UCRL-50027-95
Volume 2

Environmental Report 1995

Lawrence Livermore National Laboratory

Lead Compositor
Beverly L. Chamberlain

Art and Design
Lee Dravidzius

Proofreader
Jill S. Sprinkle

Publication Services
Candy K. Justin
Brenda M. Staley

Cover Design:

Amsinckia grandiflora (large-flowered fiddleneck) at Site 300, by Lee Dravidzius. Photo credit: Don Gonzalez.

This report was created using electronic publishing. The word processing and layout were performed using Microsoft Word on the Macintosh, and the art was created using Adobe Illustrator. This report can be accessed on the Internet at http://www.llnl.gov/saer.

For additional information about this report, please contact:

Bert Heffner, Area Relations Manager,
LLNL Public Affairs Department
P.O. Box 808, L-404
Livermore, CA 94550
(510) 424-4026

Available to DOE and DOE contractors from the Office of Scientific and Technical Information
P.O. Box 62, Oak Ridge, TN 37831
Prices available from (615) 576-8401, FTS 626-8401

Available to the public from the National Technical Information Service U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract W-7405-Eng-48.

Environmental Report 1995, Volume 2

Authors

Robert J. Harrach
Rebecca A. Failor
Gretchen M. Gallegos
Paula J. Tate
Eric Christofferson
Erich R. Brandstetter
Jennifer M. Larson
Arthur H. Biermann
Richard A. Brown
Barbara C. Fields
Lucinda M. Garcia
Allen R. Grayson

Editor

Howard L. Lentzner

Contributing Authors

Michael J. Taffet
Richard G. Blake
Kris A. Surano
Joel H. White
Sabre J. Coleman
Constance E. DeGrange
John Celeste
Donald H. MacQueen
Ellen Eagan
Karen J. Folks
Frank J. Gouveia
Stephen P. Harris
Dawn M. Chase
Jamie M. Bennett
Mathew Mlekush
Saverio P. Mancieri
Jim S. Woollett, Jr.
Kenneth C. Zahn
Robert J. Vellinger
Tina M. Carlsen
Charlotte van Warmerdam
Joseph R. McIntyre
Sandra Mathews
Stephanie S. Goodwin
David Rice
William G. Hoppes
Bern J. Qualheim
Charlene H. Grandfield
Richard Ragaini
Jack Sims

September 3, 1996 **Lawrence Livermore National Laboratory**

UCRL-50027-95
Distribution Category UC-702

Preface

This is Volume 2 of the Lawrence Livermore National Laboratory's (LLNL's) annual *Environmental Report 1995,* prepared for the U.S. Department of Energy. Volume 1, *Environmental Report 1995* (with no volume number designation) is intended to provide all information on LLNL's environmental impact and compliance activities that is of interest to most readers. This second volume, entitled *Environmental Report 1995, Volume 2*, supports Volume 1 summary data and is essentially a detailed data report that provides individual data points, where applicable. Some summary data are also included in Volume 2, and more detailed accounts are given of sample collection and analytical methods. Not all of the data in Volume 2 tables have been reduced to the proper number of significant figures; however, summary data in both volumes are expressed using the proper number of significant figures.

The two volumes are parallel in their organization to assist with cross-referencing between them. Volume 2 includes information in the eight chapters on monitoring of air, air effluent, sewage, surface water, ground water, soil and sediment, vegetation and foodstuff, and environmental radiation, as well as the three chapters on ground water protection, compliance self-monitoring and quality assurance. The other four chapters in Volume 1 contain no additional information in Volume 2.

As in last year's annual report, data are presented in Système International (SI) units. In particular, the primary units used for radiological results are becquerels and sieverts for activity and dose, with curies and rem used secondarily ($1\ \text{Bq} = 2.7 \times 10^{-11}\ \text{Ci}$; $1\ \text{Sv} = 100\ \text{rem}$).

Table of Contents

Indicates no supplemental data in Volume 2. Please see Volume 1 for detailed information on this subject.

Table of Contents

Indicates no supplemental data in Volume 2. Please see Volume 1 for detailed information on this subject.

List of Tables

List of Tables

List of Tables

There is no supplemental data in this chapter.
Please see Volume 1 for details about
Site Overview.

There is no supplemental data in this chapter.
Please see Volume 1 for details about
Compliance Summary

There is no supplemental data in this chapter.
Please see Volume 1 for details about
Environmental Program Information.

4. Air Monitoring

Paula J. Tate
Joel White

Air Surveillance Sampling Methods

For air surveillance monitoring, two networks monitor the air particulates in the environs of LLNL; and one network monitors the environs of Site 300, including one sampler in the City of Tracy. All the networks use continuously operating, high volume samplers located as shown in Figures 4-1, 4-2, and 4-3 in Volume 1. The LLNL site perimeter network maintains six samplers at the perimeter and two at areas of special interest (diffuse sources); the Livermore Valley network consists of five samplers located in the least prevalent wind directions (FCC, FIRE, HOSP, RRCH, and ERCH) considered to be upwind or background and four samplers located in the most prevalent downwind directions (PATT, ZON7, TANK, and ALTA). An additional sampler is located in an area of special interest (LWRP) because of a release in 1967 (see Results Section in Volume 1). These air samplers are positioned to ensure reasonable probability that any significant concentration of particulate effluents from LLNL operations will be detected.

One of the sampling locations, ERCH, was removed from service in October of 1995 because of logistical problems at the location. The geographical details of the particulate sampling locations are outlined in a procedure in the Appendix A of the *Environmental Monitoring Plan* (Tate et al. 1995).

Each air particulate sampler pulls air continuously at a constant rate of $400\ L/min$ through a $20.3\ cm \times 25.4\ cm$ Whatman-41 cellulose filter. The flow is maintained at better than the DOE requirement of ±20% of the nominal flow by using a mass flow controller that adjusts motor speed. These flow rates are verified at regular intervals with a portable field calibration unit. If a sampler fails, it is repaired and then calibrated with a spirometer that itself was calibrated using a unit traceable to the National Institute for Standards and Technology.

An easily dissolvable filter with a low trace-metal background is required for airborne beryllium analyses. Whatman-41 filters provide a balance between such requirements and particulate collection efficiency (Lindeken et al. 1963).

Particulate filters are changed each week at all locations. After each particulate filter is removed from a sampler, it is identified by location, date on, date off, elapsed time, and flow rate and is given a sample identifier (a four-field code) that accompanies it throughout the analysis. Filters are then placed in glassine envelopes, and the sample information is recorded in a field tracking notebook. After a four-day delay for decay of the radon-thoron daughters, gross alpha and gross beta activities on the filters are determined with a gas flow proportional

counter. The gross alpha, gross beta, and beryllium analyses are completed by a contract laboratory.

The analytical laboratory uses ^{241}Am and ^{137}Cs as calibration sources to determine alpha and beta counting efficiencies, respectively. Cross checks using ^{230}Th and ^{90}Sr are also completed periodically. These standards are certified by EPA. Counting-efficiency measurements are made for each set of counted filters. A background count is taken at the beginning of each run and between each set of 20 samples. Records are kept of background and counting-efficiency variations that occur in the counting equipment. The analytical laboratory reports the actual instrumentation values, including negative results that arise when background measurements are higher than those for the filters.

Monthly composites of filters from each of the Livermore site perimeter locations (SALV, MESQ, CAFE, MET, VIS, and COW) are placed into individual plastic bags. The six bags are then combined and sealed in a 214-cm^3 aluminum can and are counted for gamma-emitting radionuclides using low-background Ge(Li) detectors. The Site 300 filters are sealed and counted in a similar manner. Following gamma counting, the composited filters from each Livermore site perimeter location are analyzed by LLNL's Chemistry and Materials Science Environmental Services Laboratory for the presence of ^{239}Pu, ^{235}U, and ^{238}U. The off-site samples from the Livermore Valley are analyzed for ^{239}Pu, and all of the Site 300 samples are composited and analyzed for ^{239}Pu, ^{235}U, and ^{238}U. The filters are ashed and then dissolved in a mixture of nitric acid and hydrochloric and/or hydrofluoric acids. Plutonium and uranium are separated by an ion-exchange process. Each separated element is purified further by ion exchange. Then plutonium is electroplated onto a stainless steel disk and submitted for alpha spectrometry, while uranium solutions are submitted for analysis by mass spectrometry.

Replicate samples are processed to confirm the results obtained from the samplers. In addition, a duplicate quality control (QC) sampler is operated for two months in parallel with the permanent sampler at a given site. The QC filters also are exchanged weekly, and both filter sets are submitted for analysis in the usual manner. After two months, the QC sampler is rotated to another location.

A total volume of approximately 4 ML of air is sampled at each location each week. The details of air particulate sampling and sample change-out are described in Appendix A of the *Environmental Monitoring Plan* (Tate et al. 1995). Details of high-volume sampler flow calibration are also discussed in a procedure, and details of air sample analysis procedures are outlined in Hall and Edwards (1994).

As outlined in U.S. Department of Energy (1991), gross alpha and gross beta air filter results are used only as trend indicators; specific radionuclide analysis is done for plutonium, uranium, and all gamma emitters. All analytical results are reported as a measured concentration per volume of air, or at the minimum detection limit (MDL) when no activity is detected. In all cases, the MDL is more than adequate for demonstrating compliance with the pertinent regulatory requirements for radionuclides that are present or may be present in the air sample. Particle size distributions are not determined because the estimated effective dose equivalent to the maximally exposed individual is well below the 0.01 mSv (1 mrem) allowable limit.

Beryllium measurements are made on portions of each of the weekly air filters from the Livermore site perimeter and Site 300 samplers that are composited by sampling location every month. The analytical laboratory adds 40 mL of 10% nitric acid to each composite. The solution is heated for 30 minutes and decanted into a separate beaker where more nitric acid is added. This step is repeated two more times and the solution is evaporated to less than 20 mL (care is taken to prevent the samples from boiling or baking dry). The samples are diluted to 20 mL with deionized water. Quantification is accomplished by graphite furnace atomic absorption spectroscopy.

LLNL also maintains 11 continuously operating airborne tritium samplers on the Livermore site (Volume 1, Figure 4-1) and 5 samplers in the Livermore Valley (Volume 1, Figure 4-2). Four of the Livermore site locations (B331, B292, B514, and B624) monitor diffuse source emissions. The tritium sample locations are detailed in Appendix B of the *Environmental Monitoring Plan* (Tate et al. 1995). The tritium samplers, operating at a flow rate of 700 mL/min, use silica gel in flasks to collect water vapor. These flasks are changed every 2 weeks, and the samples are identified by location, date on, date off, elapsed sampling time, and flow rate. The flow rate is the average of the initial and final flow rates, which are measured biweekly with a rotometer that is calibrated once a year. Each sample is given a sample identifier that accompanies it through analysis. Two additional samplers are rotated among the locations at 2-month intervals to provide duplicate QC samples. Details of the actual tritium sampling and a description of tritium sampler calibration can be found in Appendix A of the *Environmental Monitoring Plan* (Tate et al. 1995).

Once the samples are taken, the water is separated from the silica gel by freeze-dried vacuum distillation, and the tritium concentration in the water is determined by liquid-scintillation counting. Airborne tritium sample analysis is done by LLNL's Chemistry and Materials Science Environmental Services Laboratory. All analytical results are reported as a measured concentration per unit volume of air flow through the sampling medium. Details of the analytical procedure are described in Hall and Edwards (1994).

Data

Monthly summaries of gross alpha and gross beta data are presented in **Tables 4-1**, **4-2**, and **4-3**. **Tables 4-4** and **4-5** present monthly gamma activity on air filters for the Livermore site perimeter and Site 300. Monthly plutonium data for each sampling location are shown in **Tables 4-6** through **4-9**. Monthly uranium data for the Livermore site perimeter and Site 300 are presented in **Tables 4-10** and **4-11**. Biweekly tritium data for sampling locations in the Livermore Valley, Livermore site perimeter, and diffuse sources are shown in **Tables 4-12**, **4-13**, and **4-14**. **Tables 4-15** and **4-16** present monthly beryllium data for Livermore site perimeter and Site 300 sampling locations.

The data generally reflect historic data values for these analytes at these locations. A detailed discussion of these results is provided in Volume 1 of this report.

Table 4-1. Median gross alpha and gross beta activities (Bq/mL) at the LLNL perimeter, summarized by month and location, 1995.

Month	SALV	MESQ	CAFE	MET	VIS	COW
Gross alpha						
Jan	-3.1×10^{-12}	-3.1×10^{-11}	-1.3×10^{-11}	-9.0×10^{-11}	4.3×10^{-13}	-2.4×10^{-11}
Feb	-3.2×10^{-11}	-5.0×10^{-11}	1.4×10^{-12}	-2.8×10^{-11}	-4.2×10^{-11}	-3.5×10^{-11}
Mar	7.8×10^{-12}	1.7×10^{-11}	-1.4×10^{-11}	8.3×10^{-12}	2.0×10^{-11}	3.9×10^{-12}
Apr	9.8×10^{-12}	-1.7×10^{-11}	-5.6×10^{-12}	-5.4×10^{-12}	-1.0×10^{-11}	-1.1×10^{-11}
May	-1.0×10^{-11}	-9.5×10^{-12}	3.5×10^{-12}	1.2×10^{-11}	-1.1×10^{-11}	-1.5×10^{-11}
Jun	6.3×10^{-12}	7.9×10^{-12}	8.6×10^{-12}	2.8×10^{-12}	1.9×10^{-11}	2.0×10^{-11}
Jul	2.5×10^{-11}	-3.1×10^{-11}	-5.3×10^{-12}	-8.0×10^{-12}	1.1×10^{-12}	-7.7×10^{-12}
Aug	1.1×10^{-11}	-3.8×10^{-11}	6.2×10^{-12}	-2.2×10^{-11}	-1.3×10^{-11}	-1.1×10^{-11}
Sep	1.7×10^{-11}	3.2×10^{-11}	-2.1×10^{-11}	5.4×10^{-12}	-4.9×10^{-11}	4.2×10^{-11}
Oct	3.7×10^{-11}	3.0×10^{-11}	7.9×10^{-11}	5.5×10^{-11}	3.6×10^{-11}	-8.0×10^{-13}
Nov	2.0×10^{-11}	3.8×10^{-11}	5.7×10^{-11}	2.4×10^{-11}	6.4×10^{-11}	1.4×10^{-11}
Dec	1.6×10^{-12}	-1.3×10^{-11}	-1.3×10^{-11}	1.0×10^{-11}	-5.5×10^{-11}	-4.0×10^{-11}
Annual median[a]	$\mathbf{5.2 \times 10^{-12}}$	$\mathbf{-8.1 \times 10^{-12}}$	$\mathbf{3.7 \times 10^{-12}}$	$\mathbf{1.7 \times 10^{-12}}$	$\mathbf{-4.8 \times 10^{-12}}$	$\mathbf{-7.8 \times 10^{-12}}$
IQR[b]	$\mathbf{<2.5 \times 10^{-11}}$	$\mathbf{<2.6 \times 10^{-11}}$	$\mathbf{<2.5 \times 10^{-11}}$	$\mathbf{<3.8 \times 10^{-11}}$	$\mathbf{<3.1 \times 10^{-11}}$	$\mathbf{<2.1 \times 10^{-11}}$
Annual maximum[c]	$\mathbf{1.1 \times 10^{-10}}$	$\mathbf{1.1 \times 10^{-10}}$	$\mathbf{1.1 \times 10^{-10}}$	$\mathbf{1.5 \times 10^{-10}}$	$\mathbf{1.3 \times 10^{-10}}$	$\mathbf{1.6 \times 10^{-10}}$
Gross beta						
Jan	8.4×10^{-11}	3.5×10^{-10}	1.9×10^{-10}	2.7×10^{-10}	1.8×10^{-10}	1.9×10^{-10}
Feb	6.0×10^{-10}	8.3×10^{-10}	7.5×10^{-10}	7.5×10^{-10}	6.2×10^{-10}	7.2×10^{-10}
Mar	2.7×10^{-10}	2.7×10^{-10}	3.3×10^{-10}	2.0×10^{-10}	2.9×10^{-10}	2.4×10^{-10}
Apr	1.9×10^{-10}	2.9×10^{-10}	3.0×10^{-10}	2.0×10^{-10}	2.4×10^{-10}	3.2×10^{-10}
May	2.8×10^{-10}	2.1×10^{-10}	2.1×10^{-10}	2.5×10^{-10}	3.0×10^{-10}	2.6×10^{-10}
Jun	2.5×10^{-10}	2.6×10^{-10}	2.8×10^{-10}	2.6×10^{-10}	1.9×10^{-10}	4.4×10^{-11}
Jul	2.8×10^{-10}	2.7×10^{-10}	2.4×10^{-10}	3.2×10^{-10}	2.3×10^{-10}	2.0×10^{-10}
Aug	5.3×10^{-10}	5.3×10^{-10}	4.6×10^{-10}	4.7×10^{-10}	4.1×10^{-10}	5.6×10^{-10}
Sep	8.8×10^{-10}	8.5×10^{-10}	7.1×10^{-10}	8.0×10^{-10}	7.1×10^{-10}	6.9×10^{-10}
Oct	8.6×10^{-10}	8.1×10^{-10}	8.1×10^{-10}	8.8×10^{-10}	6.4×10^{-10}	8.0×10^{-10}
Nov	7.6×10^{-10}	7.4×10^{-10}	7.3×10^{-10}	7.6×10^{-10}	6.6×10^{-10}	8.4×10^{-10}
Dec	3.9×10^{-10}	5.4×10^{-10}	4.2×10^{-10}	6.0×10^{-10}	4.4×10^{-10}	4.0×10^{-10}
Annual median[a]	$\mathbf{4.1 \times 10^{-10}}$	$\mathbf{4.0 \times 10^{-10}}$	$\mathbf{4.6 \times 10^{-10}}$	$\mathbf{4.3 \times 10^{-10}}$	$\mathbf{3.6 \times 10^{-10}}$	$\mathbf{4.2 \times 10^{-10}}$
IQR[b]	$\mathbf{4.3 \times 10^{-10}}$	$\mathbf{4.6 \times 10^{-10}}$	$\mathbf{4.3 \times 10^{-10}}$	$\mathbf{5.0 \times 10^{-10}}$	$\mathbf{3.6 \times 10^{-10}}$	$\mathbf{4.4 \times 10^{-10}}$
Annual maximum[c]	$\mathbf{2.0 \times 10^{-9}}$	$\mathbf{2.0 \times 10^{-9}}$	$\mathbf{1.9 \times 10^{-9}}$	$\mathbf{2.4 \times 10^{-9}}$	$\mathbf{1.6 \times 10^{-9}}$	$\mathbf{1.9 \times 10^{-9}}$

a The annual median is determined from the data for the 52-week period.

b The interquartile range is determined from the data for the 52-week period. See Chapter 15, Quality Assurance.

c The annual maximum is determined from the data for the 52-week period.

Table 4-2a. Median gross alpha activities (Bq/mL) for the Livermore Valley, 1995.

Month	Livermore Valley downwind			
	PATT	**ZON7**	**TANK**	**ALTA**
Jan	-1.0×10^{-11}	-8.2×10^{-11}	-4.1×10^{-12}	-1.8×10^{-11}
Feb	-4.5×10^{-11}	-4.9×10^{-11}	-6.7×10^{-11}	-1.4×10^{-11}
Mar	1.4×10^{-11}	1.2×10^{-11}	-1.6×10^{-11}	-4.2×10^{-12}
Apr	-4.0×10^{-11}	-1.4×10^{-11}	7.1×10^{-12}	2.4×10^{-11}
May	-3.0×10^{-13}	-7.1×10^{-12}	-1.3×10^{-11}	-2.1×10^{-11}
Jun	2.0×10^{-11}	1.0×10^{-11}	-3.2×10^{-12}	2.6×10^{-11}
Jul	-2.2×10^{-11}	-2.1×10^{-11}	1.1×10^{-11}	-1.1×10^{-11}
Aug	-6.5×10^{-11}	-3.2×10^{-11}	3.5×10^{-12}	-9.1×10^{-12}
Sep	-4.3×10^{-11}	-1.2×10^{-11}	7.6×10^{-13}	-5.6×10^{-11}
Oct	-1.4×10^{-11}	6.6×10^{-11}	4.8×10^{-11}	3.5×10^{-11}
Nov	5.8×10^{-11}	2.5×10^{-11}	3.5×10^{-11}	7.1×10^{-11}
Dec	-1.5×10^{-12}	-3.3×10^{-11}	-2.0×10^{-11}	-1.4×10^{-11}
Annual median[a]	$\mathbf{-1.2 \times 10^{-11}}$	$\mathbf{-6.3 \times 10^{-12}}$	$\mathbf{-8.0 \times 10^{-13}}$	$\mathbf{5.6 \times 10^{-13}}$
IQR[b]	$\mathbf{<2.3 \times 10^{-11}}$	$\mathbf{<1.5 \times 10^{-11}}$	$\mathbf{<3.1 \times 10^{-11}}$	$\mathbf{<3.0 \times 10^{-11}}$
Annual maximum[c]	$\mathbf{1.2 \times 10^{-10}}$	$\mathbf{1.2 \times 10^{-10}}$	$\mathbf{9.1 \times 10^{-11}}$	$\mathbf{1.2 \times 10^{-10}}$
	Livermore Valley upwind			
	FCC	**FIRE**	**HOSP**	**RRCH**	**ERCH**
Jan	-6.5×10^{-11}	-1.3×10^{-11}	-1.7×10^{-11}	-1.9×10^{-11}	-2.5×10^{-11}
Feb	-3.5×10^{-12}	4.6×10^{-12}	-4.1×10^{-11}	-3.6×10^{-11}	-3.4×10^{-11}
Mar	2.0×10^{-11}	-3.1×10^{-12}	-2.2×10^{-11}	-1.9×10^{-12}	-1.1×10^{-11}
Apr	-4.6×10^{-12}	-2.1×10^{-11}	3.8×10^{-11}	-2.7×10^{-11}	-1.3×10^{-11}
May	2.9×10^{-12}	2.5×10^{-11}	-1.7×10^{-11}	-9.9×10^{-12}	-3.4×10^{-11}
Jun	-1.5×10^{-12}	6.6×10^{-12}	-8.3×10^{-12}	-2.1×10^{-11}	-8.0×10^{-12}
Jul	-2.2×10^{-11}	5.2×10^{-12}	-2.4×10^{-11}	-2.4×10^{-12}	-7.6×10^{-12}
Aug	-5.8×10^{-11}	-4.9×10^{-11}	-7.8×10^{-12}	-2.3×10^{-11}	-1.5×10^{-11}
Sep	-6.4×10^{-11}	-1.3×10^{-11}	-3.3×10^{-11}	9.4×10^{-12}	-5.4×10^{-12}
Oct	4.4×10^{-11}	5.4×10^{-11}	-1.1×10^{-11}	3.9×10^{-11}	7.6×10^{-12}
Nov	6.4×10^{-11}	-5.6×10^{-13}	-3.9×10^{-14}	9.0×10^{-11}	—[d]
Dec	6.5×10^{-12}	-1.0×10^{-11}	2.0×10^{-11}	-4.5×10^{-11}	—[d]
Annual median[a]	$\mathbf{2.8 \times 10^{-12}}$	$\mathbf{-7.3 \times 10^{-12}}$	$\mathbf{-1.1 \times 10^{-11}}$	$\mathbf{-1.6 \times 10^{-11}}$	$\mathbf{-1.2 \times 10^{-11}}$
IQR[b]	$\mathbf{<4.0 \times 10^{-11}}$	$\mathbf{<2.5 \times 10^{-11}}$	$\mathbf{<1.2 \times 10^{-11}}$	$\mathbf{<1.4 \times 10^{-11}}$	—[e]
Annual maximum[c]	$\mathbf{8.6 \times 10^{-11}}$	$\mathbf{1.2 \times 10^{-10}}$	$\mathbf{7.3 \times 10^{-11}}$	$\mathbf{1.2 \times 10^{-10}}$	$\mathbf{7.1 \times 10^{-11}}$

...concluded on next page

Table 4-2a. Median gross alpha activities (Bq/mL) for the Livermore Valley, 1995 (concluded).

Month	Special interest
	LWRP
Jan	-3.5×10^{-11}
Feb	-4.8×10^{-11}
Mar	-1.1×10^{-11}
Apr	-8.8×10^{-12}
May	-5.8×10^{-12}
Jun	-2.0×10^{-12}
Jul	-4.7×10^{-11}
Aug	-2.0×10^{-12}
Sep	2.1×10^{-11}
Oct	1.0×10^{-10}
Nov	4.3×10^{-11}
Dec	6.1×10^{-12}
Annual median[a]	$\mathbf{-5.8 \times 10^{-12}}$
IQR[b]	$\mathbf{<2.7 \times 10^{-11}}$
Annual maximum[c]	$\mathbf{1.5 \times 10^{-10}}$

a The annual median is determined from the data for the 52-week period.

b The interquartile range is determined from the data for the 52-week period. See Chapter 15, Quality Assurance.

c The annual maximum is determined from the data for the 52-week period.

d Sample location was discontinued because of logistical problems.

e Interquarterile range not calculated. See Chapter 15, Quality Assurance.

Table 4-2b. Median gross beta activities (Bq/mL) for the Livermore Valley, 1995.

Month	Livermore Valley downwind			
	PATT	ZON7	TANK	ALTA
Jan	2.7×10^{-10}	1.9×10^{-10}	1.1×10^{-10}	2.6×10^{-10}
Feb	6.2×10^{-10}	7.0×10^{-10}	6.7×10^{-10}	6.8×10^{-10}
Mar	2.3×10^{-10}	2.7×10^{-10}	3.1×10^{-10}	3.1×10^{-10}
Apr	1.8×10^{-10}	2.6×10^{-10}	2.7×10^{-10}	2.7×10^{-10}
May	3.0×10^{-10}	3.5×10^{-10}	3.5×10^{-10}	1.5×10^{-10}
Jun	2.2×10^{-10}	1.6×10^{-10}	3.2×10^{-10}	2.8×10^{-10}
Jul	1.9×10^{-10}	2.3×10^{-10}	3.0×10^{-10}	3.2×10^{-10}
Aug	4.3×10^{-10}	4.2×10^{-10}	4.5×10^{-10}	4.6×10^{-10}
Sep	5.7×10^{-10}	6.9×10^{-10}	5.3×10^{-10}	7.6×10^{-10}
Oct	7.0×10^{-10}	7.4×10^{-10}	9.8×10^{-10}	7.1×10^{-10}
Nov	4.4×10^{-10}	6.4×10^{-10}	6.3×10^{-10}	6.9×10^{-10}
Dec	2.2×10^{-10}	4.3×10^{-10}	4.3×10^{-10}	4.6×10^{-10}
Annual median[a]	$\mathbf{3.1 \times 10^{-10}}$	$\mathbf{3.9 \times 10^{-10}}$	$\mathbf{4.1 \times 10^{-10}}$	$\mathbf{3.9 \times 10^{-10}}$
IQR[b]	$\mathbf{3.0 \times 10^{-10}}$	$\mathbf{3.8 \times 10^{-10}}$	$\mathbf{3.5 \times 10^{-10}}$	$\mathbf{4.0 \times 10^{-10}}$
Annual maximum[c]	$\mathbf{1.5 \times 10^{-9}}$	$\mathbf{1.7 \times 10^{-9}}$	$\mathbf{1.6 \times 10^{-9}}$	$\mathbf{2.4 \times 10^{-9}}$

	Livermore Valley upwind				
	FCC	FIRE	HOSP	RRCH	ERCH
Jan	2.5×10^{-10}	2.2×10^{-10}	2.2×10^{-10}	2.5×10^{-10}	1.4×10^{-10}
Feb	6.7×10^{-10}	6.4×10^{-10}	8.0×10^{-10}	7.7×10^{-10}	5.6×10^{-10}
Mar	2.2×10^{-10}	2.5×10^{-10}	1.2×10^{-10}	2.2×10^{-10}	2.3×10^{-10}
Apr	2.0×10^{-10}	1.9×10^{-10}	2.9×10^{-10}	2.0×10^{-10}	1.3×10^{-10}
May	2.3×10^{-10}	1.1×10^{-10}	2.6×10^{-10}	1.9×10^{-10}	3.4×10^{-10}
Jun	1.8×10^{-10}	1.7×10^{-10}	1.7×10^{-10}	1.1×10^{-10}	8.3×10^{-11}
Jul	2.3×10^{-10}	2.5×10^{-10}	1.5×10^{-10}	3.9×10^{-10}	2.1×10^{-10}
Aug	5.2×10^{-10}	4.2×10^{-10}	4.2×10^{-10}	5.4×10^{-10}	4.4×10^{-10}
Sep	6.6×10^{-10}	7.7×10^{-10}	6.1×10^{-10}	7.7×10^{-10}	4.8×10^{-10}
Oct	8.6×10^{-10}	8.8×10^{-10}	8.6×10^{-10}	6.7×10^{-10}	2.9×10^{-10}
Nov	8.8×10^{-10}	7.1×10^{-10}	5.5×10^{-10}	7.2×10^{-10}	—[d]
Dec	4.9×10^{-10}	5.2×10^{-10}	3.4×10^{-10}	3.8×10^{-10}	—[d]
Annual median[a]	$\mathbf{3.6 \times 10^{-10}}$	$\mathbf{4.0 \times 10^{-10}}$	$\mathbf{4.1 \times 10^{-10}}$	$\mathbf{3.8 \times 10^{-10}}$	$\mathbf{2.8 \times 10^{-10}}$
IQR[b]	$\mathbf{4.7 \times 10^{-10}}$	$\mathbf{4.0 \times 10^{-10}}$	$\mathbf{3.5 \times 10^{-10}}$	$\mathbf{4.5 \times 10^{-10}}$	$\mathbf{3.0 \times 10^{-10}}$
Annual maximum[c]	$\mathbf{1.9 \times 10^{-9}}$	$\mathbf{2.1 \times 10^{-9}}$	$\mathbf{1.7 \times 10^{-9}}$	$\mathbf{1.8 \times 10^{-9}}$	$\mathbf{1.2 \times 10^{-9}}$

...concluded on next page

Table 4-2b. Median gross beta activities (Bq/mL) for the Livermore Valley, 1995 (concluded).

Month	Special interest
	LWRP
Jan	2.9×10^{-10}
Feb	9.4×10^{-10}
Mar	3.6×10^{-10}
Apr	3.3×10^{-10}
May	3.3×10^{-10}
Jun	2.1×10^{-10}
Jul	3.5×10^{-10}
Aug	5.1×10^{-10}
Sep	8.4×10^{-10}
Oct	7.9×10^{-10}
Nov	7.9×10^{-10}
Dec	6.4×10^{-10}
Annual median[(a)]	$\mathbf{4.8 \times 10^{-10}}$
IQR[(b)]	$\mathbf{4.3 \times 10^{-10}}$
Annual maximum[(c)]	$\mathbf{2.3 \times 10^{-9}}$

a The annual median is determined from the data for the 52-week period.

b The interquartile range is determined from the data for the 52-week period. See Chapter 15, Quality Assurance.

c The annual maximum is determined from the data for the 52-week period.

d Sample location was discontinued because of logistical problems.

Table 4-3. Gross alpha and gross beta activities (Bq/mL) summarized by month and location, Site 300, 1995.

Month	801E	ECP	EOBS	GOLF	LIN	NPS	WCP	WOBS	TFIR
Gross alpha									
Jan	7.5×10^{-12}	5.4×10^{-12}	-1.4×10^{-11}	3.1×10^{-13}	-1.5×10^{-11}	-2.9×10^{-11}	-2.6×10^{-11}	-2.6×10^{-11}	-8.6×10^{-11}
Feb	-2.5×10^{-11}	2.2×10^{-11}	6.1×10^{-12}	-3.3×10^{-11}	-3.0×10^{-11}	-3.3×10^{-11}	-2.9×10^{-11}	-1.8×10^{-11}	-1.4×10^{-11}
Mar	-3.0×10^{-12}	-6.6×10^{-12}	-1.3×10^{-11}	-2.4×10^{-11}	-2.3×10^{-11}	3.8×10^{-13}	-2.2×10^{-11}	-1.5×10^{-11}	-5.2×10^{-11}
Apr	-2.0×10^{-11}	-1.3×10^{-11}	-1.2×10^{-11}	-2.0×10^{-12}	-1.3×10^{-11}	-2.8×10^{-11}	-1.7×10^{-11}	-3.3×10^{-11}	-3.1×10^{-11}
May	4.1×10^{-11}	6.2×10^{-12}	1.4×10^{-11}	1.9×10^{-11}	4.1×10^{-12}	4.5×10^{-11}	1.3×10^{-11}	1.2×10^{-12}	2.1×10^{-11}
Jun	-1.6×10^{-11}	-1.7×10^{-11}	8.8×10^{-12}	3.6×10^{-11}	3.1×10^{-11}	-9.5×10^{-12}	3.4×10^{-11}	3.4×10^{-12}	1.3×10^{-11}
July	1.7×10^{-11}	1.8×10^{-11}	-2.1×10^{-11}	-1.0×10^{-11}	-9.6×10^{-12}	5.3×10^{-12}	-1.0×10^{-11}	9.2×10^{-12}	1.6×10^{-11}
Aug	-2.8×10^{-11}	-6.3×10^{-11}	-2.7×10^{-11}	-1.2×10^{-11}	-1.5×10^{-11}	-6.5×10^{-11}	-1.3×10^{-11}	2.8×10^{-12}	2.0×10^{-12}
Sept	-6.0×10^{-12}	9.2×10^{-12}	-2.0×10^{-11}	-1.6×10^{-11}	3.5×10^{-11}	-9.7×10^{-12}	2.1×10^{-11}	-1.7×10^{-12}	7.0×10^{-11}
Oct	7.2×10^{-11}	2.9×10^{-11}	2.0×10^{-11}	3.9×10^{-11}	9.9×10^{-11}	3.5×10^{-11}	5.9×10^{-11}	1.9×10^{-11}	5.5×10^{-11}
Nov	5.7×10^{-11}	-1.6×10^{-12}	3.4×10^{-11}	3.6×10^{-11}	3.0×10^{-11}	-1.8×10^{-12}	5.8×10^{-11}	1.5×10^{-11}	7.5×10^{-11}
Dec	-1.4×10^{-11}	-1.4×10^{-11}	-4.9×10^{-11}	-4.0×10^{-11}	2.4×10^{-11}	-2.5×10^{-11}	1.7×10^{-11}	-1.3×10^{-11}	-5.1×10^{-11}
Annual median[a]	$\mathbf{1.5 \times 10^{-11}}$	$\mathbf{-1.7 \times 10^{-12}}$	$\mathbf{-1.2 \times 10^{-11}}$	$\mathbf{-8.7 \times 10^{-12}}$	$\mathbf{1.9 \times 10^{-12}}$	$\mathbf{-1.8 \times 10^{-11}}$	$\mathbf{1.4 \times 10^{-12}}$	$\mathbf{-5.4 \times 10^{-12}}$	$\mathbf{2.0 \times 10^{-12}}$
IQR[b]	$\mathbf{3.5 \times 10^{-10}}$	$\mathbf{6.0 \times 10^{-11}}$	$\mathbf{5.3 \times 10^{-11}}$	$\mathbf{6.2 \times 10^{-11}}$	$\mathbf{1.3 \times 10^{-10}}$	$\mathbf{5.9 \times 10^{-11}}$	$\mathbf{1.6 \times 10^{-10}}$	$\mathbf{6.0 \times 10^{-11}}$	$\mathbf{2.3 \times 10^{-10}}$
Annual maximum[c]	$\mathbf{2.7 \times 10^{-9}}$	$\mathbf{2.1 \times 10^{-9}}$	$\mathbf{3.5 \times 10^{-9}}$	$\mathbf{2.5 \times 10^{-9}}$	$\mathbf{4.2 \times 10^{-9}}$	$\mathbf{4.0 \times 10^{-9}}$	$\mathbf{2.9 \times 10^{-9}}$	$\mathbf{4.4 \times 10^{-9}}$	$\mathbf{5.5 \times 10^{-9}}$
Gross beta									
Jan	1.5×10^{-10}	8.0×10^{-11}	1.6×10^{-10}	1.7×10^{-10}	1.2×10^{-10}	2.9×10^{-10}	1.1×10^{-10}	2.0×10^{-10}	2.5×10^{-10}
Feb	3.8×10^{-10}	6.0×10^{-10}	3.6×10^{-10}	5.7×10^{-10}	5.6×10^{-10}	5.4×10^{-10}	6.2×10^{-10}	5.6×10^{-10}	7.6×10^{-10}
Mar	3.6×10^{-10}	2.7×10^{-10}	4.0×10^{-10}	2.4×10^{-10}	2.9×10^{-10}	4.2×10^{-10}	1.2×10^{-10}	2.8×10^{-10}	4.5×10^{-10}
Apr	2.3×10^{-10}	2.0×10^{-10}	2.2×10^{-10}	2.1×10^{-10}	2.0×10^{-10}	2.6×10^{-10}	2.8×10^{-10}	2.4×10^{-10}	3.4×10^{-10}
May	3.9×10^{-10}	2.3×10^{-10}	2.4×10^{-10}	3.0×10^{-10}	2.8×10^{-10}	3.6×10^{-10}	1.3×10^{-10}	2.5×10^{-10}	3.1×10^{-10}
Jun	2.1×10^{-10}	3.8×10^{-10}	2.4×10^{-10}	2.7×10^{-10}	9.9×10^{-10}	1.9×10^{-10}	2.2×10^{-10}	1.1×10^{-10}	3.1×10^{-10}
July	3.0×10^{-10}	3.0×10^{-10}	3.6×10^{-10}	3.0×10^{-10}	3.1×10^{-10}	2.7×10^{-10}	3.5×10^{-10}	2.8×10^{-10}	4.2×10^{-10}
Aug	5.6×10^{-10}	5.1×10^{-10}	5.5×10^{-10}	4.8×10^{-10}	5.3×10^{-10}	4.6×10^{-10}	4.0×10^{-10}	5.0×10^{-10}	6.7×10^{-10}
Sept	6.9×10^{-10}	6.2×10^{-10}	7.9×10^{-10}	7.3×10^{-10}	7.1×10^{-10}	7.0×10^{-10}	5.7×10^{-10}	6.5×10^{-10}	8.4×10^{-10}
Oct	7.2×10^{-10}	6.5×10^{-10}	6.2×10^{-10}	5.2×10^{-10}	8.2×10^{-10}	7.6×10^{-10}	7.1×10^{-10}	6.6×10^{-10}	9.3×10^{-10}
Nov	6.3×10^{-10}	6.0×10^{-10}	5.9×10^{-10}	7.3×10^{-10}	8.7×10^{-10}	5.8×10^{-10}	5.4×10^{-10}	7.1×10^{-10}	1.1×10^{-10}
Dec	3.1×10^{-10}	4.3×10^{-10}	4.2×10^{-10}	5.5×10^{-10}	5.04×10^{-10}	4.5×10^{-10}	3.6×10^{-10}	4.4×10^{-10}	6.8×10^{-10}
Annual median[a]	$\mathbf{4.4 \times 10^{-10}}$	$\mathbf{4.2 \times 10^{-10}}$	$\mathbf{4.2 \times 10^{-10}}$	$\mathbf{4.5 \times 10^{-10}}$	$\mathbf{4.1 \times 10^{-10}}$	$\mathbf{4.6 \times 10^{-10}}$	$\mathbf{3.1 \times 10^{-10}}$	$\mathbf{3.8 \times 10^{-10}}$	$\mathbf{5.5 \times 10^{-10}}$
IQR[b]	$\mathbf{3.9 \times 10^{-10}}$	$\mathbf{3.8 \times 10^{-10}}$	$\mathbf{3.5 \times 10^{-10}}$	$\mathbf{3.2 \times 10^{-10}}$	$\mathbf{4.0 \times 10^{-10}}$	$\mathbf{3.8 \times 10^{-10}}$	$\mathbf{4.4 \times 10^{-10}}$	$\mathbf{4.3 \times 10^{-10}}$	$\mathbf{4.9 \times 10^{-10}}$
Annual maximum[c]	$\mathbf{1.6 \times 10^{-9}}$	$\mathbf{1.5 \times 10^{-9}}$	$\mathbf{1.8 \times 10^{-9}}$	$\mathbf{1.5 \times 10^{-9}}$	$\mathbf{1.7 \times 10^{-9}}$	$\mathbf{1.5 \times 10^{-9}}$	$\mathbf{1.7 \times 10^{-9}}$	$\mathbf{1.6 \times 10^{-9}}$	$\mathbf{1.6 \times 10^{-9}}$

a The annual median is determined from the data for the 52-week period.

b The interquartile range is determined from the data for the 52-week period. See Chapter 15, Quality Assurance.

c The annual maximum is determined from the data for the 52-week period.

Table 4-4. Gamma activity in particulate air samples, Livermore site perimeter, 1995.[a]

Month	(10^{-9} Bq/mL)	(10^{-12} Bq/mL)					
	^{7}Be	^{40}K	^{137}Cs	^{22}Na	^{226}Ra	^{228}Ra	^{228}Th
Jan	2.6 ± 0.05	<2.99	<0.14	<0.35	<0.42	<0.55	<0.38
Feb	4.5 ± 0.07	<6.62	<0.22	<0.23	<0.48	<1.03	<0.55
Mar	4.5 ± 0.12	<6.40	1.33 ± 0.61	<0.27	<0.51	<1.11	<0.61
Apr	4.7 ± 0.08	<5.29	<0.19	<0.63	<0.41	<1.37	<0.46
May	3.8 ± 0.06	<5.55	<0.17	<0.42	<0.45	<0.89	<0.46
Jun	3.7 ± 0.07	21.1 ± 7.0	<0.15	<0.16	<0.42	<1.43	<0.39
Jul	4.4 ± 0.07	16.0 ± 8.2	<0.17	<0.19	<0.51	<1.81	<1.11
Aug	5.5 ± 0.09	27.4 ± 14.0	0.38 ± 0.29	0.56 ± 0.34	1.74 ± 0.70	<1.59	<0.85
Sep	5.6 ± 0.09	22.1 ± 7.4	<0.16	<0.17	<0.50	2.45 ± 1.06	1.48 ± 0.72
Oct	6.5 ± 0.20	41.4 ± 9.4	0.47 ± 0.37	0.39 ± 0.31	<3.00	<3.17	<2.25
Nov	5.0 ± 0.09	28.8 ± 7.0	<0.16	<0.17	<1.61	<2.31	<1.04
Dec	3.8 ± 0.06	<5.99	<0.19	<0.22	<0.47	<0.95	<0.50
Median	**4.4**	**<11.30**	**<0.18**	**<0.25**	**<0.49**	**<1.40**	**<0.58**
IQR[c]	**1.3**	**<23.4**	**—[b]**	**—[b]**	**—[b]**	**—[b]**	**—[b]**
Maximum	**6.5**	**41.44**	**1.33**	**<0.63**	**<3.00**	**<3.17**	**<2.25**
DCG[d] (Bq/mL)	**1.5×10^{-3}**	**3.3×10^{-5}**	**1.5×10^{-5}**	**3.7×10^{-5}**	**3.7×10^{-8}**	**1.1×10^{-7}**	**1.5×10^{-9}**
Fraction of DCG	**3.0×10^{-6}**	**$<3.4 \times 10^{-7}$**	**$<1.2 \times 10^{-8}$**	**$<6.8 \times 10^{-9}$**	**$<1.3 \times 10^{-5}$**	**$<1.3 \times 10^{-5}$**	**$<3.9 \times 10^{-4}$**
(μCi/mL)							
Median	**1.2×10^{-13}**	**$<3.1 \times 10^{-16}$**	**$<4.9 \times 10^{-18}$**	**$<6.8 \times 10^{-18}$**	**$<1.3 \times 10^{-17}$**	**$<3.8 \times 10^{-17}$**	**$<1.6 \times 10^{-17}$**
IQR[c]	**3.6×10^{-14}**	**$<6.3 \times 10^{-16}$**	**—[b]**	**—[b]**	**—[b]**	**—[b]**	**—[b]**
Maximum	**1.8×10^{-13}**	**1.1×10^{-15}**	**3.6×10^{-17}**	**$<1.7 \times 10^{-17}$**	**$<8.1 \times 10^{-17}$**	**$<8.6 \times 10^{-17}$**	**$<6.1 \times 10^{-17}$**
DCG[d]	**4×10^{-8}**	**9×10^{-10}**	**4×10^{-10}**	**1×10^{-9}**	**1×10^{-12}**	**3×10^{-12}**	**4×10^{-14}**

Note: Radionuclide results are reported ±2σ; see Chapter 15, Quality Assurance.

a All Livermore site perimeter samples composited. See Figure 4-1, Volume I for sampling locations.

b No measure of dispersion calculated; see Chapter 15, Quality Assurance.

c Interquartile Range.

d Derived Concentration Guide.

Table 4-5. Gamma activity in particulate air samples, Site 300, 1995.[a]

Month	(10^{-9} Bq/mL)	(10^{-12} Bq/mL)					
	^{7}Be	^{40}K	^{137}Cs	^{22}Na	^{226}Ra	^{228}Ra	^{228}Th
Jan	2.2 ± 0.05	<2.1	<0.11	0.25 ± 0.17	<0.28	<0.41	<0.35
Feb	4.0 ± 0.09	6.1 ± 4.1	<0.11	0.33 ± 0.21	<0.31	<0.45	<0.37
Mar	4.7 ± 0.08	<2.0	<0.10	0.61 ± 0.30	<0.22	<0.35	<0.27
Apr	4.6 ± 0.07	5.4	<0.18	<0.61	<0.38	<0.87	<0.46
May	4.4 ± 0.10	11.4 ± 8.3	<0.11	0.70 ± 0.37	<0.69	<0.53	<0.32
Jun	3.5 ± 0.06	<4.6	<0.17	<0.39	<0.37	<1.63	<0.84
Jul	5.5 ± 0.12	<4.6	<0.15	0.60 ± 0.34	<0.35	<1.67	<0.40
Aug	6.7 ± 0.15	17.5 ± 6.5	0.40 ± 0.31	0.75 ± 0.36	1.67 ± 1.06	<0.53	<1.19
Sep	6.3 ± 0.13	18.1 ± 8.0	<0.15	0.48 ± 0.30	<1.97	<0.61	<0.41
Oct	7.2 ± 0.13	34.9 ± 5.1	0.52 ± 0.23	0.56 ± 0.26	<2.22	2.32 ± 0.67	<1.85
Nov	4.1 ± 0.11	17.7 ± 6.8	<0.17	<0.17	<1.94	<1.52	<1.47
Dec	2.7 ± 0.04	<3.6	<0.16	<0.44	<0.36	<0.64	<0.33
Median	**4.5**	**5.77**	**<0.15**	**<0.52**	**<0.38**	**<0.62**	**<0.41**
IQR[c]	**1.80**	**<17.54**	**—[b]**	**—[b]**	**—[b]**	**—[b]**	**—[b]**
Maximum	**7.18**	**34.89**	**0.52**	**0.75**	**<2.22**	**2.32**	**<1.85**
DCG[d] (Bq/mL)	**1.5×10^{-3}**	**3.3×10^{-5}**	**1.5×10^{-5}**	**3.7×10^{-5}**	**3.7×10^{-8}**	**1.1×10^{-7}**	**1.5×10^{-9}**
Fraction of DCG	**3.0×10^{-6}**	**1.7×10^{-7}**	**$<1.0 \times 10^{-8}$**	**$<1.4 \times 10^{-8}$**	**$<1.0 \times 10^{-5}$**	**$<5.7 \times 10^{-6}$**	**$<2.7 \times 10^{-4}$**
(μCi/mL)							
Median	**1.2×10^{-13}**	**1.56×10^{-16}**	**$<4.2 \times 10^{-18}$**	**$<1.4 \times 10^{-17}$**	**$<1.0 \times 10^{-17}$**	**$<1.7 \times 10^{-17}$**	**$<1.1 \times 10^{-17}$**
IQR[c]	**4.9×10^{-14}**	**$<4.7 \times 10^{-16}$**	**—[b]**	**—[b]**	**—[b]**	**—[b]**	**—[b]**
Maximum	**1.9×10^{-13}**	**9.4×10^{-16}**	**1.4×10^{-17}**	**2.0×10^{-17}**	**$<6.0 \times 10^{-17}$**	**6.3×10^{-17}**	**$<5.0 \times 10^{-17}$**
DCG[d]	**4×10^{-8}**	**9×10^{-10}**	**4×10^{-10}**	**1×10^{-9}**	**1×10^{-12}**	**3×10^{-12}**	**4×10^{-14}**

Note: Radionuclide results are reported ±2σ; see Chapter 15, Quality Assurance.

a All Site 300 perimeter samples composited. See Figure 4-3, Volume I for sampling locations.

b No measure of dispersion calculated; see Chapter 15, Quality Assurance.

c Interquartile Range.

c Derived Concentration Guide.

Table 4-6. Plutonium–239 activity in air particulate samples, Livermore Valley, 1995.

Month	Livermore Valley downwind[a]			
	ALTA	PATT	TANK	ZON7
	(10^{-15} Bq/mL)			
Jan	16.5 ± 15.4	11.6 ± 47.4	–5.5 ± 12.9	5.7 ± 11.1
Feb	12.0 ± 10.0	–0.7 ± 4.2	0.7 ± 8.0	0.7 ± 7.7
Mar	24.1 ± 14.8	–7.1 ± 9.3	9.4 ± 9.7	5.3 ± 13.5
Apr	1.7 ± 10.1	⁻12.1 ± 12.2	12.7 ± 16.6	43.7 ± 30.8
May	2.3 ± 6.1	7.1 ± 7.1	–2.6 ± 6.8	4.6 ± 6.9
Jun	17.5 ± 14.9	61.4 ± 31.5	22.5 ± 17.0	3.1 ± 8.9
Jul	117.7 ± 40.3	13.9 ± 11.4	10.8 ± 23.3	6.2 ± 7.2
Aug	11.6 ± 8.8	5.0 ± 5.8	5.2 ± 6.0	8.6 ± 14.1
Sep	–3.0 ± 6.8	–3.6 ± 9.1	–2.3 ± 13.1	11.7 ± 10.9
Oct	5.4 ± 6.2	12.3 ± 15.6	11.2 ± 14.7	21.8 ± 15.9
Nov	7.2 ± 11.1	15.8 ± 17.2	15.5 ± 15.1	11.2 ± 14.2
Dec	–1.7 ± 6.0	4.6 ± 9.5	–5.6 ± 6.4	5.7 ± 11.1
Median	**9.4**	**6.1**	**7.3**	**6.0**
IQR[b]	**14.7**	**<12.7**	**<11.6**	**6.2**
Fraction of DCG[c]	**1.3×10^{-5}**	**8.2×10^{-6}**	**9.9×10^{-6}**	**8.1×10^{-6}**
	(μCi/mL)			
Median	**2.5×10^{-19}**	**1.6×10^{-19}**	**2.0×10^{-19}**	**1.6×10^{-19}**
IQR[b]	**4.0×10^{-19}**	**$<3.4 \times 10^{-19}$**	**$<3.1 \times 10^{-19}$**	**1.7×10^{-19}**

	Livermore Valley upwind[a]				
	ERCH	FCC	FIRE	HOSP	RRCH
	(10^{-15} Bq/mL)				
Jan	3.9 ± 10.5	2.9 ± 14.5	45.5 ± 26.6	0.5 ± 10.0	–0.9 ± 5.3
Feb	11.9 ± 14.1	0.5 ± 9.7	0.6 ± 7.5	–1.4 ± 5.8	5.4 ± 8.4
Mar	–6.4 ± 11.4	–3.4 ± 11.4	1.2 ± 12.4	–1.1 ± 12.2	0.4 ± 8.9
Apr	10.5 ± 10.8	–1.9 ± 12.4	–2.1 ± 9.4	6.8 ± 13.0	1.9 ± 11.0
May	–2.0 ± 7.9	–3.2 ± 3.6	–3.2 ± 8.0	6.5 ± 8.0	–0.8 ± 5.2
Jun	13.2 ± 20.0	6.7 ± 14.3	21.0 ± 17.1	–2.0 ± 7.1	5.8 ± 13.4
Jul	9.3 ± 9.3	13.4 ± 11.0	0.0 ± 0.0	4.5 ± 16.8	9.5 ± 9.5
Aug	10.9 ± 15.4	7.3 ± 8.4	–0.0006 ± 12.8	10.8 ± 8.8	1.9 ± 19.0
Sep	4.3 ± 14.8	4.4 ± 11.5	–3.6 ± 9.3	3.9 ± 12.7	0.8 ± 4.8
Oct	—[d]	6.7 ± 8.4	12.1 ± 13.1	7.4 ± 11.0	20.1 ± 13.3
Nov	—[d]	7.6 ± 11.7	22.6 ± 18.7	–2.4 ± 8.7	0.6 ± 18.1
Dec	—[d]	1.7 ± 7.0	14.6 ± 16.0	–3.3 ± 7.3	–6.2 ± 9.8
Median	**9.3**	**3.7**	**0.9**	**2.2**	**1.4**
IQR[b]	**7.0**	**<6.8**	**<16.2**	**<6.6**	**<5.5**
Fraction of DCG[c]	**1.3×10^{-5}**	**4.9×10^{-6}**	**1.2×10^{-6}**	**3.0×10^{-6}**	**1.8×10^{-6}**
	(μCi/mL)				
Median	**2.5×10^{-19}**	**9.9×10^{-20}**	**2.5×10^{-20}**	**5.9×10^{-20}**	**3.7×10^{-20}**
IQR[b]	**1.9×10^{-19}**	**$<1.9 \times 10^{-19}$**	**$<4.4 \times 10^{-19}$**	**$<1.8 \times 10^{-19}$**	**$<1.5 \times 10^{-19}$**

...continued on next page

Table 4-6. Plutonium–239 activity in air particulate samples Livermore Valley, 1995 (concluded).

