Environmental Report 1996

Volume 2

Lawrence Livermore National Laboratory

Cover

The golden eagle (*Aquila chrysaetos*), a species protected by federal and state law, has long made its home in the coastal hills of California, foraging in grassland areas now part of both the Livermore site and Site 300 of the Lawrence Livermore National Laboratory. In 1996, the first documented breeding pair of golden eagles nested on a live power pole at Site 300. Eggs were laid and incubated in the nest, but it was abandoned. Laboratory personnel then moved the nest to a newly constructed platform with hope that the eagle pair will use it in the spring of 1998.
This year's cover was designed by Lee A. Dravidzius of LLNL's Technical Information Department. The editors thank Tom and Pat Leeson, noted photographers of North American eagles, for the use of their photograph.

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Environmental Report 1996

Volume 2

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Preface

This is Volume 2 of the Lawrence Livermore National Laboratory's (LLNL's) annual *Environmental Report 1996,* prepared for the U.S. Department of Energy. Volume 1, *Environmental Report 1996* (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 1996, 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 nine chapters on monitoring of air, air effluent, sewerable water, surface water, ground water, soil and sediment, vegetation and foodstuff, environmental radiation, and quality assurance. The other four chapters in Volume 1 contain no additional information in Volume 2.

As in our previous annual reports, 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 ($1\ Bq = 2.7 \times 10^{-11}\ Ci$; $1\ Sv = 100\ rem$).

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

3

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

4

Air Monitoring

Paula J. Tate
Paris E. Althouse

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 special interest 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 four samplers located in the least prevalent wind directions (FCC, FIRE, HOSP, and RRCH) 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 (Livermore Water Reclamation Plant [LWRP]) because of a plutonium release to sewer in 1967 that resulted in local soil contamination (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.

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 × 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 secondary calibration unit that is calibrated annually using a primary calibration source traceable to the National Institute for Standards and Technology (NIST).

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 the Environmental Protection Agency (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 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 perimeter 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 precision in analytical results obtained from the samplers. In addition, a duplicate Quality Assurance (QA) sampler is operated for two months in parallel with the permanent sampler at a given site. The QA filters also are exchanged weekly, and both filter sets are submitted for analysis in the usual manner. After two months, the QA 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 (ORAD EMP-AP-CA), and details of air sample analysis procedures are outlined in Hall and Edwards (1994a, b, and c).

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 sampled. 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 (U.S. Department of Energy 1991).

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 QA 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 (1994a, b, and c).

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 at the LLNL perimeter, summarized by month and location, 1996.

Month	SALV	MESQ	CAFE	MET	VIS	COW
Gross alpha	**(10^{-12} Bq/mL)**					
Jan	–12.2	–31.7	8.3	29.7	–19.9	–0.6
Feb	18.9	50.7	–5.0	6.8	5.2	–14.0
Mar	14.9	–32.8	12.3	4.0	–11.8	17.1
Apr	–5.0	–5.2	2.9	8.8	–5.2	–17.0
May	6.9	17.3	24.6	96.2	31.5	38.7
Jun	12.4	29.4	–15.8	17.2	–20.0	14.6
Jul	7.6	24.2	–13.8	23.3	10.2	72.5
Aug	–4.4	35.2	19.8	37.1	44.4	34.6
Sep	32.9	28.4	52.7	8.7	2.0	–28.7
Oct	–1.5	5.2	–36.3	–36.4	30.0	3.6
Nov	12.0	–4.9	62.2	10.6	–22.6	–14.4
Dec	5.8	44.9	2.9	1.8	–8.2	–7.4
Annual median[a]	**6.3**	**9.0**	**3.9**	**7.2**	**–4.2**	**4.7**
IQR[b]	**37.1**	**69.1**	**55.2**	**42.4**	**52.1**	**54.8**
Annual maximum[c]	**112.4**	**144.9**	**175.6**	**192.3**	**95.0**	**242.2**
Gross beta						
Jan	179.3	320.7	166.4	331.2	267.0	236.3
Feb	340.8	377.0	497.9	426.3	427.8	346.1
Mar	283.7	411.3	360.8	476.7	403.4	300.4
Apr	499.1	559.7	494.4	508.3	487.4	425.6
May	352.4	353.0	558.3	484.7	434.6	467.6
Jun	255.5	267.2	273.6	278.1	344.2	264.8
Jul	326.8	391.2	331.9	449.6	433.3	439.3
Aug	497.4	421.0	361.1	386.6	420.1	522.1
Sep	443.4	495.0	406.8	435.4	408.8	564.3
Oct	340.8	524.9	560.5	372.4	307.9	433.1
Nov	412.0	410.6	371.7	515.2	310.1	437.3
Dec	207.7	181.2	328.2	153.4	155.2	269.8
Annual median[a]	**326.8**	**407.6**	**389.5**	**405.2**	**368.8**	**414.2**
IQR[b]	**269.2**	**319.7**	**276.1**	**251.9**	**309.4**	**276.3**
Annual maximum[c]	**1197.5**	**1107.8**	**1201.4**	**1127.6**	**1267.5**	**1216.6**

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.

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

Table 4-2a. Median gross alpha activities for the Livermore Valley, 1996.

Month	Livermore Valley downwind				Livermore Valley upwind			
	PATT	ZON7	TANK	ALTA	FCC	FIRE	HOSP	RRCH
	(10^{-12} Bq/mL)							
Jan	–22.7	7.1	–16.4	14.5	–17.4	–0.7	–18.6	–11.5
Feb	24.7	–11.2	–6.3	26.0	5.2	–10.2	2.9	–15.7
Mar	36.7	1.2	24.8	–3.1	–16.1	19.1	14.7	–13.2
Apr	–35.7	26.8	17.3	–11.2	–4.7	–11.5	4.2	–1.5
May	34.0	9.8	14.8	30.2	45.8	31.7	55.7	32.1
Jun	7.8	43.5	0.6	–1.9	–11.3	22.0	9.8	3.6
Jul	8.2	88.0	46.6	–2.5	–22.3	25.1	16.9	32.3
Aug	31.4	26.1	–0.6	41.0	26.5	20.3	2.1	–10.4
Sep	10.8	36.9	23.4	43.1	–11.3	–11.6	11.8	5.4
Oct	3.3	21.0	–20.3	79.2	–9.8	7.4	–10.0	–33.4
Nov	21.7	5.0	–1.6	–9.1	14.9	46.4	24.1	49.5
Dec	38.1	8.0	3.4	7.5	–0.6	–6.7	1.6	–14.7
Annual median[a]	**16.0**	**15.7**	**4.7**	**13.0**	**–2.1**	**8.9**	**3.2**	**–4.8**
IQR[b]	**55.8**	**40.8**	**45.6**	**60.2**	**48.3**	**43.9**	**51.9**	**56.9**
Annual maximum[c]	**111.0**	**130.8**	**124.6**	**100.7**	**122.6**	**123.4**	**129.1**	**83.1**

Month	Special Interest
	LWRP
	(10^{-12} Bq/mL)
Jan	–2.7
Feb	–9.9
Mar	0.7
Apr	19.1
May	66.3
Jun	–3.9
Jul	2.8
Aug	31.9
Sep	–12.6
Oct	28.6
Nov	57.5
Dec	10.0
Annual median[a]	**9.9**
IQR[b]	**42.4**
Annual maximum[c]	**121.0**

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.

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

Table 4-2b. Median gross beta activities for the Livermore Valley, 1996.

Month	Livermore Valley downwind				Livermore Valley upwind			
	PATT	ZON7	TANK	ALTA	FCC	FIRE	HOSP	RRCH
	(10^{-12} Bq/mL)							
Jan	95.3	241.3	241.7	338.3	504.1	193.8	260.3	257.8
Feb	331.6	485.7	315.4	537.6	280.6	438.4	380.5	396.1
Mar	342.8	328.5	342.2	368.5	357.1	344.6	312.0	332.2
Apr	423.1	403.5	433.3	457.7	522.6	379.4	510.6	438.9
May	455.6	548.4	462.3	467.8	450.5	504.8	559.6	398.2
Jun	229.1	304.2	224.5	259.1	257.8	223.9	363.4	184.6
Jul	424.7	342.1	398.0	328.7	367.8	464.8	315.6	369.3
Aug	397.0	465.6	451.2	361.4	349.0	453.1	405.3	515.6
Sep	491.3	452.0	411.9	415.4	357.2	362.8	399.9	502.0
Oct	500.9	472.9	463.8	408.3	583.6	374.7	898.0	379.0
Nov	172.5	381.6	308.1	518.5	423.3	425.0	362.0	469.0
Dec	93.7	215.4	268.7	259.4	216.8	118.6	177.2	207.8
Annual median[a]	**364.4**	**356.6**	**367.7**	**397.5**	**361.2**	**365.3**	**341.8**	**393.1**
IQR[b]	**352.0**	**357.0**	**299.7**	**297.1**	**357.2**	**337.1**	**315.1**	**347.8**
Annual maximum[c]	**785.3**	**1666.1**	**1642.8**	**1450.4**	**1456.1**	**1456.1**	**1088.5**	**2084.7**

Month	Special Interest
	LWRP
	(10^{-12} Bq/mL)
Jan	419.7
Feb	467.1
Mar	332.2
Apr	545.4
May	569.8
Jun	307.7
Jul	406.7
Aug	476.4
Sep	374.4
Oct	439.1
Nov	495.8
Dec	277.3
Annual median[a]	**404.1**
IQR[b]	**296.6**
Annual maximum[c]	**936.6**

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.

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

Table 4-3. Gross alpha and gross beta activities summarized by month and location, Site 300, 1996.

Month	801E	ECP	EOBS	GOLF	LIN	NPS	WCP	WOBS	TFIR
Gross alpha	**(10^{-12} Bq/mL)**								
Jan	–16.4	4.6	21.1	12.7	–4.6	–24.4	6.2	–2.3	32.8
Feb	55.1	12.3	11.4	23.2	–13.0	20.6	34.8	17.9	31.3
Mar	–3.8	29.1	29.4	11.3	3.8	45.2	2.6	–14.5	33.5
Apr	–4.9	13.2	35.8	21.5	0.1	–22.4	–2.7	31.2	–34.7
May	52.8	11.8	57.6	6.7	44.6	50.7	17.2	47.3	8.5
Jun	–4.1	4.0	–26.7	–0.7	–33.1	25.6	18.3	–10.7	29.6
Jul	–15.2	–27.0	17.7	–8.5	–5.2	–6.2	–17.9	48.4	25.8
Aug	10.9	70.6	–5.0	14.3	34.0	3.5	13.3	12.0	28.5
Sept	5.6	25.3	42.4	6.0	–34.4	13.2	4.1	48.2	–2.6
Oct	–4.1	31.3	4.7	9.8	–24.1	27.8	–28.3	–14.9	–6.5
Nov	15.6	34.6	25.4	–11.8	–48.7	61.8	19.8	–4.4	–0.9
Dec	16.9	–12.7	36.4	–10.6	–2.3	–21.7	–11.3	14.1	16.6
Annual median[a]	**1.9**	**14.3**	**26.3**	**9.8**	**–4.5**	**6.1**	**9.8**	**18.2**	**17.3**
IQR[b]	**55.4**	**41.5**	**51.5**	**40.1**	**58.4**	**56.7**	**54.8**	**58.0**	**70.6**
Annual maximum[c]	**123.6**	**87.0**	**139.5**	**133.9**	**110.6**	**119.1**	**105.2**	**139.5**	**159.8**
Gross beta									
Jan	271.6	221.5	242.8	318.6	267.6	267.2	265.6	245.2	828.3
Feb	243.9	329.8	465.2	367.0	340.9	304.8	305.9	283.7	566.7
Mar	443.4	302.8	289.4	415.6	405.9	353.4	256.2	581.5	393.8
Apr	373.7	460.1	356.0	417.2	344.8	463.7	402.7	528.8	412.3
May	575.6	490.2	428.8	561.9	515.2	567.3	527.5	541.9	548.2
Jun	384.0	351.0	410.7	356.5	444.1	275.5	326.5	492.1	511.2
Jul	460.8	551.0	385.8	477.4	506.8	421.3	467.3	459.4	477.7
Aug	427.9	384.5	472.8	461.9	486.4	495.6	453.9	506.7	463.3
Sep	446.2	388.2	355.9	458.6	461.3	490.5	427.2	364.5	557.3
Oct	465.3	430.2	494.4	417.3	614.5	285.4	297.7	340.8	786.0
Nov	349.9	300.0	302.9	297.6	417.0	390.1	323.1	303.2	320.5
Dec	240.5	229.4	153.3	248.2	210.0	196.7	196.1	296.3	567.5
Annual median[a]	**388.2**	**359.8**	**356.0**	**365.6**	**405.9**	**359.7**	**328.9**	**376.6**	**480.6**
IQR[b]	**313.4**	**292.4**	**295.1**	**296.5**	**311.5**	**388.6**	**346.4**	**337.5**	**409.6**
Annual maximum[c]	**1710.9**	**1857.5**	**1814.2**	**1559.3**	**1742.3**	**1658.1**	**1716.1**	**1362.8**	**1543.4**

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.

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, 1996.[a]

Month	^{7}Be	^{40}K	^{137}Cs	^{22}Na	^{226}Ra	^{228}Ra	^{228}Th
	(10^{-9} Bq/mL)	(10^{-12} Bq/mL)					
Jan	2.9 ± 0.05	<6.9	<0.2	<0.2	<0.5	<1.1	<0.5
Feb	2.4 ± 0.04	<1.8	<0.1	<0.1	<0.2	<0.3	<0.4
Mar	6.0 ± 0.10	<3.8	<0.1	0.7 ± 0.4	<0.3	<0.6	<0.4
Apr	6.8 ± 0.14	<5.1	<0.2	0.9 ± 0.4	<0.4	2.2 ± 1.2	1.2 ± 0.7
May	5.3 ± 0.17	17.4 ± 6.6	<0.2	0.7 ± 0.4	<1.2	<1.7	<1.1
Jun	5.0 ± 0.13	25.5 ± 13.7	<0.3	<0.3	<0.6	<1.2	<0.6
Jul	5.1 ± 0.19	<8.0	<0.3	<0.3	<1.5	<2.6	<0.7
Aug	5.0 ± 0.09	25.0 ±8.7	<0.2	0.5 ±0.3	<2.8	<1.5	1.8 ± 0.7
Sep	4.9 ± 0.25	<5.4	<0.2	<0.2	<2.3	2.4 ± 1.4	1.5 ± 0.8
Oct	4.0 ± 0.08	29.4 ± 16.1	<0.3	<0.3	<0.6	2.9 ± 2.0	<1.7
Nov	3.3 ± 0.05	<2.5	<0.1	<0.1	<0.4	<1.2	<0.7
Dec	3.6 ± 0.09	<5.7	<0.2	<0.2	<0.5	<0.9	<0.5
Median	**4.9**	**<6.3**	**<0.2**	**<0.3**	**<0.6**	**<1.4**	**<0.7**
IQR[b]	**1.6**	**—**[c]	**—**[c]	**—**[c]	**—**[c]	**—**[c]	**—**[c]
Maximum	**6.8**	**29.4**	**<0.3**	**0.9**	**<2.8**	**2.9**	**1.8**
DCG[d]	$\mathbf{1.5 \times 10^{-3}}$	$\mathbf{3.3 \times 10^{-5}}$	$\mathbf{1.5 \times 10^{-5}}$	$\mathbf{3.7 \times 10^{-5}}$	$\mathbf{3.7 \times 10^{-8}}$	$\mathbf{1.1 \times 10^{-7}}$	$\mathbf{1.5 \times 10^{-9}}$
Median fraction of DCG	$\mathbf{3.3 \times 10^{-6}}$	$\mathbf{<1.9 \times 10^{-7}}$	$\mathbf{<1.3 \times 10^{-8}}$	$\mathbf{<7.8 \times 10^{-9}}$	$\mathbf{<1.5 \times 10^{-5}}$	$\mathbf{<1.2 \times 10^{-5}}$	$\mathbf{<4.6 \times 10^{-4}}$
	(μCi/mL)						
Median	$\mathbf{1.3 \times 10^{-13}}$	$\mathbf{<1.7 \times 10^{-16}}$	$\mathbf{<5.3 \times 10^{-18}}$	$\mathbf{<7.8 \times 10^{-18}}$	$\mathbf{<1.5 \times 10^{-17}}$	$\mathbf{<3.7 \times 10^{-17}}$	$\mathbf{<1.8 \times 10^{-17}}$
IQR[b]	$\mathbf{4.3 \times 10^{-14}}$	**—**[c]	**—**[c]	**—**[c]	**—**[c]	**—**[c]	**—**[c]
Maximum	$\mathbf{1.9 \times 10^{-13}}$	$\mathbf{8.0 \times 10^{-16}}$	$\mathbf{<8.6 \times 10^{-18}}$	$\mathbf{2.3 \times 10^{-17}}$	$\mathbf{<7.5 \times 10^{-17}}$	$\mathbf{7.8 \times 10^{-17}}$	$\mathbf{4.8 \times 10^{-17}}$
DCG[d]	$\mathbf{4.0 \times 10^{-8}}$	$\mathbf{9.0 \times 10^{-10}}$	$\mathbf{4.0 \times 10^{-10}}$	$\mathbf{1.0 \times 10^{-9}}$	$\mathbf{1.0 \times 10^{-12}}$	$\mathbf{3.0 \times 10^{-12}}$	$\mathbf{4.0 \times 10^{-14}}$

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

b Interquartile range.

c No measure of dispersion calculated; see Chapter 13, Quality Assurance.

d Derived Concentration Guide.

