 is the entrance to Building 801. Approximately 10 ft before the entrance, turn right onto the fire trail. The sampling location, marked by a red and white stake, is located approximately 30 ft down the fire trail and approximately 30 ft from the right side of the trail.

6.6.7. Southwest of East Observation Post (3-EOBS): From the entrance of Bunker 801, drive approximately 0.1 mile north to the first road on the right (just before you get to the road there is a "Well 1" sign). Drive up the road approximately 0.4 mile to where the road splits, take the left-hand fork, drive approximately 0.3 mile to the East Observation Post, and continue about 75 yards towards the big blue tank (Tank #9). The sampling location, marked by a red and white stake, is on the west side of the road, where the fire trail intersects with the paved road.

6.6.8. North Power Station (3-NPS): Proceeding north on Route 3, past Post 865, drive through the Advanced Test Accelerator (ATA) South Gate and proceed approximately 0.5 mile to ATA North Gate Drive. Pass through the ATA North Gate and go approximately 0.4 mile to the intersection of Route 3 and Route 4. Proceed to the right to the top of the hill where the barbed-wire fence ends. At the right is a fire trail. Take the samples from the side of the dirt mound between the fire trail entrance and the barbed wire

fence. The location is about 3 ft from the fence and about 50 ft east of the power pole, which serves as the permanent location marker.

6.6.9. **Evaporator/North of Well 8 (3-EVAP):** From the intersection of Route 3 and Doall Rd., proceed down Doall Rd. approximately 0.6 mile. The sampling location is on the right side of the road in line with Well NC7-14 and the power pole on Doall Rd. Line these markers up. Take the sample in the area of the red and white stake, which serves as the permanent location marker.

6.6.10. **Disposal Site West/Pit 7/West Landfill (3-DSW):** From the intersection of Doall Rd. and Route 4, proceed northwest on Route 4 for approximately 0.4 mile to Well K7-03, which is on the right side of the road. The permanent location marker is a stake driven into the ground in front of the well. Take samples in the dirt area around the stake, not in the gravel.

NOTE: Watch and listen for rattlesnakes when walking in tall grass.

6.6.11. **West Observation Post (3-WOBS):** From the intersection of Doall Rd. and Route 4, go south to the stop sign and turn left on Route 4. Proceed approximately 0.4 mile to a sign indicating West Observation Post (WOP) and Tank 3, take the road to the right and drive to the West OP (at the top of the hill). Take samples in the flat area north of the observation post. A USGS survey monument serves as the permanent location marker.

6.6.12. **North of Road to 851 (3-851N):** Coming from the WOP, turn right onto Route 4. Drive approximately 0.6 mile and watch for a road sign (on the right side) indicating Building 851. Turn right just after the sign and drive approximately 0.1 mile. The sampling location is approximately 100 ft before you get to the Butler Building S21, in line of sight of the power pole and the corner of the building, and approximately 30 ft from the right side of the road. The permanent location marker is on a red and white stake.

6.6.13. **North of 856 (3-856N):** Continuing south on Route 4, drive approximately 0.4 mile. Watch for a sign for Building 856 on the right side of the road. Turn right at the sign and drive approximately 0.6 mile to where the road makes a "Y". The paved road goes to the left and a fire trail goes to the right. Take the fire trail approximately 0.1 mile. The sampling location, marked by a red and white stake, is approximately 15 ft to the right of the fire trail, in line-of-sight with the West Observation Post.

6.6.14. **South of 858 (3-858S):** Continue southeast on Route 4 approximately 0.2 mile to a road just before Building 859. Turn right and drive behind Building 859 approximately 0.3 mile to the drop tower. The sampling location, marked by a red and white stake, is approximately 50 ft before the drop tower. Take the sample from the mound approximately 10 ft from the road.

6.7. SITE 300 SOIL SAMPLING FIELD TRACKING FORM

Soil samplers must complete soils Field Tracking Forms (see Attachment F) when conducting soil sampling activities in accordance with References 2 and 6. Samplers are instructed to estimate carefully the distance and compass direction from the permanent marker to the actual sampling locations and record this data on the Field Tracking Form. Samplers must also record dates and times of sampling, provide their initials for each sample, cross-reference COC numbers (Reference 6), and provide QA sample information.

7. DOCUMENTATION

Samplers must complete Field Tracking Forms and Chain of Custody Record Forms (COC) when collecting soil and sediment samples in accordance with Reference 6. Field Tracking Forms must contain

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current location designators (Reference 5). Field Tracking Forms and COCs become QA records and must be archived, along with sample data, in the Document Retention Center.

8. ACCEPTANCE CRITERIA

Only samples taken at official sampling locations will be used in the assessments of LLNL impacts on the environment, unless special samples are authorized in an approved sampling plan. Field Tracking Forms and COCs must be completed. Samples must be identified with authorized location designators (References 5 and 6) and must include pertinent information concerning the proximity of the actual sample collection area to the designated permanent location marker.

9. ATTACHMENTS

- A. Livermore Valley Soil Sampling Location Map
- B. Field Tracking Form: Livermore Valley Soil Sampling
- C. Arroyo Sediment Sampling Location Map
- D. Field Tracking Form: Arroyo Sediment Sampling
- E. Site 300 Soil Sampling Location Map
- F. Field Tracking Form: Site 300 Soil Sampling

ATTACHMENT A. LIVERMORE VALLEY SOIL SAMPLING LOCATION MAP

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ATTACHMENT B. FIELD TRACKING FORM: LIVERMORE VALLEY SOIL SAMPLING

FIELD TRACKING FORM: VALLEY SURFACE SOIL SAMPLING

Sample ID	Description	Distance	Date	Time	Initial(s)
L-MESQ-01-SO	Mesquite air sampler				
L-TANK-01-SO	Sandia tanks				
L-ZON7-01-SO	Zone 7 air sampler				
L-PATT-01-SO	proprietary				
L-FCC-01-SO	FCC air sampler				
L-HOSP-01-SO	VA Hospital air sampler				
L-MET-01-SO	NW Perimeter (Mat Tower)				
L-VIS-01-SO	Visitor's center air sampler				
L-COW-01-SO	Cow barn air sampler				
L-NEP-10-SO	NE perimeter-outside fence				
L-WRP1-01-SO	LWRP 1/3 in on north side				
L-WRP2-01-SO	LWRP 2/3 in on north side				
L-WRP3-01-SO	LWRP NW corner				
L-WRP4-01-SO	LWRP 1/3 down west side				
L-WRP5-01-SO	LWRP 2/3 down west side				
L-WRP6-01-SO	LWRP SW corner				
L-SALV-01-SO	Salvage				
L-CAFE-01-SO	South Cafeteria				
L-ALTA-01-SO	proprietary				
L-RRCH-01-SO	proprietary				
L-ERCH-01-SO	proprietary				
L-QA-____-SO	L-____-D1-SO				
L-QA-____-SO	L-____-D2-SO				

ANALYSES REQUESTED

Plutonium (NCD-ERL)
Gamma (NCD-ERL)
Ba (TMA-NORCAL)

PRESERVATIVES

none
none
none

C.O.C.	LAB

Revised 9/18/91

ATTACHMENT C. ARROYO SEDIMENT SAMPLING LOCATION MAP

ATTACHMENT D. FIELD TRACKING FORM: ARROYO SEDIMENT SAMPLING

Arroyo Sediment Sampling

Revised 9/18/91

CDB (Central Drainage Basin - same as Stormwater location)					
Date: _____		NC	COC		Initial(s) _____
		B&C			
ID	Location In feet	NC	Depth	B&C	Depth
CDB# 1	_____	L-CDB-01-AS	_____	L-CDB-01-AS	_____
CDB# 2	_____	L-CDB-02-AS	_____	L-CDB-02-AS	_____
CDB# 3	_____	L-CDB-03-AS	_____	L-CDB-03-AS	_____

CDB2 (Central Drainage Basin - near the middle)					
Date: _____		NC	COC		Initial(s) _____
		B&C			
ID	Location In feet	NC	Depth	B&C	Depth
CDB2# 1	_____	L-CDB2-01-AS	_____	L-CDB2-01-AS	_____
CDB2# 2	_____	L-CDB2-02-AS	_____	L-CDB2-02-AS	_____
CDB2# 3	_____	L-CDB2-03-AS	_____	L-CDB2-03-AS	_____

ALPE (Arroyo Las Positas East - Visitor Center stormwater location)					
Date: _____		NC	COC		Initial(s) _____
		B&C			
ID	Location In feet	NC	Depth	B&C	Depth
ALPE# 1	_____	L-ALPE-01-AS	_____	L-ALPE-01-AS	_____
ALPE# 2	_____	L-ALPE-02-AS	_____	L-ALPE-02-AS	_____
ALPE# 3	_____	L-ALPE-03-AS	_____	L-ALPE-03-AS	_____

ALPW (Arroyo Las Positas West - stormwater location near B196)					
Date: _____		NC	COC		Initial(s) _____
		B&C			
ID	Location In feet	NC	Depth	B&C	Depth
ALPW# 1	_____	L-ALPW-01-AS	_____	L-ALPW-01-AS	_____
ALPW# 2	_____	L-ALPW-02-AS	_____	L-ALPW-02-AS	_____
ALPW# 3	_____	L-ALPW-03-AS	_____	L-ALPW-03-AS	_____

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ATTACHMENT D (CONT.) FIELD TRACKING FORM: ARROYO SEDIMENT SAMPLING

Arroyo Sediment Sampling

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ASS2 (Arroyo Seco South #2 - same as Stormwater location at Sandia)					
Date: _____		NC <input type="text"/>	Initial(s) _____		
		B&C <input type="text"/>			
ID	Location in feet	NC	Depth	B&C	Depth
ASS2# 1	_____	L-ASS2-01-AS	_____	L-ASS2-01-AS	_____
ASS2# 2	_____	L-ASS2-02-AS	_____	L-ASS2-02-AS	_____
ASS2# 3	_____	L-ASS2-03-AS	_____	L-ASS2-03-AS	_____
4THA (4TH & A - same as stormwater location)					
Date: _____		NC <input type="text"/>	Initial(s) _____		
		B&C <input type="text"/>			
ID	Location in feet	NC	Depth	B&C	Depth
4THA# 1	_____	L-4THA-01-AS	_____	L-4THA-01-AS	_____
4THA# 2	_____	L-4THA-02-AS	_____	L-4THA-02-AS	_____
4THA# 3	_____	L-4THA-03-AS	_____	L-4THA-03-AS	_____
B438 (East of Building 438 - stormwater location)					
Date: _____		NC <input type="text"/>	Initial(s) _____		
		B&C <input type="text"/>			
ID	Location in feet	NC	Depth	B&C	Depth
B438# 1	_____	L-B438-01-AS	_____	L-B438-01-AS	_____
B438# 2	_____	L-B438-02-AS	_____	L-B438-02-AS	_____
B438# 3	_____	L-B438-03-AS	_____	L-B438-03-AS	_____
ALPN (Arroyo Las Positas North - stormwater location near Cowbarn)					
Date: _____		NC <input type="text"/>	Initial(s) _____		
		B&C <input type="text"/>			
ID	Location in feet	NC	Depth	B&C	Depth
ALPN# 1	_____	L-ALPN-01-AS	_____	L-ALPN-01-AS	_____
ALPN# 2	_____	L-ALPN-02-AS	_____	L-ALPN-02-AS	_____
ALPN# 3	_____	L-ALPN-03-AS	_____	L-ALPN-03-AS	_____

REVISION 1
FINAL

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Soil & Arroyo Sediment Sampling
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ATTACHMENT D (CONT.). FIELD TRACKING FORM: ARROYO SEDIMENT SAMPLING

Arroyo Sediment Sampling

Revised 9/18/91

GRNE (Greenville Rd. Northeast Stormwater location)					
Date: _____		NC	COC		Initial(s) _____
		B&C			
ID	Location in feet	NC	Depth	B&C	Depth
GRNE# 1	_____	L-GRNE-01-AS	_____	L-GRNE-01-AS	_____
GRNE# 2	_____	L-GRNE-02-AS	_____	L-GRNE-02-AS	_____
GRNE# 3	_____	L-GRNE-03-AS	_____	L-GRNE-03-AS	_____

ASW (Arroyo Saco West, Vasco Rd stormwater location)					
Date: _____		NC	COC		Initial(s) _____
		B&C			
ID	Location in feet	NC	Depth	B&C	Depth
ASW# 1	_____	L-ASW-01-AS	_____	L-ASW-01-AS	_____
ASW# 2	_____	L-ASW-02-AS	_____	L-ASW-02-AS	_____
ASW# 3	_____	L-ASW-03-AS	_____	L-ASW-03-AS	_____

WPDC (West Perimeter Drainage Channel - stormwater location outside channel)					
Date: _____		NC	COC		Initial(s) _____
		B&C			
ID	Location in feet	NC	Depth	B&C	Depth
WPDC# 1	_____	L-WPDC-01-AS	_____	L-WPDC-01-AS	_____
WPDC# 2	_____	L-WPDC-02-AS	_____	L-WPDC-02-AS	_____
WPDC# 3	_____	L-WPDC-03-AS	_____	L-WPDC-03-AS	_____

QA					
Date: _____		NC	COC		Initial(s) _____
		B&C			
ID	Location in feet	NC	Depth	B&C	Depth
QA# 1	_____	L-QA-01-AS	_____	L-QA-01-AS	_____
QA# 2	_____	L-QA-02-AS	_____	L-QA-02-AS	_____
QA# 3	_____	L-QA-03-AS	_____	L-QA-03-AS	_____

B&C: EPA 8010, EPA 8020, EPA 8080, CAM Metals (STLC)

NC: Pb, Cadmium, Tritium

ATTACHMENT E. SITE 300 SOIL SAMPLING LOCATION MAP

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ATTACHMENT F. FIELD TRACKING FORM: SITE 300 SOIL SAMPLING

FIELD TRACKING FORM: SITE 300 SURFACE SOIL SAMPLING

Sample ID	Description	Distance	Date	Time	Initial(s)
3-GOLF-01-SO	Golf Course				
3-834W-01-SO	West of 834				
3-812N-01-SO	Behind Bunker 812				
3-801E-01-SO	East of 801				
3-801W-01-SO	West of 801				
3-801N-01-SO	North of 801				
3-EOBS-01-SO	Observation Post				
3-NPS-01-SO	North Power Station				
3-EVAP-01-SO	North of Well 8/Evaporator				
3-DSW-01-SO	Disposal Site West				
3-WOBS-01-SO	West Observation Post				
3-851N-01-SO	North of road to 851				
3-856N-01-SO	North of 856				
3-858S-01-SO	South of 858				
3-QA-01-SO	3-_____-01-SO				

ANALYSES REQUESTED

Plutonium (NCD-ERL)

Gamma (NCD-ERL)

Be (TMA-NORCAL)

PRESERVATIVES

none

none

none

C.O.C.	LAB

EMP-S-S

SOIL & ARROYO SEDIMENT SAMPLING

Prepared by:

Gretchen Gallegos 12/8/94
Gretchen Gallegos date
Environmental Analyst

Reviewed by:

Duke Ramsey 12-8-94
Duke Ramsey date
Environmental Technologist, TSG

David Graves 12-8-94
David Graves date
Environmental Technologist, TSG

Paris Althouse 12/8/94
Paris Althouse date
Environmental Technologist, TSG

Approved by:

Rebecca A. Failor 12/9/94
Rebecca A. Failor date
Section Leader, EMS

Kris Surano 12/8/94
Kris Surano date
Group Leader, TAMM

Lucinda M Garcia 12/8/94
Lucinda Garcia date
Quality Assurance Coordinator, EMS

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes the methods to be used in collecting surface soil and arroyo sediment samples for EMS environmental surveillance activities at LLNL, in the Livermore Valley, and at Site 300. This procedure applies to both routine and non-routine sampling unless the non-routine sampling plan specifically states otherwise.

2. DISCUSSION

Soil is an integrating medium that can contain pollutants originally released directly to the ground, to the air, or through liquid effluents. "Periodic sampling and analysis of indicator materials, such as soil ... should be performed to determine if there is measurable long-term buildup of radionuclides in the terrestrial environment" (Reference 1). Since 1972, surface soil sampling in the vicinity of LLNL and Site 300 has been part of a continuing LLNL monitoring program designed to measure any changes in environmental levels of radioactivity and to evaluate any increase in radioactivity that might have resulted from LLNL operations. Surface soil samples at Site 300 are also analyzed for beryllium, a potentially toxic metal used at Site 300.

EMS soil sampling locations are chosen to coincide with air sampling locations or to give coverage to areas of special concern, including areas of known past contamination (Reference 2). The use of constant sampling locations allows better trending of data and closer monitoring of areas of concern. All soil sampling is conducted according to this procedure.

According to Reference 1, "The sampling of sedimentary material from streams or ponds can provide an indication of the accumulation of undissolved radionuclides in the aquatic environment. The accumulation of radioactive materials in sediment can lead to exposure of humans through ingestion of aquatic species, through sediment resuspension into drinking water supplies, or as an external radiation source..." Annual sediment samples have been collected from selected arroyos and other drainages at and around LLNL since 1988. The sediment sampling locations coincide with storm water runoff sampling locations, so results from the sampling of these two related media can be compared (Reference 3). All sediment sampling is conducted according to this procedure.

Sediments also have the potential to concentrate nonradioactive constituents present in storm water runoff, and analyses have been conducted on nonradioactive constituents of sediment samples every year since the inception of sediment monitoring. However, sediment sampling and analysis has not shown any measurable buildup of nonradioactive materials at LLNL. Analyses of sediment samples for nonradiological materials has been discontinued. Nonetheless, sediment monitoring is currently being addressed by the EPA (Reference 4). Renewed sediment sampling for nonradiological materials will depend on the outcome of this EPA effort.

3. REFERENCES

1. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
2. EMP-S-L, *Soil and Arroyo Sampling Locations*
3. EMP-RO-L, *Storm Water Runoff Sampling Locations*
4. U.S. Environmental Protection Agency (U.S. EPA 1994), *EPA's Contaminated Sediment Management Strategy*, U.S. Environmental Protection Agency, Office of Water, Washington, DC (EPA-823-F-94-001)
5. EMP-QA-CD, *Design Change Packages*
6. EMP-QA-NCR, *Nonconformance and Discrepancy Reporting*
7. EMP-QA-D, *Data Analysis*

8. EMP-QA-AER, *Annual Environmental Report*
9. EMP-QA-SL, *Sample Location Designators*
10. EMP-QA-SA, *Self Assessments*
11. EMP-QA-SD, *Sample Tracking Documentation*
12. EMP-QA-DC, *Document Retention*
13. C 998-90, *Standard Practice for Sampling Surface Soil for Radionuclides*, American Society for Testing and Materials, Philadelphia, PA, 1990.
14. EMP-QA-S, *Quality Assurance Sampling*
15. EMP-QA-CS, *Courier Service Protocol*
16. Hall and Edwards (1994), *RAS Technical Implementing Procedures*
17. EMP-QA-DM, *Data Management*

4. DEFINITIONS

Arroyo: A deep gully cut by an intermittent stream.

Auger: Tool used to bore holes in the ground. Soil or sediment samples can be collected from the auger bit after it is withdrawn from the ground.

Chain-of-Custody (COC) Record Form: A document used to track samples as they progress from sample collector, through the analytical process, to the final archiving of the data. It contains important sample information, including the name of the laboratory that will analyze the samples, sample identifiers, the identity of the sample collector, the identity of the EMS analyst responsible for the data, the EMS mailing address, the date the sample was collected, a unique COC number (printed on the upper right corner of the form), a release number of analyses to be performed by off-site laboratories, the analyses to be performed, and signatures that document custodianship of the samples as they change hands. The COC is a five-part color-coded form. An example COC for soil and sediment sampling is provided in Reference 2.

Core Sampler: An impact-driven soil sampling device for collecting an intact, undisturbed cylinder of surface soil from the ground.

Field Tracking Form (FTF): A form used to document sample collection information. It contains sample identifiers, as well as information pertinent to unspecified, or blind, quality control samples. Analysts can only decode QC sample results with information contained on the FTF. An example FTF for soil and sediment sampling is provided in Reference 2.

Sample Identifier: The four-field code that identifies an individual sample to an analytical laboratory. It is made up of the sample location designator (two fields), a sample number, and a media code (L-ZON7-01-SO, for example).

Sediment: Finely divided solid material that settles to the bottom of a liquid.

Sediment sample: An aliquot of arroyo sediment taken to a depth of 5 cm for plutonium and gamma-emitting radionuclides and to a depth of 15 cm for tritium samples.

Soil: The top layer of earth, suitable for the growth of plants.

Soil sample: An aliquot of surface soil collected to a depth of 5 cm because surface deposition from the air is the primary pathway for potential soil contamination.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS Section Leader assures that sampling methods meet regulatory guidance and that sampling is conducted in accordance with approved procedures.

5.2. TAMM GROUP LEADER

The TAMM Group Leader assures that sampling procedures meet design criteria and that sampling is conducted in accordance with approved procedures.

5.3. EMS ENVIRONMENTAL ANALYST (SOILS)

The Environmental Analyst assigned responsibility for the soil and sediment monitoring networks will decide when and where samples are to be collected. Sampling locations are described in Reference 2. The Analyst must periodically review the network sampling locations, the sample collection schedule and methods, quality assurance (QA) sampling, technical suitability of sample analytes, and data quality objectives and action limits in the context of EMS goals and missions. Furthermore, the Analyst is responsible for assessing the need to sample newly discovered areas of known or suspected contamination. The Analyst is responsible for submitting design changes regarding the network sampling locations, schedules, and sampling methods (Reference 5). The Analyst should also discuss analytical procedures, detection limits, and data delivery schedules with analytical laboratory personnel and EMS Technologists. The Analyst is responsible for keeping this procedure updated; for participating in nonconformance report activities (Reference 6); for conducting data analysis (Reference 7); for reporting results (Reference 8); and for communicating changes, as needed, to other EMS staff members. The Analyst may delegate some of these tasks to an analyst assistant, but the Analyst remains responsible for their performance.

5.4. EMS QUALITY ASSURANCE COORDINATOR

The QA Coordinator is responsible for keeping lists of all present and past sampling locations, and evaluating the need for and reviewing/approving soil sampling method design changes (Reference 5). The QA Coordinator is also responsible for inspecting and evaluating sample collection methods and documentation (References 9 and 10), for participating in nonconformance report activities (Reference 6), and for archiving all design changes and revisions of this procedure (Reference 11).

5.5. EMS TECHNOLOGISTS

The EMS Technologists are responsible for collecting soil and sediment samples according to methods detailed in this procedure at locations described in Reference 2. They must complete appropriate Field Tracking Forms (FTFs) and Chain-of-Custody Record Forms (COCs) and must make detailed notes (on FTFs) as pertinent information regarding soil and sediment samples is acquired (see References 11 and 12). In particular, they must record the distance and direction from permanent location markers to the actual sampling locations. Technologists are also responsible for providing input to the Analyst regarding the suitability of sampling locations and sampling methods, the availability of samples, any problems associated with the monitoring networks (Reference 5), and the generation of NCRs to document sampling or analytical problems (Reference 6).

6. PROCEDURE

Equipment Required:

SURFACE SOIL SAMPLING

- Stainless steel soil core sampler (custom fabricated by EMS Technologists; B-596)
- Resin striking surface
- Sledge hammer, 5 to 8 lb.
- Plastic sample collection bags
- Yellow tie-on sample tags
- Indelible marking pens
- Tape measure, 50 ft.
- Magnetic compass
- Plastic vial for soil subsample, beryllium analysis
- Adhesive labels
- Field Tracking Form (An example form is reproduced in Reference 2)
- Chain-of-Custody Record Forms (2 each—An example form is reproduced in Reference 2)
- Ice chest (no ice required; Transportainer TY-165, end of 6th St., LLNL)

ARROYO SEDIMENT SAMPLING

- Stainless steel soil core sampler (custom fabricated by EMS Technologists; B-596)
- Resin striking surface
- Sledge hammer, 5 to 8 lb.
- Hand auger w/extensions (Environmental Instruments Co., Concord CA; B-596)
- Stainless-steel tubes (Building 596)
- Pipe wrenches (2 each)
- Large screwdriver
- Ice chest w/ double-bagged ice (Transportainer TY-165, end of 6th St., LLNL)
- Wide-mouth glass sample collection containers
- Adhesive labels
- Indelible marking pens
- Teflon sheets, 4 inches by 4 inches (LLNL Pipe Shop, B-511)
- Protective caps (LLNL Pipe Shop, B-511)
- Duct tape
- Tape measure, 50 ft.
- Trowel
- Field Tracking Form (An example form is reproduced in Reference 2)
- Chain-of-Custody Record Form (An example form is reproduced in Reference 2)

DECONTAMINATION AND PERSONAL PROTECTIVE EQUIPMENT

- Disposable vinyl gloves
- Deionized water and detergent
- Large test-tube brush
- Large rinse tray (photo developing)
- Large light-duty wiping tissues
- Garbage bags
- Leather protective gloves
- Safety shoes (boots; LLNL Supervisor controlled)
- Safety glasses

All soil and sediment samples must be collected according to the methods described in this procedure. All sampling activities must take place at designated sampling locations (Reference 2). FTFs and COCs must be completed for all samples, in accordance with References 10 and 12.

6.1. SURFACE SOIL SAMPLING (LIVERMORE VALLEY/SITE 300)

The soil sampling methods are identical for the Livermore Valley and Site 300 soil monitoring networks. Site 300 access and safety procedures must be strictly followed when performing all sampling activities. Soil samples shall be collected annually, usually in the months of May or June. The collection of surface soils requires only nominal personal protective equipment (disposable vinyl gloves, safety glasses, safety boots). Soil samples for the Livermore Valley are analyzed for plutonium and gamma-emitting radionuclides. Soil samples for Site 300 are analyzed for plutonium, gamma-emitting radionuclides, and beryllium.

6.1.1. SELECTION OF SOIL SAMPLE MATERIAL

6.1.1.1. Locate the permanent soil sample location marker (red and white fence post with metal identification tag attached; Reference 2). Select an undisturbed area, free of rocks and not sheltered by trees or buildings, in the vicinity of the permanent location marker.

6.1.1.2. Choose two 1-m² areas from which to collect the sample. The sample will consist of ten subsamples, collected at the four corners and the center of each square. If two 1-m² areas are not available (such as along a roadside or a fence) the sample will be collected in a line, with each subsample being taken 1 m apart (Reference 13).

6.1.1.3. Using the tape measure and the compass for measurements, note the distance and direction of the actual sampling location from the permanent identification marker (Reference 2). Record this distance and direction on the FTF.

6.1.2. SOIL SAMPLE VOLUME

The total sample should weigh about 1.0 to 3.0 kg. A 10-g aliquot is taken from the Site 300 samples for beryllium analysis.

6.1.3. OBTAINING THE SOIL SAMPLE

Note: Prior to the actual collection of the samples, it is vital that the sampler be aware of EMS sampling hygiene. This includes wearing disposable gloves when collecting samples and discarding the gloves between locations. Take special precautions not to introduce any external contamination. This includes keeping the work area clean.

6.1.3.1. If necessary, carefully clip surface vegetation at the soil surface from the ten subsampling areas. Do not disturb the soil surface.

6.1.3.2. Place the clean, decontaminated core sampler, resin striking surface at the top, on the first subsample site. With a sledge hammer, drive the core sampler into the ground until the ground surface is level with the bottom of the steel band welded to the outside of the core sampler. (At some locations, the soil may be loose enough so you can merely twist the core sampler into the ground by hand.)

6.1.3.3. Remove the resin striking surface. Twist the core sampler in order to break off the core it contains. If the soil sample is loose within the corer, capture the soil sample by slipping a newly gloved hand under the base of the core sampler as it is removed. Be careful not to lose or contaminate any part of the sample. Should loss of subsample integrity occur, the subsample shall be discarded and another shall be collected.

6.1.3.4. Shake the contents of the core sampler into the plastic sample collection bag. If the sample is not easily shaken out, place two plastic bags over the handle of the sledge hammer and gently tap the core sample into the sample collection bag.

6.1.3.5. Repeat the collection steps 6.1.3.1 through 6.1.3.4 at the nine remaining subsample sites, combining the ten subsamples into the same sample bag.

6.1.3.6. For samples taken at Site 300, obtain an aliquot of the sample for beryllium analysis. Make sure the subsamples are adequately mixed. Then obtain an approximately 10-g aliquot from the sample and place it in a plastic vial. Place a white, self-stick label on the vial (Attachment A). Record the following information on the label: the sample identifier (including sample location designator), the type of sample, the date and year of collection, the type of analysis required (Be), the analytical laboratory, the initials "LLNL", and the collector's initials.

6.1.3.7. Secure the sampling collection bag with a rubber band. Mark the outside of the bag with the sampling location using a waterproof, indelible marking pen. Place this bag inside another plastic bag and secure the second bag with a rubber band. Attach a yellow sample identification tag to the outside bag (Attachment B). The tag shall contain, at a minimum, the sample identifier (including sample location designator), the type of sample, the date and year of collection, the analyses required (gamma, plutonium for LLNL Main Site, and gamma only for Site 300), the analytical laboratory, and the collector's initials.

6.1.4. SOIL SAMPLE FIELD DOCUMENTATION

Record the appropriate information on the FTF (References 2 and 10). Be sure to record the distance and direction from the permanent sampling location to the location at which the sample was obtained. Record any other pertinent information about the sample.

6.1.5. SOIL SAMPLE PRESERVATION

No special preservation measures are required for soil samples. However, samplers must ensure the integrity of sample containers to avoid cross-contamination.

6.1.6. SOIL QUALITY ASSURANCE SAMPLES

QA samples will be submitted with each batch of samples, in accordance with Reference 14. Duplicate samples are the only QA samples currently required for the soil sampling networks. Two duplicate samples are required for the Livermore Valley soil sampling network and two duplicate samples are required for the Site 300 soil sampling network. At locations chosen randomly for duplicate samples, two samples are to be collected. Each sample will consist of ten subsamples. At each corner and at the center of each sampling square, two cores will be collected and processed separately. For Site 300 samples, duplicate 10-g sample aliquots for beryllium analyses will also be produced. The sampling

locations of QA samples are not to be identified on the bags, sample identification tags, or vial labels (References 10 and 12). However, this information is required on FTFs, and the QA sample must be assigned a QA identification number (Reference 10).

The choice of random duplicate sample locations is made through the use of a random-number-generating function in Microsoft Excel called RANDBETWEEN. The Data Management personnel will run this function using the numbers between 1 and the total number of sampling locations and will mark the Field Tracking Form to indicate the randomly chosen locations for duplicate sampling.

6.1.7. SOIL SAMPLING EQUIPMENT DECONTAMINATION

Gloves must be discarded after collecting each sample, and must not be reused. After all subsamples are collected from a location, decontaminate the core sampler by washing it thoroughly with deionized water and a low-phosphate detergent. The large test tube brush should be used to clean the inside of the corer and to remove any particles adhering to the outside. The core sampler must then be thoroughly rinsed with deionized water. Rinse any other equipment that has come into contact with soil, using the same procedures. Dry the core sampler with a light-duty wiping tissue and place it in a plastic bag to prevent contamination.

Rinse water from equipment decontamination may be discharged to ground under most conditions. However, rinse water may not be discharged to a street, storm drain, arroyo, drainage channel, or other location where the water would be channeled rather than percolated through the ground. In addition, rinse water from highly contaminated soils cannot be discharged to ground.

6.1.8. CHAIN OF CUSTODY

Chain-of-custody procedures (Reference 10) must be followed. After all samples have been collected from a soil network, use the information from the FTF to complete a COC for each analytical laboratory. In addition to sample identification information, each COC must specify the laboratory name and the analyses to be completed.

6.1.9. SOIL SAMPLE DELIVERY

Deliver the samples in the plastic sampling bags to the Radiation Analytical Sciences (RAS) Laboratory, Building 151, Room 2143. If the samples cannot be delivered on the day of collection, they must be kept secure (Reference 10) until they can be delivered. Samples going to a contract analytical laboratory for beryllium analyses must be delivered, in accordance with Reference 15, to the sample courier. Chain-of-custody procedures must be followed whenever samples are delivered to laboratory personnel or to couriers.

Plutonium content of samples is determined by alpha spectroscopy of sample aliquots. Other sample aliquots are analyzed by gamma spectroscopy using a Ge detector (Reference 16). Beryllium content is determined by graphite-furnace atomic absorption spectroscopy.

6.1.10. SOIL DATA REVIEW, ANALYSIS, MANAGEMENT, ARCHIVING

The Analyst will review and analyze data promptly after receipt, in accordance with Reference 7. Chain-of-custody procedures will be followed for data (Reference 10), and QA samples will be identified by the Analyst when signing and returning COCs, following receipt of data, to the analytical laboratory. Data will be given to the Data Manager promptly for entry into the EMS

Monitoring Database (References 10 and 17), and will be archived according to Reference 11.

6.1.11. SOIL DATA REPORTING

The monitoring results will be reported in the Site Annual Environmental Report (Reference 8).

6.2. ARROYO SEDIMENT SAMPLING

Arroyo sediment samples shall be collected annually, in June or July, after seasonal rains have ceased. The collection of sediment samples requires the use of personal protective equipment (disposable vinyl gloves, leather gloves, safety glasses, safety shoes). Arroyo sediment samples are analyzed for plutonium, gamma-emitting radionuclides, and tritium.

Samples from individual sediment sample locations are collected from two depths. The sample to be analyzed for plutonium and gamma-emitting radionuclides is collected with the stainless steel core sampler from 10 subsample locations 5 cm deep. The sample to be analyzed for tritium is collected 15 cm deep, using the hand auger, at only one location that is within 0.5 m of one of the core sediment subsamples.

Note: The sediment sampling procedure involves the use of heavy equipment. Care should be exercised to avoid injury when using the sampling equipment. The normally high daytime temperatures during the sampling period, combined with the strenuous physical activity required to operate the hand auger, make it mandatory that a team consisting of no less than two qualified persons perform the sampling.

6.2.1. SELECTION OF ARROYO SEDIMENT SAMPLE MATERIAL

6.2.1.1. Locate the permanent sediment sampling location marker at the sampling location. A culvert/bridge or other permanent marker, described in Reference 2, serves as a reference point for that sampling location. Drive a wooden stake into the ground at the permanent location marker.

6.2.1.2. Samples for plutonium and gamma-emitting radionuclide analyses are to be collected at distances measured (in meters) from the permanent marker. Samples should be collected from a transect down the middle of the drainage channel at ten 1-meter intervals.

6.2.1.3. Samples for tritium analyses are to be collected within 0.5 m of one of the plutonium and gamma analyses subsample locations.

6.2.2. ARROYO SEDIMENT SAMPLE VOLUME

Sediment samples are obtained with two different devices. The auger should provide enough sample to fill the 250-mL glass sample container that will be submitted to RAS for tritium analysis; the core samples, which are 1 to 3 kg, are contained in plastic bags.

6.2.3. OBTAINING THE ARROYO SEDIMENT SAMPLE

Note: Prior to the actual collection of the samples, it is vital that the sampler be aware of EMS sampling hygiene. This includes wearing disposable gloves when collecting samples and discarding the gloves between samples. Take special precautions not to introduce any external contamination. This includes keeping the work area clean.

6.2.3.1. Remove any rocks from the sediment surface at the exact location where the sample is to be collected.

6.2.3.2. Place the clean, decontaminated core sampler, resin striking surface at the top, on the first subsample site. With a sledge hammer, drive the core sampler into the ground until the ground surface is level with the bottom of the steel band welded to the outside of the core sampler. (At some locations, the sediment may be loose enough so you can merely twist the core sampler into the ground by hand.)

6.2.3.3. Remove the resin striking surface. Twist the core sampler in order to break off the core it contains. If the sediment sample is loose within the corer, capture the sediment sample by slipping a newly gloved hand under the base of the core sampler as it is removed. Be careful not to lose or contaminate any part of the sample. Should loss of subsample integrity occur, the subsample shall be discarded and another shall be collected.

6.2.3.4. Shake the contents of the core sampler into the plastic sample collection bag. If the sample is not easily shaken out, place two plastic bags over the handle of the sledge hammer and gently tap the core sample into the sample collection bag.

6.2.3.5. Repeat the collection steps 6.2.3.1 through 6.2.3.4 at the nine remaining subsample sites, combining the ten subsamples into the same sample bag.

6.2.3.6. Secure the sampling collection bag with a rubber band. Mark the outside of the bag with the sampling location using a waterproof, indelible marking pen. Place this bag inside another plastic bag and secure the second bag with a rubber band. Attach a yellow sample identification tag to the outside bag (Attachment B). The tag shall contain, at a minimum, the sample identifier (including sample location designator), the type of sample, the date and year of collection, the analyses required (gamma, plutonium), the analytical laboratory, and the collector's initials.

6.2.3.7. Within 0.5 m of one of the 10 core sampling locations, dig to a depth of 15 cm from ground level using the hand auger.

6.2.3.8. Remove the auger from the hole and place the sediment that is attached to the auger bit into a 250-mL glass sample container. In the event that the sediment is dry and will not remain attached to the auger, use a trowel to fill the glass sample container with sediment from the hole.

6.2.3.9. Using the indelible marking pen, prepare an adhesive label. The label should include the sample identifier (including the sample location designator), the sample collector's initials, the type of sample, the analyses required (tritium), the analytical laboratory (RAS), and the sampling date (Attachment C). Secure the lid to the jar with duct tape, attach the label to the jar, and place the sample container into the ice chest. This portion of the sample goes to RAS for tritium and other radiological analyses, and must be kept cool prior to analyses.

6.2.4. ARROYO SEDIMENT SAMPLE FIELD DOCUMENTATION

Record appropriate information on the FTF (References 2 and 10). Record any pertinent information about the sample. Specifically, the EMS Technologist should document from which location of the ten core-subsample locations the tritium sample was collected.

6.2.5. ARROYO SEDIMENT SAMPLE PRESERVATION

Sediment samples in glass containers must be kept cool until analysis, and must be kept on ice while in the field. Upon returning to LLNL, samples for radiological analyses that are in glass sample containers should be kept in a refrigerator. The samples must still be refrigerated when delivered to the analytical laboratory.

6.2.6. ARROYO SEDIMENT QUALITY ASSURANCE SAMPLES

QA samples are to be submitted with each batch of samples, in accordance with Reference 14. A blind duplicate sample is to be taken from a randomly selected sampling location and submitted blind, as a QA sample, to analytical laboratories. The sampling locations of QA samples are not to be identified on the sample containers or COCs (Reference 10). However, this information is required on FTFs.

The choice of random duplicate sample locations is made through the use of a random-number-generating function in Microsoft Excel called RANDBETWEEN. The Data Management personnel create will run this function using the numbers between 1 and the total number of sampling locations and will mark the Field Tracking Form to indicate the randomly chosen locations for duplicate sampling.

6.2.7. ARROYO SEDIMENT SAMPLING EQUIPMENT DECONTAMINATION

Gloves must be discarded after collecting each sample, and must not be reused. Before collecting additional samples, either at the same location or at another location, the auger, stainless steel core sampler, and other sampling equipment must be decontaminated.

Wash the equipment thoroughly with deionized water and a low-phosphate detergent. The large test tube brush should be used to clean the inside of the samplers and to remove any sediment adhering to the outside of the samplers. Rinse all equipment thoroughly with deionized water. Dry the samplers with light-duty wiping tissues and place the samplers in a plastic bag to prevent subsequent contamination.

Rinse water from equipment decontamination may be discharged to ground under most conditions. However, rinse water may not be discharged to a street, storm drain, arroyo, drainage channel, or other location where the water would be channeled rather than percolated through the ground. In addition, rinse water from highly contaminated soils cannot be discharged to ground.

6.2.8. CHAIN OF CUSTODY

Chain-of-custody procedures (Reference 10) must be followed. Using information from the FTF, complete the COCs after all samples have been collected from the arroyo sediment sampling network. In addition to sample identification information, the COC must specify the laboratory name and the analyses required. Be sure to include the COC numbers on the FTF as a cross-reference.

6.2.9. ARROYO SEDIMENT SAMPLE DELIVERY

On the same day that they are collected, deliver the radiological subsamples to the RAS, Building 151, Room 2143. If the samples cannot be delivered on the day of collection, they must be kept secure (Reference 10) and refrigerated until they can be delivered. Chain-of-custody procedures must be followed when delivering samples (Reference 10).

Tritium content is determined by liquid scintillation counting of water recovered from the samples by using freeze-drying techniques (lyophilization). Plutonium content is determined by alpha spectroscopy, and other radionuclides are determined by gamma spectroscopy (Reference 16).

6.2.10. SEDIMENT DATA REVIEW, ANALYSIS, MANAGEMENT, ARCHIVING

The Analyst will review and analyze data promptly after receipt, in accordance with Reference 6. Chain-of-custody procedures will be followed for data (Reference 10), and QA samples will be identified by the Analyst when signing and returning COCs, following receipt of data, to the analytical laboratory. Data will be given to the Data Manager promptly for entry into the EMS Monitoring Database (References 10 and 17), and will be archived according to Reference 11.

6.2.11. SEDIMENT DATA REPORTING

The sediment sampling results will be reported in the Site Annual Environmental Report (Reference 8).

7. DOCUMENTATION

Samplers must complete FTFs and COCs when collecting soil and arroyo sediment samples, in accordance with Reference 10. FTFs must contain current location designators (Reference 12). FTFs and COCs become QA records and must be archived in the Document Retention Center, along with final sample data (Reference 11). Any deviations from this procedure must be documented in NCRs (Reference 6). Any changes to this procedure must be documented in an approved Design Change Package (Reference 5). All NCRs and Design Change Packages are QA records and must be archived (Reference 11).

8. ACCEPTANCE CRITERIA

Only samples taken at official sampling locations will be used in the assessments of LLNL impacts on the environment, unless special samples are authorized in an approved sampling plan. Samples will not be deemed acceptable if the proper collection and preservative methods have not been followed, if the chain-of-custody has been broken or compromised, if the documentation has not been properly completed, or if the sample label or tag is illegible. Samples must be identified with authorized location designators (References 10 and 12) and documentation must include pertinent information as required by this procedure. Furthermore, samples will not be deemed acceptable if the sample containers are not properly labeled, dated, and initialed by the sample collector, or if sample contamination is suspected.

9. ATTACHMENTS

- Attachment A. Soil Sample Label (Beryllium Analysis)
- Attachment B. Soil Sample Tag
- Attachment C. Arroyo Sediment Sample Label (Radiological Analyses)

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ATTACHMENT A. SOIL SAMPLE LABEL
(BERYLLIUM ANALYSIS)

LLNL

10/4/94

3-851N-01-SO

Annual Soil

CLS
Be

DR, DG

ATTACHMENT B. SOIL SAMPLE TAG

LLNL	10/4/94
L-CAFE-01-SO Annual Soil
RAS Pu, Gamma	DR, DG

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ATTACHMENT C. ARROYO SEDIMENT SAMPLE LABEL
(RADIOLOGICAL ANALYSES)

LLNL

10/4/94

L-CDB-01-AS
Annual Sediment

RAS
Tritium

DR, DG

EMP-SW-B196

SEWAGE SAMPLING AT B196

Prepared by:

Brian Balke 12/16/94
Brian Balke
Environmental Analyst, WGMG
date

Renee Needens 12-19-94
Renee Needens
Environmental Technologist, TSG
date

Reviewed by:

Jennifer Larson 12-20-94
Jennifer Larson
Environmental Analyst, WGMG
date

Approved by:

William G. Hoppes 12-20-94
William G. Hoppes
Group Leader, WGMG
date

Rebecca A. Failor 12/21/94
Rebecca A. Failor
Section Leader, EMS
date

Lucinda M. Garcia 12/21/94
Lucinda M. Garcia
Quality Assurance Coordinator, EMS
date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes sampling activities at the Sewage Monitoring Station (B196). Two kinds of sampling are performed: collection of daily composite samples for tracking of radiation discharges (Reference 1), and collection of grab samples to validate and characterize the significance of sewer monitoring alarms (References 2 and 3). This procedure does not cover operation and maintenance of the sewer monitoring equipment in B196 or sampling at the C196 location.

2. APPLICABILITY/DISCUSSION

The monitoring operations at B196 have two distinct purposes: (1) verification of compliance with the terms of LLNL's discharge permit from the Livermore Water Reclamation Plant (LWRP) and Department of Energy (DOE) and State guidance; and (2) monitoring to detect inadvertent releases of hazardous or radioactive substances.

Compliance sampling takes place at the C196 location as described in Reference 4. According to the conditions of the LWRP permit, samples taken at C196 are weekly composites of LLNL's effluent. In some cases, analysis of daily composite samples is necessary. For example, LLNL's arrangement with the LWRP stipulates that when a release is detected by the on-line, real-time monitoring equipment at B196, a daily composite sample for that day must be submitted to assess compliance with discharge guidelines. Furthermore, when anomalous conditions are detected in the weekly samples from C196, daily samples from B196 help to isolate the period during which the condition developed, increasing the probability of identifying the source. Finally, daily samples can be combined to obtain a true monthly effluent composite, as required by DOE for monitoring for radioisotope discharges.

For these reasons, the Water Guidance and Monitoring Group (WGMG) operates a daily composite sampler in the North Room of B196. This sampler draws, on a flow proportional basis, from the on-line analysis sample line. Each morning, Environmental Technologists collect the samples, which are analyzed for tritium, gross alpha/beta, and metals by the Hazards Control Analytical Laboratory (HCAL), and for plutonium and cesium by the Environmental Monitoring Radiation Laboratory of the Radiation Analytical Sciences Section (RAS). In addition, part of the daily sample is archived for 18 months as an historical record of LLNL releases. Each year, some of the archived samples are submitted as quality control duplicates for plutonium and cesium analyses.

When an alarm is annunciated by the monitoring system at B196, a grab sample is automatically acquired. This sample may be analyzed to validate the alarm and to determine the severity of the release. Preparation of the grab sample is described in Reference 3. Generally, the sample remains at B196 until the TSG Technologist is available to complete the necessary documentation and transport the sample to the Hazards Control Analytical Laboratory. That process is described in this procedure.

3. REFERENCES

1. EMP-SW-OP, *Sewer Monitoring Operations*
2. EMP-SW-EAR, *EPD Alarm Response*
3. EMP-SW-HCAR, *Hazards Control Alarm Response*
4. EMP-SW-C196, *Sewage Sampling at C196*
5. *EMS Sewer Monitoring Sampling Documentation Handbook*
6. EMP-QA-NCR, *Nonconformance and Discrepancy Reporting*
7. EMP-QA-DC, *Document Retention*
8. EMP-QA-SD, *Sample Tracking Documentation*

4. DEFINITIONS

Carboy volume measuring stick: A flat, wooden stick, about 30 inches long. When held against the composite sample carboy at B196, it indicates the volume of the sample, in liters.

Flow meter: Enterra flow meter, mounted in the rack in the North Room of B196, that measures the flow rate of LLNL's sanitary sewage.

Ordinal date: Five digit date identifier. The first three digits designate the number of days since January 1 of the current year, the last two digits designate the year itself. For example, the ordinal date for January 20, 1995, would be: 02095.

Peristaltic pump and controller: Located on top of the composite sample refrigerator in B196, this unit, when activated by the flow meter every 1000 gallons, adds 15 ml of sewage to a carboy in the refrigerator. The volume added is adjusted by changing the sample duration setting on the peristaltic pump controller. The standard setting is 4.5 seconds.

Sampling log: Lab notebook, kept on the desk in the North Room of B196.

5. RESPONSIBILITIES

5.1. EMS SECTION LEADER

The EMS Section Leader ensures that sampling procedures meet and conform to the appropriate regulatory guidance.

5.2. WGMG GROUP LEADER

The Group Leader assures that sampling procedures meet design criteria and that sampling is conducted according to approved procedures.

5.3. WGMG ENVIRONMENTAL ANALYST

The Environmental Analyst determines the analytes of interest and the schedule for the sampling program, and identifies the laboratories that will perform the required analyses.

5.4. TSG ENVIRONMENTAL TECHNOLOGIST

The Environmental Technologist performs the sampling activities described herein. This includes preparing sampling documentation and logging samples in on the Hazards Control Sample Tracking System (Reference 5). Missed samples and equipment failures are documented by the Technologist with an EMS NCR (see Reference 6).

The Technologist is responsible for delivering the samples to analytical laboratory personnel, and for maintaining archived sample stores.

5.5. HAZARDS CONTROL ANALYTICAL CHEMIST

The Analytical Chemist is responsible for completing the monthly composite Chain-of-Custody (COC) Record forms to cross-reference EMS samples with sample tracking IDs used by the analytical laboratory.

6. PROCEDURE

Note: Occasional failures of the sampling equipment, or mishaps in the handling of samples, can result in the exposure of personnel to raw sewage. According to Hazards Control Industrial Hygienists, exposure to sewage is not a significant health hazard if reasonable hygienic steps are taken. When performing the procedures below, gloves and other protective equipment should be worn, as described. Exposed personnel should wash with disinfectant soap (kept in the North Room of B196). If clothes become soaked with sewage, personnel should shower and change into clean clothing, and the soiled clothing should be washed as soon as possible.

6.1. B196 DAILY COMPOSITE SAMPLING

6.1.1. SAMPLE ACQUISITION

Equipment Required:
Carboy volume measuring stick
Face Shield
Five-gallon DOT carboy (2)
Four or five 500-mL polyethylene bottles
Indelible ink marker
Keys to the North Room of B196
Latex gloves, disposable
Latex gloves, long
Pine Oil
Sampling logbook

6.1.1.1. Daily composite sampling equipment and supplies are located in the North Room of B196.

6.1.1.2. If necessary, cycle the liquid crystal display (LCD) on the flow meter to the total flow value in gallons by repeatedly pressing the TIME/DATA button. Enter the 9-digit value in the sampling logbook, along with the date, time, and your initials.

6.1.1.3. The composite sample refrigerator is located on the south wall of the North Room of B196. Check the refrigerator door for special EMS instructions concerning deviations from the sampling schedule. Skip steps 6.1.1.4 through 6.1.1.11 if instructions indicate that no sampling will be needed on a given day.

6.1.1.4. Obtain gloves and face shield. The main glove supply is kept in the gray storage cabinet in the shed north of B196. One or two bags are kept available on the counter in the North Room for daily use. Labeled sample bottles can be found in the third drawer under the sink counter. Four 500-mL sample bottles are filled each day, except on Wednesdays, when five bottles are filled. The extra Wednesday sample is a duplicate sample for QA of the daily radiation analysis.

6.1.1.5. Transfer the bottles to the workbench near the sink. Using an indelible ink marker, label each bottle with the time, the ordinal date, the sampler's initials, and the location (B196). On one sample bottle, write the flow totalizer reading from step 6.1.1.2 and the sample volume (liters). Put on the face shield, long latex gloves,

and then a pair of disposable gloves. The long latex gloves prevent exposure of the wrists to splashing sewage, while the disposable gloves prevent cross-contamination of samples.

6.1.1.6. Open the refrigerator door. Hold the measuring stick (found in the refrigerator) against the side of the carboy to determine the volume (in liters) contained in the carboy. Record the volume in the sampling log and return the stick to the refrigerator.

6.1.1.7. Remove the carboy. Immediately position the replacement carboy in the refrigerator, inserting the sampling tube into its mouth.

6.1.1.8. Swirl the contents of the carboy to homogenize the sample. Fill the first sample bottle to within a half-inch of its top and cap the bottle.

6.1.1.9. Repeat step 6.1.1.8 for the remaining three or four sample bottles.

6.1.1.10. Pour the remainder of the composite sample down the sink.

Thoroughly rinse the carboy with tap water and pour the rinse water down the sink. Set the carboy aside for use the following day (Step 6.1.1.7).

6.1.1.11. Rinse and dry the outside of the sample bottles, as necessary. Wash down the counter top and sink with pine oil and water, and dry with paper towels. Remove disposable gloves. Rinse long gloves at the sink and dry with paper towels. Place paper towels and disposable gloves in the trash. Remove and store long gloves and face shield.

6.1.1.12. Log sampling event into the computer, using the terminal on the east wall of the room. If a sample was successfully taken, type in "D" and press "Return." If no sample was taken, type a message to the printer indicating the reason. The computer will then prompt you to enter the flow totalizer reading from the sample logbook (step 6.1.1.2). Type in the data, and press "Return." Finally, the computer will ask for your initials (up to three letters). Type those in, and press "Return."

6.1.2. DISPOSITION OF SAMPLES

6.1.2.1. The TSG Environmental Technologist will transfer the daily samples to HCAL, Building 253, Room 1734, by 10:00 a.m. each working day.

6.1.2.1.1. Check to ensure that each sample is within 1/2 inch of the top of the bottle and check for unusual color (black and oily, white and milky, or strong yellow color) or odor (strong chlorine odor). If the samples are questionable or unacceptable, contact the WGMG Environmental Analyst to determine how the samples should be used. Normal priority is for tritium analysis (25 mL), gross alpha/beta (200 mL), metals (500 mL), plutonium and cesium (500 mL), and archival stocks (500 mL). If samples are not acceptable, an NCR (Reference 6) should be prepared to document the disposition of the samples.

6.1.2.1.2. Log the sample in on the Hazards Control Sample Tracking System (Reference 5).

6.1.2.1.3. Sign the sample in on the monthly COC; indicate the total number of sample bottles as shown in Reference 5, and enter the samples in the HCAL environmental sample log.

6.1.2.2. The HCAL will acidify one of the sample bottles. This archive sample, along with the bottle for plutonium and cesium analysis, will be held in the HCAL refrigerator in the northwest corner of Room 1734.

6.1.2.3. The TSG technologist will transfer the archive bottles from the previous month to the transportainer to the north of B151 or the shed North of B196 by the Thursday following the first Monday of each month. The samples should be stored in boxes, by month. Boxes should be labeled with the month and year, and the ordinal dates for any days that a sample was missed.

6.1.2.4. The TSG technologist will place the preceding month's plutonium and cesium samples in a box and deliver them to RAS, Room 2347 of B151, by the Thursday following the first Monday of each month. Sample documentation is described in Reference 5. The Technologist should clearly indicate the ordinal dates for the month and the ordinal dates for any missing samples in the remarks section of the COC. The box should be labeled as described in Section 6.1.2.3.

6.1.2.5. After 18 months, the TSG Technologist should bulk LLNL archive samples for a given month into properly labeled carboys and deliver them to Hazardous Waste Management for disposal. The Hazardous Waste Technologist for B196 should advise on labeling requirements and coordinate the transfer of the consolidated waste. To locate the Hazardous Waste Technologist, call the Hazardous Waste Management Division office.

6.2. SEWER ALARM GRAB SAMPLES

When the B196 continuous monitoring system finds evidence of sewage contamination, a grab sample is acquired automatically. This sample is then poured into a 500-mL polyethylene bottle as part of the routine sewer alarm response activities (References 2 and 3). Additional grab samples may be acquired under the direction of the Environmental Analyst managing the alarm response. These samples, which are stored in the sample refrigerator in the North Room of B196, must be properly labeled and delivered for analysis.

The TSG Environmental Technologist must complete the sample labels by adding the sample identifier (see the following paragraph), log samples in on the Hazards Control Sample Tracking System, and deliver the samples to the appropriate laboratory with a properly completed Chain-of-Custody Form. Documentation requirements are described in Reference 5. If the samples are to be analyzed by Hazards Control, the samples should be delivered to Building 253, Room 1734. Upon delivery, the TSG Technologist must enter the samples in the HCAL environmental sample logbook, as described in Section 6.1.2.1.3 for the daily samples.

The grab sample identifier has the form "L-B196-NN-AG". Here, "NN" is the number of the sample taken during the alarm response. The samples should be numbered in the order they were acquired. The automatic grab sample will be "01," and subsequent manual grab samples should be labeled "02," "03," etc. These identifiers are to be used on the Chain-of-Custody Form, and also written on the sample bottle labels.

7. DOCUMENTATION/QA RECORDS

7.1. QA records generated during B196 sampling include sampling logbooks and chain-of-custody forms.

7.2. Sample collection is documented through entries in the sampling log that is kept at B196.

7.3. Labels must be properly completed by the TSG Environmental Technologist (Reference 5), who is also responsible for monitoring the supply of bottles at the sampling locations.

7.4. Submittal of daily samples to HCAL is documented by properly completed COC forms. As described in Reference 5, the COCs are drafted by the TSG Environmental Technologist, and then delivered at the start of the month to the HCAL, where they are completed. Each day that samples are delivered, the Technologist must fill in the number of sample bottles delivered, and initial the COC.