Month	Special interest[a]	
	LWRP	TFIR
	(10^{-15} Bq/mL)	
Jan	9.0 ± 14.0	6.6 ± 12.5
Feb	2.3 ± 8.8	1.6 ± 7.1
Mar	13.8 ± 16.4	3.6 ± 9.7
Apr	6.8 ± 12.4	–4.6 ± 11.7
May	4.1 ± 8.5	4.1 ± 9.5
Jun	11.7 ± 12.7	–7.2 ± 22.0
Jul	29.7 ± 17.2	14.7 ± 12.0
Aug	32.2 ± 15.2	12.7 ± 13.7
Sep	20.6 ± 14.2	–2.6 ± 10.0
Oct	125.1 ± 33.9	10.5 ± 15.6
Nov	11.8 ± 12.8	4.9 ± 10.1
Dec	132.1 ± 41.1	–4.4 ± 12.0
Median	**12.8**	**3.9**
IQR[b]	**21.9**	**<7.6**
Fraction of DCG[c]	**1.7×10^{-5}**	**5.2×10^{-6}**
	(**μCi/mL**)	
Median	**3.5×10^{-19}**	**1.0×10^{-19}**
IQR[b]	**5.9×10^{-19}**	**$<2.1 \times 10^{-19}$**

Note: Radionuclide results are reported ± 2σ. See Chapter 15, Quality Assurance.

a See Figure 4-2, Volume 1 for sampling locations. Location TFIR is in Tracy.

b Interquartile range.

c Derived Concentration Guide (DCG) = 7.4×10^{-10} Bq/mL for ^{239}Pu activity in air (2×10^{-14} μCi/mL).

d No data due to loss of sample during analysis; location ERCH was eliminated in October. See Chapter 15, Quality Assurance.

Table 4-7. Plutonium activity in air particulate samples, Livermore site perimeter, 1995.

Month	Sampling location[a]					
	SALV	MESQ	CAFE	MET	VIS	COW
	(10^{-15} Bq/mL)					
Jan	20.7 ± 13.1	29.6 ± 20.7	10.7 ± 17.6	8.2 ± 10.7	20.7 ± 12.2	23.0 ± 14.8
Feb	18.4 ± 10.6	22.9 ± 12.9	14.9 ± 13.5	23.1 ± 14.9	13.3 ± 14.8	25.2 ± 14.8
Mar	57.7 ± 25.7	12.8 ± 11.1	22.6 ± 13.9	22.6 ± 12.4	25.7 ± 13.4	20.5 ± 11.8
Apr	30.9 ± 14.9	18.6 ± 11.4	20.2 ± 13.0	20.6 ± 12.4	21.5 ± 12.6	11.7 ± 13.4
May	543.9 ± 410.7	15.7 ± 79.9	49.6 ± 35.1	22.8 ± 20.5	23.9 ± 14.5	72.5 ± 36.4
Jun	39.2 ± 21.2	22.5 ± 16.0	8.1 ± 30.2	34.1 ± 19.0	12.8 ± 21.1	758.5 ± 109.5
Jul	–0.005 ± 39.6	18.0 ± 13.6	40.0 ± 25.3	16.6 ± 13.6	22.0 ± 31.1	69.6 ± 37.4
Aug	19.2 ± 14.0	17.8 ± 15.9	38.1 ± 18.9	50.7 ± 21.6	48.5 ± 21.7	13.9 ± 16.8
Sep	19.3 ± 20.9	23.9 ± 23.0	38.1 ± 22.5	273.1 ± 61.4	36.0 ± 22.9	229.4 ± 53.3
Oct	23.3 ± 15.1	38.5 ± 17.6	26.4 ± 14.8	9.3 ± 12.8	18.3 ± 12.2	45.1 ± 17.7
Nov	23.6 ± 20.8	27.8 ± 21.2	30.5 ± 19.4	3.8 ± 26.6	50.0 ± 24.6	58.8 ± 26.2
Dec	16.4 ± 15.9	28.4 ± 20.4	13.8 ± 15.1	79.6 ± 36.4	105.5 ± 35.3	19.8 ± 16.8
Median	**22.0**	**22.7**	**24.5**	**22.7**	**22.9**	**35.2**
IQR[b]	**14.0**	**10.0**	**23.4**	**23.4**	**19.0**	**50.0**
Fraction of DCG[c]	**3.0×10^{-5}**	**3.1×10^{-5}**	**3.3×10^{-5}**	**3.1×10^{-5}**	**3.1×10^{-5}**	**4.8×10^{-5}**
	(μCi/mL)					
Median	**6.0×10^{-19}**	**6.1×10^{-19}**	**6.6×10^{-19}**	**6.1×10^{-19}**	**6.2×10^{-19}**	**9.5×10^{-19}**
IQR	**3.8×10^{-19}**	**2.7×10^{-19}**	**6.3×10^{-19}**	**6.3×10^{-19}**	**5.1×10^{-19}**	**1.4×10^{-18}**

Note: Radionuclide results are reported ± 2σ. See Chapter 15, Quality Assurance.

a See Figure 4-2, Volume 1 for sampling locations.

b Interquartile range.

c Derived Concentration Guide (DCG) = 7.4×10^{-10} Bq/mL for ^{239}Pu activity in air (2×0^{-14} μCi/mL).

Table 4-8. Plutonium activity in air particulate samples, diffuse sources, 1995.

Month	Location[a]	
	B531	CRED
	(10^{-15} Bq/mL)	
Jan	8.5 ± 13.4	1.2 ± 9.7
Feb	26.9 ± 12.8	5.4 ± 8.3
Mar	25.0 ± 12.9	2.7 ± 6.8
Apr	27.8 ± 15.1	1.2 ± 7.0
May	59.9 ± 28.2	–1.6 ± 5.9
Jun	211.3 ± 47.4	6.7 ± 10.2
Jul	488.4 ± 74.4	9.1 ± 9.2
Aug	621.6 ± 78.8	15.9 ± 11.6
Sep	1061.9 ± 106.2	23.8 ± 17.3
Oct	1047.1 ± 109.5	29.9 ± 14.5
Nov	384.8 ± 65.1	21.0 ± 17.2
Dec	44.0 ± 26.8	13.4 ± 14.7
Median	**135.6**	**7.9**
IQR[b]	**494.1**	**14.9**
Fraction of DCG[c]	**1.8×10^{-4}**	**1.1×10^{-5}**
	(μCi/mL)	
Median	**3.7×10^{-18}**	**2.1×10^{-19}**
IQR[b]	**1.3×10^{-17}**	**4.0×10^{-19}**

Note: Radionuclide results are reported ± 2σ. See Chapter 15, Quality Assurance.

a See Figure 4-1, Volume 1 for sampling locations.

b Interquartile range.

c Derived Concentration Guide (DCG)= 7.4×10^{-10} Bq/mL for ^{239}Pu activity in air (2×10^{-14} μCi/mL).

Table 4-9. Plutonium activity in air particulate samples, Site 300, 1995.[a]

Month	(10^{-15} Bq/mL) ^{239}Pu
Jan	3.2 ± 1.9
Feb	10.9 ± 4.1
Mar	3.7 ± 1.9
Apr	5.5 ± 2.9
May	5.8 ± 2.5
Jun	4.4 ± 4.8
Jul	4.7 ± 3.9
Aug	4.4 ± 2.6
Sep	6.9 ± 3.4
Oct	12.3 ± 5.0
Nov	4.8 ± 3.2
Dec	3.4 ± 3.0
Median	**4.8**
IQR[b]	**1.9**
Fraction of DCG[c]	**6.4×10^{-6}**
(μCi/mL)	
Median	**1.3×10^{-19}**
IQR[b]	**5.1×10^{-20}**

Note: Radionuclide results are reported ± 2σ. See Chapter 15, Quality Assurance.

a See Figure 4-3, Volume 1, for sampling locations.

b Interquartile range.

c Derived Concentration Guide (DCG) = 7.4×10^{-10} Bq/mL for ^{239}Pu activity in air (2×10^{-14} μCi/mL).

Table 4-10. Uranium activity in air particulate samples, Livermore site perimeter, 1995.

Location[a]	Month	[10^{-5} μg/m^3] Uranium-238	[10^{-7} μg/m^3] Uranium-235	[10^{-3}] Uranium-235/238
SALV	Jan	0.77	0.55	7.15
	Feb	1.92	1.35	7.01
	Mar	1.01	0.60	5.92
	Apr	2.45	1.79	7.31
	May	__[b]	__[b]	__[b]
	Jun	4.14	3.03	7.32
	Jul	4.10	2.90	7.08
	Aug	8.48	6.03	7.11
	Sep	8.29	6.19	7.46
	Oct	13.90	10.30	7.42
	Nov	7.66	5.72	7.47
	Dec	2.48	1.80	7.28
Median		**4.10**	**2.90**	**7.28**
IQR		**5.79**	**4.31**	**0.28**
Maximum		**13.90**	**10.30**	**7.47**
Fraction of DCG		**1.4×10^{-4}[c]**	**6.2×10^{-6}[d]**	
MESQ	Jan	1.40	0.96	6.86
	Feb	2.16	1.59	7.36
	Mar	1.41	0.99	7.01
	Apr	3.67	2.68	7.30
	May	__[b]	__[b]	__[b]
	Jun	4.45	3.25	7.30
	Jul	4.45	3.18	7.14
	Aug	7.79	5.58	7.17
	Sep	6.84	5.00	7.32
	Oct	13.40	9.93	7.40
	Nov	6.55	4.88	7.44
	Dec	2.53	1.87	7.40
Median		**4.45**	**3.18**	**7.30**
IQR		**4.35**	**3.21**	**0.23**
Maximum		**13.40**	**9.93**	**7.44**
Fraction of DCG		**1.5×10^{-4}[c]**	**6.8×10^{-6}[d]**	

...continued on next page

Table 4–10. Uranium activity in air particulate samples, Livermore site perimeter, 1995 (continued).

Location[a]	Month	[10^{-5} μg/m^3] Uranium-238	[10^{-7} μg/m^3] Uranium-235	[10^{-3}] Uranium-235/238
CAFE	Jan	1.92	1.40	7.28
	Feb	3.23	2.24	6.94
	Mar	2.16	1.49	6.91
	Apr	4.08	2.95	7.25
	May	4.04	2.95	7.31
	Jun	4.86	3.69	7.60
	Jul	6.55	4.73	7.22
	Aug	7.65	5.34	6.98
	Sep	10.60	7.47	7.06
	Oct	14.20	10.50	7.37
	Nov	7.89	5.92	7.49
	Dec	3.91	2.77	7.09
Median		**4.47**	**3.32**	**7.24**
IQR		**3.97**	**2.85**	**0.28**
Maximum		**14.20**	**10.50**	**7.60**
Fraction of DCG		**1.5×10^{-4}[c]**	**7.1×10^{-6}[d]**	
MET	Jan	1.07	0.74	6.93
	Feb	2.20	1.57	7.13
	Mar	1.13	0.79	7.01
	Apr	2.73	2.03	7.44
	May	1.96	1.51	7.70
	Jun	4.59	3.24	7.06
	Jul	4.49	3.22	7.19
	Aug	11.20	7.71	6.88
	Sep	8.43	7.28	8.64
	Oct	14.30	10.50	7.36
	Nov	7.37	5.49	7.44
	Dec	2.81	2.08	7.38
Median		**3.65**	**2.65**	**7.28**
IQR		**5.50**	**4.38**	**0.39**
Maximum		**14.30**	**10.50**	**8.64**
Fraction of DCG		**1.2×10^{-4}[c]**	**5.6×10^{-6}[d]**	

...continued on next page

Table 4-10. Uranium activity in air particulate samples, Livermore site perimeter, 1995 (concluded).

Location[a]	Month	[10^{-5} μg/m^3] Uranium-238	[10^{-7} μg/m^3] Uranium-235	[10^{-3}] Uranium-235/238
VIS	Jan	1.59	1.06	6.70
	Feb	2.77	1.97	7.11
	Mar	1.09	0.68	6.22
	Apr	2.43	1.82	7.50
	May	1.71	1.09	6.38
	Jun	2.86	15.50	54.20
	Jul	2.97	2.29	7.70
	Aug	6.09	4.40	7.23
	Sep	6.13	5.28	8.61
	Oct	12.10	9.04	7.49
	Nov	7.58	5.47	7.22
	Dec	2.81	4.50	16.00
Median		**2.84**	**3.35**	**7.36**
IQR		**3.85**	**3.69**	**0.92**
Maximum		**12.10**	**15.50**	**54.20**
Fraction of DCG		**9.5×10^{-5}[c]**	**7.1×10^{-6}[d]**	
COW	Jan	1.16	0.56	4.84
	Feb	1.65	1.12	6.80
	Mar	1.64	1.17	7.11
	Apr	5.82	4.37	7.50
	May	4.07	3.03	7.44
	Jun	4.69	4.16	8.89
	Jul	4.68	3.37	7.20
	Aug	12.40	8.97	7.23
	Sep	12.10	8.73	7.24
	Oct	19.40	14.30	7.36
	Nov	11.90	8.74	7.35
	Dec	5.60	4.06	7.26
Median		**5.15**	**4.11**	**7.25**
IQR		**8.49**	**6.17**	**0.20**
Maximum		**19.40**	**14.30**	**8.87**
Fraction of DCG		**1.7×10^{-4}[c]**	**8.7×10^{-6}[d]**	

a See Figure 4-1, Volume 1, for sampling locations.

b Sample lost during analytical processing.

c Derived Concentration Guide (DCG) = 0.3 μg/m^3 for ^{238}U activity in air.

d Derived Concentration Guide (DCG) = 0.047 μg/m^3 for ^{235}U activity in air.

Table 4-11. Uranium activity in air particulate samples, Site 300, 1995.

Location	Month	[10^{-5} μg/m^3] Uranium-238	[10^{-7} μg/m^3] Uranium-235	[10^{-3}] Uranium-235/238
Site 300[a]	Jan	0.90	0.42	4.65
	Feb	2.27	1.03	4.51
	Mar	4.20	1.27	3.03
	Apr	2.27	1.57	6.91
	May	11.40	3.56	3.11
	Jun	4.23	2.50	5.91
	Jul	4.16	2.84	6.82
	Aug	10.10	5.48	5.42
	Sep	8.47	5.33	6.29
	Oct	14.50	10.3	7.08
	Nov	7.81	5.54	7.10
	Dec	1.90	1.24	6.54
Median		**4.22**	**2.67**	**6.10**
IQR		**6.61**	**4.11**	**2.23**
Maximum		**14.50**	**10.30**	**7.10**
Fraction of DCG		**1.4×10^{-4}[b]**	**5.7×10^{-6}[c]**	

a Composite of all Site 300 samples. See Figure 4-3, Volume 1, for sampling locations.

b Derived Concentration Guide (DCG) = 0.3 μg/m^3 for ^{238}U activity in air.

c Derived Concentration Guide (DCG) = 0.047 μg/m^3 for ^{235}U activity in air.

Table 4-12. Tritium in air, Livermore Valley, 1995.

Month	Sampling location[a]				
	ZON7	ALTA	FIRE	XRDS	VET
	(10^{-9} Bq/mL)				
Jan	22.4 ± 12.1	17.9 ± 14.9	23.5 ± 16.1	<14.2	74.0 ± 23.8
	318.9 ± 35.7	24.1 ± 18.4	74.0 ± 14.5	87.7 ± 13.7	357.1 ± 22.5
Feb	42.6 ± 20.9	<20.8	42.6 ± 18.0	62.9 ± 18.9	192.4 ± 22.1
	59.2 ± 15.3	24.1 ± 15.0	42.6 ± 12.2	45.5 ± 12.7	79.6 ± 14.4
Mar	15.4 ± 14.4	—[b]	27.9 ± 15.0	<12.8	77.0 ± 21.6
	<19.8	<16.5	<16.0	<25.6	<19.6
Apr	9.6 ± 9.5	20.9 ± 11.7	13.5 ± 9.6	19.7 ± 11.3	35.6 ± 11.1
	22.1 ± 13.9	<12.0	<11.1	<11.4	<10.3
May	35.4 ± 17.9	18.2 ± 15.8	<14.5	<15.7	16.1 ± 14.4
	30.0 ± 14.0	—[b]	<12.1	<10.3	<11.5
Jun	<14.8	<10.7	<12.7	<13.1	<14.2
	21.3 ± 13.4	—[b]	<11.4	<11.5	<11.8
	44.4 ± 16.1	—[b]	40.3 ± 21.9	—[b]	60.7 ± 18.3
Jul	28.3 ± 17.8	<15.2	<16.2	<15.5	<16.5
	<17.0	<15.6	<16.2	<6.0	<16.1
Aug	20.4 ± 14.8	15.1 ± 13.8	<14.6	<13.1	21.7 ± 15.8
	40.0 ± 16.2	15.9 ± 14.4	<15.9	<13.7	26.0 ± 16.8
Sept	44.0 ± 14.4	<11.5	21.1 ± 13.1	10.4 ± 10.2	15.3 ± 12.5
	—[b]	<14.7	—[b]	17.8 ± 14.4	22.8 ± 16.0
Oct	17.9 ± 14.4	15.6 ± 13.5	<16.1	<12.8	<15.4
	22.8 ± 11.3	<10.9	14.2± 12.4	<11.1	17.4 ± 12.4
Nov	<10.1	<11.5	<12.8	<9.4	—[b]
	<13.5	<13.2	18.3 ± 16.2	<15.8	31.3 ± 16.6
	<13.5	<13.3	<15.1	<10.9	33.1 ± 17.9
Dec	—[b]	<15.3	24.8 ± 18.2	<16.2	27.8 ± 18.0
	—[b]	<13.7	<11.1	<11.5	<11.7
Median[c]	**22.1**	**<15.3**	**<16.0**	**<13.1**	**21.7**
IQR[d]	**<37.7**	**—[e]**	**<23.5**	**—[e]**	**<35.6**
Fraction of DCG[f]	**6.0×10^{-6}**	**$<4.1 \times 10^{-6}$**	**$<4.3 \times 10^{-6}$**	**$<3.6 \times 10^{-6}$**	**5.9×10^{-6}**
Dose (mSv)[g]	**4.7×10^{-6}**	**3.3×10^{-6}**	**3.4×10^{-6}**	**2.8×10^{-6}**	**4.7×10^{-6}**
	(μCi/mL)				
Median[c]	**6.0×10^{-13}**	**$<4.1 \times 10^{-13}$**	**$<4.3 \times 10^{-13}$**	**$<3.6 \times 10^{-13}$**	**5.9×10^{-13}**
IQR[d]	**$<1.0 \times 10^{-12}$**	**—[e]**	**$<6.4 \times 10^{-13}$**	**—[e]**	**$<9.6 \times 10^{-13}$**
Dose (mrem)[g]	**4.7×10^{-4}**	**3.3×10^{-4}**	**3.4×10^{-4}**	**2.8×10^{-4}**	**4.7×10^{-4}**

Note: Radionuclide results are reported ±2σ; see Chapter 15, Quality Assurance.

a See Figure 4-2 for sampling locations.

b No data; see Chapter 15, Quality Assurance.

c Livermore Valley overall median = 16.1×10^{-9} Bq/mL (4.3×10^{-13} μCi/mL).

d Interquartile range.

e No measure of dispersion calculated; see Chapter 15, Quality Assurance.

f Derived Concentration Guide (DCG) = 3.7×10^{-3} Bq/mL (1×10^{-7} μCi/mL).

g This dose is the effective dose equivalent.

Table 4–13. Tritium in air, Livermore site perimeter, 1995.

Month	Sampling location[a]						
	SALV	MESQ	CAFE	MET	VIS	COW	POOL
	(10^{-9} Bq/mL)						
Jan	558.7 ± 39.7	32.3 ± 11.6	555.0 ± 28.9	125.1 ± 19.8	209.1 ± 24.0	101.0 ± 24.4	510.6 ± 31.7
	499.5 ± 24.0	—[b]	540.2 ± 26.5	148.4 ± 19.4	373.7 ± 23.5	226.4 ± 19.9	921.3 ± 32.2
Feb	161.3 ± 27.6	141.0 ± 22.4	217.2 ± 23.7	91.8 ± 22.5	103.6 ± 23.3	83.3 ± 21.6	253.1 ± 25.1
	227.2 ± 23.6	98.1 ± 15.0	120.6 ± 15.9	90.3 ± 15.6	129.5 ± 18.3	75.9 ± 14.9	188.0 ± 17.9
Mar	81.8 ± 17.0	39.2 ± 14.4	92.5 ± 14.7	18.6 ± 12.7	38.5 ± 12.7	41.1 ± 16.3	113.6 ± 16.9
	51.4 ± 16.3	<17.7	71.4 ± 20.1	<15.1	69.6 ± 17.7	71.4 ± 24.0	136.2 ± 20.7
Apr	47.0 ± 11.3	37.7 ± 10.7	78.4 ± 11.3	20.9 ± 10.0	31.6 ± 10.2	36.0 ± 10.3	203.1 ± 15.4
	102.9 ± 19.4	<11.0	27.0 ± 11.7	<12.1	67.3 ± 14.3	48.8 ± 14.7	74.0 ± 13.9
May	370.0 ± 29.6	30.9 ± 15.9	55.5 ± 15.4	21.9 ± 15.2	74.7 ± 18.4	55.1 ± 15.9	128.0 ± 21.4
	59.6 ± 18.6	31.9 ± 13.4	21.0 ± 12.3	15.5 ± 13.8	40.3 ± 14.9	<12.0	89.9 ± 15.3
Jun	61.1 ± 19.2	<14.1	21.5 ± 14.0	<13.7	79.2 ± 17.2	40.0 ± 14.8	65.9 ± 15.9
	150.6 ± 22.0	<13.3	18.9 ± 13.1	<16.8	68.8 ± 16.0	44.8 ± 13.8	68.5 ± 14.6
	97.3 ± 30.0	83.3 ± 18.4	223.5 ± 30.4	55.1 ± 17.9	102.9 ± 27.5	71.4 ± 18.1	525.4 ± 30.5
Jul	81.8 ± 26.2	<16.2	67.3 ± 26.8	20.8 ± 18.4	96.9 ± 21.9	69.9 ± 20.7	178.3 ± 33.2
	100.6 ± 20.1	33.2 ± 18.4	145.0 ± 23.1	27.6 ± 19.0	77.7 ± 20.3	70.7 ± 20.6	303.4 ± 26.7
Aug	75.9 ± 19.2	47.0 ± 16.9	203.9 ± 23.4	38.9 ± 16.3	112.1 ± 18.4	67.3 ± 17.4	—[b]
	81.4 ± 20.2	60.7 ± 18.1	160.6 ± 21.4	<110.6	172.8 ± 21.1	114.3 ± 27.0	432.9 ± 28.1
Sep	69.2 ± 19.2	38.5 ± 13.8	107.7 ± 17.9	42.9 ± 16.4	84.0 ± 16.7	74.7 ± 16.7	268.6 ± 21.5
	158.0 ± 26.2	17.1 ± 16.0	62.9 ± 20.4	87.3 ± 30.2	77.7 ± 20.6	392.2 ± 29.0	143.9 ± 22.6
Oct	33.8 ± 18.3	19.8 ± 16.5	35.6 ± 16.8	38.9 ± 17.2	41.8 ± 17.1	111.0 ± 19.0	126.5 ± 18.9
	59.2 ± 17.5	39.2 ± 13.9	64.0 ± 14.4	44.8 ± 15.2	65.5 ± 15.3	54.4 ± 15.0	127.3 ± 16.9
Nov	41.4 ± 15.2	14.0 ± 12.1	76.6 ± 15.4	<108.4	68.1 ± 15.5	48.8 ± 14.3	151.7 ± 17.9
	36.1 ± 15.5	24.3 ± 15.0	86.2 ± 17.7	39.6 ± 17.0	48.5 ± 17.4	22.8 ± 16.2	98.4 ± 17.1
	68.5 ± 21.4	34.4 ± 15.9	74.4 ± 18.5	41.4 ± 16.8	43.7 ± 17.9	<16.9	143.9 ± 20.4
Dec	46.3 ± 20.7	42.6 ± 24.1	98.8 ± 28.0	41.8 ± 18.8	72.9 ± 22.5	34.1 ± 19.1	111.0 ± 20.3
	38.9 ± 16.6	<14.4	47.7 ± 16.7	22.2 ± 15.1	40.7 ± 14.6	29.6 ± 14.4	70.7 ± 14.3
Median[c]	**78.6**	**32.3**	**77.5**	**<39.2**	**73.8**	**61.2**	**143.9**
IQR[d]	**85.3**	**<39.2**	**81.6**	**—[e]**	**48.7**	**35.3**	**142.1**
Fraction of DCG[f]	**2.1×10^{-5}**	**8.7×10^{-6}**	**2.1×10^{-5}**	**1.1×10^{-5}**	**2.0×10^{-5}**	**1.7×10^{-5}**	**3.9×10^{-5}**
Dose (mSv)[g]	**1.7×10^{-5}**	**6.9×10^{-6}**	**1.7×10^{-5}**	**8.4×10^{-6}**	**1.6×10^{-5}**	**1.3×10^{-5}**	**3.1×10^{-5}**
	μCi/mL						
Median[c]	**2.1×10^{-12}**	**8.7×10^{-13}**	**2.1×10^{-12}**	**$<1.1 \times 10^{-12}$**	**2.0×10^{-12}**	**1.7×10^{-12}**	**3.9×10^{-12}**
IQR[d]	**2.3×10^{-12}**	**$<1.1 \times 10^{-12}$**	**2.2×10^{-12}**	**—[e]**	**1.3×10^{-12}**	**9.6×10^{-13}**	**3.8×10^{-12}**
Dose (mrem)[g]	**1.7×10^{-3}**	**6.9×10^{-4}**	**1.7×10^{-3}**	**8.4×10^{-4}**	**1.6×10^{-3}**	**1.3×10^{-3}**	**3.1×10^{-3}**

Note: Radionuclide results are reported ±2σ; see Chapter 15, Quality Assurance.

a See Figure 4-2 for sampling locations.

b No data; see Chapter 15, Quality Assurance.

c Livermore site perimeter overall median = 69.4×10^{-9} Bq/mL (1.8×10^{-12} μCi/mL).

d Interquartile range.

e No measure of dispersion calculated; see Chapter 15, Quality Assurance.

f Derived Concentration Guide (DCG) = 3.7×10^{-3} Bq/mL (1×0^{-7} μCi/mL).

g This dose is the effective dose equivalent.

Table 4-14. Tritium in air at locations near diffuse sources, 1995.

Month	Sampling locations[a]			
	B292	B331	B514	B624
	(10^{-9} Bq/mL)			
Jan	280.8 ± 18.8	3496.5 ± 52.4	239.8 ± 14.1	865.8 ± 28.6
	—[b]	2490.1 ± 49.8	525.4 ± 24.2	1113.7 ± 35.6
Feb	359.3 ± 30.9	1813.0 ± 54.4	202.8 ± 23.5	777.0 ± 37.3
	330.4 ± 22.5	3293.0 ± 56.0	170.9 ± 17.3	1043.4 ± 33.4
Mar	196.8 ± 22.2	2035.0 ± 50.9	156.9 ± 19.3	662.3 ± 31.1
	179.1 ± 21.7	3296.7 ± 69.2	—[b]	921.3 ± 35.9
Apr	141.3 ± 13.7	1820.4 ± 38.2	72.9 ± 9.4	647.5 ± 24.6
	79.2 ± 14.6	695.6 ± 26.4	29.4 ± 11.6	447.7 ± 22.8
May	150.2 ± 18.5	1420.8 ± 39.8	85.8 ± 16.1	614.2 ± 28.9
	68.8 ± 15.7	1191.4 ± 36.9	41.4 ± 10.7	425.5 ± 23.4
June	57.4 ± 16.1	1931.4 ± 46.4	53.3 ± 14.1	536.5 ± 27.4
	42.6 ± 13.7	1679.8 ± 42.0	58.5 ± 14.3	484.7 ± 25.7
	143.9 ± 20.0	24605 ± 172.2	168.4 ± 22.7	965.7 ± 36.7
July	34.3 ± 18.4	28601 ± 257.4	73.6 ± 20.1	503.2 ± 28.2
	113.2 ± 20.5	24753 ± 173.3	129.5 ± 19.6	865.8 ± 37.2
Aug	116.6 ± 19.6	37740 ± 226.4	172.8 ± 21.3	939.8 ± 34.8
	138.4 ± 20.3	43660 ± 218.3	159.8 ± 21.3	1024.9 ± 35.9
Sept	146.9 ± 18.4	15947 ± 127.6	152.1 ± 19.3	684.5 ± 27.4
	—[b]	5476 ± 82.1	159.8 ± 22.7	—[b]
Oct	78.4 ± 13.0	119.1 ± 15.7	147.6 ± 19.5	1409.7 ± 40.9
	118.4 ± 15.3	179.8 ± 16.7	171.3 ± 17.3	2279.2 ± 43.3
Nov	97.3 ± 15.4	92.5 ± 10.9	126.9 ± 15.5	1554.0 ± 34.2
	169.8 ± 20.2	122.1 ± 11.7	193.1 ± 20.5	2471.6 ± 42.0
	139.1 ± 20.0	279.7 ± 20.7	222.4 ± 22.2	3540.9 ± 53.1
Dec	109.2 ± 21.1	—[b]	111.4 ± 20.6	1920.3 ± 48.0
	65.1 ± 13.2	173.2 ± 15.9	125.8 ± 15.0	1864.8 ± 42.9
Median[c]	**128.4**	**1931.4**	**152.1**	**921.3**
IQR[d]	**76.1**	**4780.4**	**85.5**	**762.2**
Fraction of DCG[e]	**3.5×10^{-5}**	**5.2×10^{-4}**	**4.1×10^{-5}**	**2.5×10^{-4}**
Dose (mSv)[f]	**2.8×10^{-5}**	**4.1×10^{-4}**	**3.3×10^{-5}**	**2.0×10^{-4}**
	(μCi/mL)			
Median[c]	**3.5×10^{-12}**	**5.2×10^{-11}**	**4.1×10^{-12}**	**2.5×10^{-11}**
IQR[d]	**2.1×10^{-12}**	**1.3×10^{-10}**	**2.3×10^{-12}**	**2.1×10^{-11}**
Dose (mrem)[f]	**2.8×10^{-3}**	**4.1×10^{-2}**	**3.3×10^{-3}**	**2.0×10^{-2}**

Note: Radionuclide results are reported ±2σ; see Chapter 15, Quality Assurance.

a See Figure 4-2 for sampling locations.

b No data; see Chapter 15, Quality Assurance.

c Diffuse source overall median = 279.7×10^{-9} Bq/mL (7.6×10^{-12} μCi/mL).

d Interquartile range.

e Derived Concentration Guide (DCG) = 3.7×10^{-3} Bq/mL (1×10^{-7} μCi/mL).

f This dose is the effective dose equivalent.

Table 4-15. Beryllium in air particulate samples (in pg/m^3), Livermore site perimeter, 1995.

Month	Sampling location[a]					
	SALV	MESQ	CAFE	MET	VIS	COW
Jan	0.7	1.9	3.0	1.3	0.7	2.1
Feb	3.0	3.7	6.2	3.6	3.2	4.4
Mar	1.6	2.1	3.3	1.8	1.6	2.1
Apr	4.2	4.9	5.3	4.3	3.4	5.7
May	3.9	4.5	5.6	4.5	2.6	7.4
Jun	9.0	9.2	9.2	10.5	5.7	9.2
Jul	8.1	10.0	15.9	12.9	6.8	10.8
Aug	15.9	17.0	18.2	17.3	15.0	32.5
Sep	13.1	11.2	15.4	15.2	10.2	16.8
Oct	54.8	25.6	22.6	47.5	23.7	34.2
Nov	20.0	17.6	23.5	20.9	19.3	18.5
Dec	3.6	4.9	6.7	5.7	4.7	9.9
Median[b]	**6.1**	**7.0**	**8.0**	**8.1**	**5.2**	**9.5**
IQR[c]	**10.3**	**8.3**	**10.9**	**11.6**	**8.4**	**11.8**

Note: The monthly ambient concentration guide (ACG) set by the BAAQMD is 10,000 pg/m^3. To determine the fraction each value is of the monthly standard, divide the reported value for the month by 10,000; e.g., 35.0 ÷ 10,000 = 0.0035.

a See Figure 4-1 for sampling locations.

b Livermore site perimeter overall annual median is 7.1 pg/m^3.

c Interquartile range.

Table 4-16. Beryllium in air particulate samples (in pg/m^3), Site 300, 1995.

Month	Sampling location[a]								
	EOBS	ECP	WCP	LIN	GOLF	TFIR	NPS	WOBS	801E
Jan	0.7	0.6	0.5	0.7	1.7	3.0	0.6	0.7	0.5
Feb	1.4	1.4	1.7	1.7	3.2	5.4	1.8	1.4	1.7
Mar	1.3	1.0	1.2	1.5	2.2	4.2	1.5	1.4	2.1
Apr	3.2	2.6	2.8	3.5	5.2	9.9	3.5	3.3	2.9
May	6.1	5.7	2.8	6.3	5.6	9.9	4.8	3.6	14.3
Jun	5.7	4.1	5.3	18.3	6.7	13.9	6.7	5.1	11.5
Jul	8.7	6.7	8.0	8.0	9.9	21.0	9.5	9.1	13.4
Aug	10.5	9.9	13.5	14.4	16.2	26.8	12.3	13.2	16.0
Sep	8.8	8.1	8.5	10.8	10.9	24.3	9.0	15.2	11.8
Oct	44.7	33.7	38.6	21.6	20.0	73.9	29.0	57.1	43.5
Nov	17.7	12.2	10.5	14.8	13.0	19.0	16.1	19.0	18.1
Dec	2.2	1.8	2.1	2.4	2.5	5.4	1.5	2.4	2.1
Median[b]	**5.9**	**4.9**	**4.1**	**7.2**	**6.1**	**11.9**	**5.7**	**4.4**	**11.6**
IQR[c]	**7.2**	**6.8**	**7.0**	**12.2**	**8.4**	**16.4**	**8.5**	**11.6**	**12.6**

Note: The monthly ambient concentration guide (ACG) set by the BAAQMD is 10,000 pg/m^3. To determine the fraction each value is of the monthly standard, divide the reported value for the month by 10,000; e.g., 35.0 ÷ 10,000 = 0.0035.

a See Figure 4-3 for sampling locations.

b Site 300 overall annual median is 6.3 pg/m^3.

c Interquartile range.

5. Air Effluent Monitoring

Art Biermann
Paula J. Tate

Air Effluent Sampling Methods

LLNL maintains 103 continuously operating radiological sampling systems on air exhausts at 9 facilities at the Livermore site (Volume 1, Table 5-1). These samplers are used to determine actual emissions from operations involving radioactive materials at the facilities and to verify the integrity of emission control systems.

Air samples for particulate emissions are extracted downstream of high efficiency particulate air (HEPA) filters and prior to the discharge point to the atmosphere. In most cases, simple, filter-type aerosol collection systems are used. However, in some facilities (Buildings 251 and 332) continuous air monitors for alpha activity (CAMs) are used for sampling. In addition to collecting a sample of particles, the CAM units provide an alarm capability for the facility in the event of a release of alpha activity. Both types of sampling systems, the simple filter type and alpha alarm monitors, are used to monitor discharge points from Building 332. The air sampling systems in critical facilities would be switched to auxiliary power in the event of a power outage and continue to operate.

The sample filters, either 47- or 100-mm-diameter membrane filters, are changed weekly or biweekly depending on the facility. After sample collection, filters are placed in glassine envelopes; each envelope is tagged with a unique bar code label. Filter samples are logged into the Hazards Control Department (HCD) sample tracking and receiving (STAR) computer system along with information including location, equipment identification, bar code, sampling start date, sampling stop date, and flow rate. Filters are analyzed at the HCD Radiological Measurements Laboratory (RML) for gross alpha and beta activity using gas proportional counters. Analysis is delayed for at least 4 days from sample termination to allow for the decay of naturally occurring radon daughters. For verification of the operation of the counting system, calibration sources, as well as background samples, are intermixed with the sample filters for analysis. Analytical techniques are consistent with EPA-recommended procedures. Further details of sampling and analysis are discussed in the *Environmental Monitoring Plan* (Tate et al. 1995).

Each stack of the Tritium Facility (Building 331) is monitored for tritium release by both a continuous monitoring alarm system and continuous molecular sieve samplers. The alarmed samplers, Overhoff ion chambers, provide real-time tritium concentration release levels (HT and HTO combined). The sieve samplers, which can discriminate between tritiated water (HTO) vapor and

tritiated hydrogen gas (HT), provide the values used for environmental reporting. Each sieve sampler (unalarmed) is in parallel with an alarmed monitor and consists of two molecular sieves. The first sieve collects tritiated water vapor; then a palladium-coated catalyst converts tritiated hydrogen to tritiated water and collects the tritiated water on a second sieve. Sieves are exchanged weekly or biweekly. The sieve samples are logged into the HCD STAR sample tracking system and submitted to the HCD Analytical Laboratory, where tritiated water is baked out and collected. The retrieved tritium is analyzed by RML for beta activity using scintillation counting techniques.

The need for air effluent monitoring at other discharge points having the potential to release radionuclides to the atmosphere is evaluated on an annual basis according to the 40 CFR 61.93 National Emissions Standards for Hazardous Air Pollutants (NESHAPs) regulatory requirements. For the evaluation, estimates of emissions from individual discharge points are calculated using: (1) measured emissions from discharges having continuous sampling systems or (2) radionuclide inventories from discharges not having sampling systems. The radionuclide inventory approach uses isotope-specific inventory data along with EPA-accepted release factors for operations and EPA-suggested reduction factors for emission control devices to arrive at the potential release estimates. For 1995, calculated potential emissions for isotopes, including diffuse and point discharges, for the Livermore site are listed in **Table 5-1**. Since dose to individuals is isotope specific, the radionuclides have been ordered by weighting the emissions according to the inhalation committed dose equivalent of the particular isotope. The total calculated emission is estimated to be 3.9 TBq (105 Ci). Calculated emissions for radionuclides used in Site 300 operations are given in Volume 1, Table 5-4.

The need for air effluent monitoring at an atmospheric discharge point requires that an assessment of dose to the nearest member of the public be made based on the estimated emissions. Dose assessment results due to LLNL radionuclide emissions are discussed in Chapter 13 of Volume 1. Further details of the 1995 evaluation of calculated emissions and dose assessment are published in the *LLNL NESHAPs 1995 Annual Report* (Gallegos et al. 1996). As discussed in Chapter 5 Volume I, a new sampler was installed in Building 166 as a result of NESHAPs evaluations of new operations in 1995. No discharge points at Site 300 were found to require air effluent sampling systems.

Table 5-1. Calculated radioactive air emissions from the Livermore site for 1995. Radionuclides have been ordered by weighting the emissions according to the inhalation dose rate conversion factor for the isotope.

Radionuclide	Calculated emissions[a] (Bq)	Relative to ^{3}H (HTO)[b]
H-3[c]	2.6×10^{12}	1.0
U-238	5.4×10^{5}	0.19
U-234	2.6×10^{5}	0.11
Gross Alpha[d]	2.1×10^{4}	2.2×10^{-2}
N-13	1.6×10^{11}	9.9×10^{-3}
Ni-63	1.1×10^{9}	7.5×10^{-3}
U-235	1.4×10^{4}	5.3×10^{-3}
Am-241	2.7×10^{3}	4.5×10^{-3}
O-15	8.5×10^{10}	1.7×10^{-3}
Th-228	1.6×10^{3}	1.2×10^{-3}
Np-237	4.8×10^{2}	7.3×10^{-4}
Pu-242	4.1×10^{2}	4.1×10^{-4}
Pu-238	3.7×10^{2}	3.6×10^{-4}
P-32	1.9×10^{7}	3.5×10^{-4}
Am-243	82.0	1.4×10^{-4}
Pu-239	71.0	7.5×10^{-5}
Gross Beta[d]	1.0×10^{5}	7.1×10^{-5}
H-3 (HT)[c]	1.1×10^{12}	1.7×10^{-5}
U-233	37.0	1.5×10^{-5}
Eu-152	6.7×10^{3}	4.6×10^{-6}
Eu-154	3.4×10^{3}	3.0×10^{-6}
P-33	1.5×10^{5}	2.8×10^{-6}
Sr-90	2.0×10^{3}	1.4×10^{-6}
Bi-214	2.9×10^{4}	1.0×10^{-6}
Pb-214	2.9×10^{4}	7.7×10^{-7}
S-35	6.9×10^{5}	6.3×10^{-7}
Cs-137	5.2×10^{3}	4.9×10^{-7}
Ra-226	10.0	2.8×10^{-7}
Po-218	2.9×10^{4}	2.7×10^{-7}
Pa-231	0.11	1.7×10^{-7}
Co-60	2.4×10^{2}	1.6×10^{-7}
Ru-106	1.1×10^{2}	1.6×10^{-7}
Eu-155	2.6×10^{2}	3.3×10^{-8}
Pu-240	2.2×10^{-2}	2.3×10^{-8}
Ce-144	17.0	2.0×10^{-8}
U-236	3.3×10^{-2}	1.2×10^{-8}
Th-232	1.1×10^{-2}	1.2×10^{-8}
Pu-244	1.1×10^{-2}	1.1×10^{-8}
Bi-207	3.0×10^{2}	1.1×10^{-8}
Pu-236	1.7×10^{-2}	4.5×10^{-9}
C-14	9.7×10^{4}	3.6×10^{-9}
Cm-244	3.7×10^{-3}	3.3×10^{-9}
Tc-99	74.0	1.9×10^{-9}
Na-22	74.0	1.9×10^{-9}
K-40	37.0	1.5×10^{-9}
Y-90	18.0	5.2×10^{-10}
Th-230	8.0×10^{-4}	6.2×10^{-10}
Cf-252	6.2×10^{-4}	3.0×10^{-10}
Eu-156	6.3	2.8×10^{-10}
Pm-147	0.54	6.4×10^{-11}
Sb-125	1.7	6.3×10^{-11}
U-232	3.7×10^{-5}	5.5×10^{-11}
Mn-54	2.5	5.2×10^{-11}
Cs-134	0.22	3.1×10^{-11}
Co-57	0.30	8.3×10^{-12}
I-129	2.2×10^{-3}	1.2×10^{-12}
I-125	1.3×10^{-2}	9.4×10^{-13}
Np-239	4.1×10^{-3}	3.4×10^{-14}
Ba-133	1.5×10^{-5}	4.1×10^{-16}
Ni-59	2.6×10^{-7}	7.3×10^{-19}
Total	$\mathbf{3.9 \times 10^{12}}$	

a Calculated emissions are estimates made according to the National Emmision Standards for Hazardous Air Pollutants 40 CFR 61.93 except those noted as measured. Values are considered conservative.

b The importance of the emissions (as weighted by the dose rate conversion factor) relative to H-3 (HTO) emission.

c Includes measured emissions.

d Gross alpha and gross beta activitties are reported in inventories where specific isotopic content is unknown.

Data

Annual summaries of gross alpha and gross beta data for each monitored facility are presented in **Tables 5-2** through **5-10**. A detailed discussion of these results is provided in Volume 1 of this report.

Table 5-2. Gross alpha and gross beta in air effluent samples from B166 monitored emission points summarized for 1995.

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	4/28	-1.01×10^{-11}	1.11×10^{-11}	8.07×10^{-11}
Gross beta				
1	8/28	-1.20×10^{-11}	1.02×10^{-10}	3.01×10^{-10}

a Minimum detectible concentration.

Table 5-3. Gross alpha and gross beta in air effluent samples from B175 monitored emission points summarized for 1995.

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	2/25	-1.04×10^{-11}	6.73×10^{-12}	5.62×10^{-11}
2	5/25	-2.41×10^{-12}	1.43×10^{-11}	1.19×10^{-10}
3	0/25	-1.27×10^{-11}	1.05×10^{-11}	3.45×10^{-11}
4	0/25	-1.04×10^{-11}	7.13×10^{-12}	2.67×10^{-11}
5	0/25	-1.27×10^{-11}	1.78×10^{-12}	6.27×10^{-11}
6	0/25	-1.27×10^{-11}	1.99×10^{-12}	2.78×10^{-11}
Gross beta				
1	16/25	1.84×10^{-12}	1.15×10^{-10}	5.03×10^{-10}
2	18/25	-1.57×10^{-11}	2.10×10^{-10}	5.59×10^{-10}
3	9/25	-4.16×10^{-11}	5.85×10^{-11}	5.07×10^{-10}
4	14/25	-3.38×10^{-11}	6.92×10^{-11}	2.09×10^{-10}
5	1/25	-9.33×10^{-11}	2.86×10^{-12}	1.10×10^{-10}
6	2/25	-3.54×10^{-11}	-8.81×10^{-13}	1.22×10^{-10}

a Minimum detectible concentration.

Table 5-4. Gross alpha and gross beta in air effluent samples from B231 monitored emission points summarized for 1995.

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	1/45	-1.56×10^{-11}	-6.36×10^{-12}	2.74×10^{-10}
Gross beta				
1	5/45	-7.22×10^{-11}	2.27×10^{-11}	5.18×10^{-10}

a Minimum detectible concentration.

Table 5-5. Gross alpha and gross beta in air effluent samples from B251 monitored emission points summarized for 1995.

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	2/25	-4.74×10^{-11}	1.96×10^{-11}	7.51×10^{-10}
2	0/25	-1.22×10^{-11}	4.29×10^{-11}	1.20×10^{-10}
3	0/25	-2.18×10^{-11}	1.67×10^{-11}	1.18×10^{-10}
4	4/25	-1.61×10^{-11}	3.92×10^{-11}	1.55×10^{-10}
5	1/25	-9.81×10^{-11}	1.20×10^{-10}	7.66×10^{-10}
6	1/25	-4.44×10^{-11}	7.73×10^{-11}	4.14×10^{-10}
7	1/25	-2.55×10^{-11}	2.45×10^{-11}	1.97×10^{-10}
8	0/25	-1.69×10^{-10}	1.44×10^{-10}	7.22×10^{-10}
10	1/25	-4.77×10^{-11}	9.55×10^{-11}	3.51×10^{-10}
11	0/25	-1.89×10^{-10}	1.45×10^{-10}	1.13×10^{-9}
12	0/25	-9.51×10^{-12}	7.25×10^{-12}	6.44×10^{-11}
13	0/25	-2.66×10^{-11}	1.86×10^{-11}	7.10×10^{-11}
14	4/25	-2.17×10^{-11}	6.07×10^{-11}	1.01×10^{-9}
15	0/25	-1.69×10^{-10}	1.75×10^{-10}	6.92×10^{-10}
16	0/25	-2.33×10^{-11}	2.45×10^{-11}	1.31×10^{-10}
17	0/25	-1.61×10^{-11}	1.93×10^{-11}	1.48×10^{-10}
18	0/25	-1.02×10^{-11}	1.08×10^{-11}	7.99×10^{-11}
19	0/25	-1.95×10^{-10}	1.63×10^{-10}	1.28×10^{-9}
20	0/25	-9.73×10^{-12}	5.44×10^{-12}	6.55×10^{-11}
21	1/25	-5.18×10^{-11}	7.66×10^{-11}	7.22×10^{-10}
22	1/25	-9.73×10^{-12}	1.44×10^{-11}	6.62×10^{-11}
23	0/25	-1.47×10^{-10}	1.44×10^{-10}	9.84×10^{-10}
24	0/25	-1.98×10^{-11}	2.47×10^{-11}	2.31×10^{-10}
25	1/25	-2.15×10^{-11}	1.35×10^{-11}	1.50×10^{-10}
26	0/25	-3.21×10^{-11}	5.66×10^{-11}	2.26×10^{-10}
27	1/25	-4.26×10^{-11}	3.39×10^{-11}	3.68×10^{-10}
28	0/25	-3.00×10^{-11}	2.63×10^{-11}	1.42×10^{-10}
29	0/25	-2.81×10^{-11}	1.86×10^{-11}	8.84×10^{-11}
30	0/25	-2.08×10^{-11}	2.16×10^{-11}	1.11×10^{-10}
31	0/25	-2.00×10^{-10}	1.45×10^{-10}	1.02×10^{-9}
32	1/25	-1.61×10^{-11}	1.67×10^{-11}	1.95×10^{-10}
33	4/25	-8.88×10^{-12}	5.00×10^{-11}	1.23×10^{-10}
34	2/25	-1.79×10^{-11}	4.07×10^{-11}	2.06×10^{-10}
35	0/25	-1.72×10^{-11}	1.02×10^{-11}	4.92×10^{-11}
36	20/25	1.40×10^{-11}	4.08×10^{-10}	1.18×10^{-10}
37	0/25	-1.89×10^{-11}	4.26×10^{-11}	1.75×10^{-10}

...continued on next page

Table 5-5. Gross alpha and gross beta in air effluent samples from B251 monitored emission points summarized for 1995 (continued).

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha (continued)				
38	0/25	-1.22×10^{-11}	6.85×10^{-12}	6.22×10^{-11}
39	1/25	-8.40×10^{-12}	1.24×10^{-11}	8.07×10^{-11}
40	0/25	-1.17×10^{-11}	8.44×10^{-12}	5.99×10^{-11}
41	0/25	-2.39×10^{-11}	2.04×10^{-11}	1.44×10^{-10}
42	0/25	-3.95×10^{-12}	1.38×10^{-11}	5.51×10^{-11}
43	0/25	-1.02×10^{-11}	4.22×10^{-12}	4.44×10^{-11}
44	1/25	-1.81×10^{-11}	4.35×10^{-11}	1.82×10^{-10}
45	0/25	-2.08×10^{-11}	1.18×10^{-11}	1.54×10^{-10}
CAM 251034	2/50	-2.47×10^{-11}	7.33×10^{-12}	1.26×10^{-10}
CAM 251035	2/50	-2.81×10^{-11}	1.21×10^{-11}	1.61×10^{-10}
CAM 251036	1/50	-3.19×10^{-11}	9.05×10^{-12}	1.17×10^{-10}
CAM 251037	4/50	-2.47×10^{-11}	1.84×10^{-11}	1.77×10^{-10}
Gross beta				
1	5/25	7.59×10^{-11}	3.11×10^{-10}	2.09×10^{-9}
2	17/25	1.31×10^{-10}	3.89×10^{-10}	1.15×10^{-9}
3	2/25	-1.37×10^{-11}	9.69×10^{-11}	3.07×10^{-10}
4	24/25	2.15×10^{-10}	5.26×10^{-10}	1.12×10^{-9}
5	4/25	-3.39×10^{-10}	6.44×10^{-10}	2.73×10^{-9}
6	1/25	-3.30×10^{-11}	2.71×10^{-10}	6.81×10^{-10}
7	7/25	3.69×10^{-11}	2.26×10^{-10}	6.81×10^{-10}
8	3/25	-3.34×10^{-10}	9.55×10^{-10}	3.22×10^{-9}
10	12/25	7.70×10^{-11}	6.88×10^{-10}	1.55×10^{-9}
11	0/25	-5.07×10^{-10}	6.11×10^{-10}	2.57×10^{-9}
12	5/25	-1.41×10^{-11}	5.70×10^{-11}	1.61×10^{-10}
13	3/25	-2.69×10^{-11}	1.48×10^{-10}	4.29×10^{-10}
14	13/25	8.92×10^{-11}	4.03×10^{-10}	2.31×10^{-9}
15	3/25	1.73×10^{-10}	1.14×10^{-9}	2.79×10^{-9}
16	6/25	3.33×10^{-11}	3.15×10^{-10}	5.74×10^{-10}
17	16/25	1.41×10^{-10}	3.13×10^{-10}	6.66×10^{-10}
18	1/25	-8.29×10^{-11}	7.55×10^{-11}	1.27×10^{-10}
19	4/25	-5.01×10^{-10}	1.07×10^{-9}	3.53×10^{-9}
20	5/25	1.22×10^{-11}	7.10×10^{-11}	1.81×10^{-10}
21	10/25	-3.59×10^{-11}	6.62×10^{-10}	1.58×10^{-9}
22	13/25	4.55×10^{-12}	9.81×10^{-11}	2.46×10^{-10}

...concluded on next page

Table 5-5. Gross alpha and gross beta in air effluent samples from B251 monitored emission points summarized for 1995 (concluded).