Table 4-5. Gamma activity in particulate air samples, Site 300, 1996.[a]

Month	^{7}Be	^{40}K	^{137}Cs	^{22}Na	^{226}Ra	^{228}Ra	^{228}Th
	(10^{-9} Bq/mL)	(10^{-12} Bq/mL)					
Jan	2.3 ± 0.05	<4.7	<0.1	<0.2	<0.3	<1.7	<0.3
Feb	3.2 ± 0.07	<4.6	<0.1	<0.2	<0.3	<1.5	<0.4
Mar	5.7 ± 0.13	<3.9	<0.1	0.6 ± 0.4	<0.3	<0.6	<0.4
Apr	6.5 ± 0.10	<5.2	<0.2	0.7 ± 0.5	<0.4	<1.1	<0.5
May	7.1 ± 0.11	9.9 ± 3.5	0.24 ± 0.19	0.8 ± 0.3	<0.2	<0.3	<0.6
Jun	6.7 ± 0.11	12.5 ± 8.9	<0.2	1.0 ± 0.4	<0.4	<0.8	<0.5
Jul	7.4 ± 0.16	<4.6	<0.1	0.9 ± 0.4	<0.3	<1.2	<0.4
Aug	7.1 ± 0.14	<3.5	<0.1	0.7 ± 0.5	<1.5	<0.6	<0.4
Sep	5.9 ± 0.11	14.8 ± 4.5	<0.1	0.6 ± 0.3	<1.5	<0.4	<1.2
Oct	4.7 ± 0.08	<9.8	<0.3	<0.3	<0.8	<1.5	<0.7
Nov	2.8 ± 0.05	<3.2	<0.1	<0.1	<0.3	<0.9	<0.3
Dec	2.7 ± 0.04	<4.9	<0.2	<0.2	<0.4	<0.8	<0.4
Median	**5.8**	**<4.8**	**<0.1**	**0.6**	**<0.4**	**<0.9**	**<0.4**
IQR[b]	**3.7**	**—[c]**	**—[c]**	**—[c]**	**—[c]**	**—[c]**	**—[c]**
Maximum	**7.4**	**14.8**	**<0.3**	**1.0**	**<1.5**	**<1.7**	**<1.2**
DCG[d]	$\mathbf{1.5 \times 10^{-3}}$	$\mathbf{3.3 \times 10^{-5}}$	$\mathbf{1.5 \times 10^{-5}}$	$\mathbf{3.7 \times 10^{-5}}$	$\mathbf{3.7 \times 10^{-8}}$	$\mathbf{1.1 \times 10^{-7}}$	$\mathbf{1.5 \times 10^{-9}}$
Median fraction of DCG	$\mathbf{3.9 \times 10^{-6}}$	$\mathbf{<1.4 \times 10^{-7}}$	$\mathbf{<1.0 \times 10^{-8}}$	$\mathbf{<1.6 \times 10^{-8}}$	$\mathbf{<9.7 \times 10^{-6}}$	$\mathbf{<7.8 \times 10^{-6}}$	$\mathbf{<2.8 \times 10^{-4}}$
	(μCi/mL)						
Median	$\mathbf{1.6 \times 10^{-13}}$	$\mathbf{<1.3 \times 10^{-16}}$	$\mathbf{<4.0 \times 10^{-18}}$	$\mathbf{<1.6 \times 10^{-17}}$	$\mathbf{<9.7 \times 10^{-18}}$	$\mathbf{<2.3 \times 10^{-17}}$	$\mathbf{<1.1 \times 10^{-17}}$
IQR[b]	$\mathbf{1.0 \times 10^{-13}}$	**—[c]**	**—[c]**	**—[c]**	**—[c]**	**—[c]**	**—[c]**
Maximum	$\mathbf{2.0 \times 10^{-13}}$	$\mathbf{4.0 \times 10^{-16}}$	$\mathbf{<9.2 \times 10^{-18}}$	$\mathbf{2.8 \times 10^{-17}}$	$\mathbf{<4.2 \times 10^{-17}}$	$\mathbf{<4.7 \times 10^{-17}}$	$\mathbf{<3.1 \times 10^{-17}}$
DCG[d]	$\mathbf{4.0 \times 10^{-8}}$	$\mathbf{9.0 \times 10^{-10}}$	$\mathbf{4.0 \times 10^{-10}}$	$\mathbf{1.0 \times 10^{-9}}$	$\mathbf{1.0 \times 10^{-12}}$	$\mathbf{3.0 \times 10^{-12}}$	$\mathbf{4.0 \times 10^{-14}}$

a All Site 300 perimeter samples composited. See Figure 4-3. Volume 1 for sampling locations.

b Interquartile range.

c No measure of dispersion calculated; see Chapter 13, Quality Assurance.

d Derived Concentration Guide.

Table 4-6. Plutonium activity in air particulate samples, Livermore Valley, 1996.

Month	Livermore Valley downwind[a]			
	ALTA	PATT	TANK	ZON7
	(10^{-15} Bq/mL)			
Jan	3.3 ± 11.2	–3.2 ± 4.6	–2.4 ± 9.4	4.8 ± 14.5
Feb	3.0 ± 10.0	–0.4 ± 4.8	–0.4 ± 5.0	–6.9 ± 5.7
Mar	2.7 ± 5.8	6.1 ± 9.3	–5.2 ± 10.1	5.9 ± 13.1
Apr	–5.8 ± 11.3	16.2 ± 17.8	4.1 ± 12.0	–29.2 ± 35.9
May	1.6 ± 11.0	13.6 ± 14.9	1.6 ± 11.4	–11.0 ± 17.8
Jun	—[b]	–8.6 ± 7.0	–1.5 ± 11.2	12.0 ± 15.2
Jul	9.6 ± 9.6	–1.4 ± 10.7	10.0 ± 12.7	–7.5 ± 12.9
Aug	8.7 ± 11.1	5.7 ± 11.7	–6.2 ± 6.2	4.2 ± 8.5
Sep	8.6 ± 13.3	1.1 ± 6.5	2.4 ± 9.7	–2.5 ± 9.0
Oct	0.2 ± 10.8	28.5 ± 20.5	0.6 ± 12.2	7.5 ± 18.8
Nov	2.2 ± 9.2	–1.2 ± 8.3	–4.2 ± 9.0	–10.1 ± 10.2
Dec	0.6 ± 7.7	–10.7 ± 14.1	0.7 ± 13.7	–12.2 ± 7.8
Median	**2.7**	**0.4**	**0.1**	**–4.7**
IQR[c]	**4.9**	**9.8**	**4.7**	**15.4**
Fraction of DCG[d]	$\mathbf{3.6 \times 10^{-6}}$	$\mathbf{5.1 \times 10^{-7}}$	$\mathbf{1.8 \times 10^{-7}}$	$\mathbf{-6.4 \times 10^{-6}}$
	(μCi/mL)			
Median	$\mathbf{7.2 \times 10^{-20}}$	$\mathbf{1.0 \times 10^{-20}}$	$\mathbf{3.7 \times 10^{-21}}$	$\mathbf{-1.3 \times 10^{-19}}$
IQR[c]	$\mathbf{1.3 \times 10^{-19}}$	$\mathbf{2.6 \times 10^{-19}}$	$\mathbf{1.3 \times 10^{-19}}$	$\mathbf{4.2 \times 10^{-19}}$
Month	**Livermore Valley upwind[a]**			
	FCC	**FIRE**	**HOSP**	**RRCH**
	(10^{-15} Bq/mL)			
Jan	–0.5 ± 6.6	16.9 ± 21.3	2.2 ± 9.3	11.1 ± 14.1
Feb	–3.7 ± 4.2	–0.0004 ± 8.8	–6.8 ± 7.1	–4.1 ± 4.7
Mar	0.0003 ± 8.2	7.2 ± 10.9	15.9 ± 12.8	12.8 ± 12.5
Apr	5.8 ± 12.8	28.5 ± 30.9	4.9 ± 10.4	9.9 ± 12.1
May	1.1 ± 6.7	3.3 ± 11.3	7.4 ± 11.6	8.9 ± 10.9
Jun	–5.0 ± 13.7	3.5 ± 13.5	27.3 ± 24.4	10.9 ± 10.9
Jul	5.1 ± 7.2	13.1 ± 14.3	9.5 ± 9.5	3.6 ± 13.8
Aug	16.4 ± 13.1	16.8 ± 15.0	6.6 ± 10.1	1.1 ± 7.6
Sep	12.0 ± 15.1	18.1 ± 17.6	6.3 ± 12.8	12.6 ± 16.0
Oct	8.1 ± 10.7	9.4 ± 13.5	—[b]	9.4 ± 10.9
Nov	5.4 ± 9.2	–6.9 ± 12.4	9.7 ± 15.0	17.2 ± 13.1
Dec	–4.4 ± 12.3	7.4 ± 17.8	–1.7 ± 12.0	–0.3 ± 10.6
Median	**3.1**	**8.4**	**6.6**	**9.6**
IQR[c]	**7.7**	**13.4**	**6.0**	**8.5**
Fraction of DCG[d]	$\mathbf{4.2 \times 10^{-6}}$	$\mathbf{1.1 \times 10^{-5}}$	$\mathbf{8.9 \times 10^{-6}}$	$\mathbf{1.3 \times 10^{-5}}$
	(μCi/mL)			
Median	$\mathbf{8.4 \times 10^{-20}}$	$\mathbf{2.3 \times 10^{-19}}$	$\mathbf{1.8 \times 10^{-19}}$	$\mathbf{2.6 \times 10^{-19}}$
IQR[c]	$\mathbf{2.1 \times 10^{-19}}$	$\mathbf{3.6 \times 10^{-19}}$	$\mathbf{1.6 \times 10^{-19}}$	$\mathbf{2.3 \times 10^{-19}}$

Table 4-6. Plutonium activity in air particulate samples of Livermore Valley, 1996 (concluded).

Month	Special interest[a]	
	LWRP	TFIR
	(10^{-15} Bq/mL)	
Jan	5.9 ± 15.4	–2.0 ± 7.3
Feb	5.0 ± 9.8	–3.5 ± 4.0
Mar	12.5 ± 12.2	–0.7 ± 6.9
Apr	19.2 ± 20.2	–0.001 ± 14.1
May	16.7 ± 14.5	0.4 ± 7.1
Jun	37.0 ± 21.8	2.7 ± 5.4
Jul	23.9 ± 18.3	4.2 ± 9.1
Aug	29.6 ± 19.9	3.5 ± 7.5
Sep	50.7 ± 30.7	14.9 ± 16.6
Oct	36.6 ± 25.6	5.4 ± 7.7
Nov	5.5 ± 10.2	1.6 ± 6.9
Dec	–13.6 ± 14.2	5.6 ± 17.1
Median	**17.9**	**2.2**
IQR[b]	**25.6**	**4.7**
Fraction of DCG[c]	$\mathbf{2.4 \times 10^{-5}}$	$\mathbf{2.9 \times 10^{-6}}$
	(μCi/mL)	
Median	$\mathbf{4.9 \times 10^{-19}}$	$\mathbf{5.8 \times 10^{-20}}$
IQR[b]	$\mathbf{6.9 \times 10^{-19}}$	$\mathbf{1.3 \times 10^{-19}}$

Note: Radionuclide results are reported ± 2σ. See Chapter 13, 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).

Table 4-7. Plutonium activity in air particulate samples, Livermore site perimeter, 1996.

Month	Sampling location[a]					
	CAFE	COW	MESQ	MET	SALV	VIS
	(10^{-15} Bq/mL)					
Jan	34.1 ± 42.9	33.7 ± 72.5	21.8 ± 27.0	35.6 ± 28.9	–3.5 ± 13.6	32.4 ± 31.6
Feb	10.0 ± 12.2	17.1 ± 14.1	20.3 ± 19.9	16.7 ± 21.1	16.3 ± 17.5	22.8 ± 14.1
Mar	30.4 ± 17.8	34.7 ± 19.1	22.0 ± 13.6	12.7 ± 27.9	20.4 ± 16.7	24.8 ± 16.9
Apr	19.4 ± 17.3	15.4 ± 14.4	–3.0 ± 21.7	21.2 ± 22.4	19.2 ± 17.1	31.4 ± 22.9
May	–3.0 ± 17.6	17.1 ± 18.6	17.8 ± 17.3	2.6 ± 16.9	21.8 ± 7.4	40.7 ± 23.5
Jun	69.9 ± 36.2	24.0 ± 18.2	12.7 ± 23.4	13.9 ± 20.1	21.1 ± 20.5	84.4 ± 45.5
Jul	40.7 ± 26.9	37.7 ± 22.9	23.7 ± 19.4	17.4 ± 19.1	44.0 ± 29.4	6.1 ± 20.7
Aug	47.4 ± 38.9	42.6 ± 30.7	41.4 ± 29.5	11.0 ± 17.1	15.1 ± 22.9	32.2 ± 26.2
Sep	28.5 ± 34.1	42.2 ± 65.5	–2.6 ± 5.1	14.7 ± 16.4	149.5 ± 68.8	18.0 ± 26.3
Oct	10.4 ± 16.2	8.2 ± 34.5	11.5 ± 15.1	21.0 ± 38.9	2.5 ± 47.4	–3.4 ± 28.0
Nov	18.5 ± 22.2	4.9 ± 20.6	6.3 ± 11.7	1.6 ± 20.5	2.0 ± 15.9	10.6 ± 18.4
Dec	14.4 ± 19.3	13.9 ± 27.3	–11.2 ± 16.4	7.7 ± 13.0	15.2 ± 20.6	9.4 ± 19.1
Median	**23.9**	**20.6**	**15.2**	**14.3**	**17.8**	**23.8**
IQR[b]	**22.3**	**20.5**	**17.8**	**8.1**	**9.4**	**21.9**
Fraction of DCG[c]	$\mathbf{3.2 \times 10^{-5}}$	$\mathbf{2.8 \times 10^{-5}}$	$\mathbf{2.1 \times 10^{-5}}$	$\mathbf{1.9 \times 10^{-5}}$	$\mathbf{2.4 \times 10^{-5}}$	$\mathbf{3.2 \times 10^{-5}}$
	(μCi/mL)					
Median	$\mathbf{6.5 \times 10^{-19}}$	$\mathbf{5.6 \times 10^{-19}}$	$\mathbf{4.1 \times 10^{-19}}$	$\mathbf{3.9 \times 10^{-19}}$	$\mathbf{4.8 \times 10^{-19}}$	$\mathbf{6.4 \times 10^{-19}}$
IQR[b]	$\mathbf{6.0 \times 10^{-19}}$	$\mathbf{5.5 \times 10^{-19}}$	$\mathbf{4.8 \times 10^{-19}}$	$\mathbf{2.2 \times 10^{-19}}$	$\mathbf{2.5 \times 10^{-19}}$	$\mathbf{5.9 \times 10^{-19}}$

Note: Radionuclide results are reported ±2σ. See Chapter 13, 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 4-8. Plutonium activity in air particulate samples, diffuse sources, 1996.

Month	Location[a]	
	B531	CRED
	(10^{-15} Bq/mL)	
Jan	8.7 ± 13.4	5.9 ± 12.1
Feb	12.2 ± 11.9	7.5 ± 13.4
Mar	12.4 ± 15.2	7.5 ± 9.5
Apr	35.7 ± 24.8	4.8 ± 10.5
May	216.1 ± 54.4	25.3 ± 35.0
Jun	301.2 ± 61.8	34.4 ± 23.0
Jul	264.2 ± 54.8	15.9 ± 17.5
Aug	788.1 ± 96.6	5.1 ± 13.3
Sep	943.5 ± 151.7	34.2 ± 27.4
Oct	514.3 ± 81.4	14.5 ± 19.2
Nov	27.6 ± 18.5	–1.9 ± 7.3
Dec	16.8 ± 16.1	18.1 ± 21.6
Median	**125.9**	**11.0**
IQR[b]	**338.7**	**14.2**
Fraction of DCG[c]	$\mathbf{1.7 \times 10^{-4}}$	$\mathbf{1.5 \times 10^{-5}}$
	(μCi/mL)	
Median	$\mathbf{3.4 \times 10^{-18}}$	$\mathbf{3.0 \times 10^{-19}}$
IQR	$\mathbf{9.2 \times 10^{-18}}$	$\mathbf{3.8 \times 10^{-19}}$

Note: Radionuclide results are reported ± 2σ. See Chapter 13, 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, 1996.[a]

Month	(10^{-15} Bq/mL)
Jan	2.8 ± 3.5
Feb	6.5 ± 3.7
Mar	2.1 ± 2.3
Apr	6.1 ± 3.4
May	4.1 ± 2.3
Jun	1.3 ± 2.6
Jul	4.7 ± 3.2
Aug	5.2 ± 3.0
Sep	10.0 ± 4.7
Oct	2.8 ± 3.4
Nov	3.2 ± 4.0
Dec	0.2 ± 1.7
Median	3.7
IQR[b]	2.8
Fraction of DCG[c]	**4.9×10^{-6}**
	(μCi/mL)
Median	**9.9×10^{-20}**
IQR[b]	**7.5×10^{-20}**

Note: Radionuclide results are reported ± 2σ. See Chapter 13, 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 mass in air particulate samples, Livermore site perimeter, 1996.

Location[a]	Month	Uranium 238 (10^{-5} μg/m^3)	Uranium 235 (10^{-7} μg/m^3)	Uranium 235/238 (10^{-3})
SALV	**Jan**	1.56	0.98	6.25
	Feb	1.08	0.81	7.45
	Mar	1.95	1.40	7.21
	Apr	2.95	2.24	7.60
	May	8.48	6.06	7.15
	Jun	5.07	3.58	7.07
	Jul	7.43	5.18	6.97
	Aug	7.92	5.38	6.79
	Sep	8.21	5.88	7.16
	Oct	7.31	5.23	7.16
	Nov	2.16	1.54	7.10
	Dec	1.31	0.96	7.32
Median		**4.01**	**2.91**	**7.16**
IQR[b]		**5.70**	**3.97**	**0.19**
Maximum		**8.48**	**6.06**	**NA**
Fraction of DCG[c]		**1.3×10^{-4}**	**6.2×10^{-6}**	**NA**
MESQ	**Jan**	2.51	1.81	7.22
	Feb	2.00	2.47	12.40
	Mar	2.48	1.89	7.60
	Apr	3.90	2.62	6.71
	May	4.07	2.92	7.17
	Jun	6.82	4.87	7.14
	Jul	13.90	9.91	7.14
	Aug	14.00	10.10	7.22
	Sep	10.00	7.23	7.22
	Oct	8.36	5.97	7.15
	Nov	2.19	1.57	7.18
	Dec	1.28	0.88	6.92
Median		**3.99**	**2.77**	**7.18**
IQR[b]		**6.36**	**4.42**	**0.08**
Maximum		**14.00**	**10.10**	**NA**
Fraction of DCG[c]		**1.3×10^{-4}**	**5.9×10^{-6}**	**NA**

Table 4-10. Uranium mass in air particulate samples, Livermore site perimeter, 1996 (continued).