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7.5. The HCAL Analytical Chemist also prepares a COC form for the weekly composite metals analysis (Reference 5). This form cross-references the sample dates to the HCAL analysis tracking number. The blank COC should be delivered with the draft COCs of Section 7.4.

7.6. Submission of samples to RAS (Section 6.1.2.4.) is documented by properly completed COC forms (Reference 5).

7.7. QA records are archived according to the criteria of References 7 and 8.

8. ACCEPTANCE CRITERIA

Samples will be deemed acceptable if:

- the chain of custody has not been broken or compromised; and
- all required documentation is completed correctly; and
- all bottles are properly labeled, dated, and initialed by the sample collector.

9. ATTACHMENTS

none

EMP-SW-C196

SEWAGE SAMPLING AT C196

Prepared by:

Brian Balke

4/5/93

Brian Balke
Environmental Analyst, WGMG

date

Reviewed by:

Duane Rueppel

4/5/93

Duane Rueppel
Group Leader, TSG

date

Paul Dickinson

4/6/93

Paul Dickinson
Environmental Technician, TSG

date

Renee Y. Needens

4-6-93

Renee Needens
Environmental Technician, TSG

date

Approved by:

William G. Hoppes

4/7/93

William G. Hoppes
Group Leader, WGMG

date

Rebecca A. Failor

4/7/93

Rebecca A. Failor
Section Leader, EMS

date

Lucinda M Garcia

4/7/93

Lucinda M. Garcia
Quality Assurance Coordinator, EMS

date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

LLNL is required by the Livermore Water Reclamation Plant (LWRP) to monitor water quality parameters of its sewer effluent. Reference 1, EMP-SW-OP, *Sewer Monitoring Operations*, discusses the rationale and timetable for acquiring samples to establish LLNL's compliance with local, state, and federal guidance. This procedure describes the actions performed to obtain these compliance monitoring samples.

2. APPLICABILITY/DISCUSSION

The sampling requirements comprise two parts: weekly composite sampling for monitoring of metals and radiation, and monthly grab sampling and special composite sample for testing of water quality and toxic chemical concentrations. Radiation samples are submitted to Hazards Control for analysis, and metals, water-quality, and toxic-chemical samples are submitted to an off-site laboratory.

Historically, these samples were all collected at the Sewer Monitoring Station, B196. However, following a series of contamination incidents in which metal components of the sampling system were degraded by sodium hypochlorite, the LWRP mandated installation of an independent composite sampling system (Letter from Darren Greenwood, LWRP Source Control Inspector, to Dennis Fisher, Associate Director for Plant Operations, April 20, 1992). An ISCO 3710R Refrigerated Composite Sampler, with a peristaltic pump and non-contact sample sensor, was selected for this purpose. It is installed in the shelter located over the vault to the east of B196, and uses the B196 flow controller signal (contact closure once every 1,000 gallons) to pace the sampling. Additionally, the sampling history is saved in dynamic memory, and can be downloaded to a field printer to provide a detailed sampling record for regulatory review.

To obtain a truly flow-proportional weekly composite for metals analysis, as required by permit, the sampler is loaded with a five-gallon carboy, and the sample is accumulated over seven days (starting and stopping on Monday mornings). This schedule is complicated once a month, when the monthly composite sample must be acquired. On the day that the monthly sample is acquired, the weekly composite is removed and stored, the sample bottle is replaced with an empty container, and the sampler program is changed to obtain more frequent samples.

The four sections of this procedure cover the sampler setup, the weekly and monthly sampling procedures (two sections), and sampler maintenance.

3. REFERENCES

1. EMP-SW-OP, *Sewer Monitoring Operations*
2. ISCO 3710R *Refrigerated Sampler Instruction Manual*
3. ISCO *Field Printer Instruction Manual*
4. *Sewer Maintenance Menu Manual*
5. EMP-QA-CS, *Courier Service Protocol*
6. EMP-QA-SD, *Sample Tracking Documentation*
7. EMP-QA-S, *Quality Assurance Sampling*

4. DEFINITIONS

B196 Computer Room: South annex of B196, where the computer, electronics and data archives are located.

B196 Detector Room: North annex of B196, where the sample preparation and analysis equipment is located.

Carboy volume measuring stick: A flat, wooden stick, about 30 inches long. When held against the composite sample carboy, it indicates the volume of the sample, in liters.

Coliwasa: A device for sampling liquids. Made of glass or stainless steel, the coliwasa has two parts: the barrel and the thief. The thief is a glass rod that slips through the barrel. A Teflon or plastic disk (at the end of the thief) creates a seal when the thief is pulled through the barrel.

Contract analytical laboratory: The off-site laboratory, as identified by the WGMG Environmental Analyst, that performs analysis on the monthly samples.

Courier: The courier office is in B411, phone 3-7271. Drop-off times are 9 a.m. and 4 p.m.

Flow meter: Enterra flow meter, located on the east wall of the B196 Detector room.

Ordinal date: Five digit date identifier. The first three digits count the number of days in the year, the last two digits are the year itself.

ISCO 3710R Sampler: Flow-proportional sampling unit installed in the composite sampling station, east of B196. See Reference 2 for operating and service instructions.

Sampling log: Gray lab notebooks, kept at the daily sampling locations.

5. RESPONSIBILITIES

5.1. WGMG ENVIRONMENTAL ANALYST

The Environmental Analyst determines the schedule for the sampling program, and identifies the laboratories that will perform the required analyses. The Analyst verifies the programming of the ISCO 3710R sampler (Section 6.1), and specifies the monthly sample duplicates (Section 6.3). Final disposition of the documents described in section 7 is specified by the Analyst.

5.2. TSG ENVIRONMENTAL TECHNICIAN

The Environmental Technician executes the sampling procedures, prepares the sampling documentation, and delivers the samples to the courier service or analytical laboratory. Any missed samples or equipment failures must be documented with an EMS Nonconformance Report (see Reference 3).

The Technician is also responsible for maintenance of the sampler. Familiarity with Chapters 1, 2, and 4 of Reference 2 is essential.

5.3 WGMG GROUP LEADER

The Group Leader assures that sampling procedures meet design criteria and that sampling is conducted in accordance with approved procedures.

5.4 EMS SECTION LEADER

The EMS Section Leader ensures that sampling procedures meet and conform to the appropriate regulatory guidance.

6. PROCEDURES

Note: Occasional failures of the sampling equipment, or mishaps in the handling of samples, can result in the exposure of personnel to raw sewage. According to Hazards Control Industrial Hygienists, exposure to sewage is not a significant health hazard if reasonable hygienic steps are taken. When performing the procedures below, gloves and other personal protective equipment should be worn, as described. Exposed personnel should wash with disinfectant soap (PhisoHex soap, kept in the B196 Detector room). If clothes become soaked with sewage, personnel should shower and change into clean clothing, and the soiled clothing should be washed as soon as possible.

6.1. SAMPLER SETUP

6.1.1. The personnel performing the sampler setup should thoroughly review the material in Chapters 1-3 of Reference 2.

6.1.2. The sampler configuration must be initialized. The following parameters should be set and verified (Section 3.2.4 of Reference 2):

- 6.1.2.1. Clock time
- 6.1.2.2. Bottle size: refrigerated sample, 24,000 mL, confirm with "yes."
- 6.1.2.3. Suction line: 3/8-inch vinyl.
- 6.1.2.4. Suction length: 30 feet.
- 6.1.2.5. Liquid detector: enabled.
- 6.1.2.6. Rinse cycles: 0.
- 6.1.2.7. Retries: 0.

6.1.3. The weekly sampling program, with the parameters listed below, should be saved (Section 3.2.4.7 of Reference 2) as program 1.

- 6.1.3.1. Flow pacing.
- 6.1.3.2. Pulses: 8
- 6.1.3.3. Composite sample, 19,000 mL.
- 6.1.3.4. Sample volume: 30 mL.

6.1.4. The monthly sampling program, with the parameters listed below, should be saved (Section 3.2.4.7 of Reference 2) as program 2.

- 6.1.4.1. Flow pacing.
- 6.1.4.2. Pulses per sample: 2
- 6.1.4.3. Composite sample, 19,000 mL.
- 6.1.4.4. Sample volume: 150 mL.

6.2. WEEKLY COMPOSITE SAMPLING

Equipment Required:

1000-mL polyethylene bottle with nitric acid preservative, available from the contract analytical laboratory.
5-gal DOT carboy (Stock catalog #8110-67867)
Carboy volume measuring stick
Face Shield (Stock catalog #4240-58220)
Indelible ink marker
ISCO Portable Field Printer (stored in B196 computer room)
Buttons to B196 Detector room
Latex gloves, disposable (Stock catalog #8415-28311 to 13)
Latex gloves, long (Stock catalog #8415-41576 and 77)
Paper wipes (KayDry, Stock catalog #7999-63447)
Radioactivity Sampling Record Sheets (Stock catalog #7600-69183)
Sampling logbook
Sewage Sample Chain-of-Custody Record (COC) forms (2)
Two 500-mL polyethylene bottles (Stock catalog #8125-42044), to be preserved with 5 mL nitric acid preservative (2) by HCAL personnel.

6.2.1. LLNL weekly composite sampling equipment and supplies are located in the B196 Detector room.

6.2.2. Obtain gloves and safety glasses from the gray storage cabinet on the east wall of the Detector room.

6.2.3. Put on the face shield, long latex gloves and then a pair of disposable gloves. The long latex gloves prevent exposure of the wrists to splashing sewage, while the disposable gloves prevent cross-contamination of samples.

6.2.4. Use the "STOP" button on the ISCO 3710 sampler to stop the sample program.

6.2.5. Connect the field printer to the sampler and print out the sampler program and sampler history (i.e., press the "Print" button twice. See Reference 3.). Using the carboy volume measuring stick (found in the C196 sampling shed), measure the volume of the sample and record it on the sampler printout.

6.2.6. Remove the sample, dry the interior of the sampler if necessary, and replace the punched-out cap with the whole cap on the new carboy.

6.2.7. Skip the following two steps, if the next operation is to set up for the monthly sample (Section 6.3).

6.2.7.1. Install the empty carboy in the sampler. Replace the solid cap with the punched-out cap and insert the first two to four inches of the sampling hose.

6.2.7.2. Press the "START SAMPLING" and "ENTER" buttons to restart the sampler. Do not use "RESUME," as only "START SAMPLING" clears the history data in the sampler's memory.

6.2.8. Transfer the sample to the B196 Detector room.

6.2.9. On the flow meter, read the total flow value, in gallons. If the flow total is not displayed, pressing the "Time/Date" key will cycle the display to the flow total. Write the value on the printout sheet from the field printer, along with the date, time, and your initials. On the maintenance terminal, access the WGMG "Other Operations" Menu (see Reference 4 for instructions) to log the sampling event, sample volume, and flow total on the alarm printer.

6.2.10. Thoroughly mix the sample, and pour the sample aliquots (one 1,000-mL bottle, two 500-mL bottles). Pour the remainder of the sample down the drain, clean the carboy thoroughly by rinsing with hot water, and set it aside for the following week. Rinse the outside

of the sample bottles as required, and dry the sample bottles. Remove disposable gloves, then rinse long gloves and dry with paper towels. Place paper towels and disposable gloves in the trash. Remove long gloves and face shield.

6.2.11. Complete the sample paperwork for the metals analysis, as shown in Attachment B. Be certain to indicate in the "Comments" section of the COC form that the preliminary analytical report is due on the tenth day of the following month.

6.2.12. If taking the monthly sample (Section 6.3), perform steps 6.3.2 to 6.3.8.

6.2.13. File the sample history printout, by month, in the bottom half of the horizontal file cabinet in the B196 Computer Room.

6.2.14. Deliver the 1,000-mL metals sample to the courier for delivery to the contract lab (Reference 5), along with paperwork shown in Attachment B.

6.2.15. Deliver the two 500-mL samples to the Hazards Control Analytical Laboratory (HCAL), Room 1734 of B253. The samples must be logged in by completion of a record in the HCAL environmental sample log (Any questions should be directed by the HCAL chemist). The two bottles will be acidified by the chemist. One sample is analyzed for gross alpha/beta and tritium. At the HCAL, complete two HC Radioactivity Sampling Record forms (Attachment A).

6.2.15.1. In the column marked "Sample I.D." of the RSRs, and in the "Date Off" block, enter the last date in the COC "Date" column (i.e., the date that the sample was taken from the sampler).

6.2.15.2. In the "Date On" block, enter the first date in the COC "Date" column.

6.2.15.3. In the "Swipe or RT Volume" column, enter the total composite sample volume, as measured in section 6.2.6, and recorded in section 6.2.9.

6.2.15.4. Complete the forms as indicated in Attachment A.

6.2.16. The remaining 500 mL bottle is stored in the refrigerator in the HCAL. By the first Thursday following the first Monday of each month, these samples are transferred to the transportainer to the north of B151. The samples are archived for 20 weeks, then bulked with the excess B196 archived samples for disposal (see Section 6.2.5 of Reference 6).

6.3. MONTHLY TOXIC CHEMICALS AND WATER QUALITY SAMPLING AT C196

Equipment Required:

5-gal DOT carboy (Stock catalog #8110-67867)
Analysis Request List (Attachment C)
Bottles for monthly toxic sampling (Attachment C)
Carboy volume measuring stick
Coliwasa (3/4" bore by 40" length)
Cordless drill
Face Shield (Stock catalog #4240-58220)
Grab sample dipper
Ice chest and ice
Indelible ink marker
ISCO Portable Field Printer (stored in B196 Computer Room)
Buttons to B196 Detector room
Buttons to B196 sample locker
Latex gloves, disposable (Stock catalog #8415-28311 to 13)
Latex gloves, long (Stock catalog #8415-41576 and 77)
Paper wipes (KayDry, Stock catalog #7999-63447)
Pipette bulb (Stock catalog #6640-18938)
Radioactivity Sampling Record Sheets (Stock catalog #7600-69183)
Sampling logbook
Sewage Sample Chain-of-Custody Record (COC) forms (2)
Size 18 silicone tubing, 5' (Cole-Parmer Masterflex 6411-18)
Equipment required (continued)

Stainless-steel bucket
Stainless-steel paint stirrer (available at Paint Shop)
Tubing pinch cock (Stock catalog #6640-18809)
Vinyl tape (Stock catalog group 75)
Vinyl tubing, 6-ft by 3/4-in. ID

6.3.1 PREPARATION FOR MONTHLY SAMPLING

6.3.1.1. To permit incorporation of the sampling results in the monthly report to LWRP, monthly sampling must be performed during the first week of the month. Be certain that sample bottles have been ordered from the contract analytical laboratory in time to arrive for the sampling. See Attachment C for a list of the sample bottles required. Be certain to include the bottles needed for the quality control sampling discussed in the next section.

6.3.1.2. To meet the quality control requirements of Reference 7, once each month, Quality Control (QC) duplicates will be submitted for two analyses, to be specified by the Environmental Analyst.

6.3.1.2.1. On the monthly sample list (Attachment C), check the box under 'QC' for those analyses that will be submitted in duplicate.

6.3.1.2.2. For those QC samples that are part of the composite or grab sample list, write in the analysis and bottle count under section three of the sample list ("Quality Control Samples").

6.3.1.2.3. If an Oil and Grease sample is to be taken in duplicate, check the 'QC' box under the planned sample time, and write the sample time in under section five of the sample list ("Quality Control Sample").

6.3.1.2.4. Cross out the line in section three or five for the "L-C196-08-SW" quality control sample that is not being submitted.

6.3.1.2.5. Make a copy of the completed monthly sample list and forward to the Environmental Analyst.

6.3.1.3. Prepare the Chain-of-Custody record form for the monthly samples (an example is provided in Attachment D). Use the sample identifiers from the monthly sample list (Attachment C). For the QC samples (L-C196-07-SW to L-C196-08-SW), the analysis and bottle count can be read from sections three and five of the monthly sample list, filled out in section 6.3.1.2.

6.3.2 START MONTHLY COMPOSITE SAMPLE

6.3.2.1. From the B196 Detector Room, collect long gloves, face shield, pen, and 5-gallon carboy. From the B196 Computer Room, collect the ISCO Portable Field Printer. Take them to the C196 location.

6.3.2.2. If you have not just finished taking the weekly sample (Section 6.2), perform the following steps:

6.3.2.2.1. Use the "STOP" key to pause the weekly sample program.

6.3.2.2.2. Connect the field printer and print the sample program and sample history (i.e., press the "Print" button twice). Measure the volume of the weekly sample using the carboy volume measuring stick, and record the value (use ink) on the sample history printout.

6.3.2.2.3. Put on long gloves and face shield. Cap the weekly sample and store it in the refrigerated sample locker outside B196 (northeast corner of the building).

6.3.2.3. Retrieve the monthly sample program in the ISCO memory.

6.3.2.3.1 On the ISCO sampler control panel, press the "ENTER/PROGRAM" key. Then use the arrow buttons to activate, in the order given, the following selections. When selected (flashing on the ISCO controller display), use the "ENTER/PROGRAM" key to go on to the next selection. I.e. - when "CONFIGURE" is flashing, "ENTER/PROGRAM" will enable you to use the arrow buttons to select "PROGRAMMING MODE."

CONFIGURE.

PROGRAMMING MODE

EXTENDED

LOAD STORED PROGRAM

#2

6.3.2.3.2. Use EXIT PROGRAM to return to standby mode.

6.3.2.4. Fill the glass carboy to 21 L, place on the overflow scale, and adjust the scale setting. Drain the carboy and place it in the sampler, inserting the sample tube at least 2 in. into the mouth of the carboy.

6.3.2.5. Remove long gloves. Start the sampler using the "START SAMPLING" key. Clear and lock the station.

6.3.2.6. On the maintenance terminal in the B196 Detector Room, select "Start monthly sample" from the "Other WGMG Operations" menu (Reference 4). Enter your initials, the flow meter reading, and the current volume of the weekly sample (which could be zero, if the monthly sample is being started on a Monday morning).

6.3.2.7. Return the Field Printer to the B196 Computer room. File the sample history printout, by month, in the bottom half of the horizontal file cabinet.

6.3.3. MONTHLY OIL AND GREASE GRAB SAMPLES

The day following the start of the monthly composite sample, four oil and grease grab samples need to be acquired.

6.3.3.1. Four oil and grease samples are acquired, at 6 a.m., 10 a.m., 2 p.m. and 6 p.m. Prior to starting the sampling, label the sample bottles with the sample identifier (L-C196-03-SW to L-C196-06-SW), the ordinal date, the sample time (6 a.m. for sample "03-", and add four hours for each increment in the sample ID), the analysis to be performed, and the sampler's initials.

6.3.3.2. Collect gloves, safety glasses, laundry detergent, paper towels, and a large plastic bag (for trash) from the B196 Detector Room. Turn on the wash water using the switch on the alarm panel.

6.3.3.3. Descend into the flume with the sampling equipment and two bottles. Put on the face shield, long latex gloves and then a pair of disposable gloves. The long latex gloves prevent exposure of the wrists to splashing sewage, while the disposable gloves prevent cross-contamination of samples.

6.3.3.4. Clean the coliwasa with laundry detergent and flush thoroughly with wash water.

6.3.3.5. Uncap the sample bottles, turning labels so that they face away from the entry point of the coliwasa when a sample is added. Fill the two bottles together, alternating draws from the coliwasa. Because it takes roughly five minutes to fill a bottle, filling one bottle at a time may result in very different levels of oil and grease in the two samples. For best sampling efficiency, the thief should be dropped into the flume while the tube is above the flow level, and then the tube should be lowered into the flow.

6.3.3.6. Rinse and dry the coliwasa, and cap and carefully dry the sample bottles. Leave the bottles in the vault until the final sample is taken. Put trash and disposable gloves in the plastic bag, remove face shield and long gloves, and exit the flume.

6.3.3.7. Turn off the wash-water switch in the B196 Detector Room.

6.3.3.8. Repeat steps 6.3.3.3 through 6.3.3.7 every four hours during the day, until all four samples have been acquired.

6.3.4. MONTHLY COMPOSITE SAMPLE ALIQUOTS

The composite sample must be transferred into analysis bottles 24 hours after starting the sampling. Using a permanent ink marker, the composite sample bottles (see Attachment C) should be labeled with the sample identifier (L-C196-01-SW), the ordinal date, the sample time, the analysis to be performed, and the sampler's initials.

Verify that the sample has sufficient volume. A minimum of 17 L is required to fill the sample bottles. If the sampler appears to be operating properly, allow the sampler to run past the 24 hour period until the volume reaches 17 L.

6.3.4.1. Collect gloves, face shield, paper wipes, an empty 5-gallon plastic carboy and pens from the B196 Detector Room. Turn on the wash water switch on the alarm panel and get the field printer from the B196 Computer Room. If the weekly sample has been saved, retrieve it from the sample locker.

6.3.4.2. Use the "STOP" key on the sampler controller to terminate sampling.

6.3.4.3. Connect the field printer and print out the sampling program and sample history.

6.3.4.4. Put on the face shield, long latex gloves and then a pair of disposable gloves. The long latex gloves prevent exposure of the wrists to splashing sewage, while the disposable gloves prevent cross-contamination of samples.

6.3.4.5. Remove the composite sample. Fill the empty plastic carboy with wash water to 21 L (use the carboy measuring stick to determine the volume). Place the carboy on the overflow scale, adjust the overflow setting, pour the wash water down the drain, and restore the weekly sample.

6.3.4.6. Restore the weekly sampling program. Repeat the procedure of Section 6.3.2.3.1, except select "#1" instead of #2.

6.3.4.7. Use the "START SAMPLING" key to resume sampling.

6.3.4.8. Secure the sampling station and transfer the monthly composite to the B196 Detector Room.

6.3.4.9. Measure the volume of the composite sample using the carboy measuring stick. On the maintenance terminal, select "End monthly sample" from the "Other WGMG Operations" menu. Enter your initials, the reading from the Enterra flow meter, and the volume of the monthly sample. Also write this information on the sample history printout (6.3.4.3).

6.3.4.10. Fill the composite sample analysis bottles (see list in Attachment C). Collect the stainless-steel bucket, vinyl tube and tape, pipette bulb, stainless-steel paint stirrer and cordless drill, and sample bottles.

6.3.4.10.1. Place the carboy on an elevated surface (3 to 4 ft) and mix the sample using the paint stirrer and cordless drill. Insert the vinyl hose so that the end touches the bottom of the carboy and wrap vinyl tape around the carboy to hold the tube in place.

6.3.4.10.2. Put the stainless-steel bucket under the end of the hose.

6.3.4.10.3. Use the pipette bulb to start flow through the tube: compress the bulb, mate the suction valve to the end of the tube, and rapidly reinflate the bulb. Once flow has been established, attach the tubing clamp to block the flow.

6.3.4.10.4. Fill the sample bottles.

6.3.4.10.5. Mix the samples as necessary to minimize settling of sediments.

6.3.4.10.6. Write the time on all of the analysis bottles, and place in the ice chest.

6.3.4.11. Fill two 500 mL plastic sample bottles for radiation analysis by Hazards Control. Using the permanent ink marker, label the bottles with the ordinal date, location "C196", the time, the sampler's initials, and the sample identifier (L-C196-01-SW).

6.3.4.12. Drain and rinse the composite sample bottle. Wash down the floor of the shed, rinse the outside of the sample bottles as required, and dry the sample bottles. Remove disposable gloves, then rinse long gloves and dry with paper towels. Place paper towels and disposable gloves in the trash. Remove long gloves and face shield. Return sampling equipment to the B196 Detector Room.

6.3.4.13. Return the Field Printer to the B196 Computer room, and file the sample history printout, by month, in the bottom half of the horizontal file cabinet.

6.3.4.14. The samples acquired in section 6.3.4.11 should be transferred to the HCAL for acidification as soon after sampling as is possible. When the samples are delivered, log them into the HCAL environmental logbook, complete a Radiation Sampling Record Sheet (Attachment A), and add the sample to the C196 monthly radiation Chain-of-Custody form (Attachment A).

6.3.5. MONTHLY GRAB SAMPLES

The monthly grab samples should be taken at a time that represents normal laboratory usage of the sewer (i.e., when sewer flow is at or near normal daily flow levels), but also at a time that will allow timely delivery (within two hours) to the courier service (see Reference 5).

6.3.5.1. Use a permanent ink marker to label the composite sample bottles (See Attachment C) with the sample identifier (L-C196-02-SW), the ordinal date, the analysis to be performed, and the sampler's initials.

6.3.5.2. When you are ready to take samples, verify that the vault blower is running (the power switch is located at its base). Hazards Control does not consider the vault to be a confined space hazard if the blower is operating. If the blower won't function,

it must be repaired prior to sampling. After the blower has been running for a few minutes, descend into the vault. An observer should remain outside the vault to assist with handling the sample bottles.

6.3.5.3. Using the grab sample dipper stored in the vault, fill the grab sample bottles (as indicated on the list in Attachment C). When taking a duplicate of an analysis performed on a grab sample, be certain to fill both sample bottles (the original and the duplicate) from the same dipper of liquid. Cap and clean the bottles, use a permanent ink marker to write the time on the bottle, and place the bottles in the ice chest.

6.3.6. DISPOSITION OF MONTHLY SAMPLES

Complete a COC form (Attachment D) for the samples, clearly indicating in the comments section the due date for delivery of the preliminary results (the tenth of the following month) and the final report (the eighteenth of the following month). Deliver the samples, analysis list (Attachment C), and COC to the contract laboratory courier service (Reference 5).

6.4. C196 MAINTENANCE

Equipment Required:

Graduated cylinder
Face shield (Stock catalog #4240-58220)
Lab coat or lab apron
Paper wipes (KayDry, Stock catalog #7999-63447)
Silastic pump tubing, 42" length (ISCO part number 60-3704-026)

When the sampler has accrued 50,000 pump counts, it will flash a warning message that the tubing life has expired. The first time this occurs, the tubing can simply be reversed, with the feed end (the end previously inserted into the refrigerator cavity) being wrapped around the pump rollers. The second time, the tubing must be replaced.

Personnel who perform this procedure must be familiar with Chapter 3 of Reference 2.

6.4.1. Remove the tubing and thoroughly clean the rollers and pump cavity to remove any silicon residue (a damp paper wipe is useful). Thoroughly dry the pump cavity and any other moist surfaces. Install the tubing, leaving only 1 in. extending past the input side of the liquid-sensor case.

6.4.2. Recalibrate the sample volume using the "calibrate sample volume" option in the "CONFIGURE" section of the sampler setup menu.

6.4.3. Reset the tubing lifetime counter as prompted in the "CONFIGURE" section of the sampler setup menu.

7. DOCUMENTATION/QA RECORDS

7.1. Sampler performance is documented by printers of the sampling history. Prior to archival, these printouts are stored in B196.

7.2. Sample collection is documented via entries in sampling logs kept at the sampling locations; by printed records of the ISCO sampler performance; and by time stamps, flow and volume records on the monthly alarm printout, and the status log file on the microVAX computer.

7.3. Sample labels must be properly completed and applied to all sample bottles.

7.3.1. For samples submitted to the HCAL, labels are prepared and attached to bottles by the TSG Environmental Technician, who is also responsible for monitoring the supply of

bottles at the sampling locations (see Section 7 of Reference 1 for details). The labeled bottles are stored in the gray cabinet to the left of the alarm printer in the B196 Detector Room.

7.3.2. For samples submitted to the outside contract laboratory, labels are obtained from the contract laboratory, but are attached and filled out by the TSG Environmental Technician. The label shall include the sample identifier, the analysis to be performed, the ordinal date, the time and the sampler's initials.

7.4. Submission of weekly samples to HCAL must be documented by properly completed sample records (Attachment A) and by COCs (Section 9 of Reference 5). 6.2.1. Each month, a preformatted COC form should be delivered to the Hazards Control Analytical Laboratory (HCAL, Room 1734 of B253). See Section 7 of Reference 1.

7.5. Submission of weekly metals (Attachment A) and monthly water quality and toxics samples (Attachments C and D) to the contract analytical laboratory must be documented by properly completed COC forms.

7.6. The Environmental Analyst establishes archival requirements for this documentation.

8. ACCEPTANCE CRITERIA

8.1. Samples will not be deemed acceptable if the chain of custody has been broken or compromised (see Section 8 of Reference 1).

8.2. Samples will not be deemed acceptable if documentation is not correctly completed.

8.3. Samples will not be deemed acceptable if bottles are not properly labeled, dated, and initialed by the sample collector.

8.4. Samples will not be deemed acceptable if EPA holding times are exceeded.

8.4. Samples will not be deemed acceptable if the sampler printout shows more than four consecutive hours of sample failures, or if the ratio of the total flow during a sampling period to the sample volume suggests that more than 50% of all samples have been missed.

9. ATTACHMENTS

Attachment A: Sample Documentation for Weekly Radiation Samples

Attachment B: Sample Documentation for Weekly Metals Samples

Attachment C: Analysis List for Sewage Monthly Samples

Attachment D: Sample Documentation for Monthly Water Quality and Toxics Sampling

REVISION 1
FINAL

EMP-SW-C196
Sewage Sampling at C196

Effective date: 04/15/93
Page 13 of 21

Attachment A
Sample Documentation for Weekly Radiation Samples

Chain-of-Custody Record

Laboratory: Hazards Control / B263			Project Name/Analyst: Brian Balke / WQMG			Number of containers			Analysis Requested			REMARKS
Sample Identifier:			Date			Title			Type			
site	location	number	media	date	time	number	type	title	type	type	type	
L	C196	01	SW	243-25082		2	X	X				(Hazards Control Sample Tracking numbers are written here)
.	.	.	.	250-25792		2	X	X				
.	.	.	.	257-25482		2	X	X				
.	.	.	.	264-27192		2	X	X				
.	.	.	.	24882		2	X	X				
.	.	.	.									
.	.	.	.									
.	.	.	.									
.	.	.	.									
.	.	.	.									
Relinquished by Sampler:						Date/Time		Received by Courier:		Date/Time		Data received by EMQ analyst:
Relinquished by Courier:						Date/Time		Received for Laboratory by:		Date/Time		Received by Date Manager:
Relinquished by Analyst:						Date/Time		Received by Date Manager:		Date/Time		Data received by Archivist:
Relinquished by Archivist:						Date/Time		Received by Archivist:		Date/Time		Archive Number:

Form CAP-8-2
Rev. 1
July 1992

Environmental Monitoring Group
Lawrence Livermore National Laboratory
P.O. Box 808, L-266
Livermore, CA 94551

ALL SIGNATURES TO BE MADE ON WHITE COPY
DISPOSITION OF COPIES (after signatures)

Goldenrod: Sampler (Return to analyst; other copies to courier w/ samples)
Pink: Courier (Return to analyst; other copies to Laboratory w/ samples)
Canary: Laboratory (send with data and other copies to Analyst; returned to Laboratory for their files by Analyst after data receipt and signature)
Green: Analyst (keep for files; white to Archivist w/ data)
White: Archivist (archive w/ data; send photocopies of completed white to Analyst, QA Coordinator)

Attachment A
Sample Documentation for Weekly Radiation Samples

Sheet 1 of 2

(12) (Your Name) Health & Safety Tech Phone Ext. Radio Page

(13) Brian Balke Health Physicist to Nully

(14) Comments:

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

HEALTH AND SAFETY TECHNICIAN			
Check One Only	Sample Type	Check One Only	Priority
0	AT	0	X Routine
1	Liquid	1	Special
2	Sludge	2	Rush
3	Solid	3	Spill
4		4	
5		5	
6	Mixed Sludge	6	
7	Feces	7	
8	Urine	8	
9	Misc.	9	
1		0	
		9	

HEALTH AND SAFETY TECHNICIAN			
Room No.	Sample Loc.	Sample Date	Sample Time
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100

1 2 3 4 5 6 7 8 9 10

11 12 13 14 15 16 17 18 19 20

21 22 23 24 25 26 27 28 29 30

31 32 33 34 35 36 37 38 39 40

41 42 43 44 45 46 47 48 49 50

51 52 53 54 55 56 57 58 59 60

61 62 63 64 65 66 67 68 69 70

71 72 73 74 75 76 77 78 79 80

81 82 83 84 85 86 87 88 89 90

91 92 93 94 95 96 97 98 99 100

Chain-of-Custody Record

Laboratory 3CA

Project Name/Analyst: Brian Balke / WQIMQ

Chain-of-Custody Record

Sample Identifier:				Date	Number of containers	Metals	Analytes tested				REMARKS
site	location	number	media								
L	C198	01	- SW	243-25092	1	X					Analyza for: Ag, Al, As, Be, Cd, Cr, Cu, Fe, Hg, Ni, Pb, Zn

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Pink: Courier (Return to analyst; other copies to Laboratory w/ samples)
Canary: Laboratory (send with data and other copies to Analyst; returned to Laboratory for their files by Analyst after data receipt and signature)
Green: Analyst (keep for files; while to Archivist w/ data)
White: Archivist (archive w/ data; send photocopies of completed while to Analyst, QA Coordinator)

Environmental Monitoring Group
Lawrence Livermore National Laboratory
P.O. Box 808, L-255
Livermore, CA 94551

Form QAP-B-2
Rev. 1
July 1992

Attachment C
Analysis List for Sewage Monthly Samples

LLNL Monthly Sewer Effluent Sampling

Date : _____ Sampler: _____ CoC# : _____

1. COMPOSITE SAMPLE : L-C196-01-SW

Analysis	Bottles ^a			Pres.	Dup.	QC
	#	Tp	Vol.			
BOD ¹	1	P	500 mL			
Anions and Cations - B, Cl, NO ₂ , SO ₄ , Alkalinity	1	P	500 mL			
COD	1	P	250 mL	H ₂ SO ₄		
Metals - Ag, Al, As, Be, Ca, Cd, Cr, Cu, Fe, Hg, K, Mg, Na, Ni, Pb, Se, Zn	1	P	16 oz	HNO ₃		
Nutrients - Ammonia Nitrogen (as N), Nitrate Nitrogen (as N), Total Kjeldahl Nitrogen (as N), Total Phosphorus	1	P	16 oz	H ₂ SO ₄		
Settleable Solids	1	P	1/2 gal			
Solids - TDS, TSS, TS, VS	1	P	500 mL			
Total Organic Carbon	2	G	40 mL (VOA)	H ₂ SO ₄	Yes	
TICH Pesticides (RWQCB)	2	G	1 L		Yes	

¹ 24-hour hold time.

2. GRAB SAMPLE : L-C196-02-SW

CoC# : _____

Analysis	Bottles ^a			Pres.	Dup.	QC
	#	Tp	Vol.			
CN	1	P	32 oz	NaOH		
Phenols	1	G	32 oz	H ₂ SO ₄		
EPA Method 624	2	G	40 mL (VOA)		Yes	
EPA Method 625	2	G	1 L ¹		Yes	

¹ Amber bottle, with teflon cap.

3. QUALITY CONTROL SAMPLES (Optional)

L-C196-07-SW Analysis: _____ Bottles: _____

L-C196-08-SW Analysis: _____ Bottles: _____

^a Bottle specifier includes the number of bottles (including the duplicate), the type of the bottle (P for plastic, G for glass) and the bottle volume.

Attachment C
Analysis List for Sewage Monthly Samples

LLNL Monthly Sewer Effluent Sampling

Date : _____ Sampler: _____ CoC # : _____

4. OIL AND GREASE SAMPLES - (EPA Method 413.1)

Analysis	Sample ID	Bottles ^a			Pres.	Dup.	Smpl Time	QC
		#	Tp	Vol.				
Oil and Grease	L-C196-03-SW	2	G	32 oz	H ₂ SO ₄	Yes	6 AM	
Oil and Grease	L-C196-04-SW	2	G	32 oz	H ₂ SO ₄	Yes	10 AM	
Oil and Grease	L-C196-05-SW	2	G	32 oz	H ₂ SO ₄	Yes	2 PM	
Oil and Grease	L-C196-06-SW	2	G	32 oz	H ₂ SO ₄	Yes	6 PM	

5. QUALITY CONTROL SAMPLE (Optional)

L-C196-08-SW Analysis: Oil and Grease Bottles: 2 Sample Time: _____

^a Bottle specifier includes the number of bottles (including the duplicate), the type of the bottle (P for plastic, G for glass) and the bottle volume.

Attachment D

Sample Documentation for Monthly Water Quality and Toxic Chemicals Sampling

Laboratory: BCA	Project Name/Analyst: Brian Balke / WQMG		
Sample Identifier:	Site	Location	Date
1. C196	01	SW	9/1/92
1. C196	07	SW	9/1/92
1. C196	08	SW	9/1/92
(As Necessary)			
Send results to Brian Balke			
L-621, 422-5711			
For September sewage samples:			
Preliminary results due 10/19/92			
Final report due 10/19/92			
Assess charges accordingly			
Relinquished by Sampler:	Date/Time	Received by Courier:	
Relinquished by Courier:	Date/Time	Received for Lab:	

ALL SIGNATURES TO BE MADE ON WHITE COPY
DISPOSITION OF COPIES (after signatures)

Goldendow: Sampler (Return to analyst); other copies to courier w/ samples)
Pink: Courier (Return to analyst); other copies to Laboratory w/ samples)
Canary: Laboratory (send with data and other copies to Analyst; returned to Laboratory for their files by Analyst after data receipt and signature)
Green: Analyst (keep for files; white to Archivist w/ data)
White : Archivist (archive w/ data; send photocopies of completed white to Analyst, QA Coordinator)

Environmental Monitoring Group
Lawrence Livermore National Laboratory
P.O. Box 808, L-286
Livermore, CA 94551

Form QAP.8-2
Rev. 1
July 1992

Attachment D
Sample Documentation for Monthly Water Quality and Toxic Chemicals Sampling

Chain-of-Custody Record

Laboratory: BCA				Project Name/Analyst: Brian Baker / WSMC				Chain-of-Custody Record				REMARKS	
Sample Identification		Date	Number of containers	Analysis Requested									
Site Location	Number			Phenols	EPA 624	EPA 625							
L - C196	02	SW	8/1/92	7	X	X	X	X					
L - C196	07	SW	8/1/92	1									
L - C196	08	SW	8/1/92	1									
(As Necessary)													
* Sand residue to Brian Baker													
* L-621, 423-5711													
* For September sewage samples:													
* Preliminary results due 10/7/92													
* Final report due 10/18/92													
* Assess charges accordingly													
Relinquished by Sampler:				Date/Time	Received by Courier:				Date/Time	Data relinquished from Lab by:			
Relinquished by Courier:				Date/Time	Received for Laboratory by:				Date/Time	Data relinquished by EMO Analyst:			
Data relinquished by Data Manager:				Date/Time	Data received by Data Manager:				Date/Time	Data received by Archivist:			
Archived by:				Date/Time	Archive Number:								

ALL SIGNATURES TO BE MADE ON WHITE COPY
DISPOSITION OF COPIES (after signatures)

Goldend: Sampler (Return to analyst; other copies to courier w/ samples)
Pink: Courier (Return to analyst; other copies to Laboratory w/ samples)
Cyan: Laboratory (send with data and other copies to Analyst; returned to Laboratory for final files by Analyst after data review and signature)
Green: Analyst (keep for files; white to Archivist w/ d
White: Archivist (archive w/ data; send photocopies to Analyst, DA Coordinator)

Environmental Monitoring Group
Lawrence Livermore National Laboratory
P.O. Box 808, L-255
Livermore, CA 94551

Form CAP-6-2
1
992

Form OAF-8-2
Rev. 1
July 1982

EMP-SW-CA

SEWER EQUIPMENT CALIBRATIONS

Prepared by:

Brian Balke

4/5/93

Brian Balke
Environmental Analyst, WGMG

date

Reviewed by:

Paul Dickinson

4/6/93

Paul Dickinson
Environmental Technician, TSG

date

Duane Rueppel

4/5/93

Duane Rueppel
Group Leader, TSG

date

Approved by:

William G. Hoppes

4/7/93

William G. Hoppes
Group Leader, WGMG

date

Rebecca A. Failor

4/7/93

Rebecca A. Failor
Section Leader, EMS

date

Lucinda M. Garcia

4/7/93

Lucinda M. Garcia
Quality Assurance Coordinator, EMS

date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

To demonstrate compliance with its discharge permit issued by the City of Livermore Water Reclamation Plant (LWRP), the Lawrence Livermore National Laboratory (LLNL) is required to monitor its effluent as it leaves the site. For this purpose, compliance monitoring equipment has been installed at Building 196, the Sewer Monitoring Station. Furthermore, LLNL has installed equipment—beyond that required for compliance monitoring—that enables early detection of serious releases and allows timely notification of the LWRP should such an incident occur. In addition, the Sewer Diversion Facility, which is activated by the in-line monitoring equipment in B196, enables LLNL to divert much of the non-sewerable material before it leaves the site.

This procedure documents the equipment calibration that must be performed to guarantee that alarm conditions are accurately and reliably detected.

2. APPLICABILITY/DISCUSSION

LLNL's responsibilities for maintaining accurate calibrations of its sewer monitoring equipment at Building 196 are defined by its formal permit with the LWRP and an informal agreement covering alarm annunciation at LWRP. Continuous (compliance) monitoring of sewage flow and pH are required by the permit. The reliable annunciation of alarm conditions by the Sewer Monitoring UpGrade (SMUG) system further requires that the gain and response functions of the x-ray fluorescence and gamma spectroscopy systems be well characterized. This procedure describes the calibration of the above instruments.

The procedure does not cover the calibration of analytical instruments used by on-site laboratories for the bulk of the sewage compliance analysis. Maintenance of the monitoring equipment is covered in EMP-SW-M (Reference 1).

3. REFERENCES

1. EMP-SW-M, *Sewer Equipment Maintenance*
2. EMP-SW-TP, *Sewer Monitoring Test Plan*
3. EMP-QA-NCR, *Non-Conformance Reports*
4. WALCHEM WC-150 Series pH Controller instruction manual
5. VAX/VMS Spectroscopy Applications Package User's Manual, Nuclear Data Systems pub. 07-0196
6. *Sewer Maintenance Menu Manual*
7. EMP-SW-M, *Sewer Equipment Maintenance*
8. EMP-QA-DC, *Document Retention*

4. DEFINITIONS

Air-gap Water Supply: The maintenance water supply activated by a dial switch in the lower right-hand corner of the annunciator panel in the Building 196 detector room, above the desk on the north wall.

B196 Computer Room: The south half of Building 196, containing the x-ray and gamma-X counting electronics and the microVAX computer that monitors and logs the condition of the monitoring equipment and sewage.

B196 Detector Room: The room in the north half of Building 196, containing the pH probe and the pH buffer solutions, the x-ray and gamma-X detectors, and the x-ray power supplies.

Buffer Solution: A substance capable of maintaining the relative concentrations of hydrogen and hydroxyl ions in a solution.

Cyclonic Separator: A large steel canister located on the south wall of the detector room, mounted with a pH probe.

DI Water: Deionized and charcoal-filtered water.

Flow Calibration Stick: A yardstick used to measure the water depth in the stilling well. It has an adjustable screw and is calibrated on one side to read gallons per minute of flow. The flow calibration stick is found in the Parschal flume located in the Building 196 below-ground vault.

Flowmeter: The flowmeter is located in the B196 computer room, on the east wall between the x-ray power supplies and the x-ray fluorescence cells.

Gamma-X Radiation Shield: A 4-inch-thick lead shield that contains the flow cell and detector used to monitor for radioactivity in the sewage. The lead shields the detector from ambient radiation.

LWRP: The Livermore Water Reclamation Plant. The LWRP issues LLNL's sewer discharge permit, reviews monitoring data, and receives alarm documentation and investigation reports.

Maintenance Terminal: The computer terminal in the detector room.

Parschal Flume: A 6-inch flume with two main parts: a chute that restricts the flow through the flume, and a hydrostatically driven stilling well.

Stilling Well: A standing water well connected to the flume. Its level is measured to determine the flow rate.

Vault, Parschal Flume: Below-ground concrete box, located just to the east of B196, which contains the flow-monitoring equipment. The C196 sampling station is mounted on top of the vault. Entry to the vault is through a hinged plate, followed by a ten-foot descent on metal rungs set in the concrete side of the vault.

X-Ray Calibration Standards: Metals solutions poured into x-ray flow cells during fluorescence calibration. They are stored in polyethylene bottles and are prepared by the Hazards Control Analytical Laboratory.

X-Ray Fluorescence Cell: Three x-ray fluorescence (XRFA) cells are found in the detector room. Each XRFA cell consists of a plastic flow cell, a SiLi detector, an x-ray generator, and a mounting block. Each sits by a large liquid nitrogen (LN) dewar, and the three dewars are bolted to the table on the east side of the detector room. The mounting block maintains the critical geometry between the flow cell and the detector.

X-Ray Power Supplies: The x-ray generator for each fluorescence cell pulls current and a DC reference voltage from a power supply mounted in a rack three feet to the north of the x-ray fluorescence cells.

5. RESPONSIBILITIES

5.1. EMG ENVIRONMENTAL ANALYST

The EMG (Effluent Monitoring Group) Environmental Analyst is responsible for scheduling and evaluation of procedures for flume calibration, and x-ray and gamma-X system calibrations (described in Sections 6.1, 6.3 and 6.4). The Environmental Analyst is responsible for assuring that software used in the metals calibration procedure (Section 6.3.2) performs the requirements), for purchasing all standards required for completion of the procedure, for

scheduling the calibration, and for ensuring detailed execution of the procedure. Lastly, the Environmental Analyst is responsible for tracking execution of the Parschal flume calibration (Section 6.2). If the Parschal flume calibration is not performed on schedule, the Plant Engineering M/O Industrial Electronics and Control shop supervisor must be contacted (x3-0316).

The Analyst is also responsible for authorizing the release of keys to the B196 detector and computer rooms. Personnel that routinely perform calibration procedures will be issued a permanent set of keys. Otherwise, access to B196 shall be provided by the Analyst or the TSG Environmental Technician.

5.2. TSG ENVIRONMENTAL TECHNICIAN

The TSG Environmental Technician is responsible for conducting the calibration of the pH probe (Section 6.2).

5.3. PLANT ENGINEERING M/O INDUSTRIAL ELECTRONICS AND CONTROL SHOP

The Shop Personnel execute the Enterra flow recorder calibration procedure. (Section 6.1. See responsibilities of the EMG Analyst, Section 5.5.) In general, the shop personnel will take any actions necessary to re-establish normal operation of the equipment if the results of the calibration procedure are not acceptable.

5.4. PLANT ENGINEERING MECHANICAL UTILITIES GROUP LEADER

The Mechanical Utilities Group Leader is responsible for certification of the flow calibration report (Attachment A).

5.5. CANBERRA NUCLEAR SYSTEMS MAINTENANCE SUPPORT

Canberra, the vendor of the SMUG data acquisition system, maintains staff capable of providing assistance in using the Nuclear Data acquisition system to perform the calibrations. However, they are not responsible for actual execution of procedures. The Maintenance Support personnel can be reached at 455-9940.

5.6. EMG GROUP LEADER

The EMG Group Leader is responsible for identifying the resources necessary for calibration to be completed as scheduled, and for communicating to the EMS Section Leader any performance problems related to a lack of sufficient resources.

5.7. EMS SECTION LEADER

The EMS Section Leader is responsible for assuring that sufficient resources are allocated to allow calibration to be completed as scheduled.

6. PROCEDURE

6.1. ENTERRA FLOW RECORDER CALIBRATION

The flow recorder calibration must be performed in the first month of each quarter of the year. The calibration is performed by the personnel of the Plant Engineering M/O Industrial Electronics and Control Shop (IECS). When the calibration is completed, the EMS Environmental Analyst should be contacted at the number indicated at the bottom of Attachment A. If the Analyst does not receive notification at the end of the month, he should

contact the IECS to verify that the calibration has been performed, and file a non-conformance report (Reference 3) if the calibration has not been performed.

Equipment Required:

Face Shield (Stock catalog #4240-58220)
Flow calibration stick (see definitions)
Flow calibration worksheet (Attachment A)
Keys to B196 detector room (see Section 5.1)
Lab coat or lab apron
Long latex gloves (Stock catalog #8415-28311 to 13)
Paper wipes (KayDry, stock catalog #7999-63447)
Pen

6.1.1. Collect latex gloves, pens, paper wipes, and a flow calibration worksheet (see attachment A). Turn on the air-gap water supply.

6.1.2. At the Parschal flume vault in back of Building 196, verify that the blower is operating. If it has been switched off, turn it on and allow to operate for a few minutes before entering the vault. If the blower is broken, have it repaired before entering the vault.

6.1.3. Don latex gloves and clean off the calibration stick (stored in the vault) using paper wipes and water from the tap in the vault. Use the stick to take a reading of the depth in the stilling well with the calibration rod. Check the stick for two readings: (1) depth in inches, and (2) percent of maximum flow. Record these readings and the time taken on the flow calibration worksheet.

6.1.4. In Building 196, record the flow rate as read on the flowmeter. Next to the flowmeter there is a conversion chart from flow to head height. Record the head height that corresponds to the flow rate shown on the flowmeter. Record the time of the reading.

6.1.5. Record percent of maximum flow as read on the circular chart recorder, and time the reading was taken.

6.1.6. Switch off the air-gap water supply.

6.1.7. Using the readings acquired in Subsections 6.1.3 to 6.1.5, perform the calculations outlined on the calibration worksheet. Submit the worksheet for certification by the Plant Engineering Mechanical Utilities Group Leader (Pat Dempsey, x3-1868, L-601). The certified form is delivered to the Environmental Analyst for archival in the annual sewer data binder.

6.1.8. Contact the Environmental Analyst (at the extension given at the bottom of Attachment A) to confirm that the calibration has been performed. If the results of the calibration procedure are not acceptable (i.e., a "No" response is found in Section III.A of the calibration worksheet), contact the EMG Environmental Analyst for authorization to make repairs of the system. The Analyst will complete a non-conformance report (Reference 3) documenting the problem and its resolution.

6.2. Calibration of pH Probe

Equipment Required:

Deionized water (available from Hazards Control, Room 1734, B253)
Face shield (Stock catalog #4240-58220)
Keys to B196 detector room (see Section 5.1)
Lab coat or lab apron
Long latex gloves (Stock catalog #8415-28311 to 13)
Paper wipes (KayDry, stock catalog #7999-63447)
Pen
pH buffer solutions: 7, and 4 or 10
(Stock catalog #6810-13174, 73 and 75)
pH Calibration Worksheet (Attachment B)
Replacement pH probes - Sensorex model S655CD or equivalent.
Timepiece

6.2.1. Personnel performing this procedure should be familiar with the contents of Reference 4. The procedure must be performed once per month. The form shown in Attachment B must be filled out and completed during execution of the procedure. If the calibration is not completed on schedule, the Analyst will fill out a non-conformance report (Reference 3).

6.2.2. Don safety glasses and latex gloves.

6.2.3. Remove the pH probe from the cyclonic separator. Loosen the large, white wing nut. Gently withdraw the probe until it reaches its safety stop. Close the 1-inch ball valve and loosen the plastic hex nut at the cable end of the pH probe. Withdraw the probe.

6.2.4. Rinse the probe with deionized water, and wipe gently with a wet soft paper wipe. Inspect the probe for physical damage (cracking of the membrane is of paramount concern).

6.2.5. Set up the pH controller for the calibration operation.

6.2.5.1. On the pH probe controller panel, press any key to enter control mode. Push the "INC" key until the display shows "2-point calibration," and then press the "E" button.

6.2.5.2. The calibration requires two pH points: one at a pH of 7, and the other at 4 or 10. (Calibration using a pH 10 buffer solution is preferred, since the pH of the effluent is often near 9.) When the controller reads "Buffer pH =", enter in the pH of the second solution (either 4 or 10) using the digit keys followed by "E."

6.2.5.3. The controller will display "Cal Temp =." Press "E" as this information is not critical to the accuracy of the calibration.

6.2.6. The controller display will read "Sensor in pH 7." A plastic tray labelled "pH Buffer Solutions" has been attached to the unistrut by the cyclonic separator. Rinse the 7.0 pH test tube with 7.0 pH buffer solution, then fill to half-capacity.

6.2.7. Rinse the probe with pH 7 buffer solution, then immerse in the pH solution. For at least ten seconds, agitate the solution by raising and lowering the probe. Press any key.

6.2.8. The controller will read "Key if OK". When the reading has stabilized, check to be certain that the reading is in the range 0 ± 27 mV. Press any key.

6.2.9. The display will read "Sensor in pH X," i.e., where 'X' is the pH entered in step 6.2.3.2.

6.2.10. Remove the probe from the pH 7 buffer and rinse with deionized water.

6.2.11. Rinse the pH 4 or 10 test tube (whichever was selected in step 6.2.5.2) with the corresponding buffer solution and fill to half capacity.

6.2.12. Rinse the probe with the second buffer solution, immerse in the buffer solution, and agitate for 10 seconds. After the reading has stabilized, make certain the reading is in the acceptable range (177 ± 27 mV for pH of 4, -177 ± 27 mV for pH of 10). Press any key.

6.2.13. The controller will display a message "PERCNT DIFF =" followed by a number. The number should be less than 30. If it is greater than 30, the sensor should be replaced. Similarly, if the values shown in steps 6.2.8 or 6.2.12 are out of tolerance, the sensor should be replaced, and the calibration procedure repeated. A non-conformance report (Reference 3) must be generated to document the replacement of the probe.

To remove the pH probe, thoroughly dry the exterior of the sensor and mount. Grasp with one hand on either side of the joint in the barrel. Holding the probe in front of you, rotate your right hand towards you. Now pull the sensor out. Insert the new sensor, being careful that the male and female ends of the electrical connectors are properly aligned. Secure the connection by rotating the sensor relative to the mount, reversing the motion used in disconnecting the sensor.

6.2.14. Rinse the probe and reinstall in the cyclonic separator. Secure the hex nut (finger tight), then open the 1-inch ball valve and gently lower the probe until the white tape marker is within 2-3 inches of the probe feedthrough. Hand-tighten the wing nut.

6.2.15. Press the "R" key to resume monitoring.

6.2.16. Clean up, throwing paper wipes and gloves in the trash. Mark the pH flow chart "pH probe calibrated" with your initials and the date at the spikes generated by the calibration procedure. Deliver the pH Calibration Worksheet to the Environmental Analyst.

6.3. X-RAY FLUORESCENCE CALIBRATION

The x-ray fluorescence calibration is a very time consuming process, requiring almost four hours to complete. It is performed each year in June. The calibration shall be performed by the EMS Environmental Analyst or his designee. If the calibration is not performed on schedule, the Environmental Analyst shall complete a non-conformance report (Reference 3) documenting the delay and its resolution.

For the detector energy calibration, a ^{57}Co source is used. The flow cell is removed, and the spectrum is acquired where the source is located so the count rate will be typical of normal operation conditions. Standard Nuclear Data (Reference 5) routines are run to determine the new calibration curve.

In the concentration calibration, solutions of each of the eight metals, in four different concentrations, are loaded by hand into the flow cells. Five spectra are acquired at each concentration. The suite of spectra is analyzed to determine metals concentration calibration constants. Finally, the new constants are entered in the appropriate source files on the Building 196 microVAX; and the code is regenerated.

6.3.1. METALS ENERGY CALIBRATION

Equipment Required:

^{57}Co source (see Attachment C for a purchase order)
Keys to B196 detector room (see Section 5.1)
Lab coat or lab apron
Pen
Tape

6.3.1.1. To perform the energy calibration, a ^{57}Co source is required. Since this is a low-intensity sealed source, no special handling requirements apply. The source should be replaced every three years (it has a half-life of 270 days). A sample purchase order for obtaining the source is shown in Attachment C. The source is currently stored in the sink cabinet by the entry to the detector room.

6.3.1.2. In the B196 computer room, log on to the ND9000 terminal (the display with the two-by-two spectra plots). Then set up for the metals calibration using the following commands:

```
$ SET DEF [SEWER.CALIB.METALS]
$ @MAKE_METALS_CALIB_ROI
```

6.3.1.3. Determine the operating count rate for the XRFA units.

6.3.1.3.1. Position the display cursor in the "Screen Control" box, and use the "Next MAIN" button to advance to the XRFA1 spectrum.

6.3.1.3.2. Position the display cursor in the spectrum statistics window (red background), and use the "Next Page" button until the region of interest (ROI) statistics page is shown.

6.3.1.3.3. Position the display cursor in the "ROI" box, and use the "Advance" button until the the cursors bracket the whole XRFA1 spectrum.

6.3.1.3.4. Read the counts per second from the spectrum statistics window. Write down this number.

6.3.1.3.5. As in step 6.3.1.3.1, advance the active spectrum to the XRFA2 display. Repeat steps 6.3.1.3.2 to 6.3.1.3.4 for XRFA2.