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross beta (continued)				
23	3/25	6.68×10^{-11}	1.07×10^{-9}	3.67×10^{-9}
24	3/25	-2.20×10^{-11}	1.34×10^{-10}	4.92×10^{-10}
25	0/25	-4.51×10^{-11}	1.52×10^{-10}	2.47×10^{-10}
26	0/25	-7.73×10^{-11}	1.42×10^{-10}	4.00×10^{-10}
27	0/25	-2.30×10^{-11}	2.29×10^{-10}	5.29×10^{-10}
28	12/25	-1.94×10^{-11}	3.25×10^{-10}	7.25×10^{-10}
29	4/25	-4.55×10^{-11}	1.41×10^{-10}	4.92×10^{-10}
30	0/25	-1.54×10^{-11}	1.59×10^{-10}	3.81×10^{-10}
31	3/25	-4.59×10^{-10}	1.28×10^{-9}	3.06×10^{-9}
32	3/25	-3.74×10^{-11}	1.51×10^{-10}	3.20×10^{-10}
33	22/25	9.51×10^{-11}	3.81×10^{-10}	7.62×10^{-10}
34	21/25	1.26×10^{-10}	4.29×10^{-10}	9.44×10^{-10}
35	2/25	-2.54×10^{-11}	9.47×10^{-11}	2.73×10^{-10}
36	25/25	7.76×10^{-11}	4.12×10^{-10}	9.23×10^{-10}
37	16/25	-6.57×10^{-12}	4.18×10^{-10}	8.81×10^{-10}
38	1/25	-1.66×10^{-11}	7.84×10^{-11}	1.35×10^{-10}
39	6/25	-1.45×10^{-11}	6.99×10^{-11}	1.05×10^{-9}
40	8/25	2.25×10^{-11}	9.01×10^{-11}	1.88×10^{-10}
41	10/25	-3.70×10^{-11}	3.27×10^{-10}	5.88×10^{-10}
42	4/25	-1.54×10^{-11}	5.48×10^{-11}	1.82×10^{-10}
43	2/25	-3.68×10^{-11}	5.81×10^{-11}	1.36×10^{-10}
44	8/25	1.18×10^{-10}	2.47×10^{-10}	4.74×10^{-10}
45	3/25	-1.04×10^{-10}	1.68×10^{-10}	4.85×10^{-10}
CAM 251034	24/50	5.74×10^{-12}	2.01×10^{-10}	8.81×10^{-10}
CAM 251035	25/50	-7.36×10^{-11}	2.16×10^{-10}	1.62×10^{-9}
CAM 251036	19/50	-7.77×10^{-11}	1.04×10^{-10}	1.68×10^{-9}
CAM 251037	25/50	-8.33×10^{-11}	2.27×10^{-10}	9.21×10^{-10}

[a] Minimum detectible concentration.

Table 5-6. Tritium in air effluent samples from B331 monitored emission points summarized for 1995.

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
HT				
Stack 1	48/50	8.80×10^{-6}	3.10×10^{-5}	2.91×10^{-3}
Stack 2	49/49	4.74×10^{-5}	2.43×10^{-3}	6.45×10^{-3}
HTO				
Stack 1	50/50	2.48×10^{-4}	6.13×10^{-4}	2.09×10^{-3}
Stack 2	50/50	1.79×10^{-3}	5.65×10^{-3}	9.62×10^{-3}

[a] Minimum detectible concentration.

Table 5-7. Gross alpha and gross beta in air effluent samples from B332 summarized for 1995.

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
SP-1	0/50	-2.25×10^{-11}	1.99×10^{-11}	1.51×10^{-10}
SP-2	0/50	-2.33×10^{-11}	1.82×10^{-11}	1.05×10^{-10}
SP-3	0/50	-4.03×10^{-11}	1.75×10^{-11}	2.71×10^{-10}
SP-4	0/49	-4.70×10^{-11}	1.95×10^{-11}	1.75×10^{-10}
SP-5	0/50	-2.70×10^{-11}	1.73×10^{-11}	1.17×10^{-10}
SP-6	0/50	-2.36×10^{-11}	3.45×10^{-11}	2.26×10^{-10}
SP-7	0/50	-4.70×10^{-11}	3.50×10^{-11}	2.09×10^{-10}
SP-8	0/50	-2.01×10^{-11}	1.85×10^{-11}	1.42×10^{-10}
SP-9	0/50	-2.43×10^{-11}	1.96×10^{-11}	1.30×10^{-10}
SP-10	0/50	-7.59×10^{-11}	3.41×10^{-11}	2.97×10^{-10}
SP-11	0/50	-4.03×10^{-11}	2.07×10^{-11}	1.74×10^{-10}
SP-12	0/50	-4.14×10^{-11}	3.41×10^{-11}	2.19×10^{-10}
Gross beta				
SP-1	4/50	-1.24×10^{-11}	1.33×10^{-10}	5.51×10^{-10}
SP-2	6/50	-3.85×10^{-11}	1.38×10^{-10}	3.74×10^{-10}
SP-3	1/50	-6.62×10^{-11}	1.53×10^{-10}	5.94×10^{-10}
SP-4	0/50	-1.93×10^{-10}	1.69×10^{-10}	6.55×10^{-10}
SP-5	1/50	-8.73×10^{-11}	9.93×10^{-11}	3.38×10^{-10}
SP-6	1/50	-2.80×10^{-10}	1.59×10^{-10}	7.92×10^{-10}
SP-7	4/50	-1.09×10^{-10}	1.46×10^{-10}	7.92×10^{-10}
SP-8	0/50	-3.03×10^{-11}	1.06×10^{-10}	2.78×10^{-10}
SP-9	3/50	-4.81×10^{-11}	9.25×10^{-11}	4.00×10^{-10}
SP-10	5/50	-2.84×10^{-10}	2.78×10^{-10}	1.12×10^{-9}
SP-11	0/50	-7.33×10^{-11}	1.02×10^{-10}	5.51×10^{-10}
SP-12	4/50	-2.36×10^{-10}	1.87×10^{-10}	6.96×10^{-10}

[a] Minimum detectible concentration.

Table 5-8. Gross alpha and gross beta in air effluent samples from B419 monitored emission points summarized for 1995.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	23/39	1.22×10^{-11}	6.77×10^{-11}	2.07×10^{-10}
2	27/40	6.96×10^{-12}	6.88×10^{-11}	2.29×10^{-10}
Gross beta				
1	40/40	2.31×10^{-10}	5.64×10^{-10}	1.01×10^{-9}
2	40/40	1.68×10^{-10}	5.85×10^{-10}	1.02×10^{-9}

[a] Minimum detectible concentration.

Table 5-9. Gross alpha and gross beta in air effluent samples from B490 monitored emission points summarized for 1995.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	0/25	-9.44×10^{-12}	5.14×10^{-12}	5.51×10^{-11}
2	1/23	-9.18×10^{-12}	9.77×10^{-12}	1.50×10^{-10}
3	0/25	-2.02×10^{-11}	9.18×10^{-12}	5.51×10^{-11}
4	2/22	-2.06×10^{-11}	9.68×10^{-12}	8.99×10^{-11}
Gross beta				
1	5/25	-8.48×10^{-11}	-1.27×10^{-11}	6.11×10^{-10}
2	7/23	-1.82×10^{-11}	5.96×10^{-11}	1.38×10^{-9}
3	8/25	-2.96×10^{-11}	5.99×10^{-11}	4.96×10^{-10}
4	8/23	-2.45×10^{-11}	8.99×10^{-11}	5.81×10^{-10}

[a] Minimum detectible concentration.

Table 5-10. Gross alpha and gross beta in air effluent samples from B491 monitored emission points summarized for 1995.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	1/49	-1.11×10^{-11}	-6.20×10^{-12}	1.84×10^{-10}
Gross beta				
1	5/50	-5.11×10^{-11}	2.82×10^{-11}	1.41×10^{-9}

[a] Minimum detectible concentration.

6. Sewage Monitoring

Jennifer M. Larson

Methods

LLNL operates a flow proportional composite sampler in B196 (Volume 1, Figure 6-1). This sampler uses a peristaltic pump that functions for 4 s for every 3785 L of effluent to create a 24-hour composite of Livermore site sewage effluent. Each day, 500-mL aliquots of this 24-hour composite are transferred to polyethylene bottles. Aliquots are submitted for analysis as follows:

First, two aliquots are submitted to LLNL's Hazards Control Analytical Laboratory (HCAL) for daily analyses of the gross alpha, gross beta, and tritium activity. For the gross alpha and gross beta analyses, HCAL plates sample onto a planchette and submits the planchette to the Radiological Measurements Laboratory (RML) for a 60-minute count in a gas proportional counter. For the tritium analyses, HCAL distills the sample and submits the distillate to the RML. The RML prepares the distillate with nitric acid and scintillation cocktail and counts it for 100-minutes in a liquid scintillation counter. The analytical results for the gross alpha, gross beta, and tritium analyses are shown in **Table 6-1.**

Finally, an aliquot is submitted to LLNL's Chemistry and Materials Science Environmental Services (CES). Each month, CES creates a composite sample from the aliquots submitted for that month and analyzes it first for ^{239}Pu and then for ^{137}Cs. CES begins the ^{239}Pu analysis by adding MnO_2 to the entire volume of the monthly composite sample, approximately 15 L, to precipitate the plutonium. After digestion of the composite volume with concentrated HNO_3, ion-exchange chromatography is used to separate out the plutonium from the rest of the sample. The plutonium eluted from the ion-exchange column is electroplated onto a stainless steel disk, and its activity is measured by alpha spectroscopy. It should be noted that CES, prior to beginning analysis for ^{137}Cs activity in the monthly composite, returns any non-plutonium sample material generated from the ion-exchange process to the monthly composite sample. For the ^{137}Cs analysis, CES adds NH_4MoPO_4 to the monthly composite sample in order to precipitate the cesium and then counts the composite sample using gamma spectroscopy. The analytical results for the ^{239}Pu and ^{137}Cs analyses are reported in Volume 1, Table 6-2.

LLNL also operates a flow proportional, peristaltic pump, composite sampler in a fiberglass enclosure adjacent to B196. This sampler functions as a weekly composite sampler, except for 12 days of the year, 1 day per month, when it serves as a single-day composite sampler. As a weekly composite sampler, the sampler typically runs for 7 days; an exception to the 7-day sampling period occurs when the operating mode of the sampler must be changed in order to collect the single-day of composite sample. When operating in the weekly

compositing mode, the sampler is programmed to acquire a 30-mL sample for every 30,280 L of effluent discharged. Operating as a single day composite sampler, the sampler runs for 24 hours, collecting a 150-mL sample for every 7570 L of effluent discharged.

Aliquots are acquired each week from the weekly composite sample and every month from the 24-hour composite sample. From the weekly composite, one 1-L aliquot is transferred to a polyethylene bottle. This aliquot is submitted to a contract laboratory for aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, nickel, silver, and zinc analyses; the analytical results for these analyses are presented in **Table 6-2**; the EPA Methods used for these analyses are identified in **Table 6-3**. Two additional aliquots are submitted each week from the weekly composite. These two 500-mL aliquots are submitted to HCAL for analyses of the gross alpha, beta, and tritium activities. A subset of these results contribute to the completeness of the daily analytical results for gross alpha, gross beta, and tritium; this subset is reported and footnoted in the table for the daily results for gross alpha, gross beta, and tritium (**Table 6-1**).

Aliquots are submitted to the contract analytical laboratory for a far more extensive set of analyses on the 24-hour composite than the weekly composite sample. Under the heading of *Composite sample parameters*, the left column of **Table 6-3** lists the requested analyses with corresponding analytical methods. The analytical methods are EPA methods unless otherwise indicated. The remainder of the table reports the results by the month during which the 24-hour composite was acquired. It should be noted that **Table 6-2** also reports the monthly metals analytical results; these results are footnoted. In addition to the **Table 6-3** aliquots from the 24-hour composite, there are two 500-mL aliquots submitted to HCAL. These aliquots are submitted for analyses of the gross alpha, beta, and tritium activities. The results for the analyses are recorded with the gross alpha, gross beta, and tritium results from the weekly composite.

Concurrent with the monthly acquisition of a 24-hour composite, a portable peristaltic pump sampler is used to collect instantaneous grab samples from the sewage stream in the vault adjacent to B196. These samples are submitted to a contract analytical laboratory for additional monitoring of water quality parameters and organic compounds. The results of this monitoring are found in **Table 6-3** under the *Grab sample parameters* heading. The left column lists the parameters and the EPA method numbers used for the analyses. The last four entries in the column are for oil and grease analysis of samples that were acquired at 4-hour intervals during the day; the time of collection of each oil and grease sample is indicated in the column.

LLNL maintains flow monitoring equipment. A flow chart recorder is located inside of B196, and an ultrasonic flow sensor is installed in a vault adjacent to

B196. A flow totalizer reading from the flow chart recorder is entered into the B196 daily sampling log every day when the B196 daily composite sample is acquired. The daily total flows are determined by subtracting sequentially recorded flow totalizer readings. For days that flow totalizer readings are not available, daily flow totals are calculated by averaging. **Table 6-4** presents the daily total flows for 1995.

Two 500-mL aliquots of treated effluent from LWRP are collected daily by LWRP employees. These daily 500-mL aliquots are used to create two different composite samples. The first of the samples contains a week of daily aliquots. This weekly sample, composited in a 1-gallon polyethylene bottle, is collected each week by LLNL and submitted to HCAL for gross alpha, gross beta, and tritium analyses. **Table 6-5** shows the tritium results for the LWRP weekly composite sample. The other composite sample contains a month of daily aliquots. This monthly sample, composited in a 5-gallon polyethylene carboy, is collected each month by LLNL. CES analyzes the monthly composite for ^{137}Cs using gamma spectroscopy and for ^{239}Pu using alpha spectroscopy.

Two 500-mL composite samples from the LWRP digesters are acquired monthly by LWRP employees. The composites consist of aliquots taken from the circulating sludge once a week. Every month LLNL collects the composite samples and submits one 500-mL composite to HCAL and one to CES. HCAL analyzes the monthly composite for gross radioactivity and metals. CES composites the monthly samples on a quarterly basis and analyzes the quarterly composites for plutonium, cesium, and gamma-emitting radionuclides, using alpha spectroscopy for the plutonium and gamma spectroscopy for the cesium and gamma-emitting radionuclides. Volume 1, Table 6-2 shows the results for the ^{239}Pu analyses.

Standard quality control and quality assurance procedures are followed. When each sewage field sample is collected, it is labeled with the sampling location and date of sampling. In the laboratory, each sample is assigned a number that accompanies that sample during analysis. Additionally, split samples account for approximately 20% of the samples submitted for analytical work in 1995.

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995.

Sample date		Parameter					
		Gross alpha (μBq/mL		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity	LOS[a]	Activity	LOS	Activity	LOS
January	1	0.818 ± 128	128	71.4 ± 157	157	–0.632 ± 10.3	10.3
	2	–38.1 ± 132	132	27.8 ± 158	158	2.80 ± 10.6	10.6
	3	0.147 ± 129	129	120 ± 157	157	5.12 ± 9.90	9.90
	4	–6.92 ± 156	156	566 ± 140	163	–2.71 ± 11.0	11.0
	5	12.0 ± 187	187	599 ± 140	179	160 ± 6	10.9
	6	72.5 ± 186	186	316 ± 120	179	9.26 ± 10.2	10.2
	7	199 ± 130	184	2870 ± 260	179	5.50 ± 10.2	10.2
	8	–88.1 ± 156	156	877 ± 160	174	13.6 ± 1.0	9.79
	9	10.1 ± 152	152	4030 ± 300	173	3.35 ± 10.7	10.7
	10	–71.0 ± 195	195	932 ± 170	181	9.21 ± 10.4	10.4
	11	47.7 ± 195	195	685 ± 160	182	189 ± 7	14.0
	12	155 ± 179	179	529 ± 130	167	9.26 ± 9.26	14.1
	13	131 ± 200	200	633 ± 150	171	7.30 ± 13.7	13.7
	14	176 ± 206	206	618 ± 150	182	177 ± 7	14.2
	15	37.7 ± 184	184	109 ± 178	178	1.60 ± 13.9	13.9
	16	160 ± 206	206	403 ± 130	182	10.9 ± 13.6	13.6
	17	62.2 ± 216	216	306 ± 130	184	–0.608 ± 13.4	13.4
	18	36.1 ± 227	227	611 ± 150	186	–0.0935 ± 11.5	11.5
	19	60.7 ± 259	259	914 ± 170	193	49.4 ± 2.9	10.6
	20	11.1 ± 173	173	477 ± 130	164	9.51 ± 10.5	10.5
	21	68.1 ± 177	177	360 ± 140	180	18.7 ± 1.3	10.8
	22	31.6 ± 152	152	79.6 ± 174	174	–0.0932 ± 11.1	11.1
	23	28.1 ± 149	149	16.5 ± 174	174	7.27 ± 7.27	13.1
	24	51.8 ± 196	196	618 ± 160	183	0.923 ± 14.0	14.0
	25	47.0 ± 175	175	718 ± 160	168	–1.86 ± 13.3	13.3
	26	82.9 ± 173	173	577 ± 140	168	11.0 ± 0.8	9.53
	27	–4.81 ± 197	197	540 ± 150	181	–72.9 ± 16.2	16.2
	28	42.6 ± 248	248	648 ± 170	192	9.72 ± 13.8	13.8
	29[a]	145 ± 185	185	418 ± 138	180	15.5 ± 1.16	10.0
	30[a]	145 ± 185	185	418 ± 138	180	15.5 ± 1.16	10.0
	31	2.11 ± 176	176	914 ± 160	167	–0.682 ± 13.4	13.4

Note: LOS = limit of sensitivity.

...continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity	LOS	Activity	LOS	Activity	LOS
February	1	117 ± 187	187	810 ± 160	169	12.5 ± 0.9	12.4
	2	–62.2 ± 183	183	470 ± 140	168	–8.47 ± 14.2	14.2
	3	47.7 ± 181	181	437 ± 140	167	3.57 ± 13.1	13.1
	4	45.1 ± 195	195	729 ± 160	170	–1.65 ± 13.6	13.6
	5	48.8 ± 166	166	164 ± 164	165	4.27 ± 13.4	13.4
	6	–3.25 ± 176	176	279 ± 120	167	5.07 ± 13.5	13.5
	7	12.5 ± 184	184	400 ± 130	168	0.292 ± 13.7	13.7
	8	32.4 ± 194	194	455 ± 140	170	69.0 ± 3.7	10.8
	9	57.4 ± 234	234	707 ± 160	179	1.04 ± 11.7	11.7
	10	199 ± 209	209	666 ± 150	174	3.62 ± 10.9	10.9
	11	30.6 ± 222	222	766 ± 170	177	11.0 ± 11.4	11.4
	12	–44.4 ± 332	332	500 ± 150	186	7.49 ± 7.49	11.0
	13	21.2 ± 293	293	437 ± 140	184	4.68 ± 11.0	11.0
	14	111 ± 204	204	699 ± 160	172	13.1 ± 11.0	11.0
	15	92.9 ± 270	270	662 ± 150	239	1.88 ± 11.3	11.3
	16	113 ± 212	212	829 ± 170	175	35.6 ± 7.5	10.9
	17	154 ± 280	280	788 ± 170	238	5.92 ± 11.1	11.1
	18	–34.0 ± 273	273	599 ± 150	236	–12.8 ± 12.3	12.3
	19	–18.4 ± 221	221	164 ± 225	225	–3.81 ± 11.2	11.2
	20	112 ± 310	310	377 ± 140	244	3.92 ± 11.2	11.2
	21	52.2 ± 232	232	181 ± 227	227	1.87 ± 11.2	11.2
	22	50.7 ± 301	301	781 ± 160	243	4.77 ± 11.1	11.1
	23	4.51 ± 283	283	747 ± 160	239	27.0 ± 7.0	10.8
	24	30.2 ± 255	255	470 ± 140	232	15.0 ± 6.1	9.84
	25	157 ± 280	280	710 ± 160	238	0.892 ± 10.4	10.4
	26	–14.9 ± 337	337	588 ± 150	246	7.44 ± 10.5	10.5
	27	–10.0 ± 256	256	503 ± 140	232	3.74 ± 11.0	11.0
	28	–74.0 ± 267	267	581 ± 150	235	0.881 ± 10.4	10.4

...continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity	LOS	Activity	LOS	Activity	LOS
March	1	72.2 ± 279	279	633 ± 150	238	7.77 ± 10.4	10.4
	2	71.0 ± 289	289	603 ± 170	198	22.6 ± 7.0	11.1
	3	42.6 ± 323	323	733 ± 180	200	6.59 ± 10.8	10.8
	4	80.3 ± 298	298	559 ± 160	184	–0.888 ± 10.8	10.8
	5	64.4 ± 228	228	381 ± 140	178	8.25 ± 10.9	10.9
	6	58.5 ± 195	195	180 ± 110	170	10.3 ± 6.2	10.2
	7	87.7 ± 178	178	829 ± 160	220	5.18 ± 10.7	10.7
	8	26.0 ± 218	218	662 ± 150	228	5.74 ± 10.3	10.3
	9	–57.0 ± –293	293	781 ± 160	244	10.1 ± 10.1	10.1
	10	61.1 ± 293	293	533 ± 150	244	6.29 ± 10.5	10.5
	11	9.58 ± 214	214	492 ± 140	224	6.85 ± 10.6	10.6
	12	35.4 ± 95	95	231 ± 99	191	7.84 ± 10.5	10.5
	13	77.7 ± 269	269	353 ± 130	235	4.40 ± 10.5	10.5
	14	10.7 ± 269	269	574 ± 150	235	10.8 ± 6.4	10.4
	15	–17.9 ± 269	269	925 ± 180	235	13.3 ± 6.5	10.7
	16	96.9 ± 310	310	873 ± 170	245	4.14 ± 10.8	10.8
	17	33.1 ± 94	94	596 ± 130	193	3.67 ± 10.5	10.5
	18	31.6 ± 266	266	747 ± 160	238	10.6 ± 11.1	11.1
	19	–2.29 ± 194	194	343 ± 120	223	2.46 ± 11.1	11.1
	20[b]	7.47 ± 174	174	551 ± 138	219	11.7 ± 5.85	9.44
	21	44.4 ± 248	248	988 ± 180	233	5.88 ± 10.5	10.5
	22[c]	33.3 ± 95	95	385 ± 115	194	8.58 ± 10.4	10.4
	23	14.1 ± 94	94	164 ± 194	194	5.03 ± 9.58	9.58
	24	–1.20 ± 94	94	255 ± 100	194	7.03 ± 9.99	9.99
	25	–12.1 ± 286	286	725 ± 160	243	0.160 ± 10.3	10.3
	26	5.51 ± 95	95	259 ± 100	194	0.796 ± 9.99	9.99
	27	86.2 ± 95	95	212 ± 98	194	7.07 ± 9.32	9.32
	28	–16.5 ± 287	287	751 ± 170	244	1.64 ± 10.2	10.2
	29	53.3 ± 287	287	618 ± 150	244	–7.07 ± 10.3	10.3
	30	12.6 ± 95	95	356 ± 110	195	6.92 ± 10.4	10.4
	31	126 ± 268	268	1070 ± 180	240	1.58 ± 10.2	10.2

...continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity	LOS	Activity	LOS	Activity	LOS
April	1	20.6 ± 95	95	603 ± 130	194	3.30 ± 10.2	10.2
	2	57.7 ± 195	195	161 ± 224	224	2.08 ± 10.6	10.6
	3	25.7 ± 95	95	286 ± 110	194	9.29 ± 10.3	10.3
	4	0.230 ± 95	95	511 ± 120	194	7.70 ± 9.69	9.69
	5	–30.2 ± 213	213	525 ± 140	227	8.44 ± 9.58	9.58
	6	45.5 ± 94	94	448 ± 120	192	37.0 ± 6.7	10.1
	7	58.8 ± 94	94	525 ± 130	192	2.32 ± 10.4	10.4
	8	65.5 ± 94	94	555 ± 130	192	–2.79 ± 10.5	10.5
	9	21.1 ± 94	94	115 ± 192	192	7.51 ± 10.1	10.1
	10	4.88 ± 94	94	243 ± 100	192	0.918 ± 10.5	10.5
	11	56.6 ± 211	211	403 ± 130	225	6.11 ± 9.81	9.81
	12	18.6 ± 72	72	740 ± 140	139	4.29 ± 10.4	10.4
	13	18.4 ± 175	175	618 ± 150	166	4.07 ± 10.3	10.3
	14	–4.44 ± 72	72	352 ± 110	140	1.78 ± 10.7	10.7
	15	17.5 ± 115	115	320 ± 120	152	1.14 ± 10.2	10.2
	16	–1.45 ± 72	72	159 ± 95	140	2.00 ± 10.4	10.4
	17	5.22 ± 72	72	196 ± 98	140	8.33 ± 9.81	9.81
	18	5.85 ± 72	72	154 ± 94	140	–0.773 ± 10.4	10.4
	19	53.7 ± 72	72	330 ± 110	140	2.56 ± 10.5	10.5
	20	85.8 ± 149	149	363 ± 130	163	13.3 ± 6.2	10
	21	4.96 ± 73	73	358 ± 110	141	–2.22 ± 10.2	10.2
	22	–2.99 ± 73	73	429 ± 120	141	–1.96 ± 10.3	10.3
	23	–7.47 ± 73	73	131 ± 130	141	1.36 ± 10.3	10.3
	24	29.2 ± 73	73	106 ± 141	141	2.36 ± 10.5	10.5
	25	11.6 ± 73	73	429 ± 120	141	5.40 ± 10.0	10.0
	26	–2.64 ± 73	73	392 ± 110	141	6.81 ± 9.88	9.88
	27	33.9 ± 73	73	374 ± 110	141	3.45 ± 10.6	10.6
	28	53.3 ± 116	116	481 ± 130	153	4.59 ± 10.7	10.7
	29	5.55 ± 73	73	307 ± 110	141	2.89 ± 11.0	11.0
	30	44.0 ± 73	73	105 ± 141	141	4.88 ± 11.4	11.4

...continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).
...continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
Sample date		Activity	LOS	Activity	LOS	Activity	LOS
June	1	189 ± 130	165	488 ± 140	165	2.80 ± 11.0	11.0
	2	26.3 ± 73	73	338 ± 110	141	2.04 ± 10.4	10.4
	3	17.5 ± 73	73	463 ± 120	141	0.348 ± 10.3	10.3
	4	51.1 ± 73	73	124 ± 141	141	2.50 ± 10.7	10.7
	5	21.4 ± 73	73	135 ± 141	141	3.47 ± 10.7	10.7
	6	16.2 ± 73	73	607 ± 130	142	–8.33 ± 10.8	10.8
	7	19.8 ± 151	151	622 ± 150	164	8.29 ± 9.95	9.95
	8	82.5 ± 151	151	514 ± 140	164	10.7± 6.1	9.99
	9	8.58 ± 73	73	629 ± 130	142	6.99 ± 10.4	10.4
	10	39.6 ± 73	73	485 ± 120	142	–2.83 ± 11.1	11.1
	11	8.25 ± 73	73	12.4 ± 142	142	9.36 ± 9.84	9.84
	12	26.9 ± 73	73	312 ± 110	142	3.66 ± 10.4	10.4
	13	61.8 ± 179	179	585 ± 150	168	25.1 ± 7.3	11.3
	14	80.3 ± 151	151	618 ± 150	164	61.8 ± 7.4	10.3
	15	70.3 ± 154	154	488 ± 140	164	13.5 ± 6.1	9.73
	16	138 ± 180	180	463 ± 130	168	19.4 ± 6.2	9.81
	17	86.2 ± 184	184	437 ± 140	168	11.4 ± 5.9	9.66
	18	–14.4 ± 143	143	124 ± 162	162	9.58 ± 5.8	9.55
	19	14.8 ± 145	145	107 ± 162	162	2.53 ± 9.88	9.88
	20	178 ± 186	186	544 ± 140	169	6.66 ± 10.1	10.1
	21	–9.07 ± 171	171	470 ± 140	167	14.5 ± 6.3	9.99
	22	–18.1 ± 191	191	777 ± 160	170	8.77 ± 9.66	9.66
	23	136 ± 220	220	1190 ± 190	179	5.70 ± 10.5	10.5
	24	116 ± 222	222	862 ± 170	178	23.9 ± 6.7	10.3
	25	361 ± 200	224	992 ± 180	178	46.3 ± 7.4	10.5
	26	108 ± 192	192	496 ± 140	171	25.9 ± 6.7	10.4
	27	79.2 ± 175	175	559 ± 150	167	7.70 ± 10.1	10.1
	28	–33.4 ± 149	149	317 ± 120	163	23.4 ± 6.3	9.66
	29	–20.8 ± 188	188	284 ± 120	169	5.14 ± 9.77	9.77
	30	64.0 ± 167	167	354 ± 130	166	26.6 ± 6.6	10.2

..continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity	LOS	Activity	LOS	Activity	LOS
July	1	49.6 ± 174	174	396 ± 130	167	12.9 ± 6.5	10.5
	2	27.8 ± 134	134	99.5 ± 160	160	3.15 ± 10.9	10.9
	3[d]	–16.8 ± 152	152	213 ± 113	164	9.62 ± 10.9	10.9
	4	38.1 ± 202	202	357 ± 130	172	2.25 ± 10.7	10.7
	5	-38.9 ± 134	134	58.5 ± 159	159	0.529 ± 10.8	10.8
	6	–955 ± 2442	2442	611 ± 1809	1809	10.5 ± 6.3	10.3
	7	80.7 ± 171	171	585 ± 150	167	10.4 ± 10.5	10.5
	8[e]	22.9 ± 154	154	577 ± 144	164	8.58 ± 10.4	10.4
	9[e]	22.9 ± 154	154	577 ± 144	164	8.58 ± 10.4	10.4
	10	14.0 ± 138	138	165 ± 110	161	1.23 ± 10.5	10.5
	11	12.6 ± 176	176	488 ± 140	169	–0.803 ± 10.7	10.7
	12	29.7 ± 161	161	334 ± 130	167	4.14 ± 10.4	10.4
	13	143 ± 165	165	562 ± 150	167	3.11 ± 10.6	10.6
	14	31.8 ± 171	171	1450 ± 200	168	0.796 ± 10.4	10.4
	15[f]	40.0 ± 162	162	603 ± 145	165	12.4 ± 6.5	10.6
	16[f]	40.0 ± 162	162	603 ± 145	165	12.4 ± 6.5	10.6
	17	–25.3 ± 131	131	85.1 ± 160	160	13.8 ± 6.3	10.1
	18	86.6 ± 183	183	614 ± 150	170	4.51 ± 10.7	10.7
	19	11.4 ± 170	170	681 ± 160	168	6.07 ± 10.5	10.5
	20	94.7 ± 162	162	466 ± 140	167	–1.68 ± 10.7	10.7
	21[g]	28.7 ± 172	172	282 ± 121	166	–0.444 ± 10.7	10.7
	22	–48.8 ± 176	176	533 ± 140	167	2.83 ± 10.7	10.7
	23	-35.6 ± 158	158	225 ± 110	164	–15.8 ± 12.0	12.0
	24	84.0 ± 150	150	313 ± 120	162	13.4 ± 5.6	9.10
	25	5.62 ± 177	177	485 ± 140	167	0.529 ± 10.3	10.3
	26	–43.7 ± 194	194	840 ± 170	170	–0.0877 ± 10.8	10.8
	27	58.5 ± 181	181	670 ± 150	169	11.3 ± 6.5	10.5
	28	75.1 ± 172	172	570 ± 140	168	7.33 ± 10.1	10.1
	29	24.8 ± 244	244	892 ± 180	182	4.55 ± 10.8	10.8
	30	46.3 ± 159	159	164 ± 166	166	15.0 ± 6.5	10.5
	31	13.2 ± 136	136	117 ± 161	161	10.4 ± 10.5	10.5

.continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity	LOS	Activity	LOS	Activity	LOS
August	1	102 ± 191	191	577 ± 150	171	10.2 ± 10.4	10.4
	2	33.3 ± 213	213	529 ± 150	177	13.6 ± 6.3	10.1
	3[h]	14.3 ± 169	169	307 ± 123	167	2.55 ± 10.4	10.4
	4	43.7 ± 168	168	466 ± 140	168	–1.41 ± 10.5	10.5
	5	–41.8 ± 171	171	522 ± 140	165	5.81 ± 10.3	10.3
	6	0.729 ± 118	118	65.1 ± 152	152	1.85 ± 10.7	10.7
	7	52.9 ± 134	134	157 ± 158	158	3.24 ± 10.4	10.4
	8	44.8 ± 196	196	796 ± 160	170	9.58 ± 10.5	10.5
	9	168 ± 202	202	796 ± 160	171	10.8 ± 6.3	10.2
	10[i]	12.8 ± 153	153	314 ± 122	165	17.6 ± 6.2	9.81
	11[i]	12.8 ± 153	153	314 ± 122	165	17.6 ± 6.2	9.81
	12	106 ± 162	162	703 ± 150	164	0.925 ± 10.2	10.2
	13	–12.1 ± –125	125	114 ± 155	155	6.25 ± 10.5	10.5
	14	59.9 ± 117	117	57.7 ± 152	152	1.42 ± 10.7	10.7
	15	112 ± 205	205	799 ± 160	172	–0.178 ± 10.7	10.7
	16	114 ± 171	171	592 ± 150	165	1.59 ± 11.0	11.0
	17	44.4 ± 170	170	562 ± 140	165	5.55 ± 10.4	10.4
	18	–26.4 ± 177	177	651 ± 150	166	–1.76 ± 10.5	10.5
	19	67.7 ± 188	188	577 ± 140	168	10.8 ± 5.7	9.44
	20	52.9 ± 131	131	108 ± 108	157	4.85 ± 9.81	9.81
	21	–38.1 ± 130	130	78.8 ± 157	157	10.5 ± 5.8	9.51
	22	93.2 ± 201	201	548 ± 140	171	–0.881 ± 10.7	10.7
	23	25.2 ± 172	172	696 ± 150	168	2.06 ± 9.99	9.99
	24	57.7 ± 160	160	566 ± 140	166	5.11 ± 10.3	10.3
	25	48.5 ± 181	181	481 ± 140	169	8.47 ± 10.5	10.5
	26	185 ± 130	176	685 ± 150	168	9.40 ± 10.5	10.5
	27	12.5 ± 128	128	163 ± 110	158	14.7 ± 6.2	9.81
	28	13.1 ± 130	130	126 ± 159	159	8.33 ± 10.0	10.0
	29	9.18 ± 177	177	651 ± 150	169	0.618 ± 10.5	10.5
	30	12.7 ± 146	146	347 ± 120	162	2.21 ± 10.4	10.4
	31	–3.85 ± 181	181	466 ± 140	168	116 ± 9	10.3

..continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

	Parameter					
	Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
Sample date	Activity	LOS	Activity	LOS	Activity	LOS
September 1	12.7 ± 167	167	503 ± 140	166	4.22 ± 10.1	10.1
2	221 ± 150	188	562 ± 150	169	2.02 ± 10.5	10.5
3	–13.2 ± 141	141	96.2 ± 161	161	–0.884 ± 10.9	10.9
4	55.9 ± 135	135	18.0 ± 159	159	7.14 ± 10.4	10.4
5	–11.5 ± 132	132	9.32 ± 158	158	2.90 ± 10.5	10.5
6	94.4 ± 162	162	455 ± 130	165	6.44 ± 10.4	10.4
7	59.9 ± 157	157	448 ± 130	164	–1.15 ± 10.4	10.4
8	13.8 ± 167	167	357 ± 130	167	5.48 ± 10.4	10.4
9	96.6 ± 176	176	836 ± 170	169	5.29 ± 10.6	10.6
10	1.85 ± 126	126	–7.10 ± 158	158	8.03 ± 9.84	9.84
11	1.70 ± 128	128	8.92 ± 159	159	4.00 ± 10.7	10.7
12	152 ± 272	272	740 ± 170	185	144 ± 9	10.6
13	64.0 ± 189	189	940 ± 170	171	22.5 ± 6.5	10.0
14	189 ± 202	202	766 ± 160	172	24.6 ± 6.9	10.7
15	45.9 ± 169	169	529 ± 140	167	0.673 ± 10.5	10.5
16	–7.92 ± 170	170	751 ± 160	167	37.4 ± 7.1	10.4
17	–39.6 ± 136	136	53.7 ± 161	161	–2.83 ± 10.8	10.8
18[j]	44.0 ± 161	161	477 ± 138	167	23.1 ± 6.5	10.0
19	239 ± 392	392	4960 ± 500	346	37.7 ± 7.2	10.5
20	10.1 ± 164	164	603 ± 140	167	5.07 ± 11.0	11.0
21	74.0 ± 159	159	596 ± 150	166	20.2 ± 6.7	10.4
22	47.7 ± 175	175	718 ± 160	169	8.14 ± 10.2	10.2
23	–46.3 ± 149	149	366 ± 130	165	5.44 ± 9.99	9.99
24	14.4 ± 132	132	84.4 ± 161	161	3.92 ± 10.5	10.5
25	–24.0 ± 130	130	–27.8 ± 160	160	5.18 ± 10.4	10.4
26	60.7 ± 152	152	280 ± 120	165	–19.9 ± 11.7	11.7
27	70.7 ± 151	151	537 ± 140	162	3.24 ± 10.5	10.5
28	122 ± 185	185	662 ± 150	168	–5.81 ± 10.8	10.8
29	44.8 ± 169	169	400 ± 130	165	5.44 ± 11.0	11.0
30	25.5 ± 159	159	429 ± 130	164	4.85 ± 11.2	11.2

..continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
Sample date		Activity	LOS	Activity	LOS	Activity	LOS
October	1	75.9 ± 128	128	180 ± 100	157	11.0 ± 6.7	10.9
	2	45.1 ± 147	147	73.3 ± 162	162	18.8 ± 6.6	10.4
	3	45.5 ± 199	199	766 ± 160	171	45.5 ± 7.3	10.9
	4	32.8 ± 171	171	359 ± 130	168	50.0 ± 8.0	10.6
	5	–57.7 ± 185	185	418 ± 130	170	2.38 ± 10.7	10.7
	6	122 ± 261	261	829 ± 170	184	44.0 ± 7.0	10.3
	7	15.2 ± 156	156	315 ± 130	168	12.1 ± 5.6	10.5
	8	–13.4 ± 148	148	65.9 ± 167	167	0.305 ± 10.8	10.8
	9	16.6 ± 148	148	42.6 ± 167	167	-0.246 ± 10.9	10.9
	10	–1.214 ± 170	170	392 ± 130	170	5.99 ± 10.4	10.4
	11	113 ± 198	198	759 ± 160	173	44.8 ± 7.2	10.1
	12	–0.622 ± 154	154	331 ± 130	168	4.00 ± 10.7	10.7
	13	95.8 ± 199	199	555 ± 140	173	31.4 ± 6.3	10.3
	14	32.6 ± 186	186	581 ± 150	172	3.47 ± 10.2	10.2
	15	33.6 ± 167	167	196 ± 110	169	1.94 ± 10.3	10.3
	16	128 ± 160	160	248 ± 120	168	2.42 ± 10.6	10.6
	17	62.9 ± 165	165	466 ± 140	168	3.20 ± 10.4	10.4
	18	–38.9 ± 178	178	400 ± 130	168	0.222 ± 10.7	10.7
	19	94.0 ± 191	191	300 ± 120	171	0.0392 ± 10.6	10.6
	20	34.9 ± 206	206	596 ± 150	174	12.7 ± 6.2	10.6
	21	78.4 ± 209	209	525 ± 150	175	3.70 ± 10.4	10.4
	22	–18.4 ± 182	182	181 ± 110	169	5.74 ± 9.92	9.92
	23	–7.47 ± 228	228	625 ± 160	179	8.21 ± 8.21	9.88
	24	16.8 ± 200	200	389 ± 140	172	93.2 ± 8	10.5
	25	15.3 ± 189	189	514 ± 140	172	2.96 ± 10.2	10.2
	26	15.1 ± 191	191	544 ± 150	172	1.28 ± 10.4	10.4
	27	51.1 ± 188	188	666 ± 150	172	7.66 ± 10.1	10.1
	28	–59.6 ± 181	181	636 ± 150	171	4.03 ± 10.0	10.0
	29	48.5 ± 160	160	194 ± 110	167	3.89 ± 10.3	10.3
	30	17.7 ± 184	184	274 ± 120	171	4.26 ± 10.6	10.6
	31	–3.23 ± 206	206	485 ± 150	176	-1.75 ± 10.5	10.5

..continued on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (continued).

	Parameter					
	Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
Sample date	Activity	LOS	Activity	LOS	Activity	LOS
November 1	–20.1 ± 168	168	514 ± 140	169	5.07 ± 10.1	10.1
2	66.6 ± 175	175	418 ± 130	167	1.23 ± 10.3	10.3
3	–21.3 ± 178	178	403 ± 130	167	–4.66 ± 10.5	10.5
4	238 ± 150	188	659 ± 150	169	2.39 ± 10.2	10.2
5	112 ± 162	162	295 ± 120	165	0.947 ± 10.4	10.4
6	–0.592 ± 169	169	211 ± 110	166	1.79 ± 10.7	10.7
7	124 ± 186	186	581 ± 150	169	–0.895 ± 10.4	10.4
8	170 ± 364	364	1190 ± 300	336	1.60 ± 11.3	11.3
9	53.3 ± 190	190	488 ± 140	172	4.74 ± 10.4	10.4
10	–26.1 ± 208	208	548 ± 150	176	92.1 ± 8.2	10.4
11	51.1 ± 191	191	655 ± 150	172	4.22 ± 10.5	10.5
12	34.5 ± 176	176	259 ± 120	169	4.74 ± 10.7	10.7
13	–36.5 ± 178	178	250 ± 120	169	4.85 ± 10.3	10.3
14	74.4 ± 193	193	433 ± 140	172	2.27 ± 10.4	10.4
15	31.2 ± 177	177	522 ± 140	169	8.36 ± 10.2	10.2
16	92.9 ± 193	193	459 ± 140	172	6.29 ± 10.6	10.6
17	-20.4 ± 172	172	500 ± 140	167	10.3 ± 6.2	10.0
18	72.5 ± 154	154	670 ± 150	167	–0.170 ± 10.8	10.8
19	–0.844 ± 165	165	294 ± 120	169	1.48 ± 10.8	10.8
20	–14.3 ± 154	154	94.4 ± 167	167	16.3 ± 7.0	11.2
21	49.2 ± 186	186	792 ± 170	172	4.63 ± 11.0	11.0
22	44.0 ± 155	155	296 ± 120	164	–1.98 ± 10.7	10.7
23	31.9 ± 180	180	455 ± 140	168	1.99 ± 10.4	10.4
24	34.4 ± 163	163	36.3 ± 166	166	3.46 ± 10.7	10.7
25	1.65 ± 151	151	36.8 ± 164	164	1.78 ± 10.8	10.8
26	–15.1 ± 162	162	76.6 ± 166	166	5.81 ± 10.6	10.6
27	32.0 ± 149	149	2.82 ± 164	164	–3.16 ± 10.8	10.8
28	62.5 ± 165	165	426 ± 130	166	6.03 ± 10.1	10.1
29	–6.62 ± 198	198	588 ± 150	172	0.343 ± 11.0	11.0
30	67.7 ± 189	189	707 ± 170	170	5.81 ± 10.8	10.8

..concluded on next page

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1995 (concluded).

	Parameter					
	Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
Sample date	Activity	LOS	Activity	LOS	Activity	LOS
December 1	48.1 ± 185	185	681 ± 160	169	5.00 ± 10.7	10.7
2	–22.3 ± 165	165	588 ± 150	166	1.02 ± 10.8	10.8
3	15.4 ± 141	141	62.9 ± 162	162	0.951 ± 10.9	10.9
4	29.9 ± 143	143	57.4 ± 162	162	2.56 ± 10.7	10.7
5	30.6 ± 159	159	269 ± 120	165	5.37 ± 10.5	10.5
6	–135 ± 185	185	29,900 ± 810	169	3.33 ± 10.8	10.8
7	122 ± 183	183	1380 ± 19	168	7.07 ± 10.4	10.4
8	52.2 ± 178	178	1120 ± 180	167	7.07 ± 10.1	10.1
9	26.8 ± 181	181	618 ± 15	168	2.55 ± 10.6	10.6
10	45.9 ± 164	164	308 ± 120	165	2.54 ± 10.4	10.4
11	59.2 ± 164	164	503 ± 140	165	0.500 ± 10.9	10.9
12	76.2 ± 169	169	592 ± 150	166	–2.85 ± 11.5	11.5
13	98.4 ± 158	158	844 ± 160	165	4.51 ± 10.8	10.8
14	130 ± 182	182	973 ± 180	168	8.44 ± 10.4	10.4
15	78.8 ± 179	179	696 ± 150	168	–1.89 ± 10.9	10.9
16	46.3 ± 169	169	381 ± 130	165	4.14 ± 10.5	10.5
17	35.3 ± 225	225	555 ± 150	176	–1.56 ± 10.8	10.8
18	13.3 ± 174	174	343 ± 130	165	4.22 ± 10.6	10.6
19	11.6 ± 174	174	433 ± 130	165	7.36 ± 10.2	10.2
20	75.5 ± 170	170	655 ± 150	165	–0.199 ± 10.3	10.3
21	-24.8 ± 164	164	585 ± 150	164	4.29 ± 10.4	10.4
22	8.51 ± 173	173	592 ± 150	165	2.97 ± 10.7	10.7
23	28.3 ± 168	168	455 ± 140	166	0.736 ± 0.279	10.3
24	–19.6 ± 169	169	289 ± 120	166	1.90 ± 10.4	10.4
25	61.4 ± 151	151	84.4 ± 164	164	–1.51 ± 10.5	10.5
26	84.0 ± 141	141	164 ± 110	161	4.44 ± 10.6	10.6
27	171 ± 171	171	168 ± 110	167	9.81 ± 10.2	10.2
28	124 ± 181	181	278 ± 120	168	0.611 ± 10.5	10.5
29	9.84 ± 162	162	492 ± 140	165	0.451 ± 10.6	10.6
30	61.4 ± 156	156	210 ± 110	163	10.2 ± 10.5	10.5
31	–2.01 ± 158	158	283 ± 120	163	–1.86 ± 10.8	10.8

Note: Dates for which the daily monitoring results are not available have been footnoted. The results shown for these dates are the monitoring results for the weekly composite sample. The footnotes below indicate the sampling periods for the weekly composite samples.

[a]January 23 – 29, 1995.
[b]March 13 – 19, 1995.
[c]March 20 – 26, 1995.
[d]June 26 – July 2, 1995.
[e]July 3 – 6, and 8 – 9, 1995.
[f]July 10 –16, 1995.
[g]July 17 – 23, 1995.
[h]July 31, and August 1, 3 – 6, 1995.
[i]August 7 – 13, 1995.
[j]September 11 – 17, 1995.

Table 6-2. Weekly and 24-hour composite results for metals in the sanitary sewer effluent, 1995.

Composite dates	Parameter (mg/L)					
	Al	As	Be	Cd	Cr	Cu
Dec. 27, 1994-Jan.2, 1995	0.28	0.0024	<0.00050	<0.005	<0.010	0.065
January 3-4, 6-8[a]	<0.20	0.0027	<0.00050	<0.005	<0.010	0.062
January 5[b]	0.69	<0.0020	<0.00050	<0.005	0.027	0.11
January 9-16	0.51	0.0042	<0.00050	<0.005	0.014	0.079
January 17-22	0.30	0.0056	<0.00050	<0.005	0.016	0.071
January 23-29	0.39	0.0054	<0.00050	<0.005	<0.010	0.090
Jan. 30-Feb.1, Feb. 3-5[a]	<0.20	<0.0020	<0.00050	<0.005	<0.010	0.092
February 2[b]	<0.20	<0.0020	<0.00050	<0.005	<0.010	0.067
February 6-12	0.21	0.0049	<0.00050	<0.005	0.020	0.099
February 13-20	0.32	0.0027	<0.00050	<0.005	<0.010	0.12
February 21-26	0.31	0.0025	<0.00050	<0.005	<0.010	0.15
February 27-March 5	0.32	0.0049	<0.00050	<0.005	<0.010	0.10
March 6, 8-12[a]	0.32	0.0062	<0.00050	<0.005	<0.010	0.068
March 7[b]	1.0	0.0025	<0.00050	<0.005	0.011	0.13
March 13-19	0.28	0.0055	<0.00050	<0.005	0.011	0.099
March 20-26	1.3	0.0026	<0.00050	<0.005	0.011	0.085
March 27-April 2	0.47	0.0026	<0.00050	<0.005	0.010	0.088
April 3, 5-9[a]	0.49	0.0039	<0.00050	<0.005	<0.010	0.091
April 4[b]	0.66	0.0033	<0.00050	<0.005	<0.010	0.077
April 10-17	0.26	<0.0020	<0.00050	<0.005	<0.010	0.068
April 18-23	0.55	<0.0020	<0.00050	<0.005	0.011	0.12
April 24-30	0.33	<0.0020	<0.00050	<0.005	<0.010	0.14
May 1, 3-7[a]	0.29	<0.0020	<0.00050	<0.005	<0.010	0.086
May 2[b]	0.63	<0.0020	<0.00050	<0.005	<0.010	0.16
May 8-14	<0.20	<0.0020	<0.00050	<0.005	<0.010	0.090
May 15-21	0.50	<0.0020	<0.00050	<0.005	0.014	0.13
May 22-29	0.41	<0.0020	0.00077	<0.005	0.011	0.11
May 30-June 4	0.33	0.0030	<0.00050	<0.005	<0.010	0.090
June 5, 7-11[a]	0.36	0.0031	<0.00050	<0.005	<0.010	0.083
June 6[b]	0.49	0.0025	<0.00050	<0.005	<0.010	0.096
June 12-18	0.27	<0.0020	<0.00050	<0.005	0.011	0.093
June 19-25	0.37	0.0035	<0.00050	<0.005	<0.010	0.071
June 26-July 2	<0.20	0.0032	<0.00050	<0.005	<0.010	0.053
July 3-6, 8-9[a]	<0.20	0.0025	<0.00050	<0.005	0.016	0.12
July 7[b]	0.20	<0.0020	<0.00050	<0.005	0.017	0.14
July 10 -16	0.43	<0.0020	<0.00050	<0.005	0.015	0.12

...continued on next page

Table 6-2. Weekly and 24-hour composite results for metals in the sanitary sewer effluent, 1995 (continued).

Composite dates	Parameter (mg/L)					
	Fe	Pb	Hg	Ni	Ag	Zn
Dec. 27, 1994-Jan.2, 1995	0.87	0.0075	0.00024	0.0082	<0.010	0.096
January 3-4, 6-8[a]	0.89	0.013	0.00097	0.0096	<0.010	0.11
January 5[b]	2.1	0.022	0.0076	0.011	<0.010	0.22
January 9-16	1.1	0.014	0.0013	0.0064	0.010	0.18
January 17-22	1.0	0.0079	0.0013	<0.0050	0.017	0.16
January 23-29	1.1	<0.002	0.00086	<0.0050	<0.010	0.19
Jan. 30-Feb.1, Feb. 3-5[a]	0.68	0.030	0.00052	<0.0050	0.012	0.17
February 2[b]	0.36	0.019	0.00052	<0.0050	<0.010	0.12
February 6-12	1.1	0.010	0.00020	0.0069	0.016	0.20
February 13-20	1.0	0.013	0.00056	0.0051	0.014	0.20
February 21-26	0.92	0.019	0.00044	0.0078	0.013	0.28
February 27-March 5	0.86	0.028	0.00041	0.0076	0.020	0.44
March 6, 8-12[a]	0.98	0.016	<0.00020	0.0066	<0.010	0.11
March 7[b]	1.8	0.035	<0.00020	0.0079	0.019	0.23
March 13-19	0.74	0.0079	0.0012	<0.0050	<0.010	0.17
March 20-26	1.8	0.0087	0.0012	0.0076	<0.010	0.19
March 27-April 2	1.1	0.0093	<0.00020	<0.0050	0.018	0.19
April 3, 5-9[a]	1.2	0.013	0.00024	0.0072	<0.010	0.16
April 4[b]	1.4	0.009	0.00039	0.0051	<0.010	0.18
April 10-17	1.1	0.0072	0.00021	<0.0050	<0.010	0.13
April 18-23	1.6	0.013	0.00039	0.0071	0.014	0.19
April 24-30	1.1	0.030	0.00023	0.0070	0.011	0.25
May 1, 3-7[a]	1.0	0.014	0.00038	<0.0050	<0.010	0.18
May 2[b]	1.2	0.032	0.00071	0.0079	0.013	0.21
May 8-14	1.2	0.019	0.00033	<0.0050	<0.010	0.22
May 15-21	1.6	0.049	0.00034	0.021	0.014	0.24
May 22-29	1.6	0.026	0.00033	0.0059	0.027	0.21
May 30-June 4	1.1	0.013	0.00034	<0.0050	0.074	0.19
June 5, 7-11[a]	1.0	0.018	<0.00020	0.0051	0.012	0.20
June 6[b]	1.3	0.011	0.00042	<0.0050	<0.010	0.25
June 12-18	1.3	0.0085	0.00033	<0.0050	0.012	0.20
June 19-25	0.93	0.0077	0.0011	<0.0050	<0.010	0.21
June 26-July 2	0.4	0.0067	<0.0002	<0.0050	<0.010	0.08
July 3-6, 8-9[a]	1.1	0.016	0.00081	<0.0050	<0.010	0.51
July 7[b]	1.3	0.029	0.0010	0.0069	0.015	0.57
July 10 -16	1.1	0.013	0.00058	<0.0050	<0.010	0.39

...continued on next page

Table 6-2. Weekly and 24-hour composite results for metals in the sanitary sewer effluent, 1995 (continued).