Location[a]	Month	Uranium 238 (10^{-5} μg/m^3)	Uranium 235 (10^{-7} μg/m^3)	Uranium 235/238 (10^{-3})
CAFE	**Jan**	3.11	2.17	6.97
	Feb	2.91	2.08	7.13
	Mar	3.60	3.35	9.28
	Apr	4.57	3.22	7.05
	May	4.54	3.15	6.94
	Jun	6.69	4.82	7.20
	Jul	9.23	6.42	6.95
	Aug	8.50	6.10	7.18
	Sep	9.41	6.56	6.97
	Oct	8.19	5.87	7.17
	Nov	4.24	2.99	7.05
	Dec	2.59	1.87	7.21
Median		**4.56**	**3.29**	**7.09**
IQR[b]		**4.79**	**3.14**	**0.22**
Maximum		**9.41**	**6.56**	**NA**
Fraction of DCG[c]		**1.5×10^{-4}**	**7.0×10^{-6}**	**NA**
MET	**Jan**	1.91	1.38	7.24
	Feb	1.85	1.42	7.69
	Mar	2.37	1.76	7.41
	Apr	4.63	3.06	6.62
	May	5.28	3.78	7.17
	Jun	7.20	5.19	7.20
	Jul	4.02	2.70	6.72
	Aug	8.08	5.78	7.15
	Sep	8.13	5.81	7.15
	Oct	6.33	4.53	7.17
	Nov	2.25	1.61	7.13
	Dec	1.12	0.77	6.86
Median		**4.33**	**2.88**	**7.16**
IQR[b]		**4.38**	**3.13**	**0.15**
Maximum		**8.13**	**5.81**	**NA**
Fraction of DCG[c]		**1.4×10^{-4}**	**6.1×10^{-6}**	**NA**

Table 4-10. Uranium mass in air particulate samples, Livermore site perimeter, 1996 (concluded).

Location[a]	Month	Uranium 238 (10^{-5} μg/m^3)	Uranium 235 (10^{-7} μg/m^3)	Uranium 235/238 (10^{-3})
VIS	**Jan**	1.89	1.36	7.19
	Feb	1.28	0.97	7.62
	Mar	2.22	1.71	7.70
	Apr	4.13	2.78	6.71
	May	4.26	3.07	7.21
	Jun	4.75	3.40	7.16
	Jul	11.10	7.92	7.13
	Aug	5.80	4.19	7.22
	Sep	6.50	4.66	7.17
	Oct	5.45	3.91	7.17
	Nov	2.03	1.45	7.12
	Dec	0.90	0.59	6.51
Median		**4.20**	**2.93**	**7.17**
IQR[b]		**3.54**	**2.55**	**0.09**
Maximum		**11.10**	**7.92**	**NA**
Fraction of DCG[c]		**1.4×10^{-4}**	**6.2×10^{-6}**	**NA**
COW	**Jan**	4.89	3.44	7.05
	Feb	1.87	1.38	7.39
	Mar	3.96	3.02	7.62
	Apr	6.90	5.04	7.31
	May	5.40	4.00	7.40
	Jun	20.50	15.00	7.33
	Jul	26.10	18.70	7.14
	Aug	19.10	13.70	7.20
	Sep	16.90	12.20	7.23
	Oct	10.70	7.64	7.15
	Nov	2.96	2.15	7.27
	Dec	2.49	1.70	6.83
Median		**6.15**	**4.52**	**7.25**
IQR[b]		**13.74**	**9.77**	**0.20**
Maximum		**26.10**	**18.70**	**NA**
Fraction of DCG[c]		**2.1×10^{-4}**	**9.6×10^{-6}**	**NA**

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

b Interquartile range.

c Derived Concentration Guide (DCG) = 0.3 μg/m^3 for ^{238}U activity in air; DCG = 0.047 μg/m^3 for ^{235}U activity in air.

NA = Not applicable.

Table 4-11. Uranium mass in air particulate samples, Site 300, 1996.

Location	Month	Uranium 238 (10^{-5} μg/m^3)	Uranium 235 (10^{-7} μg/m^3)	Uranium 235/238 (10^{-3})
Site 300[a]	**Jan**	0.60	0.38	6.35
	Feb	1.03	0.69	6.73
	Mar	1.58	1.23	7.74
	Apr	5.16	2.79	5.40
	May	3.68	2.63	7.14
	Jun	3.81	2.85	7.48
	Jul	9.91	4.93	4.98
	Aug	6.41	4.07	6.36
	Sep	7.64	4.95	6.48
	Oct	6.56	4.73	7.21
	Nov	20.20	4.56	2.26
	Dec	0.52	0.30	5.81
Median		4.49	2.82	6.42
IQR[b]		5.39	3.51	1.45
Maximum		20.20	4.95	**NA**
Fraction of DCG[c]		**1.5×10^{-4}**	**6.0×10^{-6}**	**NA**

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

b Interquartile range.

c Derived Concentration Guide (DCG) = 0.047 μg/m^3 for ^{235}U activity in air; DCG = 0.3 μg/m^3 for ^{238}U activity in air.

NA = Not applicable.

Table 4-12. Tritium in air, Livermore Valley, 1996.

Month	Sampling Location[a]					
	ZON7	ALTA	FIRE	XRDS	VET	HOSP
	(10^{-9} Bq/mL)					
Jan	<17.4	<16.1	<16.2	<15.4	<13.0	—[b]
	30.1 ± 22.4	<14.1	14.2 ± 13.7	<21.1	<13.1	—[b]
Feb	<20.8	<9.6	<18.0	<20.7	24.8 ± 17.8	—[b]
	70.7 ± 22.2	31.7 ± 15.8	24.0 ± 13.4	41.8 ± 14.7	—[b]	—[b]
Mar	42.9 ± 12.7	27.8 ± 11.3	33.2 ± 11.5	18.0 ± 12.0	38.1 ± 11.8	—[b]
	27.1 ± 17.3	21.4 ± 12.2	41.4 ± 10.6	15.6 ± 13.0	36.6 ± 12.4	—[b]
Apr	18.7 ± 12.5	13.3 ± 10.5	<11.0	14.9 ± 11.7	20.1 ± 11.5	—[b]
	48.1 ± 17.1	<12.0	<13.1	<13.7	23.2 ± 13.2	—[b]
May	27.2 ± 11.6	15.8 ± 10.2	21.6 ± 11.6	17.2 ± 12.1	34.4 ± 13.0	—[b]
	52.5 ± 14.9	32.6 ± 12.4	<11.4	<8.7	12.7 ± 7.3	—[b]
	40.7 ± 15.1	14.5 ± 14.3	<14.4	<12.0	<14.7	—[b]
Jun	28.0 ± 12.7	<12.6	<11.7	<7.1	21.8 ± 13.5	—[b]
	22.3 ± 14.9	<14.6	<14.5	<12.2	<15.4	—[b]
Jul	64.8 ± 15.5	23.9 ± 13.5	<13.7	<10.0	35.2 ± 15.1	—[b]
	40.7 ± 15.0	14.9 ± 13.1	<14.3	<13.3	23.7 ± 15.3	—[b]
Aug	25.0 ± 15.5	20.4 ± 14.8	<14.9	18.9 ± 12.9	<15.7	—[b]
	46.6 ± 14.7	18.0 ± 12.9	<14.0	28.5 ± 13.5	36.7 ± 15.8	—[b]
Sep	34.2 ± 17.7	<16.8	<17.3	28.0 ± 16.6	<17.6	—[b]
	75.5 ± 14.9	45.5 ± 14.4	53.3 ± 15.5	30.1 ± 13.9	112.5 ± 17.1	—[b]
Oct	514.3 ± 30.3	165.4 ± 23.0	33.7 ± 18.8	170.6 ± 22.2	63.6 ± 18.5	—[b]
	146.2 ± 22.2	116.6 ± 21.2	99.5 ± 20.3	49.6 ± 18.5	204.6 ± 23.7	—[b]
	74.0 ± 8.8	32.4 ± 8.8	32.6 ± 7.7	21.3 ± 8.1	23.6 ± 6.8	—[b]
Nov	78.8 ± 17.7	30.2 ± 16.0	33.1 ± 13.7	32.2 ± 14.9	69.9 ± 17.2	—[b]
	89.9 ± 29.0	<30.0	25.8 ± 24.0	<23.8	36.6 ± 20.3	<23.4
Dec	43.7 ± 24.3	18.9 ± 18.4	19.6 ± 18.0	<17.8	39.6 ± 20.9	<24.3
	48.5 ± 11.1	13.9 ± 11.9	46.6 ± 8.2	21.8 ± 10.6	58.1 ± 10.5	9.8 ± 8.6
Median[c]	**43.3**	**<18.5**	**<17.7**	**<18.4**	**24.8**	**<23.4**
IQR[d]	**41.8**	—[e]	—[e]	—[e]	—[e]	—[e]
Fraction of DCG[f]	$\mathbf{1.2 \times 10^{-5}}$	$\mathbf{<5.0 \times 10^{-6}}$	$\mathbf{<4.8 \times 10^{-6}}$	$\mathbf{<5.0 \times 10^{-6}}$	$\mathbf{6.7 \times 10^{-6}}$	$\mathbf{<6.3 \times 10^{-6}}$
Dose (mSv)[g]	$\mathbf{9.3 \times 10^{-6}}$	$\mathbf{4.0 \times 10^{-6}}$	$\mathbf{3.8 \times 10^{-6}}$	$\mathbf{4.0 \times 10^{-6}}$	$\mathbf{5.3 \times 10^{-6}}$	$\mathbf{5.0 \times 10^{-6}}$

Table 4-12. Tritium in air, Livermore Valley, 1996 (concluded).

Month	Sampling Location[a]					
	ZON7	ALTA	FIRE	XRDS	VET	HOSP
	(μCi/mL)					
Median[c]	1.2×10^{-12}	$<5.0 \times 10^{-13}$	$<4.8 \times 10^{-13}$	$<5.0 \times 10^{-13}$	6.7×10^{-13}	$<6.3 \times 10^{-13}$
IQR[d]	1.1×10^{-12}	—[e]	—[e]	—[e]	—[e]	—[e]
Dose (mrem)[g]	9.3×10^{-4}	4.0×10^{-4}	3.8×10^{-4}	4.0×10^{-4}	5.3×10^{-4}	5.0×10^{-4}

Note: Radionuclide results are reported $\pm 2\sigma$; see Chapter 13, Quality Assurance.

a See Figure 4-2 for sampling locations.

b No data; see Chapter 13, Quality Assurance.

c Livermore Valley overall median = 23.5×10^{-9} Bq/mL (6.4×10^{-13} μCi/mL).

d Interquartile range.

e No measure of dispersion calculated; see Chapter 13, 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, 1996.

Month	Sampling location[a]						
	SALV	MESQ	CAFE	MET	VIS	COW	POOL
	(10^{-9} Bq/mL)						
Jan	22.3 ± 19.8	34.5 ± 18.3	35.8 ± 16.5	45.5 ± 26.6	48.5 ± 17.4	30.2 ± 17.4	129.9 ± 23.2
	45.1 ± 19.9	20.0 ± 14.5	38.5 ± 14.8	14.7 ± 14.5	64.4 ± 17.7	68.1 ± 19.1	69.2 ± 16.7
Feb	40.7 ± 18.8	39.6 ± 21.6	110.6 ± 21.4	21.3 ± 12.8	50.3 ± 20.0	23.5 ± 18.0	145.4 ± 22.8
	72.2 ± 17.0	83.3 ± 15.2	183.9 ± 19.3	—[b]	108.8 ± 16.6	223.1 ± 21.2	76.6 ± 16.1
Mar	82.1 ± 12.9	75.5 ± 14.4	135.8 ± 14.7	68.1 ± 11.7	159.1 ± 15.3	101.8 ± 14.3	281.2 ± 19.4
	242.7 ± 18.0	85.8 ± 15.5	283.1 ± 19.5	95.5 ± 14.6	176.1 ± 17.1	74.4 ± 13.6	447.7 ± 26.9
Apr	80.7 ± 12.9	19.9 ± 11.9	71.8 ± 12.7	22.5 ± 10.6	129.9 ± 13.9	64.8 ± 13.1	115.1 ± 15.6
	110.6 ± 16.0	38.1 ± 15.9	136.2 ± 16.7	35.0 ± 14.1	146.2 ± 17.7	44.4 ± 14.1	—[b]
May	213.5 ± 16.9	42.9 ± 13.0	230.1 ± 18.9	49.2 ± 13.5	161.7 ± 16.0	103.2 ± 15.3	301.6 ± 22.6
	49.2 ± 12.7	29.9 ± 14.1	77.0 ± 13.7	38.1 ± 13.2	143.6 ± 16.8	88.4 ± 14.9	—[b]
	66.2 ± 15.8	<14.1	165.0 ± 18.6	<14.2	153.2 ± 18.4	86.2 ± 17.5	—[b]
Jun	31.7 ± 9.3	32.9 ± 14.4	78.4 ± 15.3	21.8 ± 13.1	86.2 ± 14.4	45.1 ± 13.9	179.8 ± 23.7
	42.9 ± 15.7	<15.3	33.6 ± 15.6	<14.9	114.0 ± 17.9	44.8 ± 16.6	104.7 ± 26.7
Jul	138.0 ± 18.4	19.5 ± 15.5	183.9 ± 20.0	26.9 ± 14.7	162.1 ± 18.2	62.9 ± 15.9	232.4 ± 34.6
	47.0 ± 15.9	27.9 ± 15.6	54.8 ± 16.9	21.3 ± 14.9	130.6 ± 16.7	72.2 ± 16.4	130
Aug	44.4 ± 16.3	<16.7	89.5 ± 21.1	<15.2	122.5 ± 18.1	116.6 ± 19.1	171.7 ± 38.1
	156.9 ± 48.9	33.7 ± 15.5	155.0 ± 19.4	43.7 ± 15.1	229.4 ± 67.2	84.0 ± 16.3	276.4 ± 51.4
Sep	67.0 ± 19.0	28.4 ± 19.9	94.7 ± 20.0	36.3 ± 17.9	179.8 ± 21.8	116.9 ± 21.3	203.1 ± 39.0
	145.8 ± 18.2	87.3 ± 16.7	481.0 ± 26.0	64.0 ± 15.6	204.6 ± 17.4	—[b]	736.3 ± 42.7
Oct	514.3 ± 30.3	67.0 ± 21.0	510.6 ± 30.6	92.5 ± 19.8	1095.2 ± 38.3	758.5 ± 36.4	495.8 ± 41.6
	384.8 ± 27.7	462.5 ± 29.6	891.7 ± 36.6	178.0 ± 23.3	348.2 ± 24.7	407.0 ± 28.5	1483.7 ± 62.3
	101.4 ± 9.6	75.5 ± 9.3	239.8 ± 12.5	72.9 ± 9.0	178.0 ± 10.7	187.2 ± 11.4	536.5 ± 20.4
Nov	187.6 ± 20.6	141.3 ± 19.8	207.6 ± 19.3	116.9 ± 18.1	237.9 ± 21.4	158.0 ± 20.1	373.7 ± 27.3
	66.6 ± 22.8	106.9 ± 26.1	168.0 ± 23.2	63.6 ± 25.1	179.8 ± 20.3	247.9 ± 28.3	348.9 ± 31.1
Dec	84.4 ± 23.4	61.4 ± 21.5	206.8 ± 23.6	46.3 ± 20.0	120.3 ± 20.7	152.4 ± 23.8	240.9 ± 27.5
	106.2 ± 12.6	131.7 ± 12.8	179.5 ± 12.4	48.1 ± 10.3	102.1 ± 10.5	64.0 ± 9.7	332.6 ± 19.0
Median[c]	**81.4**	**38.9**	**160.0**	**43.7**	**149.7**	**86.2**	**240.9**
IQR[d]	**96.3**	**53.3**	**126.2**	**42.3**	**63.8**	**88.4**	**223.3**
Fraction of DCG[e]	2.2×10^{-5}	1.1×10^{-5}	4.3×10^{-5}	1.2×10^{-5}	4.0×10^{-5}	2.3×10^{-5}	6.5×10^{-5}
Dose (mSv)[f]	1.7×10^{-5}	8.3×10^{-6}	3.4×10^{-5}	9.4×10^{-6}	3.2×10^{-5}	1.8×10^{-5}	5.2×10^{-5}
	(μCi/mL)						
Median[c]	2.2×10^{-12}	1.1×10^{-12}	4.3×10^{-12}	1.2×10^{-12}	4.0×10^{-12}	2.3×10^{-12}	6.5×10^{-12}
IQR[d]	2.6×10^{-12}	1.4×10^{-12}	3.4×10^{-12}	1.1×10^{-12}	1.7×10^{-12}	2.4×10^{-12}	6.0×10^{-12}
Dose(mrem)[f]	1.7×10^{-3}	8.3×10^{-4}	3.4×10^{-3}	9.4×10^{-4}	3.2×10^{-3}	1.8×10^{-3}	5.2×10^{-3}

Note: Radionuclide results are reported ±2σ; see Chapter 13, Quality Assurance.

a See Figure 4-2 for sampling locations.

b No data; see Chapter 13, Quality Assurance.

c Livermore Valley overall median = 95.5×10^{-9} Bq/mL (2.6×10^{-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 4-14. Tritium in air at locations near diffuse sources, 1996.