6.3.1.3.6. As in step 6.3.1.3.1, advance the active spectrum to the XRFA3 display. Repeat steps 6.3.1.3.2 to 6.3.1.3.4 for XRFA3.

6.3.1.4. Call Fire Dispatch (x2-7595) and inform them that the system will be offline for calibration, and that any alarms should be ignored. In the B196 detector room, go to the maintenance terminal and put the system in clean/calibrate mode (Reference 5). Turn off the macerator and the booster pump, close the valve between the cyclonic separator and the macerator, and turn off the x-ray generator power.

6.3.1.5. Remove the flow cell for XRFA 1 (Reference 7, Section 6.6), and tape the source to the brass positioning block, facing through the opening to shine on the detector vacuum housing.

6.3.1.6. The next step of the calibration is performed at the ND9000 terminal in the computer room. Advance the active spectrum to the current XRFA display. Position the cursor in the "Collect or Erase" box, then use the "Erase" and "ACQ On" buttons. Allow the spectrum to accumulate for about 20 seconds, then use the "ACQ Off" button. Check the count rate in the spectrum statistics window. If the count rate does not match (within 30 percent) the number obtained in step 6.3.1.3.4, reposition the cobalt source so as to either increase or decrease the count rate.

6.3.1.7. Use the "ACQ On" function to take a calibration spectrum. When the cobalt peaks are well resolved, use "ACQ Off" to stop acquisition. Save the spectra as follows:

```
$ MOVE XRFAn [SEWER.CALIB.ENERGY]XnCO_mmmmyy.CNF
$ HOME
$ MOVE XRFAn [SEWER]XRAYnDEF.CNF
```

Here "n" is the number of the XRFA unit, and "mmm" is the three-letter abbreviation for the month, and "yy" is the year.

6.3.1.8. Repeat steps 6.3.1.5-7 for the two remaining XRFA units.

6.3.1.9. Using the "Circle and Expand" function, blow up the calibration peaks on the ND9000 display. Write down the approximate centroid channel for each peak in each of the three spectra. This will be easier if the display is toggled to linear format.

6.3.1.10. From the interactive session window on the ND9000, use the Nuclear Data functions to perform the calibration.

6.3.1.10.1. Type "CALIB/UPDATE/CONF/LIST=\$PRINTER XRF1"

6.3.1.10.2. When prompted for the certificate data, reply:

"[SEWER.CALIB.ENERGY]SEWERSILT"

6.3.1.10.3. As prompted, enter the line centroids obtained in step 6.3.1.4. CALIB will ask you to confirm the data before proceeding to the next line.

6.3.1.10.4. Reply with a "Y" to the final prompt to save the calibration results.

6.3.1.10.5. Print out the peaks for the calibration spectrum to confirm the results:

```
$ PEAK/LIST=LP: XRFn
$ PEAK/LIST={SEWER.CALIB.ENERGY}X1CO_mmyy.PEAKS
```

6.3.1.10.6. Repeat steps 6.3.1.10.1 to 6.3.1.10.5 for XRF2 and XRF3, substituting "2" and "3" for "n" in the commands shown.

6.3.1.11. Save the calibrated configuration as the current operating configuration, using the following commands ("n" is the number of the x-ray unit):

```
$ MOVE XRFAn [SEWER]XRAYnDEF.CNF
```

6.3.1.12. Restore the ND 9000 to its normal state by typing the following commands:

```
$ SET DEF [SEWER.CALIB.METALS]
$ @DEL_METALS_CALIB_ROI
$ LO
```

6.3.1.13. In the detector room, open the valve closed in step 6.3.14, and turn on the booster pump and macerator. At the maintenance terminal, put the system in normal mode (Reference 6). When the electronics failure alarm has cleared, reset the alarm panel. Notify Fire Dispatch that the system is operating normally.

6.3.1.14. Return the ⁵⁷Co source to the sink cabinet by the entry to the detector room.

6.3.2. METALS CONCENTRATION CALIBRATION

Equipment Required:

Deionized water
Face shield
Keys to B196 (see Section 5.1)
Lab coat or lab apron
Long latex gloves
Masking tape
Metals concentration standards, in various mixtures and concentrations (see step 6.3.2.1)
Pen
Sewage sample—1,000 mL
Tygon tubing

6.3.2.1. Obtain 500 mL of the following metals standards mixtures from the Hazards Control Analytical Laboratory (x2-7595). For mixed standards, the

concentration of the three metals in the solution is identical. The concentrations need only be approximate.

Metals	Concentrations [mg/L]
Cr	100, 50, 20, 10
Ni+Zn+Pb	100, 50, 20, 10
Cu+Hg+As	100, 50, 20, 10
Pd, Cd	100, 50, 20, 10

Along with the samples, HCAL must supply an analytical determination of the actual concentrations in each standard. Also submit 1,000 mL of sewage (to be used later as a standard) for metals analysis.

6.3.2.2. In the B196 computer room, log on to the ND9000 terminal (the display with the two-by-two spectra). Then set up for the metals calibration, using the following commands:

```
$ SET DEF [SEWER.CALIB.METALS]  
$ @MAKE_METALS_CALIB_ROI
```

6.3.2.3. Call Fire Dispatch (x2-7595) and inform them that the system will be offline for calibration, and that any alarms should be ignored. In the B196 detector room, go to the maintenance terminal and put the system in clean/calibrate mode (Reference 6). Turn off the macerator and the booster pump, and close the valves between the macerator and the cyclonic separator.

6.3.2.4. Clean the XRFA flow cells, as described in Section 6.6 of Reference 1. However, do not remount the cells, and do not reconnect the sampling hoses. Instead, attach 8-inch pieces of clean tygon tubing to the hose connections. Adjust the hose fittings so that the tubing will point upwards when the cell is attached to its mounting block, and secure the tubing with masking tape.

6.3.2.5. In the computer room, start a new SEWER session on the DEC GPX workstation. Execute the following commands:

```
$ SET DEF [SEWER.CALIB]  
$ R METALCALIB
```

This is a menu-driven program that includes all necessary instructions. The screen menu is shown in Attachment D. Set the calibration output file name to XRFACAL_mmmmyy ("mmmm" is the month, e.g., Jan, and "yy" is the year, e.g., '92). Set the acquisition multiplicity to 5. Clear the configuration table.

6.3.2.6. Set up to acquire the spectra for the 10 mg/L standards. Declare the XRFA 1 sample as Chrome, and enter the concentration determined by the laboratory analysis. Setup for XRFA 2 with Ni, Zn and Pb, and XRFA 3 as Ag and Cd. Enter the analytical concentrations for each of the metals.

6.3.2.7. Load the appropriate standards into each of the flow cells. Flush the flow cell with 50 mL of the standard, then fill by adding solution to the tube connected to the lower hose fitting, until the solution is visible in both tubes at a level above the top of the flow cell. Attach the flow cell to its mounting block. In the METALCALIB routine, start the acquisition sequence.

6.3.2.8. When the acquisition is complete, dismount the flow cell and flush with deionized water.

6.3.2.9. Repeat steps 6.3.2.6 through 6.3.2.8 for the 20, 50 and 100 mg/L standards.

6.3.2.10. In METALCALIB, clear the configuration table, and acquire spectra for XRFA 2 using the four standards with Cu, Hg and As. This essentially repeats steps 6.3.2.6 through 6.3.2.9 for XRFA 2 alone.

6.3.2.11. Fill the flow cells with deionized water. Clear the configuration table, then activate the appropriate metals in each XRFA configuration at zero concentration. Acquire the analysis spectra. When acquisition is complete, drain the flow cells.

6.3.2.12. Wear gloves and face shield when handling the sewage in this step. Flush and then load the flow cells with the sewage standard. Load the configuration table with the concentrations determined by HCAL. Acquire the analysis spectra.

6.3.2.13. When acquisition is complete, drain the flow cells. Reconnect the sample hoses. Open the valve between the cyclonic separator and the macerator. Turn on the macerator and the booster pump. Put the system in normal mode (Reference 6). Call Fire Dispatch (x2-7595) when the electronics failure alarm has been cleared to advise them that the system is again operational.

6.3.2.14. The calibration data must now be analyzed and the results documented. A PVWave routine has been generated to perform the analysis. From the DEC workstation terminal, execute the following commands:

```
$ SET DEF [SEWER.CALIB]
$ R PVWAVE
    WAVE> RUN PLOTAL
    WAVE> READINPUTFILE      XRFACAL_mmmmyy.DAT
    WAVE> PLOTAL 'CR'
```

Repeat the last command for all metals (Ni, Cu, Zn, Hg, Pb, As, Cd, Ag)...

```
WAVE> EXIT
```

As each of the PLOTAL commands is executed, the metals calibration constants will be displayed on the screen (see example in Attachment D). Write down these numbers.

6.3.2.15. To transfer the calibration results to the online system, the calibration constants must be written into the code. The file to be changed is SEWER\$INCLUDE:METALS_K2.INC. Copy the calibration constants table and comment out the previous version. Replace the old calibration constants in the copy with the new numbers. Then rebuild the code:

```
$ SET DEF [SEWER]
$ @BUILD_SEWER_ALL "" "" "COPY"
```

6.3.2.16. Now switch to the sewer interface window. In the main control table, use the "Change Control Options," and then the "Metals Calibration Coefficients" option, to access the working coefficient table. Change the coefficients to their new values.

6.3.2.17. Note the execution of the metals calibration procedure in the alarm log and the maintenance log. Print out the calibration constants file ((SEWER.CALIB.METALS)XRFACAL_mmmmyy.DAT), and METALS_K2.INC. Have the SMUG programmer make plots of the calibration fits. This data should be kept in the file cabinet in the computer room, and a copy should be saved by the Environmental Analyst.

6.4. GAMMA-X ENERGY AND EFFICIENCY CALIBRATION

This procedure must be performed once each year.

Equipment Required:

Keys to B196 (see Section 5.1)
Mixed gamma standard (see Attachment E for a purchase order)
Paper
Pen
Tape

6.4.1. To perform the gamma-X calibration, a NIST-traceable source of mixed radionuclides is required. (A sample purchase order for obtaining these sources is shown in Attachment E.) The standard should be replaced every two to three years. The current source is stored in the sink cabinet by the entry to the detector room.

6.4.2. When the source arrives, the certificate activities must be converted to $\mu\text{Ci/mL}$ and added to the calibration certificate file (Attachment E). Instructions on the use of the Nuclear Data certificate file editor can be found in Reference 5, starting at page 3-16.

6.4.2.1. Log on at the VT600 display in the computer room. Run the Nuclear Data certificate file editor.

```
$ SET DEF [SEWER.CALIB.ENERGY]
$ CFE/OUT=GAMCAL_YYYYY SEWER
> PRINT/OUT=$PRINTER ALL
```

Here "YYYYY" is the three-letter abbreviation for the month, and "yy" is the year. Get the output of the PRINT command.

6.4.2.2. Set the title and certificate date. See page 3-25 of Reference 5 for examples.

6.4.2.3. Edit the decay rate for each of the decay lines. The commands must be entered for each line.

```
> SET <record #>
> SET RATE <decay rate>
```

6.4.2.4. If lines must be added or deleted, see Reference 5 for more information.

6.4.2.6. Print out the certificate records: "PRINT/OUT=\$PRINTER ALL"

6.4.2.5. Exit the CFE using the "EXIT" command.

6.4.3. Call Fire Dispatch (>2-7595) and inform them that the system will be offline for calibration, and that any alarms should be ignored. In the B196 detector room, go to the maintenance terminal and put the system in clean/calibrate mode (Reference 6).

6.4.4. Open the gamma-X radiation shield. Remove the Marinelli beaker, and load the nuclide standard.

6.4.5. The next step of the calibration is performed at the ND9000 terminal in the computer room. Log on to the ND9000 terminal. Put the cursor in the "Screen Control" box and use "Next MAIN" to advance the active display to the GAMMA window. Then position the cursor in the "Collect or Erase" box and use the "Erase" and "ACQ On" buttons to take a calibration spectrum. When the nuclide peaks are well resolved, use the "ACQ Off" button to stop acquisition. Save the calibration spectrum with the command:

```
$ MOVE GAMMA [SEWER.CALIB.ENERGY]GAMCAL_YYYYY.CNF
```

6.4.6. From the interactive session window on the ND9000, use the Nuclear Data functions to perform the calibration.

6.4.6.1. Type "CALIB/UPDATE/CONF/LIST=SPRINTER GAMMA"

6.4.6.2. When prompted for the certificate data, reply:

"[SEWER.CALIB.ENERGY]GAMCAL_mmmmyy"

6.4.6.3. Reply with a "Y" to the final prompt to save the calibration results. To establish the calibrated configuration as the working configuration, issue the command:

```
$ MOVE GAMMA GAMMADEF.CNF
```

6.4.6.4. Print out the peaks for the calibration spectrum to confirm the results:

```
$ PEAK/LIST=LP: GAMMA
```

```
$ PEAK/LIST=[SEWER.CALIB.ENERGY]GAMCAL_mmmmyy.PEAKS
```

6.4.7. Log off the interactive session on the ND9000 (Type "LO"). In the detector room, remove the calibration standard and return the Marinelli beaker to its place. In the detector room, use the maintenance interface to return the system to normal operating mode (Reference 6). When the electronics failure alarm has cleared, reset the alarm panel. Notify Fire Dispatch that the system is operating normally.

6.4.8. Lock the gamma source in the computer room. Sources are stored in the top drawer on the right-hand side of the sink.

6.4.9. The certificate file listing and the peak search results of step 6.4.6 should be saved in the Building 196 file cabinet. Copies should be delivered to the EMG Environmental Analyst.

7. DOCUMENTATION

7.1. The Enterra flowmeter calibration shall be documented by completion of the Calibration Worksheet (Attachment A), including certification by the Plant Engineering Mechanical Utilities Group Leader.

7.2. Calibration of the pH meter shall be documented by completion of the pH Calibration Worksheet (Attachment B), and through notes in the Building 196 Maintenance Log and on the pH circular chart.

7.3. Calibration of the Building 196 x-ray and gamma-X detectors shall be documented in the B196 maintenance log, and through printouts of the calibration lines and the results of peak searches following the successful execution of the calibration.

7.4. The metals concentration calibration of the XRFA units will be documented with the metals standards analysis performed by the Hazards Control Analytical Laboratory, by printouts of the calibration data generated by the METALCALIB routine, and with plots of the calibration curves as generated through execution of the PVWAVE PLOTICAL routine. A printout of the altered source file SEWERS\$INCLUDE:METALS_K2.INC will also be included in the documentation.

7.5. All calibration records shall be stored as per the requirements of Reference 8.

8. ACCEPTANCE CRITERIA

8.1. The flowmeter calibration will be considered acceptable upon approval by the Plant Engineering Mechanical Utilities Group Leader. The calibration is acceptable if the difference in the measured and calculated flow rates is less than 5 percent.

8.2. The other procedures will be considered acceptable upon completion of the documentation, and appropriate review by the Environmental Analyst.

9. ATTACHMENTS

Attachment A: Flow Calibration Worksheet

Attachment B: pH Calibration Worksheet

Attachment C: Cobalt Source Order Sheet and Nuclear Data Certification

Attachment D: Metals Calibration Examples and Output

Attachment E: Gamma Calibration Order Sheet and Nuclear Data Certification File

Attachment A: Flow Calibration Worksheet

FLOWMETER CALIBRATION CERTIFICATION
ENTERRA FLOW RECORDER
BUILDING 196

I. Data

Date: _____

A. Calibration rod reading: _____ of maximum flow

_____ height (inches)

Time of reading: _____

Divide height by 12: _____ head height (decimal feet)

B. Flow meter reading: _____ GPM

Time of reading: _____

_____ head height (feet)

C. Flow recorder reading: _____ % of maximum flow

Time of reading: _____

II. Calculations

A. Divide calibration rod head height by flowmeter head height. Subtract one, multiply results by 100 to get percent deviation.

(_____ ft / _____ ft) - 1 x 100 = _____ % deviation.

B. From the flow conversion chart, determine flow rate in GPM equivalent to head height: _____ GPM. Divide this by flowmeter GPM and determine the percent deviation as above.

(_____ GPM / _____ GPM) - 1 x 100 = _____ % deviation.

C. Divide calibration rod % of maximum flow by flow recorder % of maximum flow. Determine percent deviation as above.

(_____ % / _____ %) - 1 x 100 = _____ % deviation.

III. Certification

A. Percent deviation recorded in II A,B and C above is less than or equal to 5%(yes/no): _____.
If no, corrective action must be taken. Describe action taken and record new data on back of page.

Signature _____

B. I certify that I have reviewed the above calibration information and that it indicates the flow monitoring data is correctly calibrated.

Signature: _____

Reg. Eng. # _____

Date: _____

The completed form must be routed to Pat Dempsey in Plant Engineering (L-601, 3-1868) for review and final certification. The original signed copy must then be submitted to and retained by Brian Balke in Environmental Protection (L- 621, x3-5711).

Attachment B: pH Calibration Worksheet

pH PROBE CALIBRATION RECORD
BUILDING 196

I. Calibration Data

Date: _____

A. Probe readings:

pH Buffer	Sensor Voltage	Acceptable range
4	_____ mV	177 ± 27 mV
7	_____ mV	0 ± 27 mV
10	_____ mV	-177 ± 27 mV

B. "PERCNT DIFF" value reported by the controller at the end of the calibration: _____

II. Acceptance Criteria

A. Are the sensor voltages (I.A) in the acceptable range? Y or N

B. Is the value of part I.A less than 30? Y or N

C. If "N" for either II.A or II.B, replace the pH probe and recalibrate, using a new worksheet.

Signature _____

Authorized by _____

Attachment C: Cobalt Source Order Sheet
and Nuclear Data Certification File

Print Time : 11-NOV-1992 09:47:17.50
Certificate file name : \$DISK1:(SEWER.CALIB.ENERGY)SEWERSILI.CER;1
Certificate title : SEWER CO-57 STANDARD
Certificate date : 7-OCT-1988 00:00:00.00
Certificate quantity : 2.00000E+02

Rcd	Nuclide	Half-life	CAL/ INIT	Energy	Rate	%Abun	Activity (uCi)
1	CO-57	270.00D	Yes	6400.00	1.0000E+03	100.00	2.7027E-02
2	CO-57	270.00D	No	7053.00	1.0000E+02	10.00	2.7027E-02
3	CO-57	270.00D	Yes	14410.00	1.0000E+04	100.00	2.7027E-01

Attachment D: Metals Calibration Examples and Output

Off-line Metals Calibration Procedure

Run the interactive metals calibration program:

- Open a new workstation window and log on as SEWER.
- \$ SET DEF {SEWER.SOURCES.NUCDATA.CALIB}
- R METALCALIB

From the menu, you can perform the following operations:

- Set the output file name (see example below).
- Modify the metal sample configuration table (menu).
 - Declare XRFA #1 metal(s) and concentration(s).
 - Declare XRFA #2 metal(s) and concentration(s).
 - Declare XRFA #3 metal(s) and concentration(s).
 - Clear the current configuration table.
- Set the number of 5-minute datapoints per concentration.
- Start the acquisition sequence.
- Exit

After each 5-minute acquisition, a line for each selected metal is appended to the output file. The data and column headers are also written to the file each time that the program is run.

Example output file:

01-AUG-1991	METAL	PPM	LOWEV	HIGHEV	METALCNTS	X#	SCATTERCNTS
11:14:30	CR	10	5284.	5538.	170	1	44395
11:14:30	NI	10	7299.	7642.	397	2	245592
11:14:30	CU	10	7899.	8204.	402	2	245592
11:14:30	ZN	10	8485.	8790.	292	2	245592
11:14:30	HG	10	9783.	10183.	403	2	245592
11:14:30	AS	10	10460.	10696.	282	2	245592
11:14:30	PB	10	10460.	10696.	282	2	245592
11:19:30	CR	10	5284.	5538.	170	1	44395
11:19:30	NI	10	7299.	7642.	397	2	245592
11:19:30	CU	10	7899.	8204.	402	2	245592
11:19:30	ZN	10	8485.	8790.	292	2	245592
11:19:30	HG	10	9783.	10183.	403	2	245592
11:19:30	AS	10	10460.	10696.	282	2	245592
11:19:30	PB	10	10460.	10696.	282	2	245592

Attachment D: Metals Calibration Examples and Output

POST-ACQUISITION ANALYSIS

PVWAVE is used to analyze and graphically present the calibration data. The PVWAVE routine PLOTICAL reads in the output file from METALCALIB and plots the data points for the requested metal. All of the data points at each concentration are plotted and a least-squares fit is made to a straight line. The results for the fit parameters, which are to be added to the METALSK2.INC file, are displayed on the plot.

To run the calibration analysis program:

- \$ SET DEF {SEWER.SOURCES.NUCDATA.CALIB
- \$ PVWAVE
 - WAVE> RUN PLOTICAL
 - WAVE> READINPUTFILE, 'RESULTS.DATA' ; output from above.
 - WAVE> PLOTICAL, 'HG' ; Plot mercury.
 - WAVE> PLOTICAL, 'ZN'
 - WAVE> EXITL

Attachment D: Metals Calibration Examples and Output

```
$ SET DEF SEWER$CALIB
$ R METALCALIB
```

```
*****
***                                     ***
***          SEWER MONITORING UPGRADE          ***
***                                     ***
*** METALS CONCENTRATION CALIBRATION PROGRAM ***
***                                     ***
*****
```

```
MAIN MENU -- METALS CALIBRATION PROGRAM
 1 - Set output file name (cur=METALCAL:CALIBRESULTS.DAT)
 2 - Modify metal samples configuration table (menu)
 3 - Display metal samples configuration table
 4 - Set # times to repeat 5-min acq (cur=10)
 5 - GO -- prepare to and start sample acquisition
 9 - QUIT
Enter choice: 2
```

```
-----
XRAY # 1 -- none
XRAY # 2 -- none
XRAY # 3 -- none
-----
```

```
MENU -- MODIFY METAL SAMPLES CONFIGURATION TABLE
 1 - Declare XRAY # 1 metal and concentration
 2 - Declare XRAY # 2 metal(s) and concentration
 3 - Declare XRAY # 3 metal(s) and concentration
 4 - Clear XRAY 1, 2, and 3 metals table
 9 - Return to previous menu
Enter choice: 1
```

```
XRAY # 1 metals are: CR U1
Enter 2-char metal name and PPM (e.g. ZN 100): CR 100
```

```
-----
XRAY # 1
      CR    100 ppm,    5284. eV to    5538. eV
XRAY # 2 -- none
XRAY # 3 -- none
-----
```

Attachment D: Metals Calibration Examples and Output

MENU -- MODIFY METAL SAMPLES CONFIGURATION TABLE

- 1 - Declare XRAY # 1 metal and concentration
- 2 - Declare XRAY # 2 metal(s) and concentration
- 3 - Declare XRAY # 3 metal(s) and concentration
- 4 - Clear XRAY 1, 2, and 3 metals table
- 9 - Return to previous menu

Enter choice: 2

XRAY # 2 metals are: NI CU ZN HG AS PB BR U2
Enter 2-char metal name and PPM (e.g. ZN 100): ZN 50

XRAY # 1
CR 100 ppm, 5284. eV to 5538. eV
XRAY # 2
ZN 50 ppm, 8485. eV to 8790. eV
XRAY # 3 -- none

MENU -- MODIFY METAL SAMPLES CONFIGURATION TABLE

- 1 - Declare XRAY # 1 metal and concentration
- 2 - Declare XRAY # 2 metal(s) and concentration
- 3 - Declare XRAY # 3 metal(s) and concentration
- 4 - Clear XRAY 1, 2, and 3 metals table
- 9 - Return to previous menu

Enter choice: 3

XRAY # 3 metals are: CD AG U3
Enter 2-char metal name and PPM (e.g. ZN 100): AG 75

XRAY # 1
CR 100 ppm, 5284. eV to 5538. eV
XRAY # 2
ZN 50 ppm, 8485. eV to 8790. eV
XRAY # 3
AG 75 ppm, 21913. eV to 22288. eV

MENU -- MODIFY METAL SAMPLES CONFIGURATION TABLE

- 1 - Declare XRAY # 1 metal and concentration
- 2 - Declare XRAY # 2 metal(s) and concentration
- 3 - Declare XRAY # 3 metal(s) and concentration
- 4 - Clear XRAY 1, 2, and 3 metals table
- 9 - Return to previous menu

Enter choice: 2

Attachment D: Metals Calibration Examples and Output

XRAY # 2 metals are: NI CU ZN HG AS PB BR UZ
Enter 2-char metal name and PPM (e.g. ZN 100): HG 60

XRAY # 1
CR 100 ppm, 5284. eV to 5538. eV

XRAY # 2
ZN 50 ppm, 8485. eV to 8790. eV
HG 60 ppm, 9783. eV to 10183. eV

XRAY # 3
AG 75 ppm, 21913. eV to 22288. eV

MENU -- MODIFY METAL SAMPLES CONFIGURATION TABLE

- 1 - Declare XRAY # 1 metal and concentration
- 2 - Declare XRAY # 2 metal(s) and concentration
- 3 - Declare XRAY # 3 metal(s) and concentration
- 4 - Clear XRAY 1, 2, and 3 metals table
- 9 - Return to previous menu

Enter choice: 9

MAIN MENU -- METALS CALIBRATION PROGRAM

- 1 - Set output file name (cur=CALIBRESULTS.DAT)
- 2 - Modify metal samples configuration table (menu)
- 3 - Display metal samples configuration table
- 4 - Set # times to repeat 5-min acq (cur=10)
- 5 - GO -- prepare to and start sample acquisition
- 9 - QUIT

Enter choice: 4

[Currently, -->10-- 5.0-minute counts will be done]

Enter new number of counts to do: 3

MAIN MENU -- METALS CALIBRATION PROGRAM

- 1 - Set output file name (cur=CALIBRESULTS.DAT)
- 2 - Modify metal samples configuration table (menu)
- 3 - Display metal samples configuration table
- 4 - Set # times to repeat 5-min acq (cur= 3)
- 5 - GO -- prepare to and start sample acquisition
- 9 - QUIT

Enter choice: 5

CALIBRATION SAMPLE INSTALLATION:

Now you may install your sample solution(s) in the corresponding XRAY(s).
Make sure the samples match the configuration table.

Attachment D: Metals Calibration Examples and Output

```

-----
XRAY # 1
  CR    100 ppm,    5284. eV to    5538. eV
XRAY # 2
  ZN     50 ppm,    8485. eV to    8790. eV
  HG     60 ppm,    9783. eV to   10183. eV
XRAY # 3
  AG     75 ppm,   21913. eV to   22288. eV
-----

```

Type EXIT to return to main menu, or
type OK to start samples acquisition: OK

MCA CREATE XRAY1 AI:13 /DEF=SEWERS\$DIR:XRAY1DEF/NOEFF
MCA CREATE XRAY2 AI:14 /DEF=SEWERS\$DIR:XRAY2DEF/NOEFF
MCA CREATE XRAY3 AI:15 /DEF=SEWERS\$DIR:XRAY3DEF/NOEFF

15:37:09 Starting acquisition ... 3 acquisitions at 5.0 minutes each

```

Moving spectra XRAY1 to file METALCAL:X1_OCT91_CR100.CNF;1
Moving spectra XRAY2 to file METALCAL:X2_OCT91_ZN050_HG060.CNF;1
Moving spectra XRAY3 to file METALCAL:X3_OCT91_AG075.CNF;1
09-OCT-1991 METAL PPM LOWEV HIGHEV METALCNTS X# SCATTERCNTS
15:37:09 CR 100 5284. 5538. 0 1 0
15:37:09 ZN 50 8485. 8790. 0 2 0
15:37:09 AG 75 21913. 22288. 0 3 0
15:37:09 HG 60 9783. 10183. 0 2 0
Moving spectra XRAY1 to file METALCAL:X1_OCT91_CR100.CNF;2
Moving spectra XRAY2 to file METALCAL:X2_OCT91_ZN050_HG060.CNF;2
Moving spectra XRAY3 to file METALCAL:X3_OCT91_AG075.CNF;2
15:42:14 CR 100 5284. 5538. 0 1 0
15:42:14 ZN 50 8485. 8790. 0 2 0
15:42:14 AG 75 21913. 22288. 0 3 0
15:42:14 HG 60 9783. 10183. 0 2 0
Moving spectra XRAY1 to file METALCAL:X1_OCT91_CR100.CNF;3
Moving spectra XRAY2 to file METALCAL:X2_OCT91_ZN050_HG060.CNF;3
Moving spectra XRAY3 to file METALCAL:X3_OCT91_AG075.CNF;3
15:47:18 CR 100 5284. 5538. 0 1 0
15:47:18 ZN 50 8485. 8790. 0 2 0
15:47:18 AG 75 21913. 22288. 0 3 0
15:47:18 HG 60 9783. 10183. 0 2 0

```

MAIN MENU -- METALS CALIBRATION PROGRAM

9 - QUIT

Enter choice: 9

Attachment D: Metals Calibration Examples and Output

C METALS_K2.INC - metals coefficient-2 and K2 tables

C

CHARACTER*40 METALS_K2_FILE/'SEWER\$SHARED:METALS_K2.TBL'/

C

REAL*4 XCOEF2(MTBL_SIZE) / 5862.0, 28528.0, 19664.0, 12567.0,

C

1 Hg As Pb Br
18753.0, 7633.0, 15809.0, 5000.0,

C

2 Cd Ag
5991.0, 6883.0, 10*1.0/

C

3 Cr Ni Cu Zn Hg
XK2(MTBL_SIZE) / -29.40, -47.88, -35.13, -17.10, -30.44,

C

4 As Pb Br Cd Ag
-8.49, -18.58, -5.00, -15.40, -13.62,

5 10*1.0/

COMMON /MK2/ XCOEF2, XK2

Attachment D: Metals Calibration Examples and Output

REVISION 1
FINAL

EMP-SW-CA
Sewer Equipment Calibrations

Effective date: 04/15/93
Page 27 of 28

Attachment E: Gamma Calibration Order Sheet
and Nuclear Data Certification File

SHIP TO		SHIP TO		SHIP TO	
NAME	ADDRESS	CITY	STATE	ZIP	PHONE
UNIVERSITY OF CALIFORNIA	8059422 B	LIVERMORE	CA	94550	
SHIP VIA (SEE 4000)		SHIP VIA (SEE 4000)		SHIP VIA (SEE 4000)	
1. AIR	2. AIR	3. AIR	4. AIR	5. AIR	6. AIR
7. AIR	8. AIR	9. AIR	10. AIR	11. AIR	12. AIR
SHIP VIA (SEE 4000)		SHIP VIA (SEE 4000)		SHIP VIA (SEE 4000)	
1. AIR	2. AIR	3. AIR	4. AIR	5. AIR	6. AIR
7. AIR	8. AIR	9. AIR	10. AIR	11. AIR	12. AIR

ANALYTICS, INC.
ATTN: SUSAN RUCKER
1360 SEABOARD INDUSTRIAL BLVD.
ATLANTA, GA 30318

UNIVERSITY OF CALIFORNIA

FOR CONTRACT NO. W-7405-ENG-48
OR CONTRACT NO. DE-AC03-78SF00088
WITH THE DEPARTMENT OF ENERGY
PURCHASE ORDER COPY 4

For Regulatory Department
USE - INFORMATION COPY

DO NOT CONTACT SELLER
FOR INFORMATION CALL PURCHASING DEPT.
BERKELEY EXT. 4571, OR LIVERMORE EXT. 2-4548

SHIP TO
UNIVERSITY OF CALIFORNIA 8059422 B
LAWRENCE LIVERMORE NATIONAL LABORATORY
FOR U.S. DEPARTMENT OF ENERGY
7000 EAST AVENUE
LIVERMORE, CA 94550

ATTN: SCHUMACHER BLDG. 231 VAULT FOR: JIM CATE
CONFIRMING TELEPHONE ORDER OF 08/24 WITH SUSAN RUCKER - DO NOT DUPLICATE

SHIP VIA (SEE 4000)		SHIP VIA (SEE 4000)		SHIP VIA (SEE 4000)	
1. AIR	2. AIR	3. AIR	4. AIR	5. AIR	6. AIR
7. AIR	8. AIR	9. AIR	10. AIR	11. AIR	12. AIR
SHIP VIA (SEE 4000)		SHIP VIA (SEE 4000)		SHIP VIA (SEE 4000)	
1. AIR	2. AIR	3. AIR	4. AIR	5. AIR	6. AIR
7. AIR	8. AIR	9. AIR	10. AIR	11. AIR	12. AIR

ITEM NO.	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE	REMARKS
1	Source, Radioisotope Check, Water Equivalent Solid, Cast in 1 Liter Marinelli Beaker (University supplied). Isotopes to be Standard Mix (CO-109, CO-57, CE-139, HG-203, IN-113, CS-137, CO-60, Y-88, AM-241). Total Activity 3 Microcuries. Beaker to be Filled to Top.	1	770.00	770.00	08/26/88

Controlled Materials
Department of Energy license by-product material is not required. As a contractor of DOE, the University is exempt under the provisions of the Code of Federal Regulations, Title 10 part 30, paragraph 30.12. Title to material reverts to the Government under the terms of Article 11 - Title, on the reverse of this Order.

Hazardous Material - Shipment Regulations
The Vendor certifies that any Hazardous Materials covered by this Order are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Material Safety Data Sheets - Hazardous Chemicals and Chemical Products
Identification of the health hazards of any chemical, chemical compound, or mixture of chemical elements and compounds which may be provided under provisions of this Order must be furnished in the appropriate material safety data sheets (MSDS). Furnishing of such data sheets is a requirement of the Federal Occupational Safety and Health Administration (OSHA) Regulation 29 CFR 1910.1200. The MSDS data sheets, appropriately

The Terms and Conditions On The Reverse Side
Constitute A Part Of This Order

Authorized by _____ UNIVERSITY OF CALIFORNIA

Attachment E: Gamma Calibration Order Sheet
and Nuclear Data Certification File

Print Time : 11-NOV-1992 09:49:39.87
Certificate file name : \$DISK1:[SEWER.CALIB.ENERGY]SEWER.CER;1
Certificate title : analytics std # 28543-28
Certificate date : 1-JUL-1988 12:00:00.00
Certificate quantity : 1.10000E+03

Rcd	Nuclide	Halflife	CAL/		Rate	Activity	
			INIT	Energy		%Abun	(uCi)
1	cd-109	464.00D	No	88.03	3.1640E+03	3.72	2.2988E+00
2	co-57	270.90D	No	122.06	1.9420E+03	85.51	6.1381E-02
3	ce-139	137.70D	No	165.85	1.9580E+03	80.35	6.5861E-02
4	sn-113	115.00D	No	391.69	3.8870E+03	64.90	1.6187E-01
5	cs-137	30.00Y	Yes	661.65	2.5940E+03	85.10	8.2383E-02
6	y-88	106.64D	No	898.02	7.8320E+03	93.40	2.2663E-01
7	y-89	106.64D	No	1836.04	8.2530E+03	99.38	2.2445E-01
8	co-60	5.27Y	No	1173.21	3.9060E+03	100.00	1.0557E-01
9	co-60	5.27Y	Yes	1332.47	3.9160E+03	100.00	1.0584E-01
10	hg-203	46.62D	No	279.19	5.2210E+03	77.30	1.8255E-01
11	am-241	432.00Y	No	59.54	3.8100E+03	35.90	2.8683E-01

Sewer Sampling Documentation Handbook

LLNL ENVIRONMENTAL
MONITORING SECTION
UNCONTROLLED COPY
FOR INFORMATION ONLY

	Approval	Date
Brian Balke, Sewer Analyst	<i>Brian Balke</i>	1/10/95
Jennifer Larson, Sewer Analyst	<i>Jennifer Larson</i>	1/10/95
Cindy Garcia, EMS QA Coordinator	<i>Cynthia M. Garcia</i>	1/11/95
Bill Hoppes WGMG Leader	<i>Bill Hoppes</i>	1/11/95

What is the Sewer Sampling Documentation Handbook?**Definition**

The Sewer Sampling Documentation Handbook is a compilation of sample labels and Chain of Custody Forms that can be used as examples by sampling technologists and environmental analysts assigned to sewer monitoring.

When to Use

The Sewer Sampling Documentation Handbook should be used:

- when filling out labels for sewer samples
- when filling out Chain of Custody Forms prior to submitting sewer samples to an analytical laboratory
- when training personnel newly assigned to the sewer monitoring network

In this Manual

This manual includes the following information:

Topic	See Page
Labels Used in Sewer Sampling	3
Chain of Custody Forms Used in Sewer Sampling	8
Table of Ordinal Dates - Non-Leap Years	45
Table of Ordinal Dates - Leap Years	46
Rush Samples	47

Labels Used in Sewer Sampling

Introduction

This section gives examples of the different types of labels used for sewer sampling and describes where each is used.

In this section

This section includes the following labels:

Label	See Page
Daily Sampling Bottle	4
LWRP Weekly Composite Sample	5
LWRP Monthly Composite Sample	6

Daily Sampling Bottle Label

Where Used

This label is used for the 500 ml polyethylene bottles used for:

- daily samples at B196
- radiation analysis samples at C196
- daily archive samples at SNLL (SS163)
- alarm grab samples

Example

This is an example of a blank daily sampling bottle label:

DATE	_____
TIME	_____
LOCATION	_____
INITIALS	_____

Information Needed

The following information must be included on the daily sampling bottle labels:

- date sample was taken
- time sample was taken
- location where sample was taken
- sampler's initials

Sample Location

The sample location is taken from the second field in the Sample Identifier shown on the chain of custody form.

For example:

The sample location for sample identifier L-B196-01 would be B196.

The sample location for sample identifier L-C196-03 would be C196.

LWRP Weekly Composite Sample Label

Where Used

This label is affixed to the 1-gallon bottle delivered to the LWRP each week for sampling of LWRP effluent.

Example

This is an example of a blank LWRP Weekly Composite label:

LWRP Weekly	
L-WRPE-01-SW	
Sample Days:	
☐ _____	☐ _____
☐ _____	☐ _____
☐ _____	☐ _____
☐ _____	

Information Needed

The sampling technologist must fill in the sample dates prior to attaching the label to the bottle.

The first sampling date will be the Monday that the sample bottle is delivered.

Notes

When preparing sample bottles for delivery, technologists should determine whether the following Monday will be a holiday. In a case where Monday is a holiday, two bottles should be prepared and delivered the previous week (one for that week's sample and one for the week with a Monday holiday).

The LWRP technicians will add 500 ml of their wastewater to the sample bottle each day of the week and check the box next to the sampling date when the sample is added.

The TSG sampling technologist must verify that all boxes are checked when picking up the sample.

- IF all boxes are not checked, the TSG technologist should find out why from the LWRP technician.
- IF the box was not checked due to an oversight, the TSG technologist should check the box.
- IF a sample was actually missed, the TSG technologist should write an NCR.

LWRP Monthly Composite Sample Label**Where Used**

This label is affixed to the 15-gallon carboy delivered to the LWRP on the last Monday of each month for LWRP wastewater sampling.

Example

This is an example of a blank LWRP Monthly Composite label:

LWRP Monthly Composite: L-WRPE-02-SW			
Month: _____		Year: _____	
☐ 1	☐ 9	☐ 17	☐ 25
☐ 2	☐ 10	☐ 18	☐ 26
☐ 3	☐ 11	☐ 19	☐ 27
☐ 4	☐ 12	☐ 20	☐ 28
☐ 5	☐ 13	☐ 21	☐ 29
☐ 6	☐ 14	☐ 22	☐ 30
☐ 7	☐ 15	☐ 23	☐ 31
☐ 8	☐ 16	☐ 24	

Information Needed

The sampling technologist must fill in the month and the year prior to attaching the label to the bottle.

The month and year of the following month should be used.

Example:

When filling out a label on December 27, 1994, the month should read "01" and the year should read "1995"

Notes

LWRP Monthly Composite Sample Label continued

LWRP technicians will add 500 ml of their wastewater to the sample bottle each day of the month and check the box next to the sampling day when the sample is added. The TSG sampling technologist must verify that all boxes are checked when picking up the sample at the end of the month.

- IF all boxes are not checked, the TSG technologist should find out why from the LWRP technician.
- IF the box was not checked due to an oversight, the TSG technologist should check the box.
- IF a sample was actually missed, the TSG technologist should write an NCR.

Chain of Custody Forms Used in Sewer Sampling

Introduction

This section gives examples of the different types of Chain of Custody Forms used for sewer sampling.

In this chapter

This chapter includes the following sections:

Label	See Page
B196 Chain of Custody Forms	9
C196 Chain of Custody Forms	16
LWRP Chain of Custody Forms	29
Alarm Traceback Chain of Custody Forms	38

Chain of Custody Forms Used for B196 Sampling

Introduction

This section gives examples of the different types of Chain of Custody Forms used for sewer sampling at B196 and describes where each is used.

In this section

This section includes the following COCs:

COC	Description (Laboratory)	See Page
B196-01	Daily Gross Alpha/Beta and Tritium (Hazards Control)	10
B196-02	Weekly Metals (Hazards Control)	12
B196-03	Monthly Plutonium and Cesium (RAS)	14

Ordinal Dates

Tables of ordinal dates for non-leap years and leap years are given on pages 45 and 46. Ordinal dates must be used when filling out COCs.

Rush Samples

Rules to be used to determine which COCs should be marked "RUSH" are given on page 47.

Chain of Custody Form B196-01

Purpose	This form is used for submitting daily sewage samples from B196 to the Hazards Control Analytical Laboratory for analysis for gross alpha, gross beta, and tritium.
Applicable Procedures	The EMS procedure that defines the sampling that requires this COC form is EMP-SW-B196, <i>Sewage Sampling at B196</i> .
Sample	See page 11 for an example of a completed COC form B196-01.
Process	<ol style="list-style-type: none">1. The TSG sampling technologist should draft this COC prior to the beginning of each month and deliver it to Hazards Control, Building 252, Room 1748.2. Each day that samples are delivered, the sampling technologist must write in the number of samples actually delivered and initial the COC next to the sampling date when samples are delivered to the laboratory.
Notes	<p>This COC will consist of two pages so that all days of the month in which sampling occurs can be included.</p> <p>Hazards Control chemists will write Hazards Control tracking numbers in the Remarks column of the COC.</p>

Page 1 of 2

Chain-of-Custody Record

Laboratory: Hazards Control / B253				Chain-of-Custody Record				Sample Group Description				
Project Name/Analyst: Jennifer Larson / WGMG				Analyses Requested				Logbook ID No:				
Sampler (signature)				Number of Containers				REMARKS				
Sample Identifier:				Date								
site	location	number	medium									
L	B196	01	SW	00192	5	X	X	X	X	(Hazards Control Sample Tracking numbers are written here.)		
				00292	4	X	X	X	X			
Previously location 093-07				00392	4	X	X	X	X			
				00492	4	X	X	X	X			
				00592	4	X	X	X	X			
				00692	4	X	X	X	X	(TSG Technician must initial here when the sample is delivered to HCLC custody)		
				00792	4	X	X	X	X			
				00892	5	X	X	X	X			
				00992	4	X	X	X	X			
				01092	4	X	X	X	X			
				01192	4	X	X	X	X			
				01292	4	X	X	X	X			
				01392	4	X	X	X	X			
				01492	4	X	X	X	X			
				01592	5	X	X	X	X			
				01692	4	X	X	X	X			

Release Number:	TRR:	Relinquished by Sampler:	Date/Time	Received by Counter at LLNL
		Relinquished by Counter to Lab:	Date/Time	Received at Laboratory
		Data relinquished from Lab:	Date/Time	Data received by Analyst
		Data relinquished by Analyst:	Date/Time	Data received by Data Manager

DISPOSITION OF COPIES (after analysis):

Guidance: Sample (chain) to analyzing other facilities counter or samples
 Place: Laboratory. Return to analyst upon receipt of analysis other analyst to Laboratory of samples
 Counter Laboratory

Guidance: Sample (chain) for file when to Data Manager or data
 when Data Manager (chain) to data and analysis of completed data is analyzed

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Form OAP-8
Rev. 5
October 1993

Environmental Monitoring Section
 Lawrence Livermore National Laboratory
 P.O. Box 005, L-821
 Livermore, CA 94551

Form OAP-8
Rev. 5
October 1993

Chain of Custody Form B196-02

Purpose	This form is used for submitting weekly sewage samples from B196 to the Hazards Control Analytical Laboratory for analysis for metals.
Applicable Procedures	The EMS procedure that defines the sampling that requires this COC form is EMP-SW-B196, <i>Sewage Sampling at B196</i> .
Sample	See page 13 for an example of a completed COC form B196-02.
Process	<ol style="list-style-type: none">1. The TSG sampling technologist should draft this COC prior to the beginning of each month and deliver it to Hazards Control, Building 252, Room 1748.2. Analytical laboratory personnel will composite the daily samples to produce the weekly composite sample and initial the COC next to the sample identifier.
Notes	Hazards Control chemists will write Hazards Control tracking numbers in the Remarks column of the COC.

page 1 of 1

Chain-of-Custody Record

[illegible]

Chain of Custody Form B196-03

Purpose	This form is used for submitting monthly sewage samples from B196 to the Radiation Analytical Sciences Laboratory for analysis for Cesium and Plutonium.
Applicable Procedures	The EMS procedure that defines the sampling that requires this COC form is EMP-SW-B196, <i>Sewage Sampling at B196</i> .
Sample	See page 15 for an example of a completed COC form B196-03.
Process	1. The TSG sampling technologist should draft this COC prior to delivering monthly samples to RAS.
Notes	<p>Any days that when a sample was not taken should be noted in the "Remarks" section of the COC as:</p> <p style="text-align: center;">Missing day #####</p> <p>Where ##### is the ordinal date of the sampling date that was missed.</p>

page_1_of_1_

Chain-of-Custody Record

[illegible]

Chain of Custody Forms Used for C196 Sampling

Introduction

This section gives examples of the different types of Chain of Custody Forms used for sewer sampling at C196 and describes where each is used.

In this section

This section includes the following COCs:

COC	Description (Laboratory)	See Page
C196-01	Weekly Metals (CLS)	17
C196-02	Weekly Radiation (Hazards Control)	19
C196-03	Monthly Water Quality (CLS)	21
C196-04	Monthly Toxic Chemicals (CLS)	23
C196-05	Monthly Oil and Grease (CLS)	25
C196-06	Monthly QA samples (GTEL)	27

Chain of Custody Form C196-01

Purpose	This form is used for submitting weekly sewage samples from C196 to California Laboratory Services for analysis for metals.
Applicable Procedures	<p>The EMS procedure that defines the sampling that requires this COC form is EMP-SW-C196, <i>Sewage Sampling at C196</i>.</p> <p>The EMS procedure that defines the procedure to be followed in completing paperwork for submitting samples to a contract analytical laboratory is EMP-QA-SD, <i>Sample Tracking Documentation</i>.</p> <p>The EMS procedure that defines the steps to be followed in submitting samples to a courier for delivery to an outside analytical laboratory is EMP-QA-CS, <i>Courier Service</i>.</p>
Sample	See page 18 for an example of a completed COC form C196-01.
Process	<ol style="list-style-type: none"> 1. The TSG sampling technologist should draft this COC prior to delivering samples to the CLS courier. 2. Additional steps to be followed prior to submitting samples to the courier are defined in EMS procedures EMP-QA-SD and EMP-QA-CS.
Notes	<ul style="list-style-type: none"> • All samples submitted to contract analytical laboratories must include direction for routing of analytical results. Write: Report results to Nina Hankia, L-629, (510) 422-9306 at the bottom of the sample identifier column. • When completing the COC for the week during which monthly sampling occurs, write: Not including day ##### (Monthly Sample) (where ##### is the ordinal date of the day the monthly sample was taken) under the sample identifier, as shown in the sample form. • Mark "RUSH" in the results column for the last sample of the month only. • Rules for determining which COCs should be marked "RUSH" are given on page 47.

Example: Chain of Custody Form C196-01

[illegible]

Chain of Custody Form C196-02

Purpose	This form is used for submitting weekly sewage samples from C196 to the Hazards Control Analytical Laboratory for analysis for radiation.
Applicable Procedures	<p>The EMS procedure that defines the sampling that requires this COC form is EMP-SW-C196, <i>Sewage Sampling at C196</i>.</p> <p>The EMS procedure that defines the procedure to be followed in completing paperwork for submitting samples to a contract analytical laboratory is EMP-QA-SD, <i>Sample Tracking Documentation</i>.</p> <p>The EMS procedure that defines the steps to be followed in submitting samples to a courier for delivery to an outside analytical laboratory is EMP-QA-CS, <i>Courier Service</i>.</p>
Sample	See page 20 for an example of a completed COC form C196-02.
Process	<ol style="list-style-type: none"> 1. The TSG sampling technologist should draft this COC prior to the beginning of each month and deliver it to Hazards Control, Building 252, Room 1748. 2. The sampling technologist must write in the number of samples actually delivered and initial the COC next to the number of containers when samples are delivered to the laboratory.
Notes	<ul style="list-style-type: none"> • During the week in which the monthly sample is collected, a special sample is taken from the 24-hour composite. This sample is listed at the bottom of the COC and noted in the Sample Identifier column. • In the sample form shown, the monthly sample was taken on day 24592.

Chain of Custody Form C196-03

Purpose	This form is used for submitting monthly 24-hour composite sewage samples from C196 to California Laboratory Services for analysis for water quality.
Applicable Procedures	<p>The EMS procedure that defines the sampling that requires this COC form is EMP-SW-C196, <i>Sewage Sampling at C196</i>.</p> <p>The EMS procedure that defines the procedure to be followed in completing paperwork for submitting samples to a contract analytical laboratory is EMP-QA-SD, <i>Sample Tracking Documentation</i>.</p> <p>The EMS procedure that defines the steps to be followed in submitting samples to a courier for delivery to an outside analytical laboratory is EMP-QA-CS, <i>Courier Service</i>.</p>
Sample	See page 22 for an example of a completed COC form C196-03.
Process	<ol style="list-style-type: none">1. The TSG sampling technologist should draft this COC prior to delivering samples to the CLS courier.2. Additional steps to be followed prior to submitting samples to the courier are defined in EMS procedures EMP-QA-SD and EMP-QA-CS.
Notes	<ul style="list-style-type: none">• All samples submitted to contract analytical laboratories must include direction for routing of analytical results. Write: Report results to Nina Hankla, L-629, (510) 422-9306 at the bottom of the sample identifier column.• The report due date must be specified on the COC. Preliminary results are due on the seventh of the following month; final results are due on the 18th of the following month, two days prior to delivery of the report to the LWRP.

Chain of Custody Form C196-04

Purpose	This form is used for submitting monthly grab sewage samples from C196 to California Laboratory Services for analysis for toxic chemicals.
Applicable Procedures	<p>The EMS procedure that defines the sampling that requires this COC form is EMP-SW-C196, <i>Sewage Sampling at C196</i>.</p> <p>The EMS procedure that defines the procedure to be followed in completing paperwork for submitting samples to a contract analytical laboratory is EMP-QA-SD, <i>Sample Tracking Documentation</i>.</p> <p>The EMS procedure that defines the steps to be followed in submitting samples to a courier for delivery to an outside analytical laboratory is EMP-QA-CS, <i>Courier Service</i>.</p>
Sample	See page 24 for an example of a completed COC form C196-04.
Process	<ol style="list-style-type: none">1. The TSG sampling technologist should draft this COC prior to delivering samples to the CLS courier.2. The pH value of the sample submitted for cyanide (CN) analysis should be recorded on the COC.3. Two separate samples are taken for EPA 624 analysis. The sampling technologist should record the time that each of these samples was taken on the COC.3. Additional steps to be followed prior to submitting samples to the courier are defined in EMS procedures EMP-QA-SD and EMP-QA-CS.
Notes	<ul style="list-style-type: none">• All samples submitted to contract analytical laboratories must include direction for routing of analytical results. Write: Report results to Nina Hankla, L-629, (510) 422-9306 at the bottom of the sample identifier column.• The report due date must be specified on the COC. Preliminary results are due on the seventh of the following month; final results are due on the 18th of the following month, two days prior to delivery of the report to the LWRP.

Chain of Custody Form C196-05

Purpose	This form is used for submitting monthly sewage samples from C196 to California Laboratory Services for analysis for oil and grease.
Applicable Procedures	<p>The EMS procedure that defines the sampling that requires this COC form is EMP-SW-C196, <i>Sewage Sampling at C196</i></p> <p>The EMS procedure that defines the procedure to be followed in completing paperwork for submitting samples to a contract analytical laboratory is EMP-QA-SD, <i>Sample Tracking Documentation</i></p> <p>The EMS procedure that defines the steps to be followed in submitting samples to a courier for delivery to an outside analytical laboratory is EMP-QA-CS, <i>Courier Service</i></p>
Sample	See page 26 for an example of a completed COC form C196-05.
Process	<ol style="list-style-type: none">1. The TSG sampling technologist should draft this COC prior to delivering samples to the CLS courier.2. Additional steps to be followed prior to submitting samples to the courier are defined in EMS procedures EMP-QA-SD and EMP-QA-CS.
Notes	<ul style="list-style-type: none">• All samples submitted to contract analytical laboratories must include direction for routing of analytical results. Write: Report results to Nina Hankla, L-629, (510) 422-9306 at the bottom of the sample identifier column.• The report due date must be specified on the COC. Preliminary results are due on the seventh of the following month; final results are due on the 18th of the following month, two days prior to delivery of the report to the LWRP.

page_1_of_1_

Laboratory: Cal Lab Services

[illegible][illegible]

**Environmental Monitoring Sealion
Lawrence Livermore National Laboratory
P.O. Box 808, L-621
Livermore, CA 94551**

Form CAP-8
Rev. 5
October 1983

Chain of Custody Form C196-06

Purpose	This form is used for submitting monthly duplicate sewage samples from C196 to GTEL for analysis for selected QC parameters.
Applicable Procedures	<p>The EMS procedure that defines the sampling that requires this COC form is EMP-SW-C196, <i>Sewage Sampling at C196</i>.</p> <p>The EMS procedure that defines the procedure to be followed in completing paperwork for submitting samples to a contract analytical laboratory is EMP-QA-SD, <i>Sample Tracking Documentation</i>.</p> <p>The EMS procedure that defines the steps to be followed in submitting samples to a courier for delivery to an outside analytical laboratory is EMP-QA-CS, <i>Courier Service</i>.</p>
Sample	See page 28 for an example of a completed COC form C196-06.
Process	<ol style="list-style-type: none">1. The TSG sampling technologist should draft this COC prior to delivering samples to the CLS courier.2. Additional steps to be followed prior to submitting samples to the courier are defined in EMS procedures EMP-QA-SD and EMP-QA-CS.
Notes	<ul style="list-style-type: none">• All samples submitted to contract analytical laboratories must include direction for routing of analytical results. Write: Report results to Nina Hankla, L-629, (510) 422-9306 at the bottom of the sample identifier column.• The report due date must be specified on the COC. Preliminary results are due on the seventh of the following month; final results are due on the 18th of the following month, two days prior to delivery of the report to the LWRP.