Composite dates	Parameter (mg/L)					
	Al	As	Be	Cd	Cr	Cu
July 17-23	<0.2	0.0033	<0.00050	<0.005	<0.010	0.072
July 24-30	0.64	<0.0020	<0.00050	<0.005	0.015	0.18
July 31, August 1, 3-6[a]	0.61	0.0033	<0.00050	<0.005	0.015	0.22
August 2[b]	1.0	<0.0020	<0.00050	<0.005	0.019	0.15
August 7-13	0.58	0.0043	<0.00050	<0.005	<0.010	0.11
August 14-20	0.43	0.0036	<0.00050	<0.005	<0.010	0.13
August 21-27	0.56	<0.0020	<0.00050	<0.005	0.021	0.14
August 28-September 3	0.26	0.0030	<0.00050	<0.005	<0.010	0.082
September 4-6, 8-10[a]	0.53	<0.0020	<0.00050	<0.005	0.012	0.15
September 7[b]	0.71	<0.0020	<0.00050	<0.005	0.019	0.095
September 11-17	0.49	<0.0020	<0.00050	<0.005	0.023	0.18
September 18-24	0.47	<0.002	<0.00050	<0.005	0.014	0.16
September 25-October 1	0.52	<0.0020	<0.00050	<0.005	0.011	0.18
October 2, 4-8[a]	0.44	0.0022	<0.00050	<0.005	<0.010	0.17
October 3[b]	0.57	<0.0020	<0.00050	<0.005	0.020	0.13
October 9-15	0.84	0.0031	<0.00050	<0.005	0.021	0.15
October 16-22	0.67	0.0020	<0.00050	<0.005	0.015	0.13
October 23-29	0.33	<0.0020	<0.00050	<0.005	<0.010	0.043
October 30-November 5	0.92	0.0020	<0.00050	<0.005	0.018	0.12
November 6, 8-12[a]	0.56	0.0029	<0.00050	<0.005	0.016	0.12
November 7[b]	1.4	0.0021	<0.00050	<0.005	0.020	0.16
November 13-19	0.47	0.0024	<0.00050	<0.005	<0.010	0.12
November 20-26	0.45	0.0026	<0.00050	<0.005	<0.010	<0.01
November 27-December 3	<0.20	<0.0020	<0.00050	<0.005	<0.010	0.014
December 4-5, 7-10[a]	1.9	<0.0050	<0.00050	<0.001	0.015	0.21
December 6[b]	0.60	<0.0050	<0.00050	<0.001	0.020	0.12
December 11-17	1.4	<0.0050	<0.00050	<0.001	0.023	0.13
December 18-24	0.80	<0.0050	<0.00050	<0.001	<0.001	0.10
December 25-31	1.3	0.0055	<0.00050	<0.005	<0.010	0.32

...concluded on next page

Table 6-2. Weekly and 24-hour composite results for metals in the sanitary sewer effluent, 1995 (concluded).

Composite dates	Parameter (mg/L)					
	Fe	Pb	Hg	Ni	Ag	Zn
July 17-23	0.36	0.012	<0.00020	<0.0050	<0.010	0.25
July 24-30	2.2	0.032	0.00066	0.0057	0.018	0.38
July 31, August 1, 3-6[a]	1.6	0.049	0.00055	<0.0050	0.014	0.29
August 2[b]	1.9	0.023	0.0011	<0.0050	0.017	0.31
August 7-13	1.4	0.024	0.00040	0.0064	<0.010	0.21
August 14-20	0.95	0.023	0.00046	0.0093	<0.010	0.32
August 21-27	1.1	0.021	0.00032	0.0063	0.037	0.19
August 28-September 3	1.0	0.015	<0.00020	<0.0050	<0.010	0.18
September 4-6, 8-10[a]	1.4	0.018	0.00024	<0.0050	0.011	0.20
September 7[b]	1.4	0.018	0.00042	0.0061	<0.010	0.21
September 11-17	1.4	0.020	0.0014	<0.0050	<0.010	0.22
September 18-24	1.2	0.024	0.00043	<0.0050	<0.010	0.20
September 25-October 1	1.7	0.045	0.0010	0.0062	0.010	0.29
October 2, 4-8[a]	2.0	0.019	0.0011	0.010	<0.010	0.32
October 3[b]	1.6	0.054	0.00078	0.013	<0.010	0.26
October 9-15	1.5	0.031	0.00030	0.0056	<0.010	0.24
October 16-22	1.4	0.021	0.00040	0.0053	<0.010	0.27
October 23-29	0.64	0.015	0.00085	0.0053	<0.010	0.11
October 30-November 5	1.8	0.0038	0.00034	0.0051	<0.010	0.25
November 6, 8-12[a]	1.3	0.017	0.00046	0.0056	0.015	0.20
November 7[b]	2.7	0.010	0.00076	0.0060	0.013	0.32
November 13-19	1.1	0.023	<0.00020	0.0066	<0.010	0.24
November 20-26	1.1	0.017	<0.00020	<0.0050	<0.010	0.27
November 27-December 3	0.72	0.017	0.00036	0.030	<0.010	0.18
December 4-5, 7-10[a]	1.2	0.095	<0.00020	<0.0050	0.007	0.29
December 6[b]	0.87	0.030	<0.00020	<0.0050	<0.005	0.18
December 11-17	2.2	0.028	0.00030	<0.0050	0.006	0.28
December 18-24	1.6	0.010	0.00020	<0.0050	<0.005	0.22
December 25-31	2.1	0.019	<0.00020	0.012	<0.010	1.0

a Sampling for these weeks omitted one day because the sampling equipment was devoted to the monthly sample.

b Results from the monthly composite sample. Effluent from this date is not included in the normal weekly composite because the sampling equipment was devoted to the monthly sample. These results are included to complete reporting for that week.

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995.

Composite sample parameters	Sample month					
	January	February	March	April	May	June
Oxygen demand (mg/L)						
Biochemical oxygen demand - EPA 405.1	250	135	160	340	90	240
Chemical oxygen demand - EPA 410.4	140	100	130	300	360	120
Solids (mg/L)						
Total settleable solids (mL/L/h) - EPA 160.5	25	13	17	5	27	23
Total dissolved solids (TDS) - EPA 160.1	210	360	470	250	300	230
Total suspended solids (TSS) - EPA 160.2	210	120	20	22	230	180
Volatile solids - EPA 160.4	82	72	100	100	79	80
Anions (mg/L) - 300.0						
Bromide	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrate (as N)	<0.5	1.1	<0.5	<0.1[b]	<0.1[b]	<0.5
Nitrate (as NO_3)	<22[b]	4.9[b]	<22[b]	<0.5	<0.5	<22[b]
Nitrite (as N)	<0.5	<0.5	0.51	<0.2[b]	<0.2[b]	<0.5
Nitrite (as NO_2)	<16[b]	<16[b]	1.7[b]	<0.5	<0.5	<16[b]
Chloride	45	49	73	45	36	36
Sulfate	16	49	66	35	24	22
Alkalinity (mg/L) - 310.1						
Total alkalinity (as $CaCO_3$)	200	260	290	150	190	180
Bicarbonate alk (as $CaCO_3$)	200	260	290	150	190	180
Carbonate alk (as $CaCO_3$)	<1	<1	<1	<1	<1	<1
Hydroxide alk (as $CaCO_3$)	<1	<1	<1	<1	<1	<1
Nutrients (mg/L)						
Ammonia nitrogen (as N) - EPA 350.2	32	26	40	21	0.3	39
Total Kjeldahl nitrogen - EPA 351.3	47	38	48	—[c]	42	41
Total phosphorus (as P) - Standard 4500	5.2	5.0	8.2	4.4	6.8	6.4
Organic carbon (mg/L) - 415.1						
Total organic carbon (TOC)	41	35	60	29	53	45
Polychlorinated biphenyls (μg/L) - 608						
Aroclor 1016	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1221	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1232	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1242	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1248	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1254	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1260	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample Month					
	July	August	September	October	November	December
Oxygen demand (mg/L)						
Biochemical oxygen demand - EPA 405.1	250	171	220	320	190	200
Chemical oxygen demand - EPA 410.4	60	470	180	—[a]	490	530
Solids (mg/L)						
Total settleable solids (mL/L/h) - EPA 160.5	26	27	30	34	27	25
Total dissolved solids (TDS) - EPA 160.1	170	210	260	400	240	280
Total suspended solids (TSS) - EPA 160.2	220	230	280	330	150	410
Volatile solids - EPA160.4	44	91	64	78	98	110
Anions (mg/L) - 300.0						
Bromide	<0.5	<0.5	<0.5	—[a]	<0.5	<10
Nitrate (as N)	<0.1[b]	<0.5	0.5	—[a]	0.25[b]	<0.1[b]
Nitrate (as NO_3)	<0.5	<22[b]	2.2[b]	—[a]	1.1	<5
Nitrite (as N)	<0.2[b]	<0.5	<0.3[b]	—[a]	<15[b]	<15[b]
Nitrite (as NO_2)	<0.5	<16[b]	<1	—[a]	<5	<5
Chloride	30	51	71	—[a]	63	78
Sulfate	16	17	20	—[a]	18	59
Alkalinity (mg/L) - 310.1						
Total alkalinity (as $CaCO_3$)	160	180	130	—[a]	210	220
Bicarbonate alk (as $CaCO_3$)	160	180	130	—[a]	210	220
Carbonate alk (as $CaCO_3$)	<1	<1	<1	—[a]	<1	<1
Hydroxide alk (as $CaCO_3$)	<1	<1	<1	—[a]	<1	<1
Nutrients (mg/L)						
Ammonia nitrogen (as N) - EPa 350.2	35	45	40	—[a]	48	37
Total Kjeldahl nitrogen - EPA 351.3	42	36	62	—[a]	65	58
Total phosphorus (as P) - Standard 4500	2.9	3.3	3.5	—[a]	1.1	1.2
Organic carbon (mg/L) - 415.1						
Total organic carbon (TOC)	31	40	54	—[a]	62	78
Polychlorinated biphenyls (μg/L) - 608						
Aroclor 1016	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1221	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1232	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1242	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1248	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1254	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Aroclor 1260	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	January	February	March	April	May	June
Organochlorine pesticides (μg/L) - 608						
Aldrin	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05
BHC, alpha isomer	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05
BHC, beta isomer	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05
BHC, delta isomer	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05
BHC, gamma isomer (Lindane)	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05
Chlordane	<0.5	<0.5	<0.5	<0.5	<25	<0.5
Dieldrin	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
Endosulfan I	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05
Endosulfan II	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
Endosulfan sulfate	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
Endrin	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
Endrin aldehyde	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
Heptachlor	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05
Heptachlor epoxide	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05
Methoxychlor	<0.5	<0.5	<0.5	<0.5	<25	<0.5
Toxaphene	<1	<1	<1	<1	<5	<1
p,p'-DDD	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
p,p'-DDE	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
p,p'-DDT	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
Total metals (mg/L)						
Aluminum - EPA 200.7	0.69	<0.20	1.0	0.66	0.63	0.49
Arsenic - EPA 206.2	<0.0020	<0.0020	0.0025	0.0033	<0.0020	0.0025
Beryllium - EPA 210.2	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium - EPA 200.7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium - EPA 200.7	11	33	35	20	13	13
Chromium - EPA 200.7	0.027	<0.010	0.011	<0.010	<0.010	<0.010
Copper - EPA 200.7	0.11	0.067	0.13	0.077	0.16	0.096
Iron - EPA 200.7	2.1	0.36	1.8	1.4	1.2	1.3
Lead - EPA 239.2	0.022	0.019	0.035	0.009	0.032	0.011
Magnesium - EPA 200.7	2.4	14	16	6.6	2.8	2.9
Mercury - EPA 245.2	0.0076	0.00052	<0.00020	0.00039	0.00071	0.00042
Nickel - EPA 249.2	0.011	<0.0050	0.0079	0.0051	0.0079	<0.0050
Potassium - EPA 200.7	18	19	22	12	16	18
Selenium - EPA 270.2	0.0042	<0.0020	0.0027	<0.0020	<0.0020	<0.0020
Silver - EPA 200.7	<0.01	<0.01	0.019	<0.01	0.013	<0.01

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	July	August	September	October	November	December
Organochlorine pesticides (μg/L) - 608						
Aldrin	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BHC, alpha isomer	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BHC, beta isomer	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BHC, delta isomer	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BHC, gamma isomer (Lindane)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chlordane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dieldrin	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan II	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulfate	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin aldehyde	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Toxaphene	<1	<1	<1	<1	<1	<1
p,p'-DDD	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total metals (mg/L)						
Aluminum - EPA 200.7	0.20	1.0	0.71	0.57	1.4	0.60
Arsenic - EPA 206.2	<0.002	<0.002	<0.002	<0.002	0.0021	<0.005
Beryllium - EPA 210.2	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium - EPA 200.7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001
Calcium - EPA 200.7	9.4	11	11	15	18	27
Chromium - EPA 200.7	0.017	0.019	0.019	0.02	0.02	0.02
Copper - EPA 200.7	0.14	0.15	0.095	0.13	0.16	0.12
Iron - EPA 200.7	1.3	1.9	1.4	1.6	2.7	0.87
Lead - EPA 239.2	0.029	0.023	0.018	0.054	0.01	0.03
Magnesium - EPA 200.7	2.0	2.4	2.1	3.6	4.4	9.0
Mercury - EPA 245.2	0.001	0.0011	0.00042	0.00078	0.00076	<0.0002
Nickel - EPA 249.2	0.0069	<0.005	0.0061	0.013	0.006	<0.005
Potassium - EPA 200.7	15	19	24	18	17	17
Selenium - EPA 270.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005
Silver - EPA 200.7	0.015	0.017	<0.01	<0.01	0.013	<0.005

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	January	February	March	April	May	June
Total metals (mg/L) (continued)						
Sodium - EPA 200.7	33	50	61	38	26	31
Zinc - EPA 200.7	0.22	0.12	0.23	0.18	0.21	0.25
Volatile organic compounds (μg/L) - EPA 624						
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1	<1	<1	<1
1,1-Dichloroethene	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	<1	<1	<1	<1	<1	<1
1,2-Dichloroethane	<1	<1	<1	<1	<1	<1
1,2-Dichloroethene (total)	<1	<1	<1	<1	<1	<1
1,2-Dichloropropane	<1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	<1	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	<1	<1	<1	<1	<1	<1
2-Butanone	<40	<40	<40	<40	<40	<40
2-Chloroethylvinylether	<40	<40	<40	<40	<40	<40
2-Hexanone	<10	<10	<10	<10	<10	<10
4-Methyl-2-pentanone	<10	<10	<10	<10	<10	<10
Acetone	76	110	43	<40	57	44
Benzene	<1	<1	<1	<1	<1	<1
Bromodichloromethane	<1	1.1	1.7	3.2	<1	<1
Bromoform	<1	<1	<1	<1	<1	<1
Bromomethane	<2	<2	<2	<2	<2	<2
Carbon disulfide	<1	<1	<1	<1	<1	<1
Carbon tetrachloride	<1	<1	<1	<1	<1	<1
Chlorobenzene	<1	<1	<1	<1	<1	<1
Chloroethane	<2	<2	<2	<2	<2	<2
Chloroform	14	5.7	6.4	12	26	12
Chloromethane	<2	<2	<2	<2	<2	<2
Dibromochloromethane	<1	<1	<1	1.4	<1	<1
Dibromomethane	<1	<1	<1	<1	<1	<1
Dichlorodifluoromethane	<2	<2	<2	<2	<2	<2
Ethylbenzene	<1	<1	<1	<1	<1	<1
Freon 113	<1	<1	<1	<1	<1	<1
Methylene chloride	<1	<1	1.0	<1	<1	<1

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	July	August	September	October	November	December
Total metals (mg/L) (continued)						
Sodium - EPA 200.7	25	41	140	90	46	43
Zinc - EPA 200.7	0.57	0.31	0.21	0.26	0.32	0.18
Volatile organic compounds (μg/L)—EPA 624						
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1	<1	<1	<1
1,1-Dichloroethene	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	<1	<1	<1	<1	<1	<1
1,2-Dichloroethane	<1	<1	<1	<1	<1	<1
1,2-Dichloroethene (total)	<1	<1	<1	<1	<1	<1
1,2-Dichloropropane	<1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	<1	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	<1	<1	<1	<1	<1	<1
2-Butanone	<40	<40	<40	<40	<40	<40
2-Chloroethylvinylether	<40	<40	<40	<40	<40	<40
2-Hexanone	<10	<10	<10	<10	<10	<10
4-Methyl-2-pentanone	<10	<10	<10	<10	<10	<10
Acetone	120	220	79	290	<200	120
Benzene	<1	<1	<1	<1	<1	<1
Bromodichloromethane	<1	<1	<1	<1	<1	<1
Bromoform	<1	<1	<1	<1	<1	<1
Bromomethane	<2	<2	<2	<2	<2	<2
Carbon disulfide	<1	<1	<1	<1	<1	<1
Carbon tetrachloride	<1	<1	<1	<1	<1	<1
Chlorobenzene	<1	<1	<1	<1	<1	<1
Chloroethane	<2	<2	<2	<2	<2	<2
Chloroform	7.2	9.2	6	5.3	11	7.5
Chloromethane	<2	<2	<2	<2	<2	<2
Dibromochloromethane	<1	<1	<1	<1	<1	<1
Dibromomethane	<1	<1	<1	<1	<1	<1
Dichlorodifluoromethane	<2	<2	<2	<2	<2	<2
Ethylbenzene	<1	<1	<1	<1	<1	<1
Freon 113	<1	<1	<1	<1	<1	<1
Methylene chloride	<1	1.5	1.8	<1	<1	<1

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	January	February	March	April	May	June
Volatile organic compounds (μg/L)—EPA 624 (continued)						
Styrene	<1	<1	<1	<1	<1	<1
Tetrachloroethene	<1	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<1
Total xylene isomers	<2	<2	<2	<2	<2	<2
Trichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	<1	<1	<1	<1	<1	<1
Vinyl acetate	<10	<10	<10	<10	<10	<10
Vinyl chloride	<2	<2	<2	<2	<2	<2
cis-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
trans-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
Semivolatile organic compounds (μg/L)—EPA 625						
1,2,4-Trichlorobenzene	<10	<10	<10	<10	<10	<100
1,2-Dichlorobenzene	<10	<10	<10	<10	<10	<100
1,3-Dichlorobenzene	<10	<10	<10	<10	<10	<100
1,4-Dichlorobenzene	<10	<10	<10	<10	<10	<100
2,4,5-Trichlorophenol	<10	<10	<10	<10	<10	<100
2,4,6-Trichlorophenol	<10	<10	<10	<10	<10	<100
2,4-Dichlorophenol	<10	<10	<10	<10	<10	<100
2,4-Dimethylphenol	<10	<10	<10	<10	<10	<100
2,4-Dinitrophenol	<50	<50	<50	<50	<50	<500
2,4-Dinitrotoluene	<10	<10	<10	<10	<10	<100
2,6-Dinitrotoluene	<10	<10	<10	<10	<10	<100
2-Chloronaphthalene	<10	<10	<10	<10	<10	<100
2-Chlorophenol	<10	<10	<10	<10	<10	<100
2-Methylphenol	<10	<10	<10	<10	<10	<100
2-Methyl-4,6-dinitrophenol	<50	<50	<50	<50	<50	<500
2-Methylnaphthalene	<10	<10	<10	<10	<10	<100
2-Nitroaniline	<50	<50	<50	<50	<50	<500
2-Nitrophenol	<10	<10	<10	<10	<10	<100
3,3'-Dichlorobenzidine	<20	<20	<20	<20	<20	<200
3-Nitroaniline	<50	<50	<50	<50	<50	<500
4-Bromophenylphenylether	<10	<10	<10	<10	<10	<100
4-Chloro-3-methylphenol	<20	<20	<20	<20	<20	<200
4-Chloroaniline	<20	<20	<20	<20	<20	<200

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	July	August	Septembe	October	November	December
Volatile organic compounds (μg/L)—EPA 624 (continued)						
Styrene	<1	<1	<1	<1	<1	<1
Tetrachloroethene	<1	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<1
Total xylene isomers	<2	<2	<2	<2	<2	<2
Trichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	<1	<1	<1	<1	<1	<1
Vinyl acetate	<10	<10	<10	<10	<10	<10
Vinyl chloride	<2	<2	<2	<2	<2	<2
cis-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
trans-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
Semivolatile organic compounds (μg/L)—EPA 625						
1,2,4-Trichlorobenzene	<10	<10	<10	<10	<10	<10
1,2-Dichlorobenzene	<10	<10	<10	<10	<10	<10
1,3-Dichlorobenzene	<10	<10	<10	<10	<10	<10
1,4-Dichlorobenzene	<10	<10	<10	<10	<10	<10
2,4,5-Trichlorophenol	<10	<10	<10	<10	<10	<10
2,4,6-Trichlorophenol	<10	<10	<10	<10	<10	<10
2,4-Dichlorophenol	<10	<10	<10	<10	<10	<10
2,4-Dimethylphenol	<10	<10	<10	<10	<10	<10
2,4-Dinitrophenol	<50	<50	<50	<50	<50	<50
2,4-Dinitrotoluene	<10	<10	<10	<10	<10	<10
2,6-Dinitrotoluene	<10	<10	<10	<10	<10	<10
2-Chloronaphthalene	<10	<10	<10	<10	<10	<10
2-Chlorophenol	<10	<10	<10	<10	<10	<10
2-Methylphenol	<10	<10	<10	<10	<10	<10
2-Methyl-4,6-dinitrophenol	<50	<50	<50	<50	<50	<50
2-Methylnaphthalene	<10	<10	<10	<10	<10	<10
2-Nitroaniline	<50	<50	<50	<50	<50	<50
2-Nitrophenol	<10	<10	<10	<10	<10	<10
3,3'-Dichlorobenzidine	<20	<20	<20	<20	<20	<20
3-Nitroaniline	<50	<50	<50	<50	<50	<50
4-Bromophenylphenylether	<10	<10	<10	<10	<10	<10
4-Chloro-3-methylphenol	<20	<20	<20	<20	<20	<20
4-Chloroaniline	<20	<20	<20	<20	<20	<20

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	January	February	March	April	May	June
Semivolatile organic compounds (μg/L)—EPA 625 (continued)						
4-Chlorophenylphenylether	<10	<10	<10	<10	<10	<100
4-Nitroaniline	<50	<50	<50	<50	<50	<500
4-Nitrophenol	<50	<50	<50	<50	<50	<500
Acenaphthene	<10	<10	<10	<10	<10	<100
Acenaphthylene	<10	<10	<10	<10	<10	<100
Anthracene	<10	<10	<10	<10	<10	<100
Benzo(a)anthracene	<10	<10	<10	<10	<10	<100
Benzo(a)pyrene	<10	<10	<10	<10	<10	<100
Benzo(a)fluoranthene	<10	<10	<10	<10	<10	<100
Benzo(g,h,i)perylene	<10	<10	<10	<10	<10	<100
Benzo(k)fluoranthene	<10	<10	<10	<10	<10	<100
Benzoic acid	<50	<50	<50	<50	<50	<500
Benzyl alcohol	<20	37	<20	59	44	270.
Bis(2-chloroethoxy)methane	<10	<10	<10	<10	<10	<100
Bis(2-chloroethyl)ether	<10	<10	<10	<10	<10	<100
Bis(2-chloroisopropyl)ether	<10	<10	<10	<10	<10	<100
Bis(2-ethylhexyl)phthalate	<10	<10	<10	<10	19.	<100
Butylbenzylphthalate	<10	<10	<10	<10	<10	<100
Chrysene	<10	<10	<10	<10	<10	<100
Di-n-butylphthalate	<10	<10	<10	<10	<10	<100
Di-n-octylphthalate	<10	<10	<10	<10	<10	<100
Dibenzo(a,h)anthracene	<10	<10	<10	<10	<10	<100
Dibenzofuran	<10	<10	<10	<10	<10	<100
Diethylphthalate	<10	<10	<10	<10	<10	<100
Dimethylphthalate	<10	<10	<10	<10	<10	<100
Fluoranthene	<10	<10	<10	<10	<10	<100
Fluorene	<10	<10	<10	<10	<10	<100
Hexachlorobenzene	<10	<10	<10	<10	<10	<100
Hexachlorobutadiene	<10	<10	<10	<10	<10	<100
Hexachlorocyclopentadiene	<10	<10	<10	<10	<10	<100
Hexachloroethane	<10	<10	<10	<10	<10	<100
Indeno(1,2,3-c,d)pyrene	<10	<10	<10	<10	<10	<100
Isophorone	<10	<10	<10	<10	<10	<100

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	July	August	Septembe	October	November	December
Semivolatile organic compounds (μg/L)—EPA 625 (continued)						
4-Chlorophenylphenylether	<10	<10	<10	<10	<10	<10
4-Nitroaniline	<50	<50	<50	<50	<50	<50
4-Nitrophenol	<50	<50	<50	<50	<50	<50
Acenaphthene	<10	<10	<10	<10	<10	<10
Acenaphthylene	<10	<10	<10	<10	<10	<10
Anthracene	<10	<10	<10	<10	<10	<10
Benzo(a)anthracene	<10	<10	<10	<10	<10	<10
Benzo(a)pyrene	<10	<10	<10	<10	<10	<10
Benzo[a]fluoranthene	<10	<10	<10	<10	<10	<10
Benzo(g,h,i)perylene	<10	<10	<10	<10	<10	<10
Benzo(k)fluoranthene	<10	<10	<10	<10	<10	<10
Benzoic acid	<50	<50	<50	<50	<50	<50
Benzyl alcohol	<20	<20	1,100	<20	<20	33
Bis(2-chloroethoxy)methane	<10	<10	<10	<10	<10	<10
Bis(2-chloroethyl)ether	<10	<10	<10	<10	<10	<10
Bis(2-chloroisopropyl)ether	<10	<10	<10	<10	<10	<10
Bis(2-ethylhexyl)phthalate	12	14	<10	29	<10	17
Butylbenzylphthalate	<10	<10	<10	<10	<10	<10
Chrysene	<10	<10	<10	<10	<10	<10
Di-n-butylphthalate	<10	<10	<10	<10	<10	<10
Di-n-octylphthalate	<10	<10	<10	<10	<10	<10
Dibenzo(a,h)anthracene	<10	<10	<10	<10	<10	<10
Dibenzofuran	<10	<10	<10	<10	<10	<10
Diethylphthalate	<10	<10	<10	<10	<10	<10
Dimethylphthalate	<10	<10	<10	<10	<10	<10
Fluoranthene	<10	<10	<10	<10	<10	<10
Fluorene	<10	<10	<10	<10	<10	<10
Hexachlorobenzene	<10	<10	<10	<10	<10	<10
Hexachlorobutadiene	<10	<10	<10	<10	<10	<10
Hexachlorocyclopentadiene	<10	<10	<10	<10	<10	<10
Hexachloroethane	<10	<10	<10	<10	<10	<10
Indeno(1,2,3-c,d)pyrene	<10	<10	<10	<10	<10	<10
Isophorone	<10	<10	<10	<10	<10	<10

...continued on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (continued).

Composite sample parameters	Sample month					
	January	February	March	April	May	June
Semivolatile organic compounds (μg/L)— EPA 625 (continued)						
N-Nitrosodi-n-propylamine	<10	<10	<10	<10	<10	<100
N-Nitrosodiphenylamine	<10	<10	<10	<10	<10	<100
Naphthalene	<10	<10	<10	<10	<10	<100
Nitrobenzene	<10	<10	<10	<10	<10	<100
Pentachlorophenol	<50	<50	<50	<50	<50	<500
Phenanthrene	<10	<10	<10	<10	<10	<100
Phenol	<10	<10	<10	<10	<10	<100
Pyrene	<10	<10	<10	<10	<10	<100
m- and p-Cresol	<10	<10	<10	15	<10	<100
Phenolics (mg/L)— EPA 420.1						
Total recoverable phenolics	0.038	0.025	0.026	0.017	0.027	0.025
Cyanide (mg/L)—EPA 335.2						
Total cyanide	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Oil and grease (mg/L)—EPA 413.1						
Total oil and grease (6 A.M.)	<5	6.7	6.3	<5	<5	<5
Total oil and grease (10 A.M.)	26	17	20	36	41	33
Total oil and grease (2 P.M.)	29	14	25	24	47	29
Total oil and grease (6 P.M.)	66	<5	8.2	8.6	9.6	16

...concluded on next page

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the sanitary sewer effluent, 1995 (concluded).

Composite sample parameters	Sample month					
	July	August	September	October	November	December
Semivolatile organic compounds (μg/L)—EPA 625 (continued)						
N-Nitrosodi-n-propylamine	<10	<10	<10	<10	<10	<10
N-Nitrosodiphenylamine	<10	<10	<10	<10	<10	<10
Naphthalene	<10	<10	<10	<10	<10	<10
Nitrobenzene	<10	<10	<10	<10	<10	<10
Pentachlorophenol	<50	<50	<50	<50	<50	<50
Phenanthrene	<10	<10	<10	<10	<10	<10
Phenol	<10	<10	<10	<10	<10	<10
Pyrene	<10	<10	<10	<10	<10	<10
m- and p-Cresol	<10	<10	<10	<10	<10	<10
Phenolics (mg/L)—EPA 420.1						
Total recoverable phenolics	0.019	0.059	0.018	0.52	0.027	0.3
Cyanide (mg/L)—EPA 335.2						
Total cyanide	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Oil and grease (mg/L)—EPA 413.1						
Total oil and grease (6 A.M.)	<5	<5	8.3	<5	<5	8.1
Total oil and grease (10 A.M.)	23	19	55	24	51	20
Total oil and grease (2 P.M.)	30	20	32	21	45	40
Total oil and grease (6 P.M.)	14	8.2	22	16	21	66

[a] Insufficient composite sample volume to test for this parameter. The LWRP removed sample from the October composite sample for routine verification of LLNL's analytical results.

[b] This result was not provided by the contract analytical laboratory. It was calculated from the provided nitrate or nitrite result, as appropriate.

[c] The analysis was not requested.

Tabe 6-4. Daily flow totals for sanitary sewer effluent in megaliters (ML), 1995.

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.725	1.525	1.472	0.640	0.321	1.250	1.023	1.034	1.133	0.329	1.105	1.278
2	0.655	1.178	1.707	0.640	1.120	1.090	0.431	1.535	1.114	0.224	1.020	0.913
3	0.490	1.561	1.947	0.640	1.127	1.124	0.757	0.210	0.512	0.755	1.016	0.298
4	1.525	1.612	1.947	2.370	1.408	0.638	0.757	0.821	0.498	0.804	1.022	0.219
5	1.045	0.464	0.775	1.416	1.215	0.420	0.506	0.870	0.369	0.884	0.456	1.426
6	1.290	0.296	0.289	1.273	1.159	1.118	1.114	0.412	1.112	0.932	0.522	1.284
7	1.352	1.362	1.396	1.317	0.406	1.106	1.020	0.302	1.012	0.751	1.334	1.735
8	0.487	1.356	1.710	1.849	0.316	1.554	0.961	1.068	1.055	0.254	1.188	1.110
9	0.232	1.757	1.486	0.537	0.532	1.239	0.331	0.924	1.034	0.381	1.388	0.944
10	1.352	1.452	1.499	0.248	1.000	1.202	0.218	0.981	0.793	0.833	1.489	0.328
11	1.342	1.452	1.798	1.461	1.011	0.542	1.031	0.981	0.116	0.725	1.374	0.401
12	1.488	0.771	0.725	1.461	1.319	0.366	1.207	0.981	1.079	0.923	0.678	1.077
13	1.337	0.465	0.739	1.461	1.160	0.917	1.094	0.334	1.074	0.918	0.548	1.367
14	1.591	1.372	1.541	1.419	0.573	1.159	1.022	0.119	1.163	0.835	1.162	0.901
15	1.110	1.620	1.508	1.587	0.336	1.179	0.604	0.899	1.069	0.344	1.270	0.912
16	0.728	1.523	1.577	0.933	1.392	1.392	0.604	1.457	1.030	0.223	1.182	0.950
17	0.442	1.616	1.689	0.915	1.062	1.192	0.604	0.936	0.589	0.887	1.225	1.091
18	1.540	1.689	1.056	0.322	1.072	0.697	1.158	0.924	0.451	0.972	0.967	0.508
19	1.721	0.794	1.056	1.416	1.072	0.367	0.950	0.895	1.154	0.927	0.518	1.179
20	1.463	1.008	1.056	1.365	0.998	1.272	1.031	0.178	0.760	0.936	0.222	0.840
21	2.298	0.948	1.729	1.289	0.535	1.217	1.075	0.190	0.941	0.814	0.993	0.889
22	1.654	0.948	2.059	1.399	0.416	1.218	0.959	1.154	1.150	0.385	0.183	0.916
23	1.698	1.435	2.059	0.608	1.145	1.130	0.334	0.769	1.130	0.441	0.611	0.799
24	1.290	1.479	1.800	0.243	1.049	1.236	0.363	0.938	0.749	1.121	0.453	0.303
25	1.408	1.426	1.296	1.170	1.331	1.005	0.896	1.052	0.358	1.025	0.577	0.447
26	1.349	0.780	1.296	1.160	1.142	0.317	1.175	0.885	1.113	1.067	0.486	0.354
27	1.336	0.401	1.296	1.235	1.077	1.686	0.899	0.574	1.126	0.899	0.389	0.135
28	2.319	1.420	1.656	1.131	0.450	1.586	0.982	0.287	1.064	0.919	1.157	0.907
29	0.772		1.616	1.243	0.507	1.521	0.797	1.293	1.094	0.381	1.171	0.750
30	0.772		1.590	0.466	0.299	1.723	0.405	0.913	0.866	0.211	1.160	0.894
31	0.772		1.553		1.011		0.249	1.121		1.269		0.427

Note: Actual daily flow totals for dates in shaded areas are not available; estimated daily flow totals are shown in the shaded areas.

Table 6-5. Weekly composite results for tritium (in mBq/L) for the LWRP effluent, 1995.

Composite Dates	Activity	LOS
December 26, 1994–January 1, 1995	10.4 ± 0.8	9.69
January 2–8	0.512 ± 0.512	10.6
January 9–15	6.08 ± 6.08	10.8
January 16–22	–3.96 ± –3.96	14.4
January 23–29	1.85 ± 1.85	13.5
January 30–February 5	2.63 ± 2.63	13.7
February 6–12	3.60 ± 3.60	10.7
February 13–19	2.95 ± 2.95	11.3
February 20–26	5.44 ± 5.44	10.5
February 27–March 5	1.71 ± 1.71	10.1
March 6–12	7.47 ± 7.47	9.66
March 13–19	1.45 ± 1.45	9.47
March 20–26	–0.507 ± –0.507	10.2
March 27–April 2	5.03 ± 5.03	10.2
April 3–9	–1.46 ± –1.46	10.4
April 10–16	–9.10 ± –9.10	11.4
April 17–23	–4.18 ± –4.18	10.9
April 24–30	3.66 ± 3.66	10.4
May 1–7	1.51 ± 1.51	10.5
May 8–14	2.01 ± 2.01	10.4
May 15–21	–2.66 ± –2.66	10.5
May 22–28	–2.05 ± –2.05	10.7
May 29–June 4	0.766 ± 0.766	10.2
June 5–11	3.09 ± 3.09	10.1
June 12–18	1.41 ± 1.41	10.6
June 19–25	4.40 ± 4.40	10.0
June 26–30	–1.27 ± –1.27	11.2
July 2–9	1.05 ± 1.05	10.5
July 10–16	–1.46 ± –1.46	10.5
July 17–23	–1.24 ± –1.24	10.5
July 24–30	2.11 ± 2.11	10.3
July 31–August 6	–2.73 ± –2.73	10.9
August 7–13	0.176 ± 0.176	10.5
August 14–20	3.74 ± 3.74	10.1
August 21–27	1.50 ± 1.50	10.4
August 28–September 3	7.47 ± 7.47	9.92

...concluded on next page

Table 6-5. Weekly composite results for tritium (in mBq/L) for the LWRP effluent, 1995 (concluded).

Composite Dates	Activity	LOS
September 4–10	–1.40 ± –1.40	10.5
September 11–17	–2.46 ± –2.46	10.9
September 18–24	–3.35 ± –3.35	9.77
September 25–October 1	0.00736 ± 0.00736	10.8
October 2–8	–3.60 ± –3.60	10.5
October 9–15	–1.21 ± –1.21	10.6
October 16–22	–1.92 ± –1.92	10.5
October 23–29	4.03 ± 4.03	9.32
October 30–November 5	3.10 ± 3.10	10.5
November 6–12	1.97 ± 1.97	10.3
November 13–19	–0.242 ± –0.242	10.6
November 20–26	5.55 ± 5.55	10.4
November 27–December 3	0.0640 ± 0.0640	10.7
December 4–10	–2.46 ± –2.46	11.0
December 11–17	0.327 ± 0.327	10.5
December 18–24	–3.06 ± –3.06	10.7
December 25–31	5.74 ± 5.74	10.6

Note: The LWRP did not provide a sample aliquot for July 1.

7. Surface Water Monitoring

Erich R. Brandstetter
Richard A. Brown
Eric Christofferson

Introduction

Lawrence Livermore National Laboratory performs surface water monitoring at the Livermore site, in surrounding regions of the Livermore Valley, and at Site 300 and vicinity in the nearby Altamont Hills. At the first two locales, LLNL monitors reservoirs and ponds, the LLNL swimming pool, rainfall, tap water, and storm water runoff. Water samples are analyzed for radionuclides and a wide range of nonradioactive constituents. At Site 300 and vicinity, surface water monitoring encompasses rainfall and storm water runoff. These water samples are analyzed for radionuclides, explosives, total organic carbon, total organic halides, total suspended solids, conductivity, and pH. Volume 1, Chapter 7, includes summary data tables and a detailed discussion and analysis of the data. This chapter presents the complete dataset for 1994, including a summary of analyses requested in storm water samples and a summary of constituents for which analyses were conducted but which were never detected.

Surface Water Methods

Surface and drinking water near the Livermore site and in the Livermore Valley are sampled according to procedures EMP-W-L and EMP-W-S. LLNL technicians use a tethered pail to collect water samples from surface sources; other locations are sampled directly from the outfall. Samples for tritium analysis are collected in 500-mL, argon-flushed glass containers; those for other radiological analyses are collected in acidified 1000-mL polyethylene bottles.

The on-site swimming pool and drinking water source (POOL and TAP) are sampled, as described above, for gross alpha, gross beta, and tritium. POOL is sampled monthly, and TAP is sampled quarterly.

Rainfall Methods

Detailed descriptions of station locations are given in EMS Procedure EMP-RA-L. Rainfall sampling and sample tracking protocols are described in EMS Procedure EMP-RA-S. Essentially, rainfall is collected in stainless steel buckets mounted about 1 m above the ground. Samples are decanted into 500-mL argon-flushed flint-glass bottles fitted with glass stoppers.

Storm Water Methods

Procedures EMP-RO-L and EM7P-RO-S describe storm water sampling procedures and locations. LLNL technicians collect storm water samples for nonradiological analysis directly into sample bottles for storm water runoff grab samples. Samples analyzed for tritium are collected in 250-mL, argon-flushed glass containers; samples for gross alpha and gross beta measurements are collected in 1,000-mL polyethylene bottles.

Table 7-1. Radioactivity in surface and drinking waters (Bq/L), Livermore Valley, 1995.[(a)]

Location	Date	Tritium	Gross alpha	Gross beta
Drinking waters				
BELL	01/13/95	0.614 ± 0.111	0.049 ± 0.009	0.141 ± 0.011
	05/03/95	0.614 ± 0.138	0.018 ± 0.048	0.096 ± 0.052
	09/21/95	0.518 ± 0.162	0.002 ± 0.033	0.044 ± 0.048
	11/28/95	0.455 ± 0.158	0.092 ± 0.059	0.089 ± 0.052
GAS	01/13/95	0.844 ± 0.125	0.017 ± 0.010	0.100 ± 0.010
	05/03/95	0.341 ± 0.341	–0.015 ± 0.037	0.111 ± 0.052
	09/21/95	0.492 ± 0.138	–0.022 ± 0.041	0.063 ± 0.052
	11/27/95	0.459 ± 0.140	–0.014 ± 0.035	0.063 ± 0.052
PALM	01/13/95	0.633 ± 0.113	0.058 ± 0.011	0.222 ± 0.012
	05/03/95	0.422 ± 0.335	0.044 ± 0.056	0.174 ± 0.059
	09/21/95	0.603 ± 0.154	0.011 ± 0.070	0.081 ± 0.067
	11/27/95	0.440 ± 0.151	0.048 ± 0.052	0.078 ± 0.052
ORCH	01/13/95	0.881 ± 0.128	0.174 ± 0.035	0.662 ± 0.037
	05/03/95	0.725 ± 0.133	0.381 ± 0.248	0.588 ± 0.181
	09/21/95	0.666 ± 0.136	0.089 ± 0.163	0.418 ± 0.174
	11/27/95	0.418 ± 0.153	–0.026 ± 0.174	0.229 ± 0.174
TAP	01/13/95	0.821 ± 0.122	0.034 ± 0.005	0.022 ± 0.009
	05/03/95	0.414 ± 0.105	0.016 ± 0.025	0.015 ± 0.044
	09/21/95	0.381 ± 0.118	0.085 ± 0.041	0.037 ± 0.048
	11/27/95	0.481 ± 0.133	0.085 ± 0.026	0.026 ± 0.048
Surface waters				
CAL	01/13/95	0.466 ± 0.099	0.029 ± 0.007	0.079 ± 0.010
	05/03/95	1.258 ± 1.258	–0.001 ± 0.029	0.041 ± 0.048
	09/21/95	0.433 ± 0.143	0.026 ± 0.041	0.037 ± 0.048
	11/28/95	0.131 ± 0.131	0.115 ± 0.059	0.818 ± 0.096
DEL	01/13/95	0.533 ± 0.098	0.159 ± 0.013	0.266 ± 0.012
	05/03/95	0.485 ± 0.122	0.011 ± 0.048	0.229 ± 0.059
	09/21/95	0.688 ± 0.172	0.015 ± 0.052	0.067 ± 0.052
	11/27/95	0.294 ± 0.192	0.026 ± 0.048	0.070 ± 0.052
DUCK	01/13/95	1.676 ± 0.164	0.168 ± 0.057	0.343 ± 0.048
	05/03/95	1.373 ± 0.404	0.004 ± 0.200	0.318 ± 0.281
	09/21/95	1.310 ± 0.185	0.074 ± 0.481	0.555 ± 0.518
	11/27/95	1.350 ± 0.170	0.037 ± 0.592	0.851 ± 0.518

...concluded on next page

Table 7-1. Radioactivity in surface and drinking waters (Bq/L), Livermore Valley, 1995[a]. (concluded)

Location	Date	Tritium	Gross alpha	Gross beta
ALAG	01/13/95	1.828 ± 0.152	0.109 ± 0.013	0.186 ± 0.012
	05/03/95	1.180 ± 0.160	0.092 ± 0.126	0.078 ± 0.100
	09/21/95	1.820 ± 0.164	0.252 ± 0.178	0.222 ± 0.133
	11/28/95	1.602 ± 0.159	0.022 ± 0.152	0.204 ± 0.144
SHAD	01/13/95	2.194 ± 0.165	0.095 ± 0.015	0.162 ± 0.013
	05/03/95	1.913 ± 0.362	0.011 ± 0.107	0.096 ± 0.130
	09/21/95	1.983 ± 0.184	0.096 ± 0.118	0.111 ± 0.081
	11/28/95	1.761 ± 0.192	–0.089 ± 0.092	0.144 ± 0.115
ZON7	01/13/95	0.855 ± 0.115	0.021 ± 0.010	0.152 ± 0.011
	05/03/95	0.343 ± 0.343	0.067 ± 0.059	0.115 ± 0.056
	09/21/95	0.555 ± 0.155	0.010 ± 0.033	0.104 ± 0.052
	11/27/95	0.422 ± 0.131	0.081 ± 0.052	0.070 ± 0.052
Onsite pool				
POOL	01/13/95	5.920 ± 1.711	0.0226 ± 0.032	0.201 ± 0.042
	02/27/95	5.846 ± 1.900	–0.065 ± 0.031	0.142 ± 0.026
	03/20/95	8.917 ± 1.864	0.001 ± 0.022	0.141 ± 0.020
	04/28/95	7.289 ± 2.048	0.004 ± 0.137	0.170 ± 0.192
	05/03/95	5.661 ± 2.021	0.348 ± 0.259	0.314 ± 0.185
	06/29/95	8.029 ± 2.762	–0.007 ± 0.152	0.222 ± 0.166
	07/27/95	Not collected	Not collected	Not collected
	08/27/95	Not collected	Not collected	Not collected
	09/21/95	6.068 ± 2.227	0.078 ± 0.218	0.144 ± 0.200
	10/27/95	2.327 ± 2.327	0.089 ± 0.240	0.255 ± 0.170
	11/28/95	2.327 ± 2.327	0.041 ± 0.196	0.289 ± 0.192
	12/12/95	4.366 ± 2.179	–0.033 ± 0.152	0.155 ± 0.166

[a] Drinking water MCLs: tritium = 740 Bq/L, gross alpha = 0.555 Bq/L, gross beta = 1.85 Bq/L.

Table 7-2. Radioactivity in storm water runoff (Bq/L) at Livermore site, 1995.

Location	Date	Tritium	Gross alpha	Gross beta
ALPE	Mar 2	51.1 ± 3.06	0.100 ± 0.0211	0.286 ± 0.0144
	May 13	2.42 ± 1.83	0.111 ± 0.0703	0.207 ± 0.0592
	Dec 11	6.14 ± 2.48	0.107 ± 0.0777	0.348 ± 0.0703
ALPO	Dec 11	5.77 ± 2.46	0.962 ± 0.407	0.740 ± 0.259
ASS2	Mar 3	4.74 ± 1.77	0.0881 ± 0.0133	0.235 ± 0.0115
	May 13	<1.77	0.104 ± 0.0481	0.226 ± 0.0592
	Dec 11	6.59 ± 2.49	0.0777 ± 0.0592	0.248 ± 0.0629
ASW	Mar 2	38.1 ± 2.78	0.138 ± 0.0078	0.228 ± 0.0111
	May 13	<1.70	0.0366 ± 0.0296	0.100 ± 0.0518
	Dec 11	9.92 ± 2.60	0.111 ± 0.0851	0.426 ± 0.0777
CDB	Mar 2	18.3 ± 2.27	0.117 ± 0.0085	0.234 ± 0.0130
	May 13	<1.77	0.0352 ± 0.0289	0.100 ± 0.0518
	Dec 11	3.65 ± 2.39	0.0555 ± 0.0407	0.111 ± 0.0518
CDB2	Mar 3	28.8 ± 2.48	0.0833 ± 0.0107	0.189 ± 0.0122
	May 13	12.5 ± 2.18	0.0740 ± 0.0481	0.189 ± 0.0555
	Dec 11	9.32 ± 2.58	0.0888 ± 0.0703	0.303 ± 0.0666
CDBX	Dec 12	14.13 ± 2.49	0.0481 ± 0.0518	0.181 ± 0.0555
GRNE	Mar 2	14.2 ± 2.15	0.122 ± 0.0122	0.222 ± 0.0111
	May 13	<1.82	0.152 ± 0.0814	0.274 ± 0.0666
	Dec 11	3.06 ± 2.38	2.41 ± 1.07	1.89 ± 0.703
WPDC	Mar 2	16.9 ± 2.14	0.0988 ± 0.0081	0.178 ± 0.0107
	May 13	3.30 ± 1.86	0.107 ± 0.0629	0.259 ± 0.0629
	Dec 11	3.61 ± 2.39	0.167 ± 0.107	0.366 ± 0.0925
	Dec 12	11.3 ± 2.40	0.163 ± 0.130	0.485 ± 0.118

Table 7-3. Tritium in rain (Bq/L), Livermore site and Livermore Valley.

Location	Date						
	2/15/95	3/2/95	4/19/96	5/13/96	6/16/96	12/11/95	12/12/95
Onsite							
B343	20.239 ± 2.4290	36.741 ± 2.6090	72.89 ± 3.5720	44.03 ± 2.9500	22.422 ± 2.4220	7.955 ± 2.4100	4.92 ± 2.0860
B291	13.949 ± 2.2320	17.612 ± 2.0960	19.351 ± 2.2830	10.545 ± 2.0770	5.402 ± 1.8800	2.19 ± 2.1900	4.329 ± 2.1640
CDB	9.842 ± 2.1750	18.241 ± 2.1160	24.457 ± 2.4210	11.544 ± 2.2280	5.735 ± 1.8810	2.168 ± 2.1680	3.363 ± 2.0620
VIS	8.991 ± 2.0860	12.913 ± 2.1180	8.88 ± 1.9270	2.342 ± 1.7780	2.287 ± 2.2870	2.538 ± 2.2850	5.217 ± 2.2020
COW	8.695 ± 2.1300	8.325 ± 1.9560	9.361 ± 2.1530	1.82 ± 1.8200	3.204 ± 1.7880	2.312 ± 2.2270	4.847 ± 2.1760
SALV	14.837 ± 2.3150	31.45 ± 2.4850	9.176 ± 2.5880	3.7 ± 1.8320	1.754 ± 1.7540	2.198 ± 2.1980	2.168 ± 2.0860
MET	2.405 ± 2.4050	7.955 ± 1.9410	2.02 ± 1.8910	3.101 ± 1.8140	2.183 ± 2.1830	NA	1.972 ± 1.9720
Offsite							
ESAN	55.87 ± 3.2400	55.87 ± 3.0730	6.105 ± 1.8250	1.857 ± 1.8570	1.794 ± 1.7940	2.128 ± 2.1280	4.81 ± 2.1840
ZON7	6.031 ± 2.0140	8.436 ± 1.9490	3.774 ± 1.9620	1.835 ± 1.8350	1.754 ± 1.7540	2.198 ± 2.1980	1.813 ± 1.8130
AQUE	21.682 ± 2.4720	28.342 ± 2.4090	4.958 ± 1.8000	1.724 ± 1.7240	1.78 ± 1.7800	2.102 ± 2.1020	2.05 ± 1.9920
SLST	1.824 ± 1.8240	2.797 ± 1.5800	2.164 ± 2.1640	1.68 ± 1.6800	2.079 ± 1.8300	2.172 ± 2.1720	1.968 ± 1.9680
GTES	NA	NA	1.639 ± 1.6390	1.661 ± 1.6610	1.769 ± 1.7690	2.782 ± 2.0200	1.92 ± 1.9200
VINE	7.77 ± 2.0590	9.546 ± 1.8420	1.687 ± 1.6870	1.672 ± 1.6720	1.783 ± 1.7830	2.176 ± 2.1760	1.917 ± 1.9170
BVA	1.865 ± 1.8650	17.057 ± 2.0810	1.635 ± 1.6350	1.687 ± 1.6870	2.046 ± 1.8070	2.15 ± 2.1500	1.891 ± 1.8910
VET	7.03 ± 2.6860	20.683 ± 2.1920	1.628 ± 1.6280	1.61 ± 1.6100	1.787 ± 1.7870	NA	1.865 ± 1.8650

Table 7-4. Storm water runoff, detected nonradioactive parameters, Livermore site, 1995.

Parameter	Storm date	ALPE	ALPO[a]	ASS2	ASW	CDB	CDB2	GRNE	WPDC
Metals and minerals and others (mg/L)									
Aluminum	3/2	<0.2			<0.2	<0.2		<0.2	<0.2
	3/3			<0.2			<0.2		
	5/13	<0.2		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	12/11	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2
Antimony	3/2	<0.06			<0.06	<0.06		<0.06	<0.06
	3/3			<0.06			<0.06		
	5/13	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
	12/11	0.009	<0.005	<0.005	<0.005	<0.005	0.71	<0.005	<0.005
Arsenic	3/2	0.0029			<0.002	0.003		0.0039	0.0053
	3/3			0.0029			0.0042		
	5/13	0.0044		0.0041	<0.002	0.0022	0.0044	0.0066	0.0049
	12/11	<0.005	<0.005	<0.005	<0.005	<0.005	0.78	<0.005	<0.005
Barium	3/2	0.1			0.029	0.086		0.15	0.099
	3/3			0.11			0.11		
	5/13	0.084		0.12	0.042	0.048	0.11	0.24	0.17
	12/11	0.17	0.43	0.11	0.15	0.04	1	1.5	0.23
Beryllium	3/2	0.00054			<0.0005	<0.0005		<0.0005	<0.0005
	3/3			<0.0005			<0.0005		
	5/13	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005	0.00069	0.00057
	12/11	0.002	0.0012	<0.0005	<0.0005	<0.0005	0.86	0.0042	<0.0005
Bicarbonate alk (as $CaCO_3$)	3/2	130			10	9.5		42	10
	3/3			70			17		
	5/13	42		19	12	7.6	19	38	18
	12/11	21	180	11	11	11	17	51	22
Boron	3/2	4.1			<0.1	<0.1		0.23	<0.1
	3/3			0.45			<0.1		
	5/13	1.5		<0.1	<0.1	<0.1	<0.1	0.21	0.14
	12/11	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	0.4	0.1
Cadmium	3/2	<0.0005			<0.0005	0.00073		<0.0005	<0.0005
	3/3			<0.0005			0.0011		
	5/13	<0.0005		0.0017	<0.0005	0.0015	0.0011	<0.0005	<0.0005
	12/11	<0.001	<0.001	<0.001	<0.001	<0.001	0.95	<0.001	<0.001

...continued on next page

Table 7-4. Storm water runoff, detected nonradioactive parameters, Livermore site, 1995 (continued).