Month	Sampling locations[a]			
	B292	B331	B514	B624
	(10^{-9} Bq/mL)			
Jan	143.6 ± 21.1	293.0 ± 24.0	124.3 ± 19.9	1924.0 ± 46.2
	123.2 ± 17.1	258.6 ± 20.7	88.1 ± 15.5	—[b]
Feb	87.7 ± 19.9	—[b]	152.1 ± 20.7	2982.2 ± 65.6
	161.0 ± 18.5	695.6 ± 29.9	242.7 ± 19.9	3811.0 ± 68.6
Mar	230.5 ± 16.6	440.3 ± 20.3	825.1 ± 26.4	7437.0 ± 490.8
	268.6 ± 18.8	492.1 ± 23.6	2464.2 ± 49.3	19758.0 ± 118.5
Apr	105.8 ± 14.1	228.3 ± 15.3	403.3 ± 18.6	8473.0 ± 76.3
	135.1 ± 16.9	244.9 ± 15.4	762.2 ± 26.7	10249.0 ± 92.2
May	207.6 ± 19.1	—[b]	888.0 ± 30.2	11803.0 ± 82.6
	—[b]	647.5 ± 25.9	432.9 ± 22.9	11766.0 ± 105.9
	52.5 ± 12.8	506.9 ± 26.4	231.6 ± 20.6	8843.0 ± 97.3
Jun	107.3 ± 16.1	895.4 ± 32.2	451.4 ± 24.8	13024.0 ± 117.2
	54.8 ± 16.5	558.7 ± 28.5	218.3 ± 20.7	6253.0 ± 87.5
Jul	88.4 ± 16.4	1010.1 ± 35.4	580.9 ± 28.5	9361.0 ± 103.0
	78.4 ± 16.6	821.4 ± 32.9	252.3 ± 22.0	4366.0 ± 69.9
Aug	61.8 ± 17.0	1084.1 ± 40.1	166.1 ± 19.9	5291.0 ± 79.4
	145.4 ± 18.0	1117.4 ± 35.8	381.1 ± 24.8	6660.0 ± 86.6
Sep	66.2 ± 19.3	5550.0 ± 83.3	188.7 ± 22.1	4995.0 ± 79.9
	170.9 ± 18.6	2105.3 ± 46.3	327.1 ± 22.2	6327.0 ± 82.3
Oct	300.1 ± 25.5	10027.0 ± 110.3	832.5 ± 36.6	5550.0 ± 88.8
	510.6 ± 31.1	21349.0 ± 149.4	—[b]	9028.0 ± 108.3
	200.2 ± 12.0	4662.0 ± 46.6	219.0 ± 11.0	3663.0 ± 44.0
Nov	233.1 ± 20.5	680.8 ± 28.6	3885.0 ± 81.6	3385.5 ± 57.6
	153.2 ± 26.7	1295.0 ± 47.9	488.4 ± 32.2	3737.0 ± 78.5
Dec	180.6 ± 24.0	728.9 ± 35.0	810.3 ± 46.2	3922.0 ± 74.5
	260.9 ± 17.2	—[b]	—[b]	3178.3 ± 47.7
Median[c]	**145.4**	**728.9**	**392.2**	**6253.0**
IQR[d]	**119.1**	**706.7**	**555.4**	**5217.0**
Fraction of DCG[e]	$\mathbf{3.9 \times 10^{-5}}$	$\mathbf{2.0 \times 10^{-4}}$	$\mathbf{1.1 \times 10^{-4}}$	$\mathbf{1.7 \times 10^{-3}}$
Dose (mSv)[f]	$\mathbf{3.1 \times 10^{-5}}$	$\mathbf{1.6 \times 10^{-4}}$	$\mathbf{8.4 \times 10^{-5}}$	$\mathbf{1.3 \times 10^{-3}}$
	(μCi/mL)			
Median[c]	$\mathbf{3.9 \times 10^{-12}}$	$\mathbf{2.0 \times 10^{-11}}$	$\mathbf{1.1 \times 10^{-11}}$	$\mathbf{1.7 \times 10^{-10}}$
IQR[d]	$\mathbf{3.2 \times 10^{-12}}$	$\mathbf{1.9 \times 10^{-11}}$	$\mathbf{1.5 \times 10^{-11}}$	$\mathbf{1.4 \times 10^{-10}}$
Dose (mrem)[f]	$\mathbf{3.1 \times 10^{-3}}$	$\mathbf{1.6 \times 10^{-2}}$	$\mathbf{8.4 \times 10^{-3}}$	$\mathbf{1.3 \times 10^{-1}}$

Note: Radionuclide results are reported ±2σ; see Chapter 13, Quality Assurance.

a See Figure 4–2 for sampling locations.

b No data; see Chapter 13, Quality Assurance.

c Diffuse source overall median = 558.7×10^{-9} Bq/mL (1.5×10^{-11} 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, 1996.

Month	Sampling Location[a]					
	SALV	MESQ	CAFE	VIS	MET	COW
Jan	2.1	5.3	6.2	3.1	3.1	10.3
Feb	2.4	3.8	5.2	3.0	1.9	3.2
Mar	2.6	5.4	8.4	4.5	3.2	6.6
Apr	1.6	5.8	6.9	7.8	5.7	4.9
May	2.7	4.8	7.2	5.4	10.9	11.0
Jun	6.7	9.4	8.3	7.7	11.1	19.0
Jul	9.7	19.1	12.5	6.8	11.0	43.4
Aug	12.6	19.5	12.8	8.2	16.4	36.7
Sep	8.9	12.4	13.6	14.8	13.6	24.2
Oct	16.2	16.4	13.1	9.7	11.2	19.3
Nov	4.7	6.2	7.1	4.1	5.4	5.9
Dec	0.5	0.9	4.0	0[b]	0.2	3.7
Median[c]	**3.7**	**6.0**	**7.7**	**6.1**	**8.3**	**10.6**
Maximum	**16.2**	**19.5**	**13.6**	**14.8**	**16.4**	**43.4**
IQR[d]	**6.8**	**8.2**	**5.8**	**4.1**	**7.9**	**14.9**
Fraction of ACG[e]	$\mathbf{3.7 \times 10^{-4}}$	$\mathbf{6.0 \times 10^{-4}}$	$\mathbf{7.7 \times 10^{-4}}$	$\mathbf{6.8 \times 10^{-4}}$	$\mathbf{8.3 \times 10^{-4}}$	$\mathbf{1.1 \times 10^{-3}}$

Note: The monthly Ambient Concentration Guide (ACG) set by the Bay Area Air Quality Management District (BAAQMD) is 10,000 pg/m^3.

a See Figure 4-1 for sampling locations.

b Actual reported value of 0.

c Livermore site perimeter overall annual median is 6.8 pg/m^3.

d Interquartile range.

e Fractional value of the annual standard determined by dividing annual median by the ACG.

Table 4-16. Beryllium in air particulate samples (in pg/m^3), Site 300 network, 1996.

Month	Sampling locations[a]								
	EOBS	ECP	WCP	LIN	GOLF	TFIR	NPS	WOBS	801E
Jan	0.6	0.5	0.9	0.7	1.4	4.0	0.7	1.3	0.8
Feb	2.2	2.2	2.0	1.7	2.9	4.0	1.5	1.8	1.0
Mar	2.1	2.2	2.1	1.4	4.1	5.0	2.2	1.5	2.5
Apr	4.1	4.9	5.2	6.5	2.8	6.3	5.9	2.8	13.1
May	3.1	3.1	4.3	5.4	4.1	8.8	4.2	4.7	5.1
Jun	4.7	4.6	4.1	5.8	6.3	16.1	4.3	4.8	8.2
Jul	8.6	8.4	7.3	7.1	9.7	18.0	7.1	7.5	10.2
Aug	10.8	9.1	8.7	10.6	13.9	18.5	11.8	7.5	9.0
Sep	8.8	6.6	8.5	6.9	8.0	10.3	6.4	6.8	15.6
Oct	12.9	11.1	10.1	9.1	19.1	30.2	12.1	10.9	15.2
Nov	2.4	4.6	8.8	4.1	5.8	3.1	4.2	1.9	2.0
Dec	0.6	0.5	0.2	0.6	1.2	2.5	0.5	0.6	0.5
Median[b]	**3.6**	**4.6**	**4.8**	**5.6**	**4.9**	**7.6**	**4.2**	**3.8**	**6.6**
Maximum	**12.9**	**11.1**	**10.1**	**10.6**	**19.1**	**30.2**	**12.1**	**10.9**	**15.6**
IQR[c]	**6.4**	**4.8**	**6.5**	**5.3**	**5.5**	**12.6**	**4.6**	**5.3**	**9.1**
Fraction of ACG[d]	3.6×10^{-4}	4.6×10^{-4}	4.8×10^{-4}	5.6×10^{-4}	4.9×10^{-4}	7.6×10^{-4}	4.2×10^{-4}	3.8×10^{-4}	6.6×10^{-4}

Note: The monthly Ambient Concentration Guide (ACG) set by the Bay Area Air Quality Management District (BAAQMD) is 10,000 pg/m^3.

a See Figure 4-1 for sampling locations.

b Site 300 overall annual median is 4.7 pg/m^3.

c Interquartile range.

d Fractional value of the annual standard determined by dividing annual median by the ACG.

5

Air Effluent Monitoring

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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. In October of 1996, those sampling locations having 100-mm-diameter filter holders were replaced with 47-mm filter holders. 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 1996, 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. 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 1996 evaluation of calculated emissions and dose assessment are published in the *LLNL NESHAPs 1996 Annual Report* (Gallegos and Biermann 1997). 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 1996. Radionuclides have been ordered by weighting the emissions according to the inhalation dose rate conversion factor for the isotope.

Radionuclides	Calculated emissions (Bq)	Relative to HTO
H-3	7.0×10^{12}	1.0
U-234	9.5×10^{5}	1.4×10^{-1}
Th-228	3.3×10^{5}	9.6×10^{-2}
U-238	2.2×10^{5}	1.4×10^{-1}
Pu-239	3.9×10^{4}	1.5×10^{-2}
Gross alpha	3.5×10^{4}	1.4×10^{-2}
N-13	1.6×10^{11}	3.7×10^{-3}
U-235	8.8×10^{3}	1.2×10^{-3}
Am-243	1.6×10^{3}	9.6×10^{-4}
Am-241	1.1×10^{3}	6.9×10^{-4}
O-15	8.5×10^{10}	6.1×10^{-4}
Pu-238	6.4×10^{2}	2.3×10^{-4}
Cs-137	5.9×10^{6}	2.1×10^{-4}
P-32	1.9×10^{7}	1.3×10^{-4}
Gross beta	2.6×10^{5}	6.7×10^{-5}
Sr-90	1.4×10^{5}	3.4×10^{-5}
Ra-226	2.2×10^{3}	2.3×10^{-5}
Th-232	3.9×10^{1}	1.6×10^{-5}
H-3 (HT)	1.2×10^{12}	7.1×10^{-6}
Co-57	3.7×10^{5}	3.8×10^{-6}
Np-237	3.7	2.1×10^{-6}
Pu-242	5.3	1.9×10^{-6}
P-33	1.6×10^{5}	1.1×10^{-6}
Bi-214	2.9×10^{4}	3.8×10^{-7}
Ni-63	1.1×10^{5}	3.0×10^{-7}
Pb-214	2.9×10^{4}	2.9×10^{-7}
S-35	6.1×10^{5}	2.1×10^{-7}
U-232	3.7×10^{-1}	2.0×10^{-7}
U-233	1.2	1.8×10^{-7}
Eu-152	5.4×10^{2}	1.4×10^{-7}
Po-218	2.9×10^{4}	1.0×10^{-7}

Radionuclides	Calculated emissions (Bq)	Relative to HTO
Eu-154	2.4×10^{2}	7.8×10^{-8}
Pu-236	7.6×10^{-1}	7.6×10^{-8}
Se-75	7.4×10^{3}	5.1×10^{-8}
Th-230	1.4×10^{-1}	4.0×10^{-8}
Tc-99	7.3×10^{2}	7.0×10^{-9}
U-236	3.7×10^{-2}	5.3×10^{-9}
Eu-155	6.1×10^{1}	2.9×10^{-9}
C-14	1.7×10^{5}	2.3×10^{-9}
Ce-144	3.9	1.7×10^{-9}
Cm-244	3.7×10^{-3}	1.2×10^{-9}
Sb-124	3.7×10^{1}	1.1×10^{-9}
K-40	5.1×10^{1}	7.5×10^{-10}
Na-22	7.4×10^{1}	6.9×10^{-10}
Pu-240	9.3×10^{-4}	3.6×10^{-10}
Sb-125	1.5×10^{1}	2.0×10^{-10}
Y-90	1.8×10^{1}	1.9×10^{-10}
Cf-252	6.2×10^{-4}	1.1×10^{-10}
Ni-59	1.0×10^{2}	1.1×10^{-10}
Co-60	3.0×10^{-1}	7.4×10^{-11}
Pm-147	8.7×10^{-1}	3.9×10^{-11}
Fe-55	1.9×10^{1}	2.8×10^{-11}
Ru-106	2.6×10^{-2}	1.4×10^{-11}
Y-88	7.4×10^{-2}	4.2×10^{-12}
Mn-54	3.0×10^{-1}	2.3×10^{-12}
Cm-242	3.4×10^{-5}	6.9×10^{-13}
I-129	2.2×10^{-3}	4.4×10^{-13}
I-125	1.3×10^{-2}	3.5×10^{-13}
Np-239	4.1×10^{-3}	1.3×10^{-14}
Zr-95	1.8×10^{-4}	2.9×10^{-15}
Ba-133	1.5×10^{-5}	1.5×10^{-16}

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. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 166, 1996.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	0/46	-1.20×10^{-11}	3.90×10^{-12}	7.10×10^{-11}
Gross beta				
1	15/46	-2.55×10^{-11}	9.56×10^{-11}	5.48×10^{-10}

a Minimum detectable concentration.

Table 5-3. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 175, 1996.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	1/25	-7.07×10^{-12}	1.65×10^{-11}	5.22×10^{-11}
2	9/25	-1.25×10^{-11}	1.95×10^{-11}	1.08×10^{-10}
3	1/25	-1.43×10^{-11}	9.55×10^{-12}	2.66×10^{-11}
4	5/25	-7.07×10^{-12}	1.81×10^{-11}	8.58×10^{-11}
5	1/25	-7.62×10^{-12}	2.05×10^{-12}	3.35×10^{-11}
6	6/25	-7.62×10^{-12}	9.40×10^{-12}	9.32×10^{-11}
Gross beta				
1	15/25	5.07×10^{-12}	9.84×10^{-11}	2.61×10^{-10}
2	21/25	-3.96×10^{-12}	1.21×10^{-10}	7.18×10^{-10}
3	8/25	-3.74×10^{-12}	5.92×10^{-11}	2.01×10^{-10}
4	17/25	2.55×10^{-11}	1.26×10^{-10}	3.29×10^{-10}
5	8/25	-3.77×10^{-12}	3.24×10^{-11}	1.63×10^{-10}
6	10/25	-2.07×10^{-11}	6.62×10^{-11}	6.55×10^{-10}

a Minimum detectable concentration.

Table 5-4. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 231, 1996.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
Vault	1/47	-3.30×10^{-11}	5.07×10^{-12}	2.05×10^{-10}
Gross beta				
Vault	1/47	-8.58×10^{-11}	3.09×10^{-11}	4.63×10^{-10}

a Minimum detectable concentration.

Table 5-5. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 251, 1996.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	1/24	-6.55×10^{-11}	6.14×10^{-11}	5.62×10^{-10}
2	3/25	-2.15×10^{-11}	6.59×10^{-11}	2.63×10^{-10}
3	0/25	-1.74×10^{-11}	2.55×10^{-11}	1.14×10^{-10}
4	4/25	3.81×10^{-12}	7.92×10^{-11}	2.21×10^{-10}
5	1/25	-2.64×10^{-10}	1.47×10^{-10}	1.33×10^{-9}
6	1/25	-1.03×10^{-10}	1.07×10^{-11}	2.00×10^{-10}
7	0/24	-1.91×10^{-11}	3.32×10^{-11}	2.87×10^{-10}
8	1/25	-1.94×10^{-10}	2.04×10^{-10}	1.43×10^{-9}
10	0/25	-5.18×10^{-11}	1.48×10^{-10}	5.85×10^{-10}
11	0/25	-2.80×10^{-10}	1.32×10^{-10}	1.10×10^{-9}
12	0/25	-1.96×10^{-11}	4.11×10^{-12}	5.51×10^{-11}
13	0/25	-3.44×10^{-11}	9.69×10^{-12}	1.29×10^{-10}
14	3/25	-1.24×10^{-11}	5.14×10^{-11}	5.22×10^{-10}
15	1/25	-1.61×10^{-10}	4.26×10^{-10}	1.97×10^{-9}
16	0/25	-6.73×10^{-11}	2.31×10^{-11}	1.55×10^{-10}
17	2/25	3.22×10^{-12}	4.22×10^{-11}	2.73×10^{-10}
18	0/25	-1.19×10^{-11}	1.35×10^{-11}	4.59×10^{-11}
19	0/25	-1.94×10^{-10}	7.99×10^{-11}	7.10×10^{-10}
20	0/25	-9.62×10^{-12}	6.62×10^{-12}	5.74×10^{-11}
21	1/25	-1.10×10^{-10}	8.58×10^{-11}	5.40×10^{-10}
22	0/25	-1.34×10^{-11}	1.45×10^{-11}	3.74×10^{-11}
23	10/25	-1.70×10^{-10}	7.66×10^{-10}	3.16×10^{-9}
24	0/25	-2.55×10^{-11}	1.99×10^{-11}	3.20×10^{-10}
25	0/25	-5.03×10^{-11}	5.81×10^{-12}	8.25×10^{-11}
26	0/25	-4.70×10^{-11}	3.53×10^{-11}	1.22×10^{-10}
27	0/25	-4.44×10^{-11}	5.88×10^{-11}	3.22×10^{-10}
28	2/25	-1.97×10^{-11}	5.48×10^{-11}	2.02×10^{-10}
29	0/25	-3.92×10^{-11}	1.65×10^{-11}	1.26×10^{-10}
30	0/25	-4.18×10^{-11}	5.00×10^{-11}	2.17×10^{-10}
31	0/25	-3.96×10^{-10}	8.18×10^{-11}	1.17×10^{-9}
32	1/25	-2.27×10^{-11}	2.79×10^{-11}	1.91×10^{-10}
33	7/25	2.37×10^{-11}	5.88×10^{-11}	2.66×10^{-10}
34	2/25	-2.08×10^{-11}	3.89×10^{-11}	2.02×10^{-10}
35	1/25	-1.79×10^{-11}	2.93×10^{-11}	1.30×10^{-10}
36	23/25	2.18×10^{-11}	6.11×10^{-11}	1.58×10^{-10}
37	1/25	-2.19×10^{-11}	3.30×10^{-11}	2.20×10^{-10}

Table 5-5. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 251, 1996 (continued).