Example: Chain of Custody Form C196-06

Laboratory: GTEL				Chain-of-Custody Record				Page 1 of 1	
Project Name/Analyst: Jennifer Larson / WQMG				Sample Group Description					
Sampler: (signature)				Logbook ID No:					
Sample Identifier:				Number of Containers					
Site		Location		Date		Analyses Requested			
L		C196		07		SW		9/1/92	
L		C196		08		SW		9/1/92	
L		C196		09		SW		9/1/92	
L		C196		10		SW		9/1/92	
L		C196		11		SW		9/1/92	
L		C196		12		SW		9/1/92	
L		C196		13		SW		9/1/92	
L		C196		14		SW		9/1/92	
L		C196		15		SW		9/1/92	
L		C196		16		SW		9/1/92	
L		C196		17		SW		9/1/92	
L		C196		18		SW		9/1/92	
L		C196		19		SW		9/1/92	
L		C196		20		SW		9/1/92	
L		C196		21		SW		9/1/92	
L		C196		22		SW		9/1/92	
L		C196		23		SW		9/1/92	
L		C196		24		SW		9/1/92	
L		C196		25		SW		9/1/92	
L		C196		26		SW		9/1/92	
L		C196		27		SW		9/1/92	
L		C196		28		SW		9/1/92	
L		C196		29		SW		9/1/92	
L		C196		30		SW		9/1/92	
L		C196		31		SW		9/1/92	
L		C196		32		SW		9/1/92	
L		C196		33		SW		9/1/92	
L		C196		34		SW		9/1/92	
L		C196		35		SW		9/1/92	
L		C196		36		SW		9/1/92	
L		C196		37		SW		9/1/92	
L		C196		38		SW		9/1/92	
L		C196		39		SW		9/1/92	
L		C196		40		SW		9/1/92	
L		C196		41		SW		9/1/92	
L		C196		42		SW		9/1/92	
L		C196		43		SW		9/1/92	
L		C196		44		SW		9/1/92	
L		C196		45		SW		9/1/92	
L		C196		46		SW		9/1/92	
L		C196		47		SW		9/1/92	
L		C196		48		SW		9/1/92	
L		C196		49		SW		9/1/92	
L		C196		50		SW		9/1/92	
L		C196		51		SW		9/1/92	
L		C196		52		SW		9/1/92	
L		C196		53		SW		9/1/92	
L		C196		54		SW		9/1/92	
L		C196		55		SW		9/1/92	
L		C196		56		SW		9/1/92	
L		C196		57		SW		9/1/92	
L		C196		58		SW		9/1/92	
L		C196		59		SW		9/1/92	
L		C196		60		SW		9/1/92	
L		C196		61		SW		9/1/92	
L		C196		62		SW		9/1/92	
L		C196		63		SW		9/1/92	
L		C196		64		SW		9/1/92	

Chain of Custody Forms Used for LWRP Sampling

Introduction

This section gives examples of the different types of Chain of Custody Forms used for sewer sampling at the LWRP

In this section

This section includes the following COCs:

COC	Description (Laboratory)	See Page
LWRP-01	Weekly Radioactivity (Hazards Control)	30
LWRP-02	Monthly Plutonium and Cesium (RAS)	32
LWRP-03	Monthly Metals and Gross Alpha/Beta (Hazards Control)	34
LWRP-04	Quarterly Pu and Gamma for Digesters (RAS)	36

Chain of Custody Form LWRP-01

Purpose	This form is used for submitting weekly sewage samples from LWRP to the Hazards Control Analytical Laboratory for analysis for gross alpha, gross beta, and tritium.
Applicable Procedures	The EMS procedure that defines the sampling that requires this COC form is EMP-SW-LWRP, <i>Sewage Sampling at LWRP</i> .
Sample	See page 31 for an example of a completed COC form LWRP-01.
Process	<ol style="list-style-type: none">1. The TSG sampling technologist should draft this COC prior to the beginning of each month and deliver it to Hazards Control, Building 252, Room 1748.2. The sampling technologist must write in the number of samples actually delivered and initial the COC when samples are delivered to the laboratory.
Notes	The first week of the month is always analyzed in duplicate (laboratory split).

Chain of Custody Form LWRP-02

Purpose	This form is used for submitting monthly sewage samples from LWRP to the Radiation Analytical Sciences Laboratory for analysis for Plutonium and Cesium.
Applicable Procedures	The EMS procedure that defines the sampling that requires this COC form is EMP-SW-LWRP, <i>Sewage Sampling at LWRP</i> .
Sample	See page 33 for an example of a completed COC form LWRP-02.
Process	The TSG sampling technologist should draft this COC prior to delivering monthly samples to RAS.
Notes	<p>Any days that when a sample was not taken should be noted in the "Remarks" section of the COC as:</p> <p style="text-align: center;">Missing day #####</p> <p>Where ##### is the ordinal date of the sampling date that was missed.</p>

Chain-of-Custody Record

page 1 of 1

[illegible]

Chain of Custody Form LWRP-03

Purpose	This form is used for submitting monthly digester samples from LWRP to the Hazards Control Analytical Laboratory for analysis for metals.
Applicable Procedures	The EMS procedure that defines the sampling that requires this COC form is EMP-SW-LWRP, <i>Sewage Sampling at LWRP</i> .
Sample	See page 35 for an example of a completed COC form LWRP-03.
Process	The TSG sampling technologist should draft this COC prior to delivering monthly samples to RAS.

page 1 of 1

Chain-of-Custody Record

[illegible]

Chain of Custody Form LWRP-04

Purpose	This form is used for submitting quarterly digester samples from LWRP to the Radiation Analytical Sciences Laboratory for analysis for Plutonium and gamma.
Applicable Procedures	The EMS procedure that defines the sampling that requires this COC form is EMP-SW-LWRP, <i>Setong Sampling at LWRP</i> .
Sample	See page 37 for an example of a completed COC form LWRP-04.
Process	The TSC sampling technologist should draft this COC prior to delivering monthly samples to RAS.

Chain of Custody Forms Used for Alarm Traceback Sampling

Introduction

This section gives examples of the different types of Chain of Custody Forms used for alarm traceback sewer sampling and describes where each is used.

In this section

This section includes the following COCs:

COC	Description (Laboratory)	See Page
ALARM-01	Satellite Station and Daily Composite (Hazards Control)	39
ALARM-02	Grab Sample for Alarm Parameter (Hazards Control)	41
ALARM-03	SDF Holding Tank Analysis for Alarm Parameter, pH, and Normality (Hazards Control)	43

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Chain of Custody Form ALARM-01

Purpose	This form is used for submitting satellite station and daily composite sewage Samples to the Hazards Control Analytical Laboratory for analysis for alarm parameters after a sewer alarm.
Applicable Procedures	The EMS procedures that define the sampling that requires this COC form are EMP-SW-SAS <i>Satellite Sewer Stations Alarm Sampling</i> , and EMP-SW-EAR, <i>Sewer Alarm Response</i> .
Sample	See page 40 for an example of a completed COC form ALARM-01.
Process	The TSG sampling technologist should draft this COC prior to delivering alarm samples to HCAL.

Example: Chain of Custody Form ALARM-01

page 1 of 1

Chain-of-Custody Record

Laboratory: HCAL/B253			Project Name/Analyst: Jennifer Larson / WGMG		Sample Group Description	
Sampler: (signature)			Number of Containers		Logbook ID No:	
Sample Identifier:			Date		REMARKS	
site	location	number	medium			
L	M40	01	SW	2/93	X	(This space is reserved for Hazards Control sample tracking numbers.)
L	M40	02	SW	2/93	X	
L	M51	01	SW	2/93	X	
L	M53	01	SW	2/93	X	
L	M69	01	SW	2/93	X	
L	M86	01	SW	2/93	X	
L	M125	01	SW	2/93	X	
L	M177	01	SW	2/93	X	
L	M177	02	SW	2/93	X	
L	M185	01	SW	2/93	X	
L	M185	02	SW	2/93	X	
L	M231	01	SW	2/93	X	
L	M231	02	SW	2/93	X	
L	B196	01	SW	2/93	X	
L	SNLL	02	SW	2/93	X	

Relinquished by Sampler:		Received by Counter at LLNL:	
Date/Time		Date/Time	
Relinquished by Counter to Lab:		Received at Laboratory:	
Data relinquished from Lab:		Data received by Analyst:	
Data relinquished by Analyst:		Data received by Data Manager:	

Release Number:	TRR:
-----------------	------

DISPOSITION OF COPIES (after signatures):
 Contaminated Sample Return to analyst after copies to counter and sampler.
 Field Laboratory Return to analyst upon receipt of samples, other copies to Laboratory or sampler.
 County Laboratory
 County: Analyze (keep for back with the Data Manager or data)
 State: Analyze (keep for back with the Data Manager or data)
 Federal: Analyze (keep for back with the Data Manager or data)
ALL SIGNATURES MUST BE MADE ON WRITE COPY

Environmental Monitoring Section
 Lawrence Livermore National Laboratory
 P.O. Box 808, L-621
 Livermore, CA 94551

Form OAP-8
 Rev. 5
 October 1993

Chain of Custody Form ALARM-02

Purpose	This form is used for submitting grab sewage samples to the Hazards Control Analytical Laboratory for analysis for alarm parameters after a sewer alarm.
Applicable Procedures	The EMS procedures that define the sampling that requires this COC form are EMP-SW-HCAR, <i>Hazards Control Off-Shift Sewer Alarm Response</i> , and EMP-SW B196, <i>Sewage Sampling at B196</i> .
Sample	See page 42 for an example of a completed COC form ALARM-02.
Process	The TSG sampling technologist should draft this COC prior to delivering alarm samples to HCAL.

page_1_of_1_

Chain-of-Custody Record

[illegible]

Chain of Custody Form ALARM-03

Purpose	This form is used for submitting sewer diversion facility holding tank sewage samples to the Hazards Control Analytical Laboratory for analysis for alarm parameters, pH, and normality after a sewer alarm.
Applicable Procedures	The EMS procedures that define the sampling that requires this COC form are EMP-SW-EAR, <i>Sewer Alarm Response</i> , and EMP-SW-DS, <i>Diversion Facility Tank Sampling..</i>
Sample	See page 44 for an example of a completed COC form ALARM-03.
Process	The TSG sampling technologist should draft this COC prior to delivering alarm Samples to HCAL.

Page 1 of 1

Chain-of-Custody Record

[illegible]

Ordinal Dates - Non-Leap Years

Purpose

This table is used to determine ordinal dates for non-leap years.

Table of Ordinal Dates - Non-Leap Years

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	1	32	60	91	121	152	182	213	244	274	305	335	1
2	2	33	61	92	122	153	183	214	245	275	306	336	2
3	3	34	62	93	123	154	184	215	246	276	307	337	3
4	4	35	63	94	124	155	185	216	247	277	308	338	4
5	5	36	64	95	125	156	186	217	248	278	309	339	5
6	6	37	65	96	126	157	187	218	249	279	310	340	6
7	7	38	66	97	127	158	188	219	250	280	311	341	7
8	8	39	67	98	128	159	189	220	251	281	312	342	8
9	9	40	68	99	129	160	190	221	252	282	313	343	9
10	10	41	69	100	130	161	191	222	253	283	314	344	10
11	11	42	70	101	131	162	192	223	254	284	315	345	11
12	12	43	71	102	132	163	193	224	255	285	316	346	12
13	13	44	72	103	133	164	194	225	256	286	317	347	13
14	14	45	73	104	134	165	195	226	257	287	318	348	14
15	15	46	74	105	135	166	196	227	258	288	319	349	15
16	16	47	75	106	136	167	197	228	259	289	320	350	16
17	17	48	76	107	137	168	198	229	260	290	321	351	17
18	18	49	77	108	138	169	199	230	261	291	322	352	18
19	19	50	78	109	139	170	200	231	262	292	323	353	19
20	20	51	79	110	140	171	201	232	263	293	324	354	20
21	21	52	80	111	141	172	202	233	264	294	325	355	21
22	22	53	81	112	142	173	203	234	265	295	326	356	22
23	23	54	82	113	143	174	204	235	266	296	327	357	23
24	24	55	83	114	144	175	205	236	267	297	328	358	24
25	25	56	84	115	145	176	206	237	268	298	329	359	25
26	26	57	85	116	146	177	207	238	269	299	330	360	26
27	27	58	86	117	147	178	208	239	270	300	331	361	27
28	28	59	87	118	148	179	209	240	271	301	332	362	28
29	29		88	119	149	180	210	241	272	302	333	363	29
30	30		89	120	150	181	211	242	273	303	334	364	30
31	31		90		151		212	243		304		365	31

Ordinal Dates - Leap Years

Purpose

This table is used to determine ordinal dates for leap years.

Table of Ordinal Dates - Leap Years

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	1	32	61	92	122	153	183	214	245	275	306	336	1
2	2	33	62	93	123	154	184	215	246	276	307	337	2
3	3	34	63	94	124	155	185	216	247	277	308	338	3
4	4	35	64	95	125	156	186	217	248	278	309	339	4
5	5	36	65	96	126	157	187	218	249	279	310	340	5
6	6	37	66	97	127	158	188	219	250	280	311	341	6
7	7	38	67	98	128	159	189	220	251	281	312	342	7
8	8	39	68	99	129	160	190	221	252	282	313	343	8
9	9	40	69	100	130	161	191	222	253	283	314	344	9
10	10	41	70	101	131	162	192	223	254	284	315	345	10
11	11	42	71	102	132	163	193	224	255	285	316	346	11
12	12	43	72	103	133	164	194	225	256	286	317	347	12
13	13	44	73	104	134	165	195	226	257	287	318	348	13
14	14	45	74	105	135	166	196	227	258	288	319	349	14
15	15	46	75	106	136	167	197	228	259	289	320	350	15
16	16	47	76	107	137	168	198	229	260	290	321	351	16
17	17	48	77	108	138	169	199	230	261	291	322	352	17
18	18	49	78	109	139	170	200	231	262	292	323	353	18
19	19	50	79	110	140	171	201	232	263	293	324	354	19
20	20	51	80	111	141	172	202	233	264	294	325	355	20
21	21	52	81	112	142	173	203	234	265	295	326	356	21
22	22	53	82	113	143	174	204	235	266	296	327	357	22
23	23	54	83	114	144	175	205	236	267	297	328	358	23
24	24	55	84	115	145	176	206	237	268	298	329	359	24
25	25	56	85	116	146	177	207	238	269	299	330	360	25
26	26	57	86	117	147	178	208	239	270	300	331	361	26
27	27	58	87	118	148	179	209	240	271	301	332	362	27
28	28	59	88	119	149	180	210	241	272	302	333	363	28
29	29	60	89	120	150	181	211	242	273	303	334	364	29
30	30		90	121	151	182	212	243	274	304	335	365	30
31	31		91	122	152		213	244		305		366	31

Rush COCs

Purpose

This section tells how to determine which COCs should be marked "RUSH"

When Used

For regulatory reporting purposes, the last day of the sampling period is defined as the day before the samples are collected.

When samples are collected on Monday, the last day of the sampling period is Sunday. Samples are collected every Monday with the exceptions listed below.

- When Monday is a holiday, samples are collected on Tuesday and the last day of the sampling period is Monday.
- If both Monday and Tuesday are holidays, samples are collected on Wednesday and the last day of the sampling period is Tuesday.

The last sampling period that ends within a given month is sent in "RUSH".

Example

COCs for CLS metals samples taken at C196 on the following days must be marked "RUSH"

January 30, 1995
February 27, 1995
March 27, 1995
May 1, 1995
May 29, 1995
June 26, 1995
July 31, 1995
August 28, 1995
September 25, 1995
October 30, 1995
November 27, 1995
December 27, 1995

EMP-SW-DS

DIVERSION FACILITY TANK SAMPLING

Prepared by:

Brian Balke

4/5/93

Brian Balke

date

Environmental Analyst, WGMG

Reviewed by:

Paul Dickinson

4/6/93

Paul Dickinson

date

Environmental Technician, TSG

Renee Needens

4-6-93

Renee Needens

date

Environmental Technician, TSG

Approved by:

William G. Hoppes

4/7/93

William G. Hoppes

date

Group Leader, WGMG

Rebecca A. Failor

4/7/93

Rebecca A. Failor

date

Section Leader, EMS

Lucinda M. Garcia

4/7/93

Lucinda M. Garcia

date

Quality Assurance Coordinator, EMS

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes the steps to be followed to sample sewage held in Sewer Diversion Facility tanks. The procedure uses special measures to ensure that the spread of any contaminants is minimized.

2. APPLICABILITY/DISCUSSION

The Sewer Diversion Facility (SDF) is a diversion system and tank farm located at the north-west corner of the LLNL site. The facility, which is automatically activated when the Sewer Monitoring Station at B196 annunciates an alarm (Reference 1), diverts sewage leaving the site into one or more of eleven tanks. The SDF serves to protect the operations of the City of Livermore Water Reclamation Plant (LWRP), and to prevent the potential contamination of normal municipal waste flowing towards the LWRP.

This procedure applies to all personnel engaged in sampling sewage from the LLNL Sewer Diversion Facility tanks. After sewage is diverted to the SDF, each tank must be sampled to determine what treatment and disposal options can be used. Options include discharge to the sanitary sewer, treatment in place, shipment to an off-site disposal facility, or treatment at LLNL's Hazardous Waste Management Facility. EPD's Wastewater and Tank Systems Group, with the responsibility for determining the ultimate disposition method, requires accurate and complete characterization of the tank contents upon which to base its decision.

Each diversion tank holds up to 20,000 gallons of sewage and has four sampling ports: one at the base of the tank, and three ports along the side of each tank at heights of 3, 8 and 14.5 feet. Normally, the homogeneity of the tank contents is maintained by air mixers, and any one of the side ports is useable as a sample point. Alternatively, certain forms of *in situ* treatment may require separation of the phases of the stored liquid. In this case, samples may be acquired from each port separately.

There are two special considerations for sampling at the SDF. First and foremost, sampling must be performed in such a way as to prevent the spread of contaminants through spilling of sewage during sampling. Secondly, particulate matter kept in suspension by aeration, and metals-fixing bacteria, tend to collect near or in the sampling pipes. Therefore thorough purging of the sampling ports is necessary to prevent sample contamination by material that accumulates in the sampling ports.

3. REFERENCES

1. EMP-SW-AR, *Sewer Alarm Response*
2. EMP-RT-DA, *Retention Tank Release Authorization* (Formerly WATS Procedure No. 201)
3. Sewer Diversion Facility Safety Procedure
4. EMP-QA-DC, *Document Control*
1. EMP-QA-NCR, *Non-Conformance Reports*

4. DEFINITIONS

HCAL: Hazards Control Analytical Laboratory. This laboratory performs waste characterization of retention tank samples (such as the Sewer Diversion Facility tanks). Samples are submitted at Room 1734A of Building 253. The results are returned to the WGMG sewage analyst, and then forwarded to a Wastewater Analyst for a determination concerning the disposition of the tank contents.

Rinse Bottle: The 500-mL polyethylene bottle located on one leg of the sampling hose.

Sampling Manifold: Manifold used to connect the tank sampling port, the DOT carboy used to capture purge and rinse water, and the sample bottle. Layout and valve designation are shown in Attachment A.

Sewer Diversion Facility: Eleven 20,000-gallon tanks (designated B-193) located at the northwest corner of the LLNL site, just east of Building 196. A map of the facility is included as Attachment B (the symbols and labels are described in the text).

WGMG: Water Guidance and Monitoring Group. The group is responsible for compliance and spill monitoring of the LLNL sanitary sewer, among other monitoring activities, and also for analysis of the analytical results following sampling.

5. RESPONSIBILITIES

5.1. WGMG ENVIRONMENTAL ANALYST

The Environmental Analyst is responsible for identifying the tanks and ports from which the Environmental Technician will acquire samples, and for specifying the analyses to be performed on the sample. Finally, the Analyst must transfer analytical results to a Wastewater Analyst for a determination of the proper disposition of the material (Reference 2).

5.2. TSG ENVIRONMENTAL TECHNICIAN

The Environmental Technician acquires samples, performing the necessary documentation. This includes filling out the sample log, the sampling paperwork, the SDF tank tracking documentation, and waste labels on the DOT carboys. When sampling is completed, the technician delivers samples to the HCAL at Building 253.

When sample results are received and reviewed, the Environmental Technician is also responsible for proper disposal of purge waters accumulated during sampling.

5.3. WGMG GROUP LEADER

The WGMG Group Leader is responsible for ensuring that sufficient resources are allocated to allow sampling to be completed in a timely fashion.

5.4. EMS SECTION LEADER

The EMS Section Leader is responsible for ensuring that sufficient resources are allocated to allow sampling to be completed in a timely fashion.

6. PROCEDURE

Equipment Required:

The following equipment is stored in the north room of the B196 Sewer Monitoring Station:

500-mL polyethylene bottles (Stock catalog #8125-42044)
5-gallon DOT carboy (Stock catalog #8125-45694), one per sample to be acquired.
Face shield (Stock catalog #4240-58220)
Hard hat (Stock catalog #8415-64767)
Indelible ink marker
Latex gloves, disposable (Stock catalog #8415-64994 or 64995)
Latex gloves, long (Stock catalog #8415-41576 and 77)
Safety shoes
Sampling hose (see definitions)
Sampling log
Sewage sample chain-of-custody record form
Sodium Hypochlorite, 5.25% solution (Stock catalog #6810-53325)
Waste Labels (Stock catalog #4280-70983)

6.1. Prior to sampling, the ports to be sampled and the analysis to be performed must be specified by the WGMG Environmental Analyst. Which ports are sampled depends upon the level of the liquid in the tank, and whether sediments have been allowed to settle. The analysis performed generally will be only to confirm the presence of materials reported by the sewer monitoring alarm system. In specifying the analyses to be performed, the analyst must consult with WATS and Hazardous Waste Management chemists to ascertain, given the alarm parameters, whether the liquid is likely to contain constituents that, if the sewage were treated, might result in the generation of hazardous gas. In particular, pH adjustment of caustic liquid containing cyanide or sulfides (e.g. - from a plating shop spill or septic sewage) may be hazardous. In these cases, cyanide or sulfide analysis should also be obtained, as appropriate. The Environmental Analyst will specify additional sampling protocols if such circumstances arise, including the type of sample bottle and documentation that will be required.

6.2. The required sampling equipment, including personal protective equipment, can be found in the north half of B196.

6.3. Add roughly two cups of sodium hypochlorite solution to each of the carboys. Affix a waste label to each carboy. Fill out the label as follows:

6.2.1. Generator - your full name, and LLNL extension.

6.2.2. Contents - "Chlorinated sewage from the SDF. Contains ", followed by the contaminant specified by the Environmental Analyst in 6.1.

6.2.3. Workplace Start Date

6.2.4. Sample analysis # - The Chain of Custody form number.

6.2.5. Hazardous properties - Other - "Sanitary Sewage."

6.2.6. Waste form - Liquid.

6.4. Hard hats and safety shoes are required safety equipment when working in the tank farm (Reference 3). Don this gear, and then transfer the sampling equipment to the first sampling location. At the SDF control center, turn on the washwater. The location of the washwater switch is shown in Attachment B.

6.5. Connect the sampling manifold to the tank sampling port, and to the DOT carboy. Close the sample valve and the rinse valve, and open the port valve and the purge valve. Connect the sample and rinse valves with the sample line.

6.6. Set aside the necessary sample bottles (a 500 mL sample bottle, plus any additional bottles specified in Section 6.1). Label the sample bottle(s) with the date and time, the sample identifier (Section 7.1), and sampler's initials. Enter this same data in the logbook, and then attach the bottle to the sampling hose. Write the tank and sampling port identifiers in the "contents" section of the waste label on the DOT carboy.

6.7. Purge any liquid standing above the tank sampling port into the DOT carboy. Open the valve on the tank sampling port, and allow the carboy to fill to roughly 70% of its volume. Close the purge valve.

6.8 Purge the sampling line. Open the rinse valve, then the sample valve. Rinse the sample line for a couple of seconds, then close the sample and rinse valves.

6.9. Take a sample immediately.

6.9.1. Hold the open sample bottle under the rinse valve end of the sampling line. Remove the line from the valve, and insert into the sample bottle. Drainage from the rinse valve and sample line should be captured in the sample bottle.

6.9.2. Slowly open the sample valve, taking care not to overfill the bottle. When the sample bottle is full to roughly 80% of its capacity, close the sample valve.

6.9.3. Reattach the sampling line to the rinse valve.

6.9.4. Cap the sample bottle.

6.10. Drain the sampling manifold. Close the tank valve, open the purge valve, and drain any excess sewage into the DOT carboy. Slowly disconnect the sampling manifold from the tank sampling port, allowing any trapped sewage to drain into the carboy. Open the sample and rinse valves and drain any excess sewage into the DOT carboy. Close all valves and disconnect the sampling manifold from the tank sampling port.

6.11. Locate a wash-water hose bib. As a single unit, transfer the DOT carboy and sampling manifold to that location.

6.11.1. Connect the tank port hose fitting to the wash-water line. Open the wash-water line.

6.11.2. Open the port valve, then the rinse valve, and finally the sample valve. This last must be opened slowly or the pressure from the washwater line may cause the sampling line to separate from its connections. After a few seconds, close the sample and rinse valves.

6.11.3. Open the purge valve and flush the tubing for a few seconds.

6.11.4. Shut off the wash water.

6.11.5. Slowly disconnect the sampling manifold from the wash water line, allowing any trapped water to drain into the DOT carboy. Open the sample and rinse valves and drain any rinse water into the DOT carboy.

6.11.6. Close all valves, except the sample valve.

6.12. Disconnect the sampling manifold from the DOT carboy, and immediately cap the carboy. Return the equipment to the sampling location.

6.13. Repeat steps 6.5 through 6.12 for all required sampling ports.

6.14. Move on to the next tank to be sampled, repeating steps 6.5 through 6.13.

6.15. When sampling is complete, turn off the wash-water pumps activated in step 6.3, and store the sampling equipment.

6.16. In the Diversion Facility Control Center, fill out the Sewer Diversion Facility Tank Tracking Documentation for each tank sampled (Attachment C). The number in the upper right-hand corner is the diversion event number. This can be obtained by calling the Plant Engineering shift supervisor at x2-9762. Find the sheets for the current event and current tank, and add an entry for the sampling event, such as shown in the second item of the example (4:30 PM on 7/11/91).

6.17. Complete analysis request documentation.

6.17.1. Fill out the Chain-of-Custody record form (COC) as shown in attachment D. The sample identifier should be identical to that used on the bottle label. The required analyses should be specified as per the instructions of the Environmental Analyst (step 6.1).

6.17.2. For radiation analysis, a Radioactivity Sampling Record Sheet (RSRS) (Attachment E) must also be completed. Use the COC "Identifier" (the tank number) for the RSRS "Location" field. The combined COC sample number and media (port number) should be used in the RSRS "Identifier" field. The "Date On" should be the sampling date.

6.18. Deliver the samples and documentation to the HCAL. At the laboratory, the HCAL chemist will aid the Environmental Technician in completing analysis request documentation for non-radiological analyses (i.e., - pH, and any metals or other chemical analyses required).

6.19. When the sampling results are received, the Wastewater Analyst will determine if the diverted sewage may be returned to the sanitary sewer. If so, the Environmental Technician shall pour the contents of the DOT carboys (filled during sampling) into the diversion box in the wet well berm (See Attachment B). Rinse the carboy thoroughly, and return to B196 for later use. If the tank contents are not sewerable, the Environmental Analyst shall coordinate with Plant Engineering and Hazardous Waste Management to have the carboy contents bulked with the tank contents when the diverted sewage is removed from the SDF.

7. DOCUMENTATION

As described in the procedure, sampling will be documented in the Sampling Logbook, with cross-reference to the WGMG Chain-of-Custody record form (COC). The analytical report and associated paperwork will be stored in the Environmental Analyst's incident files, and then be archived as described in Reference 4.

7.1. A unique location identifier must be constructed for each sample. The COC requires site, location, number and media.

7.1.1. The site is "L".

7.1.2. The location should be the tank identifier, which is painted on the side of the tank.

Treatment tank: R1A1

Diversion tanks 1 through 9: Use designators R1O1 through R1O9

Diversion tanks 10 and 11: Use designators R1OA and R1OB, respectively

Wet Well: R1U1

Pressurized Gap Water Supply: S101

Chemical Feed Tank: Z1A1

7.1.3. Number: Two characters, the first being the sample port id, the second is the sample number (if the Environmental Analyst requires more than one sample from a single port). The ports are labelled 'A' through 'D', as shown on the tag on the sampling port.

7.1.4. Media: SW

7.4. Analyses Requested: The alarm constituent, as identified by the Environmental Analyst (Section 6.1).

7.3. Comments: Only use the lines below the last sample entry, as the space immediately to the right of the sample entry is reserved for the HCAL analysis tracking number.

7.3.1. For a low-pH alarm, include the statement: "If normality exceeds the limit, please calculate the adjustment using 25% NaOH."

7.3.2. For a high-pH alarm, include the statement: "If normality exceeds the limit, please calculate the adjustment using 93% sulfuric acid."

7.4. The rest of the form should be completed as shown in Attachment D.

Revision 1 FINAL	EMP-SW-DS Diversion Facility Tank Sampling	Effective Date: 04/15/93 Page 7 of 12
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8. ACCEPTANCE CRITERIA

When all of the steps given in Section 6 have been performed, the samples have been accepted by the HCAL, and the documentation listed in Section 7 has been completed and distributed to the appropriate individuals, the operation will be considered satisfactorily completed. If any conditions prevent successful completion of the procedure, a non-conformance report must be generated (Reference 5).

9. ATTACHMENTS

Attachment A: Sampling Hose Layout

Attachment B: Map of the Sewer Diversion Facility

Attachment C: Example of Sewer Diversion Facility Tank Tracking Documentation

Attachment D: Chain-of-Custody Record Form for Tank Samples

Attachment E: Radioactivity Sampling Record Sheet for Gross Alpha/Beta Analysis of Tank Samples

Attachment A
Sampling Manifold Layout

Attachment B
Map of the Sewer Diversion Facility

Sewer Diversion Facility Layout for Tank Sampling

Attachment C
Example of Sewer Diversion Facility Tank Tracking Documentation

Tank 7

Log the date and time and describe the operation undertaken with the tank. Example operations which should be recorded are: diverting/tank filling, tank transferring, tank draining, sampling, etc.

Date 7/11/91 Time 3:30 pm Authorized by N/A

Completed by Tim Briggs Operation Automatic diversion
into tank. Full to 10 feet. Alarm # 3

Date 7/11/91 Time 4:30 pm Authorized by N/A

Completed by Brian Balke Operation Samples taken
by EMC

Date 7/22/91 Time 2:30 pm Authorized by N/A

Completed by Wayne Fritschy Operation Transferred tank
contents into HWM tanker trucks.

Date _____ Time _____ Authorized by _____

Completed by _____ Operation _____

Date _____ Time _____ Authorized by _____

Completed by _____ Operation _____

Date _____ Time _____ Authorized by _____

Completed by _____ Operation _____

Date _____ Time _____ Authorized by _____

Completed by _____ Operation _____

Chain-of-Custody Record

Laboratory: HQAL / B253						Criminal Justice Laboratory - Houston								
Project Name/Analyst: Brian Balke / WONG						Analysis Requested						REMARKS		
Sample Identifier:				Date		Number of containers		Cr						
Site - Location - Number - Media														
L - R101	- D1	- SW		11/10/80	1	X								
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
*	*	*												
Relinquished by Sampler:				Date/Time	Received by Courier:						Date relinquished from Lab by:		Date/Time	Data received by EMG analyst:
Relinquished by Courier:				Date/Time	Received for Laboratory by:						Data relinquished by EMG Analyst:		Date/Time	Received by Data Manager:
											Data relinquished by Data Manager:		Date/Time	Data received by Archivist:

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DISPOSITION OF COPIES (after signatures)

GoKemoed: Sampler (Return to analyst; other copies to counter w/ samples,
Pink: Counter (Return to analyst; other copies to Laboratory w/ samples)
Carney: Laboratory (send with data and other copies to Analyst; returned
to Laboratory for their files by Analyst after data receipt and signature)
Green: Analyst (keep for files; white to Archival w/ data)
White : Archival (archive w/ data; send photocopies of completed white
to Analyst, QA Coordinator)

Environmental Monitoring Group
Lawrence Livermore National Laboratory
P.O. Box 808, L-255
Livermore, CA 94551

Form OAP-B-2
Rev. 1
July 1992

Howe	1	2	3	4	5	6	7	8	9	10
Howe	1	2	3	4	5	6	7	8	9	10

13. School # of

12. (Your name) _____ Phone Ext. _____ Radio Page _____
Health & Safety Tech _____

11. Brian Burke _____
Health Physicist to Neely _____

10. Comments: _____

EMP-SW-HCAR

HAZARDS CONTROL OFF-SHIFT SEWER ALARM RESPONSE

Prepared by:

Duane Rueppel 10/19/93
Duane Rueppel date
Group Leader, TSG

Jennifer M. N. Larson 10/21/93
Jennifer M. N. Larson date
Environmental Analyst, WGMG

Reviewed by:

Brian Balke 10/29/93
Brian Balke date
Environmental Analyst, WGMG

Laurlee D. Fry 11-4-93
Laurlee Fry date
Training Coordinator, Operational Safety Division
Hazards Control

Approved by:

William G. Hoppes 10/24/93
William G. Hoppes date
Group Leader, WGMG

Rebecca A. Failor 11/2/93
Rebecca A. Failor date
Section Leader, EMS

Lucinda M. Garcia 11/10/93
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

**LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure is the health and safety technician's off-shift response manual for the sewer monitoring alarm station and is intended to provide the knowledge and skills required to perform a preliminary assessment of a potential release of hazardous material to the sanitary sewer system and to initiate further response activities by EPD personnel. It provides health and safety technicians a procedure for off-shift response to alarms at the sewer monitoring alarm station. It also describes procedures that may need to be performed by EPD technical support staff during on-shift alarm response activities.

2. DISCUSSION

The Environmental Protection Department (EPD) at Lawrence Livermore National Laboratory (LLNL) is responsible for responding to emergencies involving releases of hazardous materials to the sanitary sewer system, and for management of subsequent recovery operations. The Department's Wastewater Guidance and Monitoring Group (WGMG), in the Environmental Monitoring and Analysis Division (EMAD), is the principle response organization during sewer alarms. During off-shift hours, however, the Hazards Control Off-Shift Health and Safety Technician will be the first responder to an event. The Health and Safety Technician is responsible for assessing incidents, and calling out additional support. Principally, this would be the WGMG Environmental Analyst, who assumes leadership and technical responsibility during incidents (Reference 1).

The overall goal of this procedure is to minimize upset at the Livermore Water Reclamation Plant (LWRP), protect the public health, and minimize damage to property and the environment following an inadvertent release of hazardous material to the sanitary sewer system. Rapid detection and notification, prompt initial response, and good judgment are the essential ingredients in effectively mitigating the effects of a release.

2.1. BACKGROUND

LLNL, with over 11,000 workers on site each day, is the single largest source of the sanitary sewage processed by the Livermore Water Reclamation Plant (LWRP). LLNL and Sandia National Laboratories, Livermore (SNLL) together produce an average of 350,000 gallons of sewage each day. The combined LLNL and SNLL volume, consisting primarily of sanitary wastewater and cooling tower blowdown, is discharged to the City of Livermore sewer system at the northwest corner of the LLNL main site. It represents nearly one-tenth of the volume treated at the LWRP. After treatment, the wastewater is pumped out of the valley through a pipeline and discharged into the San Francisco Bay. The sludge produced in the treatment process is disposed of in landfills.

Because of the many industrial processes performed at LLNL and SNLL, and the wide range of hazardous and radioactive materials handled, the two facilities have the potential to adversely affect operations of the treatment plant. These potential impacts range from complete disruption through poisoning of the biological processes that provide the actual treatment, to the imposition of added cost due to accumulation of contaminants at levels that preclude disposal of sludge in local landfills. To prevent such occurrences, LLNL has developed comprehensive sewer discharge control and monitoring programs.

The Wastewater Guidance and Monitoring Group of LLNL's Environmental Protection Department is responsible for identifying wastewater compliance requirements, for developing guidance for LLNL programs to implement processes and programs to maintain compliance with those requirements, and for performing monitoring activities that assess the success of the compliance programs.

As part of that effort, WGMG operates and maintains the equipment in the Sewer Monitoring Station (B196) located at the point of discharge of LLNL's sewage to the City of

Livermore collection system. To enable mitigating actions to be taken prior to the arrival at the LWRP of a potentially disruptive release, B196 contains equipment that continuously monitors LLNL effluent for regulated metals, radioactivity, and corrosive materials. The automated system annunciates alarms that initiate diversion of the potentially contaminated sewage to the Sewer Diversion Facility, and alert alarm assessment and spill investigation teams to respond to incidents.

2.2. SYSTEM DESCRIPTION

A floor plan and a sewage flow diagram for Building 196 are included as Attachments A and B, respectively. Maintenance of the equipment discussed is described in EMP-SW-M, *Sewer Equipment Maintenance* (Reference 2).

The major components of the monitoring system include a flow meter, pressure sensors, x-ray fluorescence metals analyzers, a gamma spectrometer, and associated power supplies, amplifiers and digitizers. A microVAX computer, running Canberra Nuclear Systems GENII spectrometry software, acquires the data. Software developed at LLNL tracks the system performance, analyzes and trends sensor data, initiates alarm response activities, and allows users to update the operating parameters of the system.

2.3. DATA ANALYSIS

Any time the pH, metals concentration, or radiation exceeds alarm levels, an alarm is sent by the computer through the annunciator panel to the fire dispatcher, LWRP, and the sewer diversion facility. Pertinent data are printed on the printer in the detector room and archived on disk. This archived information can be reviewed at any time.

3. REFERENCES

1. EMP-SW-EAR, *EPD Sewer Alarm Response*
2. EMP-SW-M, *Sewer Equipment Maintenance*

4. DEFINITIONS

4.1. GENERAL DEFINITIONS

Computer Room: Room 100 of Building 196. This room is also called the "dry-side"; it houses some of the electronics and the microVAX II computer.

Detector Room: Room 200 of Building 196. This room is also called the "wet-side"; it houses the sewage analysis equipment and associated electronics.

Hazards Control 14 (HC-14): The radio call name for the Hazards Control Off-shift Health and Safety Technician.

LWRP: The Livermore Water Reclamation Plant, located on the west side of Livermore near the airport, is the sewage treatment plant for the City of Livermore.

Sewer Diversion Facility (SDF): In the advent of an alarm, LLNL sewage is diverted automatically into the holding tanks of this LLNL facility.

4.2. DETECTOR ROOM DEFINITIONS

Alarm Printout: The computer printout where all alarm information is printed. The printer is located in front of the electronics rack.

Analysis Flow: The one gpm of sewage, removed from the 15 gpm entering B196, used for on-line analysis. The analysis flow is extracted in the cyclonic separator and passed through a macerator/emulsifier which grinds up solids into very small particles to produce a more homogeneous flow. A small peristaltic pump injects one milliliter per minute of chlorine into the analysis flow to minimize bacterial growth and odor.

Annunciator Panel: The gray box (above the desk) with alarm-status lights and a single reset button. The annunciator panel annunciates alarms at the fire dispatch and triggers diversions to the Sewer Diversion Facility.

Cyclonic Separator: A small tank which separates out the solids in the sewage entering B196. Sewage flows into the southwest corner of the monitoring station and then into the cyclonic separator.

Electronics Rack: A standard nineteen inch roll-around rack on the east wall behind the computer printer. The electronics rack contains the sewer monitoring alarm panel and the power supplies for the x-ray generators used in the x-ray fluorescence analysis system. The maintenance terminal sits on top of the rack.

Flow Meter: A circular chart recorder that receives signals from the underground ultrasonic transducer and converts the water level signal to flow rate. The flow signal is read by the computer. Normal daytime flow rate is around 555 gpm; weekend and nighttime flow rate is about 70 gpm.

Gamma Radiation Detector: The radiation detection system. The analysis flow that leaves the secondary phase separator passes through a Marinelli beaker that surrounds the large-area, liquid-nitrogen-cooled, germanium, gamma-radiation detector. The detector and Marinelli beaker are contained inside a lead shield that attenuates background radiation.

Grab Sampler: In the advent of an alarm, a timed hydraulic valve is opened to allow two liters of sewage to flow into a plastic five-gallon carboy. The Grab Sampler can also be operated manually from the sewer monitoring alarm panel.

Logbooks: There are two of these on top of the desk. One logbook is to note maintenance operations. The other is to note alarm information.

Maintenance Terminal: The computer terminal on top of the electronics rack. It is connected to the microVAX in the Computer Room and is used to switch the system into maintenance mode and record maintenance information whenever the system is to be worked on. While the system is in maintenance mode, sewage monitoring and alarms are disabled. However, if the system is left in maintenance mode for more than five minutes, an electronic failure alert sounds.

pH Electrode: Mounted inside the cyclonic separator, the pH electrode, connected to a pH meter, monitors for acid or caustic conditions in LLNL sewage. The pH meter displays the current pH value and is read by the computer and a circular chart recorder.

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Portable pH Meter: Used for pH analysis of alarm grab samples, this hand-held unit is located on the top of the work bench.

Secondary Phase Separator: A Plexiglas container which separates grease and heavy particles from the analysis flow. Its presence, in the line after the macerator, helps prevent both grease clogs and build-up of silt in the flowcells. The silt often carries metal that can cause false high readings, resulting in false metals alarms.

Sewer Monitoring Alarm Panel: The blue panel with alarm-status lights and reset buttons in the middle of the electronics rack. The sewer monitoring alarm panel indicates the specific alarm condition.

Swipe Counter: Used to check for radioactivity in grab samples; the swipe counter can differentiate between alpha-emitting and non-alpha-emitting (beta or gamma emitting) radioisotopes. It is located on top of the desk.

Uninterruptable Power Supply (UPS): Located in the northwest corner, the UPS system is rated at 3kVA, and maintains power to the computer and electronics during service interruptions.

X-Ray Fluorescence Analysis System (XRFA): Detects specific metals in the analysis flow. There are three such systems and each x-ray fluorescence system has been optimized to detect certain metals that may be present in the analysis flow. The analysis flow passes from the gamma radiation detector sequentially through the x-ray fluorescence units. The systems sit on a table top and the power supplies for the x-ray generators are in the top of the Electronics Rack. After passing through the x-ray flow-cells, the analysis flow is returned to the sewer system.

5. RESPONSIBILITIES

5.1. FIRE DISPATCHER

When an alarm is annunciated between the hours of 0800 and 1645, the Fire Dispatcher must use List 1 of the call-out lists (Attachment C) to call EPD personnel, or, when an alarm is annunciated on weekends or holidays, or between the hours of 1645 and 0800 during the work-week, must call the on-duty Hazards Control Off-shift Health and Safety Technician (HC-14).

5.2. HAZARDS CONTROL OFF-SHIFT HEALTH AND SAFETY TECHNICIAN

The Hazards Control Off-shift Health and Safety Technician must understand the general operation of the sewer monitoring equipment and the available emergency response resources and capabilities. The Technician must respond at Building 196, the Sewer Monitoring Alarm Station, to sewer monitoring alarms between the hours of 1645 to 0800 during the week and on the weekends when contacted by the Fire Dispatcher. EP-2044, the Sewer Alarm Response Training class, must be taken to be qualified for off-shift response.

The primary role of the Health and Safety Technician, in response to a sewer monitoring alarm, is to evaluate the condition of the monitoring system during an alarm, and notify EPD response personnel. The Health and Safety Technician also completes response documentation to ensure that critical information is available to the EPD Responder for the incident evaluation.

5.3. EPD RESPONDER

It is the responsibility of the EPD Responder to understand and be able to follow EMP-SW-EAR (Reference 1). The EPD Responder assumes leadership of alarm response upon contact with the Hazards Control Off-shift Health and Safety Technician.

5.4. WGMG ENVIRONMENTAL ANALYST

It is the responsibility of the WGMG Environmental Analyst to understand the general operation of the sewer monitoring equipment and the available emergency response resources and capabilities. The Analyst is responsible for establishing alarm validation and follow-up activities as described in Reference 1.

5.5. TSG ENVIRONMENTAL TECHNICIAN

During an alarm, the TSG Environmental Technician is responsible for being able to perform the alarm assessment activities described in this procedure. In some cases, the Technician may not be fully qualified as an EPD Responder.

5.6. WGMG GROUP LEADER

The WGMG group leader is responsible for evaluating the effectiveness of sewer alarm response protocol and procedures, and for reviewing additional requirements deemed necessary to ensure that the spill control protocol and procedures are adequate.

5.7. EMS SECTION LEADER

The EMS Section Leader is responsible for evaluation of the adequacy of the spill control system at B196 to prevent significant impact on LWRP operations and allocating adequate resources for spill response within EMS.

6. PROCEDURE

6.1. GENERAL INFORMATION

6.1.1. TYPES OF ALARMS

There are four possible alarm conditions:

- pH
- Metals
- Radiation
- Combination (from the above three)

There is no distinction between pH and metals alarms on the annunciator panel or at the fire dispatch center, so the person responding must ascertain the actual alarm condition to know which sections of the procedure to follow. This can be done in B196 by observing the lights on the sewer monitoring alarm panel, or by reading the computer printout.

6.1.2. TYPES OF ADVISORIES

There are two advisories (sometimes called alarms by the fire dispatcher):

- Hardware alert
- Electronic failure

For either of the advisories, refer to Attachment D, "Hardware Alert and Electronic Failure."

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6.1.3. RESPONSE SHIFTS

6.1.3.1. Regular shift (0800 to 1645): Response is by Environmental Protection Department personnel. EMP-SW-EAR (Reference 1) details the procedure for alarm response during the regular shift.

6.1.3.2. Off Shift (1645 to 0800) and the weekends: Initial response is by Hazards Control Off-shift Health and Safety Technicians (HC-14) whose response duties are covered by this procedure.

6.1.4. OVERVIEW OF REQUIRED RESPONSES

6.1.4.1. REQUIRED ALARM RESPONSE

For any of the four alarm conditions (pH, metals, radiation, or combination), the responding Health and Safety Technician must telephone LWRP within 20 minutes of the first alarm indication and inform them that appropriate response personnel will be contacted. An EPD responder, from the Call-Out Lists, List 1 (Attachment C), must also be contacted.

6.1.4.2. REQUIRED ADVISORY RESPONSE

For either a hardware alert or an electronic failure, the Health and Safety Technician may attempt to trouble shoot the system (Attachment D) or call in either off-shift maintenance or EPD personnel to correct the condition. If the problem has not been diagnosed within thirty minutes of arrival at B196, the EPD responder must be contacted. The Health and Safety Technician should not hesitate to contact EPD personnel for help in diagnosing either a hardware alert or an electronic failure mode.

6.2. ALARM RESPONSE

NOTE: Before proceeding, obtain a copy of the HC Sewer Response Report (Attachment E) from the top middle desk drawer in the B196 Detector Room. This form can be used as a guideline and should be completed as the appropriate information is obtained.

6.2.1. NOTIFY LWRP

Call Livermore Water Reclamation Plant at 373-5293, ask for the shift supervisor, and state, "This is _____ at LLNL verifying that we have had a sewer monitoring alarm. I have been notified by our dispatcher and am here to assess the alarm and notify appropriate response personnel." Get the LWRP shift supervisor's name. Write the name and time on the Response Report. This is the "warm body" call to let LWRP know we are on the job.

NOTE: The call should be made within 20 minutes of the time of the alarm. If LWRP receives an alarm and is not called within 20 minutes, they will call the fire dispatcher to see why they have not been contacted.

6.2.2. VERIFY ALARM LIGHTS AND CHECK PRINTOUT

6.2.2.1. Check the annunciator and sewer monitoring alarm panel for illuminated lights. Indicate the status of the panels on the Response Report by circling the appropriate Table 2 entries.

Use the table below to establish the nature of the alarm condition. The alarm condition is the same as the alarm type if no more than one light is lit on the Sewer Monitoring Alarm Panel. If more than one light is lit, then the alarm condition is a combination. The combination alarm condition will be the result of some or all of the alarm types listed in the table below.

ILLUMINATED LIGHTS on the Annunciator Panel	and Sewer Monitoring Alarm Panel	= ALARM TYPE
pH/metals	pH alarm	pH
pH/metals	metals alarm	metals
radiation	gamma or transuranic/beta	radiation

6.2.2.2. Locate below the relevant alarm condition section, pH alarm, metals alarm, radiation alarm, or combination alarm (Section 6.2.2.2.1, 6.2.2.2.2, 6.2.2.2.3, or 6.2.2.2.4, respectively). Upon completion of one of these sections, proceed to section 6.2.3.

6.2.2.2.1. pH ALARM. Find the alarm entries on the computer printout. If the alarm is a pH alarm, the computer printout will indicate the pH level as shown in the example below.

ALARM 03-JUN-1993 01:04:06 pH									
03-JUN-1993 01:04:06 -- Flow rate = 100. gpm.									
03-JUN-1993 01:04:06 pH history (newest to oldest)									
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.9
4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5.0
03-JUN-1993 01:20:06 pH alarm condition ended.									

Record the following in the appropriate section of Table 2 on the Response Report:

1. the date and time of the first alarm indication,
2. the flow rate at the time of the alarm,
3. the minimum or maximum pH causing the alarm, and
4. if the alarm has cleared, the date and time that the alarm cleared; otherwise, indicate that it is ongoing.

6.2.2.2.2. METALS ALARM. Find the alarm entries on the computer printout. If the alarm is a Metals Alarm, the computer printout will indicate which metals are above alarm concentrations, as shown in the example below.

```
01-JUL-1993 15:35:50 *ALARM* 15:35:50 XRFA 2 alarm condition.
01-JUL-1993 15:35:50 -- Flow rate = 169. gpm.
01-JUL-1993 15:35:50 XRFA results: last five minutes
15:35:50
-----
Status | Metals | Amount (grams) | Conc (ppm)
-----
*ALARM* copper      52.      16.3      0.2616E-02
*ALARM* zinc       71.      22.2      0.3124E-02
*ALARM* lead       27.       8.3      0.1981E-02
.
.
.
01-JUL-1993 16:10:15 XRFA 2 metal alarm ended.
```

Record the following in the appropriate section of Table 2 on the Response Report:

1. the date and time of the first alarm indication,
 2. the flow rate at the time of the alarm,
 3. the metals causing the alarm and their concentrations, and
 4. if the alarm has cleared, the date and time that the alarm cleared;
- otherwise, indicate that it is ongoing.

6.2.2.2.3. RADIATION ALARM. Find the alarm entries on the computer printout. If the alarm is a Radiation Alarm, the computer printout will identify the isotope if the radiation alarm was caused by a gamma emitter. Otherwise, the printout will state "transuranic" or "bremsstrahlung." (See examples below.)

```
09-JUL-1993 10:35:15 *ALARM* 10:35:15 Gamma alarm condition.
09-JUL-1993 10:35:15 -- Flow rate = 643. gpm.
09-JUL-1989 10:35:15 Gamma: last five minutes
10:35:54 | isotope | conc (uCi/ml) | ADL | total (uCi) | type
-----|-----|-----|-----|-----|-----
*ALARM*   AM-241   0.2642745E-06  1.761830  3.213743  AP
.
.
.
09-JUL-1993 10:45:15 Gamma alarm condition ended.
```

or

```
13-APR-1993 07:26:08 *ALARM* 07:26:08 Transuranic
13-APR-1993 07:26:08 -- Flow rate = 249. gpm.
.
.
.
13-APR-1993 07:31:08 Transuranic alarm condition ended.
```

or

```
30-JUL-1993 09:29:28 *ALARM* 09:29:28 Bremsstrahlung...possible Beta emitter
30-JUL-1993 09:29:28 Bremsstrahlung net: 755.
30-JUL-1993 09:29:28 -- Flow rate = 532. gpm.
.
.
.
30-JUL-1993 09:39:28 Bremsstrahlung alarm condition ended.
```

Record the following in the appropriate section of Table 2 on the Response Report:

1. the date and time of the first alarm indication,
2. the flow rate at the time of the alarm,
3. the type of radiation causing the alarm (gamma, transuranic, or bremsstrahlung) and concentration, if given, and
4. if the alarm has cleared, the date and time that the alarm cleared; otherwise, indicate that it is ongoing.

6.2.2.2.4. COMBINATION ALARM. Find the alarm entries on the computer printout. If the alarm is a Combination Alarm, more than one set of alarm entries will be shown on the computer printout. For examples of what these consecutive alarm entries might look like, refer to the above sections (6.2.2.2.1, 6.2.2.2.2, and 6.2.2.2.3).

From the printout, record the following in the appropriate section of Table 2 on the Response Report:

1. the date and time of the first alarm indication,
2. the flow rate at the time of the first alarm indication,
3. the relevant information for the alarm types composing the combination: the minimum and maximum pH contributing to the alarm, and/or the metals contributing to the alarm and their respective concentrations, and/or the type of radiation contributing to the alarm (gamma, transuranic, or bremsstrahlung) and concentration, if given, and
4. if the alarm has cleared, the date and time that the alarm cleared; otherwise, indicate that it is ongoing.

6.2.3. EVALUATE THE FACILITY CONDITION

Most frequently, false alarms are caused by failure of the mechanical or electrical components of the monitoring system. Some of these can be identified through a quick assessment of the building conditions. Check the analysis flow return line from the x-ray fluorescence units to verify that sewage is being properly pumped. Note any large leaks of sewage from the plumbing. Look for signs of frost on the vacuum arms extending from the bottom of the LN dewars. Note any unusual conditions in the alarm log, and communicate them to the EPD Responder.

6.2.4. CALL EPD RESPONDER

Call an Environmental Protection Department (EPD) responder (List 1 in Attachment C). Call in order until you contact someone. Either let the phone ring ten times or an answering machine respond before trying the next name. Leave messages for the first three people.

Inform your responder of the situation. The EPD responder may choose to respond in person.

Note: If you are unable to reach anyone on the Call-out List, call the Fire Department dispatcher (Ext. 2-7595). Have the dispatcher contact the Environmental Duty Officer and ask them to contact you at B196 (Ext. 3-4318, 2-4112, or 2-4080).

6.2.5. COLLECT GRAB SAMPLE

6.2.5.1. Don a pair of protective gloves from the storage cabinet next to the maintenance terminal, and replace the grab-sample carboy with the replacement carboy standing nearby.

6.2.5.2. Remove a sample bottle from the third drawer down in the work bench. With a marking pen, complete the sample bottle label as shown (type in bold uppercase is pre-printed on the label):

type of alarm (specifics of alarm type)

DATE the date of the alarm
TIME the time of the alarm
LOCATION B196 ALARM
INITIALS yours

The DATE, TIME and the type of alarm including the specifics of the alarm type should be obtained from the computer printout. For an example label, refer to the relevant alarm type section, pH alarm, metals alarm, or radiation alarm (6.2.5.2.5.1, 6.2.5.2.5.2, or 6.2.5.2.5.3, respectively) below. If the alarm is a combination alarm, label as many sample bottles as there are different alarm types. The DATE, TIME, LOCATION, and INITIALS should be the same on each label; however, each sample bottle label should reflect a different alarm type.

6.2.5.2.5.1. pH ALARM. The parentheses following "pH alarm" should contain the minimum and maximum pH.

pH alarm (4.9 and 5.0)

DATE 03-JUN-1993
TIME 01:04
LOCATION B196 ALARM
INITIALS ID

6.2.5.2.5.2. METALS ALARM. The parentheses following "metals alarm" should contain the metals causing the alarm.

metals alarm (copper, zinc, lead)

DATE 01-JUL-1993
TIME 15:35
LOCATION B196 ALARM
INITIALS ID

6.2.5.2.5.3. **RADIATION ALARM.** The parentheses following "radiation alarm" should show the isotope(s) if the radiation alarm was caused by a gamma emitter. Otherwise, "transuranic" or "bremsstrahlung" should be indicated.

radiation alarm (AM-241)

DATE 09-JUL-1993
TIME 10:35
LOCATION B196 ALARM
INITIALS ID

or

radiation alarm (transuranic)

DATE 13-APR-1993
TIME 07:26
LOCATION B196 ALARM
INITIALS ID

or

radiation alarm (bremsstrahlung)

DATE 30-JUL-1993
TIME 09:29
LOCATION B196 ALARM
INITIALS ID

6.2.5.4. In order to create a homogenous mixture of sewage, agitate the grab-sample carboy. Fill one sample bottle with the sewage from the grab-sample carboy. In the case of a combination alarm, fill all of the sample bottles from the grab-sample carboy, re-agitating the carboy between sample bottles.

Empty the remainder of the sewage from the carboy into the sink and rinse out the carboy (do not use antibacterial soap, just tap water).

6.2.6. PERFORM GRAB SAMPLE ANALYSIS

If the alarm condition involves either a pH alarm or a radiation alarm, the grab sample needs to be analyzed. For a pH alarm, see Attachment F, Section 1. For a radiation alarm, see Attachment F, Section 2. Using Table 3, Grab Sample Analysis, record the results in the Response Report.

6.2.7. UPDATE EPD RESPONDER. COMPLETE REQUESTED ACTIVITIES.

6.2.7.1. Call the EPD Responder with the results of the grab sample analysis and any changes in the computer printout. If the alarm condition has not ended, the responder may provide further instructions.

6.2.7.2. The following may be requested by the EPD responder:

6.2.7.2.1. When the computer printout indicates "(metals, pH, pH/metals or radiation) alarm condition has ended," reset the alarm as described in Section 1 of Attachment G.

6.2.7.2.2. Call the Fire Department Dispatcher (see Attachment G, Section 2).

6.2.7.2.3. Collect additional grab samples (see Section 3 of Attachment G).

6.2.7.2.4. Analyze the additional grab sample (see Attachment F, Section 1 for a pH alarm and Section 2 for a radiation alarm) and record the results in Table 5 on the Response Report. Note that it is unnecessary to recalibrate the pH probe or take another background count.