Parameter	Storm date	ALPE	ALPO[a]	ASS2	ASW	CDB	CDB2	GRNE	WPDC
Metals and minerals and others (mg/L) (continued)									
Calcium	3/2	32			3.6	5.3		20	4.3
	3/3			32			6.3		
	5/13	11		5.1	3.4	2.5	6.2	10	5.6
	12/11	9	48	3.7	3.5	4.8	5.5	4.4	7.5
Chemical oxygen demand	3/2	37			24	31		44	22
	3/3			20			29		
	5/13	38		18	16	18	25	23	14
	12/11	41	95	45	43	49	61	76	59
Chloride	3/2	170			1	1.4		16	1.8
	3/3			35			2.2		
	5/13	47		3.9	3	2.5	5.2	7	7.8
	12/11	19	160	14	11	12	14	22	22
Chromium	3/2	0.017			<0.01	0.015		0.016	0.017
	3/3			<0.01			0.021		
	5/13	0.015		0.018	<0.01	<0.01	0.017	0.026	0.025
	12/11	0.044	0.05	0.028	0.034	0.012	1	0.2	0.047
Copper	3/2	<0.05			<0.05	<0.05		<0.05	<0.05
	3/2	0.021			0.015	0.028		0.017	0.031
	3/3			<0.05			<0.05		
	3/3			0.013			0.026		
	5/13	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	5/13	0.015		0.019	0.01	0.012	0.019	0.017	0.016
	12/11	0.022	0.06	0.018	0.025	0.012	1	0.09	0.029
	12/11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoride	3/2	0.51			<0.05	<0.05		0.11	<0.05
	3/3			0.09			<0.05		
	5/13	0.31		0.068	<0.05	<0.05	0.06	0.22	0.079
	5/13	0.31		0.068	<0.05	<0.05	0.06	0.22	0.079
	12/11	0.07	0.45	<0.05	<0.05	<0.05	0.062	0.11	0.069
Iron	3/2	<0.1			<0.1	<0.1		<0.1	<0.1
	3/2	6.4			2	6.2		7.4	7.9
	3/3			<0.1			<0.1		
	3/3			4			8.3		
	5/13	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

...continued on next page

Table 7-4. Storm water runoff, detected nonradioactive parameters, Livermore site, 1995. (continued)

Parameter	Storm date	ALPE	ALPO[a]	ASS2	ASW	CDB	CDB2	GRNE	WPDC
Metals and minerals and others (mg/L) (continued)									
Iron	5/13	5		8.4	2.5	2.8	6.7	14	12
	12/11	14	22	8.4	11	1.6	2.2	120	18
	12/11	<0.1	<0.1	0.15	0.15	0.25	0.18	0.15	0.1
Lead	3/2	0.0086			0.0051	0.012		0.0034	0.0086
	3/3			0.0039			0.013		
	5/13	0.0067		0.0071	0.003	0.0051	0.0081	0.0076	0.0085
	12/11	0.014	0.014	0.007	0.011	<0.005	1.1	0.03	<0.005
Magnesium	3/2	15			1	1.2		6	1.3
	3/3			14			1.8		
	5/13	4.1		1.4	0.97	0.57	1.8	2.8	1.6
	12/11	2.2	15	1.1	1.1	1.4	1.8	1.5	2.2
Manganese	3/2	<0.03			<0.03	<0.03		<0.03	<0.03
	3/2	0.15			0.041	0.16		0.11	0.16
	3/3			<0.03			<0.03		
	3/3			0.08			0.14		
	5/13	<0.03		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	5/13	0.1		0.17	0.049	0.062	0.12	0.2	0.23
	12/11	0.37	0.7	0.18	0.23	0.07	1.1	1.9	0.33
	12/11	0.066	0.082	<0.03	<0.03	0.058	0.08	<0.03	0.061
Nickel	3/2	<0.1			<0.1	<0.1		<0.1	<0.1
	3/2	0.025			0.0067	0.017		0.017	0.018
	3/3			<0.1			<0.1		
	3/3			0.011			0.021		
	5/13	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	5/13	0.018		0.02	0.0061	0.0082	0.019	<0.005	0.023
	12/11	0.18	0.35	0.035	0.031	0.06	1	0.28	0.036
	12/11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (as N)	3/2	6.7			2.5	6.4		31	4
	3/3			4.1			2.9		
	5/13	17		3.6	1.9	1.5	2.7	11	2.8
	12/11	4.3	4.8	<5	<5	4.4	<5	9.2	<5
Ortho-phosphate	5/13	1.4		<1	<1	<1	<1	<1	<1
	12/11	<10	<10	<10	<10	<10	<10	<10	<10

...continued on next page

Table 7-4. Storm water runoff, detected nonradioactive parameters, Livermore site, 1995 (continued).

Parameter	Storm date	ALPE	ALPO[a]	ASS2	ASW	CDB	CDB2	GRNE	WPDC
Metals and minerals and others (mg/L) (continued)									
Potassium	3/2	2.8			1.5	1.4		2.4	1.2
	3/3			3.5			1.5		
	5/13	3.1		2.3	1.8	1.2	2	1.6	1.3
	12/11	1.3	3.7	2.3	2	2.3	2.1	<1	2.4
Selenium	3/2	<0.002			<0.002	<0.002		<0.002	<0.002
	3/3			<0.002			<0.002		
	5/13	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	12/11	<0.005	<0.005	<0.005	<0.005	<0.005	0.65	<0.005	<0.005
Silver	3/2	<0.0005			<0.0005	<0.0005		<0.0005	<0.0005
	3/3			<0.0005			<0.0005		
	5/13	0.0029		0.00095	0.00098	0.0014	0.0012	0.0016	0.001
	12/11	<0.005	0.011	<0.005	<0.005	<0.005	0.81	<0.005	<0.005
Sodium	3/2	160			3	2.3		19	3.6
	3/3			39			4.2		
	5/13	53		5.2	3.4	2.4	5.4	13	7.9
	12/11	7.2	86	1.8	2.1	2.4	3.4	16	7.6
Sulfate	3/2	110			2.2	3.3		19	2.5
	3/3			79			5.1		
	5/13	40		2.3	1.8	1.4	4.8	6.7	8.1
	12/11	27	130	21	18	26	28	29	48
Thallium	3/2	<0.005			<0.005	<0.005		<0.005	<0.005
	3/3			<0.005			<0.005		
	5/13	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	12/11	<0.001	<0.001	<0.02	<0.001	<0.001	0.89	<0.001	<0.001
Total alkalinity (as $CaCO_3$)	3/2	130			10	9.5		42	10
	3/3			70			17		
	5/13	42		19	12	7.6	19	38	18
	12/11	21	180	11	11	11	17	51	22
Total dissolved solids (TDS)	3/2	590			37	48		170	40
	3/3			270			53		
	5/13	250		69	39	38	77	130	89
	12/11	110	450	45	55	61	57	74	85

...continued on next page

Table 7-4. Storm water runoff, detected nonradioactive parameters, Livermore site, 1995 (continued).

Parameter	Storm date	ALPE	ALPO[a]	ASS2	ASW	CDB	CDB2	GRNE	WPDC
Metals and minerals and others (mg/L) (continued)									
Total hardness (as $CaCO_3$)	3/2	140			13	18		75	16
	3/3			140			23		
	5/13	44		18	12	8.6	23	37	21
	12/11	32	180	14	13	18	21	17	28
Total organic carbon (TOC)	3/2	15			6.4	11		9.3	6.4
	3/3			6.2			8.5		
	5/13	15		6.3	5.6	6.4	9.5	7.9	5.8
	12/11	11	16	11	12	16	21	16	20
Total suspended solids (TSS)	5/13	120		64	37	39	86	150	210
	12/11	200	1000	210	310	45	210	2300	400
Zinc	3/2	<0.05			0.056	0.16		0.11	0.075
	3/2	0.054			0.095	0.26		0.26	0.19
	3/3			<0.05			<0.05		
	3/3			0.1			0.14		
	5/13	<0.05		<0.05	<0.05	0.084	<0.05	<0.05	<0.05
	5/13	0.037		0.1	0.079	0.14	0.083	0.079	0.14
	12/11	0.09	0.12	0.37	0.13	0.18	1	0.4	0.21
	12/11	<0.05	<0.05	0.13	<0.05	0.14	<0.05	<0.05	<0.05
General indicator parameters									
pH (Units)	3/2	8			6.7	6.4		7.3	6.6
	3/3			7.7			7		
	5/13	7.6		6.9	6.8	6.5	6.9	7.7	6.9
	12/11	7.6	7.4	6.8	6.8	6.6	6.8	8.4	6.9
Specific conductance	3/2	910			41	51		230	48
(µmho/cm)	3/3			410			62		
	5/13	330		61	43	31	70	120	82
	12/11	92	730	38	57	54	59	100	120

...concluded on next page

Table 7-4. Storm water runoff, detected nonradioactive parameters, Livermore site, 1995 (concluded).

Parameter	Storm date	ALPE	ALPO[a]	ASS2	ASW	CDB	CDB2	GRNE	WPDC
Bioassay (percent)[b]									
Aquatic bioassay, LC-50	12/11								
Control									90
1% dilution									98
3% dilution									100
10% dilution									55
30% dilution									93
100% (undiluted)									85
Aquatic bioassay, survival	12/11	100	95					100	95
EPA Method 615 (µg/L)									
2,4,5-T	3/2	1.4			<5	<5		<5	<5
	3/3			<5			<5		
	5/13	<50		<0.5	<5	<5	<0.5	<2500	<5
	12/11	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-D	3/2	120			<10	<10		<10	<10
	3/3			<10			<10		
	5/13	1000		<0.5	7.2	14	<0.5	17000	13
	12/11	<1	<1	<1	<1	<1	<1	<1	<1
EPA Method 624 (µg/L)									
Chloroform	3/2	<1			<1	<1		<1	<1
	3/3			<1			<1		
	5/13	1.9		<1	<1	<1	<1	<1	<1
	12/11	<1	<1	<1	<1	<1	<1	<1	<1

a Location ALPO was added in the fall; therefore, there are no 1995 data prior to 12/11/95.

b In accordance with NPDES No. CA0030023/WDR 95-174, bioassay is conducted only at selected locations.

Table 7-5. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters .

Parameter	Number of samples	Detection limit
Metals and minerals and others (mg/L)		
Antimony	15	<0.06
Bromide	15	<5
Carbonate alk (as $CaCO_3$)	23	<1
Cobalt	1	<0.05
Chromium (VI)	16	<0.01
Hydroxide alk (as $CaCO_3$)	23	<1
Mercury	14	<0.0002
Molybdenum	1	<0.05
Nitrite (as NO_2)	15	<5
Oil and grease	23	<5
Selenium	15	<0.005
Surfactant	23	<0.5
Thallium	15	<0.005
Tin	1	<0.005
Diesel fuel (µg/L)	1	<50
Gasoline fingerprint (µg/L)	1	<50
EPA Method 504 (mg/L)		
Ethylene dibromide	1	<0.00001
EPA Method 601 (µg/L)		
1,1,1-Trichloroethane	1	<0.5
1,1,2,2-Tetrachloroethane	1	<0.5
1,1,2-Trichloroethane	1	<0.5
1,1-Dichloroethane	1	<0.5
1,1-Dichloroethene	1	<0.5
1,2-Dichlorobenzene	1	<0.5
1,2-Dichloroethane	1	<0.5
1,2-Dichloroethene (total)	1	<0.5
1,2-Dichloropropane	1	<0.5
1,3-Dichlorobenzene	1	<0.5
1,4-Dichlorobenzene	1	<0.5
2-Chloroethylvinylether	1	<0.5
Bromodichloromethane	1	<0.5
Bromoform	1	<0.5
Bromomethane	1	<0.5
Carbon tetrachloride	1	<0.5

...continued on next page

Table 7-5. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (continued).

Parameter	Number of samples	Detection limit
EPA Method 601 (μg/L) (continued)		
Chlorobenzene	1	<0.5
Chloroethane	1	<0.5
Chloromethane	1	<0.5
Dibromochloromethane	1	<0.5
Dichlorodifluoromethane	1	<0.5
Freon 113	1	<0.5
Methylene chloride	1	<0.5
Tetrachloroethene	1	<0.5
Trichloroethene	1	<0.5
Trichlorofluoromethane	1	<0.5
Vinyl chloride	1	<0.5
cis-1,3-Dichloropropene	1	<0.5
trans-1,3-Dichloropropene	1	<0.5
EPA Method 602 (μg/L)		
1,2-Dichlorobenzene	1	<0.3
1,3-Dichlorobenzene	1	<0.3
1,4-Dichlorobenzene	1	<0.3
Benzene	1	<0.3
Chlorobenzene	1	<0.3
Ethylbenzene	1	<0.3
Toluene	1	<0.3
Total xylene isomers	1	<0.6
EPA Method 608 (μg/L)		
Aldrin	22	<0.05
BHC, alpha isomer	22	<0.05
BHC, beta isomer	22	<0.05
BHC, delta isomer	22	<0.05
BHC, gamma isomer (Lindane)	22	<0.05
Chlordane	22	<0.5
Dieldrin	22	<0.1
Endosulfan I	22	<0.05
Endosulfan II	22	<0.1
Endosulfan sulfate	22	<0.1

...continued on next page

Table 7-5. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (continued).

Parameter	Number of samples	Detection limit
EPA Method 608 (μg/L) (continued)		
Endrin	22	<0.1
Endrin aldehyde	22	<0.1
Heptachlor	22	<0.05
Heptachlor epoxide	22	<0.05
Methoxychlor	22	<0.5
Toxaphene	22	<1
p,p'-DDD	22	<0.1
p,p'-DDE	22	<0.1
p,p'-DDT	22	<0.1
EPA Method 615 (μg/L)		
2,4,5-TP (Silvex)	10	0.2
	10	2
	1	20
	1	1000
4-(2,4-Dichlorophenoxy)butyric acid	10	2
	10	20
	1	200
	1	10,000
Dalapon	10	2
	10	20
	1	200
	1	10,000
Dicamba	10	1
	10	10
	1	100
	1	5000
Dichloroprop	10	2
	10	20
	1	200
	1	10,000
Dinoseb	10	1
	10	5
	9	10
	1	100
	1	5000

...continued on next page

Table 7-5. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (continued).

Parameter	Number of samples	Detection limit
EPA Method 615 (μg/L) (continued)		
MCPA	10	250
	10	2500
	1	25,000
	1	1,200,000
MCPP	10	250
	10	2500
	1	25,000
	1	1,200,000
EPA Method 624 (μg/L)		
1,1,1-Trichloroethane	22	<1
1,1,2,2-Tetrachloroethane	22	<1
1,1,2-Trichloroethane	22	<1
1,1-Dichloroethane	22	<1
1,1-Dichloroethene	22	<1
1,2-Dichlorobenzene	22	<1
1,2-Dichloroethane	22	<1
1,2-Dichloroethene (total)	22	<1
1,2-Dichloropropane	22	<1
1,3-Dichlorobenzene	22	<1
1,4-Dichlorobenzene	22	<1
2-Butanone	22	<40
2-Chloroethylvinylether	22	<40
2-Hexanone	22	<10
4-Methyl-2-pentanone	22	<10
Acetone	22	<40
Benzene	22	<1
Bromodichloromethane	22	<1
Bromoform	22	<1
Bromomethane	22	<2
Carbon disulfide	22	<1
Carbon tetrachloride	22	<1
Chlorobenzene	22	<1
Chloroethane	22	<2

...continued on next page

Table 7-5. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (continued).

Parameter	Number of samples	Detection limit
EPA Method 624 (μg/L) (continued)		
Chloromethane	22	<2
Dibromochloromethane	22	<1
Dibromomethane	22	<1
Dichlorodifluoromethane	22	<2
Ethylbenzene	22	<1
Freon 113	22	<1
Methylene chloride	22	<1
Styrene	22	<1
Tetrachloroethene	22	<1
Toluene	22	<1
Total xylene isomers	22	<2
Trichloroethene	22	<0.5
Trichlorofluoromethane	22	<1
Vinyl acetate	22	<10
Vinyl chloride	22	<2
cis-1,3-Dichloropropene	22	<1
trans-1,3-Dichloropropene	22	<1
EPA Method 625 (μg/L)		
1,2,4-Trichlorobenzene	22	<10
1,2-Dichlorobenzene	22	<10
1,3-Dichlorobenzene	22	<10
1,4-Dichlorobenzene	22	<10
2,4,5-Trichlorophenol	22	<10
2,4,6-Trichlorophenol	22	<10
2,4-Dichlorophenol	22	<10
2,4-Dimethylphenol	22	<10
2,4-Dinitrophenol	22	<50
2,4-Dinitrotoluene	22	<10
2,6-Dinitrotoluene	22	<10
2-Chloronaphthalene	22	<10
2-Chlorophenol	22	<10
2-Methylphenol	22	<10

...continued on next page

Table 7-5. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (continued).

Parameter	Number of samples	Detection limit
EPA Method 625 (μg/L) (continued)		
2-Methyl-4,6-dinitrophenol	22	<50
2-Methylnaphthalene	22	<10
2-Nitroaniline	22	<50
2-Nitrophenol	22	<10
3,3'-Dichlorobenzidine	22	<20
3-Nitroaniline	22	<50
4-Bromophenylphenylether	22	<10
4-Chloro-3-methylphenol	22	<20
4-Chloroaniline	22	<20
4-Chlorophenylphenylether	22	<10
4-Nitroaniline	22	<50
4-Nitrophenol	22	<50
Acenaphthene	22	<10
Acenaphthylene	22	<10
Anthracene	22	<10
Benzo(a)anthracene	22	<10
Benzo(a)pyrene	22	<10
Benzo(b)fluoranthene	22	<10
Benzo(g,h,i)perylene	22	<10
Benzo(k)fluoranthene	22	<10
Benzoic Acid	22	<50
Benzyl Alcohol	22	<20
Bis(2-chloroethoxy)methane	22	<10
Bis(2-chloroethyl)ether	22	<10
Bis(2-chloroisopropyl)ether	22	<10
Bis(2-ethylhexyl)phthalate	22	<10
Butylbenzylphthalate	22	<10
Chrysene	22	<10
Di-n-butylphthalate	22	<10
Di-n-octylphthalate	22	<10
Dibenzo(a,h)anthracene	22	<10

...concluded on next page

Table 7-5. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (concluded).

Parameter	Number of samples	Detection limit
EPA Method 625 (μg/L) (continued)		
Dibenzofuran	22	<10
Diethylphthalate	22	<10
Dimethylphthalate	22	<10
Fluoranthene	22	<10
Fluorene	22	<10
Hexachlorobenzene	22	<10
Hexachlorobutadiene	22	<10
Hexachlorocyclopentadiene	22	<10
Hexachloroethane	22	<10
Indeno(1,2,3-c,d)pyrene	22	<10
Isophorone	22	<10
N-Nitrosodi-n-propylamine	22	<10
N-Nitrosodiphenylamine	22	<10
Naphthalene	22	<10
Nitrobenzene	22	<10
Pentachlorophenol	22	<50
Phenanthrene	22	<10
Phenol	22	<10
Pyrene	22	<10
m- and p-Cresol	22	<10

8. Routine Ground Water Monitoring at Site 300

Eric Christofferson

Methods

We obtained representative samples of ground water from monitoring wells by following written protocols contained in *LLNL Livermore Site and Site 300 Environmental Restoration Project Standard Operating Procedures* (Dibley and Depue 1995). The written protocols cover sampling techniques and specific information for the analytes that we routinely search for in ground water. We applied different sampling techniques to different wells depending on their construction, that is, whether they were fitted with submersible pumps, or had to be bailed, or contained Barcad devices, where we used pressurized nitrogen gas to extract water samples.

Typically, sampling technologists purged wells of standing water and waited for the wells to recover before they obtained water samples. They wore disposable vinyl gloves to prevent accidental contamination during sampling. They cleaned pH and depth-to-water probes with deionized water after each use. For quality assurance purposes, they obtained field blank samples and equipment blank samples to test the cleanliness of the sampling methods. They used clean sample containers and, where required, they used ultrapure chemicals (mostly acids) to preserve the samples. Off-site laboratories performed most of the water analyses under contract with LLNL. LLNL personnel primarily measured tritium activity. The analytical laboratories pre-acidified some of the sample containers for preservation purposes, but we halted this procedure after we detected phenols in some field blanks.

In **Table 8-1,** we list the inorganic and radioactive constituents of concern (COCs) in ground water and the EPA methods used to measure them. In **Table 8-2**, we list suites of organic COCs by EPA method. For each COC, we list a reporting limit (RL) of concentration or activity. An RL is the lowest concentration or activity at which the detection of a COC is certain. Concentration or activity of a COC below its RL is called a nondetection (n.d.). To indicate nondetection of an individual COC in data **Tables 8-3** to **8-35**, we use less-than (<) with the RL for the constituent. To simplify reporting nondetections of entire suites of organic compounds that may have different RLs, we list the EPA method followed by (n.d.) in **Tables 8-3** to **8-35**. In such instances, the reader is referred to **Table 8-2** for constituents and RLs.

Site 300 Pit 1, Pit 7, and HE Process Areas

For compliance purposes during 1995, we obtained samples of ground water quarterly from 22 monitoring wells at Site 300. We used 17 wells to monitor chemical concentrations and radioactivity in the ground water in the vicinity of two RCRA-closed landfills: Pit 1 (8 wells) and Pit 7 (9 wells). We used five wells (plus seven lysimeters and two leachate collection systems) to monitor ground water chemicals in the vicinity of two Class II surface impoundments, where process water is evaporated. During 1995, we complied with all of the monitoring and reporting requirements contained in the following documents:

1. Waste Discharge Requirements (WDR) Order 93-100 for Pits 1 and 7, administered by the California Central Valley Regional Water Quality Control Board (CVRWQCB), (CVRWQCB 1993);
2. WDR Order 85-188 for the surface impoundments, administered by the CVRWQCB (CVRWQCB 1985); and
3. The Lawrence Livermore National Laboratory (LLNL) Site 300 Resource Conservation and Recovery Act (RCRA) Closure and Post-Closure Plans for Landfill Pits 1 and 7 (Rogers / Pacific Corporation, 1990), approved by the California Department of Health Services, and administered under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Federal Facility Agreement.

As required by the monitoring and reporting sections of these documents, during 1995 we determined the ground water concentrations of toxic metals, high-explosive (HE) compounds, toxic organic compounds (including pesticides and herbicides), general radioactivity (gross alpha and gross beta activities) and the activities of certain radioisotopes, including tritium. We previously tabled and discussed the analytical data obtained during 1995 for Pit 1, Pit 7, and the HE Process Area in four quarterly monitoring reports and one annual report (Christofferson and MacQueen 1995a, 1995b, 1995c, 1996a, 1996b). We submitted these compliance monitoring reports to state and federal agencies, including the CVRWQCB and the DOE. Thus, the lengthy data tables are not repeated in this volume. However, we have summarized our compliance monitoring results for Pit 1, Pit 7, and the HE Process Area in Volume 1, Chapter 8.

Pit 6

We performed ground water surveillance monitoring in the vicinity of the closed landfill Pit 6 during 1995, where we obtained two sets of ground water samples from six monitoring wells. We analyzed the samples for toxic metals; volatile organic compounds, HE compounds, herbicides, pesticides, radioactivity (gross alpha and gross beta), and tritium activity. We present the analytical data for Pit 6 surveillance monitoring in **Tables 8-3** to **8-8**. We discuss the data in Volume 1, Chapter 8.

Pit 2

We performed ground water surveillance monitoring in the vicinity of the closed landfill Pit 2 during 1995, where we obtained quarterly sets of ground water samples from seven multiple completion wells that are fitted with Barcad sampling devices. We analyzed the samples for toxic metals, radioactivity (gross alpha and gross beta), and tritium activity. We present the analytical data for Pit 2 surveillance monitoring in **Tables 8-9** to **8-15**. We discuss the data in Volume 1, Chapter 8.

Pit 9

We performed ground water surveillance monitoring in the vicinity of the closed landfill Pit 9 during 1995, where we obtained one set of ground water samples from four monitoring wells. For three wells, we analyzed the samples for toxic metals, radioactivity, radioisotopes, HE compounds, and volatile organic compounds. For a fourth monitoring well, number K9-04, we analyzed only for radioactivity, because the well did not produced sufficient water for additional analyses. We present the analytical data for Pit 9 surveillance monitoring in **Table 8-16**. We discuss the data in Volume 1, Chapter 8.

Elk Ravine Drainage Area

We performed ground water surveillance monitoring in the the Elk Ravine drainage area during 1995, where we obtained quarterly sets of ground water samples from nine monitoring wells and one spring. We analyzed the samples for toxic metals, radioactivity (gross alpha and gross beta), tritium activity, HE compounds, and volatile organic compounds. We present the analytical data for Elk Ravine surveillance monitoring in **Tables 8-17** to **8-26**. We discuss the data in Volume 1, Chap. 8.

Wells 18 and 20

We performed potable water surveillance monitoring of two on-site wells during 1995 , where we obtained monthly and quarterly ground water samples from wells number 20 and 18. Well 20 is the primary potable water well at Site 300 and Well 18 is the backup well. We analyzed water samples monthly for volatile organic compounds. We analyzed water samples quarterly for toxic metals, general radioactivity, and tritium activity. We present the analytical data for wells 20 and 18 surveillance monitoring in **Tables 8-27**to **8-28**. We discuss the data in Volume 1, Chapter 8.

Off-Site Water-Supply Wells

We performed potable water surveillance monitoring of 12 off-site wells near Site 300 during 1995. We obtained quarterly samples from six of these wells. Of these six, we analyzed two for volatile organic compounds and four for organic compounds and toxic metals. We sampled six additional off-site wells once during 1995 and analyzed the samples for toxic metals, organic compounds, general radioactivity, and tritium activity. We present the analytical data for the 12 off-site potable water well surveillance monitoring in **Tables 8-29** to **8-35**. We discuss the data in Volume 1, Chapter 8.

Table 8-1. List of ground water analyses showing inorganic constituent, EPA, or other standard measurement method used, and typical reporting limit used by analytical laboratory (a statistically determined concentration limit, above which detection is certain).

Constituent	Method	Reporting limit
Metals and minerals (mg/L)		
All alkalinities	EPA 310.1	1
Aluminum	EPA 200.7	0.02
Ammonia nitrogen (as N)	EPA 350.3	0.03
Antimony	EPA 200.7	0.06
Arsenic	EPA 206.2	0.002
Barium	EPA 200.7	0.05
Beryllium	EPA 210.2	0.0005
Cadmium	EPA 213.2	0.0005
Calcium	EPA 200.7	0.5
Chloride	EPA 325.3	1
Chromium	EPA 218.2	0.010
Cobalt	EPA 200.7	0.025
Copper	EPA 200.7	0.05
Fluoride	EPA 340.2	0.1
Hardness, total (as $CaCO_3$)	EPA 2320B	1
Iron	EPA 200.7	0.1
Lead	EPA 239.2	0.002
Magnesium	EPA 200.7	0.5
Manganese	EPA 200.7	0.03
Mercury	EPA 245.1	0.0002
Molybdenum	EPA 200.7	0.05
Nickel	EPA 249.2	0.005
Nitrate (as N)	EPA 353.2	0.1
Potassium	EPA 200.7	1
Selenium	EPA 270.2	0.002
Silver	EPA 272.2	0.010
Sodium	EPA 200.7	1
Sulfate	EPA 300.0	1
Surfactants	EPA 425.1	0.5
Thallium	EPA 279.2	0.005
Total dissolved solids	EPA 160.1	1
Total Kjeldahl nitrogen	EPA 351.4	0.2
Total suspended solids	EPA 160.2	1

...concluded on next page

Table 8-1. List of ground water analyses showing inorganic constituent, EPA, or other standard measurement method used, and typical reporting limit used by analytical laboratory (a statistically determined concentration limit, above which detection is certain) (concluded).

Constituent	Method	Reporting limit
Metals and minerals (mg/L) (continued)		
Vanadium	EPA 200.7	0.05
Zinc	EPA 200.7	0.02
Phenolics (mg/L)		
Phenolics	EPA 420.1	0.005
General indicator parameters		
pH, units	EPA 150.1	none
Specific conductance (μmhos/cm)	EPA 120.1	1
Total organic carbon (mg/L)	EPA 415.1	0.5
Total organic halides (mg/L)	EPA 9020	0.01
Explosive compounds (μg/L)		
HMX	HPLC	5
RDX	HPLC	5
TNT	HPLC	5
Radioactivity (Bq/L)		
Gross alpha	EPA 900	0.06
Gross beta	EPA 900	0.05
Radioisotopes (Bq/L)		
Radium-226	EPA 903	0.003
Thorium-228	U-NAS-NS-3050	0.009
Thorium-232	U-NAS-NS-3050	0.006
Tritium	LLNL-RAS-011	0.050
Uranium-234	U-NAS-NS-3050	0.004
Uranium-235	U-NAS-NS-3050	0.003
Uranium-238	U-NAS-NS-3050	0.004

Table 8-2. List of ground water analyses showing EPA Method, organic constituent, and typical reporting limit used by analytical laboratory (a statistically determined concentration limit, above which detection is certain).

Constituent	Reporting limit (μg/L)
EPA Method 502.2	
1,1,1,2-Tetrachloroethane	0.2
1,1,1-Trichloroethane	0.2
1,1,2,2-Tetrachloroethane	0.2
1,1,2-Trichloroethane	0.2
1,1-Dichloroethane	0.2
1,1-Dichloroethene	0.2
1,1-Dichloropropene	0.2
1,2,3-Trichlorobenzene	0.2
1,2,3-Trichloropropane	0.2
1,2,4-Trichlorobenzene	0.2
1,2,4-Trimethylbenzene	0.2
1,2-Dichlorobenzene	0.2
1,2-Dichloroethane	0.2
1,2-Dichloropropane	0.2
1,3,5-Trimethylbenzene	0.2
1,3-Dichlorobenzene	0.2
1,3-Dichloropropane	0.2
1,4-Dichlorobenzene	0.2
2,2-Dichloropropane	0.2
2-Chlorotoluene	0.2
4-Chlorotoluene	0.2
Benzene	0.2
Bromobenzene	0.2
Bromochloromethane	0.2
Bromodichloromethane	0.2
Bromoform	0.2
Bromomethane	0.2
Carbon tetrachloride	0.2
Chlorobenzene	0.2
Chloroethane	0.2
Chloroform	0.2
Chloromethane	0.2
cis-1,2-Dichloroethene	0.2
cis-1,3-Dichloropropene	0.5
Dibromochloromethane	0.2
Dibromomethane	0.2
Dichlorodifluoromethane	0.2
Ethylbenzene	0.2
Freon-113	0.2
Hexachlorobutadiene	0.2
Isopropylbenzene	0.2
m- and p-Xylene isomers	0.2
Methylene chloride	0.2
n-Butylbenzene	0.2
n-Propylbenzene	0.2
Naphthalene	0.2
o-Xylene	0.2
Isopropyl toluene	0.2
sec-Butylbenzene	0.2
Styrene	0.2
tert-Butylbenzene	0.2
Tetrachloroethene	0.2
Toluene	0.2
trans-1,2-Dichloroethene	0.2
trans-1,3-Dichloropropene	0.2
Trichloroethene	0.2
Trichlorofluoromethane	0.2
Vinyl chloride	0.2
EPA Method 524.2	
1,1,1,2-Tetrachloroethane	1
1,1,1-Trichloroethane	1
1,1,2,2-Tetrachloroethane	1

Table 8-2. List of ground water analyses showing EPA Method, organic constituent, and typical lower limit of detection reported by analytical laboratory (continued).

Constituent	Reporting limit (μg/L)
EPA Method 524.2 (continued)	
1,1,2-Trichloroethane	1
1,1-Dichloroethane	1
1,1-Dichloroethene	1
1,1-Dichloropropene	1
1,2,3-Trichlorobenzene	1
1,2,3-Trichloropropane	1
1,2,4-Trichlorobenzene	1
1,2,4-Trimethylbenzene	1
1,2-Dibromo-3-chloropropane	2
1,2-Dichlorobenzene	1
1,2-Dichloroethane	1
1,2-Dichloropropane	1
1,3,5-Trimethylbenzene	1
1,3-Dichlorobenzene	1
1,3-Dichloropropane	1
1,4-Dichlorobenzene	1
2-Chlorotoluene	1
4-Chlorotoluene	1
Benzene	1
Bromobenzene	1
Bromodichloromethane	1
Bromoform	1
Bromomethane	2
Carbon tetrachloride	1
Chlorobenzene	1
Chloroethane	2
Chloroform	1
Chloromethane	2
cis-1,2-Dichloroethene	1
cis-1,3-Dichloropropene	1
Dibromochloromethane	1
Dibromomethane	1
Dichlorodifluoromethane	2
Ethylbenzene	1
Ethylene dibromide	1
Freon-113	1
Hexachlorobutadiene	1
Isopropylbenzene	1
m- and p-Xylene isomers	1
Methylene chloride	1
n-Butylbenzene	1
n-Propylbenzene	1
Naphthalene	1
o-Xylene	1
Isopropyl toluene	1
sec-Butylbenzene	1
Styrene	1
tert-Butylbenzene	1
Tetrachloroethene	1
Toluene	1
trans-1,2-Dichloroethene	1
trans-1,3-Dichloropropene	1
Trichloroethene	0.5
Trichlorofluoromethane	1
Vinyl chloride	2
EPA Method 601	
1,1,1-Trichloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,1,2-Trichloroethane	0.5
1,1-Dichloroethane	0.5
1,1-Dichloroethene	0.5
1,2-Dichlorobenzene	0.5

Table 8-2. List of ground water analyses showing EPA Method, organic constituent, and typical lower limit of detection reported by analytical laboratory (continued).

Constituent	Reporting limit (μg/L)
EPA Method 601 (continued)	
1,2-Dichloroethane	0.5
1,2-Dichloroethene (total)	0.5
1,2-Dichloropropane	0.5
1,3-Dichlorobenzene	0.5
1,4-Dichlorobenzene	0.5
2-Chloroethylvinylether	0.5
Bromodichloromethane	0.5
Bromoform	0.5
Bromomethane	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
Chloroethane	0.5
Chloroform	0.5
Chloromethane	0.5
cis-1,3-Dichloropropene	0.5
Dibromochloromethane	0.5
Dichlorodifluoromethane	0.5
Freon-113	0.5
Methylene chloride	0.5
Tetrachloroethene	0.5
trans-1,3-Dichloropropene	0.5
Trichloroethene	0.5
Trichlorofluoromethane	0.5
Vinyl chloride	0.5
1,2-Dichlorobenzene	0.5
1,3-Dichlorobenzene	0.3
1,4-Dichlorobenzene	0.3
Benzene	0.4
Chlorobenzene	0.3
Ethylbenzene	0.3
m- and p-Xylene isomers	0.4

Constituent	Reporting limit (μg/L)
o-Xylene	0.4
Toluene	0.3
Total xylene isomers	0.4
EPA Method 608	
Aldrin	0.05
BHC, alpha isomer	0.05
BHC, beta isomer	0.05
BHC, delta isomer	0.05
BHC, gamma isomer (Lindane)	0.05
Chlordane	0.5
Dieldrin	0.1
Endosulfan I	0.05
Endosulfan II	0.1
Endosulfan sulfate	0.1
Endrin	0.1
Endrin aldehyde	0.1
Heptachlor	0.05
Heptachlor epoxide	0.05
Methoxychlor	0.5
4,4'-DDD	0.1
4,4'-DDE	0.1
4,4'-DDT	0.1
Toxaphene	1
EPA Method 615	
2,4,5-T	0.5
2,4,5-TP (Silvex)	0.2
2,4-D	1
2,4-Dichlorophenoxy acetic acid	2
Dalapon	2
Dicamba	1
Dichloroprop	2

Table 8-2. List of ground water analyses showing EPA Method, organic constituent, and typical lower limit of detection reported by analytical laboratory (continued).

Constituent	Reporting limit (μg/L)
EPA Method 615 (continued)	
Dinoseb	1
MCPA	250
MCPP	250
EPA Method 624	
1,1,1-Trichloroethane	1
1,1,2,2-Tetrachloroethane	1
1,1,2-Trichloroethane	1
1,1-Dichloroethane	1
1,1-Dichloroethene	1
1,2-Dichlorobenzene	1
1,2-Dichloroethane	1
1,2-Dichloroethene (total)	1
1,2-Dichloropropane	1
1,3-Dichlorobenzene	1
1,4-Dichlorobenzene	1
2-Butanone	10
2-Chloroethylvinylether	10
2-Hexanone	10
4-Methyl-2-pentanone	10
Acetone	10
Benzene	1
Bromodichloromethane	1
Bromoform	1
Bromomethane	2
Carbon disulfide	1
Carbon tetrachloride	1
Chlorobenzene	1
Chloroethane	2
Chloroform	1
Chloromethane	2

Constituent	Reporting limit (μg/L)
cis-1,3-Dichloropropene	1
Dibromochloromethane	1
Dibromomethane	1
Dichlorodifluoromethane	2
Ethylbenzene	1
Freon-113	1
Methylene chloride	1
Styrene	1
Tetrachloroethene	1
Toluene	1
Total xylene isomers	2
trans-1,3-Dichloropropene	1
Trichloroethene	0.5
Trichlorofluoromethane	1
Vinyl acetate	10
Vinyl chloride	2
EPA Method 625	
1,2,4-Trichlorobenzene	10
1,2-Dichlorobenzene	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
2,4,5-Trichlorophenol	10
2,4,6-Trichlorophenol	10
2,4-Dichlorophenol	10
2,4-Dimethylphenol	10
2,4-Dinitrophenol	50
2,4-Dinitrotoluene	10
2,6-Dinitrotoluene	10
2-Chloronaphthalene	10
2-Chlorophenol	10
2-Methylphenol	10

Table 8-2. List of ground water analyses showing EPA Method, organic constituent, and typical lower limit of detection reported by analytical laboratory (continued).

Constituent	Reporting limit (μg/L)
EPA Method 625 (continued)	
2-Methyl-4,6-dinitrophenol	50
2-Methylnaphthalene	10
2-Nitroaniline	50
2-Nitrophenol	10
3,3'-Dichlorobenzidine	20
3-Nitroaniline	50
4-Bromophenylphenylether	10
4-Chloro-3-methylphenol	20
4-Chloroaniline	20
4-Chlorophenylphenylether	10
4-Nitroaniline	50
4-Nitrophenol	50
Acenaphthene	10
Acenaphthylene	10
Anthracene	10
Benzo(a)anthracene	10
Benzo(a)pyrene	10
Benzo(b)fluoranthene	10
Benzo(g,h,i)perylene	10
Benzo(k)fluoranthene	10
Benzoic acid	50
Benzyl alcohol	20
Bis(2-chloroethoxy)methane	10
Bis(2-chloroisopropyl)ether	10
Bis(2-ethylhexyl)phthalate	10

Constituent	Reporting limit (μg/L)
Butylbenzylphthalate	10
Chrysene	10
Di-n-butylphthalate	10
Di-n-octylphthalate	10
Dibenzo(a,h)anthracene	10
Dibenzofuran	10
Diethylphthalate	10
Dimethylphthalate	10
Fluoranthene	10
Fluorene	10
Hexachlorobenzene	10
Hexachlorobutadiene	10
Hexachlorocyclopentadiene	10
Hexachloroethane	10
Indeno(1,2,3-c,d)pyrene	10
Isophorone	10
m- and p-Cresol	10
N-Nitrosodi-n-propylamine	10
N-Nitrosodiphenylamine	10
Naphthalene	10
Nitrobenzene	10
Pentachlorophenol	50
Phenanthrene	10
Phenol	10
Pyrene	10

Table 8-3. Pit 6 Well K6-01.

Constituents of concern	Sampled	
	1/27/95	8/15/95
Elements (mg/L)		
Arsenic	0.019	0.02
Barium	0.033	<0.05
Beryllium	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005
Chromium	<0.01	<0.01
Cobalt	<0.025	<0.05
Copper	<0.05	<0.05
Lead	<0.002	<0.002
Manganese	0.076	0.075
Mercury	<0.0002	<0.0002
Nickel	<0.1	<0.1
Selenium	<0.002	<0.002
Silver	<0.0005	<0.01
Thallium	<0.005	<0.001
Vanadium	<0.025	<0.05
Zinc	<0.05	<0.05
HE compounds (μg/L)		
HMX, RDX, TNT	<15	<5
Organic compounds[a]		
EPA Method 601	(n.d.)	(n.d.)
EPA Method 608	(n.d.)	(n.d.)
EPA Method 615	(n.d.)	(n.d.)
Radioactivity (Bq/L)		
Gross alpha	0.160	0.000
Gross beta	0.305	0.374
Radioisotopes (Bq/L)		
Tritium	<1.5	<1.8

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-4. Pit 6 Well K6-03.

Constituents of concern	Sampled 1/27/95	Sampled 8/16/95
Elements (mg/L)		
Arsenic	0.025	0.022
Barium	<0.025	<0.05
Beryllium	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005
Chromium	<0.01	<0.01
Cobalt	<0.025	<0.05
Copper	<0.05	<0.05
Lead	<0.002	<0.002
Manganese	0.072	0.068
Mercury	<0.0002	<0.0002
Nickel	<0.1	<0.1
Selenium	<0.002	<0.002
Silver	<0.0005	<0.01
Thallium	<0.005	<0.001
Vanadium	<0.025	<0.05
Zinc	<0.05	<0.05
HE compounds (μg/L)		
HMX, RDX, TNT	<15.	<5
Organic compounds[a]		
EPA Method 601	(n.d.)	(n.d.)
EPA Method 608	(n.d.)	(n.d.)
EPA Method 615	(n.d.)	(n.d.)
Radioactivity (Bq/L)		
Gross alpha	0.053	0.007
Gross beta	0.287	0.278
Radioisotopes (Bq/L)		
Tritium	<1.6	<1.9

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-5. Pit 6 Well K6-04.

Constituents of concern	Sampled	
	1/27/95	8/15/95
Elements (mg/L)		
Arsenic	0.019	0.017
Barium	<0.025	<0.05
Beryllium	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005
Chromium	<0.01	<0.01
Cobalt	<0.025	<0.05
Copper	<0.05	<0.05
Lead	0.0027	<0.002
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002
Nickel	<0.1	<0.1
Selenium	0.0022	<0.002
Silver	<0.0005	<0.01
Thallium	<0.005	<0.001
Vanadium	<0.025	<0.05
Zinc	<0.05	<0.05
HE compounds (µg/L)		
HMX, RDX, TNT	<15.	<5
Organic compounds[a]		
EPA Method 601	(n.d.)	(n.d. except)
Trichloroethene (TCE; µg/L)	(n.d.)	0.53[b]
EPA Method 615	(n.d.)	(n.d.)
EPA Method 608	(n.d.)	(n.d.)
Radioactivity (Bq/L)		
Gross alpha	0.103	0.022
Gross beta	0.35	0.281
Radioisotopes (Bq/L)		
Tritium	<1.5	<1.8

a See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

b TCE was n.d. (<0.5 µg/L) when resampled 10/6/95

Table 8-6. Pit 6 Well EP6-07.

Constituents of concern	Sampled 1/27/95	Sampled 8/15/95
Elements (mg/L)		
Arsenic	0.025	0.024
Barium	<0.025	<0.05
Beryllium	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005
Chromium	<0.01	<0.01
Cobalt	<0.025	<0.05
Copper	<0.05	<0.05
Lead	<0.002	<0.002
Manganese	0.15	0.12
Mercury	<0.0002	<0.0002
Nickel	<0.1	<0.1
Selenium	0.0023	<0.002
Silver	<0.0005	<0.01
Thallium	<0.005	<0.001
Vanadium	<0.025	<0.05
Zinc	<0.05	<0.05
HE compounds (μg/L)		
HMX, RDX, TNT	<15	<5
Organic compounds[a]		
EPA Method 601	(n.d.)	(n.d.)
EPA Method 608	(n.d.)	(n.d.)
EPA Method 615	(n.d.)	(n.d.)
Radioactivity (Bq/L)		
Gross alpha	0.046	–0.026
Gross beta	0.206	0.292
Radioisotopes (Bq/L)		
Tritium	<1.5	2.0

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-7. Pit 6 Well EP6-08.

Constituents of concern	Sampled	
	1/27/95	8/15/95
Elements (mg/L)		
Arsenic	0.021	0.019
Barium	<0.025	<0.05
Beryllium	<0.0005	<0.0005
Cadmium	0.0007	<0.0005
Chromium	<0.01	<0.01
Cobalt	<0.025	<0.05
Copper	<0.05	<0.05
Lead	<0.002	<0.002
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002
Nickel	<0.1	<0.1
Selenium	0.0041	<0.002
Silver	<0.0005	<0.01
Thallium	<0.005	<0.001
Vanadium	<0.025	<0.05
Zinc	<0.05	<0.05
HE compounds (μg/L)		
HMX, RDX, TNT	<15	<5
Organic compounds[a]		
EPA Method 601	(n.d. except)	(n.d. except)
Chloroform	1.3	1.2
Tetrachloroethene (PCE)	0.75	0.6
EPA Method 615	(n.d.)	(n.d.)
EPA Method 608	(n.d.)	(n.d.)
Radioactivity (Bq/L)		
Gross alpha	0.088	<0.218
Gross beta	0.207	0.370
Radioisotopes (Bq/L)		
Tritium	<1.5	<1.9

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-8. Pit 6 Well EP6-08.

Constituents of concern	Sampled 1/27/95	Sampled 8/15/95
Elements (mg/L)		
Arsenic	0.016	0.019
Barium	<0.025	<0.05
Beryllium	<0.0005	<0.0005
Cadmium	0.0008	<0.0005
Chromium	<0.01	<0.01
Cobalt	<0.025	<0.05
Copper	<0.05	<0.05
Lead	<0.002	<0.002
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002
Nickel	<0.1	<0.1
Selenium	0.0058	<0.002
Silver	<0.0005	<0.01
Thallium	<0.005	<0.001
Vanadium	<0.025	<0.05
Zinc	<0.05	<0.05
HE compounds (μg/L)		
HMX, RDX, TNT	<15	<5
Organic compounds[a] (μg/L)		
EPA Method 601	(n.d. except)	(n.d. except)
Trichloroethene (TCE;	28	11
EPA Method 615	(n.d.)	(n.d.)
EPA Method 608	(n.d.)	(n.d.)
Radioactivity (Bq/L)		
Gross alpha	0.029	0.011
Gross beta	0.291	0.455
Radioisotopes (Bq/L)		
Tritium	<1.5	<1.8

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-9. Pit 2 Barcad K1-01A.

Constituents of concern	Sampled		
	1/27/95	8/18/95	11/9/95
Elements (mg/L)			
Arsenic	0.018	0.018	0.012
Barium	0.029	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005
Chromium	0.0011	<0.01	<0.01
Lead	<0.002	<0.002	<0.002
Mercury	<0.0002	<0.0002	<0.0002
Selenium	<0.002	<0.002	<0.002
Silver	<0.0005	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.025
Radioactivity (Bq/L)			
Gross alpha	0.085	0.037	0.044
Gross beta	0.134	0.155	0.178
Radioisotopes (Bq/L)			
Tritium	<1.4	7.4	<2

Table 8-10. Pit 2 Barcad K1-01B.

Constituents of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.013	0.015	0.012	0.012
Barium	0.056	0.055	0.047	0.052
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.001	<0.001	<0.01	<0.01
Lead	<0.002	<0.002	<0.002	<0.002
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.025	<0.025
Radioactivity (Bq/L)				
Gross alpha	0.056	0.184	0.011	<0.126
Gross beta	0.117	0.271	0.196	0.085
Radioisotopes (Bq/L)				
Tritium	<1.4	<1.7	<1.8	<2.1

Table 8-11. Pit 2 Barcad K1-02A.

Constituents of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.016	<0.002	0.015	<0.002
Barium	0.052	0.026	0.035	0.036
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	0.0008
Chromium	0.0015	<0.001	<0.01	<0.01
Lead	<0.002	<0.002	<0.002	<0.002
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.025	<0.025
Radioactivity (Bq/L)				
Gross alpha	0.114	0.031	0.015	0.007
Gross beta	0.146	0.164	0.174	0.148
Radioisotopes (Bq/L)				
Tritium	<1.4	<1.8	<1.8	<1.8

Table 8-12. Pit 2 Barcad K2-01A.

Constituents of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	<0.002	0.018	<0.002	<0.002
Barium	<0.025	0.044	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.001	<0.001	<0.01	<0.01
Lead	<0.002	<0.002	<0.002	<0.002
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.025	<0.025
Radioactivity (Bq/L)				
Gross alpha	0.107	0.142	0.026	–0.019
Gross beta	0.117	0.139	0.133	0.126
Radioisotopes (Bq/L)				
Tritium	<1.3	2.8	<2.1	<1.8

Table 8-13. Pit 2 Barcad K2-01B.

Constituents of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.022	0.027	0.021	0.019
Barium	<0.025	<0.025	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	0.0007
Chromium	<0.001	<0.001	<0.01	<0.01
Lead	<0.002	<0.002	<0.002	<0.002
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.025	<0.025
Radioactivity (Bq/L)				
Gross alpha	0.152	0.050	0.074	0.044
Gross beta	0.162	0.151	0.167	0.111
Radioisotopes (Bq/L)				
Tritium	3.4	4.8	4.3	6.2

Table 8-14. Pit 2 Barcad K2-02A.

Constituents of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.052	0.06	0.046	0.048
Barium	<0.025	<0.025	<0.025	0.026
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.001	<0.001	<0.01	<0.01
Lead	<0.002	<0.002	<0.002	<0.002
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	0.0026	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.025	<0.025
Radioactivity (Bq/L)				
Gross alpha	0.179	0.266	0.118	0.078
Gross beta	0.133	0.154	0.207	0.185
Radioisotopes (Bq/L)				
Tritium	<1.4	<1.7	<2.1	<1.7

Table 8-15. Pit 2 Barcad K2-02B.

Constituents of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	<0.002	<0.002	<0.002	0.0045
Barium	<0.025	<0.025	0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.001	<0.001	<0.01	<0.01
Lead	<0.002	<0.002	<0.002	<0.002
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Selenium	<0.002	0.0022	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.025	<0.025
Radioactivity (Bq/L)				
Gross alpha	0.063	0.049	–0.015	0.033
Gross beta	0.137	0.230	0.133	0.104
Radioisotopes (Bq/L)				
Tritium	<1.5	1.9	<2.2	<1.8

Table 8-16. Pit 9 Wells.

	K9-01	K9-02	K9-03	K9-04
	Sample quarter			
Constituent of concern	**1st**	**2nd**	**3rd**	**4th**
Elements (mg/L)				
Arsenic	0.0047	0.0032	0.012	0.0038
Barium	<0.05	<0.05	<0.05	<0.05
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Copper	<0.05	<0.05	—[a]	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	0.072	0.042	—[a]	0.16
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	—[a]	<0.1
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.05	<0.05	<0.05	<0.05
Zinc	<0.05	<0.05	—[a]	<0.05
HE compounds (µg/L)				
HMX, RDX, TNT	<5	<5	<5	<5
Organic compounds[b]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	–0.067	0.037	0.037	0.015
Gross beta	0.263	0.518	0.518	0.562
Radioisotopes (Bq/L)				
Radium-226	0.002	0.003	—[a]	0.007
Tritium	5.1	<2.0	<2.0	<2.0
Uranium-234	0.009	0.016	0.020	0.017
Uranium-235	0.002	0.000	0.001	0.005
Uranium-238	0.003	0.007	0.007	0.009

a Analysis not part of the sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-17. Elk Ravine Well K7-07.

Constituent of concern	Sample quarter[a]		
	2nd	3rd	4th
Elements (mg/L)			
Arsenic	0.014	0.014	0.015
Barium	0.054	0.082	0.083
Beryllium	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01
Cobalt	<0.025	<0.05	<0.05
Copper	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	—[b]
Manganese	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1
Selenium	<0.002	<0.002	<0.002
Silver	0.001	<0.01	<0.01
Vanadium	<0.025	0.031	<0.025
Zinc	<0.05	<0.05	<0.05
HE compounds (μg/L)			
HMX, RDX, TNT	<5	<5	<5
Organic compounds[c]			
EPA Method 601	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)			
Gross alpha	0.322	0.063	0.936
Gross beta	0.190	0.255	1.132
Radioisotopes (Bq/L)			
Tritium	1160	962	833

a Well dry during first quarter.

b Analysis not part of the sampling plan.

c See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-18. Elk Ravine Well NC7-61.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.019	0.013	0.016	0.014
Barium	0.11	0.12	0.13	0.11
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.05	<0.025	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	<0.001	<0.01	<0.01
Vanadium	0.097	0.085	0.091	0.076
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15.	<5.	<5.	<5.
Organic compounds[a]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.325	0.309	0.200	0.329
Gross beta	0.368	0.236	0.355	0.466
Radioisotopes (Bq/L)				
Tritium	7290.	7070.	6620.	6920.

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-19. Elk Ravine Well NC7-69.