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha (continued)				
38	0/25	-1.53×10^{-11}	1.38×10^{-11}	5.96×10^{-11}
39	5/25	-1.72×10^{-11}	1.54×10^{-11}	2.21×10^{-10}
40	0/25	-1.64×10^{-11}	4.77×10^{-12}	3.96×10^{-11}
41	0/25	-2.39×10^{-11}	1.15×10^{-11}	2.06×10^{-10}
42	1/25	-1.01×10^{-11}	5.48×10^{-12}	6.96×10^{-11}
43	0/24	-2.09×10^{-11}	8.36×10^{-12}	6.96×10^{-11}
44	1/25	-2.27×10^{-11}	4.51×10^{-11}	1.65×10^{-10}
45	0/25	-3.74×10^{-11}	3.30×10^{-11}	2.15×10^{-10}
46	4/24	-1.62×10^{-11}	5.22×10^{-11}	1.54×10^{-10}
47	5/25	-3.20×10^{-11}	7.55×10^{-11}	1.37×10^{-10}
48	5/24	1.18×10^{-12}	4.22×10^{-11}	4.77×10^{-10}
49	2/25	-2.26×10^{-11}	4.59×10^{-11}	1.47×10^{-10}
Gross beta				
1	3/24	-3.37×10^{-11}	2.73×10^{-10}	2.05×10^{-9}
2	21/25	8.62×10^{-11}	4.33×10^{-10}	9.36×10^{-10}
3	4/25	-6.14×10^{-12}	1.65×10^{-10}	6.36×10^{-10}
4	23/25	1.33×10^{-10}	4.55×10^{-10}	1.07×10^{-9}
5	6/25	-2.17×10^{-11}	7.70×10^{-10}	4.92×10^{-9}
6	8/25	1.26×10^{-11}	4.37×10^{-10}	1.84×10^{-9}
7	11/24	3.17×10^{-11}	2.48×10^{-10}	9.18×10^{-10}
8	4/25	-2.73×10^{-10}	1.04×10^{-9}	4.85×10^{-9}
10	16/25	1.59×10^{-10}	8.88×10^{-10}	1.77×10^{-9}
11	4/25	2.59×10^{-10}	1.19×10^{-9}	5.81×10^{-9}
12	5/25	-5.74×10^{-12}	5.96×10^{-11}	3.70×10^{-10}
13	9/25	3.46×10^{-11}	2.13×10^{-10}	1.45×10^{-9}
14	19/25	1.92×10^{-10}	3.92×10^{-10}	1.03×10^{-9}
15	15/25	3.39×10^{-10}	2.75×10^{-9}	1.44×10^{-8}
16	8/25	4.85×10^{-11}	2.98×10^{-10}	1.30×10^{-9}
17	23/25	9.14×10^{-11}	4.00×10^{-10}	1.07×10^{-9}
18	8/25	2.65×10^{-12}	8.25×10^{-11}	1.12×10^{-9}
19	7/25	4.88×10^{-11}	1.27×10^{-9}	5.48×10^{-9}
20	16/25	3.40×10^{-11}	9.47×10^{-11}	4.22×10^{-10}
21	15/25	1.30×10^{-10}	7.51×10^{-10}	5.48×10^{-9}
22	13/25	3.77×10^{-11}	1.02×10^{-10}	3.44×10^{-10}

Table 5-5. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 251, 1996 (concluded).

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross beta (continued)				
23	18/25	1.92×10^{-10}	7.03×10^{-9}	1.66×10^{-8}
24	1/25	-1.09×10^{-10}	1.72×10^{-10}	7.14×10^{-10}
25	5/25	-4.37×10^{-11}	1.09×10^{-10}	8.55×10^{-10}
26	3/25	1.64×10^{-11}	1.53×10^{-10}	8.21×10^{-10}
27	6/25	-1.17×10^{-10}	2.61×10^{-10}	1.17×10^{-9}
28	14/25	-4.88×10^{-12}	2.93×10^{-10}	1.01×10^{-9}
29	5/25	4.07×10^{-11}	1.90×10^{-10}	1.39×10^{-9}
30	4/25	6.96×10^{-11}	2.28×10^{-10}	1.20×10^{-9}
31	1/25	-1.39×10^{-10}	9.47×10^{-10}	7.70×10^{-9}
32	4/25	3.18×10^{-11}	1.73×10^{-10}	4.55×10^{-10}
33	25/25	2.23×10^{-10}	3.92×10^{-10}	7.03×10^{-10}
34	19/25	7.22×10^{-11}	4.26×10^{-10}	9.84×10^{-10}
35	8/25	2.64×10^{-11}	1.28×10^{-10}	1.17×10^{-9}
36	25/25	2.16×10^{-10}	4.30×10^{-10}	8.30×10^{-10}
37	20/25	1.39×10^{-10}	3.77×10^{-10}	1.22×10^{-9}
38	9/25	1.28×10^{-11}	1.04×10^{-10}	5.29×10^{-10}
39	16/25	3.96×10^{-11}	9.36×10^{-11}	8.62×10^{-10}
40	7/25	1.17×10^{-11}	9.25×10^{-11}	3.20×10^{-10}
41	5/25	-2.58×10^{-11}	1.41×10^{-10}	1.04×10^{-9}
42	5/25	-2.50×10^{-11}	4.81×10^{-11}	3.06×10^{-10}
43	7/24	2.49×10^{-12}	7.70×10^{-11}	7.88×10^{-10}
44	15/25	7.40×10^{-11}	2.90×10^{-10}	7.77×10^{-10}
45	7/25	-1.30×10^{-10}	1.74×10^{-10}	1.63×10^{-9}
46	23/24	1.47×10^{-10}	5.46×10^{-10}	1.61×10^{-9}
47	23/25	1.36×10^{-10}	5.51×10^{-10}	1.50×10^{-9}
48	17/24	3.81×10^{-11}	3.54×10^{-10}	1.40×10^{-9}
49	15/25	5.40×10^{-11}	3.07×10^{-10}	1.41×10^{-9}

[a] Minimum detectable concentration.

Table 5-6. Summary of tritium in air effluent samples from monitored emission points at Building 331, 1996.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
HT				
Stack 1	53/54	5.14×10^{-6}	1.83×10^{-5}	2.06×10^{-3}
Stack 2	54/54	1.62×10^{-5}	1.02×10^{-3}	8.55×10^{-2}
HTO				
Stack 1	54/54	9.44×10^{-6}	3.78×10^{-4}	2.97×10^{-2}
Stack 2	53/54	4.11×10^{-6}	1.10×10^{-2}	1.64×10^{-1}

a Minimum detectable concentration.

Table 5-7. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 332, 1996.

Sampler no.	No. >MDC[a]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
SP-1A	0/51	-2.39×10^{-11}	1.27×10^{-11}	1.08×10^{-10}
SP-1B	0/51	-2.38×10^{-11}	1.29×10^{-11}	1.11×10^{-10}
SP-2A	0/51	-2.37×10^{-11}	3.27×10^{-11}	1.10×10^{-10}
SP-2B	0/51	-2.41×10^{-11}	3.17×10^{-11}	1.14×10^{-10}
SP-3	0/52	-3.10×10^{-11}	1.28×10^{-11}	1.12×10^{-10}
SP-4	0/52	-1.79×10^{-11}	2.03×10^{-11}	1.16×10^{-10}
SP-5	0/52	-1.80×10^{-11}	1.26×10^{-11}	1.16×10^{-10}
SP-6A	0/52	-2.41×10^{-11}	1.26×10^{-11}	8.84×10^{-11}
SP-6B	0/51	-3.10×10^{-11}	1.42×10^{-11}	1.13×10^{-10}
SP-7A	0/52	-2.38×10^{-11}	1.87×10^{-11}	1.13×10^{-10}
SP-7B	0/52	-3.10×10^{-11}	1.36×10^{-11}	1.11×10^{-10}
SP-8	0/51	-2.34×10^{-11}	1.27×10^{-11}	1.09×10^{-10}
SP-9	0/52	-3.10×10^{-11}	1.27×10^{-11}	1.14×10^{-10}
SP-10	0/50	-4.74×10^{-11}	2.54×10^{-11}	2.67×10^{-10}
SP-11	0/51	-1.79×10^{-11}	3.27×10^{-11}	8.92×10^{-11}
SP-12	0/50	-4.74×10^{-11}	2.71×10^{-11}	2.66×10^{-10}
Gross beta				
SP-1A	2/51	-6.70×10^{-11}	1.30×10^{-10}	3.36×10^{-10}
SP-1B	0/51	-4.88×10^{-11}	9.44×10^{-11}	2.35×10^{-10}
SP-2A	7/51	7.55×10^{-12}	1.41×10^{-10}	3.08×10^{-10}
SP-2B	16/51	-5.55×10^{-11}	1.75×10^{-10}	3.89×10^{-10}
SP-3	2/52	-4.92×10^{-11}	1.10×10^{-10}	2.71×10^{-10}
SP-4	5/52	-1.26×10^{-11}	1.22×10^{-10}	3.26×10^{-10}
SP-5	3/52	-7.66×10^{-11}	9.60×10^{-11}	2.90×10^{-10}
SP-6A	4/52	-8.36×10^{-11}	1.17×10^{-10}	3.48×10^{-10}
SP-6B	3/51	-1.27×10^{-11}	1.15×10^{-10}	2.88×10^{-10}
SP-7A	1/52	-3.01×10^{-11}	6.75×10^{-11}	3.07×10^{-10}
SP-7B	3/52	-6.11×10^{-11}	1.10×10^{-10}	2.74×10^{-10}
SP-8	3/51	-1.72×10^{-11}	1.14×10^{-10}	3.12×10^{-10}
SP-9	4/52	-3.52×10^{-11}	1.14×10^{-10}	3.30×10^{-10}
SP-10	7/50	-1.24×10^{-10}	2.28×10^{-10}	7.73×10^{-10}
SP-11	5/51	-4.88×10^{-11}	1.14×10^{-10}	4.59×10^{-10}
SP-12	4/50	-1.69×10^{-10}	2.38×10^{-10}	6.92×10^{-10}

[a] Minimum detectable concentration.

Table 5-8. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 419, 1996.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	25/47	-1.82×10^{-11}	5.70×10^{-11}	3.30×10^{-10}
2	10/47	-2.88×10^{-11}	3.08×10^{-11}	2.31×10^{-10}
Gross beta				
1	36/47	9.84×10^{-12}	7.14×10^{-10}	1.22×10^{-9}
2	36/47	-1.12×10^{-10}	6.07×10^{-10}	1.13×10^{-9}

[a] Minimum detectable concentration.

Table 5-9. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 490, 1996.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	0/23	-1.49×10^{-11}	2.13×10^{-12}	3.26×10^{-11}
2	0/30	-2.25×10^{-11}	2.06×10^{-12}	4.85×10^{-11}
3	0/26	-1.52×10^{-11}	2.10×10^{-12}	4.77×10^{-11}
4	0/27	-1.32×10^{-11}	2.50×10^{-12}	3.55×10^{-11}
Gross beta				
1	1/23	-3.77×10^{-11}	3.07×10^{-12}	1.92×10^{-10}
2	2/30	-5.77×10^{-11}	1.10×10^{-11}	2.89×10^{-10}
3	0/26	-7.88×10^{-11}	2.87×10^{-12}	6.51×10^{-11}
4	1/27	-4.88×10^{-11}	1.31×10^{-11}	1.90×10^{-10}

[a] Minimum detectable concentration.

Table 5-10. Summary of gross alpha and gross beta in air effluent samples from monitored emission points at Building 491, 1996.

Sampler no.	No. >MDC[(a)]/ Total samples	Minimum (Bq/mL)	Median (Bq/mL)	Maximum (Bq/mL)
Gross alpha				
1	1/54	-1.52×10^{-11}	2.12×10^{-12}	7.96×10^{-11}
Gross beta				
1	2/54	-2.86×10^{-11}	2.67×10^{-11}	6.14×10^{-10}

[a] Minimum detectable concentration.

6

Sewerable Water

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Methods

LLNL operates a flow-proportional peristaltic pump composite sampler in Building 196 (B196) (Volume 1, Figure 6-1), that creates a 24-hour composite of Livermore site sewage effluent by taking a sample for every 3765 L of 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 6-6.

LLNL also operates a flow proportional peristaltic pump composite sampler 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; a routine 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 acquires 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 each weekly composite (and each monthly 24-hour 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 by the method numbers 200.7, 206.2, 210.2, 200.7, 200.7, 200.7, 200.7, 239.2, 245.2, 249.2, 200.7, and 200.7, respectively. Two additional aliquots are submitted each week from the weekly composite. These two 500-mL aliquots are analyzed by HCAL for 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 **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," the left column of **Table 6-3** lists the parameters and the EPA method numbers used for the analyses. 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 only **Table 6-2** reports the monthly metals analytical results for those metals mentioned in the previous paragraph; 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" 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.

A flow chart recorder is located inside 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 and monthly averages for 1996.

Treated ground water discharges to the sanitary sewer are evaluated on the basis of Livermore Water Reclamation Plant (LWRP) self-monitoring permit 1510G. **Tables 6-5** and **6-6** show discharge dates and monitoring data for organic compounds, metals, and cyanide.

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-gal polyethylene bottle, is collected each week by LLNL and submitted to HCAL for gross alpha, gross beta, and tritium analyses. **Table 6-7** 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-gal 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 6-6 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 10% of the samples submitted for analytical work in 1996.

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996.

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS[b]	Activity[a]	LOS	Activity[a]	LOS
January	1	–0.307	164	169 ± 110	164	9.14	10.2
	2	44.0	146	160	161	12.4 ± 6.2	10.0
	3	–31.7	147	314 ± 120	161	6.99	10.3
	4	98.4	205	529 ± 150	174	5.66	10.3
	5	–1.15	157	315 ± 120	165	7.25	10.5
	6[c]	24.8	181	444 ± 130	162	8.62	10.3
	7	58.5	147	271 ± 120	163	2.73	10.5
	8	–15.0	152	181 ± 110	164	2.15	10.3
	9	28.4	172	751 ± 160	167	8.62	10.8
	10[d]	27.4	199	618 ± 150	164	7.66	10.4
	11	26.6	157	363 ± 130	164	2.41	10.5
	12	26.2	154	1162 ± 190	164	3.33	10.6
	13	89.5	165	581 ± 150	165	2.62	10.4
	14	–14.4	147	91.8	163	0.422	10.6
	15	29.5	159	241 ± 120	165	6.44	10.4
	16	–6.92	162	459 ± 130	165	1.27	10.5
	17	95.1	169	426 ± 130	166	0.973	10.7
	18	–32.3	185	666 ± 150	162	–0.562	10.5
	19	2.88	183	492 ± 140	162	–0.385	10.7
	20	122	213	685 ± 150	167	4.29	10.5
	21	12.4	159	213 ± 110	159	1.76	10.6
	22	112	153	54.0	158	–0.918	10.7
	23	88.8	171	426 ± 130	160	0.544	10.7
	24	26.3	179	381 ± 130	162	0.407	10.9
	25	–17.0	297	4218 ± 330	179	–2.10	11.1
	26	60.3	174	655 ± 150	161	6.14	10.9
	27	75.1	186	570 ± 140	162	5.96	11.1
	28	41.8	155	185 ± 110	158	3.56	11.3
	29	62.2	151	109	157	–2.25	11.5
	30	14.0	174	929 ± 170	161	3.85	11.1
	31	57.4	172	673 ± 150	161	–2.65	11.2
February	1	61.4	165	544 ± 140	160	2.62	11.0
	2	59.9	173	718 ± 150	161	3.43	10.8
	3	10.8	170	455 ± 130	161	4.96	10.8
	4	18.4	142	98.1	156	2.62	11.5

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
February	5	61.8	151	227 ± 110	158	5.29	10.6
	6	–34.8	168	585 ± 140	161	5.92	11.2
	7	–363	171	8547 ± 440	161	–0.755	11.3
	8	–9.07	179	1036 ± 180	162	2.56	11.2
	9	–20.3	187	1125 ± 180	164	–0.223	11.3
	10	2.56	179	622 ± 140	162	4.55	11.1
	11	20.9	142	188 ± 110	156	6.70	11.0
	12	27.7	161	160 ± 110	159	–1.88	11.4
	13	24.8	178	703 ± 150	162	23.0± 6.9	10.6
	14	205 ± 110	189	699 ± 150	164	1.37	10.7
	15	73.6	180	866 ± 160	161	9.32	10.5
	16	68.5	158	368 ± 130	158	9.03	10.9
	17	42.9	183	844 ± 160	162	11.6± 6.1	10.0
	18	–25.0	150	281 ± 120	157	1.06	10.9
	19	6.51	149	98.8	157	7.59	10.5
	20	11.3	157	202 ± 110	158	16.7± 6.3	10.0
	21	81.0	192	851 ± 160	163	–3.48	11.1
	22	153	170	492 ± 130	161	2.76	11.1
	23	155	190	1066 ± 170	162	–0.289	10.5
	24	91.4	169	544 ± 140	159	4.81	10.5
	25	71.8	164	681 ± 150	158	5.96	10.6
	26	84.0	152	273 ± 110	157	–4.48	11.0
	27	4.92	169	407 ± 130	159	–9.07	11.5
	28	51.8	187	829 ± 160	162	3.50	10.3
	29	–95.8	180	2427 ± 240	161	3.37	10.5
March	1	30.7	169	599 ± 140	160	1.43	10.7
	2	52.2	174	566 ± 140	161	3.07	10.5
	3	–6.70	139	229 ± 110	154	4.48	10.6
	4	84.4	168	110	159	2.11	10.4
	5	44.4	158	304 ± 120	158	4.14	10.9
	6	46.3	178	540 ± 140	162	6.44	10.4
	7	–2.26	166	281 ± 120	160	1.63	10.8
	8	–22.2	188	677 ± 150	164	–4.51	11.1
	9	152	170	361 ± 120	161	–3.21	10.7
	10	13.2	155	170 ± 110	158	5.77	10.6

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
March	11	20.8	165	112	160	0.844	10.4
	12	117	179	448 ± 130	162	6.99	11.0
	13	141	184	1399 ± 200	162	50.3 ± 7.5	11.1
	14	87.7	198	1743 ± 210	165	32.4 ± 7.8	11.9
	15	266 ± 120	186	958 ± 170	163	19.7 ± 7.5	11.6
	16	45.9	182	1032 ± 180	162	1.99	13.8
	17	–61.8	159	178 ± 110	159	3.55	13.5
	18	16.0	169	156	161	3.13	13.8
	19	51.8	196	1169 ± 190	165	6.66	13.6
	20	0.936	178	544 ± 140	162	–3.41	13.8
	21	–56.6	171	751 ± 160	161	0.197	11.2
	22	185 ± 100	164	670 ± 150	160	1.00	11.2
	23	307 ± 130	191	1195 ± 180	164	2.54	10.5
	24	77.7	164	143	160	5.77	10.8
	25	107	157	114	159	0.429	11.2
	26	119	167	466 ± 130	161	–2.92	11.5
	27	47.0	186	596 ± 140	163	11.5 ± 6.2	10.7
	28	28.5	179	570 ± 140	162	8.55	10.7
	29	148	201	725 ± 150	165	16.4 ± 7.0	11.4
	30	297 ± 130	204	1032 ± 180	167	47.4 ± 7.6	10.7
	31	32.6	153	213 ± 110	159	5.11	10.9
April	1	31.0	156	117	159	–3.51	11.4
	2	29.0	82.5	485 ± 120	138	1.67	11.1
	3	13.0	261	3537 ± 300	176	13.2 ± 6.3	10.4
	4	–47.4	175	636 ± 150	161	3.14	10.8
	5	34.9	175	759 ± 150	161	4.81	11.1
	6	46.6	162	503 ± 140	160	5.51	10.8
	7	–26.7	144	137	157	2.38	11.3
	8	–22.0	151	208 ± 110	158	2.81	11.2
	9	137	165	279 ± 120	161	10.4	10.7
	10	112	179	433 ± 130	160	11.6 ± 6.9	10.9
	11	111	200	670 ± 150	164	24.8 ± 6.9	11.1
	12	82.5	176	636 ± 150	161	16.8 ± 6.9	11.1
	13	–16.4	175	640 ± 150	161	–3.44	11.2
	14	78.4	138	127	154	6.36	10.6