6.2.7.2.5. Purge the Marinelli beaker as described in Section 4 of Attachment G.

6.2.7.2.6. Call out Analytical and/or Counting Lab personnel (see Section 5 of Attachment G).

6.2.7.2.7. Update the EPD responder (see Section 6 of Attachment G).

6.2.8. CLEAN UP

Use antibacterial soap and water to clean anything (including the floor and your hands) that has come into contact with sewage (except the grab-sample carboy and pH probe, which are cleaned with water, no soap).

6.2.9. LOGBOOK ENTRY

Record the following in the alarm logbook:

- Date and Time of first alarm indication,
- Type of Alarm,
- Any unusual facility conditions (loss of flow, facility running on emergency power, etc.), and
- Your signature.

7. DOCUMENTATION/QA RECORDS

Any response to the Sewer Monitoring Alarm Station must be described in either the Alarm Logbook or the Maintenance Logbook by the responding personnel. If the nature of the alarm is pH, metals, radiation, or a combination, the HC Sewer Response Report must be completed.

8. ACCEPTANCE CRITERIA

The Health and Safety Technician alarm response is considered complete and acceptable when documentation described in Section 7 is complete.

9. ATTACHMENTS

- Attachment A: Equipment Layout in B 196
- Attachment B: B 196 Flow Diagram
- Attachment C: Call-out Lists
- Attachment D: Hardware Alert and Electronic Failure
- Attachment E: HC Sewer Response Report
- Attachment F: Grab Sample Analysis
- Attachment G: Possible Requested Activities

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ATTACHMENT A: EQUIPMENT LAYOUT IN B 196

[illegible]

ATTACHMENT C: CALL-OUT LISTS

List 1: Sewer Alarms
Environmental Protection Department Responders
Environmental Monitoring Section
Rebecca Failor, Section Leader

Call in order until you contact someone. Either let the phone ring 10 times or voice mail/the answering machine respond before trying the next name. Leave messages for the first three people.

	Name	Lab Extension	Dial Page	Home Phone
1.	Jennifer Larson	3-8887	37700-04643	(510) 373-7254
2.	Brian Balke	3-5711	37700-04520	(510) 373-9735
3.	Duane Rueppel	2-5223	37700-04465	(510) 606-6270
4.	Paul Dickinson	2-9130	37700-04519	(510) 625-1501
5.	Duke Ramsey	2-3817	37700-04365	(209) 825-4265
6.	Shari Brigdon	3-7665	37700-04272	(209) 599-2453

Remarks: If no one on Sewer Alarms List can be reached, have the Fire Dispatcher contact the Environmental Duty Officer.

List 2: Analytical Lab Personnel

Call in order until you contact someone. Let the phone ring ten times before trying the next name.

	Name	Lab Extension	Dial Page	Home Phone
1.	Rohit Shah	3-7348	37700-03296	(510) 373-0231
2.	Mary Ann Lee	2-7737		(510) 447-8014

List 3: Counting Lab Personnel

Call in order until you contact someone. Let the phone ring ten times before trying the next name.

	Name	Lab Extension	Dial Page	Home Phone
1.	Gary Seibel	2-5232		(510) 447-5754
2.	Joane Westermarck	2-5234		(510) 449-8190

ATTACHMENT C: CALL-OUT LISTS CONTINUED

List 4: Other Important Responders

Name	Phone
LLNL Fire Dispatch	2-7595
Livermore Water Reclamation Plant Office	373-5230
24-hour Plant Supervisor	373-5293
Maintenance Mechanics	2-9762
Maintenance Mechanic First Line Supervisor	2-9762
LLIX	3-8800

ATTACHMENT D: HARDWARE ALERT AND ELECTRONIC FAILURE

GENERAL CONSIDERATIONS

The most frequent condition that will require off-shift response at B196 will be the failure of mechanical or electrical equipment. Fortunately, most of these are not difficult to fix, and those that require special expertise can usually be delayed until an EPD responder can arrive. Although the sewer monitoring team must be notified of a hardware problem, often a voice-mail message will be sufficient, rather than a wake-up call. If the problem can be fixed without EPD input, be certain to document the condition and actions taken in the Maintenance Log. Additionally, in the Alarm Log, note the time, date, hardware alert or electronic failure condition and your name.

1. HARDWARE ALERTS

1.1. If the "hardware" light is lit on the annunciator panel, check the computer printout to see which unit has failed.

1.1.1. If the printout indicates a "gamma hardware failure," no corrective action is possible without EPD involvement. Notify the EPD responder (Attachment C) so that the hardware alarm can be disabled and repair begun.

1.1.2. If the printout indicates "XRFA hardware failure," it may be possible to re-establish normal system operation.

1.1.2.1. X-ray generator power off - Check the voltage and current LED's on the x-ray source power supply (black rack-mount units in the electronics rack). These are stacked in numerical order, with XRFA1 on top.

1.1.2.1.1. If the voltage and current readings are "0.00" for either XRFA1 or XRFA3, press the green "High Voltage ON" button. The voltage and current should return to preset values. If the voltage does not return to normal, contact an EPD responder (Attachment C) so that the hardware alert can be disabled.

1.1.2.1.2. If the voltage and current readings are "0.00" for XRFA2, contact an EPD responder (Attachment C) for instructions on restoring the voltage.

1.1.2.2. Loss of flow - Check the analysis flow return line coming from the x-ray analysis system (Tyson hose entering gray PVC piping at the south-east corner of the table holding the x-ray units) for flow. If flow is not visible, listen for flow in the main sewage return line (in the south-east corner of the room). If no flow is apparent, contact the Maintenance Mechanic First Line Supervisor (2-9762) to have the water shop personnel come out to restore flow in the sampling pumps at Building 193 (the Sewer Diversion Facility). Otherwise, contact the EPD responder (Attachment C) for advice on how to repair the loss of flow.

1.1.2.3. X-ray generators, solid-state detectors or electronics have gone bad - Contact the EPD responder, who will guide you through shutdown of the x-ray power supply. They will initiate repairs the next day.

1.1.3. Flow rate hardware error - flow chart recorder on East wall shows 0 or 100% flow rate. Leave a voice-mail message for the EPD responder.

1.1.4. If the printout indicates a pH hardware problem, the pH reading on the pH meter will be either 0 or 14. Replace the pH probe (Contact an EPD responder (Attachment C) for instructions, if necessary). If the reading does not return to normal, contact an EPD responder (Attachment C) to have the pH hardware alert disabled. The responder will initiate repairs the next working day.

ATTACHMENT D: HARDWARE ALERT AND ELECTRONIC FAILURE CONTINUED

1.2. If the "hardware" light is not lit, the computer printout indicates nothing, no flow failure is evident, and the hardware alert sounds intermittently at the fire station, the cause may be a failure of the leased-line connection between B196 and the Fire Dispatcher. Contact LLIX phone repair (3-8800), and leave a voice-mail message for the EPD responder (Attachment C).

2. ELECTRONIC FAILURE

This usually indicates that the software system has locked up, or that the maintenance terminal has been used to place the system in "clean/calibrate" mode. Call the EPD responder, who will respond to restart the analysis software, or who will instruct you in returning the system to "normal" mode.

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ATTACHMENT E: HC SEWER RESPONSE REPORT

NAME: _____

DATE: _____

Table 1

Section	Activity	Page #	Time
6.2.1	Notify LWRP.	8	
	NAME OF LWRP CONTACT:		
6.2.2	Verify alarm lights and check printout (Tables 2A-C).	8	
6.2.3	Assess facility conditions.	11	
6.2.4	Call EPD responder.	11	
	NAME of RESPONDER:		
6.2.5	Collect grab sample.	11	
6.2.6	Analyze grab sample (Attachment F, Table 3).	12	
6.2.7	Update EPD responder. Complete requested activities (Table 4).	13	
6.2.8	Clean up.	13	
6.2.9	Logbook entry.	13	

Tables 2A-C

ANNUNCIATOR PANEL	
pH/metals	Radiation

SEWER MONITORING ALARM PANEL			
Metals	pH	gamma	transuranic beta

ALARM PRINTOUT

DATE and TIME of first alarm indication:

FLOW:

If pH alarm, MINIMUM and MAXIMUM pH:

If metals or pH/metals alarm, record metals and concentrations:

If a gamma radiation alarm, record radioactive isotopes and concentrations (uCi/mL):

DATE and TIME that alarm cleared (or "Ongoing"):

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ATTACHMENT E: HC SEWER RESPONSE REPORT CONTINUED

Table 3

GRAB SAMPLE ANALYSIS (Attachment F)	
pH meter reading:	
Radioactivity Analysis	
BACKGROUND	SAMPLE
Count Length:	Count Length:
α counts:	α counts:
β/γ counts:	β/γ counts:

Table 4

REQUESTED ACTIVITIES			
Attachment	Activity	Requested?	Time Completed
G.1	Reset Alarms.	Yes/No	
G.2	Call Dispatcher.	Yes/No	
	NAME of Dispatcher:		
G.3	Collect additional grab sample.	Yes/No	
F	Analyze additional grab sample (Table 5).	Yes/No	
G.4	Purge Marinelli beaker.	Yes/No	
G.5	Call out Analytical and/or Counting Lab personnel.	Yes/No	
G.6	Update EPD responder.	Yes/No	

Table 5

ANALYSIS OF ADDITIONAL GRAB SAMPLE (Attachment F)	
pH meter reading:	
Radioactivity Analysis	
BACKGROUND	SAMPLE
Count Length:	Count Length:
α counts:	α counts:
β/γ counts:	β/γ counts:

ATTACHMENT F: GRAB SAMPLE ANALYSIS

1. PH DETERMINATION

Use the following procedure to determine the pH of the grab sample.

1.1. Check the calibration of the portable pH meter :

- 1.1.1. Rinse the probe with deionized water from the squeeze bottle on the counter.
- 1.1.2. Squirt pH 7 buffer into the half-bottle (labeled "pH 7") next to the sink until the buffer is 1/2 inch deep.
- 1.1.3. Put the probe into this aliquot of buffer, and use it to stir the buffer for several seconds.
- 1.1.4. Set the selector button to "pH."
- 1.1.5. Adjust the portable pH meter to read 7.0 ± 0.3 , allowing one minute for the response to stabilize.
- 1.1.6. Repeat Steps 1.1.1 through 1.1.5 for buffers 4 and 10.

NOTE: If readings for all the buffers are generally the same, advise your responder. The pH meter is not working properly.

1.2. Use the portable pH meter to check the pH of the sewage in the sample bottle:

- 1.2.1. Using deionized water from the squeeze bottle, rinse the probe well. Buffer is potent, so you must remove it thoroughly.
- 1.2.2. Place the probe into the sewage in the sample bottle.
- 1.2.3. Stir the sewage gently with the probe for one minute while the reading stabilizes, read the pH indication on the portable pH meter.
- 1.2.4. Rinse the probe in deionized water.
- 1.2.5. Put the probe back into its storage bottle (contains buffer pH 4).
- 1.2.6. Turn off the portable pH meter.
- 1.2.7. Record the pH of the grab sample in the appropriate table of the Response Report.

2. RADIATION COUNT DETERMINATION

Using the following procedure, check and record the radioactivity of the bottled grab sample. The necessary equipment should be on the lab counter top or in the "radiation equipment" drawer in the work bench; the swipe counter is on the desk.

- 2.1. Using a pipette and pipette aid (do not mouth pipette), transfer a 2-ml aliquot of sewage from the sample bottle to a 2-in. stainless steel planchette. Throw away the used pipette.
- 2.2. Place the filled planchette on the hot plate, under the heat lamp.
- 2.3. Dry the sewage sample by turning on the heat lamp and the hot plate to the 200 setting.
- 2.4. While the sample is drying, use the another 2-in. stainless steel planchette to obtain a 10-min. background count on the swipe counter. (See the *Swipe Manual* for counter operation and counting procedures.) Record the background count rate on the Response Report. Return the planchette to the drawer.
- 2.5. Turn off the heat lamp and hot plate when the sample is dry.
- 2.6. Count the sewage sample planchette for alpha-beta-gamma activity for 5 min. Record the sample count rate on the Response Report. Throw away the used planchette.

ATTACHMENT G: POSSIBLE REQUESTED ACTIVITIES

1. RESET ALARMS

1.1. For pH, metals or pH/metals alarms, press the following three buttons in sequence:

- Sewer monitoring alarm panel—"pH/Metals Reset" and "Grab Sample Reset"
- Annunciator panel—"Reset button"

1.2 For radiation alarms, press the following three buttons in sequence:

- Sewer monitoring alarm panel—"radiation reset" and "grab sample reset"
- Annunciator panel—"Reset button"

Performing step 1.1 or 1.2 above turns all of the alarm lights off.

2. CALL DISPATCHER

Call the Fire Department dispatcher (Ext. 2-7595) to let them know that either the alarm has cleared or you are leaving and the EPD responder is coming in.

3. COLLECT SUBSEQUENT GRAB SAMPLE

Eject a second grab sample to confirm that the alarm condition has ended. To take this manual grab sample, press, in sequence, the following three buttons on the sewer monitoring alarm panel: "Grab Sample Reset," "Manual Grab," and "Grab Sample Reset" (to reset the manual grab after the sample has been ejected).

Collect the sample as in Step 6.2.5 of Section 6, Alarm Response.

4. PURGE MARINELLI BEAKER

4.1. Take the handle (cam lever) on the right side of the Gamma Radiation System and rotate it down to the floor. (This turns a cam that raises the shield's 300 pound lid.) Grasp the handle on the top of the lid and rotate the lid to the right and back, exposing the marinelli beaker and radiation detector. Remove the copper ring that lies on top of the lead canister. Set aside carefully without denting or bending the ring.

4.2. Lift the Marinelli beaker out of the shield. Be extremely careful, here and in the steps to follow, to avoid puncturing the thin beryllium vacuum window on top of the detector vacuum housing (under the Marinelli beaker). The beaker and the detector are separated by a plastic bag. If the plastic bag comes out with the beaker, slowly slip it back over the detector.

4.3. Invert the Marinelli beaker, shaking it back and forth to dislodge (as possible) any solid material that may be trapped on the bottom. The beaker discharges at its top, so tilting the beaker to bring the discharge line to the lowest position may also help to bring solid material to the outlet.

4.4. Using paper wipes, wipe away any moisture on the Marinelli beaker, on the plastic bag, or on the bottom of the shield cavity. Do not touch the top of the detector head!

4.5. Partially lower the Marinelli beaker onto the detector, then rotate until the hoses fall over the cutout in the rim of the shield. Push the hoses into place, and gently lower the beaker into position. Do not push down on the beaker.

4.6. Replace the copper ring. Rotate the shield lid into place, checking for proper clearance with the hose clamps on the beaker. The bands on the hose clamps may have to be held down to allow the lid to rotate into place. Raise the cam lever to seat the lid in place.

4.7. Wait ten minutes. If the EPD Responder has decided to remain off-site, report back with the final alarm condition.

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ATTACHMENT G: POSSIBLE REQUESTED ACTIVITIES CONTINUED

5. CALL OUT ANALYTICAL AND/OR COUNTING LAB PERSONNEL.

The responder may ask you to call out Analytical and/or Counting Lab personnel (for the phone numbers, see Attachment C, List 2 or 3, respectively) to analyze a sample; if no one can come in within one hour and forty-five minutes, inform your responder.

6. UPDATE EPD RESPONDER

Provide EPD responder with requested information.

EMP-SW-LWRP

SEWAGE SAMPLING AT LWRP

Prepared by:

Jennifer Larson 1/25/95
Brian Balke date
Environmental Analyst, WGMG

Reviewed by:

Jennifer Larson 1/25/95
Jennifer Larson date
Environmental Analyst, WGMG

Renee Needens 1-25-95
Renee Needens date
Environmental Technologist, TSG

Approved by:

William G. Hoppes 1-25-95
William G. Hoppes date
Group Leader, WGMG

Rebecca A. Failor 1-25-95
Rebecca A. Failor date
Section Leader, EMS

Lucinda M. Garcia 1/25/95
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

**LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

Lawrence Livermore National Laboratory (LLNL) is required by the Livermore Water Reclamation Plant (LWRP) to monitor the water quality parameters of Laboratory sewer effluent. However, in the case of tritium and plutonium, LLNL must also be sensitive to the ultimate fate of its contaminants. For this reason, LLNL has agreed to analyze samples of LWRP process and discharge streams. This procedure describes the procedure used to sample LWRP effluent.

2. APPLICABILITY/DISCUSSION

Sampling at the LWRP is conducted primarily to complete the pathway analysis for the release of pollutants at LLNL. The most important of these pollutants are the various radioisotopes used in LLNL operations. Plutonium, cesium and heavy metals are most likely to be concentrated in dried sludge, while tritium is most likely to be discharged to the Bay with the clarified water.

Chemists at the LWRP sample and analyze process liquids to ensure that the plant is operating optimally. These personnel are trained in wastewater sampling techniques, and have agreed to acquire daily samples of LWRP's clarified effluent and monthly composite samples of the sludge in the digester tanks. The sludge has a very high solids concentration, so month-to-month variations in the analysis results will reflect actual conditions in LWRP's dried sludge.

The Technical Support Group (TSG) of the Environmental Monitoring Section (EMS) provides the LWRP with bottles for the effluent sampling, picks up the samples each week, and delivers the samples (with completed paperwork) to the Hazards Control Analytical Laboratory (HCAL) under the direction of Environmental Analysts from the Water Guidance and Monitoring Group (WGMG). Since sampling practices are determined by LWRP personnel, this procedure is concerned primarily with WGMG's scheduling and documentation of LWRP sampling activities. LWRP sampling is performed according to EPA method 831B94-001, "Industrial User Inspection and Sampling Manual for POTW." Further information regarding this sampling may be obtained by calling Jacqui Tourray at the LWRP.

This procedure does not cover other sewage sampling performed by EMS.

3. REFERENCES

1. EMP-SW-OP, *Sewer Monitoring Operations*
2. EMS *Sewer Monitoring Sampling Documentation Handbook*
3. EMP-QA-NCR, *Nonconformance and Discrepancy Reporting*
4. EMP-QA-DC, *Document Retention*
5. EMP-QA-SD, *Sample Tracking Documentation*

4. DEFINITIONS

Ordinal date: Five digit date identifier. The first three digits designate the number of days since January 1 of the current year, the last two digits designate the year itself. For example, the ordinal date for January 20, 1995, would be: 02095.

Sample refrigerator: Storage refrigerator in the North room of B196.

5. RESPONSIBILITIES

5.1 EMS SECTION LEADER

The EMS Section Leader ensures that sampling procedures meet and conform to the appropriate regulatory guidance.

5.2. WGMG GROUP LEADER

The Group Leader assures that sampling procedures meet design criteria and that sampling is conducted in accordance with approved procedures

5.3. WGMG ENVIRONMENTAL ANALYST

The Environmental Analyst determines the analytes of interest and the schedule for the sampling program, and identifies the laboratories that will perform the required analyses. Retention of the documents described in section 7 is overseen by the Environmental Analyst.

5.4. TSG ENVIRONMENTAL TECHNOLOGIST

The Environmental Technologist delivers clean sample bottles to the LWRP, collects filled sample bottles for delivery to the analytical laboratory, and is responsible for properly preparing sample documentation (Reference 2). The Technologist also prepares NCRs (Reference 3) when samples or sampling documentation are not properly completed.

6. PROCEDURE

Note: Occasional failures of the sampling equipment, or mishaps in the handling of samples, can result in the exposure of personnel to raw sewage. According to Hazards Control Industrial Hygienists, exposure to sewage is not a significant health hazard if reasonable hygienic steps are taken. When performing the procedures below, gloves and other protective equipment should be worn, as described. Exposed personnel should wash with disinfectant soap (kept in the North room of B196). If clothes become soaked with sewage, personnel should shower and change into clean clothing, and the soiled clothing should be washed as soon as possible.

Equipment Required:
1-gallon polyethylene bottles (4-5 per month)
500-mL polyethylene bottles (6 per month)
5-gallon carboy (1 per month)
EMS chain-of-custody record forms
Indelible ink marker
Sample bottle labels (Reference 2)

6.1. SAMPLE ACQUISITION

6.1.1. BOTTLE LABELS

To assist LWRP personnel in documenting sample composition, labels must be affixed to the sample bottles prior to delivery to the LWRP. For weekly sample bottles (one 1-gallon bottle per week), use the "LWRP Weekly" labels in Reference 2. The Environmental Technologist must fill in the sample dates to the right of the check-boxes. For monthly samples (one 5-gallon carboy per month), use the "LWRP Monthly Composite"

labels described in Reference 2. The month and year must be filled in, and the label attached to the carboy.

The 500-mL bottles used for digester sampling are labeled using the Daily Sampling bottle labels described in Reference 2. The Technologist must ensure that the "Location" section (e.g. - "LWRP Digester 1"), "Date" section (the month and year), and the sample identifier at the bottom of the label (e.g. - L-WRD1-01-SW) are filled in.

6.1.2. BOTTLE DELIVERY

The first working day of each week, the Environmental Technologist will deliver one labeled weekly composite sample bottle to the LWRP. The bottles should be delivered to the chemistry personnel at the 1250 Kitty Hawk building. The primary contact is Jacqui Tourray, at 373-5291. On the last week of the month, the Technologist will also deliver six labeled 500-mL digester sample bottles and a labeled 5-gallon carboy to the LWRP to be used for the next month's composite sample.

LWRP effluent samples are composed of midnight-to-midnight flow-proportional composite samples. Two 500-mL samples are taken each day; one becomes part of a weekly composite sample, the other part of a monthly composite.

Monthly composite samples are also obtained from three different digesters. 200 mL aliquots are placed into a carboy for each digester every Tuesday of the month. At the end of the month, LLNL sample bottles are filled from each of the three carboys.

6.1.3. SAMPLE COLLECTION AND DELIVERY TO ANALYTICAL LABORATORY

The first workday of each week, the Environmental Technologist will accept custody of the weekly LWRP effluent and, if available, the monthly digester samples and the monthly LWRP effluent composite. The bottles will be checked for complete labeling (at a minimum, the sampling date and location) and sufficient quantity of digester samples (bottles should be at least half full.) Any discrepancies should be brought to the attention of the LWRP staff, and documented with an NCR (Reference 3).

Prior to delivery of the samples to the Hazards Control Analytical Laboratory (HCAL - Sections 6.2.2 and 6.2.4) or the Environmental Monitoring Radiation Laboratory of the Radiation Analytical Sciences Section (RAS - Sections 6.2.3 and 6.2.5), the samples shall be kept in the custody of the TSG technologist, or stored in the sample refrigerator inside The North room of B196.

6.2 DELIVERY OF SAMPLES TO ANALYTICAL LABORATORIES.

6.2.1. The TSG Environmental Technologist will transfer the weekly samples to HCAL, Building 253, Room 1734.

6.2.1.1. Check to ensure that each sample is within 1/2 inch of the top of the bottle. If the samples are questionable or unacceptable, contact the WCMG Environmental Analyst to determine how the samples should be used. If samples are not acceptable, an NCR (Reference 6) should be prepared to document the disposition of the samples.

6.2.1.2. Log the sample in on the Hazards Control Sample Tracking System (Reference 5).

6.2.2. Examples of the documentation for the weekly effluent samples, consisting of a completed EMS Chain-of-Custody Record form (COC), are given in Reference 2 (Chain of Custody Form LWRP-1). In addition, delivery of the samples to the HCAL must be documented in the HCAL environmental sample delivery log.

6.2.3. By the Thursday following the first Monday of each month, the 5-gallon carboy containing the preceding month's effluent composite sample should be delivered to RAS in room

2347 of B151. Sample documentation is shown in Reference 2 (COC LWRP-2). The Environmental Technologist should indicate the calendar dates for the month that the sample was acquired, and the calendar dates for any missing samples in the comments section of the COC.

6.2.4. One bottle of the monthly sludge composite from each of the three digesters should be submitted for metals and gross alpha/beta analysis to the HCAL. Sample documentation is presented in Reference 2 (COC LWRP-3), along with data for logging the sample into the HCAL sample tracking system. Finally, delivery of the samples to the HCAL must be documented in their environmental sample delivery log.

6.2.5. The remaining monthly sludge samples should be submitted to RAS. The documentation shown in Reference 2 (COC LWRP-4) must be submitted with the samples. RAS composites and analyzes these samples for Plutonium and Cesium on a quarterly basis.

6.2.5.1. The sampling technologist should draft a COC and submit it with the first samples of each quarter.

6.2.5.2. When samples are delivered, the technologist should enter the month and year in the "Date" column, enter the number of bottles delivered in the "Number of Containers" column, and write their initials next to the number of bottles on the COC.

6.3. SAMPLE ARCHIVES

HCAL does not use the full sample volume in its radiation analysis of LWRP weekly effluent. The bottle containing the residual sample should be collected from the HCAL refrigerator located in the northwest corner of Room 1734 of Building 253, and moved to the B196 storage shed by the Thursday following the first Monday of the month. Residual weekly effluent samples should be stored in boxes, separated and labeled by month, for six months.

6.4. SAMPLE DISPOSAL

After six months, the LWRP weekly effluent samples may be poured down the sink at B196. Because the LWRP treatment process removes pollutants and no sample preservatives are used, the samples are not considered to be hazardous waste.

7. DOCUMENTATION/QA RECORDS

7.1. Sample labels will be affixed to all sample bottles, and properly completed. The labels are prepared and attached to bottles by the TSG Environmental Technologist. See Reference 2 for bottle label formats.

7.2. Submission of weekly samples to the HCAL must be documented by properly completed COCs (Sample COCs are presented in Reference 2).

7.3. Submission of monthly samples to RAS by the TSG Environmental Technologist must be documented by properly completed COCs (Reference 2).

7.4. QA records are archived according to the criteria of References 4 and 5.

8. ACCEPTANCE CRITERIA

Samples will be deemed acceptable when:

8.1. The chain of custody has not been broken or compromised; and

8.2. All required documentation is completed correctly; and

8.3. Bottles are properly labeled, dated, and initialed by the sample collector.

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9. ATTACHMENTS

none

EMP-SW-M

SEWER EQUIPMENT MAINTENANCE

Prepared by: Brian Balke 4/7/93
 Brian Balke
 Environmental Analyst, WGMG
 date

Reviewed by: Duane Rueppel 4/7/93
 Duane Rueppel
 Group Leader, TSG
 date

Paul Dickinson 4/7/93
 Paul Dickinson
 Environmental Technician, TSG
 date

Renee Needens 4-7-93
 Renee Needens
 Environmental Technician, TSG
 date

Approved by: William G. Hoppes 4/7/93
 William G. Hoppes
 Group Leader, WGMG
 date

Rebecca A. Failor 4/7/93
 Rebecca A. Failor
 Section Leader, EMS
 date

Lucinda M. Garcia 4/7/93
 Lucinda M. Garcia
 Quality Assurance Coordinator, EMS
 date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure documents the equipment maintenance that must be performed in Building 196 to guarantee that compliance and spill monitoring operations are accurately and reliably accomplished.

2. DISCUSSION

In order to demonstrate compliance with its discharge permit issued by the City of Livermore Water Reclamation Plant (LWRP), LLNL is required to monitor effluent that leaves the site. For this purpose, compliance monitoring equipment has been installed at Building 196, the Sewer Monitoring Station. Furthermore, LLNL has installed equipment which would allow early detection of serious releases (should they occur), allowing timely notification of the LWRP. Through the automatic signal to LLNL's Sewer Diversion Facility, this in-line monitoring capability enables diversion of non-sewerable, alarm-inducing wastewater before it leaves the site.

LLNL's agreements with the LWRP, as well as DOE Orders, define the requirements for sewage monitoring. Continuous monitoring of sewage flow and pH, and analysis of weekly composites for metals concentrations, are required by the permit. Real-time metals monitoring has been installed by agreement with the LWRP. Both real-time and laboratory analysis for radioactivity are required by DOE guidelines.

This procedure does not cover the calibration of the monitoring equipment, which is discussed in Reference 1.

The following is a table of contents for the maintenance procedures in Section 6, "Procedure."

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3. REFERENCES

1. EMP-SW-CA, *Sewer Equipment Calibrations*
2. Best Power Technology, Inc. *FERRUPS FC3 & FC5KVA Owner's Manual*
3. Best Power Technology, Inc. *FERRUPS FC2-5KVA Options, Technical Information*

4. DEFINITIONS

Air-Gap Water Header: In the B196 Detector Room, a set of four in-line valves in the southwest corner of the room. The valves are connected to the red rubber floor hoses that, during flushing operations, introduce air-gap water at key points in the flow system.

Alarm Printer: In the B196 Detector Room, the dot-matrix printer in the middle of the room. All alarm information, system status changes, and daily summary statistics are printed here.

Annunciator Panel: Grey alarm light panel above the desk in the B196 Detector Room. The air-gap supply switch is located in the lower right corner of the panel.

B196 Computer Room: The south half of Building 196, containing the x-ray and gamma-X counting electronics, and the microVAX computer that monitors and logs the condition of the monitoring equipment and sewage.

B196 Detector Room: The room in the north half of Building 196 that contains the pH probe and the pH buffer solutions, the x-ray and gamma-X detectors, and the x-ray power supplies.

Cyclonic Separator: Located in the Detector Room, this is a large steel canister with a conical bottom that is located on the south wall just to the right of the refrigerator.

Flow Calibration Stick: A yardstick with an adjustable screw, calibrated on one side to read gallons per minute of flow. The flow calibration stick is found in the flume, generally on the east side of the vault.

Flow Recorder: The flowmeter is located in the B196 counting room, on the east wall between the x-ray power supplies and the x-ray fluorescence cells.

Gamma-X Lead Shield: Found on the floor in the southeast corner of the detector room, this 4-inch lead shield screens the flow cell and detector from external radiation.

Maintenance Log: A ledger binder kept on the desk in the Detector Room. All maintenance operations must be documented in the log.

Maintenance Terminal: The computer terminal in the Detector Room, above the racks holding the x-ray fluorescence power supplies. This terminal is used to disable the monitoring system when maintenance is performed.

Parschal Flume: Located in a below-ground vault to the east of Building 196, the flume has two main parts: a chute which levels and smooths the flow through the flume, and a hydrostatically driven stilling well. The level of liquid in the stilling well is measured to determine the flow rate.

Sewer Diversion Facility: A diversion structure and tank farm located to the east of Building 196. The Sewer Diversion Facility contains the sampling pumps that feed the monitoring equipment in the Detector Room.

Stilling Well: A standing water well, connected to the flume. Its level is measured to determine the flow rate of sewage leaving the site.

X-Ray Fluorescence Cell: Three x-ray fluorescence (XRFA) cells are found in the Detector Room. Each XRFA cell consists of a plastic flow cell, a SiLi detector, an x-ray generator, and a mounting block. Each sits by a large liquid nitrogen (LN) dewar, and the three dewars are bolted to the table on the east side of the Detector Room. The mounting block maintains the critical geometry between the flow cell and the detector.

X-Ray Power Supplies: The x-ray generator for each fluorescence cell pulls current and a dc reference voltage from a power supply rack mounted three feet to the north of the x-ray fluorescence cells.

5. RESPONSIBILITIES

5.1. WGMG ENVIRONMENTAL ANALYST

The WGMG Environmental Analyst is responsible for scheduling and tracking the performance of procedures described in Sections 6.2, 6.3, and 6.9.

The Analyst is also responsible for maintenance of the Canberra hardware service contract, including annual review of the terms of the contract, and for organizing and supervising maintenance visits (see Section 6.15).

5.2. TSG ENVIRONMENTAL TECHNICIAN

The TSG Environmental Technician is responsible for the scheduling and execution of all maintenance procedures aside from those specifically assigned to the Environmental Analyst (section 5.1). He is also responsible for maintaining adequate stocks of the required maintenance supplies.

5.3. PLANT ENGINEERING

Plant Engineering personnel provide support functions to the Laboratory to maintain equipment that may present an electrical or mechanical hazard. Personnel in the Electrician's Main Shop and the Battery Shop are responsible for testing and maintenance of the B196 emergency power generator (section 6.9) and the load cells in the uninterruptable power supply (sections 6.11 and 6.12). Plant Engineering is responsible for proper training and supervision of these personnel.

5.4. WGMG GROUP LEADER

The WGMG Group Leader is responsible for indentifying the resources necessary for maintenance to be completed as scheduled, and for communicating to the EMS Section Leader any performance problems related to a lack of sufficient resources.

5.5. EMS SECTION LEADER

The EMS Section Leader is responsible for ensuring that sufficient resources are allocated to allow maintenance to be completed in a timely fashion.

6. PROCEDURE

Notes:

- Occasional failures of the sampling equipment, or mishaps in the handling of samples, can result in the exposure of personnel to raw sewage. According to Hazards Control Industrial Hygienists, exposure to sewage is not a significant health hazard if reasonable hygienic steps are taken. When performing the procedures described below, gloves and other personal protective equipment should be worn. Exposed personnel should wash with disinfectant soap (PhisoHex soap, kept in Satellite Station 163A). If clothes become soaked with sewage, personnel should shower and change into clean clothing, and the soiled clothing should be washed as soon as possible.
- As a safety precaution, the eye wash should be checked for proper operation before performing any maintenance that might result in exposure to sewage.

6.1. MAINTENANCE SCHEDULE

Maintenance of the various pieces of equipment in Building 196 is scheduled on a daily, weekly, bi-weekly, quarterly, semi-annual, or annual basis.

6.1.1. Maintenance of the pH probe will be performed daily except for weekends (see Section 6.2). This work is performed by the Plant Engineering Alarms under guidance from the WGMG.

6.1.2. Filling of the monitoring system's liquid nitrogen dewars will be performed Mondays, Wednesdays and Fridays (see Section 6.3). WGMG contracts with Plant Engineering maintenance machinists for this work.

6.1.3. The following maintenance procedures will be performed each Friday morning prior to resumption of site operations, preferably between 5 a.m. and 7 a.m., when the flow is low. For more details, see text sections indicated in parentheses.

- Sampling room flow system maintenance (Section 6.4)
- Gamma-X flow-cell maintenance (Section 6.5)
- X-ray flow-cell maintenance (Section 6.6)
- pH and flow chart replacement (Section 6.7)

6.1.4. On-line sample pump and stilling well maintenance will be performed every other Friday (Section 6.8).

6.1.5. The following maintenance procedure will be performed quarterly: inspection of emergency power generator by Plant Engineering (Section 6.9) and macerator and pump maintenance (Section 6.10).

6.1.6. The following maintenance procedure will be performed semi-annually: uninterruptible power supply battery check by Plant Engineering Battery Shop (Section 6.11).

6.1.7. The following maintenance procedure will be performed every two years: replace batteries in the uninterruptible power supply (Section 6.12).

6.1.8. The following maintenance will be performed as required:

- Restocking of chlorine drums (Section 6.13)
- Cleaning of composite sample refrigerator (Section 6.14)

- Repair of nuclear data analysis equipment, including the x-ray fluorescence, gamma-X radiation monitoring equipment and the alpha-spectroscopy system, along with the associated electronics and computer equipment (Section 6.15)

For many maintenance procedures requiring disassembly or disruption of monitoring operations, the alarms at B196 must be disabled to prevent the annunciation of false alarms. The following steps must be taken when performing maintenance procedures 6.4, 6.5, 6.6, and 6.10.

6.1.9. Prior to maintenance:

6.1.9.1. Contact Fire Dispatch at extension 2-7595 to inform them that the system will be off-line for routine maintenance, and that sewer monitoring alarms should be ignored until further notice.

6.1.9.2. At the maintenance terminal, put the system into clean calibrate mode.

6.1.9.2.1. The System Status screen should be displayed. Select "1" for WGMG operations.

6.1.9.2.2. In the next screen, select the appropriate reason for performance of the maintenance operation.

6.1.9.2.3. The next screen will allow selection of a list of maintenance operations to be performed. Select all the operations to be done (the corresponding number will be bolded on the terminal). When ready, press "S" to switch the mode. A maintenance message will be printed on the alarm printer.

6.1.9.2.4. The program will prompt for your initials prior to switching to clean/calibrate.

6.1.9.3. Make an entry in the maintenance log that the system was shut down for maintenance, and briefly list the maintenance procedures performed.

6.1.10. Following maintenance:

6.1.10.1. At the maintenance terminal, enter "1" to return the system to normal mode. The program will prompt for your initials, and then print a message on the alarm printer.

6.1.10.2. Contact Fire Dispatch at extension 2-7595 to inform them that maintenance is complete. Any sewer monitoring alarms should be responded to as normally required.

6.1.10.3. In the maintenance log, note the time that the system was returned to normal operating conditions.

Finally, performance of maintenance that does not require switching to "clean/calibrate" mode should be logged in the maintenance log, and reported to the computer. When performing any operation except 6.4, 6.5, 6.6 or 6.10:

6.1.11. Prior to maintenance:

6.1.11.1. Write a brief note in the maintenance log describing the maintenance performed. Include the date, time and your initials.

6.1.11.2. At the maintenance terminal, enter "1."

6.1.11.3. At the next screen, enter "O."

6.1.11.4. The next screen will contain a list of standard maintenance operations. Select the proper entry, or type in a custom entry using the "T" option. When done, the computer will prompt for your initials, and print a message to the alarm printer.

6.2. MAINTENANCE OF PH PROBE

Equipment Required:

Face Shield (Stock catalog #4240-58220)
Keys to B196 Detector Room (WGMG or Maintenance Machinists)
Latex gloves (Stock catalog #8415-28311 to 13)
Paper towels (KayDry, stock catalog #7999-63447)
Ball-point Pen

Don latex gloves and face shield, and follow the steps outlined below.

6.2.1. Remove the pH probe from the cyclonic separator. To do this, first loosen the back-up (the white teflon nut near the top of the pH probe) on the compression seal/insertion tube clamp. Gently withdraw the insertion tube to its safety stop. Close the 1-inch ball valve and loosen the packing gland retainer (thumb nut) until the pH probe is free in its holder.

6.2.2. Remove the probe and rinse it with warm tap water (to dissolve grease). Wipe off the probe with a wet KayDry and dry with a KayDry. Inspect it for any physical damage, grease or oily films, discoloration or milkiness, and leakage.

6.2.3. If the probe is damaged, replacements can be found in the grey supply cabinet next to the alarm printer. Instructions for purchase and calibration of a replacement probe are given in section 6.2 of Reference 1.

6.2.4. Place the probe back into the cyclonic separator, making sure the packing gland retainer is tight before opening the ball valve. Insert the probe up to the bottom of the white tape (leaving 2-3 inches of the probe barrel extending above the seal), and tighten the compression seal. Check for leaks around the pH probe. If leaks are found, contact the Environmental Technician for assistance.

6.2.5. Use a sponge to wipe up any sewage that may have been spilled during the maintenance. Place trash in the trash can. Rinse gloves with tap water, and dry with paper towels. Remove gloves and face shield.

6.2.6. Open the pH recorder cabinet and write "pH probe cleaned," and initial it, on the pH chart under the pen position. This documents that any swings that occurred during cleaning were not due to acid or caustic in the sewage.

6.2.7. At the maintenance terminal, select "P." The terminal will prompt for your initials, and then print a message on the alarm printer.

6.3. FILLING OF LIQUID NITROGEN DEWARS

The level of the liquid nitrogen dewars is maintained by Plant Engineering maintenance machinists, according to their approved procedures. If any problem should arise with the service, contact the Plant Engineering supervisor at ext. 2-9762. Sign-off sheets (including the time, date, and maintenance machinist's initials) should be posted prominently by the dewars to allow service tracking.

6.4. B196 DETECTOR ROOM FLOW SYSTEM MAINTENANCE

Equipment Required:

100 feet of Tygon tubing (Stock catalog #9330-66355)
Broom
Face Shield (Stock catalog #4240-58220)
Flat-blade screwdriver
Floor squeegee
Keys to B196 detector room (WGMG or Maintenance Machinists)
Lab coat or lab apron
Latex gloves (Stock catalog #8415-28311 to 13)
Paper towels (KayDry, stock catalog #7999-63447)
Ball-point Pen
Phisohex (Stock catalog #6505-29794)
Pine oil (Stock catalog #6840-13789)
Maintenance log

6.4.1. Inspect all flow system tubing. If the tubing is opaque, cut replacement lengths. When cleaning immediately adjacent equipment in the procedure below, swap in the new tubing.

The majority of the tubing in the system is stock number 9330-66355.

6.4.2. Disable the monitoring system (see Section 6.1.9.). Turn on the air gap water supply using the switch on the annunciator panel.

6.4.3. Don protective equipment (latex gloves, face shield and optional lab coat).

6.4.4. Flush grit from the macerator, main lines and cyclonic separator.

6.4.4.1. Lift the protective macerator and booster pump cover. Direct clean water hose to flow into the floor drain (nearest to floor valve 'B') and turn on. To flush sediment build-up caused by the piping layout, open macerator discharge flushing valve (the lowest valve on the piping that feeds down from the piping between the two macerators). Once a month, the macerators are switched: after approximately five minutes, turn off power to the active macerator, close the valve (located between the cyclonic separator and the active macerator) that controls flow from the cyclonic separator to the active macerator, close the valve (located between the macerators, nearest to the active macerator) that controls flow from the active macerator to the composite sampler and the x-ray flow cells, open the valve (located between the cyclonic separator and the inactive macerator) that controls flow from the cyclonic separator to inactive macerator and, finally, open the valve (located between the macerators, nearest to the inactive macerator) that would control flow from the inactive macerator to the composite sampler and the x-ray flow cells and, finally, turn on the power to the inactive macerator.

6.4.4.2. Open floor valve 'B' to the east of the cyclonic separator. This flushes to the sewer any heavy material captured in the overhead line and the cyclonic separator itself. If the sound of grit is audible (like a lot of little marbles), flush the system with clear water by opening air-gap valve no. 4 of the four in-line valves on the header to the south of the sink. After the bulk of the grit has washed through, as determined by the sound of the flow, shut off the clear water.

6.4.4.3. Close macerator discharge flushing valve and replace protective macerator and booster pump cover. Switch off the macerator and booster pump power.

6.4.5. Flush the sampling lines.

6.4.5.1. Partially close the valve on the discharge line from the top of the cyclonic separator. Rotate the valve approximately one-quarter turn. This forces the majority of the flushing flow (Section 6.5) through the flow cell sampling lines.

6.4.5.2. Run clear water through the lines by opening valve no. 2 on the air-gap water header. Open the valve slowly, and occasionally pinch the tygon tubing, leaving the cyclonic separator to determine the direction of the flow. Continue to increase the flow through valve no. 2 until the flow in the tubing reverses, passing into the cyclonic separator.

6.4.6. While the clear flow is flushing the sampling lines, clean the pH probe (see Section 6.2).

6.4.7. Clean the secondary phase separator (the transparent plastic cylinder to the east of the sampling refrigerator).

6.4.7.1. If the rest of the sewer monitoring equipment is on-line, open the bypass valve above the separator and close the valves on the inlet and outlet lines; this allows the flushing water to continue to clean downstream lines while the separator is being drained. Otherwise, these valves may be left alone.

6.4.7.2. Arrange the rubber floor hose so that it will wash the material leaving the drain valve (at the base of the separator) into the cyclonic separator floor drain. Start a moderate flow through the hose (valve no. 1 on the air-gap water header).

6.4.7.3. Uncap and open the drain valve at the base of the separator, turning the separator so that the discharge is directed towards the floor drain. To speed draining of the trapped sludge, open the vent valve (on the overhead line above the separator) and rock the cylinder.

6.4.7.4. Using water from the rubber floor hose, cycle the liquid level in the separator by spraying water back through the drain valve. Continue to wash the discharge down the floor drain.

6.4.7.5. When the bulk of the sludge has been washed from the separator, refill the separator by adding water through the drain valve. Close the drain valve and thoroughly rinse the outside of the separator. Re-cap the drain valve.

6.4.7.6. Reset the separator flow valves so the flow once again passes through the separator. When the separator is completely full, close the separator vent valve on the overhead pipe.

6.4.8. Use floor hose to rinse the floor. Shut off the floor hose flow by closing air-gap valve no. 1.

6.4.9. Perform Gamma-X flow-cell maintenance (see Section 6.5).

6.4.10. As necessary, turn off all clear water and the booster pump.

6.4.11. Perform x-ray flow cell maintenance (see Section 6.6).

6.4.12. Every other week, check the vent line on the east wall, by XRFA-1, for blockage and clean if necessary. Also dismount the flow monitor between XRFA-1 and the vent line. Clean with a soft wipe and pine oil, removing any built-up grease, and re-mount.

6.4.13. Once a month when macerators are switched (Section 6.4.4.1), or sooner if necessary, perform macerator maintenance (see Section 6.10). Close floor valve 'B'. Wait for sewage to refill cyclonic separator; audible running water in the return line indicates that the cyclonic separator is full. If the maintenance is complete, open the valve between the cyclonic separator and macerator. Start the macerator and the booster pump. Check for leaking out of the Marinelli beaker (located inside of the gamma-X canister) and the XRFA units.

6.4.14. Open the ball valve labelled "active" between the cyclonic separator and active macerator. Start the macerator and the booster pump. Notify Fire Dispatch that maintenance is complete (see Section 6.1.10).

6.4.15. Wash the floor down with pine oil and water (using the floor hose, and water from air-gap valve no.1). Squirt the floor with pine oil and water, mixing the two together with a broom. Scrub the floor with the broom, then brush and squeegee the soapy water down the floor drains.

6.4.16. Clean up, throwing refuse in the trash can. Rinse gloves with tap water, and dry with paper towels. Remove gloves and face shield.

6.5. GAMMA-X FLOW-CELL MAINTENANCE

Equipment Required:

Face Shield (Stock catalog #4240-58220)
Flat-blade screwdriver
Keys to B196 Detector Room (WGMG or Maintenance Machinists)
Lab coat or lab apron
Latex gloves (Stock catalog #8415-28311 to 13)
Marinelli Beaker
Paper towels (KayDry, stock catalog #7999-63447)
Ball-point Pen
Small, adjustable wrench
Stainless-steel bucket
Maintenance log

6.5.1. If not already accomplished, disable the monitoring system (see Section 6.1.9) and don protective equipment (latex gloves, face shield and optional lab coat).

6.5.2. Pressing down on the lever on the right side of the gamma-X cannister, raise the lid on the lead shield. Rotate the lid forward to expose the cavity.

6.5.3. Remove the Marinelli beaker, being careful not to lose the Cu-Cd shield pieces that fill the gap where the tubing penetrates the shielding. If the plastic bag that covers the detector casing comes free during removal, replace it immediately. The thin beryllium window that caps the detector casing will corrode rapidly if exposed to water, destroying the detector.

6.5.4. Generally, any sludge that has settled in the bottom of the beaker can be dislodged by inverting and shaking the beaker.

6.5.5. If the beaker remains dirty, it must be manually cleaned or replaced. Replacement beakers can be obtained from the Hazards Control Radiological Measurements Laboratory (room 1711 in B253).

6.5.5.1. If clear water is being used to flush the system, shut off the flow.

6.5.5.2. Shut off the macerator and booster pump. Close the valves between the cyclonic separator and the macerators.

6.5.5.3. Put a stainless steel bucket on the floor by the gamma-x cannister and put the Marinelli beaker inside. The orientation of the hoses on the lid is important to obtain proper orientation of the beaker in the cannister, so use caution when handling the beaker.

6.5.5.4. Remove the screws on the lid of the beaker, and then the small brass air plug. Separate the two pieces of the beaker. Rinse the bottom in the sink, and wipe the lid clean with paper towels. Put the towels in the trash. If the bottom of the beaker will not wash clean, obtain a replacement from the grey supply cabinets.

6.5.5.5. Replace the air plug and re-assemble the beaker.

6.5.6. Dry the beaker and replace over the detector in the lead shield. Replace the thin shield plates (Cu-Cd pieces described in Section 6.5.3) in the hose cutout before replacing hoses. Push the lid back over the shield and lower in place.

6.5.7. If maintenance is complete, open the valve between the cyclonic separator and active macerator. Start the macerator and the booster pump. Notify Fire Dispatch that maintenance is complete (see Section 6.1.10).

6.5.8. Clean up, washing off the sink and throwing refuse in the trash can. Rinse gloves with tap water, and dry with paper towels. Remove gloves and face shield.

6.6. X-RAY FLOW CELL MAINTENANCE

Equipment Required:

1/3 mil kapton roll, 3" wide
4 μ m mylar sheets, 4"x4" squares, box of 1000 (Spex Industries, Inc.)
Face Shield (Stock catalog #4240-58220)
Flat-blade screwdriver
Hex-head screwdrivers
Keys to B196 Detector Room (WGMG or Maintenance Machinists)
Lab coat or lab apron
Latex gloves (Stock catalog #8415-28311 to 13)
Paper towels (KayDry, stock catalog #7999-63447)
Paper towels
Pine Oil (Stock catalog #6840-13789)
Ball-point Pen
Stainless-steel bucket
Maintenance log

6.6.1. Kapton and mylar film can be ordered from Spex Industries, Inc., or any equivalent supplier. The film must be spectroscopy grade (i.e., free of heavy metal impurities). Spex can be reached at 1-800-522-7739.

6.6.2. If not already accomplished, disable the monitoring system (see Section 6.1.9) and don protective equipment (latex gloves, face shield and optional lab coat).

6.6.3. Shut off the macerator and booster pump. Close the valves between the cyclonic separator and the macerators.

6.6.4. If performing weekly maintenance, it is generally most efficient to perform the cleaning operations on all three units in parallel, instead of one following the next.

6.6.5. Turn off the power to the XRFA controllers. XRFA1 and XRFA3 can be turned off using the push button on the regulator supply. Before turning off XRFA2, dial the voltage and current to zero.

6.6.6. Place a stainless steel bucket under the flow cell to be dismantled. Detach the upper (discharge) hose, and drain into the bucket. Detach the lower hose and allow the flow cell to drain into the bucket.

6.6.7. Dismount the XRFA flow cell. For XRFA 1 and 2, this entails loosening the thumb nuts on the leaded plastic casing, and removing the two roundhead screws on the aluminum base. On XRFA 3, remove the microswitch on the upper left hand side of the unit, and then remove the hex-head nuts on the aluminum base.

6.6.8. At the sink, remove the six flat-head screws that hold the plastic casing to the aluminum base.

6.6.9. Disassemble the flow cell. To separate the middle "channel" plate from the plastic faceplate, it may be necessary to pry gently with a screwdriver. Discard the plastic film. Remove and clean the "O"-rings. Using pine oil and warm water, wash the plastic faceplate and the channel plate. Flush the feed throughs on the plastic faceplate. Remove gloves and dry the flow cell pieces.

6.6.10. Tear a 3"x3" sheet of orange kapton film from the cardboard dispenser on the rack above the sink. Lay down on the aluminum base to cover the opening, and smooth until flat. Lay a sheet of clear mylar film (found in a stack on the rack above the sink) over the kapton, and smooth until flat. It may help to lay the mylar film down at a 45-degree angle with respect to the kapton.

6.6.11. Replace the "O"-rings in their grooves. Mate the face plate to the channel plate, being sure to use the proper orientation on XRFA 1 and 2 (the hose connections should lay over the elongated part of the channel). Check the base plate for the "up" or "down" marking. Lay the channel plate down on the base plate with the proper orientation (the axis of the hose connections should be aligned with the "up" marker). Be careful not to rotate or slide the plastic film when positioning the channel plate.

6.6.12. Clamp the plates together using the round-head screws. After starting each of the screws, it may be necessary to tap on the face plate with the butt of the screwdriver to achieve a proper seat in its well. Hold the plate firmly in place during this operation, to prevent wrinkling of the plastic film. Continue tightening the screws. When compression of the "O"-ring is clearly visible through the face plate, switch to a six-pointed star rotation as you gradually finish seating the screws. This prevents cracking of the face plate.

6.6.13. Put gloves back on. Remount the flow cell, reversing the steps outlined in 6.6.6 and 6.6.7.

6.6.14. If XRFA2 was turned off, restore power, but not voltage. Restore power to XRFA1 and XRFA3 controllers. If power will not come on, check the positioning of the microswitches. The voltage for XRFA2 will have to be readjusted to the operating value. Pause when the voltage reaches 38 on the digital readout. After 30 seconds or so, complete the adjustment to 45. The pause is to prevent sparking of the x-ray generator; if sparking occurs, reduce the voltage back down to 38 and repeat readjustment to 45 at a slower rate.

6.6.15. If maintenance is complete, open the valve between the cyclonic separator and macerator. Start the macerator and the booster pump. Verify proper system flow. At the terminal, leave maintenance mode (step 6.1.10.1). Wait until the electronic failure light on sewer monitoring alarm panel clears and then reset the annunciator panel. Notify Fire Dispatch that maintenance is complete (step 6.1.10.2). In the maintenance log, note the time that the system was returned to normal operating conditions.

6.6.16. Clean up, washing off the sink and throwing refuse in the trash can. Rinse gloves with tap water, and dry with paper towels. Remove gloves and face shield.

6.7. PH AND FLOW CHART REPLACEMENT

Equipment Required:

Circular flow charts, 7-day
Circular pH charts, 7-day
Pen
Replacement chart pens

6.7.1. Replacement circular charts and chart pens must be ordered from offsite-suppliers. Pens for the pH recorder are available from Omega, part #CT-1000-red. For the flow recorder, order part #061-0003 from Enterra. The pH charts are also available from Omega, part #CT-1000C-100/7, and flow charts are available from Honeywell, part #24001661-001.

6.7.2. The pH circular charts are stored behind the sample refrigerator. Flow charts are kept on the electronics cabinet by the flow chart recorder. Before loading the new chart, write the date and approximate time (within five minutes) on its center.

6.7.3. To replace the flow chart, open the flow recorder cabinet. Lift the recorder pen from the chart. With the other hand, remove the chart. Put the new chart on the spindle. An alignment pin orients the chart to the correct time and day, as shown on the outside of the chart. If the chart orientation has drifted significantly, rotate the alignment pin so the chart records at the correct time. Close the cabinet.

6.7.4. To replace the pH chart, open the cabinet. Raise the pen using the "up" arrow control key at the upper left hand corner of the enclosure. Straighten the clamp on the spindle and swap the charts. Position the new chart to the correct time and date. Secure with the spring clamp and press the down arrow key to lower the pen into place. Close the cabinet. Squeeze at the hasp to latch the door.

6.7.5. If the chart trace is becoming faded, replace the chart pen. Follow the instructions outlined in 6.7.3 or 6.7.4 to pause the chart action. Then slip the old pen off of the stylus, and clip in a new pen. Spare pens are kept with the blank charts.

6.8. ON-LINE SAMPLE PUMP AND STILLING WELL MAINTENANCE

Equipment Required:

Face Shield (Stock catalog #4240-58220)
Keys to B196 Detector Room (WGMG or Maintenance Machinists)
Latex gloves (Stock catalog #8415-28311 to 13)
Paper towels (KayDry, stock catalog #7999-63447)
Ball-point Pen

6.8.1. Plant Engineering maintains the sampling pumps in the Sewer Diversion Facility.

6.8.2. Obtain latex gloves and face shield from the detector room. Turn on the air-gap water using the switch on the annunciator panel.

6.8.3. If the vault blower is not on, turn it on and allow to operate for a few minutes before entering the vault. Hazards Control has determined that, as long as the blower is operating, the vault does not qualify as a confined space. If the blower is broken, immediately contact the WGMG Environmental Technician to arrange for its repair. Maintenance cannot be performed unless the blower is operating.

6.8.4. Enter the vault. Don gloves and face shield. Using the clear water lance, flow purge the channel connecting the stilling well to the flume. This is accomplished by placing the lance in the stilling well, and directing the water jet through the channel. The channel is on the west side of the well, near the bottom.

6.8.5. Shut off the water, and remove gloves and face shield.

6.8.6. Exit the vault. Return gloves and face shield to the Detector Room. If the wash water is not required for any further maintenance, turn it off.

6.8.7. Adding water to the stilling well will artificially elevate the flow reading for a short period. Open the flow recorder cabinet and write the time and your initials on the flow chart above the current pen position, with the note "Stilling Well Cleaned."

6.8.8. In the maintenance log, put the date, time, and your initials, and list the maintenance performed.

6.9. INSPECTION OF EMERGENCY POWER GENERATOR

The emergency power generator is inspected and tested once each quarter by the Plant Engineering Maintenance and Operation (M/O) Electricians Main Shop (ext. 2-7751). This is performed under the Laboratory's Emergency Preparedness Program.

6.10. MACERATOR AND BOOSTER PUMP MAINTENANCE

Equipment Required:

Face Shield (Stock catalog #4240-58220)
Flat-blade screwdriver
Keys to B196 detector room (WGMG or Maintenance Machinists)
Lab coat or lab apron
Latex gloves (Stock catalog #8415-28311 to 13)
Maintenance log
Paper towels (KayDry, stock catalog #7999-63447)
Paper towels
Pen
Scrub brush
Adjustable wrench
Teflon tape

6.10.1. Disable the monitoring system (see Section 6.1.9) and don protective equipment (latex gloves and face shield, and optional lab). Turn on the air-gap wash water.