	Sample quarter			
Constituent of concern	**1st**	**2nd**	**3rd**	**4th**
Elements (mg/L)				
Arsenic	0.0023	0.0025	<0.002	<0.002
Barium	0.026	0.03	<0.025	0.028
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.025	<0.025	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	0.0031	<0.002	<0.002	<0.002
Manganese	0.053	0.065	0.068	0.056
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	0.0015	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.025	<0.025
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[a]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.065	0.047	–0.019	–0.026
Gross beta	0.132	0.151	0.178	0.237
Radioisotopes (Bq/L)				
Tritium	<0.1	<0.1	<0.1	<0.1

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-20. Elk Ravine Well K2-04D.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.013	0.012	0.01	1.4
Barium	<0.05	0.032	<0.025	0.036
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	—[a]	<0.01	<0.01
Cobalt	<0.05	—[a]	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	0.0028	0.021	<0.002	<0.002
Silver	<0.0005	<0.01	<0.01	<0.01
Vanadium	0.061	—[a]	0.057	0.033
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[b]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.108	0.164	0.041	0.096
Gross beta	0.100	0.137	0.107	0.104
Radioisotopes (Bq/L)				
Tritium	344	870	603	342

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-21. Elk Ravine Well K2-04S.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.016	0.013	0.015	1.2
Barium	<0.05	0.044	0.056	0.061
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.05	<0.025	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	0.0022	<0.002	0.002	<0.002
Silver	<0.0005	0.0011	<0.01	<0.01
Vanadium	0.072	0.053	0.053	0.040
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[a]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.300	0.152	0.229	0.078
Gross beta	0.278	0.105	0.226	0.159
Radioisotopes (Bq/L)				
Tritium	929	1195	1410	1373

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-22. Elk Ravine Well K2-01C.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.0072	0.0044	0.0039	<0.002
Barium	<0.05	0.068	0.042	0.058
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.05	<0.025	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	0.00021	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	0.0069	<0.01	<0.01
Vanadium	<0.05	<0.025	0.031	<0.025
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[(a)]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.518	0.847	0.337	0.503
Gross beta	0.359	0.411	0.292	0.366
Radioisotopes (Bq/L)				
Tritium	374	121	212	200

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-23. Elk Ravine Well NC2-11D.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.015	0.015	0.015	0.011
Barium	<0.05	<0.025	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.05	<0.025	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	0.0025	<0.002	<0.002	<0.002
Silver	<0.0005	0.0055	<0.01	<0.01
Vanadium	0.051	<0.025	0.050	0.029
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[a]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.169	0.258	0.189	0.115
Gross beta	0.195	0.181	0.303	0.196
Radioisotopes (Bq/L)				
Tritium	91	77	89	93

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-24. Elk Ravine Well NC2-12D.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.014	0.011	0.014	0.011
Barium	<0.05	<0.025	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	—[b]	<0.01	<0.01
Cobalt	<0.05	—[b]	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	0.0022	<0.002	0.0069	<0.002
Silver	<0.0005	<0.01	<0.01	<0.01
Vanadium	<0.05	—[b]	0.044	0.026
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	—[b]	—[b]	<5	<5
Organic compounds[a]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.122	0.192	0.026	0.122
Gross beta	0.249	0.192	0.192	0.137
Radioisotopes (Bq/L)				
Tritium	154	152	157	174

a See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

b Analysis not part of sampling plan.

Table 8-25. Elk Ravine Spring 812CRK.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.025	0.025	0.034	0.023
Barium	0.21	0.03	<0.025	0.047
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	—[a]	<0.01	<0.01
Cobalt	<0.05	—[a]	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	0.0042	0.0034	0.0026	<0.002
Silver	<0.0005	<0.01	<0.01	<0.01
Vanadium	<0.05	—[a]	0.079	0.053
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[b]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d. except)
Tetrachloroethene (PCE)				0.57[c]
Trichloroethene (TCE)				0.73[c]
Radioactivity (Bq/L)				
Gross alpha	0.263	0.204	0.163	0.059
Gross beta	0.279	0.250	0.211	0.192
Radioisotopes (Bq/L)				
Tritium	<1	<1	—[a]	<1

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

c Additional sampling/analysis showed n.d. for PCE and TCE.

Table 8-26. Elk Ravine Well NC2-07.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	—[a]	—[a]	0.031	0.034
Barium	—[a]	—[a]	<0.025	0.028
Beryllium	—[a]	—[a]	<0.0005	<0.0005
Cadmium	—[a]	—[a]	<0.0005	<0.0005
Chromium	—[a]	—[a]	<0.01	<0.01
Cobalt	—[a]	—[a]	<0.05	<0.025
Copper	—[a]	—[a]	<0.05	<0.05
Lead	—[a]	—[a]	<0.002	<0.002
Manganese	—[a]	—[a]	<0.03	<0.03
Mercury	—[a]	—[a]	<0.0002	<0.0002
Nickel	—[a]	—[a]	<0.1	<0.1
Selenium	—[a]	—[a]	<0.002	<0.002
Silver	—[a]	—[a]	<0.01	<0.01
Vanadium	—[a]	—[a]	0.044	0.046
Zinc	—[a]	—[a]	<0.05	<0.05
HE compound (μg/L)s				
HMX, RDX, TNT	—[a]	—[a]	<5	<5
Organic compounds[b]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.629	0.368	0.181	0.407
Gross beta	0.334	0.396	0.192	0.292
Radioisotopes (Bq/L)				
Tritium	<2	<2	<2	<2

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-27. Water Supply Well 20.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	<0.002	<0.002	<0.002	<0.002
Barium	—[a]	<0.025	—[a]	—[a]
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	—[a]	<0.0005	—[a]	—[a]
Chromium	<0.01	<0.001	<0.01	<0.01
Cobalt	—[a]	—[a]	—[a]	—[a]
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	—[a]	<0.001	—[a]	—[a]
Vanadium	—[a]	<0.025	<0.025	<0.025
Zinc	0.053	<0.05	<0.05	<0.05
Organic compounds[b]				
EPA Method 502.2	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.001	0.094	0.033	0.085
Gross beta	0.381	0.448	3.489	0.389
Radioisotopes (Bq/L)				
Tritium	<0.1	<0.3	—[a]	<0.1

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-28. Standby Supply Well 18.

	Sample quarter			
Constituent of concern	**1st**	**2nd**	**3rd**	**4th**
HE compounds (μg/L)				
HMX, RDX, TNT (μg/L)	<15	—[a]	—[a]	—[a]
Organic compounds[b]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)
EPA Method 502.2	—[a]	(n.d. except)	(n.d. except)	(n.d. except)
Trichloroethene (TCE)		0.2	0.4	0.5
Radioactivity (Bq/L)				
Gross alpha	0.031	0.104	–0.045	0.006
Gross beta	0.176	0.389	0.196	0.319
Radioisotopes (Bq/L)				
Tritium	—[a]	<0.1	<1	<0.2

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-29. Off-site Well CARNRW2.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.0029	0.0026	0.0021	0.0036
Barium	<0.05	<0.025	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.05	<0.025	—[a]	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	0.04	0.034	0.04	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	0.0024	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.001	<0.01
Vanadium	—[a]	<0.025	<0.025	<0.025
Zinc	0.053	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[b]				
EPA Method 608	(n.d.)	(n.d.)	(n.d.)	(n.d.)
EPA Method 615	(n.d.)	—[a]	(n.d.)	(n.d.)
EPA Method 502.2	(n.d.)	(n.d.)	(n.d.)	(n.d. except)
Bromodichloromethane				1.0
Bromoform				2.4
Chloroform				0.6
Dibromochloromethane				2.1
Radioactivity (Bq/L)				
Gross alpha	0.027	–0.048	–0.078	0.052
Gross beta	0.492	0.323	0.215	0.226
Radioisotopes (Bq/L)				
Tritium	—[a]	—[a]	<1	<1

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-30. Off-site Well CDF1.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.0042	0.0066	0.0021	<0.002
Barium	<0.05	0.031	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.05	<0.025	—[a]	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	0.04	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	0.0039	<0.002	<0.002	<0.002
Silver	<0.0005	0.0041	<0.001	<0.01
Vanadium	—[a]	—[a]	<0.025	<0.025
Zinc	0.16	<0.05	<0.05	0.074
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[b]				
EPA Method 502.2	(n.d.)	(n.d.)	(n.d.)	(n.d.)
EPA Method 608	(n.d.)	(n.d.)	(n.d.)	(n.d.)
EPA Method 615	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	0.067	–0.048	0.274	0.059
Gross beta	0.335	0.323	0.370	0.303
Radioisotopes (Bq/L)				
Tritium	—[a]	—[a]	0.25	0.22

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-31. Off-site Well CON1.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	<0.002	0.0043	<0.002	0.0024
Barium	<0.05	0.025	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.05	<0.025	<0.025	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	0.14	0.12	0.12	0.11
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	0.004	<0.01	<0.01
Vanadium	—[a]	—[a]	—[a]	<0.025
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[b]				
EPA Method 502.2	(n.d.)	(n.d.)	(n.d.)	(n.d.)
EPA Method 608	(n.d.)	(n.d.)	(n.d.)	(n.d.)
EPA Method 615	(n.d.)	(n.d.)	(n.d.)	(n.d.)
Radioactivity (Bq/L)				
Gross alpha	–0.053	0.015	–0.122	–0.056
Gross beta	0.474	0.064	0.426	0.329
Radioisotopes (Bq/L)				
Tritium	—[a]	—[a]	<1	<1

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-32. Off-site Well GALLO1.

Constituent of concern	Sample quarter			
	1st	2nd	3rd	4th
Elements (mg/L)				
Arsenic	0.0034	0.003	0.0029	0.0044
Barium	<0.025	<0.025	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.025	<0.025	<0.05	<0.025
Copper	<0.05	<0.05	<0.05	<0.05
Lead	<0.002	<0.002	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.01	<0.01
Vanadium	<0.025	<0.025	<0.05	<0.025
Zinc	<0.05	<0.05	<0.05	<0.05
HE compounds (μg/L)				
HMX, RDX, TNT	<15	<5	<5	<5
Organic compounds[a]				
EPA Method 608	(n.d.)	(n.d.)	(n.d.)	(n.d.)
EPA Method 615	(n.d.)	(n.d.)	(n.d.)	(n.d.)
EPA Method 502.2	(n.d. except)	(n.d. except)	(n.d. except)	(n.d. except)
Trichloroethene (TCE)	0.4	0.3	0.3	0.3
Radioactivity (Bq/L)				
Gross alpha	–0.105	0.084	0.007	–0.070
Gross beta	0.065	0.196	0.078	0.163
Radioisotopes (Bq/L)				
Tritium	—[b]	—[b]	<1	<1

a See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

b Analysis not part of sampling plan.

Table 8-33. Off-site Well CARNRW1.

Constituent of concern	Sampled			
	1/25/95	5/17/95	8/18/95	10/23/95
Organic compounds[(a)]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-34. Off-site Well CON2.

Constituent of concern	Sampled			
	1/25/95	5/17/95	8/18/95	10/23/95
Organic compounds[(a)]				
EPA Method 601	(n.d.)	(n.d.)	(n.d.)	(n.d.)

[a] See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

Table 8-35. Annually monitored off-site surveillance wells.

Constituent of concern	MUL1	MUL2	VIE1	VIE2	STN	W35A-04
	Sampled					
	8/23/95	8/23/95	8/24/95	8/24/95	8/2/95	2/9/95
Elements (mg/L)						
Arsenic	0.0047	<0.002	0.013	<0.002	<0.002	—[a]
Barium	0.033	<0.025	0.052	<0.025	0.031	0.040
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	—[a]
Cadmium	<0.0005	<0.0005	0.00084	<0.0005	<0.0005	<0.0005
Chromium	0.013	<0.01	<0.01	0.031	<0.01	—[a]
Copper	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	0.0021	<0.002	<0.002	0.0084	<0.002	<0.002
Manganese	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	—[a]
Silver	0.021	0.024	0.014	<0.01	<0.001	<0.01
Vanadium	<0.025	<0.025	<0.025	<0.025	<0.025	—[a]
Zinc	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Organic compounds[b]						
EPA Method 502.2	(n.d.)	(n.d.)	(n.d.)	(n.d.)	(n.d.)	(n.d.)[c]
EPA Method 608	(n.d.)	(n.d.)	(n.d.)	(n.d.)	(n.d.)	—[a]
EPA Method 615	(n.d.)	(n.d.)	(n.d.)	(n.d.)	(n.d.)	—[a]
Radioactivity (Bq/L)						
Gross alpha	0.078	–0.052	0.130	0.096	—[a]	—[a]
Gross beta	0.340	0.215	0.274	0.163	—[a]	—[a]
Radioisotopes (Bq/L)						
Tritium	<0.2	<0.2	<0.1	<1.0	<1.0	—[a]

a Analysis not part of sampling plan.

b See **Table 8-2** for method constituents and their reporting limits. n.d. = not detected above reporting limits.

c Well W35A-04 analyzed by EPA Methods 601 and 602 (see **Table 8-2**).

9. Livermore Ground Water Protection Management Program

Richard A. Brown
Richard C. Blake

Methods

The Environmental Analyst or Analyst Assistant responsible for ground water develops a ground water sampling plan each quarter. This plan is documented and given to the Sampling Coordinator at least one month prior to the start of the quarter in which sampling will occur. Sampling personnel then sample the wells at the desired intervals according to Standard Operating Procedures (SOPs; Dibley and Depue 1995), which include special instructions for individual classes of analytes. The overall ground water sampling procedure is documented in EMP-GW-S (1996).

Wells are typically purged of standing water (via ERD SOPs 2.1 and 2.7) prior to extracting the representative ground water samples. Water samples for volatile organic compounds are taken first, followed by the other analytes. The sampling technologists also measure the following parameters in the field: depth to water, water temperature, pH, and specific conductance, as well as gallons of water purged. Sample equipment is maintained and cleaned between sampling events so that the sample equipment does not contaminate the water samples. Sampling technologists wear disposable gloves to avoid contaminating the samples.

All nonradiological ground water samples collected during 1995 were sent to CLS Analytical Laboratory on the same day as collected, if possible. All radiological samples collected during 1995 were delivered to and analyzed by the Chemistry and Materials Science's Environmental Services on-site laboratory (CES).

Tables 9-1 and **9-2** present all detections of organic data for the upgradient wells and downgradient wells, respectively; **Tables 9-3** and **9-4** present all inorganic data results for the upgradient wells and downgradient wells, respectively; and **Tables 9-5** and **9-6** present all calculated values for radioactivity for the upgradient wells and downgradient wells, respectively.

Livermore Valley Wells

Water samples for tritium analysis were collected in 250-mL, argon-flushed, flint-glass bottles fitted with glass stoppers. The CES laboratory measurements of tritium are performed utilizing liquid scintillation, achieving a minimum detectable activity of approximately 1.85 Bq/L (50 pCi/L). Four 50-minute counting intervals were used for all sample measurements. Sample results for tritium are presented in Tables 9-8, 9-9, and 9-10 of Volume 1 and discussed in Volume 1, Chapter 9.

Table 9-1. Analyses for organic compounds in upgradient wells in the southeastern corner of the Livermore site, 1995.

Organic compound (μg/L)	Date	Monitor wells			
		W–017	W–107	W–117	W–268
Volatile organic compounds (EPA 601)					
1,1-Dichloroethene	3/9-17	<0.5	<0.5	<0.5	<0.5
	6/5–21	<0.5	<0.5	<0.5	1.2
	9/5–8	<0.5	<0.5	<0.5	1.2
	11/27–30	<0.5	<0.5	<0.5	1.4
1,2-Dichloroethane	3/9–17	<0.5	<0.5	<0.5	<0.5
	6/5–21	<0.5	<0.5	<0.5	<0.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<0.5	<0.5	<0.5	<0.5
Carbon tetrachloride	3/9-17	<0.5	<0.5	<0.5	<0.5
	6/5–21	<0.5	<0.5	<0.5	<0.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<0.5	<0.5	<0.5	<0.5
Chloroform		<0.5	<0.5	<0.5	<0.5
	6/5–21	<0.5	<0.5	<0.5	<0.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<0.5	<0.5	<0.5	<0.5
Freon 113	3/9–17	<0.5	27	<0.5	22
	6/5–21	<0.5	<0.5	<0.5	29
	9/5–8	<0.5	23	<0.5	21
	11/27–30	<0.5	30	<0.5	27
Tetrachloroethene	3/9–17	<0.5	<0.5	<0.5	0.78
	6/5–21	<0.5	<0.5	<0.5	<0.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<0.5	<0.5	<0.5	<0.5
Trichloroethene	3/9–17	<0.5	1.4	0.87	1.9
	6/5–21	<0.5	<0.5	<0.5	1.1
	9/5–8	<0.5	<0.5	<0.5	0.86
	11/27–30	<0.5	<0.5	<0.5	0.95
Trichlorofluoromethane	3/9–17	<0.5	<0.5	<0.5	<0.5
	6/5–21	<0.5	<0.5	<0.5	<0.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<0.5	<0.5	<0.5	<0.5
Semivolatile organics (EPA 625)					
Bis(2-ethylhexyl)phthalate	3/9–17	<10	<10	<10	<10
	6/5–21	<10	<10	<10	<10
	9/5–8	<10	11	<10	<10
	11/27–30	<10	<10	<10	<10

Table 9-2. Analyses for organic compounds in downgradient wells in the southeastern corner of the Livermore site, 1995.

Organic compound (μg/L)	Date	Monitor wells			
		W–217	W–270	W–359	W–622
Volatile organic compounds (EPA 601)					
1,1-Dichloroethene	3/9–17	17	<0.5	6.7	110
	6/5–21	14	<0.5	7.1	79
	9/5–8	15	<0.5	5.6	83
	11/27–30	12	<0.5	6.1	88
1,2-Dichloroethane	3/9–17	<0.5	<0.5	1	<0.5
	6/5–21	<0.5	<0.5	0.88	<0.5
	9/5–8	<0.5	<0.5	0.81	<0.5
	11/27–30	<0.5	<0.5	0.94	<0.5
Carbon tetrachloride	3/9–17	31	<0.5	1.2	210
	6/5–21	29	<0.5	1.2	84
	9/5–8	28	<0.5	0.86	110
	11/27–30	23	<0.5	0.83	110
Chloroform	3/9–17	2	1.4	6.1	15
	6/5–21	2	<0.5	6.5	7.4
	9/5–8	1.6	<0.5	4	9.5
	11/27–30	1.9	<0.5	5	12
Freon 113	3/9–17	2	<0.5	31	46
	6/5–21	3.4	<0.5	34	23
	9/5–8	2.8	<0.5	27	26
	11/27–30	2.4	<0.5	29	20
Tetrachloroethene	3/9–17	2.7	<0.5	13	290
	6/5–21	3.3	<0.5	10	69
	9/5–8	3.5	<0.5	9.9	160
	11/27–30	5.3	<0.5	10	140
Trichloroethene	3/9–17	42	<0.5	180	290
	6/5–21	30	<0.5	120	230
	9/5–8	29	<0.5	140	190
	11/27–30	28	<0.5	130	220
Trichlorofluoromethane	3/9–17	3.8	<0.5	<0.5	1.3
	6/5–21	7.8	<0.5	<0.5	<2.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	4	<0.5	<0.5	1.2
Semivolatile organics (EPA 625)					
Bis(2-ethylhexyl)phthalate	3/9–17	<10	<10	<10	<10
	6/5–21	<10	<10	11	<10
	9/5–8	<10	<10	32	<10
	11/27–30	<10	<10	<10	<10

Table 9-3. Analyses for inorganic constituents in upgradient wells.

	Date	Monitor wells			
		W–017	W–107	W–117	W–268
General indicators					
pH	3/9–17	7.2	7.4	8.7	7.2
	6/5–21	7.3	7.5	9.7	7.4
	9/5–8	7.5	7.5	8.9	7.4
	11/27–30	7.4	7.3	9.5	7.2
Specific conductance (μmho/cm)	3/9–17	770	560	530	700
	6/5–21	850	620	49	700
	9/5–8	990	740	640	740
	11/27–30	840	590	410	740
Total dissolved solids (mg/L)	3/9–17	581	411	380	431
	6/5–21	671	421	240	501
	9/5–8	511	401	280	461
	11/27–30	531	410	240	431
Water table elevation (m)	3/9–17	169.40	168.08	165.09	165.38
	6/5–21	169.53	167.96	165.18	135.35
	9/5–8	169.68	168.24	165.37	135.71
	11/27–30	169.69	168.21	165.35	165.74
Metals and minerals (mg/L)					
Bicarbonate alkalinity (as $CaCO_3$)	3/9–17	180	170	190	150
	6/5–21	180	160	10	150
	9/5–8	180	160	340	190
	11/27–30	180	160	92	150
Carbonate alkalinity (as $CaCO_3$)	3/9–17	<1	<1	37	<1
	6/5–21	<1	<1	100	<1
	9/5–8	<1	<1	18	<1
	11/27–30	<1	<1	19	<1
Hydroxide alkalinity (as $CaCO_3$)	3/9–17	<1	<1	<1	<1
	6/5–21	<1	<1	<1	<1
	9/5–8	<1	<1	<1	<1
	11/27–30	<1	<1	<1	<1
Total alkalinity (as $CaCO_3$)	3/9–17	180	170	230	150
	6/5–21	180	160	110	150
	9/5–8	180	160	360	190
	11/27–30	180	160	110	150

...continued on next page

Table 9-3. Analyses for inorganic constituents in upgradient wells (continued).

		Monitor wells			
	Date	W–017	W–107	W–117	W–268
Aluminum	3/9–17	<0.2	<0.2	<0.2	<0.2
	6/5–21	<0.2	<0.2	<0.2	<0.2
	9/5–8	<0.2	<0.2	<0.2	<0.2
	11/27–30	<0.2	<0.2	<0.2	<0.2
Antimony	3/9–17	<0.01	<0.01	<0.01	<0.005
	6/5–21	<0.06	<0.06	<0.06	<0.005
	9/5–8	<0.005	<0.005	<0.005	<0.005
	11/27–30	<0.005	<0.005	<0.005	<0.005
Arsenic	3/9–17	<0.002	0.0021	0.0041	0.0068
	6/5–21	0.0026	0.002	0.0022	<0.002
	9/5–8	0.0035	0.003	0.007	<0.002
	11/27–30	0.0025	<0.002	0.0027	0.0028
Barium	3/9–17	0.21	0.13	0.36	0.19
	6/5–21	—[a]	—[a]	—[a]	0.2
	9/5–8	0.2	0.13	0.52	0.19
	11/27–30	0.21	0.12	0.36	0.18
Beryllium	3/9–17	<0.0005	<0.0005	<0.0005	<0.0005
	6/5–21	<0.0005	<0.0005	<0.0005	<0.0005
	9/5–8	<0.0005	<0.0005	<0.0005	<0.0005
	11/27–30	<0.0005	<0.0005	<0.0005	<0.0005
Boron	3/9–17	0.45	0.17	0.1	0.29
	6/5–21	0.61	0.24	0.18	0.35
	9/5–8	0.48	0.22	0.24	0.31
	11/27–30	0.34	0.11	0.12	0.21
Bromide	3/9–17	0.91	<0.5	<0.5	<0.5
	6/5–21	0.9	0.72	<0.5	0.78
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<5	<5	<5	<5
Cadmium	3/9–17	<0.0005	<0.0005	<0.0005	<0.0005
	6/5–21	<0.0005	<0.0005	<0.0005	<0.0005
	9/5–8	<0.0005	<0.0005	<0.0005	<0.0005
	11/27–30	<0.0005	<0.0005	<0.0005	<0.0005
Calcium	3/9–17	71	37	17	52
	6/5–21	63	34	8.2	49
	9/5–8	67	82	25	48
	11/27–30	70	38	8.9	53

[a] Analysis not done

...continued on next page

Table 9-3. Analyses for inorganic constituents in upgradient wells (continued).

		Monitor wells			
	Date	W–017	W–107	W–117	W–268
Chloride	3/9–17	180	100	78	140
	6/5–21	180	110	78	120
	9/5–8	180	110	76	130
	11/27–30	190	100	100	160
Chromium (VI)	3/9–17	0.012	0.012	0.032	0.012
	6/5–21	0.011	0.011	<0.01	<0.01
	9/5–8	0.014	0.012	0.016	0.01
	11/27–30	0.011	0.016	0.016	0.0099
Copper	3/9–17	<0.05	<0.05	<0.05	<0.05
	6/5–21	<0.05	<0.05	<0.05	<0.05
	9/5–8	<0.05	<0.05	<0.05	<0.05
	11/27–30	<0.05	<0.05	<0.05	<0.05
Cyanide	3/9–17	<0.02	<0.02	<0.02	<0.02
	6/5–21	<0.02	<0.02	<0.02	<0.02
	9/5–8	<0.02	<0.02	<0.02	<0.02
	11/27–30	<0.02	<0.02	<0.02	<0.02
Fluoride	3/9–17	0.46	0.53	0.37	0.45
	6/5–21	0.42	0.5	0.27	0.49
	9/5–8	0.46	0.54	0.48	0.4
	11/27–30	0.46	0.53	0.31	0.4
Total hardness (as $CaCO_3$)	3/9–17	370	200	210	240
	6/5–21	330	270	86	410
	9/5–8	360	340	260	230
	11/27–30	370	210	100	250
Iron	3/9–17	<0.1	<0.1	<0.1	<0.1
	6/5–21	<0.1	<0.1	<0.1	<0.1
	9/5–8	<0.1	<0.1	<0.1	<0.1
	11/27–30	<0.1	<0.1	<0.1	<0.1
Lead	3/9–17	<0.002	<0.002	<0.002	<0.002
	6/5–21	<0.002	<0.002	<0.002	0.0032
	9/5–8	<0.002	<0.002	<0.002	<0.002
	11/27–30	<0.002	<0.002	<0.002	<0.002
Magnesium	3/9–17	46	27	41	27
	6/5–21	42	25	16	26
	9/5–8	46	33	49	27
	11/27–30	48	29	20	29

...continued on next page

Table 9-3. Analyses for inorganic constituents in upgradient wells (continued).

	Date	Monitor wells			
		W–017	W–107	W–117	W–268
Manganese	3/9–17	<0.03	<0.03	<0.03	<0.03
	6/5–21	<0.03	<0.03	<0.03	<0.03
	9/5–8	<0.03	<0.03	<0.03	<0.03
	11/27–30	<0.03	<0.03	<0.03	<0.03
Mercury	3/9–17	<0.0002	<0.0002	<0.0002	<0.0002
	6/5–21	<0.0002	<0.0002	<0.0002	<0.0002
	9/5–8	<0.0002	<0.0002	<0.0002	<0.0002
	11/27–30	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	3/9–17	<0.05	<0.05	<0.05	<0.025
	6/5–21	—[a]	—[a]	—[a]	<0.025
	9/5–8	<0.025	<0.025	<0.025	<0.025
	11/27–30	<0.025	<0.025	<0.025	<0.025
Nickel	3/9–17	<0.1	<0.1	<0.1	<0.1
	6/5–21	<0.1	<0.1	<0.1	<0.1
	9/5–8	<0.1	<0.1	<0.1	<0.1
	11/27–30	<0.1	<0.1	<0.1	<0.1
Nitrate (as NO_3)	3/9–17	11	13	<0.5	16
	6/5–21	11	13	0.54	16
	9/5–8	11	13	<0.5	15
	11/27–30	9	8.8	<5	12
Orthophosphate	3/9–17	<1	<1	<1	<1
	6/5–21	<1	<1	<1	<1
	9/5–8	<1	<1	<1	<1
	11/27–30	<10	<10	<10	<10
Potassium	3/9-17	1.6	1.2	2.2	1.5
	6/5–21	1.5	1.1	2.8	1.4
	9/5–8	1.6	2.5	2.5	1.5
	11/27–30	1.7	1.3	2.9	1.6
Selenium	3/9–17	<0.002	<0.002	<0.002	<0.002
	6/5–21	<0.002	<0.002	<0.002	<0.002
	9/5–8	<0.002	<0.002	<0.002	<0.002
	11/27–30	<0.002	<0.002	<0.002	<0.002
Silver	3/9–17	<0.0005	<0.0005	<0.0005	<0.0005
	6/5–21	<0.0005	<0.0005	<0.0005	<0.0005
	9/5–8	<0.01	<0.01	<0.0005	<0.0005
	11/27–30	<0.0005	0.0005	<0.0005	0.0005

...concluded on next page

Table 9-3. Analyses for inorganic constituents in upgradient wells (concluded).

		Monitor wells			
	Date	W–017	W–107	W–117	W–268
Sodium	3/9–17	61	69	66	64
	6/5–21	57	65	63	61
	9/5–8	62	76	74	66
	11/27–30	66	73	68	70
Sulfate	3/9–17	42	24	7.9	29
	6/5–21	45	23	6.1	28
	9/5–8	52	25	6	28
	11/27–30	66	73	68	54
Surfactant	3/9–17	<0.5	<0.5	<0.5	<0.5
	6/5–21	<0.5	<0.5	<0.5	<0.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<0.5	<0.5	<0.5	<0.5
Thallium	3/9–17	<0.005	<0.005	<0.005	<0.005
	6/5–21	<0.001	<0.001	<0.001	<0.001
	9/5–8	<0.001	<0.001	<0.001	<0.001
	11/27–30	<0.001	<0.001	<0.001	<0.001
Vanadium	3/9–17	<0.02	<0.02	<0.02	<0.025
	6/5–21	—[a]	—[a]	—[a]	<0.025
	9/5-8	<0.025	<0.025	<0.025	<0.025
	11/27–30	<0.025	<0.025	<0.025	<0.025
Zinc	3/9–17	<0.05	<0.05	<0.05	<0.05
	6/5–21	<0.05	<0.05	<0.05	<0.05
	9/5–8	<0.05	<0.05	<0.05	<0.05
	11/27–30	<0.05	<0.05	<0.05	<0.05

[a] Analysis not done.

Table 9-4. Analyses for inorganic compounds in downgradient wells in the southeastern corner of the Livermore site, 1995.

		Monitor wells			
	Date	W–217	W–270	W–359	W–622
General indicator parameters					
pH	3/9–17	7.3	7.4	7.2	7.4
	6/5–21	7.5	7.4	7.3	8.2
	9/5–8	7.6	7.4	7.5	8.3
	11/27–30	7.3	7.3	7.2	7.2
Specific conductance (μmhos/cm)	3/9–17	1100	840	600	500
	6/5–21	1000	830	660	520
	9/5–8	1000	760	690	570
	11/27–30	690	870	680	530
Total dissolved solids (mg/L)	3/9–17	980	640	430	360
	6/5–21	1100	540	450	380
	9/5-8	780	540	400	400
	11/27–30	650	540	390	410
Water table elevation (m)	3/9–17	165.15	165.39	164.98	164.11
	6/5–21	165.32	165.25	165.24	164.44
	9/5–8	165.59	165.76	165.47	164.82
	11/27–30	165.76	165.79	165.54	164.92
Metals and minerals (mg/L)					
Bicarbonate alkalinity (as $CaCO_3$)	3/9–17	110	190	140	130
	6/5–21	88	190	140	110
	9/5–8	85	150	140	130
	11/27–30	61	170	140	140
Carbonate alkalinity (as $CaCO_3$)	3/9–17	<1	<1	<1	<1.
	6/5–21	<1	<1	<1	<1.
	9/5–8	<1	<1	<1	<1
	11/27–30	<1	<1	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	3/9–17	<1	<1	<1	<1
	6/5–21	<1	<1	<1	<1
	9/5–8	<1	<1	<1	<1
	11/27–30	<1	<1	<1	<1
Total alkalinity (as $CaCO_3$)	3/9–17	110	190	140	130
	6/5–21	88	190	140	110
	9/5–8	85	150	140	130
	11/27-30	61	170	140	140

...continued on next page

Table 9-4. Analyses for inorganic compounds in downgradient wells in the southeastern corner of the Livermore site, 1995 (continued).

		Monitor wells			
	Date	W–217	W–270	W–359	W–622
Aluminum	3/9–17	<0.2	<0.2	<0.2	<0.2
	6/5–21	<0.2	<0.2	<0.2	<0.2
	9/5–8	<0.2	<0.2	<0.2	<0.2
	11/27–30	<0.2	<0.2	<0.2	<0.2
Antimony	3/9–17	<0.01	<0.01	<0.01	<0.011
	6/5–21	<0.005	<0.005	<0.005	<0.005
	9/5–8	<0.005	<0.005	<0.005	<0.005
	11/27–30	<0.005	<0.005	<0.005	<0.005
Arsenic	3/9–17	0.0027	<0.002	<0.002	<0.002
	6/5–21	<0.002	<0.002	<0.002	<0.002
	9/5–8	<0.002	<0.002	<0.002	<0.002
	11/27–30	0.003	<0.002	<0.002	<0.002
Barium	3/9–17	0.72	0.17	0.17	0.34
	6/5–21	0.57	0.19	0.17	0.37
	9/5–8	0.49	0.18	0.16	0.37
	11/27–30	0.5	0.18	0.16	0.32
Beryllium	3/9–17	<0.0005	<0.0005	<0.0005	<0.0005
	6/5–21	<0.0005	<0.0005	<0.0005	<0.0005
	9/5–8	<0.0005	<0.0005	<0.0005	<0.0005
	11/27–30	<0.0005	<0.0005	<0.0005	<0.0005
Boron	3/9–17	0.12	0.23	0.38	0.21
	6/5–21	0.23	0.31	0.4	0.32
	9/5–8	0.14	0.25	0.33	0.25
	11/27–30	<0.1	0.15	0.35	0.16
Bromide	3/9–17	0.91	<0.5	<0.5	<0.5
	6/5–21	0.89	0.61	0.88	<0.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<5	<5	<5	<5
Cadmium	3/9–17	<0.0005	<0.0005	<0.0005	<0.0005
	6/5–21	<0.0005	<0.0005	<0.0005	<0.0005
	9/5–8	<0.0005	<0.0005	<0.0005	<0.0005
	11/27–30	<0.0005	<0.0005	<0.0005	<0.0005
Calcium	3/9–17	130	62	54	59
	6/5–21	100	49	50	54
	9/5–8	91	48	48	54
	11/27–30	76	59	55	63

...continued on next page

Table 9-4. Analyses for inorganic compounds in downgradient wells in the southeastern corner of the Livermore site, 1995 (continued).

		Monitor wells			
	Date	W–217	W–270	W–359	W–622
Chloride	3/9–17	350	100	120	83
	6/5–21	290	100	110	75
	9/5–8	220	98	120	94
	11/27–30	200	140	140	96
Chromium (VI)	3/9–17	<0.01	0.031	<0.01	<0.01
	6/5–21	<0.01	0.019	<0.01	<0.01
	9/5–8	0.012	0.023	<0.01	<0.01
	11/27–30	0.012	0.017	0.0092	0.0077
Copper	3/9–17	<0.05	<0.05	<0.05	<0.05
	6/5–21	<0.05	<0.05	<0.05	<0.05
	9/5–8	<0.05	<0.05	<0.05	<0.05
	11/27–30	0.0015	<0.001	0.0016	0.0017
Cyanide	3/9–17	<0.02	<0.02	<0.02	<0.02
	6/5–21	<0.02	<0.02	<0.02	<0.02
	9/5–8	<0.02	<0.02	<0.02	<0.02
	11/27–30	<0.02	<0.02	<0.02	<0.02
Fluoride	3/9–17	0.24	0.35	0.31	0.25
	6/5–21	0.26	0.38	0.37	0.23
	9/5–8	0.22	0.31	0.33	0.27
	11/27–30	0.22	0.31	0.31	0.25
Total hardness (as $CaCO_3$)	3/9–17	510	310	230	220
	6/5–21	400	250	210	200
	9/5–8	360	240	210	200
	11/27–30	300	280	240	240
Iron	3/9–17	<0.1	<0.1	<0.1	<0.1
	6/5–21	<0.1	<0.1	<0.1	<0.1
	9/5–8	<0.1	<0.1	<0.1	<0.1
	11/27–30	<0.1	<0.1	<0.1	<0.1
Lead	3/9–17	<0.002	<0.002	<0.002	<0.002
	6/5–21	<0.002	<0.002	<0.002	<0.002
	9/5–8	<0.002	<0.002	<0.002	<0.002
	11/27–30	<0.002	<0.002	<0.002	<0.002

...continued on next page

Table 9-4. Analyses for inorganic compounds in downgradient wells in the southeastern corner of the Livermore site, 1995 (continued).

		Monitor wells			
	Date	W–217	W–270	W–359	W–622
Magnesium	3/9–17	45	37	23	17
	6/5–21	34	30	21	16
	9/5–8	31	29	22	16
	11/27–30	26	33	24	20
Manganese	3/9–17	<0.03	<0.03	<0.03	<0.03
	6/5–21	<0.03	<0.03	<0.03	<0.03
	9/5–8	<0.03	<0.03	<0.03	<0.03
	11/27–30	<0.03	<0.03	<0.03	<0.03
Mercury	3/9–17	<0.0002	<0.0002	<0.0002	<0.0002
	6/5–21	<0.0002	<0.0002	<0.0002	<0.0002
	9/5–8	<0.0002	<0.0002	<0.0002	<0.0002
	11/27–30	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	3/9–17	<0.05	<0.05	<0.05	<0.025
	6/5–21	<0.025	<0.025	<0.025	<0.025
	9/5–8	<0.025	<0.025	<0.025	<0.025
	11/27–30	<0.025	<0.025	<0.025	<0.025
Nickel	3/9–17	<0.1	<0.1	<0.1	<0.1
	6/5–21	<0.1	<0.1	<0.1	<0.1
	9/5–8	<0.1	<0.1	<0.1	<0.1
	11/27–30	<0.1	<0.1	<0.1	<0.1
Nitrate (as NO_3)	3/9–17	46	15	14	19
	6/5–21	39	18	15	17
	9/5–8	42	17	15	18
	11/27–30	29	12	14	12
Orthophosphate	3/9–17	<1	<1	<1	<1
	6/5–21	<1	<1	<1	<1
	9/5–8	<1	<1	<1	<1
	11/27–30	<1	<1	<1	<1
Potassium	3/9–17	2.6	2.4	1.8	2.9
	6/5–21	2.4	2.2	1.7	2.8
	9/5–8	2.5	2.2	1.8	2.8
	11/27–30	2.2	2.3	1.9	2.8
Selenium	3/9–17	<0.002	<0.002	<0.002	<0.002
	6/5–21	<0.002	<0.002	<0.002	<0.002
	9/5–8	<0.002	<0.002	<0.002	<0.002
	11/27–30	<0.002	<0.002	<0.002	<0.002

...concluded on next page

Table 9-4. Analyses for inorganic compounds in downgradient wells in the southeastern corner of the Livermore site, 1995 (concluded).

		Monitor wells			
	Date	W–217	W–270	W–359	W–622
Silver	3/9–17	<0.0005	<0.0005	<0.0005	<0.0005
	6/5–21	<0.0005	<0.0005	<0.0005	<0.0005
	9/5–8	<0.0005	<0.0005	<0.0005	<0.0005
	11/27–30	<0.0005	<0.0005	<0.0005	<0.0005
Sodium	3/9–17	54	100	61	35
	6/5–21	49	96	58	37
	9/5–8	48	93	62	36
	11/27–30	46	97	66	39
Sulfate	3/9–17	5.2	160	28	18
	6/5–21	9.5	96	27	16
	9/5–8	11	83	28	18
	11/27–30	10	160	60	15
Surfactant	3/9–17	<0.5	<0.5	<0.5	<0.5
	6/5–21	<0.5	<0.5	<0.5	<0.5
	9/5–8	<0.5	<0.5	<0.5	<0.5
	11/27–30	<0.5	<0.5	<0.5	<0.5
Thallium	3/9–17	<0.005	<0.005	<0.005	<0.005
	6/5–21	<0.001	<0.001	<0.001	<0.001
	9/5–8	<0.001	<0.001	<0.001	<0.001
	11/27–30	<0.001	<0.001	<0.001	<0.001
Vanadium	3/9–17	<0.02	<0.02	<0.02	<0.02
	6/5–21	<0.025	<0.025	<0.025	<0.025
	9/5–8	<0.025	<0.025	<0.025	<0.025
	11/27–30	<0.025	<0.025	<0.025	<0.025
Zinc	3/9–17	<0.05	<0.05	<0.05	<0.05
	6/5–21	<0.05	<0.05	<0.05	<0.05
	9/5–8	<0.05	<0.05	<0.05	<0.05
	11/27–30	<0.05	<0.05	<0.05	<0.05

Table 9-5. Radiological analyses for upgradient wells in the southeastern corner of the Livermore site, 1995.

			Monitor wells			
	Date	MCL[a]	W–017	W–107	W–117	W–268
Gross alpha (Bq/L)	3/9–17	0.56	0.0562	–0.0361	0.0213	–0.00363
	6/5–21		–0.0135	–0.0114	–0.0392	–0.0388
	9/5–8		0.0977	–0.0411	–0.0681	–0.0282
	11/27–30		0.119	0.03	0.013	0.00729
Gross beta (Bq/L)	3/9–17	1.85	0.146	0.0507	0.272	0.0866
	6/5–21		0.37	0.137	0.297	0.221
	9/5–8		0.186	0.0788	0.0536	0.0518
	11/27–30		0.217	0.101	0.107	0.0881
Radioisotopes						
^{238}Pu (mBq/L)	3/9–17	None	0.0388	0.0492	–0.00252	–0.0201
	6/5–21		0.0958	–0.057	0.154	0.0208
	9/5–8		0.194	0.0211	0.107	0.173
	11/27–30		0.418	0.105	–0.00429	0.102
^{239,240}Pu (mBq/L)	3/9–17	None	–0.0138	–0.0233	0.04	0.0176
	6/5–21		0.105	–0.0633	0.0625	0.0208
	9/5–8		0.169	–0.084	0.0622	–0.205
	11/7		0.0881	–0.00437	–0.0385	0.0255
^{226}Ra (Bq/L)	3/9–17	0.185	0.0266	0.00762	0.0182	0.00187
	6/5–21		0.0111	0.00183	0.0111	0.00167
	9/5–8		0.105	0.0544	0.0544	0.0403
	11/27–30		0.0444	0.0313	0.0596	0.0559
^{228}Th (mBq/L)	3/9–17	None	0.648	–0.836	2.53	1.75
	6/5–21		2.09	0.899	0.899	0.77
	9/5–8		0.625	0.733	0.00811	0.311
	11/27–30		0.448	0.34	0.625	–0.0503
^{232}Th (mBq/L)	3/9–17	None	0.0307	0.566	0.818	–1.26
	6/5–21		0.313	0.275	6.88	1.22
	9/5–8		0.192	0.181	0.0459	0.0666
	11/27–30		0.0307	–0.0544	0.0947	0.0966
Tritium (Bq/L)	3/9–17	740	<1.59	1.81	<1.61	<1.62
	6/5–21		<1.78	2.46	<1.84	<1.86
	9/5–8		2.63	2.64	2.51	2.51
	11/27–30		2.97	2.56	3.0	2.13

...concluded on next page

Table 9-5. Radiological analyses for upgradient wells in the southeastern corner of the Livermore site, 1995 (concluded).

			Monitor wells			
	Date	MCL[a]	W–017	W–107	W–117	W–268
^{234}U (Bq/L)	3/9–17	0.74	0.104	0.0317	0.0451	0.0265
	6/5–21		0.0907	0.0403	0.0166	0.03
	9/5–8		0.121	0.0392	0.031	0.0303
	11/27–30		0.111	0.0332	0.0134	0.0282
^{235}U (Bq/L)	3/9–17	0.74	0.00312	0.00117	0.0013	0.000814
	6/5–21		0.00268	0.00358	0.000377	0.000238
	9/5–8		0.00385	0.00188	0.000289	0.000485
	11/27–30		0.0024	0.00184	0.000969	0.00135
^{238}U (Bq/L)	3/9–17	0.74	0.0648	0.0204	0.0241	0.016
	6/5–21		0.0614	0.0251	0.00696	0.0159
	9/5–8		0.0773	0.0264	0.0167	0.0171
	11/27–30		0.0644	0.0206	0.0077	0.0172

[a] MCL = Maximum allowable contaminant level.

Table 9-6. Radiological analyses for downgradient wells in the southeastern corner of the Livermore site, 1995.

			Monitor wells			
		MCL[a]	W–217	W–270	W–359	W–622
Gross alpha (Bq/L)	3/9–17	0.56	–0.0736	0.0116	–0.00518	–0.0126
	6/5–21		–0.0681	0.0167	–0.0555	–0.02
	9/5–8		–0.0451	–0.0692	–0.0255	–0.0655
	11/27–30		0.00273	0.0807	0.0396	0.0344
Gross beta (Bq/L)	3/9–17	1.85	0.113	0.159	0.0426	0.141
	6/5–21		0.0662	0.158	0.0455	0.103
	9/5–8		0.199	0.0211	–0.00221	0.0308
	11/27–30		0.171	0.125	0.0921	0.139
Radioisotopes:						
^{238}Pu (mBq/L)	3/9–17	None	0.0363	–0.0138	–0.0574	–0.0414
	6/5–21		0.0585	–0.00781	0.0448	0.11
	9/5–8		–0.173	–0.0799	0.451	0.0585
	11/27–30		0.007	–0.00728	–0.00264	0.0014
^{239,240}Pu (mBq/L)	3/9–17	None	0.0585	–0.00781	0.0448	–0.0305
	6/5–21		–0.00903	0.0176	–0.0503	–0.0305
	9/5–8		–0.0688	–0.0133	–0.0696	–0.161
	11/27–30		–0.00093	0.00131	0.0470	0.000877
^{226}Ra (Bq/L)	3/9–17	0.185	0.00362	0.0218	0.00224	0.00522
	6/5–21		0.00437	0.00544	0.00137	0.00803
	9/5–8		0.122	0.0253	0.0236	0.0411
	11/27–30		0.0466	0.0184	0.0444	0.0548
^{228}Th (mBq/L)	3/9–17	None	0.666	2.94	0.175	–0.636
	6/5–21		1.41	1.32	1.62	2.34
	9/5–8		0.722	0.111	0.112	0.477
	11/27–30		0.566	0.0574	0.206	0.282
^{232}Th (mBq/L)	3/9–17	None	0.4	1.04	–0.316	0.574
	6/5–21		1.46	0.0766	3.56	2.03
	9/5–8		0.0559	–0.0198	0.0525	–0.121
	11/27–30		0.136	–0.0551	–0.122	–0.106
Tritium (Bq/L)	3/9–17	740	28.8	1.63	15.4	19.4
	6/5–21		17.7	1.86	11.3	16.1
	9/5–8		11.6	2.52	19	18.2
	11/27–30		8.95	2.03	13.7	13.1

...concluded on next page

Table 9-6. Radiological analyses for downgradient wells in the southeastern corner of the Livermore site, 1995 (concluded).

			Monitor wells			
		MCL[a]	W–217	W–270	W–359	W–622
^{234}U (Bq/L)	3/9–17	0.74	0.022	0.0599	0.0213	0.0151
	6/5–21		0.0221	0.0496	0.0209	0.0121
	9/5–8		0.0235	0.0511	0.025	0.0171
	11/27–30		0.019	0.0533	0.0206	0.0162
^{235}U (Bq/L)	3/9–17	0.74	0.000781	0.00171	0.000807	0.000429
	6/5–21		0.000714	0.000747	0.000198	0.000836
	9/5–8		0.000855	0.00169	0.000829	0.000688
	11/27–30		0.000733	0.00151	0.000555	0.000832
^{238}U (Bq/L)	3/9–17	0.74	0.0141	0.0364	0.013	0.0105
	6/5–21		0.0107	0.0283	0.0111	0.00803
	9/5–8		0.0162	0.0307	0.0158	0.012
	11/27–30		0.0122	0.0299	0.0133	0.0094

[a] MCL = Maximum allowable contaminant level.

10. Soil and Sediment Monitoring

Gretchen M. Gallegos

Soil Methods

Prior to 1988, soil samples were collected at sites selected at random from Livermore Valley locations previously sampled for a 1971–1972 study. That earlier study 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 with contaminants from past incidents or of other special concern. In 1991, five additional soil sampling locations associated with air sampling locations were established. The 1995 Livermore site soil samples were collected from the same locations as those in 1991 to 1994. The 1995 Site 300 soil samples were collected from the same 14 sampling locations as in 1990 to 1994. The use of constant sampling locations from year to year allows more meaningful trending of data.

Sampling locations at areas with known or suspected contaminants were monitored to delimit the extent of the contaminants and to track the contaminants from year to year. For example, six soil sampling locations were located near the Livermore Water Reclamation Plant (LWRP) to monitor soils that contain slightly elevated plutonium levels originating from a 1967 accidental release to the sewer.

Soil sampling is conducted according to written, standardized procedures contained in the *Environmental Monitoring Plan* (Tate et al. 1995). Samples are collected from undisturbed areas near the permanent sampling location marker. These areas generally are level, free of rocks, and are unsheltered by trees or buildings. The sampling technician chooses two 1-m squares from which to collect the sample and records how far away and in what direction from the permanent marker the sample is collected. Each sample is a composite consisting of 10 subsamples that are collected with a 8.25-cm-diameter stainless steel core sampler at the four corners and the center of each square. All subsamples are collected from the top 5 cm of soil because surface deposition from the air is the primary pathway for potential contamination.

Quality assurance (QA) samples are submitted with each batch of soil samples. Two identical samples are collected and, at locations chosen for duplicate sampling, adjacent cores are collected from the corners and center of the sampling squares. Separate composites of 10 cores each are made, and the duplicate samples are identified with unique sample identifier codes.

Samples are delivered to LLNL's Chemistry and Materials Sciences Environmental Services (CES) laboratory for analyses. Soil samples are dried, ground, sieved, and blended. The plutonium content of a sample aliquot is determined by alpha spectroscopy (Hall and Edwards 1994). Other sample aliquots (300 g) are analyzed for more than 150 radionuclides by gamma spectroscopy, using a high-purity germanium (HPGe) detector (Hall and Edwards 1994). The 10-g subsamples of samples from Site 300 are sent to a contract analytical laboratory and are analyzed by graphite-furnace atomic absorption spectroscopy for beryllium. Chain-of-custody procedures are followed throughout the sampling, delivery, and analytical processes.

Sediment Methods

Samples of recent sediment are collected annually from drainages at and around the Livermore site after the cessation of spring runoff. For 1995, samples were analyzed for radionuclides. The analytical results from 5 years of sediment sampling for heavy metals and organic compounds did not yield sufficient evidence of contamination to warrant further yearly sampling for these materials (Tate et al. 1995). A new monitoring program conducted in arroyo channels as part of the Ground Water Protection Management Plan will be instituted in 1996 to determine if materials present in the channels could lead to contamination of the ground water.

Sediment was sampled from seven Livermore-site drainages. The sediment sampling locations coincide with storm water runoff sampling locations so it would be possible to compare the sampling results from these two media.

A culvert, bridge, or other permanent marker serves as a reference point for each sampling location. Ten subsamples, 5-cm deep, are collected at 1-m intervals along a transect of the arroyo or drainage channel. At one of the subsample locations, a 15-cm deep sample is acquired for tritium analysis. The sample collection technicians record how far away and in what direction from the permanent marker the samples are actually collected. As with soils samples, QA samples are submitted with each batch of sediment samples.

Samples are delivered to LLNL's CES laboratory for analysis. For samples collected for tritium analyses, CES uses freeze-drying techniques to recover water from the samples and determines the tritium content of the water by liquid-scintillation counting. The plutonium content of a sample aliquot is determined by alpha spectroscopy. Other sample aliquots are analyzed for more than 150 radionuclides using gamma spectroscopy as described above for soil samples. The radioanalytical methods employed by the CES laboratory enable detection of concentrations at levels far more sensitive than regulatory limits. Chain-of-custody procedures are followed throughout the sampling, delivery, and analytical processes.

Data

Table 10-1 presents the analytical data for radionuclides and beryllium for soils and sediments samples collected in 1995. The data generally reflect historic data values for these analytes at these locations. A detailed discussion of these results is provided in Volume 1 of this report.

Table 10-1. Radionuclides and beryllium in soils and sediments, 1995.

	Plutonium-239 10^{-3} Bq/dry g	Americium-241[a] Bq/dry g	Cobalt-60[b] 10^{-3} Bq/dry g	Cesium-137 10^{-3} Bq/dry g	Potassium-40 Bq/dry g
Livermore Valley soils					
L-ALTA-SO	0.26 ± 0.030	—[a]	—[b]	0.94 ± 0.31	0.640 ± 0.022
L-CAFE-SO	0.63 ± 0.035	—[a]	—[b]	2.6 ± 0.2	0.429 ± 0.012
L-COW-SO	0.028 ± 0.005	—[a]	—[b]	0.44 ± 0.13	0.592 ± 0.017
L-ERCH-SO	0.090 ± 0.010	—[a]	—[b]	4.7 ± 0.2	0.347 ± 0.012
L-FCC-SO	0.077 ± 0.008	—[a]	—[b]	2.8 ± 0.2	0.463 ± 0.037
L-HOSP-SO	0.13 ± 0.01	—[a]	—[b]	4.8 ± 0.3	0.500 ± 0.016
L-MESQ-SO	0.041 ± 0.006	—[a]	—[b]	1.2 ± 0.2	0.525 ± 0.015
L-MET-SO	0.050 ± 0.007	—[a]	—[b]	1.8 ± 0.2	0.551 ± 0.024
L-NEP-SO	0.081 ± 0.008	—[a]	—[b]	2.6 ± 0.3	0.463 ± 0.011
L-PATT-SO	0.018 ± 0.004	—[a]	—[b]	1.0 ± 0.2	0.585 ± 0.022
L-RRCH-SO	0.031 ± 0.005	—[a]	—[b]	8.1 ± 0.5	0.474 ± 0.012
L-SALV-SO	0.27 ± 0.02	—[a]	—[b]	2.8 ± 0.2	0.463 ± 0.016
L-TANK-SO	0.15 ± 0.01	—[a]	—[b]	4.9 ± 0.3	0.374 ± 0.010
L-VIS-SO	1.1 ± 0.1	—[a]	—[b]	1.5 ± 0.2	0.437 ± 0.017
L-ZON7-SO	0.22 ± 0.02	—[a]	—[b]	4.1 ± 0.3	0.507 ± 0.014
Median	**0.090**			**2.6**	**0.474**
Interquartile range	**0.19**			**3.1**	**0.089**
LWRP soils					
L-WRP1-SO	25 ± 1.0	0.008 ± 0.002	0.36 ± 0.12	6.2 ± 0.3	0.332 ± 0.013
L-WRP2-SO	8.8 ± 0.3	<0.002	0.45 ± 0.21	7.4 ± 0.3	0.459 ± 0.014
L-WRP3-SO	5.3 ± 0.2	<0.002	<0.065	2.5 ± 0.2	0.370 ± 0.010
L-WRP4-SO	1.4 ± 0.1	<0.002	<0.067	0.63 ± 0.2	0.403 ± 0.019
L-WRP5-SO	0.33 ± 0.04	<0.001	<0.049	0.38 ± 0.1	0.302 ± 0.011
L-WRP6-SO	1.7 ± 0.1	<0.001	<0.097	1.2 ± 0.3	0.407 ± 0.017
Median	**3.5**	**<0.002**	**<0.082**	**1.8**	**0.386**
Interquartile range	**6.4**	**—[h]**	**—[h]**	**4.5**	**0.065**
Livermore site sediments					
L-ALPE-SD	2.3 ± 0.2	—[a]	—[b]	1.4 ± 0.3	0.481 ± 0.020
L-ASS2-SD	0.017 ± 0.007	—[a]	—[b]	0.63 ± 0.19	0.488 ± 0.015
L-ASW-SD	0.006 ± 0.002	—[a]	—[b]	<0.09	0.492 ± 0.017
L-CDB-SD	0.074 ± 0.009	—[a]	—[b]	0.74 ± 0.19	0.392 ± 0.013
L-ESB-SD	3.3 ± 0.1	—[a]	—[b]	0.80 ± 0.23	0.481 ± 0.014
L-GRNE-SD	0.070 ± 0.008	—[a]	—[b]	0.92 ± 0.15	0.492 ± 0.016
L-WPDC-SD	0.022 ± 0.005	—[a]	—[b]	0.12 ± 0.10	0.529 ± 0.016
Median	**0.07**			**0.74**	**0.488**
Interquartile range	**1.2**			**0.48**	**0.011**

....continued on next page

Table 10-1. Radionuclides and beryllium in soils and sediments, 1995 (continued).