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
April	15	23.9	132	142	152	0.265	10.6
	16	89.9	163	522 ± 140	159	1.02	11.0
	17	252 ± 130	208	1088 ± 170	167	400 ± 14	11.1
	18	–21.4	214	929 ± 170	169	2.95	11.0
	19	–70.3	173	555 ± 140	161	7.96	10.8
	20	60.3	184	685 ± 150	163	0.707	11.0
	21	142	148	225 ± 110	158	0.112	11.2
	22	16.2	155	241 ± 110	159	0.320	11.1
	23	65.5	177	747 ± 160	162	0.459	13.6
	24	39.2	187	662 ± 150	164	–7.18	13.5
	25	13.4	183	796 ± 160	164	–0.799	11.7
	26	–12.0	164	463 ± 130	161	–3.13	11.3
	27	98.4	203	659 ± 150	167	231 ± 11	10.9
	28	–13.1	155	323 ± 120	159	10.0	11.0
	29	–12.5	129	18.9	152	1.54	11.6
	30	24.5	157	295 ± 120	159	4.29	10.8
May	1	10.2	182	796 ± 160	162	18.3 ± 7.1	10.8
	2	69.2	169	692 ± 150	161	3.38	11.1
	3	100	165	437 ± 130	160	–0.574	11.2
	4	73.6	165	525 ± 140	160	4.81	10.7
	5	–15.5	132	159 ± 100	152	1.28	10.6
	6	135	136	62.5	154	3.06	10.8
	7	12.1	186	662 ± 150	163	414 ± 13	10.6
	8	165	186	688 ± 150	163	10.7 ± 6.4	10.4
	9	–47.4	165	611 ± 140	159	–3.06	11.0
	10	146	170	588 ± 140	160	4.81	10.5
	11	–27.6	197	792 ± 160	165	9.92	10.6
	12	–14.1	142	136	156	2.25	10.5
	13	8.88	144	168 ± 100	157	6.81	10.4
	14	–38.1	162	422 ± 130	160	1.59	13.0
	15	108	167	492 ± 130	161	3.57	12.8
	16	224 ± 110	167	622 ± 140	159	7.77	13.1
	17	18.3	165	636 ± 150	159	10.8	12.6
	18	141	165	324 ± 120	159	1.84	13.2
	19	50.7	139	28.0	154	9.99	12.4

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
May	20	–15.0	144	236 ± 110	155	–1.80	13.2
	21	12.1	177	692 ± 150	161	14.5 ± 6.2	12.9
	22	–31.3	167	551 ± 140	159	11.8	12.8
	23	–0.881	178	562 ± 140	161	3.57	10.7
	24	74.7	162	341 ± 120	158	–3.69	11.2
	25	100	169	466 ± 130	161	8.36	11.0
	26	–12.1	136	130	155	15.5 ± 5.9	10.2
	27[e]	94.7	173	529 ± 140	162	3.37	11.2
	28[f]	58.5	181	537 ± 140	163	5.96	10.2
	29	75.9	191	488 ± 140	165	0.662	10.9
	30	60.7	160	496 ± 130	160	9.18	10.4
	31	138	170	548 ± 140	161	2.32	10.7
June	1	124	167	389 ± 120	161	4.26	10.7
	2	113	141	185 ± 100	155	0.392	10.7
	3	–21.7	134	103	153	7.22	10.5
	4	–41.8	228	2387 ± 240	170	–7.36	11.0
	5	183	206	1040 ± 180	165	–4.74	11.0
	6	122	174	485 ± 140	161	–0.492	11.0
	7	94.0	157	228 ± 110	159	7.77	10.5
	8	156	186	422 ± 130	163	4.51	10.8
	9	75.9	125	77.0	149	–0.781	10.7
	10	43.3	140	107	155	–1.06	10.6
	11	109	181	625 ± 140	162	3.63	10.5
	12	189 ± 110	189	622 ± 140	163	10.9 ± 7.3	1.06
	13	36.8	186	562 ± 140	163	12.3 ± 6.5	10.7
	14	133	177	707 ± 150	161	1.66	11.0
	15	99.9	191	636 ± 150	164	8.33	10.8
	16	–18.8	169	320 ± 120	160	4.07	10.7
	17	92.1	204	470 ± 140	166	–0.00272	10.6
	18	24.5	198	821 ± 160	165	3.05	10.6
	19	84.0	184	870 ± 170	162	8.92	10.4
	20	169	180	807 ± 160	162	7.03	11.0
	21	103	180	607 ± 150	162	1.50	10.5
	22	–24.0	196	836 ± 160	164	–3.02	10.7
	23	41.1	166	525 ± 140	160	–0.0833	10.6

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
June	24	–20.1	154	374 ± 120	158	12.2 ± 6.0	10.0
	25	51.8	157	370 ± 130	160	–0.522	10.7
	26	90.7	175	514 ± 140	162	–5.55	11.4
	27	–17.3	179	459 ± 130	163	21.0 ± 6.9	10.6
	28	40.0	187	707 ± 160	164	4.14	10.9
	29	44.4	201	851 ± 160	167	5.55	10.4
	30	–22.6	162	233 ± 110	161	6.88	10.7
July	1	96.9	181	351 ± 130	163	–1.08	11.1
	2	13.5	186	925 ± 170	164	1.60	10.6
	3	29.5	248	1225 ± 200	176	5.44	10.9
	4	108	124	574 ± 140	162	9.95 ± 5.4	8.62
	5	57.7	137	418 ± 130	164	11.8 ± 5.3	8.55
	6	213 ± 120	134	707 ± 160	164	8.95 ± 5.5	8.92
	7	6.14	121	94.7	161	3.26	8.81
	8	191 ± 110	124	259 110	162	15.8 ± 5.2	8.29
	9	131	171	418 ± 130	161	6.40	8.99
	10	–1.10	165	455 ± 130	161	1.90	8.84
	11	108	193	629 ± 140	164	6.66	9.10
	12	212 ± 130	188	466 ± 140	164	5.33	10.7
	13	36.5	187	485 ± 140	163	–0.870	11.0
	14	11.8	172	222 ± 110	161	5.77	10.6
	15	147	163	234 ± 110	160	–3.64	11.6
	16	48.1	181	381 ± 130	161	6.03	10.5
	17	125	202	681 ± 150	167	0.673	10.8
	18	135	183	629 ± 140	163	4.59	10.5
	19	131	211	1288 ± 190	168	208 ± 10	10.5
	20	175	184	662 ± 150	162	6.51	10.5
	21	36.7	158	272 ± 110	159	6.07	10.6
	22	6.51	159	117	159	0.666	11.1
	23	0.936	183	666 ± 150	161	0.270	10.8
	24	99.5	198	1029 ± 170	163	–0.888	10.8
	25	–34.4	202	662 ± 150	164	0.323	10.8
	26	104	181	788 ± 160	162	3.77	10.9
	27	36.6	153	244 ± 110	158	6.77	10.4
	28	84.7	145	139	156	–4.51	10.9

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
July	29	48.8	152	109	158	6.92	10.5
	30	147	155	312 ± 120	158	2.70	10.8
	31	24.0	163	231 ± 110	159	18.9 ± 6.4	10.7
August	1	57.0	142	103	157	0.0276	10.9
	2	120	212	1032 ± 180	169	4.44	10.8
	3	50.0	167	238 ± 110	161	3.65	10.7
	4	–9.21	157	215 ± 110	160	3.74	10.7
	5	–30.4	156	150	159	–0.929	11.2
	6	96.9	193	847 ± 160	165	1.42	11.2
	7	124	192	1402 ± 200	165	0.847	11.0
	8	63.3	182	673 ± 150	163	–2.43	11.1
	9	52.9	170	1732 ± 210	161	241 ± 11	10.7
	10	160	196	477 ± 130	165	13.6 ± 6.5	11.0
	11	182	235	414 ± 140	174	17.5 ± 6.6	10.8
	12	140	229	377 ± 130	172	8.21	10.5
	13	130	184	622 ± 140	164	4.44	10.6
	14	56.2	185	466 ± 140	162	5.74	10.8
	15	–27.8	173	459 ± 130	161	1.41	10.5
	16	–13.8	182	640 ± 150	162	5.25	10.5
	17	–58.5	170	2749 ± 260	159	5.00	10.9
	18	22.1	189	588 ± 140	162	10.7 ± 6.3	10.7
	19	–10.2	158	363 ± 120	158	2.48	10.8
	20	–72.2	185	670 ± 150	161	2.50	10.6
	21	133	166	518 ± 130	159	3.16	10.5
	22	–2.93	174	466 ± 130	159	6.25	11.0
	23	117	161	444 ± 130	159	0.784	10.8
	24	210 ± 120	176	585 ± 140	161	11.8 ± 6.4	10.8
	25	146	162	200 ± 110	159	6.48	10.8
	26	185 ± 120	171	206 ± 110	161	5.77	10.7
	27	87.0	193	855 ± 160	164	162 ± 9.6	10.4
	28	37.0	196	1639 ± 210	164	6.51	10.7
	29	63.3	214	1006 ± 170	169	146 ± 9.4	10.7
	30	93.2	179	577 ± 140	162	8.81	10.4
	31	253	273	918 ± 170	176	367 ± 12	10.6

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
September	1	154	172	256 ± 120	161	14.1 ± 6.3	10.6
	2	85.5	188	367 ± 120	163	5.11	10.8
	3	199 ± 120	161	155	159	10.2	10.4
	4	81.8	167	622 ± 140	160	244 ± 11	11.0
	5	21.6	176	777 ± 160	161	1.36	10.9
	6	44.4	225	1528 ± 210	170	336 ± 12	11.1
	7	42.9	173	566 ± 140	161	6.77	11.0
	8	36.1	162	285 ± 120	160	7.73	10.5
	9	25.5	162	236 ± 110	159	6.81	10.8
	10	106	185	825 ± 160	163	11.8 ± 6.5	10.9
	11	72.2	188	670 ± 150	164	31.0 ± 6.5	10.2
	12	54.0	184	496 ± 140	163	5.85	10.7
	13	195 ± 120	181	377 ± 130	163	7.36	10.8
	14	342 ± 150	224	1125 ± 180	170	89.2 ± 8.3	10.9
	15	43.3	172	199 ± 110	161	3.77	11.0
	16	9.25	181	356 ± 120	162	9.18	10.6
	17	285 ± 140	172	463 ± 130	161	9.18	10.4
	18	–14.8	188	688 ± 150	163	4.92	11.0
	19	5.11	193	463 ± 130	165	5.96	10.8
	20	218	235	892 ± 170	174	24.3 ± 6.8	10.5
	21	88.4	230	681 ± 160	172	57.0 ± 8.0	10.7
	22	100	172	303 ± 120	161	9.69	10.6
	23	49.2	170	326 ± 120	161	5.70	10.7
	24	133	187	570 ± 140	164	3.48	10.8
	25	15.6	185	518 ± 140	163	2.55	11.0
	26	54.8	191	655 ± 150	164	9.07	10.7
	27	–19.7	183	1018 ± 170	163	11.6 ± 6.4	10.7
	28	–9.14	180	596 ± 140	162	10.5	10.9
	29	30.5	168	353 ± 120	161	15.5 ± 6.8	11.0
	30	81.8	157	250 ± 110	159	18.3 ± 6.6	11.0
October	1	–34.4	190	781 ± 160	162	8.47	10.9
	2	14.7	155	318 ± 120	157	0.154	10.7
	3	23.8	188	736 ± 150	162	28.2 ± 6.8	10.5
	4	48.1	179	703 ± 150	161	3.15	10.8
	5	225 ± 120	172	803 ± 150	159	4.44	10.8

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
October	6	85.8	168	319 ± 120	158	19.0 ± 6.7	10.7
	7	41.4	166	282 ± 120	158	30.1 ± 6.6	10.4
	8	98.8	175	596 ± 140	159	16.1 ± 6.3	10.5
	9	22.8	147	77.0	156	–4.14	10.9
	10	149	239	1806 ± 220	173	17.8 ± 6.2	10.1
	11	–17.3	184	511 ± 140	162	15.4 ± 6.6	10.5
	12	34.0	181	666 ± 150	161	6.14	10.5
	13	6.73	160	111	158	16.2 ± 6.6	10.6
	14	–49.6	164	221 ± 110	159	12.4 ± 6.6	10.9
	15	89.2	175	433 ± 130	161	6.51	10.7
	16	76.6	191	629 ± 140	163	34.2 ± 7.2	10.7
	17	103	186	844 ± 160	162	128 ± 9.0	10.7
	18	167	198	629 ± 140	165	18.4 ± 6.6	10.6
	19	201 ± 120	190	762 ± 150	164	2.72	11.0
	20	23.6	166	319 ± 120	160	–0.0947	10.9
	21	–29.6	157	225 ± 110	159	12.5 ± 6.5	10.5
	22	180	186	622 ± 140	162	31.0 ± 7.1	10.8
	23	44.0	175	544 ± 140	160	185 ± 10	11.2
	24	49.2	181	1380 ± 190	161	2.63	11.0
	25	20.1	196	237 ± 120	164	0.170	11.1
	26	46.3	204	614 ± 150	165	–18.5	12.5
	27	–18.6	175	282 ± 120	160	–2.56	11.0
	28	–8.33	159	154	158	–0.00324	11.2
	29	22.2	196	4033 ± 310	164	2.03	10.9
	30[f]	80.7	139	1025 ± 170	167	12.7 ± 6.6	10.7
	31	180 ± 110	131	525 ± 140	164	6.55	11.0
November	1	61.1	128	481 ± 140	164	2.46	10.7
	2	41.4	142	666 ± 150	167	26.8 ± 7.0	10.9
	3	–13.1	119	249 ± 120	162	3.50	10.7
	4	–10.7	115	192 ± 110	161	0.374	10.9
	5	27.8	124	444 ± 130	163	136 ± 9.3	10.9
	6	152	180	733 ± 150	160	21.8 ± 7.0	11.0
	7	–48.1	208	1143 ± 180	166	9.44	10.4

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (continued).

Sample date		Parameter					
		Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
		Activity[a]	LOS	Activity[a]	LOS	Activity[a]	LOS
November	8	31.9	198	585 ± 150	165	0.951	10.8
	9	22.3	180	681 ± 150	160	9.03	10.6
	10	138	185	396 ± 130	161	1.96	10.8
	11	88.1	197	429 ± 130	163	10.1	10.9
	12	55.9	182	481 ± 130	162	20.6 ± 6.8	11.0
	13	105	187	566 ± 140	161	6.96	10.7
	14	–99.2	204	611 ± 150	164	4.74	10.8
	15	87.7	192	585 ± 140	162	4.88	10.3
	16	205	199	1106 ± 180	163	0.592	10.5
	17	37.0	171	1203 ± 180	159	12.7 ± 6.5	10.3
	18	–4.26	173	426 ± 130	159	6.18	10.5
	19	155	200	1247 ± 190	164	249 ± 11	10.6
	20	45.5	189	821 ± 160	163	555 ± 15	10.8
	21	86.6	217	681 ± 160	168	15.7 ± 6.4	10.6
	22	79.6	164	440 ± 130	159	2.45	10.6
	23	53.7	180	673 ± 150	161	236 ± 11	10.8
	24	–43.7	176	179 ± 110	161	1.70	11.0
	25	20.5	166	187 ± 110	159	–0.0796	11.1
	26	320	354	681 ± 250	323	525 ± 15	11.2
	27	218	229	951 ± 170	172	0.940	11.1
	28	123	249	940 ± 180	176	588 ± 15	10.9
	29	81.8	202	188 ± 110	166	1.19	11.2
	30	163	400	374 ± 220	330	5.88	10.9
December	1	118	248	503 ± 150	176	5.96	11.0
	2	127	256	451 ± 140	176	7.22	11.0
	3	193	228	973 ± 180	172	142 ± 9.4	11.1
	4	108	210	847 ± 160	168	4.70	10.6
	5	120	199	629 ± 140	165	5.44	10.8
	6	–37.4	225	1184 ± 190	171	8.84	10.7
	7	112	414	659 ± 250	332	290 ± 12	10.8
	8	12.0	215	603 ± 150	168	4.92	11.0
	9	–20.3	168	326 ± 120	160	–4.66	10.9
	10	159	187	699 ± 150	163	374 ± 13	10.6
	11	69.9	184	533 ± 140	162	4.26	10.5
	12	22.1	186	559 ± 140	163	0.932	10.8

Table 6-1. Daily monitoring results for gross alpha, gross beta, and tritium in the sanitary sewer effluent, 1996 (concluded).

Sample date	Parameter					
	Gross alpha (μBq/mL)		Gross beta (μBq/mL)		Tritium (mBq/mL)	
	Activity[(a)]	LOS	Activity[(a)]	LOS	Activity[(a)]	LOS
December 13	5.99	181	1173 ± 180	161	5.99	10.6
14	62.2	206	522 ± 140	165	339 ± 12	10.7
15	94.0	178	259 ± 120	161	5.07	10.9
16	19.3	151	131	157	4.03	11.0
17	98.1	183	518 ± 140	163	248 ± 11	10.2
18	–32.0	185	603 ± 140	163	1.48	10.8
19	54.8	179	581 ± 150	162	6.85	10.9
20	–16.8	474	5698 ± 540	347	0.759	11.3
21	75.9	176	381 ± 130	162	–2.89	11.1
22	92.9	165	171 ± 110	161	14.2 ± 6.7	10.8
23	66.2	158	99.2	159	4.00	10.9
24	–49.6	151	149	158	6.62	10.5
25	–6.73	156	138	159	3.15	10.7
26	–19.9	156	117	159	–3.40	11.1
27	57.7	159	289 ± 120	159	2.55	10.7
28	507	167	414 ± 120	159	282 ± 11	10.9
29	14.4	149	29.4	156	0.0847	10.7
30	37.0	151	135	157	3.25	10.7
31	96.6	178	596 ± 140	160	2.29	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 Ranges are only listed for activities that are above the LOS.

b LOS = Limit of sensitivity.

c January 2–3, and 5–8, 1996.

d January 9–15, 1996.

e May 21–27, 1996.

f May 28–June 3, 1996.

g October 29–November 4, 1996.

Table 6-2. Weekly and 24-hour composite results for metals in LLNL sanitary sewer effluent, 1996.