6.10.2. Shut off the macerator and booster pump. Close the valves between the cyclonic separator and the macerators.

6.10.3. Perform macerator maintenance. If needed, drawings can be found in the file drawer of the detector room desk.

6.10.3.1. Remove the eight bolts holding the cover plate onto the macerator cavity. Remove the cover plate.

6.10.3.2. Remove the macerator blade plate. Using a screwdriver or other implement, scrape the grease from the macerator cavity and the blade plate. When the bulk of the grease has been removed, use a scrub brush and water to complete the cleaning.

6.10.3.3. Re-install the blade plate and the cover plate.

6.10.4. Perform booster pump maintenance.

6.10.4.1. Remove the six cap screws that secure the pump cavity. Remove the end of the cavity.

6.10.4.2. Remove any hair or grease that has become lodged in the cavity or gears.

6.10.4.3. Close and secure the pump cavity.

6.10.4.4. If the cavity was packed with grease, disconnect the flow hoses. Remove and clean the pump fittings. Scrape the old teflon tape from the fittings with a scrub brush. Wrap with new tape and re-install.

6.10.5. If maintenance is complete, open the valve between the cyclonic separator and active macerator. Start the macerator and the booster pump. Notify Fire Dispatch that maintenance is complete (see Section 6.1.10).

6.10.6. Clean up, washing off the sink and throwing refuse in the trash can. Rinse gloves with tap water, and dry with paper towels. Remove gloves and face shield. If it is not needed for further maintenance, shut off the air-gap wash water.

6.11. UNINTERRUPTIBLE POWER SUPPLY (UPS) BATTERY CHECK

6.11.1. The battery check procedure is described in Section 6 of Reference 2, which is kept in the right-hand file of the desk in the Detector Room, in the "Uninterruptible Power Supply" folder. The test should be performed only by a qualified electrician. Contact the Plant Engineering Battery Shop to have the test performed.

6.11.2. If the battery test is failed, schedule the maintenance described in Section 6.12.

6.11.3. Enter the *date* on the battery maintenance plate on the UPS, in the space following the "Load Test Completed:" In the space following "Next Test Due:", put the date six months in the future.

6.12. REPLACING BATTERIES IN THE UNINTERRUPTIBLE POWER SUPPLY

6.12.1. Replacement of the UPS batteries is a hazardous operation and should only be performed by experienced personnel, or a qualified electrician. Qualified personnel include the Plant Engineering Battery Shop employees.

6.12.2. The FERRUPS requires four 12-volt batteries to operate. Replacement batteries can be ordered from Best Power Technology, at the address given in the manual (Reference 1) which is kept in the right-hand file of the desk in the Detector Room, in the "Uninterruptible Power Supply" folder.

6.12.3. The battery connection procedure is described in Reference 3, TIR104, "FERRUPS 2, 3 & 5KVA Internal Battery Connection," also kept in the "Uninterruptible Power Supply" folder (see Section 6.12.2 above).

6.12.4. After the batteries have been installed, perform the battery check described in Section 6.11.

6.12.5. When the battery check is completed, write the date on the maintenance history plate on the UPS, in the space following "Batteries Replaced:"

6.13. RESTOCKING OF CHLORINE DRUMS

Equipment Required:

5.25% sodium hypochlorite solution, Lab stock #6810-53325
Cole-Parmer Fluoroware fittings 6374-22 and 6367-13
Face Shield (Stock catalog #4240-58220)
Keys to B196 Detector Room (WGMG or Maintenance Machinists)
Lab coat
Latex gloves (Stock catalog #8415-28311 to 13)
Paper towels (KayDry, stock catalog #7999-63447)

6.13.1. Five labelled carboys are kept at B196 as a local supply of sodium hypochlorite (5.25%) solution (Clorox bleach). When four carboys are empty, they are refilled with 20 1-gallon containers of bleach. The bleach is store stock.

6.13.2. When the carboy in use is empty, turn off the feed pump (black persaltic pump by the cyclonic separator). Don gloves, face shield and lab coat. Swap the cap and feed line on the empty carboy with the cap on a full carboy. Reposition the carboys so that the feed line does not fall across the floor.

6.13.3. Inspect the fittings on the chlorine line. Replace when leakage is evident.

6.13.4. Turn on the feed pump.

6.13.5. Remove face shield and lab coat. Wash gloves, and dry with paper wipes.

6.14. CLEANING OF COMPOSITE SAMPLE REFRIGERATOR

Equipment Required:

500 mL polyethylene sample bottle
Face Shield (Stock catalog #4240-58220)
Keys to B196 Detector Room (WGMG or Maintenance Machinists)
Latex gloves (Stock catalog #8415-28311 to 13)
Paper towels (KayDry, stock catalog #7999-63447)
Pine oil (Stock catalog #6840-13789)
Scrub brush
Size 18 silicone tubing (Cole-Parmer Masterflex#6411-18)

6.14.1. Don gloves and face shield.

6.14.2. Obtain a 500-mL sample bottle from the grey stock cabinet. Remove the sample carboy and place the fill tube in the sample bottle.

6.14.3. Wash the inside of the refrigerator with water and pine oil. Rinse the soap and dirt down the floor drain.

6.14.4. Remove the sample bottle and re-install the composite sample.

6.14.5. Empty the sample bottle in the sink and discard in the trash. Wash down the sink. Rinse gloves with tap water, and dry with paper towels. Remove gloves and face shield.

6.14.6. Examine the peristaltic pump tubing. If any clog, discoloration, or leakage is evident, replace with 2' of size 18 silicone tubing.

6.15. REPAIR OF NUCLEAR DATA ANALYSIS EQUIPMENT

6.15.1. Failures of any of the real-time analysis equipment will generally result in hardware alarms or false contamination alarms. Should the WGMG Environmental Analysts determine that equipment failures are occurring, they shall contact the Canberra Nuclear Products Group to arrange a service call. Canberra can be reached at (510) 455-9940. The current contact is John Grasseschi. The contact will have to be called in at the East Badge Office.

6.15.2. The contract provides 72-hour response time. The equipment covered is listed in Attachment A.

7. DOCUMENTATION

7.1. Any maintenance that requires placing the monitoring system in clean/calibrate mode must be documented by an entry in the maintenance log.

7.2. As described in Sections 6.1.9-11, all maintenance operations will be recorded on the alarm printout through use of the maintenance menu program on the maintenance terminal.

8. ACCEPTANCE CRITERIA

All sewer maintenance must be performed according to the specified schedule and procedures.

9. ATTACHMENTS

Attachment A: Terms of the Canberra Nuclear Products Group sewer monitoring service contract.

Attachment A: Terms of the Canberra Nuclear Products Division
Sewer Monitoring Service Contract

CUSTOMER: UNIVERSITY OF CALIFORNIA
LAWRENCE LIVERMORE NATIONAL LABORATORY
P.O. BOX 808 L-386
LIVERMORE, CA 94550

USER: MR. DUANE RUEPPEL 415-422-5223

SYSTEM: ND9900 (96-2879)

CONTRACT: N569 TYPE: BASIC

PART # DESCRIPTION

88-0755 ND9900-T GENIE 86-0074
88-0783 ND 360 HVPS (QTY 2)
88-0717 NIM LOGIC POWER SUPPLY (QTY 2)
88-0596 ND 575 ADC 76-2374
88-0596 ND 575 ADC 76-2375
88-0596 ND 575 ADC 76-2376
88-0596 ND 575 ADC 76-2379
86-1734 TK70 TAPE DRIVE
86-1507 PARRALLEL PRINTER 80 COLUMN
70-2906 ND-VDR 342-150
70-2905 ND-DSS 340-121
70-2904 ND-PKP 341-145
70-2849 ND-ACQH-A 310-098
70-2652 DRV-11
63-0388 DHQ-11
63-0372 8 MB MEMORY EXPANSION
63-0371 4 MB MEMORY EXPANSION
63-0271 UDC-11
63-0270 KA630-AA CPU 1156HZ25
39-6169 160 MB WINCHESTER DRIVE (QTY 2)
39-6139 LOGICMOUSE C7-3S
TENNELEC TC244 AMP (QTY 2)
DYNA SYSTEMS 5 CHASSIS 12 SLOT
DEC GPX GRAPHICS DISPLAY SYSTEM
DATA TRANSLATION MODEL DT 2765-M
DETECTOR DIAGNOSTICS SERVICE

DETECTOR #1 PGT LS 33155 #1747
DETECTOR #2 PGT LS 33155 #1772
DETECTOR #3 PGT LS 33155 #1811
DETECTOR #4 GMX 25190-2 30-N40199A
DETECTOR #5 ORTEC 2535-11

SYSTEM: ALPHA (95-1008)

88-0763 ND 556 AIM
88-0775 ND 579 100 MHZ ADC, 16384 CHANNEL
88-0775 ND 579 100 MHZ ADC, 16384 CHANNEL
88-0775 ND 579 100 MHZ ADC, 16384 CHANNEL
31060 POWER SUPPLY 0-6 KV H.V.
2100 NIM BIN POWER SUPPLY
7401 ALPHA SPECTROMETER
7400-01 VACUUM PUMP 115 V 60HZ

Attachment A: Terms of the Canberra Nuclear Products Division
Sewer Monitoring Service Contract

Service Maintenance Contract

CUSTOMER _____
ADDRESS _____

TELEPHONE _____
CONTACT PERSON: _____
SYSTEM NO. _____

TERM _____ TO _____
AGREEMENT NO. _____
New _____ Renewal _____ Modification _____
TYPE OF CONTRACT: _____

SPECIAL CONDITIONS _____

This agreement is entered into between Canberra Industries, Inc. Nuclear Products Group (herein called Canberra Nuclear) and _____ (herein called customer), and it covers the items delineated in the system equipment list attached to this agreement. The initial term of this agreement shall be for one year terminated by either party at any time by giving written notice not less than 30 days prior to the effective date of such termination to the other party.

cover detector damage caused by contamination, warm-up or by neutrons or heavy charged particles. If service is required in Canberra Nuclear's opinion as a result of causes stated above, such repairs will be made at Canberra Nuclear's time and material call rates and terms then in effect. Equipment relocation, moving or reinstalling, and the installation of new accessories are not covered as a part of this agreement. Canberra Nuclear will provide labor and material required to perform these services at current rates.

1. Annual Contract Cost: \$ _____
Payment Terms: (select either a, b or c)
a. Monthly, Billing in Advance: \$ _____ /month
b. Monthly, Billing in Advance: \$ _____ /month
c. Quarterly, Billing in Advance: \$ _____ /quarter

5. Canberra Nuclear shall have complete and free access to the equipment when providing service called for in this agreement. Security escort or clearances are the responsibility of the customer.

Advance billing for annual contract will equal the sum of four (4) quarterly payments.

6. This service does not contain any provision for state or local taxes except as specifically set forth. It is understood and agreed that if any state and/or local jurisdiction requires and/or assesses Canberra Nuclear for any taxes, however designated, levied or based on, relating to, or as a result of the work to be performed in accordance with this agreement, then the customer agrees that such taxes will be in addition to the agreed price for any services and/or material furnished or provided by Canberra Nuclear and will be paid promptly by the customer upon receipt of an invoice from Canberra Nuclear.

2. Canberra Nuclear will provide all parts, labor and travel expenses necessary to keep the equipment in the same good operating conditions it was in when the contract went into effect. Spare or replacement parts are provided on an exchange basis. Canberra Nuclear will schedule mutually convenient preventive maintenance visits on the equipment covered by this agreement. Canberra Nuclear will also provide emergency service within the specified number of days covered by this agreement. All labor will be provided during the normal business hours of 9:00 a.m. to 5:00 p.m., Monday through Friday, excluding holidays, unless otherwise agreed upon in writing. Response times are based on service requests made during normal business hours or the next working day following a request made outside of normal business hours.

7. This agreement is the entire agreement between the parties and supersedes and cancels all prior oral or written agreements between the parties covering the subject matter of this agreement. No term or provision of this agreement will be modified except in writing and signed by both parties.

3. Unless the period of coverage begins immediately upon expiration of a similar maintenance agreement, or at the end of the warranty period, Canberra Nuclear will require an inspection of the equipment by our field service engineer. All labor, materials and travel expenses incurred during this visit will be billed at our standard rates.

8. This agreement shall be governed by the laws of the State of Connecticut.

FOR: CUSTOMER

BY: _____
TITLE: _____
DATE: _____

FOR: CANBERRA NUCLEAR

BY: _____
TITLE: _____
DATE: _____

Direct service is contingent upon the proper use of all equipment. It does not cover: (1) equipment which has been subjected to unusual physical or electrical stress; (2) damage due to accident, neglect, misuse, electrical storms, air conditioning, humidity control, failure of specified manufacturer, transportation, or causes other than ordinary use; (3) equipment maintained (other than preventive maintenance, i.e., cleaning fan filters, need cleaning, changing ribbons, etc.), modified, repaired, or repair attempted by other than Canberra Nuclear personnel without the prior approval of Canberra Nuclear; or (4) equipment removed from service at initial installation. This agreement does not

Please sign and return one copy. The second copy is for your records

Attachment A: Terms of the Canberra Nuclear Products Division
Sewer Monitoring Service Contract

Service Maintenance Contracts

HARDWARE MAINTENANCE CONTRACT OPTIONS

(A) BASIC

- 72 Hour On-site Response Time
- Monday – Friday
- Preventative Maintenance Visits (2 per year)
- Unlimited Telephone Support
- Unlimited Replacement Parts
- Unlimited Emergency Visits

(B) ADVANCED

- 48 Hour On-site Response Time
- Monday – Friday
- Preventative Maintenance Visits (2 per year)
- Unlimited Telephone Support
- Unlimited Replacement Parts
- Unlimited Emergency Visits

(C) CRITICAL

- 24 Hour On-site Response Time
- Monday – Friday
- Preventative Maintenance Visits (4 per year)
- Unlimited Telephone Support
- Unlimited Replacement Parts
- Unlimited Emergency Visits

(D) SUPER CRITICAL

- 24 Hour On-site Response Time
- Preventative Maintenance Visits (4 per year)
- Unlimited Telephone Support
- Unlimited Replacement Parts
- Unlimited Emergency Visits
- 7 Days Per Week Coverage

- NOTES:
1. Contracts offered are designed to meet the requirements of the majority of service maintenance customers. All contracts may be customized to meet special requirements or conditions.
 2. Response times for standard contracts is Monday to Friday, 8:00 a.m. to 5:00 p.m., excluding Holidays.
 3. All items on accompanying equipment list followed by an asterisk (*) are covered on a return-to-factory repair basis only.
 4. Detectors are only covered if itemized on the equipment list.

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EMP-SW-SAS

SATELLITE SEWER STATIONS ALARM SAMPLING

Prepared by: Brian Balke 4/5/93
 Brian Balke
 Environmental Analyst, WGMG
 date

Reviewed by: Paul Dickinson 4/6/93
 Paul Dickinson
 Environmental Technician, TSG
 date

Renee Needens 4-6-93
 Renee Needens
 Environmental Technician, TSG
 date

Approved by: William G. Hoppes 4/7/93
 William G. Hoppes
 Group Leader, WGMG
 date

Rebecca A. Failor 4/7/93
 Rebecca A. Failor
 Section Leader, EMS
 date

Lucinda M. Garcia 4/7/93
 Lucinda M. Garcia
 Quality Assurance Coordinator, EMS
 date

**LLNL ENVIRONMENTAL
 MONITORING SECTION
 UNCONTROLLED COPY
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1. PURPOSE

If a release of unacceptable material is detected at the B196 Sewer Monitoring Station (see References 1 and 2), samples that are saved in the satellite stations can be analyzed to determine the approximate time and location of the release. This procedure describes sampling at the satellite monitoring stations when responding to an alarm.

2. DISCUSSION

Ten satellite sewer monitoring stations, situated to isolate the drainage zones of the LLNL sewer system, are used to trace the inadvertent introduction of contaminants into LLNL wastewater (see Attachment A for locations of satellite monitoring stations). Each satellite sewer monitoring station is equipped with a Manning 6900 Stationary Priority Contaminant Sampler, which is housed in a weatherproof, locked shelter, measuring approximately 5 ft by 5 ft by 6 ft.

If the continuous sewer monitoring equipment at Building 196 detects the presence of contaminants in LLNL sewage, the WGMG analyst responsible for assessing the alarm (Reference 1) will, if necessary, require that samples from the satellite stations be submitted for analysis to aid in determining the time and place at which the release occurred. Since sewage may take as long as three hours to travel from the point of release to B196, quite often the bottle currently being filled at a satellite station is not the bottle that should be submitted for analysis. This document outlines the procedure for acquiring the proper spill traceback sample.

A Manning 6900 Installation and Operation Manual (Reference 3) is stored at each satellite station for maintenance and informational purposes. Routine operation of the samplers is covered in Reference 3.

3. REFERENCES

1. EMP-SW-AR, *Sewer Alarm Response*
2. EMP-SW-SID, *Sewer Spill Source Identification*
3. Manning Technology INC., *Operation and Service Manual for the S-6000 Sampler*
4. EMP-SW-SSM, *Satellite Sewer Station Maintenance*

4. DEFINITIONS

Bottle Stay: When the sample bottles are hanging from the bottle plate, this large rubber O-ring pulls the bottle bodies into a compact bundle.

Bottle Plate: Plate with 24 mounting holes for positioning the 1,000 mL sample bottles relative to the distribution assembly, which is located by two guide plates on the top of the plate.

Distribution Assembly: Consists of transparent measuring chamber with a scale (in milliliters) for reading the sample volume; a sensor for determining when the measuring chamber is filled to the desired volume; and a rotating filler spout that sequences the sample stream to the sample bottles. During operation, the distribution assembly rests on the bottle plate. During sampling or maintenance, it is lifted away, and set on the brackets at the top of the refrigerator.

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Ordinal date: Five digit date identifier. The first three digits count the number of days in the year, the last two digits are the year itself.

Refrigerator Subassembly: A refrigerated area containing a bottle rack with 24 sample bottles (1,000 mL each) and the distribution assembly.

Reserve Bottles: Last two filled bottles in the rack. Because there is a delay between sampling at a station and monitoring at B196, these bottles are set aside to allow trace-back of spills that passed the satellite station just before maintenance was started.

Rotating Filler Spout: Channels the sample to the proper bottle.

Slide rack: Frame to support the bottle plate when it is pulled out of the refrigerator. The weight of the sample plate is supported by a triangular brace that rests against the lower inside edge of the refrigerator cabinet.

5. RESPONSIBILITIES

5.1 EMS SEWER ALARM RESPONDER

The Analyst that responds to the sewer alarm, either the Effluent Monitoring Group (WGMG) Environmental Analyst or other EMS personnel, coordinates acquisition of alarm samples from the satellite stations, specifying the identification of locations and sampling times for the bottles to be collected.

5.2 WGMG ENVIRONMENTAL ANALYST

The Analyst is responsible for archival of the records generated during satellite stations sampling activities (Section 7).

5.3 TSG ENVIRONMENTAL TECHNICIAN

The TSG Environmental Technician is responsible for collection of the satellite station samples.

5.4 WGMG GROUP LEADER

The Group Leader assures that sampling procedures meet design criteria and that sampling is conducted in accordance with approved procedures.

5.5 EMS SECTION LEADER

The EMS Section Leader ensures that sampling procedures meet and conform to the appropriate regulatory guidance.

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6. PROCEDURE

Equipment Required:

Disposable gloves (Stock catalog #8415-41576 and 77)
 Extra 1,000 mL sampling bottles for the 6900 Sampler (TN Technologies part #889117).
 Face shield (Stock catalog #4240-58220)
 Kay-drys (Stock catalog #7999-63447).
 Latex gloves (Stock catalog #8415-28311 to 13).
 Radioactivity Sampling Record Sheet (Stock catalog #7600-69183)
 Sewage sample Chain-of-Custody record forms.
 Sharpie or ink pen.
 Yellow tags with string attached (Stock catalog #8135-27985).

While performing maintenance or collecting samples from satellite sewer stations, long latex gloves and a face shield must be worn to minimize exposure to sewage. In addition, to prevent possible sample contamination, disposal gloves should be worn over the latex gloves. Take special precautions to prevent contamination of the sample and/or sampling equipment. Place sample bottles only on clean surfaces, inside of the satellite station enclosure. Gloves should not be taken from one satellite station to another.

6.1. SAMPLE ACQUISITION

6.1.1. If a sewer alarm occurs (Reference 1), WGMG Analysts may require, as part of the discharge investigation, that TSG Technicians assist in collecting samples from the satellite stations.

6.1.2. The analyst will use a source locator map, the type and time of alarm, and sewage flow rates before and during the alarm to determine at which station(s) samples should be collected (Reference 2).

6.1.3. The analyst will provide the TSG technicians with the time frame for which samples should be acquired at each satellite station (Reference 2). Instructions will also be provided regarding the order in which the stations should be sampled, and on any precautions or special handling to be observed in the sampling procedure.

6.1.4. Gather the field equipment listed at the beginning of the procedure.

6.1.5. Upon arrival at a satellite station, consult the maintenance log to determine the date and time that the satellite station was last serviced. This corresponds to the time that the sample bottle labeled "START" was first filled.

6.1.6. Using the controller keypad in the upper assembly, press the "RESET" key twice to pause sampler operation.

6.1.7. Open the door on lower (refrigerator) assembly. Put on long latex gloves, disposable gloves, and plastic face shield. Lift the sample distribution assembly off of the bottle plate, and set it on the brackets at the top of the refrigerator. Take care not to move the sampling arm, because this would disrupt the bottle fill sequence.

6.1.8. Attach bottle plate slide rack to the two pins at the front of the refrigerator. Set the foot of the slide rack on the lower inside edge of the refrigerator housing. Pull the bottle plate forward onto the slide rack.

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6.1.9. Determine the time at which each bottle was first filled by referring to the time at which the sampling was started. For each successive bottle after the "START" bottle, two hours (Monday morning through Friday morning) or four hours (during weekend sampling, from Friday morning to Monday morning) should be added to the time to determine when the bottle was first filled. Identify the bottles that were filled during the time period specified by the analyst. If the time period began prior to the last maintenance, the reserve bottles at the bottom of the refrigerator must be collected.

6.1.10. After identifying the bottle(s) to be removed for analysis, secure each of these bottles with a cap. Remove the bottle stay and remove the capped bottle(s) from the bottle plate.

6.1.11. Fill out a yellow tag with the following information: station LD., time period and date that the sample represents, sampler's initials, current time and date, and the materials for which analysis is required (see Attachment B).

6.1.12. Attach the yellow tag to the bottle neck using the string supplied with each tag.

6.1.13. Put replacement bottle(s) in the bottle plate and replace the bottle stay. Slide the bottle plate back into the refrigerator. Remove the slide rack, and restore the distribution assembly to its operating location on the bottle plate.

6.1.14. Using the controller keypad in the upper assembly, restart the sampler.

6.1.14.1. Press the TIME button. Enter 00:15 hours Monday through Friday, 00:30 hours Friday through Monday. Press the ENTER button.

6.1.14.2. Press the MULTI SAMPLE button. Enter 08. Press the ENTER button.

6.1.14.3. Press the START button and then the TEST CYCLE button; a sample should be taken automatically. Check for proper functioning of the sampler. Proper functioning means that the:

- Sample filler spout advances.
- Sampler purges intake line with pressurized air.
- Pinch valve closes.
- Measuring chamber fills to the correct volume (50 mL).
- Sample is dispensed to the sample bottle.

If there is a malfunction, switch off the sampler power and contact the WGMG Environmental Analyst or TSG Environmental Technician to initiate repairs.

6.1.15. Secure the sampler. Place disposable gloves in the garbage, and remove and store the long gloves and face shield.

6.1.16. In the logbook, enter the date, time, sampler's initials, and bottle(s) removed from the satellite station (use the sampling period to identify the bottles).

6.1.17. Close and lock the shelter.

6.1.18. Repeat steps 6.1.5 through 6.1.17 at each targeted satellite station.

6.1.19. Responding technicians must report to the analyst upon completion of sampling for further instructions on handling of samples or additional samples that must be collected.

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6.2. SAMPLE ALLOCATION

6.2.1. During normal working hours, take all samples, along with the COC form (Attachment C), to the Hazard Control Analytical Laboratory (HCAL, Room 1734, Building 253).

6.2.1.1. If two or more bottles are collected at a station (e.g., location M177 in the example), the sample number should be ordered according to time, with the earliest sample taking number "1."

6.2.1.2. In order to facilitate correlation of the sample identifiers to time period during which the sample was collected, the sample time (sample interval for the bottle) should be written in the "Analysis requested" section of the COC. The "remarks" section should be left blank, because the Hazards Control sample tracking number must be written in that space.

6.2.1.3. On the last two lines of the COC, request analysis of the LLNL (B196) and SNLL composite samples. If the release occurred prior to 6:00 AM, look up the ordinal date for the day of the release. If the release occurred after 6:00 AM, look up the ordinal date for the day following the release. Enter as the "Date" for the B196 and SNLL composite samples.

6.2.1.4. The COC should be clearly marked "RUSH", and the HCAL staff should also be notified verbally of the need for rapid attention to the samples. The HCAL Laboratory also requires that sample logs and analysis tracking forms be filled out. HCAL personnel can provide assistance or training concerning this documentation.

6.2.2. For gross alpha/beta analysis, an HC Radiation Sampling Record Sheet must also be prepared (Attachment D).

7. DOCUMENTATION/QA RECORDS

7.1. EMS COC forms must be completed just prior to releasing samples to Hazards Control. Attachment C shows a sample COC form. Check with the WGMG Environmental Analyst regarding which analyses are to be performed.

7.2. If gross alpha/beta analysis is requested, a Hazards Control Radiation Sampling Record form must be submitted with the sample. See Attachment D.

7.3. Field logbooks shall be used to note all sampling activities. The notes should include (at a minimum) sample location, date and time sampled, identity of the sampler, and any difficulties or special circumstances.

7.4. The Environmental Analyst will specify archival practices for this information.

8. ACCEPTANCE CRITERIA

8.1. Samples will not be deemed acceptable if the COC has been broken or compromised.

8.2. Samples will not be deemed acceptable if the documentation (COC form and, as applicable, the HC Radioactivity Sampling Record) is not correctly completed.

8.3. Samples will not be deemed acceptable if bottles are not properly labeled, dated, and initialed by the sample collector.

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9. ATTACHMENTS

Attachment A: Locations of LLNL Sewer Satellite Monitoring Stations

Attachment B: Example Yellow Tag for Sample Bottles

Attachment C: COC Form for Samples Submitted to Hazards Control

Attachment D: Radioactivity Sampling Record Sheet for Gross Alpha/Beta Analysis

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Attachment A: Locations of LLNL Satellite Sewer Monitoring Stations

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FINAL	Satellite Sewer Station Alarm Sampling	Page 9 of 11

Attachment B: Example Yellow Tag for Sample Bottles

Satellite Station ID

(TF) 01/05/90, 11:00 a.m - 2:00 p.m.

Current date: 01/05/91
Current time: 4:35 p.m.
Sampler: TU
Analyte: Tritium

REVISION 1

FINAL

EMP-SW-SAS
Satellite Sewer Station Alarm
Sampling

Effective date: 04/15/93

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Attachment C: COC Form for Samples Submitted to Hazards Control

Chain-of-Custody Record

Laboratory: HCAL / B253		Project Name: Analyst: Brian Balke / WGMQ		Sample Identifier:		Date		Number of containers		Cr		An: s Requested		REMARKS	
site	location	number	media												
L - M40	-	01	- SW			11/10/90		1		X				0800 to 1000	This space is reserved for Hazards Control sample tracking numbers.
L - M40	-	02	- SW			11/10/90		1		X				1000 to 1200	
L - M51	-	01	- SW			11/10/90		1		X				1030 to 1230	
L - M53	-	01	- SW			11/10/90		1		X				1040 to 1240	
L - M59	-	01	- SW			11/10/90		1		X				1050 to 1250	
L - M66	-	01	- SW			11/10/90		1		X				1020 to 1220	
L - M125	-	01	- SW			11/10/90		1		X				1100 to 1300	
L - M177	-	01	- SW			11/10/90		1		X				0730 to 0930	
L - M177	-	02	- SW			11/10/90		1		X				0930 to 1130	
L - M185	-	01	- SW			11/10/90		1		X				0745 to 0945	
L - M185	-	02	- SW			11/10/90		1		X				0945 to 1145	
L - M201	-	01	- SW			11/10/90		1		X				0815 to 1015	
L - M231	-	02	- SW			11/10/90		1		X				1015 to 1215	
L - B196	-	01	- SW			31590		1		X					
L - SNEL	-	01	- SW			31590		1		X					
Relinquished by Sampler:		Date/Time	Received by Courier:		Date/Time		Data relinquished from Lab by:		Date/Time		Data received by EMG analyst:				
Relinquished by Courier:		Date/Time	Received for Laboratory by:		Date/Time		Data relinquished by EMG Analyst:		Date/Time		Received by Data Manager:				
		Date/Time			Date/Time		Data relinquished by Data Manager:		Date/Time		Data received by Archivist:				
		Date/Time			Date/Time		Archived by:		Date/Time		Archive Number:				

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 Canary: Laboratory (send with data and other copies to Analyst; returned to Laboratory for their files by Analyst after data receipt and signature)
 Green: Analyst (keep for files; white to Archivist w/ data).
 White: Archivist (archive w/ data; send photocopies of completed white to Analyst, QA Coordinator)

Attachment D: Radioactivity Sampling Record Sheet for Gross Alpha/Beta Analysis

[illegible]

EMP-SW-SNLL

SEWAGE SAMPLING AT SNLL

Prepared by:

Brian Balke

4/6/93

Brian Balke
Environmental Analyst, WGMG

date

Reviewed by:

Paul Dickinson

4/7/93

Paul Dickinson
Environmental Technician, TSG

date

Renee Needens

4/7/93

Renee Needens
Environmental Technician, TSG

date

Approved by:

William G. Hoppes

4/7/93

William G. Hoppes
Group Leader, WGMG

date

Rebecca A. Failor

4/7/93

Rebecca A. Failor
Section Leader, EMS

date

Lucinda M. Garcia

4/7/93

Lucinda M. Garcia
Quality Assurance Coordinator, EMS

date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes sampling activities at the Satellite Sewer-Monitoring Station 163A, where effluent from SNLL enters the LLNL sewerage.

2. APPLICABILITY/DISCUSSION

To obtain a complete determination of the impact of LLNL's waste-water discharge practices, an accurate characterization of discharges from SNLL is necessary (Reference 1). For this purpose, a composite sampler (Reference 2) at manhole 163A samples SNLL sewage at the point of entry to the LLNL sewerage. Although these time-proportional samples do not allow an absolute determination of the composition of SNLL sewer flow, they will reflect any anomalous conditions that might occur. Because SNLL independently acquires flow-proportional samples, LLNL Environmental Analysts can then obtain more detailed information from SNLL.

The sample stream collected by LLNL allows an adequate characterization of all of the potential contaminants of concern, which include metals, tritium, and gross radiation.

On all weekdays, including holidays, the Environmental Technician performs the sampling procedures described herein.

3. REFERENCES

1. EMP-SW-OP, *Sewer Monitoring Operations*
2. TN Technologies Inc., *Installation and Operation Manual for the 6900 Stationary Priority Contaminant Sampler*
3. EMP-QA-NCR, *Nonconformance Reports*
4. EMP-SW-SSM, *Satellite Station Maintenance*

4. DEFINITIONS

Manning 6900 Sampler: Time-proportional sampling unit installed at Satellite Sewer Monitoring Station 163A, where SNLL sewage enters the LLNL sewer system. See Reference 2 for operating and service instructions.

Ordinal date: Five-digit date identifier, of which the first three digits count the number of days in the year and the last two digits are the year itself.

5. RESPONSIBILITIES

5.1. WGMG ENVIRONMENTAL ANALYST

The Environmental Analyst determines the schedule for the sampling program, and identifies the laboratories that will perform the required analyses. The Analyst makes sure an Environmental Technician is available to perform the sampling on a holiday; if no technician is available, the Analyst writes a nonconformance report (Reference 3).

5.2. TSG ENVIRONMENTAL TECHNICIAN

The Environmental Technician performs the sampling procedures described in section 6.1 and makes sure that missed samples and equipment are documented with an EMS Nonconformance Report (see Reference 3). The Technician is responsible for preparing sample bottles with labels and storing them at Satellite Station 163A (see Section 7).

Delivery of samples to the Hazards Control Analytical Laboratory (HCAL) personnel is also the responsibility of the TSG Environmental Technician.

5.3. HAZARDS CONTROL ANALYTICAL CHEMIST

The Analytical Chemist is responsible for completing Chain-of-Custody Record (COC) forms to cross-reference EMS samples with sample tracking IDs used by the HCAL.

5.4. EMS SECTION LEADER

The EMS Section Leader is responsible for assuring that sufficient resources are allocated to allow sewage sampling at SNLL.

5.5. WCMG GROUP LEADER

The Group Leader assures that sampling procedures meet design criteria and that sampling is conducted in accordance with approved procedures.

6. PROCEDURE

Note: Occasional failures of the sampling equipment, or mishaps in the handling of samples, can result in the exposure of personnel to raw sewage. According to Hazards Control Industrial Hygienists, exposure to sewage is not a significant health hazard if reasonable hygienic steps are taken. When performing the procedures described below, gloves and other personal protective equipment should be worn. Exposed personnel should wash with disinfectant soap (Phisoex soap, kept in Satellite Station 163A). If clothes become soaked with sewage, personnel should shower and change into clean clothing, and the soiled clothing should be washed as soon as possible.

6.1. PREOPERATION CHECKS AND PROGRAMMING

Equipment Required:

Face Shield (Stock catalog #4240-58220)
Latex gloves, disposable (Stock catalog #8415-28311 to 13)
Latex gloves, long (Stock catalog #8415-41576 and 77)

6.1.1. Prior to standard operation of the 6900 Sampler, preoperation checks and tests are to be performed using the procedures in Reference 2, pages 1-1 through 1-16.

6.1.2. The configuration and program parameters for the sampler will be established by the Environmental Analyst.

6.1.2.1. The configuration parameters are described on page 2-8 and 2-9 of Reference 2. The settings should be:

- 6.1.2.1.1. OP = 1
- 6.1.2.1.2. PLEP = 1
- 6.1.2.1.3. PH0 = 6
- 6.1.2.1.4. PH1 = 150
- 6.1.2.1.5. PH2 = 20
- 6.1.2.1.6. PH3 = 8
- 6.1.2.1.7. PHLL = 1
- 6.1.2.1.8. PE = 1
- 6.1.2.1.9. PL = 2
- 6.1.2.1.10. PPPP=0000

6.1.2.2. The program parameter should be instituted as follows.

- 6.1.2.2.1. Press the TIME button.

6.1.2.2.2. Enter 00:15 hours.

6.1.3. The sample volume should be adjusted from 30 to 50 mL. Follow the procedure on page 1-17 of Reference 2. The sampler is manufacturer designed for a 100 mL minimum sample. Therefore, to achieve a smaller sample volume, the outer sleeve of the purge tube must be pulled down 0.25" from the top of the chamber (in violation of step 2 on page 1-17) and the sleeve must be rotated so that the slit in the slit tube is completely covered. After the sampler is re-assembled, a sample should be taken to confirm the sample volume; the maximum allowable sample volume is 50 mL.

6.2. SATELLITE STATION 163A DAILY COMPOSITE SAMPLING

Equipment Required:

500-mL polyethylene bottles (Stock catalog #8125-42044)
Face Shield (Stock catalog #4240-58220)
Field logbook
Indelible ink marker
Keys to B196 sampling room
Latex gloves, disposable (Stock catalog #8415-28311 to 13)
Latex gloves, long (Stock catalog #8415-41576 and 77)
Manhole hook (available from the Pipe Shop)
Pine oil (Stock catalog #6840-13789)
Radioactivity Sampling Record Sheets (Stock catalog #7600-69183)

6.2.1. The satellite station is located near the southwest corner of B111 in a green area. See Attachment A of Reference 4. The associated manhole, 163A, is located in the red area parking lot A -1. Unlock the shelter. Gloves and labeled sample bottles will be found in the station, along with an indelible ink marker. Two 500-mL sample bottles are filled each day with composite from the five gallon carboy, except on Wednesdays, when three bottles are filled. The extra sample is a duplicate for QA of the radiation analysis.

6.2.2. Enter the date and time in the field logbook. Under "Reason for Visit," put "Daily Sampling," and initial the line in the last column.

6.2.3. Using the indelible marker, label each bottle with the time, the ordinal date, the location ("SS163A"), and the sampler's initials. Put on the face shield, long latex gloves and then a pair of disposable gloves. The long latex gloves prevent exposure of the wrists to splashing sewage, while the disposable gloves prevent day-to-day cross-contamination of samples.

6.2.4. Switch the ON/OFF toggle switch of the 6900 Stationary Priority Contaminant Sampler to the OFF position.

6.2.5. Open the refrigerator door. Without disturbing the carboy lid's sample feed tube and overflow protection electrodes, remove the lid and rest on the refrigerator shelf. Lift the carboy containing the composite sample off of the plastic tray and then place the carboy on the floor inside the shelter. Using the volume scale on the carboy, determine the composite volume. Record the composite volume in the field logbook.

6.2.6. Swirl the contents of the carboy to homogenize the sample, and fill the first sample bottle. The bottle must be filled to within a half-inch of its top and must then be capped.

6.2.7. Repeat 6.2.6 for the remaining two or three sample bottles.

6.2.8. Pour the remainder of the composite sample down the floor drain. Using water from the hose, rinse the carboy thoroughly, pouring the rinse water down the drain. Rinse the outside of the sample bottles. Spray with pine oil and then rinse with the hose water the

interior of the refrigerator and the shelter floor. Restore the empty carboy to its position in the sampler and replace the carboy lid on the carboy.

6.2.9. Remove disposable gloves and place in the trash can. Rinse long gloves and dry with paper towels. Place paper towels in the trash can. Remove long gloves and face shield. Dry the outside of the sample bottles; place paper towels in the trash can.

6.2.10. Use the ON/OFF toggle switch to turn the sampler power on. Press the START button and then the TEST CYCLE button; a sample should be taken automatically. Check for proper functioning of the sampler. Proper functioning means that the:

- Sampler purges intake line with pressurized air.
- Pinch valve closes.
- Measuring chamber fills, without bubbles, to the correct volume (30 to 50 mL).
- Sample is dispensed to the carboy.

If there is a malfunction, switch off the sampler power, follow steps 6.2.11 through 6.2.13, 6.2.15, 6.2.16 and then proceed to Section 6.4, Sampler Malfunction. If the sampler has successfully taken a sample, steps 6.2.11 through 6.2.14 must be completed in the next fifteen minutes before the sampler takes another sample.

6.2.11. Fill out the Hazards Control Radioactivity Sampling Record Sheet (RSRS). An example is taped to the wall of the sampling station and is reproduced here in Attachment A.

6.2.12. Put the bottles and the completed RSRS in a plastic bag. (This bag will need to be delivered to Hazards Control laboratory personnel during normal working hours and to the refrigerator in Room 200, B196 during off-shift hours.)

6.2.13. Close and lock the shelter.

6.2.14. Using the manhole hook, remove the 163A manhole cover. If direct contact with the sampling line will be necessary to clear debris from the sampling line, long latex gloves must be donned. Clear debris from sampling line. If long latex gloves were worn, they must be rinsed and dried. Replace the manhole cover.

6.2.15. The bag containing the sample bottles with the completed RSRS must be delivered directly: during normal working hours, the bag should be taken to Hazards Control (HC) laboratory personnel; during off-shift hours, the bag should be stored in the refrigerator in Room 200, B196.

6.2.16. If for any reason samples could not be obtained, indicate the reason on the Hazards Control RSRS and in the field logbook. During normal working hours, deliver the RSRS to the WGMG Environmental Analyst and during off-shift hours, place the RSRS in the refrigerator in Room 200, B196.

6.3. DISPOSITION OF SAMPLES

6.3.1. By 10 a.m. each normal workday, the TSG Environmental Technician must produce the daily samples and deliver them with a completed RSRS form to the HC laboratory personnel in Room 1734, B253. By 10 a.m. each normal workday, any off-shift samples and RSRS forms in the refrigerator in Room 200, B196, must be transferred by the Technician to the HC laboratory personnel in Room 1734, B253.

6.3.2. The TSG Environmental Technician will check the samples for breach of security (bag mutilated) and insufficient volume. If the samples are not acceptable, the TSG Environmental Technician will contact the WGMG Environmental Analyst to determine how the samples should be used and will prepare a Nonconformance Report to document the disposition of the samples.

With acceptable samples, normal use is the analysis of 25 mL for tritium, 350 mL for gross alpha/beta and deduction of 500 mL towards the creation a weekly composite. The four to five weekly composites generated in a month are analyzed for metals at the end of the month by the HCAL.

6.3.3. On the monthly COC, the TSG Environmental Technician signs the sample in and indicates the total number of sample bottles, as shown in Attachment B. Finally, the TSG

Environmental Technician enters the samples in the HCAL environmental sample logbook; questions in filling out the logbook should be addressed to the HCAL Analytic Chemist.

6.4. SAMPLER MALFUNCTION

If the sampler does not function properly following maintenance, the TSG Environmental Technician should initiate repairs. For repair help, see Chapter 3 of Reference 2 for troubleshooting and maintenance tips. The TN Technologies service department number and shipping instructions are in Appendix A of Reference 2.

7. DOCUMENTATION/QA RECORDS

7.1. Sample collection is documented by entries in a field logbook kept at Satellite Station 163A.

7.2. Labels must be properly completed and affixed to all sample bottles (see Section 7 of Reference 1 for details). The labels are prepared and attached to bottles by the TSG Environmental Technician, who is also responsible for monitoring the supply of bottles at the sampling locations. The labeled bottles are kept in a hanging bag in Satellite Station 163A.

7.3. Submission of daily samples to the HCAL is documented by properly completed RSRS (Attachment A), and by COC forms (Attachment B). At the beginning of the month, the TSG technician drafts and then transfers the COCs to the HCAL, where they are completed by the TSG Technician and the HCAL Analytic Chemist as described in Section 8 of Reference 1.

7.4. The HCAL Analytic Chemist also prepares a COC for the weekly composite metals analysis (Attachment C). This form cross-references the sample dates to the HCAL analysis tracking number. The blank COC should be delivered with the draft COCs of Section 7.3.

7.5. The Environmental Analyst is responsible for archival of the documents.

8. ACCEPTANCE CRITERIA

8.1. Samples will not be deemed acceptable if the chain of custody has been broken or compromised (see Section 8 of Reference 1).

8.2. Samples will not be deemed acceptable if documentation is not correctly completed.

8.3. Samples will not be deemed acceptable if bottles are not properly labeled, dated, and initialed by the sample collector.

9. ATTACHMENTS

Attachment A: Hazards Control Radioactivity Sampling Record Sheet

Attachment B: Daily Sample Chain-of-Custody Record Form

Attachment C: Weekly Metals Analysis Chain-of-Custody Record Form

Attachment B
Daily Sample Chain-of-Custody Record Form

Chain-of-Custody Record

Laboratory: Hazards Control / B253			Project Name/Analyst: EMG / Brian Balke			Analytes Requested			REMARKS
Sample Identifier:	Date	Number of containers	Alpha	Beta	Gamma	DA			
site - location - number - media									
L - 163A - 01 - SW	00192	3	X	X	X	X		(Hazards Control Sample Tracking Numbers are written here.)	
Previously location 083-163.	00292	2	X	X	X				
	00392	2	X	X	X				
	00492	2	X	X	X				
	00592	2	X	X	X				
	00692	2	X	X	X				
	00792	2	X	X	X				
	00892	3	X	X	X	X			
	00992	2	X	X	X				
	01092	2	X	X	X				
	01192	2	X	X	X				
	01292	2	X	X	X				
	01392	2	X	X	X				
	01492	2	X	X	X				
	01592	3	X	X	X	X			
	01692	2	X	X	X				
Relinquished by Sampler:	Date/Time	Received by Courier:	Date relinquished from Lab by:					Date received by EMG analyst:	
Relinquished by Courier:	Date/Time	Received for Laboratory by:	Date relinquished by EMG Analyst:					Date received by Data Manager:	
			Date relinquished by Data Manager:					Date received by Archivist:	
			Archived by:					Archive Number:	

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Goldend: Sampler (Return to analyst; other copies to courier w/ samples)
Pink: Courier (Return to analyst; other copies to Laboratory w/ samples)
Canary: Laboratory (send with data and other copies to Analyst; returned to Laboratory for their files by Analyst after data receipt and signature)
Green: Analyst (keep for files; white to Archivist w/ data)
White: Archivist (archive w/ data; send photocopies of completed white to Analyst, QA Coordinator)

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Attachment A
Hazards Control Radioactivity Sampling Record Sheet

11 (Your Name) _____
Health & Safety Tech Phone Ext _____ Radio Page _____

12 _____
Health Physicist is Notify _____

13 _____
Comments: On Wednesday do an extra sheet like this with "GC" in this space.

14 _____
15 _____
16 _____
17 _____
18 _____
19 _____
20 _____
21 _____
22 _____
23 _____
24 _____
25 _____
26 _____
27 _____
28 _____
29 _____
30 _____

HEALTH AND SAFETY TECHNICIAN			
Check One Only	Check One Only	Check One Only	Check One Only
Sample Type	Priority	Special ID	Special ID
1 X Liquid	1 Special	1 No Entry	1 No Entry
2 Solid	2 High	2 Contaminated	2 Contaminated
3 Gas	3 High	3 Contaminated	3 Contaminated
4 Other	4 High	4 Contaminated	4 Contaminated
5 Other	5 High	5 Contaminated	5 Contaminated
6 Other	6 High	6 Contaminated	6 Contaminated
7 Other	7 High	7 Contaminated	7 Contaminated
8 Other	8 High	8 Contaminated	8 Contaminated
9 Other	9 High	9 Contaminated	9 Contaminated
10 Other	10 High	10 Contaminated	10 Contaminated

17 _____
18 _____
19 _____
20 _____
21 _____
22 _____
23 _____
24 _____
25 _____
26 _____
27 _____
28 _____
29 _____
30 _____

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

HEALTH AND SAFETY TECHNICIAN			
Room No.	Sample ID	Sample Size	Sample ID
1-10	1-10	1-10	1-10
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10

1 2 3 4 5 6 7 8 9 10

Attachment C
Weekly Metals Analysis Chain-of-Custody Record Form

Chain-of-Custody Record

Laboratory		Hazardous Control Ind. Hyg. / B253		Project Name/Analyst:		Sample Identifier:		Date		Number of containers		Metals		Analytes Requested		REMARKS	
Site	Location	Number	Media	Date	Number of containers	Metals	Analytes Requested										
L	B198	208-21492	SW	21492		X											(Hazardous Control Sample Tracking numbers are written here)
L	B196	215-22192	SW	22192		X											
L	B196	222-22892	SW	22892		X											
L	B196	229-23592	SW	23592		X											
L	B198	236-24292	SW	24292		X											
		Previously location 093-07															
L	163A	208-21492	SW	21492		X											
L	163A	215-22192	SW	22192		X											
L	163A	222-22892	SW	22892		X											
L	163A	229-23592	SW	23592		X											
L	163A	236-24292	SW	24292		X											
		Previously location 093-183															
Informal laboratory composites of daily samples.																	
Relinquished by Sampler:		Date/Time	Received by Courier:		Date/Time		Received for Laboratory by:		Date/Time		Relinquished from Lab by:		Date/Time		Data received by EMG analyst:		
Relinquished by Courier:		Date/Time	Received for Laboratory by:		Date/Time		Received by Data Manager:		Date/Time		Data relinquished by EMG Analyst:		Date/Time		Received by Data Manager:		
											Data relinquished by Data Manager:		Date/Time		Data received by Archivist:		
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Canary: Laboratory (send with data and other copies to Analyst; returned to Laboratory for their files by Analyst after data receipt and signature)
Green: Analyst (keep for files; white to Archivist w/ data)
White: Archivist (archive w/ data; send photocopies of completed white to Analyst, QA Coordinator)

EMP-SW-SSM

SATELLITE STATION MAINTENANCE

Prepared by:

Brian Balke

4/5/93

Brian Balke
Environmental Analyst, WGMG

date

Reviewed by:

Paul Dickinson

4/6/93

Paul Dickinson
Environmental Technician, TSG

date

Renee Needens

4-6-93

Renee Needens
Environmental Technician, TSG

date

Approved by:

William G. Hoppes

4/7/93

William G. Hoppes
Group Leader, WGMG

date

Rebecca A. Failor

4/7/93

Rebecca A. Failor
Section Leader, EMS

date

Lucinda M. Garcia

4/7/93

Lucinda M. Garcia
Quality Assurance Coordinator, EMS

date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes tri-weekly maintenance activities at the satellite sewer-monitoring stations.

2. DISCUSSION

Ten satellite sewer-monitoring stations, ranging from the south side of the Laboratory to its northwest corner, collect sewage samples from LLNL's sewer system. In the advent of an inadvertent introduction of contaminants, the appropriate samples are analyzed in order to permit a possible traceback to one of the various laboratory operations (see Attachment A for locations of satellite sewer-monitoring stations).

CURRENT SATELLITE SEWER-MONITORING STATION LOCATIONS

<u>General Location</u>	<u>Manhole Number</u>	<u>Draw (ft)</u>	<u>Head (ft)</u>
B231 North	40B	85	5.8
West of B190	51A	45	4.3
West Gate Dr and Ave A	53A	132	6.8
South of T1677	69A	56	5.1
East of B191	86B	76	6.1
North of 391	125C	8	4.9
South of B319	163A	114	11.7
T5226 North	177E	85	8.6
West of Visitor's Center	185F	40	4.1
B113 Northwest	231A	31	5.8

Each satellite sewer monitoring station is equipped with a Manning 6900 Stationary Priority Contaminant Sampler, which is housed in a weatherproof, locked shelter measuring approximately 5 ft by 5 ft by 6 ft. Each station has a plumbed potable water supply, electrical power, lighting, ventilation, fans, heater, and a floor drain that is connected to the sanitary sewer system.

A buried, 1.5-inch polyvinyl chloride (PVC) pipe connects the station to the manhole that is to be monitored. Inside this pipe is a half-inch tygon hose, one end of which is connected to the sampler, the other end to a weighted strainer that is submerged in the sewage flow.

The 6900 Sampler has two major assemblies, "upper" and "lower". The upper assembly includes the controller. The lower base unit is refrigerated and contains the sample volume measuring and distribution assemblies, a circular bottle rack containing 24 sampling bottles (1,000 mL each), and a vacuum pump that draws the sample from the sewer pipe. On weekdays the samplers collect eight 50 mL samples per bottle at the rate of one sample every 15 minutes. At this setting it takes two hours to fill one sample bottle and 48 hours to fill the 24 bottles in the sampling carousel. On Friday, the sampling frequency is changed to once every 30 minutes to accommodate the extra weekend day. At this setting it takes 72 hours to fill 18 of the 24 bottles. Maintenance on the stations is required on Monday, Wednesday and Friday. This provides the broadest possible coverage of releases from facility operations, without requiring maintenance during nonwork hours.

If the monitoring equipment at Building 196 (Reference 1) detects the presence of contaminants in LLNL sewage, the WGMG analyst who is assessing the alarm will, if necessary, require that samples be submitted for analysis to aid in determining the time and place at which the release occurred (see Reference 2). Since sewage may take as long as three hours to travel from the point of release to Building 196, quite often the bottle currently being filled is not the bottle that should be

submitted for analysis. This document does not cover the procedure for acquiring the sample that is to be submitted for analysis; that procedure is described in Reference 3.

In addition to daily maintenance, on a monthly basis the sample bottles are changed and the measuring chamber cleaned. See Section 6.4.

A Manning 6900 Operation and Service Manual (Reference 4) is available at each satellite station.

3. REFERENCES

1. EMP-SW-AR, *Sewer Alarm Response*
2. EMP-SW-SID, *Sewer Spill Source Identification*
3. EMP-SW-SAS, *Sewer Satellite Station Alarm Sampling*
4. TN Technologies INC., *Installation and Operation Manual for the 6900 Stationary Priority Contaminant Sampler*
5. EMP-QA-DC, *Document Retention*

4. DEFINITIONS

Bottle Stay: When the sample bottles are hanging from the bottle plate, this large rubber O-ring pulls the bottle bodies into a compact bundle.

Bottle Plate: Plate with 24 mounting holes for positioning the 1,000 mL sample bottles relative to the distribution assembly.

Distribution Assembly: Located by two guide plates on the top of the bottle plate. An assembly consisting of a transparent measuring chamber with a scale (in milliliters) for reading the sample volume; a sensor for determining when the measuring chamber is filled to the desired volume; and a filler spout that sequences the sample stream to the sample bottles. During operation, the distribution assembly rests on the bottle plate. During sampling or maintenance, it is lifted away, and set on the brackets located in the refrigerator above the bottle plate.

Pinch Valve: AC solenoid driven pinching device. Closes off the sample tube allowing a vacuum to be applied to the measuring chamber. Allows sample to pass to the filler spout when sampling sequence is completed.

Power Switch: Controls connection to A/C power.

Refrigerator Subassembly: A refrigerated area containing the bottle rack with 24 sample bottles (1,000 mL each) and the distribution assembly.

Reserve Bottles: Last two filled bottles in the rack. Because of the direction of sewage flow, sampling at a station occurs prior to monitoring at B196, these bottles are set aside to allow trace-back of spills that passed the satellite station just before maintenance was started.

Filler Spout: Channels the sample to the proper bottle.

Sampling Volume: Determined by a mechanical adjustment to the siphon spiral in the measuring chamber. It is set to 50 mL.

Slide rack: Frame to hold the bottle plate when it is pulled out of the refrigerator; the weight of the bottle plate is supported via the slide rack by a triangular brace that rests against the lower inside edge of the refrigerator cabinet. Stored inside the shelter exterior to the sampler.

Stepper Motor: Rotates the filler spout to the next bottle.

5. RESPONSIBILITIES

5.1. WGMG ENVIRONMENTAL ANALYST

The WGMG (Water Guidance and Monitoring Group) Environmental Analyst is responsible for establishing the operating parameters of the sampling stations (sample frequency and volume). The Analyst also coordinates acquisition of alarm samples from the satellite stations, including the identification of locations and sampling times of the bottles to be collected.

5.2. TSG ENVIRONMENTAL TECHNICIAN

The TSG Environmental Technician is responsible for proper maintenance of the satellite stations, and for the physical collection of the samples.

5.3. WGMG GROUP LEADER

The WGMG Group Leader is responsible for ensuring that sufficient resources are allocated to allow maintenance to be completed in a timely fashion.

5.4. EMS SECTION LEADER

The EMS Section Leader is responsible for ensuring that sufficient resources are allocated to allow maintenance to be completed in a timely fashion.

6. PROCEDURE

Note: Occasional failures of the sampling equipment, or mishaps in the handling of samples, can result in the exposure of personnel to raw sewage. According to Hazards Control Industrial Hygienists, exposure to sewage is not a significant health hazard if reasonable hygienic steps are taken. When performing the procedures described below, gloves and other personal protective equipment should be worn. Exposed personnel should wash with disinfectant soap (PhisoHex soap, kept in Satellite Station 163A). If clothes become soaked with sewage, personnel should shower and change into clean clothing, and the soiled clothing should be washed as soon as possible.

6.1. PREOPERATION CHECKS AND PROGRAMMING

Equipment Required:

Face Shield (Stock catalog #4240-58220)
Kay-drys (Stock catalog #7999-63447)
Latex gloves, long (Stock catalog #8415-41567 and 77)

6.1.1. Prior to standard operation of the 6900 Sampler, preoperation checks and tests are to be performed using the procedures in Reference 4, pages 1-1 through 1-16.