	Thorium-232 [c] µg/dry g	Uranium-235[d] µg/dry g	Uranium-238[e] µg/dry g	Tritium[f] Bq/L	Beryllium[g] mg/kg
Livermore Valley soils					
L-ALTA-SO	10 ± 0.3	0.025 ± 0.007	2.5 ± 0.9	—[f]	—[g]
L-CAFE-SO	4.8 ± 0.1	0.016 ± 0.004	1.7 ± 1.0	—[f]	—[g]
L-COW-SO	5.9 ± 0.2	0.018 ± 0.005	1.9 ± 0.6	—[f]	—[g]
L-ERCH-SO	6.1 ± 0.2	0.016 ± 0.005	1.9 ± 1.1	—[f]	—[g]
L-FCC-SO	6.2 ± 0.2	0.021 ± 0.005	1.7 ± 0.9	—[f]	—[g]
L-HOSP-SO	6.0 ± 0.2	0.018 ± 0.007	1.2 ± 0.5	—[f]	—[g]
L-MESQ-SO	6.7 ± 0.3	0.025 ± 0.006	2.0 ± 0.9	—[f]	—[g]
L-MET-SO	6.0 ± 0.2	0.023 ± 0.006	2.0 ± 0.6	—[f]	—[g]
L-NEP-SO	5.5 ± 0.2	0.018 ± 0.004	1.7 ± 0.6	—[f]	—[g]
L-PATT-SO	8.1 ± 0.3	0.023 ± 0.007	2.8 ± 1.0	—[f]	—[g]
L-RRCH-SO	6.5 ± 0.2	<0.018	1.7 ± 0.9	—[f]	—[g]
L-SALV-SO	7.3 ± 0.2	0.021 ± 0.005	2.2 ± 0.7	—[f]	—[g]
L-TANK-SO	5.9 ± 0.2	0.017 ± 0.004	1.7 ± 0.9	—[f]	—[g]
L-VIS-SO	7.2 ± 0.3	0.022 ± 0.007	1.8 ± 1.2	—[f]	—[g]
L-ZON7-SO	7.8 ± 0.2	0.021 ± 0.004	<1.5	—[f]	—[g]
Median	**6.2**	**0.021**	**1.8**		
Interquartile range	**1.3**	**0.005**	**0.3**		
LWRP soils					
L-WRP1-SO	5.2 ± 0.2	0.023 ± 0.004	2.9 ± 0.52	—[f]	—[g]
L-WRP2-SO	7.1 ± 0.2	0.029 ± 0.005	2.1 ± 1.20	—[f]	—[g]
L-WRP3-SO	5.8 ± 0.3	0.023 ± 0.006	2.3 ± 1.30	—[f]	—[g]
L-WRP4-SO	7.2 ± 0.2	0.018 ± 0.005	1.5 ± 1.12	—[f]	—[g]
L-WRP5-SO	5.5 ± 0.2	0.016 ± 0.004	1.6 ± 0.63	—[f]	—[g]
L-WRP6-SO	6.5 ± 0.2	0.021 ± 0.006	2.0 ± 0.70	—[f]	—[g]
Median	**6.1**	**0.022**	**2.1**		
Interquartile range	**1.3**	**0.004**	**0.5**		
Livermore site sediments					
L-ALPE-SD	8.0 ± 0.2	0.024 ± 0.005	2.0 ± 0.6	4.8 ± 2.4	—[g]
L-ASS2-SD	5.4 ± 0.2	0.016 ± 0.004	1.4 ± 1.1	8.6 ± 2.6	—[g]
L-ASW-SD	8.2 ± 0.2	<0.018	1.6 ± 0.7	6.3 ± 2.5	—[g]
L-CDB-SD	5.3 ± 0.2	<0.015	<1.0	14 ± 3	—[g]
L-ESB-SD	7.8 ± 0.3	0.024 ± 0.005	3.0 ± 1.2	20 ± 3	—[g]
L-GRNE-SD	5.2 ± 0.3	0.020 ± 0.004	1.9 ± 0.8	4.0 ± 2.4	—[g]
L-WPDC-SD	4.9 ± 0.3	0.020 ± 0.006	1.6 ± 1.1	5.2 ± 2.5	—[g]
Median	**5.4**	**0.019**	**1.6**	**6.3**	
Interquartile range	**2.7**	**—[h]**	**0.4**	**6.3**	

....continued on next page

Table 10-1. Radionuclides and beryllium in soils and sediments, 1995 (continued).

	Plutonium-239 10^{-3} Bq/dry g	Americium-241[a] Bq/dry g	Cobalt-60[b] 10^{-3} Bq/dry g	Cesium-137 10^{-3} Bq/dry g	Potassium-40 Bq/dry g
Site 300 soils					
3-801E-SO	0.051 ± 0.009	—[a]	—[b]	1.9 ± 0.3	0.511 ± 0.019
3-801N-SO	0.19 ± 0.014	—[a]	—[b]	7.4 ± 0.4	0.629 ± 0.018
3-801W-SO	0.070 ± 0.011	—[a]	—[b]	2.5 ± 0.3	0.459 ± 0.018
3-812N-SO	0.14 ± 0.01	—[a]	—[b]	5.2 ± 0.4	0.481 ± 0.013
3-834W-SO	0.055 ± 0.008	—[a]	—[b]	2.0 ± 0.3	0.400 ± 0.018
3-834W-SO (reanalysis)	—[i]	—[i]	—[i]	—[i]	—[i]
3-834W2-SO (resample)	—[i]	—[i]	—[i]	—[i]	—[i]
3-851N-SO	0.17 ± 0.02	—[a]	—[b]	6.8 ± 0.3	0.603 ± 0.025
3-856N-SO	0.17 ± 0.02	—[a]	—[b]	7.0 ± 0.3	0.562 ± 0.016
3-858S-SO	0.095 ± 0.016	—[a]	—[b]	3.5 ± 0.3	0.429 ± 0.013
3-DSW-SO	0.025 ± 0.008	—[a]	—[b]	1.0 ± 0.3	0.403 ± 0.011
3-EOBS-SO	0.052 ± 0.008	—[a]	—[b]	1.3 ± 0.3	0.422 ± 0.019
3-EVAP-SO	0.16 ± 0.03	—[a]	—[b]	6.0 ± 0.3	0.470 ± 0.017
3-GOLF-SO	0.20 ± 0.02	—[a]	—[b]	7.1 ± 0.4	0.611 ± 0.013
3-NPS-SO	0.19 ± 0.02	—[a]	—[b]	7.1 ± 0.3	0.474 ± 0.015
3-WOBS-SO	0.17 ± 0.02	—[a]	—[b]	5.6 ± 0.4	0.625 ± 0.033
Median	**0.15**			**5.4**	**0.477**
Interquartile range	**0.12**			**4.8**	**0.156**

...concluded on next page

Note: Radionuclides with 100% error are reported as less than the measured value.

a Americium-241 only detected in LWRP samples.

b Cobalt-60 is only detected in LWRP samples.

c Thorium-232 activities in Bq/dry g can be determined by dividing the weight in µg/dry g by 247.3, and pCi/dry g can be determined by dividing by 9.15.

d Uranium-235 activities in Bq/dry g can be determined by dividing the weight in µg/dry g by 12.5, and pCi/dry g can be determined by dividing by 0.463.

Table 10-1. Radionuclides and beryllium in soils and sediments, 1995 (concluded).

	Thorium-232 [c] µg/dry g	Uranium-235[d] µg/dry g	Uranium-238[e] µg/dry g	Tritium[f] Bq/L	Beryllium[g] mg/kg
Site 300 soils					
3-801E-SO	10 ± 0.3	<0.026	<2.7	—[f]	0.77
3-801N-SO	10 ± 0.4	0.063 ± 0.009	24 ± 3	—[f]	0.85
3-801W-SO	12 ± 0.4	0.034 ± 0.010	8.6 ± 2.8	—[f]	1.3
3-812N-SO	10 ± 0.4	0.016 ± 0.004	2.6 ± 1.3	—[f]	1.4
3-834W-SO	13 ± 0.5	0.33 ± 0.02	140 ± 10	—[f]	5.7
3-834W-SO (reanalysis)	—[i]	0.34 ± 0.02	140 ± 10	—[f]	1.5
3-834W2-SO (resample)	—[i]	<0.025	<2.1	—[f]	1.6
3-851N-SO	9.3 ± 0.3	0.030 ± 0.009	3.2 ± 1.7	—[f]	0.79
3-856N-SO	9.2 ± 0.4	0.028 ± 0.006	3.4 ± 0.8	—[f]	0.81
3-858S-SO	10 ± 0.4	0.025 ± 0.006	2.5 ± 0.9	—[f]	1.2
3-DSW-SO	8.8 ± 0.2	0.025 ± 0.006	2.5 ± 0.6	—[f]	1.0
3-EOBS-SO	9.1 ± 0.3	0.024 ± 0.008	2.7 ± 2.7	—[f]	1.2
3-EVAP-SO	8.4 ± 0.4	0.036 ± 0.008	4.7 ± 1.5	—[f]	0.87
3-GOLF-SO	9.4 ± 0.3	<0.021	1.6 ± 0.6	—[f]	0.68
3-NPS-SO	8.0 ± 0.2	0.016 ± 0.004	1.8 ± 0.8	—[f]	0.79
3-WOBS-SO	8.3 ± 0.3	0.025 ± 0.006	1.9 ± 0.6	—[f]	0.62
Median	**9.4**	**<0.025**	**<2.7**		**0.9**
Interquartile range	**1.3**	—[h]	—[h]		**0.5**

Note: Radionuclides with 100% error are reported as less than the measured value.

e Uranium-238 activities in Bq/dry g can be determined by dividing the weight in µg/dry g by 80.3, and pCi/dry g can be determined by dividing by 2.97.

f Tritium analysis is only conducted on sediment samples.

g Beryllium analysis is only conducted on Site 300 soils samples; the analysis is a chemical, not a radiochemical analysis.

h Interquartile range could not be calculated.

i Reanalysis and resample were conducted to investigate elevated levels of uranium and slightly elevated levels of beryllium. See Vol. 1, Ch. 10.

11. Vegetation and Foodstuff Monitoring

Gretchen M. Gallegos
Joel H. White

Vegetation Sampling Methods

When obtaining vegetation samples, LLNL avoids frequently tilled or disturbed areas and locations near buildings or other obstructions. Areas with unusual wind, precipitation, or irrigation influences also are avoided. Practical considerations also temper the location selections. These include access during inclement weather, personnel safety in vehicle operation, vehicle parking, or sample collection requirements.

The selected areas are unshaded and exhibit native vegetation for much of the year. The routine vegetation sampling locations are designated with permanent location markers. Consistent use of the same general sampling locations allows for more meaningful trending of data and closer monitoring of areas of concern. For example, every year at Site 300, LLNL examines vegetation from areas where tritium is known to be present in the subsurface soil.

In 1995, vegetation samples usually consisted of the green leaves and green stems of annual grasses. Other herbaceous vegetation or even perennial vegetation was sampled if grasses were not available. Approximately 0.5 to 1 kg of vegetation was collected for analysis. Standard chain-of-custody procedures were followed (Tate et al. 1995).

Samples are delivered on the day of collection to LLNL's Chemistry and Materials Science's Environmental Services laboratory and are kept frozen prior to processing. Water from the vegetation is collected using freeze-drying techniques (lyophilization), and the tritium content of the water is determined by liquid-scintillation counting.

Approximately 10% of the sites are sampled in duplicate to comply with quality assurance protocols (Garcia and Failor 1993). Duplicate samples are preserved, stored, processed, and analyzed with methods identical to those employed for all other samples.

Wine Sampling Methods

Wine samples were purchased in 750-mL to 1-L bottles. One wine from six of the eight non-Livermore, California, wine growing regions and one wine from four of the thirteen European wine growing regions was purchased and submitted for tritium analyses. The selection of samples from all the wines available within a geographic area was random. Any estate wine from a designated area was considered representative of that area. The most recent vintages available were

collected, with an equal mix of red and white wines. Approximately 10% of the total complement of wines were sampled in duplicate to comply with quality assurance protocols. Because of the importance of the wine sampling network, LLNL sampled and analyzed as many of the available Livermore Valley wines as possible. Twelve Livermore Valley estate wines not previously sampled were purchased and analyzed.

The wine samples were submitted for analysis unopened to prevent airborne tritium contamination. Chain-of-custody procedures were followed when delivering samples and throughout the analytical process. Wines were analyzed for tritium using ^{3}He mass spectrometry in the LLNL Isotope Sciences Division Noble Gas Mass Spectrometry Laboratory (Surano et al. 1991). LLNL used this highly sensitive method for the wine analysis to determine the small differences in the tritium content of the samples. Had less sensitive methods been used, such as those employed by commercial analytical laboratories, the tritium content of all samples would be near or below detection limits and no differences would be apparent.

Table 11-1. Tritium (in Bq/L) in vegetation, 1995.

	First quarter	Second quarter	Third quarter	Fourth quarter	Median	Interquar-tile range	Dose (μSv/y)
Sampling locations near Livermore site							
AQUE	27 ± 2.6	78 ± 3.5	6.4 ± 2.2	11 ± 2.3	19	30	0.090
VIS	21 ± 2.5	20 ± 2.2	11 ± 2.4	14 ± 2.4	17	7.3	0.080
RAIL	5.5 ± 2.0	<1.5	2.9 ± 2.1	9.1 ± 2.3	4.2	3.8	0.020
MET	2.9 ± 1.9	2.9 ± 1.6	3.7 ± 2.1	5.1 ± 2.1	3.3	1.1	0.016
MESQ	4.4 ± 1.9	8.2 ± 1.8	<2.0	13 ± 2.4	6.3	5.7	0.030
GARD	6.5 ± 2.0	3.7 ± 1.6	<2.0	2.4 ± 2.0	3.1	2.0	0.015
Sampling locations an intermediate distance from Livermore site							
PATT	<1.8	3.4 ± 1.6	<2.1	3.3 ± 2.1	<2.7	1.3	<0.013
ZON7	12 ± 2.2	5.0 ± 1.7	6.1 ± 2.2	6.3 ± 2.2	6.2	1.9	0.030
I580	<1.8	<1.5	5.7 ± 2.2	7.3 ± 2.2	<3.7	4.4	<0.018
TESW	4.8 ± 1.9	<1.5	<2.0	<2.0	<2.0	—[a]	<0.010
Sampling locations far from Livermore site							
FCC	2.1 ± 1.9	<1.5	<2.0	<2.0	<2.0	—[a]	<0.010
PARK	<1.8	2.0 ± 1.6	3.0 ± 2.1	<2.0	<2.0	0.3	<0.010
CAL	2.2 ± 1.9	<1.5	<2.0	<2.0	<2.0	—[a]	<0.010
Sampling locations at Site 300							
CARN	2.0 ± 1.8	<1.7	<2.1	<2.2	<2.1	—[a]	<0.010
GOLF	<1.8	2.7 ± 1.8	<2.1	<2.2	<2.1	—[a]	<0.010
GEO	<1.8	<1.7	<2.0	<2.2	<1.9	—[a]	<0.009
DSW	<1.7	39 ± 3	5.1 ± 2.2	530 ± 10	22	160	0.11
801E	2.3 ± 1.8	<1.7	2.9 ± 2.1	<2.2	<2.2	0.4	<0.011
EVAP	<1.7	64 ± 3.3	14 ± 2.6	10 ± 2.5	12	18	0.059

Note: Maps of sampling locations are provided in Volume 1, Figures 11-1 and 11-2.

[a] Insufficient data to calculate interquartile range.

Table 11-2. Tritium (in Bq/L) in retail wine, 1995.[a]

Sample	Area of production		
	Livermore Valley	**California**	**Europe**
1	1.56 ± 0.24	0.45± 0.14	1.75 ± 0.26
2	1.91 ± 0..27	0.41 ± 0.11	2.76 ± 0.33
3	2.16 ± 0.28	0.42 ± 0.19	1.18 ± 0.22
4	1.49 ± 0.24	1.21 ± 0.22	2.00 ± 0.19
5	2.43 ± 0.31	0.74 ± 0.20	
6	4.03 ± 0.44	0.44 ± 0.19	
7	4.85 ± 0.37		
8	6.02 ± 0.63		
9	3.66 ± 0.29		
10	2.51 ± 0..22		
11	5.05 ± 0.54		
12	2.69 ± 0.23		
Median	**2.60**	**0.45**	**1.87**
Interquartile range	**2.14**	**0.22**	**0.58**
Mean	**3.20**	**0.62**	**1.92**
Standard deviation	**1.50**	**0.31**	**0.66**

Note: radionuclide results are reported $\pm 2\sigma$ in Bq/L. See Chapter 14, Quality Assurance.

[a] Wines from a variety of vintages were purchased and analyzed during 1995. The concentrations shown are not decay-corrected to vintage year.

12. Environmental Radiation Monitoring

Barbara C. Fields
Joel H. White

Methods of Gamma Radiation Monitoring

External doses from gamma radiation are monitored at 14 Livermore site perimeter locations, 23 Livermore Valley locations, and 10 Site 300 perimeter locations. Each quarter the TLDs are exchanged, data are read and analyzed, and the doses are subsequently calculated in millirem. Thermoluminescent dosimeters (TLDs) are prepared for field deployment every quarter. The process involves heat sealing TLDs into a foil sample pouch 8.9 cm × 4.5 mm thick for protection against light and moisture. Direct gamma radiation doses are measured with reusable TLDs mounted in the field on preexisting structures (such as fences) at approximately 1 m above ground to comply with DOE Order 5400.1. The TLDs are installed with an LLNL identification label on each pouch. Additionally, duplicate, trip blanks, and transit control TLDs are prepared as well as calibration control TLDs. Each quarter, the TLDs in the field are collected and replaced with a new batch of TLDs. The exposed TLDs are placed in a reading magazine by location and taken to the Dosimetry Laboratory for processing. A chain-of-custody form accompanies the collection and field deployment of the TLDs so that each responsible party, from collection to archiving, signs the form acknowledging that the task of assigned duties has been completed.

When a TLD is damaged or missing, its annual dose value is calculated from its mean quarterly dose, as determined from available data, multiplied by four. Data from TLDs found on the ground open or damaged are not used to calculate the quarterly or annual totals. These TLDs tend to trap moisture, and the readings can yield erroneous data.

LLNL uses the Panasonic Model UD-814AS1 TLD, which contains three components of thallium-activated calcium sulfate ($CaSO_4$) and one component of lithium borate ($Li_2B_4O_7$). Energy is stored when these compounds are exposed to gamma radiation. Impurities in the TLD crystal form low-temperature trapping sites for electrons that have been excited to higher energy states by gamma radiation at normal ambient temperatures. When the TLDs are heated in the analytical laboratory, the electrons return to lower energy states, and light is emitted. The light intensity is proportional to the original absorbed energy and is measured with a photomultiplier tube. After the TLD is read, it is heated again and reread. This second reading should be near zero, indicating that all the stored energy in the traps has been released and measured. This process, called annealing, also verifies that the TLD is again ready for field deployment.

Direct gamma radiation exposures are measured in milliroentgens (mR). The measured exposure is converted to dose by calibrating the dosimeters against sources that deliver a known absorbed dose and then applying a quality factor for a beta/gamma radiation field. The resultant dose equivalents, in millisieverts (mSv) or millirem (mrem), are compared to the DOE Order 5400.5 radiation protection standards. The doses at the site boundaries are also compared to background measurements to determine the contribution, if any, from LLNL operations.

To ensure accuracy in TLD measurements, some TLDs are irradiated each quarter to specific exposures for calibration purposes, and others are irradiated to specific exposures to serve as quality control accuracy checks. Duplicate TLDs are located in the field at several locations each quarter to assess TLD measurement precision. This year we instituted methods in our procedures and policies that ensure minimum holding times so that we remain consistent with 90-day standard quarters. Additionally, we participate in the National Intercomparison Laboratory Study for external gamma radiaiton measurements.

Tables

Presented below are data tables for the 1995 gamma radiation monitoring network. **Table 12-1** presents the Livermore site perimeter data, **Table 12-2** presents the Livermore Valley data, **Table 12-3** presents the Site 300 perimeter, data, and **Table 12-4** presents Tracy and Site 300 off-site data. Summary data are discussed in detail in Volume 1 of this report.

Table 12-1. TLD environmental radiation measurements (in mSv), Livermore site perimeter, 1995.

Location	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	Total
1	0.181	0.148	0.144	0.142	0.614
4	0.140	0.156	0.156	0.148	0.600
5	0.140	0.162	0.154	0.144	0.601
6	0.139	0.156	0.158	0.149	0.601
11	0.119	0.118	0.115	0.120	0.471
14	0.125	0.145	0.134	0.132	0.536
16	0.131	0.139	0.138	0.136	0.544
42	0.137	0.139	0.148	0.136	0.561
43	0.150	0.157	0.151	0.132	0.591
47	0.127	0.136	0.137	0.135	0.536
52	0.131	0.149	0.132	0.134	0.544
56	0.135	0.140	0.145	0.136	0.557
68	0.129	0.149	0.145	0.135	0.559
69	0.131	0.141	0.137	0.129	0.538
mSv					
Mean	**0.137**	**0.145**	**0.142**	**0.136**	**0.561**
Std. dev.	**0.015**	**0.011**	**0.011**	**0.008**	**0.051**
mrem					
Mean	**13.7**	**14.5**	**14.2**	**13.6**	**55.8**
Std. dev.	**1.5**	**1.1**	**1.1**	**0.8**	**5.1**

Table 12-2. TLD environmental radiation measurements (in mSv), Livermore Valley, 1995.

Location	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	Total
18	0.107	0.114	0.110	0.117	0.448
19	0.122	0.138	0.128	0.128	0.515
22	0.135	0.154	0.152	0.144	0.586
24	0.134	0.154	0.149	0.142	0.580
27	0.140	0.162	0.158	0.149	0.609
28	0.143	0.162	0.164	0.154	0.622
30	0.129	—[a]	0.143	0.134	0.541[b]
32	0.130	0.151	0.142	0.137	0.560
33	0.133	0.146	0.145	0.143	0.567
35	—[a]	0.149	0.159	0.143	0.602[b]
37	—[a]	—[a]	0.142	0.135	0.552[b]
45	0.125	0.140	0.133	0.130	0.528
57	0.140	0.151	0.151	0.142	0.584
60	0.131	0.150	0.145	0.141	0.566
61	0.120	0.129	0.123	—[a]	0.495[b]
66	0.133	0.148	0.148	0.139	0.568
70	0.128	0.146	0.145	0.138	0.557
72	0.148	0.162	0.164	0.147	0.621
73	0.134	0.146	0.145	0.142	0.568
74	0.121	0.129	0.134	0.128	0.511
75	0.116	0.119	0.112	0.110	0.457
76	0.111	0.122	0.113	0.116	0.462
77	0.126	0.132	0.128	0.129	0.516
mSv					
Mean	**0.129**	**0.143**	**0.141**	**0.136**	**0.548**
Std. dev.	**0.010**	**0.014**	**0.016**	**0.011**	**0.051**
mrem					
Mean	**12.9**	**14.3**	**14.1**	**13.6**	**54.9**
Std. dev.	**1.0**	**1.4**	**1.6**	**1.1**	**5.1**

a No data available for these samples.

b When a TLD is missing, the annual dose is calculated as four times the mean quarterly dose, as determined from available data.

Table 12-3. TLD environmental radiation measurements (in mSv), Site 300 perimeter location, 1995.

Location	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	Total
78	0.129	0.138	0.143	0.141	0.551
81	0.161	0.182	0.191	0.181	0.715
82	0.140	0.160	—[a]	—[a]	0.640[b]
84	0.136	—[a]	—[a]	—[a]	0.544[b]
85	—[a]	—[a]	0.165	—[c]	0.660[b]
86	—[a]	—[a]	0.164	—[c]	0.656[b]
88	0.153	0.160	0.164	0.159	0.636
89	0.153	0.170	0.174	0.163	0.661
91	0.152	0.160	0.170	0.164	0.646
121	—[d]	—[a]	0.185	0.177	0.724[b]
mSv					
Mean	**0.146**	**0.162**	**0.169**	**0.164**	**0.637**
Std. dev.	**0.012**	**0.015**	**0.015**	**0.014**	**0.0-55**
mrem					
Mean	**14.6**	**16.2**	**16.9**	**16.4**	**63.7**
Std. dev.	**1.2**	**1.5**	**1.5**	**1.4**	**5.5**

a No data available for these samples because TLDs were lost in field.

b When a TLD is missing, the annual dose is calculated as four times the mean quarterly dose, as determined from available data.

c TLD was open or damaged.

d TLD was in the field for more than one quarter and could not be properly corrected.

Table 12-4. TLD environmental radiation measurements (in mSv), Site 300 vicinity, 1995.

Location	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	Total
Tracy					
92	0.138	0.138	0.149	0.144	0.569
93	0.121	0.130	0.124	0.125	0.501
mSv					
Mean	**0.130**	**0.134**	**0.137**	**0.135**	**0.535**
Std. dev.	**0.012**	**0.006**	**0.017**	**0.014**	**0.049**
mrem					
Mean	**13.0**	**13.4**	**13.7**	**13.5**	**53.5**
Std. dev.	**1.2**	**0.6**	**1.7**	**1.4**	**4.9**
Off site					
90	0.148	0.168	0.176	0.160	0.652
94	0.184	0.224	0.222	0.211	0.841
95	0.158	—[a]	—[a]	—[a]	0.632[b]
96	0.160	0.192	0.186	0.183	0.721
99	0.140	0.149	0.159	0.147	0.595
120	—[c]	0.149	0.166	0.151	0.621[b]
mSv					
Mean	**0.158**	**0.176**	**0.182**	**0.170**	**0.674**
Std. dev.	**0.016**	**0.032**	**0.025**	**0.027**	**0.087**
mrem					
Mean	**15.8**	**17.6**	**18.2**	**17.0**	**67.4**
Std. dev.	**1.6**	**3.2**	**2.5**	**2.7**	**8.7**

a No data available because sampling at this location was discontinued after the first quarter.

b When a TLD is missing, the annual dose is calculated as four times the mean quarterly dose, as determined from available data.

c TLD was in the field for more than one quarter and could not be properly corrected.

There is no supplemental data in this chapter.
Please see Volume 1 for details about
Radiological Dose Assessment.

14. Compliance Self-Monitoring

Allen R. Grayson
Robert J. Vellinger
Richard A. Brown
Karen J. Folks
Sandra Mathews

Introduction

This chapter provides detailed data on monitoring of the Drainage Retention Basin (DRB) at the Livermore site and the cooling towers at Site 300. This data supplements material provided in Chapter 14 of Volume 1.

Drainage Retention Basin

Sampling locations at the Drainage Retention Basin (DRB) used to monitor compliance with Waste Discharge Requirement (WDR) Order No. 91-091, NPDES Permit NO. CA0029289 and the Livermore site CERCLA Record of Decision are shown in Figure 14-4, Volume 1. Figure 14-5, Volume 1 shows the sampling locations used to determine the maintenance of water quality objectives. Weekly sampling for dissolved oxygen and temperature occurs at all eight locations identified in Figure 14-5. Weekly turbidity measurements and monthly, quarterly, semiannual, and annual samples are collected at sample location CDBE. **Table 14-1** shows the compliance monitoring data for the single sample collected from the Drainage Retention Basin on December 12, 1995. Monthly, quarterly, semiannual, and yearly maintenance monitoring data for 1995, that were collected at sample location CDBE are shown in **Tables 14-2, a,b,c,** and **d. Table 14-3** provides the weekly field measurements collected from sample locations CDBA, CDBC, CDBD, CDBE, CDBF, CDBJ, CDBK, and CDBL.

Table 14-1. Compliance monitoring data for the single release from the DRB.

Requested analysis	Analyte	Units	12/12/95 result
BIO	Aquatic bioassay, survival	%	80
EPA504	Ethylene dibromide	µg/L	<0.01
EPA601	1,1,1-Trichloroethane	µg/L	<0.5
	1,1,2,2-Tetrachloroethane	µg/L	<0.5
	1,1,2-Trichloroethane	µg/L	<0.5
	1,1-Dichloroethane	µg/L	<0.5
	1,1-Dichloroethene	µg/L	<0.5
	1,2-Dichlorobenzene	µg/L	<0.5
	1,2-Dichloroethane	µg/L	<0.5
	1,2-Dichloroethene (total)	µg/L	<0.5
	1,2-Dichloropropane	µg/L	<0.5
	1,3-Dichlorobenzene	µg/L	<0.5
	1,4-Dichlorobenzene	µg/L	<0.5
	2-Chloroethylvinylether	µg/L	<0.5
	Bromodichloromethane	µg/L	<0.5
	Bromoform	µg/L	<0.5
	Bromomethane	µg/L	<0.5
	Carbon tetrachloride	µg/L	<0.5
	Chlorobenzene	µg/L	<0.5
	Chloroethane	µg/L	<0.5
	Chloroform	µg/L	<0.5
	Chloromethane	µg/L	<0.5
	Dibromochloromethane	µg/L	<0.5
	Dichlorodifluoromethane	µg/L	<0.5
	Freon 113	µg/L	<0.5
	Methylene chloride	µg/L	<0.5
	Tetrachloroethene	µg/L	<0.5
	Trichloroethene	µg/L	<0.5
	Trichlorofluoromethane	µg/L	<0.5
	Vinyl chloride	µg/L	<0.5
	cis-1,3-Dichloropropene	µg/L	<0.5
	trans-1,3-Dichloropropene	µg/L	<0.5
EPA602	1,2-Dichlorobenzene	µg/L	<0.3
	1,3-Dichlorobenzene	µg/L	<0.3
	1,4-Dichlorobenzene	µg/L	<0.3
	Benzene	µg/L	<0.3
	Chlorobenzene	µg/L	<0.3
	Ethylbenzene	µg/L	<0.3
	Toluene	µg/L	<0.3
	Total xylene isomers	µg/L	<0.6

...continued on next page

Table 14-1. Compliance monitoring data for the single release from the DRB (continued).

Requested analysis	Analyte	Units	12/12/95 result
EPA625	1,2,4-Trichlorobenzene	µg/L	<10
	1,2-Dichlorobenzene	µg/L	<10
	1,3-Dichlorobenzene	µg/L	<10
	1,4-Dichlorobenzene	µg/L	<10
	2,4,5-Trichlorophenol	µg/L	<10
	2,4,6-Trichlorophenol	µg/L	<10
	2,4-Dichlorophenol	µg/L	<10
	2,4-Dimethylphenol	µg/L	<10
	2,4-Dinitrophenol	µg/L	<50
	2,4-Dinitrotoluene	µg/L	<10
	2,6-Dinitrotoluene	µg/L	<10
	2-Chloronaphthalene	µg/L	<10
	2-Chlorophenol	µg/L	<10
	2-Methylphenol	µg/L	<10
	2-Methyl-4,6-dinitrophenol	µg/L	<50
	2-Methylnaphthalene	µg/L	<10
	2-Nitroaniline	µg/L	<50
	2-Nitrophenol	µg/L	<10
	3,3'-Dichlorobenzidine	µg/L	<20
	3-Nitroaniline	µg/L	<50
	4-Bromophenylphenylether	µg/L	<10
	4-Chloro-3-methylphenol	µg/L	<20
	4-Chloroaniline	µg/L	<20
	4-Chlorophenylphenylether	µg/L	<10
	4-Nitroaniline	µg/L	<50
	4-Nitrophenol	µg/L	<50
	Acenaphthene	µg/L	<10
	Acenaphthylene	µg/L	<10
	Anthracene	µg/L	<10
	Benzo(a)anthracene	µg/L	<10
	Benzo(a)pyrene	µg/L	<10
	Benzo(b)fluoranthene	µg/L	<10
	Benzo(g,h,i)perylene	µg/L	<10
	Benzo(k)fluoranthene	µg/L	<10
	Benzoic Acid	µg/L	<50
	Benzyl Alcohol	µg/L	<20
	Bis(2-chloroethoxy)methane	µg/L	<10

...continued on next page

Table 14-1. Compliance monitoring data for the single release from the DRB (continued).

Requested analysis	Analyte	Units	12/12/95 result
EPA 625 (continued)	Bis(2-chloroethyl)ether	µg/L	<10
	Bis(2-chloroisopropyl)ether	µg/L	<10
	Bis(2-ethylhexyl)phthalate	µg/L	<10
	Butylbenzylphthalate	µg/L	<10
	Chrysene	µg/L	<10
	Di-n-butylphthalate	µg/L	<10
	Di-n-octylphthalate	µg/L	<10
	Dibenzo(a,h)anthracene	µg/L	<10
	Dibenzofuran	µg/L	<10
	Diethylphthalate	µg/L	<10
	Dimethylphthalate	µg/L	<10
	Fluoranthene	µg/L	<10
	Fluorene	µg/L	<10
	Hexachlorobenzene	µg/L	<10
	Hexachlorobutadiene	µg/L	<10
	Hexachlorocyclopentadiene	µg/L	<10
	Hexachloroethane	µg/L	<10
	Indeno(1,2,3-c,d)pyrene	µg/L	<10
	Isophorone	µg/L	<10
	N-Nitrosodi-n-propylamine	µg/L	<10
	N-Nitrosodiphenylamine	µg/L	<10
	Naphthalene	µg/L	<10
	Nitrobenzene	µg/L	<10
	Pentachlorophenol	µg/L	<50
	Phenanthrene	µg/L	<10
	Phenol	µg/L	<10
	Pyrene	µg/L	<10
	m- and p-Cresol	µg/L	<10
GENMIN	Aluminum	mg/L	2.6
	Bicarbonate alk (as $CaCO_3$)	mg/L	56
	Calcium	mg/L	14
	Carbonate alk (as $CaCO_3$)	mg/L	<1
	Chloride	mg/L	4.8
	Copper	mg/L	<0.05
	Fluoride	mg/L	0.11
	Hydroxide alk (as $CaCO_3$)	mg/L	<1

...continued on next page

Table 14-1. Compliance monitoring data for the single release from the DRB (continued).

Requested analysis	Analyte	Units	12/12/95 result
GENMIN (continued)	Iron	mg/L	1.7
	Magnesium	mg/L	3.9
	Manganese	mg/L	<0.03
	Nickel	mg/L	<0.1
	Nitrate (as NO3)	mg/L	1.2
	Potassium	mg/L	3.4
	Sodium	mg/L	5.3
	Specific conductance	µmho/cm	110
	Sulfate	mg/L	4.5
	Surfactant	mg/L	<0.5
	Total alkalinity (as CaCO3)	mg/L	56
	Total hardness (as CaCO3)	mg/L	50
	Total dissolved solids (TDS)	mg/L	85
	Zinc	mg/L	<0.05
	pH	Units	7.2
INORG	Total suspended solids (TSS)	mg/L	77
OG	Oil and grease	mg/L	<5
OXYDEM	Chemical oxygen demand	mg/L	29
RAD	Gross alpha	pCi/L	<2.3
	Gross beta	pCi/L	4.9
	Tritium	pCi/L	382
SW846-6000	Aluminum	mg/L	5.6
	Antimony	mg/L	<0.005
	Arsenic	mg/L	0.018
	Barium	mg/L	0.1
	Beryllium	mg/L	<0.0005
	Cadmium	mg/L	<0.001
	Calcium	mg/L	13
	Chromium	mg/L	0.029
	Cobalt	mg/L	<0.05
	Copper	mg/L	0.011
	Chromium (VI)	mg/L	<0.01
	Iron	mg/L	4.7
	Lead	mg/L	0.008
	Magnesium	mg/L	4.3
	Molybdenum	mg/L	<0.05
	Nickel	mg/L	<0.005

...concluded on next page

Table 14-1. Compliance monitoring data for the single release from the DRB (concluded).

Requested analysis	Analyte	Units	12/12/95 result
	Potassium	mg/L	<1
	Sodium	mg/L	5
	Thallium	mg/L	<0.001
	Tin	mg/L	<0.005
	Vanadium	mg/L	<0.02
	Zinc	mg/L	0.07
SW846-7000	Mercury	mg/L	<0.0002
	Selenium	mg/L	<0.005
	Silver	mg/L	<0.005
TPH	Diesel fuel	µg/L	<50
	Gasoline fingerprint	µg/L	<50

Table 14-2a. Annual maintenance monitoring data collected at sampling location CDBE.

Analyte	Results (1995)			Minimum	Maximum	Median	Interquartile range	No. of samples
	20-Apr	25-Sep	19-Dec					
BIO (%)								
Aquatic bioassay, survival		90		90	90	90	—[a]	1
EPA 610 (μg/L)								
Acenaphthene	<2			<2	<2	<2	—[a]	1
Acenaphthylene	<2			<2	<2	<2	—[a]	1
Anthracene	<1			<1	<1	<1	—[a]	1
Benzo(a)anthracene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Benzo(a)pyrene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Benzo(b)fluoranthene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Benzo(g,h,i)perylene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Benzo(k)fluoranthene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Chrysene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Dibenzo(a,h)anthracene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Fluoranthene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Fluorene	<2			<2	<2	<2	—[a]	1
Indeno(1,2,3-c,d)pyrene	<0.5			<0.5	<0.5	<0.5	—[a]	1
Naphthalene	<2			<2	<2	<2	—[a]	1
Phenanthrene	<1			<1	<1	<1	—[a]	1
Pyrene	<0.5			<0.5	<0.5	<0.5	—[a]	1
1,2-Dibromo-3-chloropropane	<0.01			<0.01	<0.01	<0.01	—[a]	1
EPA615 (μg/L)								
2,4,5-T			<0.5	<0.5	<0.5	<0.5	—[a]	1
2,4,5-TP (Silvex)			<0.2	<0.2	<0.2	<0.2	—[a]	1
2,4-D			<1	<1	<1	<1	—[a]	1
4-(2,4-Dichlorophenoxy)butyric acid			<2	<2	<2	<2	—[a]	1
Dalapon			<2	<2	<2	<2	—[a]	1
Dicamba			<1	<1	<1	<1	—[a]	1
Dichloroprop			<2	<2	<2	<2	—[a]	1
Dinoseb			<1	<1	<1	<1	—[a]	1
MCPA			<250	<250	<250	<250	—[a]	1
MCPP			<250	<250	<250	<250	—[a]	1

[a] Insufficient data top calculate interquartile range.

Table 14-2b. Semiannual maintenance monitoring data collected at sampling location CDBE.

Analyte	Results (1995)		Minimum	Maximum	Median	Interquartile Range	No. of Samples
	20–Apr	25–Sep					
EPA 504 (μg/L)							
Ethylene Dibromide	<0.2	<0.2	<0.02	<0.2	<0.2	—[a]	2
EPA601							
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,1,2,2-Tetrachloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,1,2-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,1-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,1-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,2-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,2-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,2-Dichloroethene (total)	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,2-Dichloropropane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,3-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
1,4-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
2-Chloroethylvinylether	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Bromodichloromethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Bromoform	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Bromomethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Carbon tetrachloride	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Chlorobenzene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Chloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Chloroform	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Chloromethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Dibromochloromethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Dichlorodifluoromethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Freon 113	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Methylene chloride	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Trichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Trichlorofluoromethane	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
Vinyl chloride	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
cis-1,3-Dichloropropene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2
trans-1,3-Dichloropropene	<0.5	<0.5	<0.5	<0.5	<0.5	—[a]	2

...continued on next page

Table 14-2b. Semiannual maintenance monitoring data collected at sampling location CDBE (continued).

Analyte	Results (1995)			Minimum	Maximum	Median	Interquartile Range	No. of Samples
	20-Apr	25-Sep	9-May					
EPA602 (μg/L)								
1,2-Dichlorobenzene	<0.3	<0.3		<0.3	<0.3	<0.3	—[a]	2
1,3-Dichlorobenzene	<0.3	<0.3		<0.3	<0.3	<0.3	—[a]	2
1,4-Dichlorobenzene	<0.3	<0.3		<0.3	<0.3	<0.3	—[a]	2
Benzene	<0.3	<0.3		<0.3	<0.3	<0.3	—[a]	2
Chlorobenzene	<0.3	<0.3		<0.3	<0.3	<0.3	—[a]	2
Ethylbenzene	<0.3	<0.3		<0.3	<0.3	<0.3	—[a]	2
Toluene	<0.3	<0.3		<0.3	<0.3	<0.3	—[a]	2
Total xylene isomers	<0.6	<0.6		<0.6	<0.6	<0.6	—[a]	2
EPA625 (μg/L)								
1,2,4-Trichlorobenzene	<10	<10		<10	<10	<10	—[a]	2
1,2-Dichlorobenzene	<10	<10		<10	<10	<10	—[a]	2
1,3-Dichlorobenzene	<10	<10		<10	<10	<10	—[a]	2
1,4-Dichlorobenzene	<10	<10		<10	<10	<10	—[a]	2
2,4,5-Trichlorophenol	<10	<10		<10	<10	<10	—[a]	2
2,4,6-Trichlorophenol	<10	<10		<10	<10	<10	—[a]	2
2,4-Dichlorophenol	<10	<10		<10	<10	<10	—[a]	2
2,4-Dimethylphenol	<10	<10		<10	<10	<10	—[a]	2
2,4-Dinitrophenol	<50	<50		<50	<50	<50	—[a]	2
2,4-Dinitrotoluene	<10	<10		<10	<10	<10	—[a]	2
2,6-Dinitrotoluene	<10	<10		<10	<10	<10	—[a]	2
2-Chloronaphthalene	<10	<10		<10	<10	<10	—[a]	2
2-Chlorophenol	<10	<10		<10	<10	<10	—[a]	2
2-Methyl Phenol	<10	<10		<10	<10	<10	—[a]	2
2-Methyl-4,6-dinitrophenol	<50	<50		<50	<50	<50	—[a]	2
2-Methylnaphthalene	<10	<10		<10	<10	<10	—[a]	2
2-Nitroaniline	<50	<50		<50	<50	<50	—[a]	2
2-Nitrophenol	<10	<10		<10	<10	<10	—[a]	2
3,3'-Dichlorobenzidine	<20	<20		<20	<20	<20	—[a]	2
3-Nitroaniline	<50	<50		<50	<50	<50	—[a]	2
4-Bromophenylphenylether	<10	<10		<10	<10	<10	—[a]	2
4-Chloro-3-methylphenol	<20	<20		<20	<20	<20	—[a]	2
4-Chloroaniline	<20	<20		<20	<20	<20	—[a]	2
4-Chlorophenylphenylether	<10	<10		<10	<10	<10	—[a]	2

..continued on next page

Table 14-2b. Semiannual maintenance monitoring data collected at sampling location CDBE (continued).

Analyte	Results (1995)			Minimum	Maximum	Median	Interquartile Range	No. of Samples
	20-Apr	25-Sep	9-May					
4-Nitroaniline	<50	<50		<50	<50	<50	—[a]	2
4-Nitrophenol	<50	<50		<50	<50	<50	—[a]	2
Acenaphthene	<10	<10		<10	<10	<10	—[a]	2
Acenaphthylene	<10	<10		<10	<10	<10	—[a]	2
Anthracene	<10	<10		<10	<10	<10	—[a]	2
Benzo(a)anthracene	<10	<10		<10	<10	<10	—[a]	2
Benzo(a)pyrene	<10	<10		<10	<10	<10	—[a]	2
Benzo(b)fluoranthene	<10	<10		<10	<10	<10	—[a]	2
Benzo(g,h,i)perylene	<10	<10		<10	<10	<10	—[a]	2
Benzo(k)fluoranthene	<10	<10		<10	<10	<10	—[a]	2
Benzoic Acid	<50	<50		<50	<50	<50	—[a]	2
Benzyl Alcohol	<20	<20		<20	<20	<20	—[a]	2
Bis(2-chloroethoxy)methane	<10	<10		<10	<10	<10	—[a]	2
Bis(2-chloroethyl)ether	<10	<10		<10	<10	<10	—[a]	2
Bis(2-chloroisopropyl)ether	<10	<10		<10	<10	<10	—[a]	2
Bis(2-ethylhexyl)phthalate	<10	<10		<10	<10	<10	—[a]	2
Butylbenzylphthalate	<10	<10		<10	<10	<10	—[a]	2
Chrysene	<10	<10		<10	<10	<10	—[a]	2
Di-n-butylphthalate	<10	<10		<10	<10	<10	—[a]	2
Di-n-octylphthalate	<10	<10		<10	<10	<10	—[a]	2
Dibenzo(a,h)anthracene	<10	<10		<10	<10	<10	—[a]	2
Dibenzofuran	<10	<10		<10	<10	<10	—[a]	2
Diethylphthalate	<10	<10		<10	<10	<10	—[a]	2
Dimethylphthalate	<10	<10		<10	<10	<10	—[a]	2
Fluoranthene	<10	<10		<10	<10	<10	—[a]	2
Fluorene	<10	<10		<10	<10	<10	—[a]	2
Hexachlorobenzene	<10	<10		<10	<10	<10	—[a]	2
Hexachlorobutadiene	<10	<10		<10	<10	<10	—[a]	2
Hexachlorocyclopentadiene	<10	<10		<10	<10	<10	—[a]	2
Hexachloroethane	<10	<10		<10	<10	<10	—[a]	2
Indeno(1,2,3-c,d)pyrene	<10	<10		<10	<10	<10	—[a]	2
Isophorone	<10	<10		<10	<10	<10	—[a]	2
N-Nitrosodi-n-propylamine	<10	<10		<10	<10	<10	—[a]	2
N-Nitrosodiphenylamine	<10	<10		<10	<10	<10	—[a]	2

..concluded on next page

Table 14-2b. Semiannual maintenance monitoring data collected at sampling location CDBE **(concluded)**.

Analyte	Results (1995)			Minimum	Maximum	Median	Inter-quartile Range	No. of Samples
	20-Apr	25-Sep	9-May					
Naphthalene	<10	<10		<10	<10	<10	—[a]	2
Nitrobenzene	<10	<10		<10	<10	<10	—[a]	2
Pentachlorophenol	<50	<50		<50	<50	<50	—[a]	2
Phenanthrene	<10	<10		<10	<10	<10	—[a]	2
Phenol	<10	<10		<10	<10	<10	—[a]	2
Pyrene	<10	<10		<10	<10	<10	—[a]	2
m- and p- Cresol	<10	<10		<10	<10	<10	—[a]	2
ORGCARB (mg/L)								
Total organic carbon (TOC)	12	4.5		4.5	12	8.25	3.75	2
RAD (pCi/L)								
Gross alpha	1.3	4.1		1.3	2	1.65	0.35	2
Gross beta	3.2	4.1		3.2	4.1	3.65	0.45	2
Tritium	422	402		402	422	412	10	2
TPH (µg/L								
Gasoline fingerprint	<50			<50	<50	<50	—[a]	2
Diesel fuel	<50		<50	<50	<50	<50	—[a]	2

[a] Insufficient data to calculate interquartile range.

Table 14-2c. Quarterly maintenance monitoring data collected at sampling location CDBE.

Analyte	Results (1995)				Minimum	Maximum	Median	Interquartile Range	No. of Samples
	19-Jan	20-Apr	11-Jul	7-Nov					
BIO (MPN/100 mL)									
Fecal coliform		13	4		4	50	10.5	15.25	4
Total coliform	900	30	13	13	13	900	21.5	234.5	4
OXYDEM (mg/L)									
Chemical oxygen demand	19	22	17	19	17	22	19	1.25	4

Table 14-2d. Monthly maintenance monitoring data collected at sampling location CDBE.

Analyte	Results (1995)							Min	Max	Med	Inter-quartile Range	No. of Samples
	19-Jan/ 14-Feb	14-Mar/ 20-Apr	9-May/ 6-Jun	11-Jul/ 11-Aug	25-Sep/ 17-Oct	7-Nov/ 19-Dec	28-Dec					
GEMIN (mg/L)												
Aluminum	<0.2/ <0.2	<0.2/ <0.2	<0.2/ <0.2	<0.2/ <0.2	<0.2/ <0.2	<0.2/ <0.2		<0.02	<3.2	<0.2	—[a]	12
Bicarbonate alk (as $CaCO_3$)	37/42	28/36	41/46	52/45	43/70	71/45		28	71	44	7.5	12
Calcium	13/14	10/11	11/12	13/15	17/19	20/13		10	20	13	3.8	12
Carbonate alk (as $CaCO_3$)	<1/<1	<1/<1	<1/<1	<1/<1	<1/<1	<1/<1		<1	<1	<1	—[a]	12
Chloride	7.7/8.1	3.9/3.1	2.9/3.7	3.6/9.8	4.8/5.4	4.8/19		2.9	19	4.8	4.1	12
Copper	<0.05/ <0.05	<0.05/ <0.05	<0.05/ <0.05	<0.05/ <0.05	<0.05/ <0.05	<0.05/ <0.05		<0.5	<0.5	<0.5	—[a]	12
Fluoride	0.066/ 0.071	0.07/ 0.068	0.073/ 0.069	0.082? 0.081	0.089/ 0.1	0.093/ 0.1		0.066	0.1	0.077	0.020	12
Hydroxide alk (as $CaCO_3$)	<1/<1	<1/<1	<1/<1	<1/<1	<1/<1	<1/<1		<1	<1	<1	—[a]	12
Iron	<0.1/ <0.1	<0.11/ <0.1	<0.1/ <0.1	<0.1/ <0.1	<0.1/ <0.1	<0.1/ 2.2		<0.1	2.2	<0.1	—[a]	12
Magnesium	3.7/3.9	2.9/2.7	2.7/3	3.2/3.7	4.2/4.6	4.7/3.7		2.7	4.7	3.7	1	12
Manganese	<0.3/ <0.3	<0.3/ <0.3	<0.3/ <0.3	<0.3/ <0.3	<0.3/ <0.3	<0.3/ <0.3		<0.3	<0.3	<0.3	—[a]	12
Nickel	<0.1/ <0.1	<0.1/ <0.1	<0.1/ <0.1	<0.1/ <0.1	<0.1/ <0.1	<0.1/ <0.1		<0.1	<0.1	<0.1	—[a]	12
Potassium	2.5/2.8	2.2/2.5	2.5/2.7	2.8/3.2	3.4/3.8	3.6/3.4		2.2	3.8	2.8	0.9	12
Sodium	6.7/9	5/4.3	4.5/4.9	5/6.9	6.4/7.9	7.4/4.8		4.3	9	5.7	2.2	12
Specific conductance (µmho/cm)	110/110	91/89	92/100	110/130	120/150	150/110		89	150	110	24.5	12
Sulfate	<5/7.1	3.7/2.8	2.8/3.4	3.1/<1	4.4/5.2	4.3/10		<1	10	4	2.0	12
Surfactant	<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	—[a]	12
Total alkalinity (as $CaCO_3$)	37/42	28/36	41/46	52/45	43/70	71/45		28	71	44	7.5	12
Total hardness (as $CaCO_3$)	48/51	37/39	39/42	47/53	60/67	70/47		37	70	47.5	13.5	12

..continued on next page

Table 14-2d. Monthly maintenance monitoring data collected at sampling location CDBE (continued).