Composite dates	Parameter (mg/L)											
	Ag	Al	As	Be	Cd	Cr	Cu	Fe	Hg	Ni	Pb	Zn
12/26/95–1/1/96	<0.01	1.3	0.0055	<0.0005	<0.005	<0.01	0.32	2.1	<0.0002	0.012	0.019	1
1/2–3, 5–8[a]	<0.01	0.66	0.0031	<0.0005	<0.005	<0.01	0.11	1.6	<0.0002	<0.005	0.012	0.22
1/4[b]	0.036	2.1	0.0044	<0.0005	<0.005	0.04	0.26	4.6	0.00027	0.0086	0.044	0.54
1/9–15	0.014	0.74	<0.002	<0.0005	<0.005	0.021	0.13	2	0.00058	0.011	0.02	0.27
1/16–22	<0.01	0.46	0.006	<0.0005	<0.005	0.011	0.099	1.3	0.00029	<0.005	0.017	0.23
1/23–29	0.013	1	<0.002	<0.0005	<0.005	0.035	0.082	1.5	0.00028	0.0089	0.012	0.21
1/30–2/5	0.028	0.71	<0.002	<0.0005	<0.005	<0.01	0.23	1.1	<0.0002	0.0094	0.019	0.15
2/6[b]	0.015	0.79	<0.002	<0.0005	<0.005	0.028	0.13	1.6	0.00046	0.033	0.031	0.24
2/7–12[a]	0.013	<0.2	<0.002	<0.0005	<0.005	0.011	0.098	0.81	<0.0002	<0.005	0.014	0.13
2/13–19	<0.01	0.33	<0.002	<0.0005	<0.005	<0.01	0.079	1	<0.0002	0.0065	0.017	0.17
2/20–26	<0.01	0.55	<0.002	0.00062	<0.005	<0.01	0.075	1.2	0.00022	<0.005	0.016	0.17
2/27–3/4	<0.01	0.48	<0.002	<0.0005	<0.005	<0.01	0.12	1.3	<0.0002	<0.005	0.013	0.23
3/5[b]	<0.01	2.4	0.003	<0.0005	<0.005	0.058	0.2	4.5	0.00041	0.011	0.035	0.46
3/6–11[a]	<0.0005	0.96	<0.002	<0.0005	<0.0005	<0.01	0.079	1.6	0.00085	<0.005	0.01	0.2
3/12–18	<0.01	0.7	<0.002	<0.0005	<0.005	0.013	0.07	1.3	<0.0002	<0.005	0.0092	0.15
3/19–25	<0.01	0.41	<0.002	<0.0005	<0.005	0.011	0.11	1.3	<0.0002	<0.005	0.014	0.22
3/26–4/1	<0.01	0.37	<0.002	<0.0005	<0.005	<0.01	0.058	1	0.00029	<0.005	0.0088	0.13
4/2[b]	<0.01	1.7	<0.002	<0.0005	<0.005	0.023	0.14	3	0.00045	<0.005	0.017	0.29
4/3–8[a]	<0.01	0.61	<0.002	<0.0005	<0.005	0.016	0.082	1.5	0.00038	0.0059	<0.002	0.2
4/9–15	0.019	0.86	<0.002	<0.0005	<0.005	0.013	0.087	1.7	0.00029	0.0067	0.012	0.22
4/16–17, 19–22[c]	<0.01	0.32	0.0024	<0.0005	<0.005	<0.01	0.058	0.88	0.00022	<0.005	0.0079	0.12
4/18[d]	<0.01	0.57	0.0032	<0.0005	<0.005	0.011	0.1	1.3	0.00034	0.0056	0.014	0.19
4/23–29	<0.01	0.52	<0.002	<0.0005	<0.005	<0.01	0.067	1.3	0.00049	0.0052	0.014	0.14
4/30, 5/1,3–6[a]	0.017	1.2	<0.002	<0.0005	<0.005	0.022	0.14	2.5	0.00068	0.027	0.019	0.26
5/2[b]	0.018	1.3	<0.002	<0.0005	<0.005	0.017	0.16	2.6	0.00038	0.018	0.025	0.31
5/7–9, 11–13[c]	<0.01	1.2	0.0028	<0.0005	<0.005	0.018	0.16	2.2	0.00052	0.0071	0.019	0.3
5/10[d]	<0.01	1.1	0.002	<0.0005	<0.005	0.012	0.095	1.3	0.00026	<0.005	0.013	0.19
5/14–20	<0.01	0.76	0.0032	<0.0005	<0.005	0.016	0.17	1.5	<0.0002	<0.005	0.041	0.25
5/21–27	<0.01	0.83	<0.002	<0.0005	<0.005	0.018	0.15	1.8	0.00056	<0.005	0.031	0.28
5/28–6/3	<0.01	0.63	<0.002	<0.0005	<0.005	0.012	0.11	1.2	0.00051	0.0055	0.051	0.32
6/4–5, 7–10[a]	<0.01	0.65	0.0028	<0.0005	<0.005	0.015	0.12	1.3	0.0002	0.005	0.044	0.18
6/6[b]	<0.01	0.36	<0.002	<0.0005	<0.005	<0.01	0.079	0.72	0.0002	<0.005	0.0096	0.15
6/11–17	<0.01	0.47	0.0032	<0.0005	<0.005	0.011	0.085	1	<0.0002	0.0052	0.018	0.2
6/18–24	<0.01	0.4	<0.002	<0.0005	<0.005	<0.01	0.084	0.89	<0.0002	<0.005	0.015	0.17
6/25–7/1	<0.01	0.38	0.0022	<0.0005	<0.005	<0.01	0.081	0.93	<0.0002	<0.005	0.03	0.16

Table 6-2. Weekly and 24-hour composite results for metals in LLNL sanitary sewer effluent, 1996 (continued).

Composite dates	Parameter (mg/L)											
	Ag	Al	As	Be	Cd	Cr	Cu	Fe	Hg	Ni	Pb	Zn
7/2–8	<0.01	0.21	<0.002	<0.0005	<0.005	<0.01	0.1	0.35	<0.0002	<0.005	0.018	0.13
7/9[b]	<0.01	0.55	0.0022	<0.0005	<0.005	0.01	0.16	0.91	0.0007	0.0066	0.031	0.27
7/10–15[a]	0.016	0.94	0.0031	<0.0005	<0.005	0.025	0.2	2.1	<0.0002	0.0063	0.024	0.27
7/16–22	<0.01	0.41	0.0031	<0.0005	<0.005	0.01	0.1	1.1	<0.0002	<0.005	0.013	0.17
7/23–29	<0.01	0.46	<0.002	<0.0005	<0.005	<0.01	0.1	1	0.00024	0.0078	0.013	0.18
7/30–8/5	<0.01	<0.2	<0.002	<0.0005	<0.005	<0.01	0.068	0.59	0.00028	<0.005	0.013	0.22
8/6[b]	<0.01	0.61	<0.002	<0.0005	<0.005	0.021	0.18	1.6	0.0016	<0.005	0.016	0.26
8/7–12[a]	<0.01	0.24	0.003	<0.0005	<0.005	<0.01	0.073	0.43	<0.0002	<0.005	0.011	0.18
8/13–19	0.012	0.82	0.0031	<0.0005	<0.005	0.02	0.14	1.6	0.0018	0.0057	0.0092	0.23
8/20–26	<0.01	0.78	<0.002	<0.0005	<0.005	0.018	0.17	1.5	0.00075	<0.005	0.099	0.25
8/27–9/2	<0.01	1.1	<0.002	<0.0005	<0.005	0.034	0.22	1.9	0.003	0.005	0.048	0.27
9/3, 5–9[a]	0.014	1.9	<0.002	<0.0005	<0.005	0.053	0.34	4.1	0.0015	0.0071	0.047	0.5
9/4[b]	0.021	1	<0.002	<0.0005	0.0066	0.017	0.15	2	0.00049	<0.005	0.046	0.25
9/10–16	<0.01	0.32	<0.002	<0.0005	<0.005	<0.01	0.032	1.6	0.0013	<0.005	0.025	0.27
9/17–23	<0.01	<0.2	<0.002	<0.0005	<0.005	<0.01	0.044	0.42	0.0044	<0.005	0.036	0.088
9/24–30	<0.01	0.27	<0.002	<0.0005	<0.005	<0.01	0.13	0.82	0.00039	<0.005	0.04	0.22
10/1–2, 4–7[a]	<0.01	<0.2	<0.002	<0.0005	<0.005	<0.01	<0.01	<0.1	0.0002	<0.005	0.028	<0.02
10/3[b]	<0.01	0.58	<0.002	<0.0005	<0.005	0.012	0.14	1.2	0.00075	<0.005	0.033	0.24
10/8–14	<0.01	0.37	<0.002	<0.0005	<0.005	0.015	0.13	0.93	0.00034	0.005	0.031	0.2
10/15–21	<0.01	0.34	<0.002	<0.0005	<0.005	<0.01	0.097	1.1	0.00059	<0.005	0.019	0.22
10/22–28	<0.01	0.49	<0.002	<0.0005	<0.005	0.011	0.094	1.1	0.00063	0.0053	0.018	0.17
10/29–11/4	<0.01	0.53	<0.002	<0.0005	<0.005	<0.01	0.098	1.2	0.00048	<0.005	0.015	0.2
11/5, 7–11[a]	<0.01	1	0.0023	<0.0005	<0.005	0.015	0.1	1.5	0.00023	<0.005	<0.002	0.2
11/6[b]	<0.01	0.41	<0.002	<0.0005	<0.005	0.018	0.063	1.1	0.00071	<0.005	0.0091	0.15
11/12–18	0.011	0.46	<0.002	<0.0005	<0.005	0.017	0.12	1.1	0.00049	<0.005	0.029	0.19
11/19–25	<0.01	0.69	0.0024	<0.0005	<0.005	0.018	0.14	1.4	0.0014	0.0068	0.024	0.21
11/26–12/2	<0.01	0.42	0.0039	<0.0005	<0.005	0.019	0.097	1.3	0.0077	0.0075	0.013	0.17
12/3–4, 6–9[a]	<0.01	0.5	0.0037	<0.0005	<0.005	0.023	<0.01	1.5	0.0016	<0.005	0.015	0.23
12/5[b]	<0.01	0.53	<0.002	<0.0005	<0.005	0.022	0.095	1.4	0.0015	0.0061	0.028	0.23
12/10–16	<0.01	0.51	<0.003	<0.0005	<0.005	<0.01	0.081	1	0.00025	<0.005	0.0098	0.17
12/17–23	<0.01	0.22	<0.002	<0.0005	<0.005	<0.01	0.036	0.49	<0.0002	<0.005	<0.002	0.15
12/24–30	<0.01	0.54	<0.002	<0.0005	<0.005	0.011	0.078	0.84	0.00022	<0.005	0.011	0.18
12/31/96–1/6/97	<0.01	0.42	<0.002	<0.0005	<0.005	0.018	0.16	1.4	0.0016	0.0055	0.049	0.28

Table 6-2. Weekly and 24-hour composite results for metals in LLNL sanitary sewer effluent, 1996 (concluded).

	Summary and Comparison											
	Ag	**Al**	**As**	**Be**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**Ni**	**Pb**	**Zn**
	Weekly composite results											
Detection frequency	10/56	52/56	20/56	1/56	0/56	32/56	54/56	55/56	39/56	24/56	53/56	55/56
Minimum (mg/L)	<0.0005	<0.2	<0.0020	<0.00050	<0.0005	<0.010	<0.010	<0.1	<0.0002	<0.005	<0.002	<0.02
Maximum (mg/L)	0.028	1.9	0.0060	0.00062	<0.0050	0.053	0.34	4.1	0.0077	0.027	0.099	1.0
Median (mg/L)	<0.010	0.52	<0.0020	<0.00050	<0.0050	0.011	0.099	1.3	0.0003	<0.005	0.017	0.20
IQR (mg/L)	—	0.39	—	—	—	0.007	0.051	0.5	0.0004	—	0.013	0.06
50% of EPL (mg/L)	0.1	—	0.03	—	0.07	0.31	0.5	—	0.005	0.31	0.1	1.5
Minimum/50% of EPL	<0.01	—	<0.07	—	<0.01	<0.03	<0.02	—	<0.04	<0.02	<0.02	<0.01
Maximum/50% of EPL	0.28	—	0.2	—	<0.07	0.17	0.7	—	1.5	0.09	1.0	0.67
Median/50% of EPL	<0.10	—	<0.1	—	<0.07	0.04	0.2	—	0.1	<0.02	0.2	0.13
	24-hour composite results											
Detection frequency	4/14	14/14	5/14	0/14	1/14	13/14	14/14	14/14	14/14	7/14	14/14	14/14
Minimum (mg/L)	<0.010	0.36	<0.0020	<0.0005	<0.0050	<0.010	0.063	0.7	0.0002	<0.005	0.0091	0.15
Maximum (mg/L)	0.036	2.4	0.0044	<0.0005	0.0066	0.058	0.26	4.6	0.0016	0.033	0.046	0.54
Median (mg/L)	<0.010	0.70	<0.0020	<0.0005	<0.0050	0.018	0.14	1.5	0.0005	<0.0053	0.027	0.25
IQR (mg/L)	—	0.70	—	—	—	0.011	0.06	1.2	0.0004	—	0.018	0.09
EPL (mg/L)	0.2	—	0.06	—	0.14	0.62	1.0	—	0.01	0.61	0.2	3.0
Minimum/EPL	<0.05	—	<0.03	—	<0.04	<0.02	0.06	—	0.02	<0.01	0.05	0.05
Maximum/EPL	0.18	—	0.07	—	0.05	0.09	0.26	—	0.16	0.05	0.23	0.18
Median/EPL	<0.05	—	<0.03	—	<0.04	0.03	0.14	—	0.05	<0.01	0.13	0.08

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

[c] Sampling for these weeks omitted one day because the sampling equipment was devoted to acquiring a second monthly composite sample.

[d] Results from a second monthly composite sample. Effluent from this date is not included in the normal weekly composite because the sampling equipment was devoted to acquiring a second 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 LLNL sanitary sewer effluent, 1996.

Parameter	Sample month					
	January	February	March	April	May	June
Composite sample						
Oxygen demand (mg/L)						
Biochemical oxygen demand – 405.1	270	240	240	190	260	82
Chemical oxygen demand – 410.4	820	380	410	180	180	58
Solids (mg/L)						
Solid settling rate (mL/L/h) – 160.5	43	16	40	15	25	18
Total dissolved solids (TDS) – 160.1	210	210	220	350	180	240
Total suspended solids (TSS) – 160.2	460	230	420	230	100	140
Volatile solids – 160.4	96	61	60	190	78	65
Anions (mg/L) – 300.0						
Bromide	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloride	42	37	36	50	59	48
Fluoride	_a	_a	_a	0.13	0.28	0.082
Nitrate (as N)	0.12[b]	<0.11[b]	<0.23[b]	<0.5	<0.5	<0.5
Nitrate (as NO_3)	0.55	<0.5	<1	<0.5	<0.5	<0.5
Nitrite (as N)	<1.5[b]	<1.5[b]	<1.5[b]	<0.5	<2.5	<0.5
Nitrite (as NO_2)	<5	<5	<5	<0.5	<2.5	<0.5
Orthophosphate	_a	_a	_a	210	17	11
Sulfate	17	17	17	17	19	18
Alkalinity (mg/L) – 310.1						
Bicarbonate alkalinity (as $CaCO_3$)	190	130	200	210	190	200
Carbonate alkalinity (as $CaCO_3$)	<1	<1	<1	<1	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1	<1	<1
Total alkalinity (as $CaCO_3$)	190	130	200	210	190	200
Nutrients (mg/L)						
Ammonia nitrogen (as N) – 350.2	23	30	39	<0.1	40	41
Total Kjeldahl nitrogen – 351.3	48	49	50	45	39	41
Total organic carbon (mg/L) – 415.1	84	65	43	45	32	32
Polychlorinated biphenyls (μg/L) – 608						
PCB 1016	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 1221	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 1232	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 1242	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 1248	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 1254	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
PCB 1260	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	July	August	September	October	November	December
Composite sample (continued)						
Oxygen demand (mg/L)						
Biochemical oxygen demand – 405.1	190	160	29.2	23.8	116.8	274
Chemical oxygen demand – 410.4	56	66	54	440	330	290
Solids (mg/L)						
Solid settling rate (mL/L/h) – 160.5	25	23	5	21	19	25
Total dissolved solids (TDS) – 160.1	240	450	190	260	420	280
Total suspended solids (TSS) – 160.2	310	94	95	220	220	250
Volatile Solids – 160.4	69	380	78	200	200	240
Anions (mg/L) – 300.0						
Bromide	<0.5	<0.5	<0.5	<1.5	<0.5	<0.5
Chloride	52	63	55	46	59	54
Fluoride	0.9	0.083	0.12	0.13	0.2	0.17
Nitrate (as N)	<0.5	<0.5	<0.5	<1.5	<5	<0.5
Nitrate (as NO_3)	<0.5	<0.5	<0.5	<1.5	9.9	<0.5
Nitrite (as N)	<0.5	<0.5	<2.5	<1.5	<5	<0.5
Nitrite (as NO_2)	<0.5	<0.5	<2.5	<1.5	<5	0.61
Orthophosphate	5.3	5.8	9.8	4.4	<20	16
Sulfate	25	31	19	29	4800	29
Alkalinity (mg/L) – 310.1						
Bicarbonate alkalinity (as $CaCO_3$)	180	200	180	190	220	240
Carbonate alkalinity (as $CaCO_3$)	<1	<1	<1	<1	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1	<1	<1
Total alkalinity (as $CaCO_3$)	180	200	180	190	220	240
Nutrients (mg/L)						
Ammonia nitrogen (as N) – 350.2	15	47	32	41	47	51
Total Kjeldahl nitrogen – 351.3	32	47	36	40	30	47
Total organic carbon (mg/L) – 415.1	4.2	—[a]	48	45	44	64
Polychlorinated biphenyls (µg/L) – 608						
PCB 1016	<0.5	<0.5	<5	<5	<0.5	<0.5
PCB 1221	<0.5	<0.5	<5	<5	<0.5	<0.5
PCB 1232	<0.5	<0.5	<5	<5	<0.5	<0.5
PCB 1242	<0.5	<0.5	<5	<5	<0.5	<0.5
PCB 1248	<0.5	<0.5	<5	<5	<0.5	<0.5
PCB 1254	<0.5	<0.5	<5	<5	<0.5	<0.5
PCB 1260	<0.5	<0.5	<5	<5	<0.5	<0.5