6.1.2. The configuration and program parameters for the sampler will be established by the Environmental Analyst.

6.1.2.1. The configuration parameters are described on page 2-8 and 2-9 of Reference 4. The settings should be:

- 6.1.2.1.1. OP = 2
- 6.1.2.1.2. PLEP = 24
- 6.1.2.1.3. PH0 = 6
- 6.1.2.1.4. PH1 = 150
- 6.1.2.1.5. PH2 = 13
- 6.1.2.1.6. PH3 = 8
- 6.1.2.1.7. PHLL = 1
- 6.1.2.1.8. PE = 1
- 6.1.2.1.9. PL = 2
- 6.1.2.1.10. PPPP = 0000

6.1.2.2. The program parameters should be as follow.

6.1.2.2.1. Program the Single Time Interval for 15 minutes (page 2-14 of Reference 4).

6.1.2.2.2. Select eight (consecutive) samples per bottle (page 2-19 of Reference 4).

6.1.3. The sample volume should be adjusted to 50 mL. Follow the procedure on page 1-17 of Reference 4. The sampler is manufacturer designed for a 100 mL minimum sample. Therefore, to achieve a 50 mL sample volume, the outer sleeve of the purge tube must be pulled down 0.25" from the top of the chamber (in violation of step 2 on page 1-17) and the sleeve must be rotated so that the slit in the slit tube is completely covered. After the sampler is re-assembled, a sample should be taken to confirm the sample volume; the maximum allowable sample volume is 60 mL.

6.2. MAINTENANCE

Equipment Required:

Face Shield (Stock catalog #4240-58220)
 Kay-drys (Stock catalog #7999-63447)
 Latex gloves, long (Stock catalog #8415-41567 and 77)
 Manhole hook (available from the Pipe Shop)
 Pen
 Pine Oil
 Portable road barrier or traffic cones (available from Plant Engineering laborers)

When performing maintenance or collecting samples from sewer satellite stations, proper hygiene requires use of a face shield and long latex gloves.

As necessary the Environmental Technician must empty satellite stations trash cans while making maintenance rounds. The trash is to be put in large plastic bags such as those used by LLNL janitors, and the bags disposed of in any LLNL garbage dumpster.

Note: Always consult the alarm printout in Room 200 of Building 196 before performing routine maintenance. If an alarm has occurred since previous maintenance, notify the Environmental Analyst to determine which samples are to be saved when bottles are drained during routine maintenance. See reference 3 for alarm sampling instructions.

- 6.2.1. Unlock the shelter and open the door
- 6.2.2. Put on long latex gloves and plastic face shield.
- 6.2.3. Open the door on upper (control) assembly and use the ON/OFF toggle switch to turn the power off.
- 6.2.4. If the manhole is situated in the middle of a street or other traffic zone, use the portable road barrier or cones to block the road in the direction of approaching traffic. Using the manhole hook, remove the manhole cover. Clear debris from sampling line and then replace the manhole cover. Remove the road barrier or cones.
- 6.2.5. Open the door on the lower (refrigerator) assembly. Mentally note the position of the filler spout (see step 6.2.8 and 6.2.9). Lift the distribution assembly off of the bottle plate, and set it on the brackets located in the refrigerator above the bottle plate.
- 6.2.6. Attach the slide rack to the two pins at the front of the refrigerator. Set the foot of the slide rack on the lower inside edge of the refrigerator housing. Pull the bottle plate forward onto the slide rack.
- 6.2.7. Enter the date, time, and your initials in the field logbook stored in the satellite station. Inspect each bottle for total volume, abnormal sample coloration and condition of sample. Record any deviant conditions in the field logbook as well as the position of the filler spout.
- 6.2.8. Remove the bottle stay.
- 6.2.9. Drain the two reserve bottles stored in the bottom of the refrigerator. Remove the last two filled bottles from the rack. Cap the bottles: use the cap labelled "2" on the last bottle that was filled (the bottle that the filler spout was positioned over when the sampler was turned off). Place the bottles in the bottom of the refrigerator. Because there is a delay between sampling at a station and monitoring at B196, these bottles are set aside to allow trace-back of spills that passed the satellite station just before maintenance was started.
- 6.2.10. Remove each bottle from the bottle plate and empty the contents into the floor drain. Thoroughly flush the bottles (including the old reserve bottles), using the garden hose that is located outside the shelter. Thoroughly rinse the exteriors of the bottles.
- 6.2.11. Spray pine oil on the bottle plate and interior of the lower (refrigerator) assembly (including door panel, shelf, and floor of unit), and thoroughly rinse. Thoroughly rinse the satellite station floor.

Note: Take extreme care not to douse the stepper motor, located above the filler spout. Use of excess water will cause premature failure of this part.

- 6.2.12. Return the bottles to the bottle plate, being certain to put the bottle labeled "START" at the front of the bottle plate. Use the old reserve bottles to complete the set. Wrap the bundle with the bottle stay. Slide the bottle plate back into the refrigerator. Remove the slide rack and return it to its storage location inside the shelter exterior to the sampler.
- 6.2.13. Restore the distribution assembly to its operating position on the bottle plate. Manually rotate the filler spout counter-clockwise until it is positioned to dispense into the first bottle to the right of the "START" bottle.

6.2.14. Use the ON/OFF toggle switch to turn the sampler power on. Press the TIME button. Enter 00:15 hours on Monday and Wednesday and 00:30 hours on Friday. Press the ENTER button. Press the MULTI SAMPLE button. Enter 08. Press the ENTER button. Press the START button and then the TEST CYCLE button; a sample should be taken automatically. Check for proper functioning of the sampler. Proper functioning means that the:

- Sample filler spout advances to the "START" bottle.
- Sampler purges intake line with pressurized air.
- Pinch valve closes.
- Measuring chamber fills, without bubbles, to the correct volume (50 mL).
- Sample is dispensed to the sample bottle.

If there is a malfunction, switch off the sampler power and initiate repairs (section 6.3).

6.2.15. If the sampler has successfully taken a sample (the first of the eight samples for the "START" bottle), rinse the gloves and dry with Kaydrys. Place refuse in the trash can. Remove face shield and gloves, and store in shelter.

6.2.16. Close and lock the shelter.

6.3. SAMPLER MALFUNCTION

If the sampler does not function properly following maintenance, see Chapter 3 of Reference 4 for helpful troubleshooting and maintenance tips. The TN Technologies service department number and shipping instructions are in Appendix A of Reference 4.

6.4 MONTHLY MAINTENANCE

6.4.1 As necessary, but at least once a month, the measuring chamber is cleaned.

6.4.2. Once a month every sample bottle is removed from the bottle plate and soaked overnight in a chlorine solution at Building 196. The empty bottle plate is filled with previously soaked sample bottles.

7. DOCUMENTATION/QA RECORDS

Field logbooks shall be used to note all maintenance activities. The notes should include (as a minimum) sample location, date and time sampled, identity of the sampler, any difficulties or special circumstances, and the position of the filler spout. All field logbooks shall be archived according to the requirements of Reference 5.

8. ACCEPTANCE CRITERIA

Maintenance will be considered complete and acceptable if:

- The sampler, sample bottles, and satellite station are cleaned adequately to prevent contamination of samples (i.e., no sediments in bottles).
- In order to minimize exposure of personnel to sewage residue, the equipment is cleaned, at the very least, with the frequency and thoroughness described in this procedure.
- The sampler operates properly.
- Maintenance activities have been documented in the field logbook.

9. ATTACHMENTS

Attachment A: Locations of LLNL Satellite Sewer-monitoring Stations

Attachment A: Locations of LLNL Satellite Sewer-monitoring Stations

EMP-VG-L

VEGETATION AND FOODSTUFF SAMPLING LOCATIONS

Prepared by:

Kris Surano 12/3/92
Kris Surano date
Group Leader, SMG

Reviewed by:

Paris Althouse 12-3-92
Paris Althouse date
Environmental Technician, TSG

Rebecca Ward 12-3-92
Rebecca Ward date
Environmental Technician, TSG

Approved by:

Rebecca A. Failor 12/3/92
Rebecca A. Failor date
Section Leader, EMS

Kris Surano 12/3/92
Kris Surano date
Group Leader, SMG

Lucinda M. Garcia 12/3/92
Lucinda Garcia date
Quality Assurance Coordinator, EMS

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes, and gives directions to, vegetation and foodstuff sampling locations at LLNL, in the Livermore and Central Valleys, and at Site 300. It also provides directions to where foodstuff samples can be purchased from commercial vendors. In addition, this procedure provides a description of Field Tracking Forms to be used in vegetation and foodstuff sampling activities.

2. APPLICABILITY/DISCUSSION

Sampling and analysis of vegetation can provide information about the presence and movement of radionuclides in the environment. References 1 and 2 provide detailed discussions regarding the rationale behind this type of monitoring. Since 1972, vegetation and foodstuff sampling in the vicinity of LLNL and Site 300 has been part of a continuing LLNL monitoring program designed to measure any changes in environmental levels of radioactivity, to evaluate any increase in radioactivity that might have resulted from LLNL operations, and to calculate potential human doses resulting from direct and indirect ingestion of affected items.

Native vegetation samples, usually annual grasses, are collected from fixed locations around the LLNL perimeter, throughout the Livermore Valley, in the Central Valley, and at Site 300. The locations have been selected to represent vegetation on or near the perimeter of the Laboratory, from locations upwind or outside the influence of LLNL (background), and in areas potentially at risk for LLNL-induced contamination. The use of constant sampling locations allows for better trending of data and closer monitoring of areas of concern; such is the case regarding Site 300 vegetation sampling activities where vegetation from areas of known tritium contamination is examined closely. All vegetation and foodstuff sampling, regardless of location, is conducted according to Reference 2.

According to Reference 1, "Milk is widely consumed by all age groups. Therefore, milk is frequently one of the most important foods contributing to the radiation dose to people if dairy animals are pastured near a nuclear site." The guidance further states that the number of locations to be sampled depends on the number and distribution of production, but should include at a minimum one background location and one potentially-affected location. Goat's milk is collected and analyzed monthly by EMS. Milk sampling locations around LLNL are limited by the distribution of producers. Because the sampling locations cannot be mandated by EMS personnel and therefore samples from all directions around the Laboratory cannot be obtained at will, EMS's goal is to obtain samples from all goat's milk producers in the Livermore Valley, and to adequately represent background locations for comparative purposes.

Honey represents another local agricultural product that can potentially be affected by LLNL operations. Honey samples are collected annually from the Livermore Valley, and also from areas outside the potential influence of LLNL (background locations). As is the case for milk, the network design is limited by the locations of the honey producers. Because the sampling locations cannot be mandated by EMS personnel and therefore samples from all directions around the Laboratory cannot be obtained at will, EMS obtains as many honey samples as possible from beekeepers in the Livermore Valley, and completes the honey sampling network with samples from representative background locations.

Wine is the most important agricultural product in the Livermore Valley, representing an approximately \$30 million (annually) industry. Potential LLNL influences on the local wine industry, primarily from tritium emissions, could have great economic, political, ecological, and public relations consequences. Wine samples of three types are collected and analyzed annually for tritium concentrations: wine produced from grapes grown in the Livermore Valley, wines produced from grapes grown in California (outside the Livermore Valley), and wines produced from grapes grown in Europe (France, Germany and Italy). California and Europe are divided into 8 (excluding Livermore) and 13 wine-producing regions, respectively. Samples from each of these regions serve as background locations

for comparative purposes. The use of wines from a number of regions provides better representation of background information because geographic variability of the wines is addressed. Because of the importance of the wine sampling network, it is EMS's goal to sample and analyze all Livermore Valley wines that are available. A variety of vintages are purchased, subject to general consumer availability, from local retailers.

Changes and additions to the vegetation and foodstuff monitoring networks since 1988 are evidence of the EMS goal to more adequately monitor all media potentially affected by LLNL operations. In general, and pursuant to Reference 1, vegetation and foodstuff sampling locations have been located in all possible directions around the site, include areas selected to represent background concentrations (distant locations unlikely to be affected by LLNL operations), and involve areas of known contamination (such as known tritium contamination at Site 300).

Some samples are collected on private property, some samples involve brand names, and some sampling location names/designators involve the use of private individuals' names. It is the policy of LLNL and EPD that brand names, the names and addresses of private parties, and directions to such sampling locations, remain in strict confidence and this information only be given out on a need-to-know basis. Samplers needing this proprietary information to perform their sampling activities should contact the Responsible Analyst.

3. REFERENCES

1. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
2. EMP-VG-S, *Vegetation and Foodstuff Sampling*
3. EMP-QA-CD, *Design Change Packages*
4. EMP-QA-SL, *Sample Location Designators*
5. EMP-QA-SD, *Sample Tracking Documentation*
6. EMP-HS-300, *Site 300 Health and Safety Work Procedure*

4. DEFINITIONS

Annual Grass: A species of the Graminae plant family, which completes its life cycle in one year or growing season. Has jointed stems and long, narrow, parallel-veined leaves. Typical pasture plants in the Livermore Valley such as wild oats (*Avena* spp.), brome grass (*Bromus* spp.), and fescue (*Festuca* spp.)

Foodstuff: Any substance made into or used as food.

Herbaceous Vegetation: A flowering plant in which persistent woody tissue does not develop. Often used to describe non-grass annual plant species, such as mustard (*Brassica* spp.), lupine (*Lupinus* spp.), and various thistles (*Compositae* spp.)

Perennial Vegetation: A plant which lives for two years or more. Typically used to describe woody plants, such as shrubs and trees.

Vegetation: Plant life in general. In the context of EMS sampling, refers to annual grasses and other herbaceous plants, and perennial vegetation as required.

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Perennial Vegetation: A plant which lives for two years or more. Typically used to describe woody plants, such as shrubs and trees.

Vegetation: Plant life in general. In the context of EMS sampling, refers to annual grasses and other herbaceous plants, and perennial vegetation as required.

5. RESPONSIBILITIES

5.1. EMS ENVIRONMENTAL ANALYST (VEGETATION AND FOODSTUFF)

The Environmental Analyst assigned responsibility for the vegetation and foodstuff monitoring networks determines the locations for collecting samples, periodically reviews the locations for technical suitability in the context of EMS goals and missions, and assesses the need to sample additional areas and additional foodstuff types. As needed, the Analyst submits design changes regarding the network sampling locations and the types of foodstuffs to be sampled (Reference 3), keeps this procedure updated, and communicates changes to other EMS staff members. The Analyst is also responsible for providing proprietary information, to Technicians' responsible for the collection of samples, regarding sample brand names and sampling locations on an in-strict-confidence/need-to-know basis.

5.2. EMS QUALITY ASSURANCE COORDINATOR

The Quality Assurance Coordinator is responsible for keeping lists of all present and past vegetation and foodstuff sampling locations and their designators (Reference 4), evaluating the need for and reviewing/approving sampling location design changes, assigning new sampling location designators as needed, and archiving all design changes and revisions of this procedure.

5.3. EMS TECHNICIANS

The EMS Technicians are responsible for collecting vegetation and foodstuff samples, using methods detailed in Reference 2, at locations described in this procedure. They must fill out appropriate and current Field Tracking Forms, making notes regarding the direction and distance from the permanent vegetation sampling location marker where samples were actually collected. This distance/direction requirement does not apply to foodstuff sampling. However, technicians are required to make detailed notes regarding foodstuff samples as they acquire pertinent information. Technicians are also responsible for providing input to the Analyst regarding the suitability of sampling locations and their permanent markers, and for providing detailed descriptions of, and directions to, the sampling locations.

6. PROCEDURE

6.1. VEGETATION AND FOODSTUFF SAMPLING LOCATION SELECTION

Choices of vegetation and foodstuff sampling locations made by the Environmental Analyst shall be based on the following criteria in accordance with Reference 1: (1) proximity to LLNL and the potential for being affected by LLNL operations, (2) background locations with vegetation/foodstuffs similar to those near LLNL, but unlikely to be affected by LLNL operations, (3) areas of known or suspected LLNL-induced contamination. Sampling locations from areas of known or suspected contamination should be selected to delimit the extent of the contamination and to track the contamination from year to year.

For vegetation samples, the Analyst shall avoid selecting frequently tilled or disturbed areas, or locations near buildings or other obstructions. The areas should be unshaded, and should exhibit native vegetation for much of the year. Sampling locations should also be chosen to avoid areas that have unusual wind or precipitation influences. Practical considerations may also temper sampling location selections. The use of private property is discouraged. Government installations (federal, state, city, regional) are usually very

cooperative in providing areas for sampling as long as pertinent parties are asked or notified. Other considerations should include access during inclement weather, and personnel safety in vehicle operation/parking or sample collection.

For honey and milk, an effort should be made to identify, contact, and collect samples from all producers in the Livermore Valley. Additional suitable background locations should also be evaluated. For wine, all available Livermore estate-grown and -bottled wines not previously analyzed should be acquired.

6.2. LIVERMORE VALLEY VEGETATION SAMPLING LOCATIONS

EMS technicians should proceed to the following locations, shown on the map presented as Attachment A, when requested to collect Livermore Valley and LLNL vegetation samples. Each location is identified by name with a permanent location marker, which is a metal tag attached to a red and white fence post or to a piece of rebar driven into the ground.

6.2.1. Mesquite (L-MESQ): Proceed west on Mesquite Way towards Vasco Rd. Turn right onto the road that runs alongside the "Sunshine Building" (LLNL Mail Services/West Badge Office) parking lot. Go to the northwest end of the perimeter fence to where the air sampler is located. A single red and white fence post is the permanent sampling location marker. Take samples anywhere in the vicinity.

6.2.2. Zone 7 (L-ZON7): Drive north on Greenville Rd. from the LLNL East Gate. Turn right on Patterson Pass Rd., proceed east approximately 0.6 miles, and turn left into the Livermore Zone 7 Water Treatment Facility. The vegetation sampling location permanent marker is near the air sampler (which is located on top of the clarifier, to the left side of the driveway before you reach the parking area.) The sample can be collected anywhere in the vicinity. Make detailed notes regarding the relationship of the actual sampling location to the permanent marker.

6.2.3. (L-PATT): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.4. FCC Station (L-FCC): The Federal Communications Commission (FCC) Station is on Lorraine Street. From Vasco Rd., proceed west on Dalton Rd., which becomes a dead end. Turn right on Ames Rd., which also becomes a dead end. Turn left on Raymond Rd. and then left on Lorraine Street. The FCC Station is located on the right-hand side of the road. The sampling location is just inside the gate to the left of the driveway, and is permanently indicated by a red and white stake.

6.2.5. Met Tower (L-MET): Drive west on West Gate Drive towards the West Gate. Just before you get to the guard shack, turn right onto the gravel road. Travel approximately 400 feet along this road to the meteorological tower. The sampling location marker is next to the air sampler and telephone pole. Collect samples anywhere in the vicinity, but be sure to measure and record the distance and direction from the marker.

6.2.6. Visitors' Center (L-VIS): Drive east on East Gate Drive. Go past the East Gate guard shack, turn into the Visitors' Center parking lot, and park. The permanent marker is a red and white stake, next to the air sampler, to which a rain-collection bucket is attached. The stake is located approximately 75 feet from the parking lot on the south side of a small arroyo that divides the parking lot from the Visitors' Center.

6.2.7. Interstate 580 (L-I580): Drive north on Greenville Rd. until you reach I-580. The sampling location is at the intersection of the I-580 overpass and Greenville Rd. The sample is to be obtained on the west side of Greenville Rd., just before reaching Altamont Pass Rd. The permanent location marker is a red and white stake located at the corner of the Caltrans boundary fence.

6.2.8. Aqueduct/East of Sandia (L-AQUE): Drive south on Greenville Rd. 0.1 miles from the intersection of East Ave. The sampling location marker is on the west side of Greenville Rd., on the gate leading to the aqueduct. The sample can be taken anywhere in the vicinity, preferably on the west side of Greenville Rd.

6.2.9. Railroad Tracks (L-RAIL): Drive North on Vasco Rd. and turn left on Brisas Rd. Make an immediate left into the construction area. Follow the dirt road until it ends, and turn left onto another dirt road, which runs parallel with the railroad tracks. Drive east 0.9 miles and park. Cross over the railroad tracks, head down the bank, and sample at the fence line on railroad property. The sampling location marker is a red and white stake.

6.2.10. (L-TESW): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.11. (L-CAL): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.12. (L-DAN): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.13. (C-MOD): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.2.14. Camp Parks (L-PARK): Proceed on I-580 west and take the Hopyard Rd./Dougherty Rd. exit. Drive north on Dougherty Rd. to the base entrance. Notify the guard, if present, of your intent. From the main gate, follow the road for 0.4 miles. The sample location is approximately 40 yards into the field due north of the Fire Station (Building 636). Look for the Camp Parks meteorological tower and the EMS rain gauge. Do not drive off the road; walk to the sample location. The post on which the rain gauge is located is the permanent sampling location marker.

6.3. LIVERMORE VALLEY VEGETATION FIELD TRACKING FORM

Vegetation samplers must complete vegetation Field Tracking Forms when conducting vegetation sampling activities in accordance with References 2 and 5. The current Livermore Valley vegetation Field Tracking Form is presented as Attachment B. Of special note is the request for information regarding the proximity of the sampling location to the permanent marker. Samplers are instructed to carefully estimate the distance and compass direction from the permanent marker to the actual sampling location and record this on the Field Tracking Form. Samplers must also record dates and times of sampling, provide their initials for each sample, cross-reference COC numbers (Reference 5), and provide QA sample information.

6.4. SITE 300 VEGETATION SAMPLING LOCATIONS

EMS technicians should proceed to the following locations when requested to collect Site 300 vegetation samples. Site 300 access and safety procedures must be strictly followed (Reference 6). The Site 300 vegetation sampling locations are shown on the map presented as Attachment C. All sampling locations are identified by a permanent location marker, which is a metal tag attached to a fence post or to a piece of rebar driven into the ground.

Note: Watch and listen for rattlesnakes when walking in tall grass.

6.4.1. Golf Course (3-GOLF): This sampling location is west of the Site 300 Cafeteria, near the putting green. Travelling from LLNL to Site 300 on Corral Hollow Rd., enter the gate marked 107 (first gate into parking lot). Take samples from the narrow strip between the fence and the road. The permanent location marker is the white road delineator located at the southeast corner of the putting green.

6.4.2. East of 801 (3-801E): This location was previously described as northeast of air sampler 10 (old air sampling location 040-10). Travel Route 1 from northbound Route 3 about 0.2 mile to the sign that is marked "Tank 5." Make a very sharp left-hand turn, and go to the top of the hill. Proceed along the fire trail to the right, and travel approximately 0.6 mile to the "T" in the road. Take the road to the right, which will bring you around in front of the air sampler. Take samples in the proximity of the permanent marker, which is by the power pole.

6.4.3. Evaporator/North of Well 8 (3-EVAP): From the intersection of Route 3 and Doall Rd., proceed west down Doall Rd. approximately 0.6 mile. The sampling location is on the right side of the road in line with Well NC7-14 and the power pole on Doall Rd. The permanent marker is the gate support post on the north side of Doall Rd. nearest the ERD evaporator.

6.4.4. Disposal Site West/Pit 7/West Landfill (3-DSW): From the intersection of Doall Rd. and Route 4, turn north on Route 4 and drive approximately 0.4 mile to the sampling location, which is on the right side of the road. The permanent location marker is a stake driven into the ground in front of Well K7-03. Take samples in the dirt area around the stake, not in the gravel.

Note: Watch and listen for rattlesnakes when walking in tall grass.

6.4.5. Carnegie Recreation Area (3-CARN): This sampling location is on the north side of Corral Hollow Rd., 40 feet east of the Carnegie Ranger Station entrance, between LLNL and Site 300. The permanent location marker is a red and white fence post.

6.4.6. Geodetic Creek (3-GEO): Proceed east on Corral Hollow Rd. for approximately 1 mile past the entrance to Site 300. Sample on the right (south) side of the road, near the top of the bank that leads down to the creek. The permanent marker is the telephone pole located on the north side of Corral Hollow Rd., directly across from the bank that leads down to the creek.

6.5. SITE 300 VEGETATION SAMPLING FIELD TRACKING FORM

Samplers must complete Site 300 vegetation Field Tracking Forms (Attachment D) in accordance with References 2 and 5. It is particularly important for samplers to carefully estimate the distance and compass direction from the permanent marker to the actual sampling location and to record this information on the Field Tracking Form. Samplers must also record dates and times of sampling, provide their initials for each sample, cross-reference COC numbers (Reference 5), and provide QA sample information.

6.6. MILK SAMPLING LOCATIONS

EMS technicians should proceed to the following locations (see the map presented as Attachment E) when requested to collect milk samples. Because the addresses of the vendors serve as the location indicators, permanent location markers are not used. Samplers should bring empty one-gallon Nalgene sample containers with them, which they will leave for the vendors to fill for the next month's sampling effort. (See Reference 2). Vendors should be notified two days prior to collection, which must be completed by the end of each calendar

month. Each vendor is paid \$5.00 per gallon. The sampler must fill out the petty cash form and receive the cash prior to picking up the samples (See Reference 2). Payments must be placed in individual envelopes marked with the vendor's name (remember to put \$10 into the envelope for the vendor who supplies the two-gallon QA sample), and are handed directly to the vendor or, in most cases, are left at the pickup location (usually on a table or in the refrigerator). Appropriate arrangements for payment must be made with the vendor when setting up the pickup date and time.

6.6.1. (L-COOL): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.6.2. (L-WRD): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.6.3. (C-CART): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.6.4. (C-STEV): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.6.5. (C-TUR): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.6.6. (C-WOOD): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.7. MILK FIELD TRACKING FORM

Samplers must complete milk Field Tracking Forms when conducting milk sampling activities in accordance with References 2 and 5. The current milk Field Tracking Form is presented as Attachment F. Samplers must record the date and time of sampling, provide their initials for each sample, cross-reference COC numbers (Reference 5), make any pertinent comments, and provide QA sample information. Note that two routine milk samples are collected at L-WRD. One is goats' milk (L-WRD-xx-ML) and the other is cow's milk (L-WRD-xx-CM).

6.8. HONEY SAMPLING LOCATIONS

Samplers must make the following contacts, at a minimum, when conducting honey sample collection. Because the actual sampling locations vary, no map is included and no permanent markers are used. The nature of the honey sampling makes the location designators more general than those of other media. Honey samples are only identified by the city in which the hives are kept. The sampler is instructed to contact the supplier and make arrangements for obtaining the sample. Payment is made at the market value with petty cash funds (Reference 2). Price is negotiated on an individual basis for each honey sample each year.

6.8.1. Livermore (L-LIV): This location involves proprietary information. Samplers requiring guidance for obtaining these samples should contact the Responsible Analyst.

6.8.2. Pleasanton (L-PLN): This location involves proprietary information. Samplers requiring guidance for obtaining these samples should contact the Responsible Analyst.

6.8.3. Tracy (L-TRY): This location involves proprietary information. Samplers requiring guidance for obtaining these samples should contact the Responsible Analyst.

6.8.4. Morgan Hill (C-MORG): This location involves proprietary information. Samplers requiring guidance for obtaining these samples should contact the Responsible Analyst.

6.8.5. San Jose (C-JOSE): This location involves proprietary information. Samplers requiring guidance for obtaining these samples should contact the Responsible Analyst.

6.8.6. Turlock (C-TUR): This location involves proprietary information. Samplers requiring guidance for obtaining these samples should contact the Responsible Analyst.

6.8.7. Lathrop (C-LATH): This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

6.9. HONEY FIELD TRACKING FORM

Samplers must complete honey Field Tracking Forms when conducting honey sampling activities in accordance with References 2 and 5. The current honey Field Tracking Form is presented as Attachment G. Samplers must provide both the location identification and the sample identifier (References 4 and 5), record the date and time of sampling, provide their initials for each sample, cross-reference COC numbers (Reference 5), make any pertinent comments (especially regarding the area in which the honey actually was produced, and the flower types if known), and provide QA sample information.

6.10. WINE SAMPLING LOCATIONS

Samplers are instructed to collect all wine samples from local commercial vendors. Reference 2 provides details on the actual sampling activities. This procedure provides information regarding purchase locations and the wine growing areas to be included in the sampling. A vendor that usually has a wide and varied selection of wines from all necessary sampling locations (including Livermore Valley wines) is the Safeway store at "1st" and "T" Streets in Livermore. Local liquor stores also are suitable. The Livermore Valley wineries themselves are also a good source of local wines. Discretion as to the nature of your purchase and security agreements should always be observed (Reference 2).

6.10.1. Livermore Valley Wines (L-LIV): Samplers are instructed to collect as many estate-grown Livermore Valley wines as possible that have not been previously analyzed. Wines from all Livermore Valley wineries are to be considered for analyses. Samplers requiring the names and locations of Livermore Valley wineries should contact the Responsible Analyst.

6.10.2. California Wines: California has been divided into nine wine growing regions for the purposes of the wine sampling program. Livermore is one of the nine areas. One estate-grown wine from each of the other eight regions is analyzed each year. The California wine growing regions are:

Monterey County (C-MONT)
Napa Valley (C-NAPA)
Sonoma Valley (C-SONO)
Sierra Foothills (C-FOOT)
Central Valley (C-VALL)
South Central Coast (C-SCEN)
Southern California (C-SCAL)
Mendocino County (C-MEND)
Livermore Valley (L-LIV)

6.10.3. European Wines: Europe has been divided into 13 wine growing regions for the purposes of the wine sampling program. One estate-grown wine from each of the regions is analyzed each year. The European wine growing regions are:

Veneto, Italy (I-VENE)
Tuscany, Italy (I-TUSC)
Piedmont, Italy (I-PIED)
Mosel-Saar-Ruwer, Germany (G-MOS)
Rheinhessen, Germany (G-HESS)
Rheinfalz, Germany (G-FALZ)
Rheingau, Germany (G-GAU)
Loire Valley, France (F-LOIR)
Alsace, France (F-ALSA)
Burgundy, France (F-BURG)
Rhône Valley, France (F-RHON)
Champagne, France (F-CHAM)
Bordeaux, France (F-BORD)

6.11. WINE FIELD TRACKING FORM

A sample Field Tracking Form for wine sampling is presented as Attachment H. There are spaces available for 14 Livermore Valley wines, although the sampling in any one year may include more or less than this number. Space is provided for one wine from each of the California wine regions and one wine from each of the European wine regions. Samplers must choose estate-grown-and-bottled wines from each of the areas. Samplers must provide the vintage, vintner, and type of each wine and should include comments for each sample, as applicable. Quality assurance samples must also be identified on the Field Tracking Form.

8. DOCUMENTATION

Samplers must complete Field Tracking Forms and Chain of Custody Record Forms (COC) when collecting vegetation and foodstuff samples in accordance with Reference 5. Field Tracking Forms must contain current location designators (Reference 4). Field Tracking Forms and COCs become QA records and must be archived with sample data in the Document Retention Center.

9. ACCEPTANCE CRITERIA

Only samples taken at official sampling locations will be used in the assessments of LLNL impacts on the environment, unless special samples are authorized in an approved sampling plan. Field Tracking Forms and COCs must be completed properly. Samples must be identified with authorized location designators (References 4 and 5) and, as applicable, pertinent information must be

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included concerning the proximity of the actual sample collection area to the designated permanent location marker.

10. ATTACHMENTS

- A. Livermore Valley Vegetation Sampling Location Map
- B. Field Tracking Form: Livermore Valley Vegetation Sampling
- C. Site 300 Vegetation Sampling Location Map
- D. Field Tracking Form: Site 300 Vegetation Sampling
- E. Milk Sampling Location Map
- F. Field Tracking Form: Milk Sampling
- G. Field Tracking Form: Honey Sampling
- H. Field Tracking Form: Wine Sampling

ATTACHMENT A. LIVERMORE VALLEY VEGETATION SAMPLING LOCATION MAP

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ATTACHMENT B. FIELD TRACKING FORM: LIVERMORE VALLEY VEGETATION SAMPLING

LOCATION DESIGNATOR	DATE	TIME	INITIALS	Distance	Direction	COMMENTS
L-PATT-01-VG						
L-ZON7-01-VG						
L-1550-01-VG						
L-AQUE-01-VG						
L-RAIL-01-VG						
L-MET-01-VG						
L-TESW-01-VG						
L-PCC-01-VG						
L-CAL-01-VG						
L-DAN-01-VG						
L-MOD-01-VG						
L-PARK-01-VG						
L-VIS-01-VG						
L-MESQ-01-VG						
L-QA-01-VG						L-01-VG
L-QA-02-VG						L-02-VG

C.O.C.	LAB

ATTACHMENT C. SITE 300 VEGETATION SAMPLING LOCATION MAP

Figure 3-V-1. Vegetation sampling locations, Site 300, 1990.

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ATTACHMENT D. FIELD TRACKING FORM: SITE 300 VEGETATION SAMPLING

FIELD TRACKING FORM: SITE 300 VEGETATION SAMPLING - EMP-VG-S-0

LOCATION DESIGNATOR	DATE	TIME	INITIALS	Distance	Direction	COMMENTS
3-CARN-01-VG						
3-GOLF-01-VG						
3-CEO-01-VG						
3-DSW-01-VG						
3-807E-01-VG						
3-EVAP-01-VG						
3-QA-01-VG						3- -D1-VG

G.O.G.	LAB

ATTACHMENT E. MILK SAMPLING LOCATION MAP

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ATTACHMENT E. FIELD TRACKING FORM: MILK SAMPLING

FIELD TRACKING FORM: MILK SAMPLING - EMP-ML-S-0

Proprietary Information	ID	DATE	TIME	INITIALS	COMMENTS
.	L-WRD-01-ML				
.	C-WOOD-01-ML				
.	C-STEY-01-ML				
.	L-WRD-01-CM				
.	C-CART-01-ML				
.	C-TUR-01-ML				
.	L-COOL-01-ML				
QA	L-QA-01-ML				L-01-ML
QA	L-QA-01-ML				

Preservatives
Refrigerate upon delivery to Nuclear Chemistry

Analyses requested
Radium, gamma

C.O.C.	LAB

REV. 10/92

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ATTACHMENT G. FIELD TRACKING FORM: HONEY SAMPLING

FIELD TRACKING FORM: HONEY SAMPLING - EMP-HY-S-0

ID	Sample Identifier	DATE	TIME	INITIALS	COMMENTS:

Analyses requested
Tritium

C.O.C.	LAB

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ATTACHMENT H. FIELD TRACKING FORM: WINE SAMPLING

IN STRICT CONFIDENCE				
Wine Sampling Field Tracking Form				Date:
Sample ID Code	Vintage	Vintner	Type	Note
L-LIV-01				
L-LIV-02				
L-LIV-03				
L-LIV-04				
L-LIV-05				
L-LIV-06				
L-LIV-07				
L-LIV-08				
L-LIV-09				
L-LIV-10				
L-LIV-11				
L-LIV-12				
L-LIV-13				
L-LIV-14				
L-OA-01				L-LIV-D
L-OA-02				L-LIV-D
C-MONT-01				
C-NAPA-01				
C-SONO-01				
C-FOOT-01				
C-VALL-01				
C-SCEN-01				
C-SCAL-01				
C-MEND-01				
C-OA-01				C -01
I-VEHE-01				
I-TUSC-01				
I-PIED-01				
G-MOS-01				
G-HESS-01				
G-FALZ-01				
G-GAU-01				
F-LOIR-01				
F-BORD-01				
F-ALSA-01				
F-BURG-01				
F-RHON-01				
F-CHAM-01				
F-OA-01				F -01

EMP-VG-S

VEGETATION AND FOODSTUFF SAMPLING

Prepared by:

Kris Surano
Kris Surano
Group Leader, SMG

12/3/92
date

Reviewed by:

Rebecca Ward
Rebecca Ward
Environmental Technician, TSG

12-4-92
date

Paris Althouse
Paris Althouse
Environmental Technician, TSG

date

David Graves
David Graves
Environmental Technician, TSG

12-4-92
date

Duke Ramsey
Duke Ramsey
Environmental Technician, TSG

12-4-92
date

Approved by:

Rebecca A. Failor
Rebecca A. Failor
Section Leader, EMS

12/4/92
date

Kris Surano
Kris Surano
Group Leader, SMG

12/3/92
date

Lucinda M. Garcia
Lucinda M. Garcia
Quality Assurance Coordinator, EMS

LLNL ENVIRONMENTAL
MONITORING SECTION
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FOR INFORMATION ONLY

1. PURPOSE

This procedure describes the methods to be used in collecting vegetation and foodstuff samples at LLNL, in the Livermore and Central Valleys, at Site 300, and from commercial vendors.

2. APPLICABILITY/DISCUSSION

Sampling and analysis of native vegetation can provide information about the presence and movement of radionuclides in the environment. Vegetation and foodstuff also represent media that can contain pollutants originally released to the soil, to the air, or through liquid effluent. Affected vegetation and food can be directly ingested or can affect human consumers if they ingest foodstuff from animals that have consumed contaminated vegetation.

Foodstuff is specifically mentioned in Reference 1 (on which much of EMS monitoring is based) as appropriate for surveillance sampling and analysis, even if potential annual effective dose equivalent from ingestion is below 1.0 mrem. Reference 1 also calls for pathway analyses, and specifically mentions the need for analyses of milk and other representative samples of the pathway-significant agricultural products grown in the proximity of the site (within 16 km). Furthermore, Reference 1 states that "Periodic sampling and analysis of indicator materials, such as soil or vegetation, should be performed to determine if there is measurable long-term buildup of radionuclides in the terrestrial environment."

Since 1972, vegetation and foodstuff sampling in the vicinity of LLNL and Site 300 has been part of a continuing LLNL monitoring program designed to measure any changes in environmental levels of radioactivity, to evaluate any increase in radioactivity that might have resulted from LLNL operations, and to calculate potential human doses resulting from direct and indirect ingestion of these items. Sampling locations are described in Reference 2. Vegetation and foodstuff samples are collected according to this procedure, are submitted for analyses using sample control and documentation procedures (References 3 and 4), and are analyzed by state-of-the-art methods (Reference 5). Quality control samples are part of all monitoring activities (Reference 6). The sample data are evaluated in comparison with background location data and data from past monitoring (Reference 7) and are entered into a computer database (Reference 8). Potential doses, using a variety of models and assumptions, are calculated (Reference 9). The monitoring data and dose calculations are reported annually (References 5 and 10) and all data and quality assurance (QA) records are archived (Reference 11).

Tritium is the nuclide of major interest in the vegetation and foodstuff monitoring program because LLNL has historically released tritium to the air in the course of routine operations, and because of tritium's propensity to move into the environment as tritiated water. Once in the environment, tritium (as tritiated water) can be easily assimilated into vegetation and foodstuff. The tritium can then be ingested directly or indirectly and can therefore contribute to human radiation dose burdens.

EMS vegetation samples, usually annual grasses, are collected and analyzed for tritium quarterly from fixed locations throughout the Livermore Valley and at Site 300. Milk samples are collected monthly from farms in the Livermore Valley and from background locations. Milk samples are analyzed for tritium and gamma-emitting isotopes (to determine background milk doses from fallout and naturally-occurring radionuclides). Honey and wine samples, collected annually from producers in the Livermore Valley and also from background locations, are analyzed for tritium.

Wine is the most important agricultural product in the Livermore Valley, representing an approximately \$30 million annual industry. Potential LLNL influences on the local wine industry, primarily from tritium emissions, could have great economic, political, ecological, and public relations consequences. All wines used in EMS sampling are purchased subject to general consumer availability. That is, they are purchased from local retailers in a variety of vintages. As such, resultant data can be used to provide data on the potential tritium dose received by the public during the year of purchase/consumption. However, wine-sample data can be decay-corrected to the original tritium

concentrations to determine trends; this may help determine the impact of LLNL operations for a particular vintage-year.

3. REFERENCES

1. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*
2. EMP-VG-L, *Vegetation and Foodstuff Sampling Locations*
3. EMP-QA-SL, *Sample Location Designators*
4. EMP-QA-SD, *Sample Tracking Documentation*
5. Lawrence Livermore National Laboratory, *Environmental Report for 1990* (UCRL-50027-90)
6. EMP-QA-S, *Quality Assurance Sampling*
7. EMP-QA-D, *Data Analysis*
8. EMP-QA-DM, *Data Management*
9. EMP-R-DA, *Dose Assessment*
10. EMP-QA-AER, *Site Annual Environmental Report*
11. EMP-QA-DC, *Document Retention Center*
12. EMP-QA-CD, *Changes in Design*
13. EMP-QA-NCR, *Nonconformance Reports*
14. EMP-HS-300, *Site 300 Health and Safety Work Procedure*
15. EMP-QA-SA, *Self Assessments*
16. Surano, et al., 1991, *Helium-3 Mass Spectrometry for Low-Level Tritium Analysis of Environmental Samples*, (UCRL-JC-107042).

4. DEFINITIONS

Annual Grass: A species of the Graminae family, completing its life cycle in one year or growing season. Has jointed stems and long, narrow, parallel-veined leaves. Typical pasture plants in California such as wild oats (*Avena* spp.), brome grass (*Bromus* spp.), and fescue (*Festuca* spp.)

Effective Dose Equivalent: An estimate of the total risk of potential effects from radiation exposure. It includes the dose incurred from ingestion of radionuclide-containing foodstuff.

Foodstuff: Any substance made into or used as food.

Herbaceous Vegetation: A flowering plant in which persistent woody tissue does not develop. Often used to describe nongrass annual plant species, such as mustard (*Brassica* spp.), lupine (*Lupinus* spp.), and various thistles (*Compositae* spp.)

Perennial Vegetation: A plant that lives for two years or more. Typically used to describe woody plants, such as shrubs and trees.

Vegetation: Plant life in general. In the context of EMS sampling, refers to annual grasses, other herbaceous plants, and perennial vegetation.

5. RESPONSIBILITIES

5.1. EMS ENVIRONMENTAL ANALYST (VEGETATION AND FOODSTUFF)

The Environmental Analyst assigned responsibility for the vegetation and foodstuff monitoring networks will decide when and where samples are to be collected. Sampling locations are described in Reference 2. The Analyst must periodically review the network

locations, the sample collection schedule, and collection methods for technical suitability in the context of EMS goals and missions; assess the need to sample additional locations and additional foodstuff types; submit design changes (Reference 12) regarding the network locations, schedules, sampling methods, types of foodstuffs to be collected, and analyses required; discuss analytical procedures, limits of detection, and data delivery schedules with analytical laboratory personnel; keep this procedure updated; participate in nonconformance report activities (Reference 13); and communicate changes regarding the vegetation/foodstuff monitoring networks to other EMS staff members as needed. The Analyst is also responsible for all vegetation and foodstuff data analysis, reporting, and dose assessments.

5.2. EMS QUALITY ASSURANCE COORDINATOR

The QA Coordinator is responsible for keeping lists of all present and past sampling locations, evaluating the need for and reviewing/approving vegetation and foodstuff sampling method design changes (Reference 12), and assigning new vegetation and foodstuff sampling location designators as needed (Reference 3). The QA Coordinator is also responsible for inspecting and evaluating sample collection methods (Reference 15), participating in nonconformance report activities (Reference 13), and for archiving all design changes and revisions of this procedure (Reference 11).

5.3. EMS TECHNICIANS

The EMS Technicians are responsible for collecting vegetation and foodstuff samples according to methods detailed in this procedure at locations described in Reference 2. They shall fill out appropriate and current Field Tracking Forms and Chain of Custody Forms in full (References 3 and 4). Technicians are further required to make detailed notes on Field Tracking Forms regarding vegetation and foodstuff samples as they acquire pertinent information. Technicians are also responsible for providing input to the Analyst regarding the suitability of sampling locations and sampling methods, the availability of samples, and any problems associated with the monitoring networks (Reference 13).

6. PROCEDURE

Equipment Required:

Vegetation Sampling

Plastic bags (1 quart; LLNL Stores Stock # 8105-27695)
Ice chest: Transportainer # TY-165 at end of 6th St.
Dry ice: Building 151 loading dock
Yellow tie-on sample tags (LLNL Stores Stock # 8135-27958)
Field Tracking Form (FTF, Reference 2)
Chain-of-Custody Record Form (COC, Reference 4)
Shears
Disposable vinyl gloves (LLNL Stores Stock # 8105-60398
(medium); # 8105-51244 (large))
Rubber Bands
Deionized water (Transportainer # TY-165 at end of 6th St.
Kaydrys (LLNL Stores Stock # 7999-63447)

Milk Sampling

Sample Bottles (1 gallon Nalgene narrow-mouth; LLNL Stores
Stock # 8125-27821)

FTF (Reference 2)
COC (Reference 4)
Petty Cash Form (Attachment A)
Ice chest: Transportainer # TY-165 at end of 6th St.
Crushed ice: Building 175 ice machine
Yellow tie-on sample tags (LLNL Stores Stock # 8135-27958)

Equipment Required: (Continued)

Honey Sampling

Sample bottles (Qorpak wide-mouth glass bottles; LLNL Stores Stock # 8125-27800)
FTF (Reference 2)
COC (Reference 4)
Petty Cash Form (Attachment A)
White stick-on labels (LLNL Stores Stock # 7530-46221)

Wine Sampling

Wine Purchase Memo (Attachment B)
Security Memo (Attachment C)
Prohibited Items Permit (Attachment D)
Wine Sales Tax Memo (Attachment E)
Annual Wine Sampling Plan
FTF (Reference 2)
COC (Reference 4)
Camera with flash and film
Petty Cash Form (Attachment A)
White stick-on labels (LLNL Stores Stock # 7530-46221)

All vegetation and foodstuff samples must be collected according to the methods described in this procedure. All sampling activities must take place at designated sampling locations (Reference 2). FTFs and COCs must be completed for all samples according to References 2 and 4.

6.1. VEGETATION SAMPLING (LIVERMORE VALLEY/SITE 300) SAMPLING NETWORKS

The vegetation sampling methods are identical for the Livermore Valley and Site 300 vegetation monitoring networks with one exception: samples from the Site 300 locations EVAP and DSW are to be triple-bagged, because of known tritium contamination at these areas, while all other samples are double-bagged. Site 300 access and safety procedures must be strictly followed when performing all sampling activities (Reference 7). Vegetation samples shall be collected quarterly, preferably at all network locations in a single day.

6.1.1. SELECTION OF VEGETATION SAMPLE MATERIAL

Vegetation samples shall consist of the green leaves and green stems of annual grasses. However, other herbaceous vegetation (preferable) or even perennial vegetation may be sampled if grasses are not available. If no green vegetation is present at the sampling location, no sample shall be collected, and that fact will be noted on the FTF and the COC (so the analytical laboratory will know not to expect a sample from that location). The Analyst shall be notified when samples cannot be collected, and a nonconformance report will be generated (Reference 13).

6.1.2. VEGETATION SAMPLE VOLUME

Approximately 0.5 to 1 kg of vegetation is required for analysis. This requires packing the plastic sampling bag (1 quart size) full. Two bags of vegetation comprise a single sample. One bag's vegetation is analyzed, and the other is archived by the analytical laboratory.

6.1.3. OBTAINING THE VEGETATION SAMPLE

Before handling any samples, put on clean disposable vinyl gloves so the sample will not become contaminated. Use the shears to trim the vegetation near the base of the plants. Remove any obviously dead leaves/stems and trim off any root material. Completely fill the plastic bag with vegetation, and seal the bag with a rubber band. Place this bag inside another plastic bag and secure the second bag with a rubber band. (At Site 300 locations EVAP and DSW, be sure to triple-bag the samples. Each bag should have its own rubber band.) Make sure the vegetation stems do not poke holes in the sample bags. Attach a yellow sample identification tag to the outside bag (Attachment F). The tag shall contain at a minimum the sample identifier (including sample location designator), the type of sample, the quarter and year of sampling, the date of collection, the analyte (tritium), and the collectors initials.

6.1.4. VEGETATION SAMPLE FIELD DOCUMENTATION

Record the appropriate information on the FTF (Reference 2 and 4). Be sure to record the distance and direction from the permanent sampling location marker to the actual location from which the sample was obtained. Record any other pertinent information about the sample, such as the species (if known) or generalized plant group (annual grass, herb, perennial shrub, tree, etc.)

6.1.5. VEGETATION SAMPLE PRESERVATION

Place the sample bags on dry ice in the ice chest. Samples must be kept cool until analysis.

6.1.6. VEGETATION QUALITY ASSURANCE SAMPLES

QA samples will be submitted with each batch of samples, in accordance with Reference 6. Duplicate samples are the only QA samples authorized for the vegetation sampling networks. Two duplicate samples are required for the Livermore Valley vegetation sampling network and one duplicate sample is required for the Site 300 vegetation sampling network. At locations chosen for duplicate samples, four bags of vegetation are to be collected; two are used as the sample (one is analyzed and one is archived), and the other two bags serve as the duplicate QA sample (one is analyzed and one is archived). The locations where QA samples are collected not to be identified on the bags or sample identification tags (References 4 and 6). However, this information is required on FTFs, and the QA sample needs to be assigned a temporary identification number (References 4 and 6).

6.1.7. VEGETATION SAMPLING EQUIPMENT DECONTAMINATION

Gloves must be discarded after collecting each sample. The same gloves are not to be worn at more than one sampling location. Shears are to be thoroughly decontaminated between sampling locations. Rinse them several times with deionized water, dry them with Kaydrys, and keep them in a clean plastic bag until they are needed.

6.1.8. CHAIN OF CUSTODY

Chain-of-custody procedures (Reference 4) must be followed. After all samples have been collected from a vegetation network, use the information from the FTF to complete the COC.

6.1.9. VEGETATION SAMPLE DELIVERY

On the same day that they are collected, deliver the samples to the Radiation Analytical Sciences Laboratory, Building 151, Room 2143. If the samples cannot be delivered that same day, they must be kept secure (Reference 4) and frozen until they can be delivered. Follow chain-of-custody procedures when delivering samples (Reference 4), and make sure the samples are placed in the freezer at the analytical lab.

Water from the vegetation will be collected using freeze-drying techniques (lyophilization). The tritium content of the recovered water will be determined by liquid-scintillation counting (Reference 5).

6.1.10. VEGETATION DATA REVIEW, ANALYSIS, MANAGEMENT, ARCHIVING

The Analyst will review and analyze data promptly after receipt, according to Reference 7, and will follow established chain-of-custody procedures (Reference 4). When signing and returning COCs to the analytical laboratory following receipt of data, the Analyst will identify the locations at which the QA samples were collected. Data will be given to the Data Manager promptly for entry into the EMS Monitoring Data Base (References 4 and 8), and will be archived according to Reference 11.

6.1.11. VEGETATION DOSE ASSESSMENT AND REPORTING

Dose assessments, based on the monitoring data and using methods detailed in Reference 9, will be conducted by the Analyst when all data for a calendar year are obtained. The monitoring and dose assessment results will be reported in the Site Annual Environmental Report (Reference 10).

6.2. MILK SAMPLING

Except during the months of December and January, when goats' milk production is limited or absent, milk samples shall be collected monthly. All milk samples must be collected by the end of the calendar month, preferably in the last week of the month.

6.2.1. MILK LOCATIONS

Milk samples generally are collected at the residences of the persons raising the goats or at the ranch where the goats are maintained (Reference 2). However, one sample is purchased from a grocery store, and another is purchased at a goat milk plant (Reference 2).

6.2.2. MILK PROVIDER NOTIFICATION

EMS Technicians must be sure to call providers of milk samples a few days in advance to arrange a collection date and time, and then must be sure to keep the appointment. If the provider cannot supply a sample, that fact must be noted on the FTF and the COC (so the analytical laboratory will know not to expect a sample from that location). The Analyst must be notified when samples cannot be obtained, and a nonconformance report must be generated (Reference 13).

6.2.3. MILK PETTY CASH ADVANCE

The milk samples are paid for out of petty cash funds. Prior to collecting the samples, fill out the LLNL Petty Cash Disbursement Request Form (Attachment A), have it

signed by the SMG Group Leader or EMS Section Leader, and bring it to the Travel Accounting Cashier in Trailer 2625. All providers are paid \$5.00 per gallon, in cash, at the time of collection. The provider who supplies the QA duplicate sample will receive \$10.00 (\$5.00 for each one-gallon sample). Four quarts of cartoned milk are purchased at a local grocery store for approximately \$10.00.

6.2.4. OBTAINING THE MILK SAMPLE

All of the milk providers want us to provide sample containers. Bring the next month's sample container with you when you pick up the current month's sample (one-gallon Nalgene containers), and the samples should be ready when you arrive. Remember to provide two containers at locations where both goat's milk and cow's milk are collected. Don't forget to make arrangements for the randomly-selected QA sample for the following month, and furnish two sample containers to that provider. After collecting each sample, attach a yellow identification tag to the container (Attachment G). The tag shall contain, at a minimum, the sample identifier (including sample location designator), the type of sample (goat milk), the month and year of sampling, the date of collection, the analytes (tritium and gamma), and the collector's initials.

6.2.5. MILK SAMPLE FIELD DOCUMENTATION

Record the appropriate information on the FTF (Reference 2 and 4), including any pertinent comments about the sample.

6.2.6. MILK SAMPLE PRESERVATION

Place the samples on double-bagged ice in the ice chest. Samples must be kept cool until analysis.

6.2.7. MILK QUALITY ASSURANCE SAMPLES

A QA sample will be submitted with each batch of samples, in accordance with Reference 6. Duplicate samples are the only QA samples authorized for the milk sampling network, for which one duplicate sample is required. At the location chosen for the QA sample, two milk samples are to be collected. The location from which the QA sample is obtained is not to be identified on the COC or the sample identification tag; however, this information is required on the FTF, and the QA sample must be given a temporary sample identifier (see References 4 and 6).

6.2.8. CHAIN OF CUSTODY

Chain-of-custody procedures (Reference 4) must be followed. After all samples have been collected use the information from the FTF to complete the COC.

6.2.9. MILK SAMPLE DELIVERY

On the same day that they are collected, deliver the samples to the Radiation Analytical Sciences Laboratory, Building 151, Room 2143. If the samples cannot be delivered that day, they must be kept secure and refrigerated until they can be delivered, and chain-of-custody procedures must be followed during delivery (see Reference 4).

A one-liter aliquot of each milk sample is to be preserved with formalin at the laboratory, placed in a Marinelli beaker, and analyzed (by using a Ge(Li) spectrometer) for gamma-emitting isotopes. The remainder of each sample is to be freeze-dried (lyophilization) and the resultant water is to be analyzed for tritium by liquid-scintillation counting (Reference 5).

6.2.10. MILK DATA REVIEW, ANALYSIS, MANAGEMENT, ARCHIVING

The Analyst will review and analyze data promptly after receipt, according to Reference 7, and will follow established chain-of-custody procedures (Reference 4). When signing and returning COCs to the analytical laboratory, following receipt of data, the Analyst will identify the locations at which the QA samples were collected. Data will be given promptly to the Data Manager for entry into the EMS Monitoring Data Base (References 4 and 8), and will be archived according to Reference 11.

6.2.11. MILK DOSE ASSESSMENT AND REPORTING

After all data for a calendar year are obtained, the Analyst will use methods detailed in Reference 9 to conduct dose assessments that are based on the monitoring data. The monitoring and dose assessment results will be reported in the Site Annual Environmental Report (Reference 10).

6.3. HONEY SAMPLING

Honey samples shall be collected annually. Samplers should obtain as many samples as possible at the beginning of September and submit them as a batch when several have been collected. Others can be collected later and submitted as a separate batch, but all samples should be collected and submitted for analysis by the end of October.

6.3.1. HONEY LOCATIONS

The production of honey in designated sampling locations can vary from year to year. Each year the Analyst and the Technicians who collect honey samples should work together to identify new honey producers, especially those in the Livermore Valley.

6.3.2. HONEY PROVIDER NOTIFICATION

Samplers should call the producers in advance to determine if the honey available is from the current year and from the desired area. Arrangements should be made for a collection date and time, or for samples to be sent to EMS. Information provided by the honey producers should be recorded on the FTF. The Analyst must be notified if samples are unavailable, and a Nonconformance Report must be generated (Reference 13).

6.3.3. HONEY PETTY CASH PROCEDURES

Petty cash funds are used to purchase honey samples. Because of the sporadic nature of honey sample collection, it is usually best to wait until all samples have been collected and paid for, and then request a petty cash refund. However, petty cash advances are possible (see 6.2.3). Honey sample prices are determined through negotiation with the providers. In general, EMS allows the individual providers to set the price, and some refuse payment. Providers are to be paid at the time of collection or immediately following the submittal of invoices (for samples that are mailed to EMS). If a supplier requests more than \$10.00 for a sample, bring it to the attention of the Analyst before making the purchase.

6.3.4. OBTAINING THE HONEY SAMPLES

Collect one to three pounds of honey for each sample, and remember to collect the designated QA duplicate sample. If requested, containers can be furnished to the providers; however, the samples will usually come in a variety of containers. Each sample should be transferred to a wide-mouth glass jar (See Equipment list). Attach a white stick-on label to the jar (Attachment H). The label shall contain, at a minimum, the sample identifier (including sample location designator), the date of collection, the analyte (tritium), and the collectors initials.

6.3.5. HONEY SAMPLE FIELD DOCUMENTATION

Record the appropriate information on the FTF (Reference 2 and 4), including any pertinent comments about the sample—especially information as to where the honey was actually produced, where the bees gathered pollen, what flower species were involved, etc.