Analyte	Results (1995)							Min	Max	Med	Interquartile Range	No. of Samples
	19-Jan/ 14-Feb	14-Mar/ 20-Apr	9-May/ 6-Jun	11-Jul/ 11-Aug	25-Sep/ 17-Oct	7-Nov/ 19-Dec	28-Dec					
Total dissolved solids (TDS)	77/78	37/81	120/130	130/130	120/130	120/100		37	130	120	49.8	12
Zinc	<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	—[a]	12
pH (units)	7.1/6.7	6.8/7	6.9/7.2	7.4/7.5	7.6/7.5	7.6/6.7		6.7	7.6	7.15	0.63	12
INORG (mg/L)												
Total suspended solids (TSS)	22/21	31/31	11/15	9/12	18/24	6/28		6	31	19.5	13.25	12
NPDES METAL (mg/L)												
Aluminum					/4.2			4.2	4.2	4.2	—[a]	1
Antimony		/<0.06		<0.06/ <0.06	<0.06/ <0.06	<0.06/ <0.005		<0.005	<0.06	<0.06	—[a]	7
Arsenic		/0.0045		0.0031/ 0.0063	0.0036/ 0.0048	<0.002/ <0.005		<0.002	0.0063	0.0045	0.0016	7
Barium		/0.12		0.086/ 0.096		0.089/ 0.08		0.08	<0.12	0.089	0.01	5
Beryllium		/<0.0005		<0.0005/ <0.0005	<0.0005/ <0.0005	<0.0005/ <0.0005		<.0005	<.0005	<0.0005	—[a]	7
Boron		/<0.1		<0.1/ <0.12	<0.1/ <0.1	<0.1/ <0.1		<0.1	<0.12	<0.1	—[a]	7
Cadmium		/<0.005		<0.0005/ <0.0005	<0.0005/ <0.0005	<0.0005/ <0.001		<.0005	<.001	<.0005	—[a]	7
Chromium		/0.019		0.02/ 0.011	0.011/ <0.01	<0.01/ 0.014		<0.01	0.02	0.011	0.006	7
Chromium(VI)		/<0.01			<0.01/			<0.01	<0.01	<0.01	—[a]	2
Copper		/0.011		0.006/ 0.0088	0.012/ <0.01	<0.001/ 0.01		<0.001	0.012	0.01	0.0031	7
Iron		/6.8		4.6/4.4	4.1/3	2.4/3.2		2.4	6.8	4.1	1.4	7
Lead		/0.0048		0.006/ 0.0044	0.0035/ <0.002	<0.002/ <0.005		<0.002	0.006	0.0044	0.0022	7
Manganese		/0.096		0.055/ 0.061	0.53/ 0.036	<0.03/ 0.05		<0.03	0.096	0.053	0.015	7
Mercury		/<0.0002		<0.0002/ <0.0002	<0.0002/ <0.0002	<0.0002/ <0.0002		<0.000 2	<0.0002	<0.0002	—[a]	7

...concluded on next page

Table 14-2d. Monthly maintenance monitoring data collected at sampling location CDBE **(concluded).**

Analyte	Results (1995)							Min	Max	Med	Inter-quartile Range	No. of Samples
	19-Jan/ 14-Feb	14-Mar/ 20-Apr	9-May/ 6-Jun	11-Jul/ 11-Aug	25-Sep/ 17-Oct	7-Nov/ 19-Dec	28-Dec					
Nickel		/0.017		0.0071/ 0.013	0.011/ 0.012	0.0052/ 0.017		0.0052	0.017	0.012	0.00595	7
Selenium		/<0.002				<0.002/ <0.005		<0.002	<0.005	<0.002	—[a]	7
Silver		/<0.0005		<0.0005/ <0.0005	<0.0005/ <0.0005	<0.0005/ <0.005		<0.0005	<0.005	<0.0005	—[a]	7
Thallium		/<0.005		<0.001/ <0.001	<0.001/ <0.001	<0.001/ <0.005		<0.001	<0.005	<0.001	0.002	7
Zinc		/0.058		0.41/ 0.051	0.058/ 0.021	0.02/ 0.07		<0.02	0.41	0.058	0.028	7
NUTRIENTS (mg/L)												
Ammonia Nitrogen (as N)	<0.1/ <0.1	<0.1/ <0.1	<0.12 <0.12	0.32/ 0.21	0.3/ <0.1	<0.1/	0.12	<0.1	0.32	0.11	0.04	12
Nitrate (as N)	<0.5/ 0.74		/<0.5					<0.5	0.74	0.5	0.12	3
Nitrate (as NO_3)	<2.215/ 3.2782	1.8/1.9	1.9/	1.5/<0.5	<0.5/ <0.5	<0.5/	3.4	<0.5	3.4	1.8	1.6	11
Nitrite (as N)	<0.5/ <0.5		/<0.5	<0.5/				<0.5	<0.5	<0.5	—[a]	4
Nitrite (as NO_2)		<0.5/ <0.5	<0.5/	/<0.5	<0.5/ <0.5	<0.5/	<0.5	<0.5	<0.5	<0.5	—[a]	8
Ortho-phosphate	<0.5/ 0.051	0.067/ 0.17	0.15/ 0.13	0.12/ 0.11	0.07/ 0.069	0.1/ 0.15		<0.05	0.17	0.105	0.067	12
Total kjeldahl nitrogen	0.46/ <0.2	*<0.2/ 0.54*	*0.52/ <0.5*	*0.47/ 0.27*	<0.5/ <0.5	0.85/ 0.71	0.54	<0.2	0.85	0.5	0.08	13
Total phosphorus (as P)	0.076/ 0.096	0.12/ 0.22	0.23/ 0.22	0.17/ 0.21	0.18/ 0.1	0.1/ 0.17		0.076	0.23	0.17	0.11	12
OG (mg/L)												
Oil and grease	<5/	/<5			<5/	<5/		<5	<5	<5	—[a]	4
ORGANICS (μg/L)												
Chlorophyll a	3.1/ 4.3	3.1/ 3	*4.9/ 2.6*	*3.6/ 5.2*	2.7/ 4.1	2/ 1.5		1.5	5.2	3.1	1.475	12

[a] Insufficient data to calculate interquartile range.

Table 14-3. Field data collected from Drainage Retention Basin locations.[a]

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
01/06/95	Dissolved oxygen (mg/L)	8.6	8.5	8.6	8.6	8.4	8.5	8.3	8.3
	Temperature (°C)	8.5	8.3	8.3	8.3	8.3	8.7	8.9	8.9
	Turbidity (m)				0.25				
01/13/95	Dissolved oxygen (mg/L)	7	7	7	7	6.4	7.7	7.5	6.6
	Temperature (°C)	12.9	11.4	11.5	11.5	10.7	12.3	11.7	11.3
	Turbidity (m)				0.30				
01/19/95	Dissolved oxygen (mg/L)	7.8	7.4	7.7	7.6	7.6	7.5	7.4	7.4
	Temperature (°C)	10	9.7	9.7	9.7	9.7	9.8	9.9	9.9
	Turbidity (m)				0.20				
01/24/95	Dissolved oxygen (mg/L)	7.7	8.3	8.5	8	7.1	8	7.5	7.5
	Temperature (°C)	10.7	11.1	11	10.6	9.9	10.3	10.4	10.4
	Turbidity (m)				0.20				
02/02/95	Dissolved oxygen (mg/L)	6.8	8.9	9.2	6.5	5.7	8.1	6.6	5.5
	Temperature (°C)	11.5	14.8	14.9	11	10.7	13.6	11.4	10.7
	Turbidity (m)				0.20				
02/10/95	Dissolved oxygen (mg/L)	9.3	10.2	9.4	7.9	5.6	8.8	8.3	5.5
	Temperature (°C)	12.5	15.4	14.9	11.7	11.4	12.8	11.7	11.4
02/14/95	Dissolved oxygen (mg/L)	8.3	9.2	8.3	8.3	8.3	8.2	8.2	7.3
	Temperature (°C)	11.5	12.4	11.9	11.9	11.9	12.6	11.8	11.9
02/24/95	Dissolved oxygen (mg/L)	7.1	8.2	8.7	7.5	7.9	8.6	7.9	7.8
	Temperature (°C)	13.6	13.8	13.7	13.7	13.7	13.9	14.1	14.2
	Turbidity (m)				0.20				
03/03/95	Dissolved oxygen (mg/L)	7.1	8	7.9	7.6	7.5	7.7	7.4	7.3
	Temperature (°C)	14.3	14	13.7	13.5	13.4	13.9	13.8	13.5
	Turbidity (m)				0.30				
04/04/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.10				
04/14/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.15				
04/20/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.13				
05/09/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.20				

... continued on next page

Table 14-3. Field data collected from Drainage Retention Basin locations (continued).[a]

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
05/16/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.22				
05/23/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.23				
06/02/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.23				
06/06/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.23				
06/13/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.20				
06/20/95	Dissolved oxygen (mg/L)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Temperature (°C)	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
	Turbidity (m)				0.25				
06/30/95	Dissolved oxygen (mg/L)	8.9	8.6	7.5	7.3	7.1	7.8	7.5	7.3
	Temperature (°C)	28.5	26.5	24.9	24.5	24.5	25.3	24.6	24.6
	Turbidity (m)				0.25				
07/11/95	Dissolved oxygen (mg/L)	8.1	8.2	7.1	7	6.9	7	6.8	7.6
	Temperature (°C)	25.5	24.1	23.5	23.3	23.3	24.2	23.8	23.5
	Turbidity (m)				0.33				
07/18/95	Dissolved oxygen (mg/L)	8.7	7.2	7	6.7	6.5	7	6.8	6.7
	Temperature (°C)	27.5	26.5	25.3	24.7	24.5	25.9	24.9	24.9
	Turbidity (m)				0.28				
07/28/95	Dissolved oxygen (mg/L)	9.2	9.2	9.1	9	9	10.2	9.4	9.4
	Temperature (°C)	30.4	25.6	25.5	25.1	24.8	27.5	25.1	25.0
	Turbidity (m)				0.33				
08/04/95	Dissolved oxygen (mg/L)	9.8	7.6	7.2	6.9	6.9	7.9	7.1	7
	Temperature (°C)	29.6	27.1	26.1	25.7	25.6	27	25.7	25.7
	Turbidity (m)				0.30				
08/11/95	Dissolved oxygen (mg/L)	9.1	8	7.6	7.4	7.3	8.5	7.7	7.6
	Temperature (°C)	29.6	26.6	24.7	23.8	23.7	25.9	23.9	23.9
	Turbidity (m)				0.23				

...continued on next page

Table 14-3. Field data collected from Drainage Retention Basin locations (continued).[a]

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
08/17/95	Dissolved oxygen (mg/L)	8.3	8.6	7	6.9	6.5	7.2	7	6.9
	Temperature (°C)	22.9	23	22.6	22.3	22.2	22.7	22.5	22.4
	Turbidity (m)				0.28				
08/22/95	Dissolved oxygen (mg/L)	8.8	8.3	7.3	4.3	2.8	7.6	4.4	4.2
	Temperature (°C)	29	25.8	26	23	22.7	27.8	23.8	24.2
	Turbidity (m)				0.33				
09/01/95	Dissolved oxygen (mg/L)	7.3	8.4	8	7.9	7.9	7.3	7.2	7.1
	Temperature (°C)	22.1	22.4	22.1	22	22	22.1	22.1	22
	Turbidity (m)								
09/08/95	Dissolved oxygen (mg/L)	8.5	7.7	7.7	7.5	7.4	7.5	7	6.8
	Temperature (°C)	29	24.4	23.9	23.3	23.2	24.5	23.3	23.2
09/25/95	Dissolved oxygen (mg/L)		5.8	8.8	8.2	8.5	8.1	7.8	7
	Temperature (°C)		22.3	22	22	22	22.3	22.2	22.1
10/09/95	Dissolved oxygen (mg/L)	7.2	7.5	7.6	7.4	7.3	7.7	7.6	6.4
	Temperature (°C)	19	19	19	19	19	19.2	19	19.1
	Turbidity (m)				0.33				
10/17/95	Dissolved oxygen (mg/L)	7.8	7.8	7.7	7.6	7.5	7.8	7.7	7.7
	Temperature (°C)	23	19.9	19.6	19	18.9	19.6	19	19.1
	Turbidity (m)				0.28				
10/24/95`	Dissolved oxygen (mg/L)	9.5	8.6	8.3	8.2	8.2	10	8.9	8.7
	Temperature (°C)	18.7	18.4	17.8	17.9	18	19.3	18.4	18.7
	Turbidity (m)				0.34				
10/31/95	Dissolved oxygen (mg/L)	9	8.6	8.6	8.6	8.6	9.4	9.3	9
	Temperature (°C)	19	18.1	17.6	17.5	17.5	17.9	18	18
	Turbidity (m)				0.36				
11/07/95	Dissolved oxygen (mg/L)	8.1	8.4	8.6	8.4	8.1	8.9	8.6	8.7
	Temperature (°C)	16.4	16.9	16.1	16.1	16.1	16.4	16.3	16.4
	Turbidity (m)				0.44				
11/16/95	Dissolved oxygen (mg/L)	9.6	9.3	9.6	9.1	9.2	9.4	9.1	8.8
	Temperature (°C)	20	18	16.9	16.8	16.8	17.7	16.9	17
	Turbidity (m)				0.58				
11/21/95	Dissolved oxygen (mg/L)	10.2	10.1	9.7	9.4	9.2	8	7.9	7.8
	Temperature (°C)	16.6	16.6	16.3	16.3	16.3	16.5	16.5	16.5
12/08/95	Dissolved oxygen (mg/L)	8.4	9.6	9.3	8.6	8.4	7.9	7.5	7.5
	Temperature (°C)	15.3	15.7	15	14.9	15	15.4	15.3	15.1
	Turbidity (m)				0.66				

... concluded on next page

Table 14-3. Field data collected from Drainage Retention Basin locations(concluded).[a]

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
12/19.95	Dissolved oxygen (mg/L)	6.3	5.3	6.2	5.8	5.4	5.6	5.3	5.2
	Temperature (°C)	13.9	11.9	12.1	11.4	11.4	12.9	11.6	11.6
	Turbidity (m)				0.25				
12/28.95	Dissolved oxygen (mg/L)	6.7	7.2	7.4	7.3	6.5	5.8	5.5	5.5
	Temperature (°C)	10.3	10.5	10.2	9.9	9.6	10.4	9.8	9.9
	Turbidity (m)				0.30				
Minimum	Dissolved oxygen (mg/L)	6.3	5.3	6.2	4.3	2.8	5.6	4.4	4.2
	Temperature (°C)	8.5	8.3	8.3	8.3	8.3	8.7	8.9	8.9
	Turbidity (m)				0.10				
Maximum	Dissolved oxygen (mg/L)	10.2	10.2	9.7	9.4	9.2	10.2	9.4	9.4
	Temperature (°C)	30.4	27.1	26.1	25.7	25.6	27.8	25.7	25.7
	Turbidity (m)				0.66				
Median	Dissolved oxygen (mg/L)	8.3	8.3	7.95	7.6	7.45	7.9	7.5	7.3
	Temperature (°C)	18.7	18.05	17.25	17.15	17.15	17.8	17.45	17.5
	Turbidity (m)				0.25				
Inter-quartile range	Dissolved oxygen (mg/L)	1.7	0.975	1.25	1.2	1.675	0.975	1.1	1.05
	Temperature (°C)	12.6	9.975	9.575	11.075	11.05	10.75	11.375	11.325
	Turbidity (m)				0.11				
Number of samples	Dissolved oxygen (mg/L)	29	30	30	30	30	30	30	30
	Temperature (°C)	29	30	30	30	30	30	30	30
	Turbidity (m)				35				

[a] Data not collected because of instrument failure.

15. Quality Assurance

Lucinda M. Garcia
Donald H. MacQueen

Sampling Location Designators

As described in Volume 1, the LLNL environmental monitoring program uses alpha-numeric location designator codes to define sampling locations. **Tables 15-1** and **15-2** decode sampling location designators used in 1995 and provide a cross-reference between current designators and those used in previous years. Changes to location designators made during 1995 are shown on those tables. **Table 15-3** decodes sampling location designators that were used prior to 1995 but were not used in 1995.

Participation in Laboratory Intercomparison Studies

During 1995, the LLNL Chemistry and Materials Science's Environmental Services Environmental Monitoring Radiation Laboratory (CES EMRL) and the Hazards Control Department's Analytical Laboratory (HCAL) participated in both the EPA's Environmental Monitoring Systems Laboratory (EMSL) inter-comparison studies program and the DOE Environmental Monitoring Laboratory (EML) intercomparison studies program.

The results of CES EMRL's participation in the EMSL studies are presented in **Table 15-4**. A review of these data indicates that 28 of 30 analyses fell within established acceptance control limits. The results of two analyses, one for natural uranium and the other for gross alpha, fell outside of the acceptance control limits. The cause of the unacceptable results for the natural uranium sample, included in the September 15 study, is still under investigation. The unacceptable results for the October 27 gross alpha analysis were probably due to a bias in the method. This is indicated by the fact that 39.5% of the 195 participants in this study exceeded the 3-sigma acceptance control limits for gross alpha and another 23.1% had results in the warning zone (between 2- and 3-sigma). EPA research indicates that matrix differences between the salt solids used to prepare the calibration curve and the salts in the sample are the source of this bias.

The results of HCAL's participation in 1995 EMSL studies are presented in **Table 15-5**. A review of these data indicates that 6 of 8 sample results fell within the 3-sigma acceptance control limits. Both samples that fell outside the acceptance control limits had gross alpha results below the lower control limit. One of these samples was from the October 27 study described above. Conversations with EMSL personnel revealed that a new solids matrix, containing nitrates, was used for the two failed tests. The HCAL double checked its results using the single-point calibration methods used by the EMSL and reconfirmed their initial results. In the single point method, the original sample was spiked with thorium-230 solution of known activity. Laboratory personnel

suspect that some of this material reacted with the plastic sample bottle during shipping. The HCAL plans to do the single-point calibration on all future EPA gross alpha in water tests.

The results of CES EMRL's participation in the EML studies are presented in **Table 15-6**. Review of these results shows that 54 of 54 results were within the established acceptance control limits; there were no unacceptable results.

HCAL's results are presented in **Table 15-7**. Review of these results show that 10 of 10 results were within the established acceptance control limits.

The HCAL also participated in four EPA Water Pollution (WP) and Water Supply (WS) intercomparison studies for metals during 1995, as shown in **Table 15-8.** The HCAL measures aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, mercury, nickel, silver, and zinc in sewage effluent for the LLNL environmental monitoring program. Review of these results shows that 68 of 70 samples fell within established acceptance control limits. The results of a sample analyzed for beryllium and a sample analyzed for molybdenum by inductively coupled plasma-atomic emission spectroscopy fell outside the acceptance control limits. Both of these samples were the lower concentration of the pair of samples supplied for each element. The larger discrepancy for beryllium appears to be due to uncompensated spectral interference by vanadium. The wavelength used for beryllium analysis has since been changed to one that is not subject to this interference. In addition, to improve accuracy for elements present in low concentrations, the HCAL is evaluating the effect of either switching from a three-point calibration to a two-point calibration or using a forced-zero calibration curve fit with the three-point calibration.

Contract laboratories are also required to participate in laboratory intercomparison programs; however, permission to publish their results for comparison purposes has not been granted.

Table 15-1. Livermore site and Livermore Valley sampling location designators for 1995.

Medium/Location	Current designator	Previous designator(s)	Notes
Air particulate			
Altamont Pass	L-ALTA	90-07	
Near Building 531	L-B531	—	
South Cafeteria (East Avenue)	L-CAFE	90-12	
Cow barn (northeast of Building 592)	L-COW	90-15	
UNCLE Credit Union (Greenville Road)	L-CRED	—	
Residence (Livermore)	L-ERCH	90-11	Abandoned 10/95
FCC Station	L-FCC	90-08	
Firehouse (East Avenue)	L-FIRE	90-17	
Livermore VA Hospital	L-HOSP	90-10	
LWRP	L-LWRP	90-16	
West parking lot (Mesquite Way)	L-MESQ	90-02	
Met. Tower (northwest perimeter)	L-MET	90-13	
Patterson Pass	L-PATT	90-05	
Residence (Livermore)	L-RRCH	90-06	
Salvage (East Avenue)	L-SALV	90-01	
Sandia tanks	L-TANK	90-03	
Visitors Center (east perimeter)	L-VIS	90-14	
Zone 7	L-ZON7	90-04	
Air tritium			
Altamont Pass	L-ALTA	93-07	
Building 292 area	L-B292	—	
Building 331 yard	L-B331	—	
Building 514 yard	L-B514	—	
Building 624 (612 yard)	L-B624	—	
South Cafeteria (East Avenue)	L-CAFE	93-12	
Cow barn (northeast of Building 592)	L-COW	93-15	
Firehouse (East Avenue)	L-FIRE	93-17	
West parking lot (Mesquite Way)	L-MESQ	93-02	
Met. Tower (northwest perimeter)	L-MET	93-13	
LLNL pool	L-POOL	—	
Salvage (East Avenue)	L-SALV	93-01	
Residence (west of Sandia)	L-VET	93-S2	
Visitors Center (east perimeter)	L-VIS	93-14	
Residence (Cross Rd.)	L-XRDS	93-S1	
Zone 7	L-ZON7	93-04	

...continued on next page

Table 15-1. Livermore site and Livermore Valley sampling location designators for 1995 (continued).

Medium/Location	Current designator	Previous designator(s)	Notes
Vegetation			
Aqueduct	L-AQUE	95-23	
Calaveras Reservoir	L-CAL	—	
FCC Station	L-FCC	95-33	
LLNL on-site garden	L-GARD		
I-580 and Greenville Road	L-I580	95-20	
Mesquite Way	L-MESQ	—	Replaced VASW
Met. Tower (northwest perimeter)	L-MET	—	Replaced VASW
Camp Parks	L-PARK	—	
Patterson Pass	L-PATT	95-04	
North of LLNL (railroad tracks)	L-RAIL	95-29	
Tesla Road (west)	L-TESW	95-32	
Visitors Center (east perimeter)	L-VIS	—	
Zone 7	L-ZON7	95-15	
Arroyo Sediment			
Arroyo Seco South No. 2	L-ASS2	—	Replaced L-ASS
Arroyo Seco West	L-ASW	L-ASN	
Drainage Retention Basin	L-CDB	CDB	
Drainage Retention Basin 2	L-CDB2	—	
Eastern Settling Basin	L-ESB	—	
Greenville Road, northeast perimeter	L-GRNE	—	
West perimeter drainage channel	L-WPDC	—	
Soil			
Altamont Pass	L-ALTA	—	
South Cafeteria (East Avenue)	L-CAFE	—	
Cow barn (northeast of Building 592)	L-COW	L-15	
Residence (Livermore)	L-ERCH	—	
FCC Station	L-FCC	L-08	
Livermore VA Hospital	L-HOSP	L-10	
West parking lot (Mesquite Way)	L-MESQ	L-02	
Met. Tower (northwest perimeter)	L-MET	L-13	
Northeast corner perimeter fence	L-NEP	L-18	
Patterson Pass	L-PATT	L-05	
Residence (Livermore)	L-RRCH	—	
Salvage (East Avenue)	L-SALV	—	

...continued on next page

Table 15-1. Livermore site and Livermore Valley sampling location designators for 1995 (continued).

Medium/Location	Current designator	Previous designator(s)	Notes
Soil (continued)			
Sandia tanks	L-TANK	L-03	
Visitors Center (east perimeter)	L-VIS	L-14	
LWRP (1/3 North)	L-WRP1	L-19	
LWRP (2/3 North)	L-WRP2	L-20	
LWRP (Northwest)	L-WRP3	L-21	
LWRP (1/3 West)	L-WRP4	L-22	
LWRP (2/3 West)	L-WRP5	L-23	
LWRP (Southwest)	L-WRP6	L-24	
Zone 7	L-ZON7	L-04	
Sewage			
Building 196 (daily composite)	L-B196	LLNL	
Building 196 (weekly composite)	L-C196	—	
LWRP (digestor)	L-WRD1	—	
LWRP (digestor)	L-WRD2	—	
LWRP (digestor)	L-WRD3	—	
LWRP (effluent)	L-WRPE	—	
Runoff			
Arroyo Las Positas (east of LLNL)	L-ALPE	01	
Greenville Road (south of L-GRNE)	L-ALPO		Reinstated mid-1995
Arroyo Seco South No. 2	L-ASS2	—	Replaced L-ASS
Arroyo Seco West (Vasco/East Avenue)	L-ASW	L-ASN;06	
Drainage Retention Basin	L-CDB	02	
Drainage Retention Basin effluent	L-CDBX	—	Drainage Retention Basin release
Greenville Road (northeast perimeter)	L-GRNE	—	
West perimeter drainage channel	L-WPDC	—	Drainage Retention Basin release
Rain			
Aqueduct	L-AQUE	—	
Building 291	L-B291	—	
Building 343	L-B343	—	
Residence (Livermore)	L-BVA	—	Reinstated in 1995
Drainage Retention Basin	L-CDB	—	
Cow barn (northeast of Building 592)	L-COW	—	
East of Sandia	L-ESAN	—	

...concluded on next page

Table 15-1. Livermore site and Livermore Valley sampling location designators for 1995 (concluded).

Medium/Location	Current Designator	Previous Designator(s)	Notes
Rain (continued)			
Greenville and Tesla Roads	L-GTES	—	Reinstated in 1995
Met. Tower (northwest perimeter)	L-MET	—	
Salvage (East Avenue)	L-SALV	—	
Residence (Livermore)	L-SLST	—	
Residence (west of Sandia)	L-VET	—	
Vineyard	L-VINE	—	Reinstated in 1995
Visitors Center (east parameter)	L-VIS	—	
Zone 7	L-ZON7	—	
Water			
Arroyo de Laguna (Sunol)	L-ALAG	92-24	
Residence (Livermore)	L-BELL	92-37	
Calaveras Reservoir	L-CAL	92-29	
Del Valle Lake	L-DEL	92-11	
Springtown duck pond	L-DUCK	92-16	
Gas station tap water	L-GAS	92-19	
Private well	L-ORCH	92-34	
Residence (Livermore)	L-PALM	92-31	
LLNL pool	L-POOL	92-43	
Shadow Cliffs	L-SHAD	92-26	
Building 151 tap water	L-TAP	92-30	
Zone 7	L-ZON7	92-15	
Drainage Retention Basin			
Surface water (shallow) location	L-CDBA		
Surface water (shallow) location	L-CDBC		
Surface water location	L-CDBD		
Mid-depth location	L-CDBE		Sampling location
Bottom location	L-CDBF		
Surface water location	L-CDBJ		
Mid-depth location	L-CDBK		
Bottom location	L-CDBL		

Table 15-2. Site 300 sampling location designators for 1995.

Medium/Location	Current designator	Previous designator(s)	Notes
Air particulate			
East of Building 801	3-801E	40-10	
East control post	3-ECP	40-02	
East observation point	3-EOBS	40-01	
West of main gate	3-GOLF	40-05	
Linac Road	3-LIN	40-04	
North power station	3-NPS	40-08	
Tracy firehouse	3-TFIR	40-06	
West control post	3-WCP	40-03	
West observation point	3-WOBS	40-09	
Soil			
East of Building 801	3-801E	3NXXH01 or 1114	
North of Building 801	3-801N	1117	
West of Building 801	3-801W	3NNWG01 or 1113	
Behind Building 812	3-812N	3NXXC01 or 1115	
West of Building 834	3-834W	3ESEI01 or 1103	
North of road to Building 851	3-851N	3WNWI01 or 1107	
North of Building 856	3-856N	3WXXK01 or 1106	
Near Building 858	3-858S	3WSWI01 or 1104	
West landfill (Disposal Site West)	3-DSW	3NWXP02 or 1111	
North of east observation point	3-EOBS	3NNWL01 or 1112	
Evaporator (north of Well 8)	3-EVAP	3WNWK01 or 1109	
Golf course (west of main gate)	3-GOLF	3SEXL01 or 1116	
North Power Station	3-NPS	3NWXP01 or 1110	
West Observation Post	3-WOBS	3WNWN01 or 1108	
Vegetation			
East of Building 801	3-801E	45-12	
Carnegie	3-CARN	45-01	
West landfill (Disposal Site West)	3-DSW	45-06	
Near Well 8	3-EVAP	45-13	
Geodetic Creek	3-GEO	45-03	
West of main gate	3-GOLF	45-02	
Water			
Monitoring well	3-W35A04		Replaced GALLO2
Well 1	3-WELL01	42-01	
Private well	3-CON1	42-07	
Private well	3-CON2	—	

...continued on next page

Table 15-2. Site 300 sampling location designators for 1995 (continued).

Medium/Location	Current designator	Previous designator(s)	Notes
Well 18	3-WELL18	42-22	
Geodetic creek	3-GEOCRK	42-14	Transferred to runoff network in 1995.
Rain	3-RAIN	42-20	
812 creek	3-812CRK	42-21	
Carnegie Retention Well 1	3-CARNRW1	42-23	
Carnegie Retention Well 2	3-CARNRW2	42-24	
Well 20	3-WELL20	42-31	
Private well	3-GALLO1	42-28	
CDF well	3-CDF1	42-27	
Private well	3-MUL1	—	
Private well	3-MUL2	—	
Private well	3-VIE1	—	
Private well	3-VIE2	—	
Private well	3-STN	—	
Cooling towers			
Building 801	3-B801	—	
Building 805	3-B805	—	
Building 809	3-B809	—	
Building 810	3-B810	—	
Building 812	3-B812	—	
Building 815	3-B815	—	
Building 817	3-B817	—	
Building 826	3-B826	—	
Building 827, Tower No. 1	3-B827-1	—	
Building 827, Tower No. 2	3-B827-2	—	
Building 828	3-B828	—	
Building 836, Tower A	3-B836A	—	
Building 836, Tower B	3-B836D	—	
Building 851, Tower No. 1	3-B851-1	—	
Building 851, Tower No. 2	3-B851-2	—	
Building 854	3-B854	—	
Building 865	3-B865	—	

...concluded on next page

Table 15-2. Site 300 sampling location designators for 1995 (concluded).

Medium/Location	Current designator	Previous designator(s)	Notes
Runoff			
North of Well NC2-07	3-NLIN	—	
East of Pit 6	3-N829	—	
South of B873	3-N883	—	
Pit 7 North Stilling Basin	3-NPT7	—	
Corral Hollow Creek	3-NSTN	—	
South East End of Pit 6	3-NPT6	—	
Geodetic Creek	3-GEOCRK	—	
Carnegie State Recreational Vehicle Area	3-CARN	—	

Table 15-3. Previously used sampling location designators not used in 1995.

Medium/Location	Location designator	Previous designator(s)	Notes
Livermore Site and Livermore Valley			
Air particulate			
Livermore City Corp Yard	L-LCCY	90-09	Abandoned in 1994
Air tritium			
Livermore City Corp Yard	L-LCCY	93-09	Abandoned in 1994
Cow milk			
Residence (Livermore)	L-WRD	—	Abandoned prior to 1994
Goat milk			
Cartoned milk	C-CART	91-97	Abandoned in 1994
Residence (Modesto)	C-MOD	91-12	Abandoned in 1994
Residence (Modesto)	C-MOD2	—	Abandoned in 1994
Residence (Ripon)	C-RIP	—	Abandoned in 1994
Residence (Stevenson)	C-STEV	—	Abandoned in 1994
Prepasteurized (Turlock)	C-TUR	—	Abandoned in 1994
Residence (Brentwood)	C-WOOD	—	Abandoned in 1994
Residence (Livermore)	L-COOL	—	Abandoned prior to 1994
Residence (Livermore)	L-LUP	91-13	Replaced prior to 1994
Residence (Livermore)	L-MZF	91-07	Abandoned prior to 1994
Residence (Livermore)	L-WRD	91-05	Abandoned in 1994
Vegetation			
Residence (Modesto)	C-MOD		Abandoned prior to 1995
Residence (Danville)	L-DAN		Abandoned prior to 1995
Vasco Road (west of LLNL)	L-VASW	95-31	Replaced by L-MESQ and L-MET
Arroyo sediment			
East of Building 438	L-438E	—	Abandoned in 1994
4th and A Streets	L-4THA	—	Abandoned in 1994
Arroyo Las Positas North	L-ALPN	—	Abandoned in 1994
Arroyo Las Positas West	L-ALPW	ALPW	Abandoned in 1994
Arroyo Seco East	L-ASE	ASE	Abandoned prior to 1994
Arroyo Seco South	L-ASS	ASS	Replaced by L-ASS2
Sewage			
Manhole 163A (Sandia)	L-163A	—	
LWRP	L-LWRP	LWRP	Replaced by L-WRPE
Manhole 125C	L-M125	L-125C	
Manhole 177E	L-M177	L-177E	
Manhole 185F	L-M185	L-185F	
Manhole 231A	L-M231	L-231A	

...concluded on next page

Table 15-3. Previously used sampling location designators not used in 1995 (concluded).

Medium/Location	Location designator	Previous designator(s)	Notes
Sewage (continued)			
Manhole 238C	L-M238	L-238C	
Manhole 40B	L-M40	L-40C	
Manhole 51A	L-M51	L-51A	
Manhole 53A	L-M53	L-53A	
Manhole 69A	L-M69	L-69A	
Manhole 86B	L-M86	L-86B	
Runoff			
4th and A Streets	L-4THA	07	Abandoned prior to 1994
Arroyo Las Positas (north at cowbarn)	L-ALPN	09	Abandoned prior to 1994
Arroyo Las Positas (northwest boundary)	L-ALPW	03	Abandoned prior to 1994
Arroyo Seco East (influent to Sandia)	L-ASE	04	Abandoned prior to 1994
Arroyo Seco South (west parking lot)	L-ASS	06	Replaced by L-ASS2
East of Building 438	L-B438	08	Abandoned prior to 1994
Rain			
Altamont	L-ALTA	—	Abandoned prior to 1994
Del Valle/Zone 7	L-DEL7	—	Abandoned prior to 1994
FCC station	L-FCC	—	Abandoned prior to 1994
Camp parks	L-PARK	—	Abandoned prior to 1994
Patterson Pass	L-PATT	—	Abandoned prior to 1994
Site 300			
Water			
Private well	3-GALLO2	—	Abandoned prior to 1994

Table 15-4. LLNL Chemistry and Materials Science's Environmental Services Environmental Monitoring Radiation Laboratory (CES EMRL) performance in the EPA Environmental Monitoring Systems Laboratory (EMSL) Intercomparison Studies Program for Water, 1995.

Analysis	Date	LLNL value (pCi/L)	Known value (pCi/L)	Control limits (3σ)	Warning limits (2σ)	Performance[a]
Gross Alpha	4/18	48.83	47.5	26.9 – 68.1	33.7 – 61.3	Acceptable
	10/27	24.47	51.2	29.0 – 73.4	36.4 – 66.0	Unacceptable
Gross Beta	7/21	21.6	19.4	10.7 – 28.1	13.6 – 25.2	Acceptable
	10/27	29.07	24.8	16.1 – 33.5	19.0 – 30.6	Acceptable
Tritium	3/10	7056.67	7435.0	6144.2 – 8725.8	6573.8 – 8296.2	Acceptable
	8/4	4523.33	4872.0	4027.1 – 5716.9	4308.3 – 5435.7	Acceptable
Ba-133	6/9	73.00	79.0	65.1 – 92.9	69.7 – 88.3	Acceptable
	11/3	99.00	99.0	81.7 – 116.3	87.4 – 110.6	Acceptable
Co-60	4/18	26.67	29.0	20.3 – 37.7	23.2 – 34.8	Acceptable
	6/9	35.00	40.0	31.3 – 48.7	34.2 – 45.8	Acceptable
	11/3	55.00	60.0	51.3 – 68.7	54.2 – 65.8	Acceptable
Cs-134	4/18	17.00	20.0	11.3 – 28.7	14.2 – 25.8	Acceptable
	6/9	42.33	50.0	41.3 – 58.7	44.2 – 55.8	Check for Error
	11/3	35.33	40.0	31.3 – 48.7	34.2 – 45.8	Acceptable
Cs-137	4/18	11.00	11.0	2.3 – 19.7	5.2 – 16.8	Acceptable
	6/9	33.67	35.0	26.3 – 43.7	29.2 – 40.8	Acceptable
	11/3	52.33	49.0	40.3 – 57.7	43.2 – 54.8	Acceptable
Pu-239	3/17	10.97	11.1	9.2 – 13.0	9.8 – 12.4	Acceptable
U-natural	2/10	22.8	25.5	20.3 – 30.7	22.0 – 29.0	Acceptable
	4/18	9.27	10.0	4.8 – 15.2	6.5 – 13.5	Acceptable
	6/16	14.07	15.2	10.0 – 20.4	11.7 – 18.7	Acceptable
	9/15	24.33	30.5	25.3 – 35.7	27.0 – 34.0	Unacceptable
Zn-65	6/9	74.00	76.0	62.1 – 89.9	66.7 – 85.3	Acceptable
	11/3	131.33	125.0	102.4 – 147.6	110.0 – 140.0	Acceptable
Ra-226	4/18	17.17	14.9	11.1 – 18.7	12.4 – 17.4	Acceptable
	6/16	14.20	14.8	11.0 – 18.6	12.3 – 17.3	Acceptable
	9/15	27.13	24.8	18.4 – 31.2	20.5 – 29.1	Acceptable
Ra-228	4/18	18.07	15.8	8.9 – 22.7	11.2 – 20.4	Acceptable
	6/16	14.47	15.0	8.4 – 21.6	10.6 – 19.4	Acceptable
	9/15	19.70	20.0	11.3 – 28.7	14.2 – 25.8	Acceptable

[a] Data are considered acceptable when they fall within the 2σ warning limits. Data should be checked for error when they are between the 2σ warning limits and the 3σ control limits. Data are considered unacceptable when they are outside the 3σ control limits.

Table 15-5. LLNL Hazards Control Analytical Laboratory (HCAL) performance in the EPA Environmental Monitoring Systems Laboratory (EMSL) Intercomparison Program for Water, 1995.

Analysis	Date	LLNL value (pCi/L)	Known value (pCi/L)	Control limits (3σ)	Warning limits (2σ)	Performance[a]
Gross alpha	1/27	4.33	5.0	0.0 – 13.7	0.0 – 10.8	Acceptable
	7/21	12.67	27.5	15.5 – 39.5	19.5 – 35.5	Not acceptable
	10/27	51.2	23.60	29.0 – 73.4	36.4 – 73.4	Not acceptable
Gross beta	1/27	5.00	5.0	0.0 – 13.7	0.0 – 10.8	Acceptable
	7/21	16.57	19.4	10.7 – 28.1	13.6 – 25.2	Acceptable
	10/27	24.47	24.8	16.1 – 33.5	19.0 – 30.6	Acceptable
Tritium	3/10	6886.67	7435.0	6144.2 – 8725.8	6573.8 – 8296.2	Acceptable
	8/4	4211.0	4872.0	4027.1 – 5716.9	4308.3 – 5435.7	Acceptable

[a] Data are considered acceptable when they fall within the 2σ warning limits. Data should be checked for error when they are between the 2σ warning limits and the 3σ control limits. Data are considered unacceptable when they are outside the 3σ control limits.

Table 15-6. LLNL's Chemistry and Materials Science's Environmental Services Environmental Monitoring Radiation Laboratory's results from the DOE Environmental Measurements Laboratory (EML) Quality Assurance Program, 1995.

Medium (units)	Analysis	Date	LLNL value	EML value	LLNL/ EML	Acceptable limits[a]	Warning limits[a]	Performance
Air filter (Bq/filter)	Ce-144	6/1	67.9	91.2	0.75	0.59 - 1.36	0.78 - 1.18	Warning
		12/1	39.5	52.1	0.76	0.59 - 1.36	0.78 - 1.18	Warning
	Co-57	6/1	10.0	12.7	0.79	0.64 - 1.45	0.79 - 1.16	Acceptable
		12/1	11.8	14.7	0.80	0.64 - 1.45	0.79 - 1.16	Acceptable
	Co-60	6/1	3.34	3.76	0.89	0.71 - 1.29	0.83 - 1.15	Acceptable
		12/1	30.1	32.6	0.92	0.71 - 1.29	0.83 - 1.15	Acceptable
	Cs-134	6/1	5.81	5.75	1.01	0.64 - 1.22	0.75 - 1.08	Acceptable
		12/1	18.5	17.9	1.03	0.64 - 1.22	0.75 - 1.08	Acceptable
	Cs-137	6/1	4.92	5.28	0.93	0.69 - 1.32	0.85 - 1.19	Acceptable
		12/1	6.33	7.25	0.87	0.69 - 1.32	0.85 - 1.19	Acceptable
	Gross Alpha	12/1	3.16	3.30	0.96	0.50 - 1.50	0.80 - 1.20	Acceptable
	Gross Beta	12/1	1.92	1.12	1.71	0.56 - 1.93	0.87 - 1.41	Warning
	Mn-54	6/1	4.14	4.71	0.88	0.74 - 1.36	0.85 - 1.20	Acceptable
		12/1	4.74	5.34	0.89	0.74 - 1.36	0.85 - 1.20	Acceptable
	Pu-238	6/1	0.116	0.122	0.95	0.48 - 1.75	0.69 - 1.14	Acceptable
		12/1	0.093	0.096	0.96	0.48 - 1.75	0.69 - 1.14	Acceptable
	Pu-239	6/1	0.060	0.062	0.96	0.57 - 1.60	0.79 - 1.15	Acceptable
		12/1	0.093	0.093	1.00	0.57 - 1.60	0.79 - 1.15	Acceptable
	Ru-106	12/1	17.4	17.0	1.02	0.59 - 1.76	0.66 - 1.25	Acceptable
	Sb-125	6/1	8.06	9.42	0.86	0.50 - 1.50	0.80 - 1.20	Acceptable
		12/1	11.2	11.4	0.98	0.57 - 1.38	0.81 - 1.13	Acceptable
	U (ug)	12/1	4.880	4.3	1.14	0.28 - 1.77	0.75 - 1.24	Acceptable
Soil (Bq/kg)	Cs-137	6/1	300	266	1.13	0.69 - 1.46	0.82 - 1.26	Acceptable
		12/1	221	207	1.07	0.69 - 1.46	0.82 - 1.26	Acceptable
	K-40	6/1	387	384	1.01	0.67 - 1.53	0.80 - 1.26	Acceptable
		12/1	369	377	0.98	0.67 - 1.53	0.80 - 1.26	Acceptable
	Pu-238	6/1	31.6	32.0	0.99	0.21 - 1.41	0.50 - 1.14	Acceptable
		12/1	17.8	17.5	1.02	0.21 - 1.41	0.50 - 1.14	Acceptable
	Pu-239	6/1	6.66	6.76	0.99	0.55 - 2.05	0.80 - 1.31	Acceptable
		12/1	5.43	5.170	1.05	0.55 - 2.05	0.80 - 1.30	Acceptable

...concluded on next page

Table 15-6. LLNL's Chemistry and Materials Sciences Environmental Service's Environmental Monitoring Radiation Laboratory's results from the DOE Environmental Measurements Laboratory (EML) Quality Assurance Program, 1995. (concluded)

Medium (units)	Analysis	Date	LLNL value	EML value	LLNL/ EML	Acceptable limits[a]	Warning limits[a]	Performance
Vegetation (Bq/kg)	Co-60	6/1	7.88	9.60	0.82	0.69 - 1.40	0.84 - 1.24	Warning
		12/1	6.74	9.17	0.74	0.69 - 1.40	0.84 - 1.24	Warning
	Cs-137	6/1	131	117.	1.12	0.69 - 1.55	0.86 - 1.29	Acceptable
		12/1	115	97.2	1.18	0.69 - 1.55	0.86 - 1.29	Acceptable
	K-40	6/1	1040	1030	1.01	0.43 - 1.48	0.78 - 1.24	Acceptable
		12/1	354	352	1.01	0.43 - 1.48	0.78 - 1.24	Acceptable
	Pu-238	6/1	0.089	0.089	1.00	0.72 - 2.08	0.83 - 1.20	Acceptable
	Pu-239	6/1	1.030	1.12	0.92	0.56 - 1.94	0.75 - 1.42	Acceptable
		12/1	0.853	0.980	0.87	0.56 - 1.94	0.75 - 1.42	Acceptable
Water (Bq/L)	Co-60	6/1	200	196	1.02	0.79 - 1.18	0.89 - 1.10	Acceptable
		12/1	193	196	0.99	0.79 - 1.18	0.79 - 1.18	Acceptable
	Cs-134	6/1	92.0	83.5	1.10	0.74 - 1.29	0.83 - 1.17	Acceptable
	Cs-137	6/1	83.5	76.8	1.09	0.82 - 1.29	0.93 - 1.15	Acceptable
		12/1	82.1	75.2	1.09	0.82 - 1.29	0.93 - 1.15	Acceptable
	Gross Alpha	12/1	1330	1310	1.02	0.46 - 1.35	0.84 - 1.25	Acceptable Acceptable
	Gross Beta	12/1	597	410	1.46	0.75 - 1.64	0.98 - 1.47	Acceptable
	Tritium	6/1	56.7	60.3	0.94	0.64 - 1.85	0.83 - 1.28	Acceptable
		12/1	151.	168.	0.90	0.64 - 1.85	0.83 - 1.28	Acceptable
	Mn-54	6/1	44.6	43.5	1.03	0.81 - 1.25	0.93 - 1.14	Acceptable
		12/1	49.3	44.9	1.10	0.81 - 1.25	0.93 - 1.14	Acceptable
	Pu-238	12/1	1.33	1.41	0.94	0.39 - 1.78	0.73 - 1.22	Acceptable
	Pu-239	6/1	0.678	0.591	1.15	0.54 - 1.34	0.70 - 1.16	Acceptable
		12/1	0.272	0.272	1.00	0.54 - 1.34	0.70 - 1.16	Acceptable
	U (ug)	12/1	0.028	0.025	1.13	0.07 - 1.27	0.86 - 1.15	Acceptable

[a] Data are considered acceptable when they fall within the 2σ warning limits. Data should be checked for error when they are between the 2σ warning limits and the 3σ control limits. Data are considered unacceptable when they are outside the 3σ control limits.

Table 15-7. LLNL's Hazards Control Analytical Laboratory results from the DOE Environmental Measurements Laboratory (EML) Quality Assurance Program, 1995.

Medium (units)	Analysis	Date	LLNL value	EML value	LLNL/ EML	Acceptable limits[a]	Warning limits[a]	Performance
Air filters (Bq/filter)	Gross alpha	6/1	4.80	3.22	1.49	0.50 - 1.50	0.80 - 1.20	Warning
		12/1	2.77	3.30	0.84	0.50 - 1.50	0.80 - 1.20	Acceptable
	Gross beta	6/1	2.60	1.85	1.41	0.50 - 1.50	0.80 - 1.20	Warning
		12/1	1.63	1.12	1.46	0.56 - 1.93	0.87 - 1.41	Warning
Water (Bq/L)	Gross alpha	6/1	1360	1340	1.02	0.50 - 1.50	0.80 - 1.20	Acceptable
		12/1	853	1310	0.65	0.46 - 1.35	0.84 - 1.25	Warning
	Gross beta	6/1	844	653.	1.29	0.50 - 1.50	0.80 - 1.20	Warning
		12/1	513	410	1.25	0.75 - 1.64	0.98 - 1.47	Acceptable
	Tritium	6/1	50.1	60.3	0.83	0.64 - 1.85	0.83 - 1.28	Acceptable
		12/1	148	168	0.88	0.64 - 1.85	0.83 - 1.28	Acceptable

[a] Data are considered acceptable when they fall within the 2σ warning limits. Data should be checked for error when they are between the 2σ warning limits and the 3σ control limits. Data are considered unacceptable when they are outside the 3σ control limits.

Table 15-8. Hazards Control Department Analytical Laboratory results from the Environmental Protection Agency (EPA) Water Pollution and Water Supply Studies.[a]

Analysis	Date	Sample	LLNL value[a] (μg/L)	True value[a] (μg/L)	Acceptable limits[b] (μg/L)	Warning limits[b] (μg/L)	Performance
Aluminum	2/10	01	129	130	93.8 – 175	104 – 165	Acceptable
		02	589	610	498 – 719	526 – 691	Acceptable
	4/12	001	683	670	568 – 750	N/A	Acceptable
	8/29	01	1030	990	830 – 1140	868 – 1100	Acceptable
		02	2700	2700	2290 – 3060	2390 – 2960	Acceptable
	11/3	001	53.3	51.0	43.2 – 67.3	N/A	Acceptable
Arsenic	2/10	01	311	311	250 – 374	265 – 358	Acceptable
		02	739	743	598 – 891	635 – 854	Acceptable
	4/12	001	53.8	61.7	52.6 – 69.7	N/A	Acceptable
	8/29	01	123	121	98.4 – 144	104 – 138	Acceptable
		02	462	462	380 – 544	400 – 523	Acceptable
	11/3	001	101	120	107 – 136	N/A	Not acceptable
Beryllium	2/10	01	360	350	294 – 395	307 – 383	Acceptable
		02	873	850	716 – 957	747 – 927	Acceptable
	4/12	001	1.45	1.33	1.13 – 1.53	N/A	Acceptable
	8/29	01	38.5	13.0	9.16 – 16.8	10.1 – 15.8	Not Acceptable
		02	98.0	92.3	77.1 – 105	80.6 – 102	Acceptable
	11/3	001	8.08	7.70	6.55 – 8.86	N/A	Acceptable
Cadmium	2/10	01	85.7	86.8	73.4 – 101	76.9 – 97.7	Acceptable
		02	743	750	638 – 870	667 – 841	Acceptable
	4/12	001	2.75	2.80	2.24 – 3.36	N/A	Acceptable
	8/29	01	13.4	13.0	10.2 – 16.1	10.9 – 15.4	Acceptable
		02	209	210	181 – 240	188 – 232	Acceptable
	11/3	001	33.8	34.0	27.2 – 40.8	N/A	Acceptable
Chromium	2/10	01	43.7	43.5	35.2 – 49.1	37.2 – 49.1	Acceptable
		02	526	529	454 – 608	473 – 589	Acceptable
	4/12	001	126	119	101 – 137	N/A	Acceptable
	8/29	01	96.0	97.2	82.9 – 111	86.5 – 108	Acceptable
		02	363	361	312 – 409	324 – 396	Acceptable
	11/3	001	36.8	37.8	32.1 – 43.5	N/A	Acceptable

...continued on next page

Table 15-8. Hazards Control Department Analytical Laboratory results from the Environmental Protection Agency (EPA) Water Pollution and Water Supply Studies (continued).[a]

Analysis	Date	Sample	LLNL value[a] (μg/L)	True value[a] (μg/L)	Acceptable limits[b] (μg/L)	Warning limits[b] (μg/L)	Performance
Copper	2/10	01	32.8	33.6	28.1 - 38.3	29.4 - 37	Acceptable
		02	175	187	164 - 208	170 - 203	Acceptable
	4/12	001	1410	1400	1260 - 1540	N/A	Acceptable
	8/29	01	52.5	50.4	41.6 - 58	43.6 - 56	Acceptable
		02	885	890	792 - 980	816 - 957	Acceptable
	11/3	001	608	630	567 - 693	N/A	Acceptable
Iron	2/10	01	65.8	64.5 - 1300	48.6 - 81.6	52.7 - 77.5	Acceptable
		02	1260		1150 - 1450	1180 - 1410	Acceptable
	8/29	01	625	626	555 - 700	573 - 682	Acceptable
		02	935	941	834 - 1070	863 - 1040	Acceptable
Lead	2/10	01	652	645	546 - 721	568 - 699	Acceptable
		02	2890	2900	2540 - 3240	2630 - 3150	Acceptable
	4/12	001	71.1	64.1	44.9 - 83.3	N/A	Acceptable
	8/29	01	182	190	162 - 218	169 - 211	Acceptable
		02	492	500	438 - 561	453 - 545	Acceptable
	11/3	001	37.1	39.0	27.3 - 50.7	N/A	Acceptable
Mercury	2/10	01	5.8	5.81	4.04 - 7.33	4.46 - 6.91	Acceptable
		02	26.7	27.1	20.6 - 32.5	22.1 - 31	Acceptable
	4/12	001	0.8	0.897	0.628 - 1.17	N/A	Acceptable
	8/29	01	1.5	1.33	0.929 - 1.77	1.03 - 1.66	Acceptable
		02	1.9	1.76	1.26 - 2.3	1.39 - 2.17	Acceptable
	11/3	001	2.8	3.00	2.1 - 3.9	N/A	Acceptable
Nickel	2/10	01	262	265	234 - 295	242 - 287	Acceptable
		02	1070	1080	959 - 1200	989 - 1170	Acceptable
	4/12	001	181	180	153 - 207	N/A	Acceptable
	8/29	01	79.5	80.9	67.7 - 91.9	70.7 - 89.9	Acceptable
		02	800	780	701 - 860	721 - 840	Acceptable
	11/3	001	390	380	323 - 437	N/A	Acceptable

...concluded on next page

Table 15-8. Hazards Control Department Analytical Laboratory results from the Environmental Protection Agency (EPA) Water Pollution and Water Supply Studies (concluded).[a]

Analysis	Date	Sample	LLNL value[a] (µg/L)	True value[a] (µg/L)	Acceptable limits[b] (µg/L)	Warning limits[b] (µg/L)	Performance
Silver	2/10	03	90.2	84.0	70 - 98.1	73.5 - 94.6	Acceptable
		04	400	410	342 - 479	359 - 461	Acceptable
	4/12	002	78.8	76.2	65.9 - 85.2	N/A	Acceptable
	8/29	03	36.3	36.9	31.2 - 42.7	32.6 - 41.3	Acceptable
		04	245	260	225 - 296	234 - 287	Acceptable
	11/3	002	52.5	54.2	47.2 - 60.2	N/A	Acceptable
Zinc	2/10	01	30.9	31.9	23.9 - 40.3	26 - 38.3	Acceptable
		02	706	726	640 - 813	661 - 791	Acceptable
	4/12	001	793	818	751 - 877	N/A	Acceptable
	8/29	01	494	484	428 - 541	443 - 527	Acceptable
		02	980	967	848 - 1080	877 - 1050	Acceptable
	11/3	001	1430	1410	1280 - 1530	N/A	Acceptable

a All results reported in µg/L. Based upon theoretical calculations or a reference value when necessary. Samples from 2/10/95 were from Water Pollution Study Number WP033. Samples from 4/12/95 were from Water Supply Study Number WS035. Samples from 8/29/95 were from Water Pollution Study Number WP034. Samples from 11/03/95 were from Water Supply Study Number WS036.

b Acceptance limits are a 99% confidence interval calculated from available performance evaluation data of EPA and state laboratories. Warning limits are a 95% confidence interval produced in the same way as the acceptable limits. Results should fall within acceptable limits 99 times out of 100. Results outside warning limits but inside acceptable limits should be reviewed for possible problems but not necessarily considered unacceptable.

Environmental Protection Department • Lawrence Livermore National Laboratory
University of California • P.O. Box 808 • Livermore, California 94551