6.3.6. HONEY SAMPLE PRESERVATION

No preservation is required for the honey samples. However, make sure that the sample container lids are securely fastened to minimize the chance of airborne cross-contamination, and keep the samples at room temperature.

6.3.7. HONEY QUALITY ASSURANCE SAMPLE

A QA sample will be submitted with each batch of samples, in accordance with Reference 6. Duplicate samples are the only QA samples authorized for the honey sampling network, which requires one duplicate sample. At a location chosen for the duplicate sample, two identical honey samples shall be collected. The location where the QA sample is obtained is not to be identified on the COC or the sample identification tag (References 4 and 6), but this information is required on the FTF, and the QA sample must be given a temporary sample identifier (References 4 and 6).

6.3.8. CHAIN OF CUSTODY

Chain-of-custody procedures (Reference 4) must be followed. If samples are not delivered for analysis immediately, they must be kept in a secure location. After all batch samples have been collected, use the information from the FTF to complete the COC.

6.3.9. HONEY SAMPLE DELIVERY

When batch collection is complete, deliver the samples to the Radiation Analytical Sciences Laboratory, Building 151, Room 2143, using established chain-of-custody procedures (Reference 4).

Honey samples are to be analyzed for tritium. The method to be employed is combustion of the samples in a Parr bomb and liquid scintillation counting of the water that is created during combustion.

6.3.10. HONEY DATA REVIEW, ANALYSIS, MANAGEMENT, ARCHIVING

The Analyst will review and analyze data promptly after receipt, according to Reference 7, and will follow established chain-of-custody procedures (Reference 4). When signing and returning COCs to the analytical laboratory, following receipt of data, the Analyst will identify the locations at which the QA samples were collected. Data will be given promptly to the Data Manager for entry into the EMS Monitoring Data Base (References 4 and 8), and will be archived according to Reference 11.

6.3.11. HONEY DATA REPORTING

Because of very limited information concerning consumption factors, no dose assessments are made for honey. However, the monitoring data will be reported in the Site Annual Environmental Report (Reference 10).

6.4. WINE SAMPLING

Because of the potential economic, political, and public relations effects the data may have and because the monitoring activities involve the purchase and possession of alcoholic beverages on-site at LLNL, the annual wine sampling is an extremely sensitive issue. Discretion is necessary regarding all aspects of the wine sampling and analysis. Of particular

sensitivity is the specific identity of the wine samples; that information is considered proprietary, and is to be kept strictly confidential on a need-to-know basis. Security and procurement issues are discussed below.

Wine samples are collected annually from local retailers (Reference 2). Sampling should be conducted in early September, and should not take more than two to three days. The sampler should wait until most or all of the desired samples are obtained and then submit them as a batch for analysis. Samples that cannot be obtained immediately can be submitted as a second batch. However, all wine sampling should be completed by the end of September so the analytical laboratory has sufficient time to complete the analyses.

6.4.1. SAMPLING PLAN

Because of the program's sensitivity, a wine sampling plan must be written each year by the Analyst and approved by the SMG Group Leader, the EMS Section Leader, and analytical laboratory personnel. The plan shall describe the number and types of wines to be collected for the annual study, including QA samples and any special study samples. Quality control loads shall be discussed, including the desired number of duplicates, blanks, lab splits, and standards to be run. Analytical methods should be described, including any anticipated method changes. The plan should include the current wine FTF and should state the proposed dates for acquisition and submittal of samples, and for data delivery.

6.4.2. BUSINESS SERVICES/PROCUREMENT AND SECURITY REQUIREMENTS

Alcoholic beverage purchases by LLNL require approval by DOE, and alcoholic beverages are one of the items not permitted on site for security reasons. Therefore, the purchase of wine samples requires the special approval of both the Business Services/Procurement and Security Departments.

The current Wine Purchase Authorization memo is shown in Attachment B. This memo, with related Business Services/Procurement Department and DOE concurrences, is on file at Business Services/Procurement. It is necessary to renew the purchase authorization each year; the Analyst should contact Business Services/Procurement and DOE-LOD in early September to obtain approval.

The approval and authorization of the Security Department must be renewed biannually. An example of the Wine Security memo is presented in Attachment C. A memo similar to this must be on file with the Security Department. The memo explains the reasons for EMS personnel to have alcoholic beverages on site, designates an authorized representative (typically the Analyst), explains how security of the samples will be maintained, and requests that a Prohibited Items Permit (see Attachment D) be issued. Renewal of the permit may not require a new memo as long as the current permit has not expired and the original memo remains on file at the Security Department; verbal requests to renew have been granted in the past. Any EMS employee over the age of 21 may purchase the wine samples, but only the authorized holder of the Prohibited Items Permit may transport and store the wines on-site.

The authorized representative must have the Prohibited Items Permit in possession whenever transporting or storing wine on-site, and the permit must be shown on demand to Security personnel. Copies of the purchase and security memos should be posted wherever wines are stored. It is also recommended that copies of the purchase and security memos be carried by samplers when collecting the wine samples.

6.4.3. SELECTION AND ACQUISITION OF WINE SAMPLES

Wines are to be purchased from retail outlets as described in Reference 2. The Safeway store in Livermore has a wide selection of estate wines from Livermore and from

other geographic areas. The local wineries (public tasting rooms) are also suitable locations at which to purchase the samples.

The wine sampling plan is to be followed at the commercial outlets, with purchases made of estate-grown wine samples produced in various geographic areas (Reference 2). Usually, a specified number of wines from the eight other California (non-Livermore) wine growing regions and a specified number of wines from the European wine growing regions are required by the sampling plan. The selection of samples from all the wines available from within a geographic area is random. Any estate wine from a designated area can serve as a representative of that area. The most recent vintages available should be collected, and an equal mix of red and white wines, if possible, is desirable. Samples of all Livermore Valley estate wines not previously analyzed are to be purchased. If more Livermore wines are found than are scheduled for analysis according to the sampling plan, they shall be collected and archived. The archived samples can be used as part of the next year's sampling, or can be submitted for analyses as analytical schedules and work loads allow.

Wine samples, which should be purchased in 750 mL to 1 L bottles, are not to be opened by EMS personnel. Make sure they are adequately sealed, and transport them in partitioned cardboard wine cases.

The nature of the purchases should not be discussed with store personnel or the general public. Because the wine sampling program involves purchases of alcoholic beverages by LLNL and subsequent radiological analyses of an economically important local crop, discretion is necessary. Unlike most LLNL purchases, where a resale number is used to avoid the payment of state sales tax, the wine purchases do require the payment of sales tax. Because explanation regarding resale numbers, sales tax, and LLNL purchases only calls attention to the sampling activity, EMS has received authorization, from the Business Services Department, to pay sales tax on the wine purchases so the samplers can make the purchases discreetly (Attachment E). The sampler is reimbursed by petty cash for all purchases, including sales tax (see Section 6.4.8).

6.4.4. WINE SAMPLE FIELD DOCUMENTATION

An example of a wine FTF is found in Reference 2. The form is to be filled out completely during the course of sampling. Samplers must identify the vintage, vintner, and type of each wine and should include comments for each sample, as applicable. Information regarding QA samples also is required on the FTF (Reference 4). The FTF should be held in strict confidence.

6.4.5. WINE QUALITY ASSURANCE SAMPLES

QA wine samples must be submitted with each batch of samples, in accordance with Reference 6. Duplicate samples are the only wine QA samples submitted by EMS. However, QA samples maintained by the analytical laboratories are also analyzed and the data are reported to EMS. These laboratory QA samples include lab splits, blanks (dead water), and standards (water and wine). The QA load should be detailed in the annual wine sampling plan. A 10% duplicate sample load submitted by EMS is required. At least one duplicate should be submitted from the California wines and one should be submitted from the European wines. The remaining QA samples should come from the Livermore wines, ensuring that a minimum of 10% of the total wine samples submitted are QA duplicates. Make sure that the QA samples are exact duplicates; vintners, vintages and wine types must match exactly. It is virtually impossible to submit the QA samples blind to the laboratory because all samples are submitted in their original bottles. However, the QA samples must be submitted with nondescript (blind) sample identifiers, according to References 3 and 4. The identities of QA samples are not to be included on COCs or on the sample identification label (Sections 6.4.9 and 6.4.7). However, information regarding the identity of duplicate sample must be included on the FTF.

6.4.6. STORAGE AND SECURITY OF WINE SAMPLES

The authorized representative (holder of the Prohibited Items Permit) is the only person authorized to transport the samples on-site. It is not necessary to declare the wine samples upon entrance to the Laboratory. However, the authorized representative must be prepared to show the Prohibited Items Permit upon demand of security personnel. Once the wines are brought on-site, they must be placed in the locked metal storage cabinet in Building 151; or in the locked office of the wine analyst.

6.4.7. WINE SAMPLE LABELS AND PHOTOS

Each wine sample is to be given a sample identifier, in accordance with Reference 4. The sample identifier contains the appropriate sample location designator (Reference 3), and must appear on the FTF and the COC. Because wine bottles are often dark in color, and the vintner's labels often do not have room for the sample identifier, a white, stick-on label on which the sample identifier is written must be attached to each sample bottle. Photographs should be taken of each sample, and these photos should clearly show the vintner, the vintage, the type of wine, and the geographic area from which the wine was produced, plus the sample identifier label (see Attachment I).

6.4.8. WINE PETTY CASH PROCEDURE

The wine samples are paid for out of petty cash funds after the sampling is completed. Fill out an LLNL Petty Cash Disbursement Request Form (Attachment A) for each commercial vendor from which samples were obtained. Attach the purchase receipts to each form, and have them signed by the SMG Group Leader or the EMS Section Leader. Any individual requests in amounts over \$100.00 require the approval and signature of the Procurement Department Head. All wine petty cash forms, regardless of amount, must be approved by Business Services (Trailer 2625). Procurement Department approval, if necessary, must be obtained first. It is a good idea to bring along copies of the wine procurement memo (Attachment B) and the wine sales tax memo (Attachment E). After all signatures have been obtained, petty cash reimbursement may be obtained from the Travel Accounting Cashier in Trailer 2625.

6.4.9. CHAIN OF CUSTODY

Chain-of-custody procedures (Reference 4) must be followed. After all samples have been collected, use the information from the FTF to complete the COC. In the "Remarks" section, provide information concerning the vintage, vintner, and type of wine for all samples except the QA duplicate samples.

6.4.10. WINE SAMPLE DELIVERY

The wine samples are to be submitted unopened (to avoid airborne tritium contamination) to the Nuclear Chemistry Noble Gas Mass Spectrometry Laboratory (Building 151). Follow chain-of-custody procedures when delivering samples (Reference 4). Wines are to be analyzed for tritium using He-3 mass spectrometry (Reference 16). Make sure the method and analytical laboratory are clearly indicated on the COC.

6.4.11. WINE DATA REVIEW, ANALYSIS, MANAGEMENT, ARCHIVING

The Analyst will review and analyze data promptly after receipt, according to Reference 7, and will follow established chain-of-custody procedures (Reference 4). When signing and returning COCs to the analytical laboratory, following receipt of data, the Analyst will identify the locations at which the QA samples were collected. Data will be given promptly to the Data Manager for entry into the EMS Monitoring Data Base (References 4 and 8), and will be archived according to Reference 11.

6.4.12. WINE DOSE ASSESSMENT AND REPORTING

Dose assessments, based on the monitoring data and using methods detailed in Reference 9, will be conducted by the Analyst when all data for a calendar year are obtained. The monitoring and dose assessment results will be reported in the Site Annual Environmental Report (Reference 10).

7. DOCUMENTATION/QA RECORDS

Samplers must complete FTFs and COCs when collecting vegetation and foodstuff samples, in accordance with Reference 4, and FTFs must contain current location designators (Reference 3). FTFs and COCs become QA records and must be archived in the Document Retention Center with final sample data (Reference 11). The wine sampling plan, wine sample photos, and copies of purchase receipts are also QA records and should be archived with the wine sampling data and other wine sampling documentation. Any deviations to this procedure must be documented in Nonconformance Reports (Reference 13). Any changes to this procedure must be documented in an approved Design Change Package (Reference 12). All Nonconformance Reports and Design Change Packages are QA records and must be archived (Reference 11).

8. ACCEPTANCE CRITERIA

Only samples taken at official sampling locations will be used in the assessments of LLNL impacts on the environment, unless special samples are authorized in an approved sampling plan. Samples will not be deemed acceptable if the proper collection and preservative methods have not been followed; if the chain of custody has been broken or compromised; if the samples are not properly labeled, dated, and initialed by the sample collector; if sample contamination is suspected; if sampling schedules have not been met; or if the documentation has not been properly completed. Samples must be identified with authorized location designators (References 3 and 4) and documentation must include pertinent information as required by this procedure.

9. ATTACHMENTS

- Attachment A. LLNL Petty Cash Disbursement Request Form
- Attachment B. Wine Purchase Memo
- Attachment C. Wine Security Memo
- Attachment D. Prohibited Items Permit (Wine)
- Attachment E. Wine Sales Tax Memo
- Attachment F. Vegetation Sample Tag
- Attachment G. Milk Sample Tag
- Attachment H. Honey Sample Label
- Attachment I. Wine Sample Photo, Label

REVISION 2
FINAL

EMP-VG-S
Vegetation and Foodstuff Sampling

Effective date: 01/04/93
Page 15 of 23

Attachment A. LLNL Petty Cash Disbursement Request Form

PETTY CASH DISBURSEMENT REQUEST

LAWRENCE LIVERMORE NATIONAL LABORATORY
LIVERMORE, CA.

Under DOE Contract W-7405-Eng-48

(For machine validation only)

VENDOR: _____

ITEMS: _____

JUSTIFICATION

AMOUNT: _____

PERSON AUTHORIZED TO RECEIVE LLL PETTY CASH FUND: _____

L No. _____
Ext. _____

DEPARTMENT: _____ ACCOUNT NO: _____

CASH RECEIVED BY: _____ DATE: _____

This is to certify that the material listed on this receipt was received in the
quantities indicated and will be used for official LLNL business.

Department Approval _____

Business Services Approval for Payment over \$50.00 _____

Attachment B. Wine Purchase Memo

Interdepartmental letterhead

ZSS

Mail Station L

3-6577

January 24, 1990

TO: Lou Young, Procurement Manager
Procurement Department

FROM: C. Susi Jackson, Acting Leader
Regulatory Affairs Division

SUBJECT: *Wine Purchase*

Received

JAN 25 1990

EQVG

The Laboratory is required by DOE (DOE Orders 5400.1, 5400.XXX) to conduct an Environmental Surveillance Program. Environmental Surveillance is defined in the orders as "the collection and analysis of samples, or direct measurements, of air, water, soil, foodstuffs, biota, and other media from DOE sites and their environs for the purpose of determining compliance with applicable standards and permit requirements, assessing radiation exposures of members of the public and assessing the effects, if any, on the local environment." Furthermore, DOE Order 5400.XY states "representative samples of pathway-significant agricultural products grown within 16 km of the site should be collected and analyzed for radionuclides potentially present from site operations. These samples should be collected in at least two locations: the place of expected maximum radionuclide concentrations and a 'background' location unlikely to be affected by radionuclides released from the site." Wine production is an important agricultural activity in the local area and wine consumption represents a potential pathway for radiation exposure to the public. Therefore, as part of our Environmental Surveillance Program, the Regulatory Affairs Division annually determines the tritium content of a number of Livermore, other California, and European retail wines.

In order to complete our 1989 analyses of Livermore Valley and other wines for tritium content, Kris A. Surano of the Environmental Monitoring Group will purchase 38 bottles of wine from local retailers. Because wines scheduled for sampling may or may not be available from any one retailer, the use of conventional requisitions/purchase orders for the purchase is impractical. It is therefore necessary that Kris receive a cash advance prior to purchasing the wines. Once the wines are purchased, he will submit receipts and return any unused portion of the cash advance.

Furthermore, the entire retail wine sampling plan is currently under review. The number of samples required to adequately support the Environmental Surveillance Program will very likely increase to between 80 and 100 samples per year. This large number of samples will require a substantially increased analytical effort. The submittal of a single batch of samples, as has been the past practice, will no longer be practical. Therefore, additional wine samples will need to be purchased periodically throughout the year by Kris Surano. It would be helpful if the cash advance system mentioned above could be used in this regard as well. Kris is a contract employee with Stone and Webster and is in charge of this project.

Arrangements have already been made with the Security and Safeguards Department regarding transport and storage of these prohibited items on site (see attachment).

If other authorization is required, in addition to this memo, please contact me as soon as possible. My extension is 3-6577.

C. Susi Jackson, Acting Leader
Regulatory Affairs Division
Environmental Protection Department

Attachment C. Wine Security Memo

Interdepartmental letterhead

Mail Station L- 255

Ext. 3-6577

February 6, 1991

TO: J. E. Krueger, Department Head
Safeguards and Security

FROM: C. Susi Jackson, Division Leader
Regulatory Affairs Division

SUBJECT: Wine Security

As part of our environmental monitoring program, the Regulatory Affairs Division annually determines the tritium content of a number of Livermore, other Californian, and European retail wines. This activity requires that we bring a prohibited item on-site. Last year, the scope of the activity necessitated that wine samples be purchased and brought on-site throughout the course of the year, instead of in a single batch. A Prohibited Items Permit was issued last year to facilitate the sampling effort. That permit (#0098) has expired. Because of our on-going need to analyze wines in increasing numbers, I am requesting that the Environmental Analyst in charge of the wine sampling effort be re-issued a Prohibited Item Permit so he can freely bring wine samples on-site in the course of his duties.

Kris Surano, an LLNL employee (#872213), is the Environmental Analyst in charge of this project. He will be the person bringing the wine samples on-site. He will then submit the wine samples to Nuclear Chemistry Division for analysis. The wine samples will be kept locked up, in Building 1680, Room 1030 (Environmental Protection Department, Regulatory Affairs Division), or in Building 151, Room 2147A (Nuclear Chemistry Division).

If other authorization is required, in addition to this memo, please contact me as soon as possible. My extension is 3-6577.

C. Susi Jackson, Division Leader
Regulatory Affairs Division
Environmental Protection Department

cc J. Sima, L-255
K. Surano, L-255
R. Silva, L-231
S. Maclean, L-233
R. Holland, L-233
RAD-91-170;CSJ;JCSJH

Attachment D. Prohibited Items Permit (Wine)

PROHIBITED ITEMS PERMIT

No. 0098

Expiration Date: 2/13/92

NAME: KRIS SURANO

Employee No. 872213 of Dept. EPD

Is hereby authorized to remove from LLNL Livermore and Site 300 the item(s) described on the reverse side. Permit holder will present this card upon request as evidence of authorization to take item(s) on or off site.

Area 1680 + 151

Security Mgr. W.R. Austin Date 2/13/91

DESCRIPTION OF ITEM	DOE/LLNL PROP. NO. or SER. NO.
WINE SAMPLES FOR ENVIRONMENTAL TESTING.	

SR-CHA-21-135323
This permit is non-transferable.

Attachment E. Wine Sales Tax Memo

Interdepartmental letterhead

255
Lab Station
3-6577

May 4, 1990

TO: Bill Hartman, L-455
Business Services

FROM: C. Susi Jackson, Leader
Regulatory Affairs Division

SUBJECT: Reimbursement for Sales Tax Costs Incurred During Petty Cash Wine Purchases

As part of our Environmental Surveillance Program, the Regulatory Affairs Division determines the tritium content of a number of Livermore, other California, and European retail wines. The wines are purchased on a petty-cash basis from local retailers by Kris A. Surano of our Environmental Monitoring Group. Previous arrangements regarding these purchases have already been made with both the Procurement and the Security & Safeguards Departments regarding purchase, transport, and storage of these prohibited items on site. However, an additional complication has surfaced with respect to the wine purchases.

The wine purchases are a sensitive issue because they involve LLNL purchases of alcoholic beverages and subsequent LLNL radiological analyses of an economically-important local crop. For these reasons, it is in the best interests of LLNL that the purchases be made discreetly, with as little attention as possible being called to the purchases. The requirement of tax-exempt status for petty cash purchases has become a problem in this regard. Wine purchases cannot be made under this rule without calling immediate attention to the purchase from both retailers and other shoppers. Therefore, I am requesting that sales tax be paid when conducting the wine sampling, and that Kris A. Surano be reimbursed for such tax when requesting reimbursement for the purchases through petty cash procedures.

Kris Surano has made recent purchases of wines (paying sales tax) and has been reimbursed for the non-tax portions of the expenditures. I am now requesting that he be reimbursed for the sales tax paid on those purchases. Copies of the receipts and the related petty cash disbursement forms in question are attached. The tax amounts are .86, 1.33, .43, .94, .62, 2.58, 2.31, and 1.09 for a total of \$10.16.

Thank you for your cooperation. If other authorization is required, in addition to this memo, please contact me as soon as possible. My extension is 3-6577.

C. Susi Jackson, Leader
Regulatory Affairs Division
Environmental Protection Department

cc: I. Sims, RAD
K. Surano, RAD
RAD90-385

REVISION 2
FINAL

EMP-VG-S
Vegetation and Foodstuff Sampling

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Attachment F. Vegetation Sample Tag

L-AQUE-Ø1-VG
VEGETATION SAMPLE
4Q91
10-31-91
TRIT.

BW

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Vegetation and Foodstuff Sampling

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Attachment C. Milk Sample Tag

L-MZF-Ø1-ML

GOAT MILK

OCTOBER 1991 SAMPLE

10-31-91

H.T.O., GAMMA

EW

REVISION 2
FINAL

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Vegetation and Foodstuff Sampling

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Attachment H. Honey Sample Label

LLNL

10-31-91

C-MORG-01-HY

TRIT

BW

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EMP-VG-S
Vegetation and Foodstuff Sampling

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Attachment I. Wine Sample Photo, Label

EMP-W-L

WATER SAMPLING LOCATIONS

Prepared by:

Duke Ramsey 12-4-92
Duke Ramsey date
Environmental Technician, TSG

William G. Hoppes 12/4/92
William G. Hoppes date
Group Leader, EMG

Reviewed by:

Rebecca Ward 12-4-92
Rebecca Ward date
Environmental Technician, TSG

David Graves 12-4-92
David Graves date
Environmental Technician, TSG

Paris Althouse 12-4-92
Paris Althouse date
Environmental Technician, TSG

Katrina G. Fischer 12-7-92
Katrina G. Fischer date
Environmental Engineer, SAIC/SMG

Approved by:

Rebecca Failor 12/5/92
Rebecca Failor date
Section Leader, EMS

Kris Surano 12/3/92
Kris Surano date
Group Leader, SMG

Lucinda M. Garcia 12/4/92
Lucinda M. Garcia date
Quality Assurance Coordinator, EMS

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure lists locations to collect water samples from a variety of sources in the Livermore Valley. These include: surface water sites, aqueducts, streams, taps, and samples of groundwater production wells of local water utilities. This procedure does not include rainfall sampling locations (EMP-RA-L), stormwater sampling locations (EMP-RO-L), or sampling locations at Site 300 (EMP-GW-L).

2. APPLICABILITY/DISCUSSION

The Environmental Monitoring Section (EMS) collects surface and ground water samples in the Livermore Valley according to Reference 1, to assess possible environmental impacts of Lawrence Livermore National Laboratory (LLNL) operations. There are two categories of sampling locations: those far enough removed from LLNL to be unaffected by laboratory operations (background samples), and those locations in areas potentially affected by LLNL operations.

Sampling locations include streams, ponds, lakes, springs and groundwater production wells.

2.1. LIVERMORE VALLEY MONITORING

Sampling location designators for the Livermore Valley contain the prefix "L" followed by an acronym for each location. For example, the acronym DUCK identifies the sample collected from the Springtown duck pond and the sample location designator is L-DUCK.

Attachment A shows the locations of water samples collected from the Livermore Valley.

2.2. PRIVATE PROPERTY

Sample locations on private property and some of the sampling location designators involve the use of private individual's names and addresses. It is the policy of LLNL and EPD that the names and addresses of private parties, and directions to such sampling locations, remain in-strict-confidence. This information only be given out on a need-to-know basis. Samplers needing this proprietary information to perform their sampling activities should contact the Responsible Analyst within the Surveillance Monitoring Group (SMG).

3. REFERENCES

1. EMP-W-S, *Water Sampling*
2. EMP-QA-SL, *Sample Location Designators*
3. EMP-QA-QS, *Quality Assurance Sample*
4. EMP-QA-DC, *Document Retention*

4. DEFINITIONS

None.

REVISION 2 FINAL	EMP-W-L Water Sampling Locations	Effective date: 01/04/93 Page 3 of 9
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5. RESPONSIBILITIES

5.1. SECTION LEADER

The EMS Section Leader has final approval authority for the selection of all sampling locations.

5.2. SMG GROUP LEADER

The SMG Group Leader assures that sampling locations meet the sampling design criteria and applicable procedures.

5.3. SMG ANALYST

The SMG Analyst selects the sampling sites so that they meet the sampling design criteria. The analyst also provides proprietary information to TSG technicians requiring it for sample collection on an in-strict-confidence.

5.4. TSG TECHNICIAN

The Technical Support Group (TSG) technician collects the samples from the correct sampling location.

6. PROCEDURE

Equipment Required:

N/A

The following is a list of the sampling locations (quarterly and annual) for Livermore Valley "Other Waters" (nongroundwater) and annual groundwater sampling locations. Attachment A is a map of the Livermore Valley surface water sampling locations; attachment B is a map of Livermore Valley groundwater sampling locations. Attachment C is a sample Field Tracking Form for surface water samples.

6.1 LIVERMORE VALLEY QUARTERLY SAMPLING LOCATIONS

Livermore Valley quarterly sampling locations include (see Attachment A):

DEL: Del Valle Reservoir. Drive south on Mines Rd. to the entrance road to Del Valle Regional Park. To gain admittance without paying the parking fee, identify yourself to the ranger at the entrance. Follow the road to the right, past the parking area, to the boat ramp. Take samples from the dock next to the boat ramp.

ZON7: Zone 7 water-treatment facility. The access road to the holding reservoir is on Patterson Pass Rd, just past the entrance to the plant, approximately 1/2 mile east of the Greenville and Patterson Pass Rd. junction. If the gate to the reservoir is locked, contact Zone 7 personnel in the plant to gain access. Continue up the access road to the holding reservoir. There is a concrete jetty at the point where the reservoir flows into the aqueduct. Take the sample from the end of this jetty, in the flowing water.

DUCK: Springtown Duck Pond. The pond is on Bluebell Drive off Springtown Blvd. Take the sample at any convenient location along the shoreline parallel to Bluebell Drive.

GAS: This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

SHAD: Shadowcliff Recreation Area. Shadowcliff Reservoir is on Stanley Blvd. in Pleasanton. The entrance to Shadow Cliffs is approximately one mile east of the intersection of Stanley and Valley Blvd. Identify yourself to the person at the entrance. You should not have to pay the parking fee. Follow the road through the parking areas to the fishing dock. Take the sample from end of the dock.

ALAG: Arroyo De La Laguna. This creek is located in Sunol at the junction of Niles Rd. and Pleasanton-Sunol Rd. Take the sample from the bridge (look for "Arroyo De La Laguna" sign on bridge) where Highway 84 crosses the creek. Take the sample in the section of the creek where the water is deepest.

CAL: Calaveras Reservoir. The reservoir is located on Calaveras Road about 7.5 miles from the Sunol Water Temple gate. Continue about 1.5 miles down the road branching to the left from Calaveras Road, and look for a wooden sign to "Calaveras Dam" on locked gate. To gain access to this road, obtain a pass and a key to the gate, from the sampling notebook in the TSG Environmental Technicians office (T1680, Room 1043). Notify San Francisco Water Department (415-862-2233) before entering the locked gate. Once past the gate, continue along the access road to the dam. Drive out onto the dam until you reach a set of concrete steps extending from the top of the dam into the water of the reservoir. Take the sample from the water at the foot of the stairs.

TAP: LLNL tap water. Nuclear Chemistry personnel collect this sample from a faucet in Room 2344 in Building 151.

PALM: This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

ORCH: This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

BELL: This location involves proprietary information. Samplers requiring directions to this location should contact the Responsible Analyst.

POOL: LLNL Pool. Before collecting the sample, identify yourself to the life guard on duty and state your business. If no pool personnel are present, collect the sample from the south edge of the pool. Avoid collecting the sample when the pool is being used.

QA: Quality Assurance sample. Select the site for this sample at random from the above listed locations (see Reference 3).

6.2 LIVERMORE VALLEY GROUNDWATER SAMPLING LOCATIONS

Samples are collected from Zone 7 drinking water production wells, California Water Service production wells, City of Pleasanton production wells, and LWRP monitoring wells and analyzed for tritium on an annual basis. Samples are collected (in bottles provided by LLNL) by the personnel at each facility. EMS supplies sample bottles to the following contacts in advance. The addresses and contacts are as follows:

6.2.1. California Water Service

Tom Fitzgerald
195 S. "N" St.
Livermore, Ca.
510-447-4900

Sample the following wells:

3S/2E9Q1 (CWS#9)
3S/2E8FI (CWS#10)
3S/2E8P1 (CWS#8)
3S/2E7P3 (CWS#24)
3S/2E16B1 (CWS#5)

6.2.2. City of Livermore (LWRP)

Jackque Touray
1250 Kittyhawk Rd.
Livermore, Ca.
510-447-2896

Sample all 9 monitoring wells

6.2.3. City of Pleasanton

Jerry Taylor
5335 Sunol
Pleasanton, Ca.

Sample the following wells:

3S/1E16L5 (#5)
3S/1E16L7 (#6)
3S/1E18A5 (#7)

6.2.4. Zone 7

Mitch Baker
601 E. Vallecitos
Livermore, Ca.

Sample the following wells:

3S/1E9M2
3S/1E9M3
3S/1E17D2
3S/1E18A1

QA: Quality Assurance Sample. The responsible analyst randomly selects the location for this sample from the above sample locations (see Ref. 3 for location designators).

7. DOCUMENTATION/QA RECORDS

Field Tracking Forms (FTFs) must accurately reflect the current sampling locations and designators. Archive FTFs and QA records according to the requirements of Reference 4.

8. ACCEPTANCE CRITERIA

Once the EMS Section Leader verifies that sampling locations meet the sampling criteria, the sampling location network is acceptable. Only samples collected from the approved locations are acceptably representative of the location.

9. ATTACHMENTS

Attachment A: Water Sampling Locations, Livermore Valley.

Attachment B: Groundwater Sampling Locations, Livermore Valley

Attachment C: Field Tracking Form.

ATTACHMENT A: WATER SAMPLING LOCATIONS, LIVERMORE VALLEY

Water sampling locations, Livermore Valley.

ATTACHMENT B: GROUNDWATER SAMPLING LOCATIONS, LIVERMORE VALLEY

FIELD TRACKING FORM: LIVERMORE VALLEY WATER SAMPLING - EMP-W-S-01

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ATTACHMENT C: FIELD TRACKING FORM

ANALYSES REQUESTED:

Alpha/Beta

H.T.O.

Preservation Blanked

none

C.O.C.	LAB
1037	N/C

LOCATION:	DATE:	TIME:	INITIALS:	COMMENTS:
L-DEL-01-OW (Del Valle)	10-3-91	1400	DS PA BW	
L-ZONT-01-OW (Zone 7)	10-3-91	1030	DS PA BW	
L-DUCK-01-OW (Springtown Pond)	10-3-91	1035	DS PA BW	
L-GAS-01-OW (ARCO)	10-3-91	1044	DS PA BW	
L-ALAG-01-OW (Arroyo Laguna)	10-3-91	1136	DS PA BW	
L-SHAD-01-OW (Shadownetts)	10-3-91	1115	DS PA BW	
L-CAL-01-OW (Calaveras)	10-3-91	1210	DS PA BW	
L-TAP-01-OW (LLNL Tap)	10-3-91	1545	DS	
L-PALM-01-OW (Palm Ave.)	10-3-91	1100	DS PA BW	
L-ORCH-01-OW (Odds Ranch 148)	10-3-91	1345	DS PA BW	
L-BELL-01-OW (Bell Ave.)	10-3-91	1250	DS PA BW	
L-POOL-01-OW (LLNL Pool)	10-3-91	0933	DS PA	
L-OA-01-OW - L-ORCH-D1-OW	10-3-91		DS PA BW	
L-OA-02-OW - L-DEL-02-OW	10-3-91		DS PA BW	
L-OA-03-OW - L-OA-T1-OW				H.T.O. use LLNL tap water. Gross alpha & beta use HPLC
L-OA-04-OW - L-01-OW				H.T.O. use LLNL tap water. Gross alpha & beta use HPLC

EMP-W-S

WATER SAMPLING

Prepared by:

Eric Christofferson 11/7/94
Eric Christofferson
Environmental Analyst, WGMG
date

Reviewed by:

Rebecca Ward 11-7-94
Rebecca Ward
Environmental Technologist, TSG
date

David Graves 11-10-94
David Graves
Environmental Technologist, TSG
date

Duke Ramsey 11-7-94
Duke Ramsey
Environmental Technologist, TSG
date

Approved by:

Rebecca A. Failor 11/7/94
Rebecca A. Failor
Section Leader, EMS
date

William G. Hoppes 11/7/94
William G. Hoppes
Group Leader, WGMG
date

Lucinda McGarcia 11/10/94
Lucinda Garcia
Quality Assurance Coordinator, EMS
date

LLNL ENVIRONMENTAL
MONITORING SECTION
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1. PURPOSE

This procedure describes methods to collect samples from surface- and tap-water locations at LLNL and Site 300 and ground water production wells in the Livermore Valley.

2. APPLICABILITY/DISCUSSION

This procedure applies to surface and ground water sampling locations described in EMP-W-L, *Water Sampling Locations* (Reference 1), and surface water sampling locations at Site 300 described in EMP-GW-L, *Ground Water Sampling Locations* (Reference 2). This monitoring is required by DOE Order 5400.1, which directs that "Environmental surveillance shall be conducted to monitor the effects, if any, of DOE activities on onsite and offsite environmental and natural resources. . . Ambient water monitoring should be conducted through a network of fixed stations from which data will establish well-defined histories of the physical, biological, and chemical conditions . . ."

3. REFERENCES

1. EMP-W-L, *Water Sampling Locations*
2. EMP-GW-L, *Ground Water Sampling Locations*
3. EMP-GW-S, *Ground Water Sampling*
4. EMP-QA-SD, *Sample Tracking Documentation*
5. EMP-QA-DC, *Document Retention*

4. DEFINITIONS

Field filtration unit: A portable mechanical pump used when samples require filtration. Filters are 0.45 micron, High Capacity Disposable Filters, #GD045700 (available from Geotech Environmental Equipment, Inc., Denver, Colorado; telephone: (303)433-7101).

Field Tracking Form: Form used in the field to document sampling activities. (For this procedure, see applicable FTFs in EMP-GW-L and EMP-W-L.)

HNO₃: Nitric acid, concentrated (70.0-71.0%), unless otherwise specified.

Livermore Valley well water: Water from Zone 7 drinking water production wells, California Water Service wells and City of Pleasanton production wells, and LWRP monitoring wells (Reference 1).

Organically pure water: Commercially acquired water designated as HPLC grade water, purged with nitrogen to remove volatile organic compounds (Baxter Health Care Corporation, Burdick and Jackson Division, Muskegon, MI 49442, (616)726-3171)

5. RESPONSIBILITIES

5.1 EMS SECTION LEADER

The EMS Section Leader ensures that sampling methods meet regulatory guidance and that sampling is conducted according to approved procedures.

5.2. WGMG GROUP LEADER

The WGMG Group Leader ensures that sampling procedures meet design criteria and that sampling is conducted according to approved procedures.

5.3. WGMG ENVIRONMENTAL ANALYST OR ANALYST ASSISTANT

The WGMG Environmental Analyst or Analyst Assistant designs appropriate sampling methods and communicates them to TSG technologists, evaluates the resulting data considering regulatory requirements, and designs changes to sampling methods as appropriate.

5.4. TSG ENVIRONMENTAL TECHNOLOGIST

The Environmental Technologist collects samples according to approved procedures.

6. PROCEDURE

The responsible technologist must clearly note, on the FTF, how the sample was collected and any sampling equipment used. Standard EMS sampling protocol includes the following:

- Wear disposable gloves when collecting samples, and do not reuse gloves.
- Take special precautions not to introduce any external contamination or cross-contamination to samples. This includes: keeping the work area clean; not placing open sample bottles or caps on any surface (vials and bottles should remain capped until used); and not touching the inside of sample bottles.
- Do not place generators in the same vehicle as the sample bottles, if possible. If a second vehicle is not available for the generator, place the ice chests containing samples in large plastic bags.
- Wear disposable gloves when handling generators.
- Place generator downwind of the sampling area, whenever possible.

Equipment Required:

1. Sample bottles (See Reference 3, Appendix A. See FTF for number and types)
2. Tags or labels for bottles
3. Kimwipes™ or Kaydrys™ disposable towels
4. Disposable rubber gloves (sizes medium and large)
5. Stainless-steel dip sampler
6. Organically pure water (HPLC grade)
7. Concentrated HNO₃
8. Ice chest with ice (ice must be double bagged)
9. Indelible marking pens
10. Field filtration unit
11. Filter cartridges (0.45 micron)
12. Gasoline-powered generator
13. Low-phosphate detergent for decontaminating equipment

6.1. SAMPLING FREQUENCY AND ANALYTES

Sampling frequency and analytes to be sampled are specified in the following table. Bottle and preservation requirements are specified in Attachment A of Reference 3.

Water Sampled	Frequency	Analytes
Livermore Valley Surface	quarterly	gross alpha, gross beta, tritium
Livermore Valley Drinking	quarterly	gross alpha, gross beta, tritium
Livermore Valley Wells	annually	tritium
LLNL Tap	quarterly	gross alpha, gross beta, tritium
LLNL Pool	monthly	gross alpha, gross beta, tritium
Site 300 Surface	quarterly	gross alpha, gross beta, tritium, metals

6.2. DIP-SAMPLING

6.2.1. Rinse stainless steel bucket and sampler handle with water to be sampled. Clean with Kimwipes and triple-rinse with water to be sampled.

6.2.2. Submerge the bucket approximately three to four inches below the water surface. Avoid sampling near the edge of surface water bodies.

6.2.3. Allow the bucket to fall into a vertical position. Using a smooth motion, withdraw the bucket from the water.

6.2.4. If sample is to be analyzed for volatile organic compounds, fill these bottles immediately. Do not use the field filtration unit to fill vials for volatile organic compound samples.

6.2.5. Clean dip-sampler with deionized water and low phosphate detergent.

6.3. LIVERMORE VALLEY WELLS

6.3.1. The TSG Technologist obtains tritium bottles from the stock maintained by Radiation Analytical Sciences.

6.3.2. The TSG Technologist delivers bottles to water service personnel (see Reference 1 for names and addresses of contacts and wells to be sampled).

6.3.3. The TSG Technologist attaches tag labeled with location ID (see Reference 1 for location ID numbers) to bottle and leaves bottles with water service personnel. Water service personnel enter date of sample on tag and COC.

6.3.4. Water service personnel collect samples, enter sample date on tag and contact EMS for pickup.

6.3.5. The TSG Technologist delivers samples to Radiation Analytical Sciences.

6.4. QUALITY CONTROL SAMPLES

6.4.1. A minimum of 10% of the locations sampled for these networks are sampled in duplicate to generate intralaboratory precision data. Locations to be duplicated are selected by the responsible Analyst or by the TSG Technologist.

6.4.2. Field blanks are taken at a rate of one per sampling event for these networks.

6.4.3. Trip blanks are not required for these networks.

7. DOCUMENTATION

FTFs must be completed during sample collection (Reference 4). Use the information from the FTFs to complete the Chain-of-Custody form (QAP-8-I). FTFs, COCs, hard copy data, and other relevant documents must be combined into data packages (Reference 4) and filed in the Document Retention Center (Reference 5).

8. ACCEPTANCE CRITERIA

Samples are considered acceptable only when all the following are true:

- 8.1. Proper sampling procedures as defined in this procedure have been followed
- 8.2. Proper sample preservative measures have been taken
- 8.3. Chain of custody has not been broken or compromised
- 8.4. All required documentation has been properly completed
- 8.5. Bottles are properly labeled by the sampler.

9. ATTACHMENTS

Attachment A: Sample Field Tracking Form, Site 300 Surface Water

Attachment B: Sample Chain-of-Custody Form, Site 300 Surface Water

Attachment C: Sample Field Tracking Form, Livermore Valley Surface Water, Livermore Valley Drinking Water, LLNL Pool, and LLNL Tap Water

Attachment D: Sample Chain-of-Custody Form, Livermore Valley Surface Water, Livermore Valley Drinking Water, LLNL Pool, and LLNL Tap Water

Attachment E: Sample Field Tracking Form, Livermore Valley Wells

Attachment F: Sample Chain-of-Custody Form, Livermore Valley Wells

Attachment G: Sample Field Tracking Form, Monthly Pool Sample

Attachment H: Sample Chain-of-Custody Form, Monthly Pool Sample

FIELD TRACKING FORM

Quarterly Site 300 Waters

LAB	COC
3150	CLS
3109	IT
3102	RAS

Special Instructions:

See ANALYTE SPECIFIC SAMPLING REQUIREMENTS sheet for definition of footnotes.

Attachment A: Sample Field Tracking Form, Site 300 Surface Water

LOCATION:	DATE:	TIME:	INITIALS:	REQUESTED ANALYSIS:	COMMENTS:
3-WELL20-01-OW (WELL 20)	8/18/94	1250	DG	☒ EPA502.2 (5X 40 mL cr gl) ☒ Metals (a-g) (500/1000mL Poly) ☒ Trilium (500mL 5mL gl) ☒ Alpha/Beta (a) (1L Poly)	pumped for 5 min then sampled
3-GEOCRK-01-OW (GEODETC CREEK)	8/16/94	1325	DG, TP	☒ Metals (a-g) (500/1000mL Poly) ☒ Trilium (500mL 5mL gl) ☒ Alpha/Beta (a) (1L Poly)	dry, no sample taken
3-812CRK-01-OW (812 CREEK)	8/16/94	1305	DG, TP	☒ Metals (a-g) (500/1000mL Poly) ☒ Trilium (500mL 5mL gl) ☒ Alpha/Beta (a) (1L Poly)	normal dirty water
3-CARNRW2-01-OW (CARNRW2)				☒ EPA502.2 (5X 40 mL cr gl) ☒ Metals (a-g) (500/1000mL Poly) ☒ Trilium (500mL 5mL gl) ☒ Alpha/Beta (a) (1L Poly)	collected at an annual sample set
3-CARNRW1-01-OW (CARNRW1)	8/16/94	1120	DG, TP	☒ EPA501 (c) (2X 40mL cr gl)	

☒ Copy given to analyst, Eric Christofferson

Revised 11/2/94 TSG

REVISION 3
FINAL

EMP-W-S
Water Sampling

Effective date: 12/01/94
Page 6 of 19

Page 1 of 1 3150

Chain-of-Custody Record

Laboratory: <u>CLS</u>				Project Name/Analysis: <u>WINE - CHRISTIANSON</u>		Sample Identifier:		Sample Group Description	
Sampler: (signature) <u>Dawn Pearce</u>				Date		Analytes Requested		Logbook ID No:	
site	location	number	medium	date	number of containers	analytes	analytes	analytes	analytes
3	GEORGE	01	OW	8-16-94	1	✓	NO SAMPLE	NO SAMPLE	S-300 OTHER WATER
3	812CRK	01	OW	8-16-94	1	✓	✓	(A) CBY EPA 200.7	
3	CARVER	01	OW	8-16-94	12	✓	✓	(BEST POSSIBLE ICP R.L.)	
3	CARNER	01	OW	8-16-94	2	✓	✓	CU BY EPA 200.7	
3	QA	51	OW	8-16-94	2	✓	✓	3-DAG NADH-11-04	
3	CON2	01	OW		2	✓	✓	(BEST POSSIBLE GEAA R.L.)	
3	QA	17	OW	8-17-94	1	✓	✓	WYPA BY EPA 239.2	
3	NC761	01	OW		3	✓	✓	(B) PLEASE PROVIDE 0.2M/L R.L.	
3	NC769	01	OW		3	✓	✓		
3	NC2110	01	OW		3	✓	✓		
3	WELL01	01	OW	8-18-94	1	✓	✓	RECEIVED	
3	WELL30	01	OW	8-18-94	1	✓	✓	SEP 15 1994	
								EM.S	

Requisitioned by Sampler:	Date/Time	Received by Courier at LLM
<u>Dawn Pearce</u>	8-18-94 1614	<u>[Signature]</u>
Requisitioned by Courier to Lab:	Date/Time	Received at Laboratory:
<u>[Signature]</u>	8-18-94 1800	<u>Mark Thompson</u>
Requisitioned from Lab:	Date/Time	Date received by Analyst:
<u>Dawn Pearce</u>	9/1/94 0910	<u>[Signature]</u>
Date/Time	Date/Time	Date received by Data Manager:
9/1/94 0910	9/1/94	<u>Christina Hankala</u>

Release Number:	TRIP:
IZJ0648	RCA

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Lawrence Livermore National Laboratory
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Livermore, CA 94551

Form QAP-6
Rev. 5
October 1993

Attachment B: Sample Chain-of-Custody Form, Site 300 Surface Water, continued

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Chain-of-Custody Record

Laboratory: 77		Project Name/Analyst: USMC - CHEMIST/RESON		Sample Group Description: 5300 Q.L.V. 3Q94	
Sampler: (signature) Duke Ramsey		Logbook ID No:		REMARKS	
Site	Location	Number	Date	Analyst	Remarks
3	NC761	01	0W	8-17-94	(A) 231, 235, 238
3	NC211B	01	0W		(B) 228, 232
3	NC769	01	0W		
3	WE220	01	0W	8-18-94	
3	WE200K	01	0W	8-16-94	
3	WE201	01	0W	8-18-94	
3	CON1	01	0W	8-17-94	
3	QA	17	0W	8-17-94	
3	CARPRW2	01	0W	8-16-94	
3	QDF1	01	0W	8-17-94	
3	K204D	01	0W	8-2-94	
3	NC748	01	0W	8-9-94	
3	NC748	01	0W	8-16-94	
3	K204S	01	0W	8-2-94	
3	NC207	01	0W	8-2-94	
3	K201C	01	0W	8-2-94	

Relinquished by Sampler:	Date/Time	Received by Counter LNL	Date/Time
Duke Ramsey	8/19/94 1402	Duke Ramsey	8-22-94 1210
Relinquished by Counter LNL:		Received at Laboratory:	

Relinquished from Lab:	Date/Time	Received by Analyst	Date/Time
Duke Ramsey	9/19/94 1402	Duke Ramsey	8-22-94 1210
Relinquished by Analyst: <td></td> <td>Received by Counter LNL: <td></td> </td>		Received by Counter LNL: <td></td>	

Release Number	TRR
AG-0134	QA

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Form QAP-8
 Rev. 5
 October 1993

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Chain-of-Custody Record

[illegible]

Attachment C: Sample Field Tracking Form, Livermore Valley Surface Water, Livermore Valley Drinking Water, LLNL Pool, and LLNL Tap Water

LAB	COC
4443	RG2
3301	IT

FIELD TRACKING FORM
Livermore Valley Other Water

Special Instructions:

Sample for Alpha/Beta (a) (1L Poly) and Tritium (500mL lint pl)

See ANALYTE SPECIFIC SAMPLING REQUIREMENTS sheet for definition of footnote (a).

LOCATION:	DATE:	TIME:	INITIALS:	COMMENTS:
L-DEL-01-OW (Del Valle)	7/13/94	1327	DG	
L-ZON7-01-OW (Zone 7)	7/13/94	0933	DG	
L-DUCK-01-OW (Springtown Pond)	7/13/94	0953	DG	lots of fathead minnows
L-GAS-01-OW (ARCO)	7/13/94	1003	DG	
L-ALAG-01-OW (Arroyo Laguna)	7/13/94	1048	DG	clear water
L-SHAD-01-OW (Shadowcliffs)	7/13/94	1024	DG	clear water
L-CAL-01-OW (Calaveras)	7/13/94	1114	DG	good water
L-TAP-01-OW (LLNL Tap - B151)	7/13/94	1500	DG	sample taken at 5426 rnc 1004
L-PALM-01-OW (Palm Ave.)	7/13/94	1221	DG	
L-ORCH-01-OW (Olds Ranch 145)	7/13/94	1308	DG	
L-BELL-01-OW (Bell Ave.)	7/13/94	1151	DG	
L-POOL-01-OW (LLNL Pool)	7/13/94	1400	DG	
L-QA-01-OW (L-DUCK-01-OW)	7/13/94		DG	
L-QA-12-OW = L-TAP-02-OW	7/13/94		DG	Spectrum HPLC water Lot # IH 345 Tritium - use LLNL tap water. Gross alpha & beta - use HPLC. Sample taken at 3426

☒ Copy given to analyst, Richard Brown

Revised 11/3/94 TSG

Page 7 of 7

Chain-of-Custody Record

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Attachment D: Sample Chain-of-Custody Form, Livermore Valley Surface Water, Livermore Valley Drinking Water, LLNL Pool, and LLNL Tap Water, continued

page 1 of 1 3301

Chain-of-Custody Record

Laboratory: IT		Project Name/Analyst: EMS Brown		Sample Group Description	
Sampler: (Signature) David Thomas		Sample Identifier:		Logbook ID No:	
site	location	number	medium	REMARKS	
L	DEL	01	OW	7/13/94	
L	ZON7	01	OW		
L	GAS	01	OW		
L	ALAG	01	OW		
L	SHAD	01	OW		
L	CAL	01	OW		
L	DUCK	01	OW		
L	TAP	01	OW		
L	BELL	01	OW		
L	PALM	01	OW		
L	ORCH	01	OW		
L	POOL	01	OW		
L	QA	81	OW		
L	QA	82	OW	7/13/94	

Relinquished by Sampler:		Received by Courier at LLNL:	
Signature	Date/Time	Signature	Date/Time
<i>David Thomas</i>	7-15-94 09:40	<i>am high</i>	
	7/15/94 09:30		
	7/13/94 13:50		
	7/19/94 16:57		

Relinquished from Lab:		Received at Laboratory:	
Signature	Date/Time	Signature	Date/Time
<i>David Thomas</i>			

Release Number: IT-50601	TR: RCA
--------------------------	---------

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Lab: Laboratory.

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Form OAP-8
Rev. 5
October 1993

REVISION 3
FINAL

EMP-W-S
Water Sampling

Effective date: 12/01/94
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Attachment E: Sample Field Tracking Form, Livermore Valley Wells

FIELD TRACKING FORM: Annual Livermore Valley Groundwaters

Rev. 6/15/94

Location: California Water Service

195 So. "N" Street; Livermore, CA.

Tom Fitzgerald (510-447-4900)

Sample Identifier	Date Bottles Delivered	Date Bottles Received	Initials
3S2E-9Q1 (CWS #9) L-3S2E-9Q1-01-OW	6-17-94	6-23-94	DE, GB
3S2E-8F1 (CWS #10) L-3S2E-8F1-01-OW			DE, GB
3S2E-7P3 (CWS #24) L-3S2E-7P3-01-OW			DE, GB
3S2E-8P1 (CWS #8) L-3S2E-8P1-01-OW			DE, GB
3S2E-16B1 (CWS #5) L-3S2E-16B1-01-OW			DE, GB
(QA) 3S2E-7P3-01-OW L-QA- 16 OW	✓	✓	DE, GB

City of Livermore -LWRP

1250 Kitty Hawk Rd. Livermore, CA.

Jackie Touray (510-447-2896)

Sample Identifier	Date Bottles Delivered	Date Bottles Received	Initials
3S1E-1P3 (WELL G-10) L-3S1E-1P3-01-OW	6-17-94	7-6-94	AS
3S1E-1P2 (WELL G-5) L-3S1E-1P2-01-OW			
3S1E-1H3 (WELL G-1) L-3S1E-1H3-01-OW			
3S1E-1R2 (WELL G-9) L-3S1E-1R2-01-OW			
3S2E-7C2 (WELL G-4) L-3S2E-7C2-01-OW			
3S1E-2R1 (WELL G-2) L-3S1E-2R1-01-OW			
3S1E-12A2 (WELL G-7) L-3S1E-12A2-01-OW			
3S1E-12G1 (WELL G-8) L-3S1E-12G1-01-OW			
3S1E-11B1 (WELL G-3) L-3S1E-11B1-01-OW		✓	✓
(QA) 3S1E-1H3-01-OW L-QA- 17 OW	✓	7-6-94	AS

Pleasanton City Corp Yard

3333 Busch Rd. Pleasanton, CA.

Susan Clough (510-484-8070)

Sample Identifier	Date Bottles Delivered	Date Bottles Received	Initials
3S1E-16L5 (#5) L-3S1E-16L5-01-OW	6-17-94	6-28-94	AS, AR
3S1E-16L7 (#6) L-3S1E-16L7-01-OW		6-28-94	AS, AR
3S1E-18A5 (#7) L-3S1E-18A5-01-OW		6-28-94	AS, AR
(QA) 3S1E-16L5-01-OW L-QA- 19 OW	✓	6-28-94	AS, AR

Del Valle- Zone 7

601 E. Vallecitos-Livermore, CA.

Gurpal S. Deol (510-447-0533)

Sample Identifier	Date Bottles Delivered	Date Bottles Received	Initials
3S1E-9M2 (MOCHO 1) L-3S1E-9M2-01-OW	6-17-94	7-20-94	DE
3S1E-9M3 (MOCHO 2) L-3S1E-9M3-01-OW			
3S1E-17D2 (HOPYARD 4) L-3S1E-17D2-01-OW		7-28-94	DE
3S1E-18A1 (HOPYARD 1) L-3S1E-18A1-01-OW		7-21-94	DE
(QA) 3S1E-17D2 L-QA- 18 OW	✓	7-28-94	DE

*NOTE: Take sample bottles to LWRP in JUNE.

Local water supply agencies should be notified prior to bottle delivery and given ample time for sample collection. These annual waters are started during the 3rd Quarter but must be completed by the end of July.

Analyses: Tritium

COC 4425 LAB: RAS

4441

4442

3251

TH 1 L-3S1E-1202-01-OW
TO THE NEW
STATION

51-10008-004

page ___ of ___ 4442

Chain-of-Custody Record

[illegible]

page ___ of ___
4441

Chain-of-Custody Record

Laboratory: RAS				Project Name/Analyst: EHS EALS CHESTER/Johnson				Sample Group Description: ANNUAL WATER			
Sampler: (signature) <i>David Johnson</i>				Logbook ID No:				REMARKS			
Sample Identifier:		Date		Number of Containers		Analysis Requested		Retained by Sampler:		Received by Courier at LNL:	
Site	Location	Number	Medium	Date	Number of Containers	Analysis Requested	Retained by Sampler:	Date/Time	Received at Laboratory:	Date/Time	Received by Analyst:
L	351E-16L5	01	OW	6-28-94	1			7-15-94	0840		
L	351E-16L7	01	OW	6-28-94	1			7-15-94	0925		
L	01-10008-004	01	OW	6-28-94	1			9/22/94	0800		
L	QA	19	OW	6-28-94	1			10/6/94	1400		
<p>REPLACED 1-351E-18A5-01-OW</p> <p>351E-16L5-D1-OW</p> <p>REMOVED 9-23-94 OW</p>											
<p>Received</p> <p>SEP 22 1994</p> <p>EMS</p>											

Release Number:

TRR:

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Notes: (Date for use; when to Date Manager w/ data)

When: (Date Manager; include w/ data and photographs of containers while to Analyst)

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Form QAP-8

Rev. 5

October 1993

4425

Chain-of-Custody Record

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3151

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Chain-of-Custody Record

[illegible]

REVISION 3 FINAL	EMP-W-S Water Sampling	Effective date: 12/01/94 Page 18 of 19
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Attachment G: Sample Field Tracking Form, Monthly Pool Sample

FIELD TRACKING FORM
MONTHLY LLNL POOL SAMPLE

Date: 7/29/94

Time Sampled: 1228

LAB	COC
RAJ	4463

Special Instructions:

See ANALYTE SPECIFIC SAMPLING REQUIREMENTS sheet for definition of footnotes.

FIELD TREATMENTS

Untreated Samples

Alpha/Beta [a] (1L Poly) ✓
Tritium (500mL flint gf) ✓

Comments:

☒ Copy given to analyst, Richard Brown

Initials: _____

DR

page 1 of 1 4:53

Chain-of-Custody Record

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