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	January	February	March	April	May	June
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
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
Toxaphene	<1	<1	<1	<1	<1	<1
Total metals (mg/L)[c]						
Calcium – 200.7	19	13	10	14	16	14
Magnesium – 200.7	4.5	3	2.5	3.2	3.4	4.7
Potassium – 200.7	17	17	19	68	19	17
Selenium – 270.2	—[a]	<0.002	<0.002	<0.01	<0.002	<0.002
Sodium – 200.7	43	29	32	31	38	35
Grab sample						
Volatile organic compounds (μg/L) – 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

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	July	August	September	October	November	December
Organochlorine pesticides (μg/L) – 608						
Aldrin	<0.05	<0.05	<0.5	<0.5	<0.05	<0.05
BHC, alpha isomer	<0.05	<0.05	<0.5	<0.5	<0.05	<0.05
BHC, beta isomer	<0.05	<0.05	<0.5	<0.5	<0.05	<0.05
BHC, delta isomer	<0.05	<0.05	<0.5	<0.5	<0.05	<0.05
BHC, gamma isomer (Lindane)	<0.05	<0.05	<0.5	<0.5	<0.05	<0.05
Chlordane	<0.5	<0.5	<5	<5	<0.5	<0.5
Dieldrin	<0.1	<0.1	<1	<1	<0.1	<0.1
Endosulfan I	<0.05	<0.05	<0.5	<0.5	<0.05	<0.05
Endosulfan II	<0.1	<0.1	<1	<1	<0.1	<0.1
Endosulfan sulfate	<0.1	<0.1	<1	<1	<0.1	<0.1
Endrin	<0.1	<0.1	<1	<1	<0.1	<0.1
Endrin aldehyde	<0.1	<0.1	<1	<1	<0.1	<0.1
Heptachlor	<0.05	<0.05	<0.5	<0.5	<0.05	<0.05
Heptachlor epoxide	<0.05	<0.05	<0.5	<0.5	<0.05	<0.05
Methoxychlor	<0.5	<0.5	<5	<5	<0.5	<0.5
p,p'-DDD	<0.1	<0.1	<1	<1	<0.1	<0.1
p,p'-DDE	<0.1	<0.1	<1	<1	<0.1	<0.1
p,p'-DDT	<0.1	<0.1	<1	<1	<0.1	<0.1
Toxaphene	<1	<1	<10	<10	<1	<1
Total metals (mg/L)[(c)]						
Calcium – 200.7	20	19	13	15	17	18
Magnesium – 200.7	3.6	3.3	3.2	3.5	4.8	4.8
Potassium – 200.7	19	20	20	19	18	20
Selenium – 270.2	<0.002	<0.002	0.0022	<0.002	<0.002	<0.002
Sodium – 200.7	38	37	26	39	44	42
Grab sample						
Volatile organic compounds (μg/L) – 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

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	January	February	March	April	May	June
Volatile organic compounds (μg/L) – 624 (continued)						
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	140	180	170	390	1400	190
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	11	9	15	15	22	6.4
Chloromethane	<2	<2	<2	<2	<2	<2
cis-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
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	<1	<1	160	<1
Styrene	<1	<1	<1	<1	<1	<1
Tetrachloroethene	<1	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	270	<1
Total xylene isomers	<2	<2	<2	<2	<2	<2
trans-1,3-Dichloropropene	<1	<1	<1	<1	<1	<1
Trichloroethene	<0.5	<0.5	<0.5	<0.5	300	<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

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	July	August	September	October	November	December
Volatile organic compounds (μg/L) – 624 (continued)						
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	170	190	120	84	55	79
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	11	11	10	7.9	9.8	7.8
Chloromethane	<2	<2	<2	<2	<2	<2
cis–1,3–Dichloropropene	<1	<1	<1	<1	<1	<1
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	<1	<1	<1	<1
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
trans–1,3–Dichloropropene	<1	<1	<1	<1	<1	<1
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

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	January	February	March	April	May	June
Semivolatile organic compounds (μg/L) – 625						
1,2,4-Trichlorobenzene	<10	<10	<10	<10	<5	<5
1,2-Dichlorobenzene	<10	<10	<10	<10	<5	<5
1,3-Dichlorobenzene	<10	<10	<10	<10	<5	<5
1,4-Dichlorobenzene	<10	<10	<10	<10	<5	<5
2,4,5-Trichlorophenol	<10	<10	<10	<10	<5	<5
2,4,6-Trichlorophenol	<10	<10	<10	<10	<5	<5
2,4-Dichlorophenol	<10	<10	<10	<10	<5	<5
2,4-Dimethylphenol	<10	<10	<10	<10	<5	<5
2,4-Dinitrophenol	<50	<50	<50	<50	<25	<25
2,4-Dinitrotoluene	<10	<10	<10	<10	<5	<5
2,6-Dinitrotoluene	<10	<10	<10	<10	<5	<5
2-Chloronaphthalene	<10	<10	<10	<10	<5	<5
2-Chlorophenol	<10	<10	<10	<10	<5	<5
2-Methylphenol	<10	<10	<10	<10	<5	<5
2-Methyl-4,6-dinitrophenol	<50	<50	<50	<50	<25	<25
2-Methylnaphthalene	<10	<10	<10	<10	<5	<5
2-Nitroaniline	<50	<50	<50	<50	<25	<25
2-Nitrophenol	<10	<10	<10	<10	<5	<5
3,3'-Dichlorobenzidine	<20	<20	<20	<20	<10	<10
3-Nitroaniline	<50	<50	<50	<50	<25	<25
4-Bromophenylphenylether	<10	<10	<10	<10	<5	<5
4-Chloro-3-methylphenol	<20	<20	<20	<20	<10	<10
4-Chloroaniline	<20	<20	<20	<20	<10	<10
4-Chlorophenylphenylether	<10	<10	<10	<10	<5	<5
4-Nitroaniline	<50	<50	<50	<50	<25	<25
4-Nitrophenol	<50	<50	<50	<50	<25	<25
Acenaphthene	<10	<10	<10	<10	<5	<5
Acenaphthylene	<10	<10	<10	<10	<5	<5
Anthracene	<10	<10	<10	<10	<5	<5
Benzo(a)anthracene	<10	<10	<10	<10	<5	<5
Benzo(a)pyrene	<10	<10	<10	<10	<5	<5
Benzo(b)fluoranthene	<10	<10	<10	<10	<5	<5
Benzo(g,h,i)perylene	<10	<10	<10	<10	<5	<5
Benzo(k)fluoranthene	<10	<10	<10	<10	<5	<5
Benzoic acid	<50	<50	<50	<50	<250	<25

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	July	August	September	October	November	December
Semivolatile organic compounds (μg/L) – 625						
1,2,4-Trichlorobenzene	<5	<5	<5	<5	<20	<10
1,2-Dichlorobenzene	<5	<5	<5	<5	<20	<10
1,3-Dichlorobenzene	<5	<5	<5	<5	<20	<10
1,4-Dichlorobenzene	<5	<5	<5	<5	<20	<10
2,4,5-Trichlorophenol	<5	<5	<5	<5	<20	<10
2,4,6-Trichlorophenol	<5	<5	<5	<5	<20	<10
2,4-Dichlorophenol	<5	<5	<5	<5	<20	<10
2,4-Dimethylphenol	<5	<5	<5	<5	<20	<10
2,4-Dinitrophenol	<25	<25	<25	<25	<100	<50
2,4-Dinitrotoluene	<5	<5	<5	<5	<20	<10
2,6-Dinitrotoluene	<5	<5	<5	<5	<20	<10
2-Chloronaphthalene	<5	<5	<5	<5	<20	<10
2-Chlorophenol	<5	<5	<5	<5	<20	<10
2-Methylphenol	<5	<5	<5	21	<20	<10
2-Methyl-4,6-dinitrophenol	<25	<25	<25	<25	<100	<50
2-Methylnaphthalene	<5	<5	<5	<5	<20	<10
2-Nitroaniline	<25	<25	<25	<25	<100	<50
2-Nitrophenol	<5	<5	<5	<5	<20	<10
3,3'-Dichlorobenzidine	<10	<10	<10	<10	<40	<20
3-Nitroaniline	<25	<25	<25	<25	<100	<50
4-Bromophenylphenylether	<5	<5	<5	<5	<20	<10
4-Chloro-3-methylphenol	<10	<10	<10	<10	<40	<20
4-Chloroaniline	<10	<10	<10	<10	<40	<20
4-Chlorophenylphenylether	<5	<5	<5	<5	<20	<10
4-Nitroaniline	<25	<25	<25	<25	<100	<50
4-Nitrophenol	<25	<25	<25	<25	<100	<50
Acenaphthene	<5	<5	<5	<5	<20	<10
Acenaphthylene	<5	<5	<5	<5	<20	<10
Anthracene	<5	<5	<5	<5	<20	<10
Benzo(a)anthracene	<5	<5	<5	<5	<20	<10
Benzo(a)pyrene	<5	<5	<5	<5	<20	<10
Benzo(b)fluoranthene	<5	<5	<5	<5	<20	<10
Benzo(g,h,i)perylene	<5	<5	<5	<5	<20	<10
Benzo(k)fluoranthene	<5	<5	<5	<5	<20	<10
Benzoic acid	76	<25	<25	<25	120	<50

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	January	February	March	April	May	June
Semivolatile organic compounds (μg/L) – 625 (continued)						
Benzyl alcohol	<20	240	230	<20	270	90
Bis(2-chloroethoxy)methane	<10	<10	<10	<10	<5	<5
Bis(2-chloroethyl)ether	<10	<10	<10	<10	<5	<5
Bis(2-chloroisopropyl)ether	<10	<10	<10	<10	<5	<5
Bis(2-ethylhexyl)phthalate	16	15	14	34	8	<20
Butylbenzylphthalate	<10	<10	<10	11	<5	<5
Chrysene	<10	<10	<10	<10	<5	<5
Di-*n*-butylphthalate	<10	<10	<10	<10	<5	<5
Di-*n*-octylphthalate	<10	<10	<10	<10	<5	<5
Dibenzo(a,h)anthracene	<10	<10	<10	<10	<5	<5
Dibenzofuran	<10	<10	<10	<10	<5	<5
Diethylphthalate	<10	<10	<10	<10	<5	<5
Dimethylphthalate	<10	<10	<10	<10	<5	<5
Fluoranthene	<10	<10	<10	<10	<5	<5
Fluorene	<10	<10	<10	<10	<5	<5
Hexachlorobenzene	<10	<10	<10	<10	<5	<5
Hexachlorobutadiene	<10	<10	<10	<10	<5	<5
Hexachlorocyclopentadiene	<10	<10	<10	<10	<5	<5
Hexachloroethane	<10	<10	<10	<10	<5	<5
Indeno(1,2,3-c,d)pyrene	<10	<10	<10	<10	<5	<5
Isophorone	<10	<10	<10	<10	<5	<5
m- and *p*-Cresol	<10	<10	<10	<10	16	<5
N-Nitrosodi-*n*-propylamine	<10	<10	<10	<10	<5	<5
N-Nitrosodiphenylamine	<10	<10	<10	<10	<5	<5
Naphthalene	<10	<10	<10	<10	<5	<5
Nitrobenzene	<10	<10	<10	<10	<5	<5
Pentachlorophenol	<50	<50	<50	<50	<25	<25
Phenanthrene	<10	<10	<10	<10	<5	<5
Phenol	<10	<10	<10	<10	<5	<5
Pyrene	<10	<10	<10	<10	<5	<5

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	July	August	September	October	November	December
Semivolatile organic compounds (μg/L) – 625 (continued)						
Benzyl alcohol	<10	54	<10	<10	130	<20
Bis(2-chloroethoxy)methane	<5	<5	<5	<5	<20	<10
Bis(2-chloroethyl)ether	<5	<5	<5	<5	<20	<10
Bis(2-chloroisopropyl)ether	<5	<5	<5	<5	<20	<10
Bis(2-ethylhexyl)phthalate	5.7	<5	6.1	<5	<20	<10
Butylbenzylphthalate	<5	<5	<5	<5	<20	<10
Chrysene	<5	<5	<5	<5	<20	<10
Di-*n*-butylphthalate	<5	<5	<5	<5	<20	<10
Di-*n*-octylphthalate	<5	<5	<5	<5	<20	<10
Dibenzo(a,h)anthracene	<5	<5	<5	<5	<20	<10
Dibenzofuran	<5	<5	<5	<5	<20	<10
Diethylphthalate	<5	<5	<5	<5	<20	<10
Dimethylphthalate	<5	<5	<5	<5	<20	<10
Fluoranthene	<5	<5	<5	<5	<20	<10
Fluorene	<5	<5	<5	<5	<20	<10
Hexachlorobenzene	<5	<5	<5	<5	<20	<10
Hexachlorobutadiene	<5	<5	<5	<5	<20	<10
Hexachlorocyclopentadiene	<5	<5	<5	<5	<20	<10
Hexachloroethane	<5	<5	<5	<5	<20	<10
Indeno(1,2,3-c,d)pyrene	<5	<5	<5	<5	<20	<10
Isophorone	<5	<5	<5	<5	<20	<10
m- and *p*-Cresol	8.5	<5	<5	<5	<20	<10
N-Nitrosodi-*n*-propylamine	<5	<5	<5	<5	<20	<10
N-Nitrosodiphenylamine	<5	<5	<5	<5	<20	<10
Naphthalene	<5	<5	<5	<5	<20	<10
Nitrobenzene	<5	<5	<5	<5	<20	<10
Pentachlorophenol	<25	<25	<25	<25	<100	<50
Phenanthrene	<5	<5	<5	<5	<20	<10
Phenol	7.6	<5	<5	8.2	<20	<10
Pyrene	<5	<5	<5	<5	<20	<10

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (continued).

Parameter	Sample month					
	January	**February**	**March**	**April**	**May**	**June**
Total recoverable phenolics (mg/L) – 420.1	0.17	0.076	0.19	0.3	0.027	0.29
Total cyanide (mg/L) – 335.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total oil and grease (mg/L) – 413.1						
6 A.M.	<5	3	5	8	6	3.8
10 A.M.	23	10	11	22	23	34
2 P.M.	28	12	18	<5	17	31
6 P.M.	12	5	8	<5	10	30

Table 6-3. Monthly monitoring results for physical and chemical characteristics of the LLNL sanitary sewer effluent, 1996 (concluded).

Parameter	Sample month					
	July	**August**	**September**	**October**	**November**	**December**
Total recoverable phenolics (mg/L) – 420.1	0.28	0.29	0.2	0.11	0.14	0.076
Total cyanide (mg/L) – 335.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total oil and grease (mg/L) – 413.1						
6 A.M.	12	2.2	3.4	4.8	6.6	4.5
10 A.M.	37	64	27	29	33	27
2 P.M.	23	22	24	30	19	26
6 P.M.	16	14	20	21	11	11

[a] The analysis was not requested.

[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 24-hour composite sample results for the metals of Table 6-2 are not re-reported in this section.

Note: Unless otherwise indicated, all of the analytical results are in mg/L and the numbers listed after the parameters show the EPA methods used for the analyses.

Table 6-4a. Daily flow totals for sanitary sewer effluent in megaliters (ML), 1996. Shaded areas indicate estimated flow totals for dates for which actual flow totals were not available. Weekend and holiday daily flow totals are shown in the boxed areas.

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.762	1.318	1.030	0.287	1.059	1.265	0.344	1.147	0.545	1.137	0.976	0.306
2	1.216	1.160	0.971	1.284	0.936	0.396	0.958	1.615	0.592	0.936	1.173	0.328
3	0.373	1.393	0.383	1.376	1.102	0.559	2.165	1.102	0.518	0.997	0.511	1.222
4	1.111	0.685	0.287	1.180	0.913	1.540	1.255	0.493	0.903	1.048	0.457	1.071
5	1.149	0.381	1.708	1.201	0.324	1.582	0.358	0.504	1.065	0.864	0.943	0.905
6	1.070	1.166	1.134	1.135	0.350	0.576	0.983	1.359	1.002	0.372	0.984	1.023
7	0.311	1.145	1.261	0.733	1.049	1.155	0.996	1.182	0.872	0.355	1.118	1.406
8	0.248	1.118	1.148	0.498	1.234	1.062	0.441	1.075	0.283	0.958	0.766	0.561
9	1.055	1.058	1.116	0.529	1.007	0.414	1.412	1.181	0.340	0.741	0.913	0.295
10	1.274	1.122	0.521	1.149	1.075	0.388	1.039	1.181	1.100	1.097	0.308	1.099
11	1.501	0.697	0.219	1.289	1.506	0.987	1.099	0.623	0.991	1.389	0.255	1.077
12	1.791	0.297	1.663	1.275	0.519	0.994	0.900	0.429	1.240	1.037	0.983	1.270
13	2.008	1.176	0.935	1.193	0.414	1.048	1.169	1.057	1.303	0.589	1.010	0.904
14	1.250	0.998	1.086	0.840	1.434	1.026	0.388	1.018	0.978	0.359	1.082	1.297
15	1.002	1.129	1.024	0.430	1.093	0.948	0.312	1.134	0.370	1.100	1.010	0.569
16	0.964	1.352	1.013	1.361	1.720	0.456	1.192	1.075	0.492	1.087	0.949	0.310
17	1.258	1.087	0.453	1.268	1.301	0.518	1.308	1.154	1.131	1.434	0.909	1.059
18	1.135	0.465	0.251	1.451	1.162	1.023	0.701	0.481	0.869	0.929	0.294	0.914
19	1.098	0.570	1.118	1.522	0.671	1.034	1.268	0.430	1.096	1.002	1.152	1.024
20	1.534	0.676	1.070	1.010	0.394	1.042	1.081	1.385	1.290	0.469	1.000	0.886
21	0.629	1.267	1.177	0.494	1.374	1.319	0.641	1.036	1.223	0.357	1.815	0.961
22	0.254	1.314	1.090	0.535	1.053	1.322	0.228	1.102	0.485	1.151	1.584	0.656
23	1.217	0.689	0.967	1.402	1.502	0.887	1.283	1.261	0.485	1.293	1.201	0.192
24	1.149	1.073	0.412	0.977	0.833	0.370	0.885	1.168	1.263	1.329	0.453	0.823
25	1.397	0.711	0.203	1.178	1.168	2.635	1.334	0.778	1.002	2.698	0.158	0.302
26	1.144	0.565	1.150	1.320	0.681	1.667	1.200	0.487	1.141	1.261	1.406	0.171
27	1.562	1.165	1.202	1.205	0.635	1.355	1.293	1.084	1.173	0.286	0.861	0.548
28	0.536	1.044	1.089	0.578	0.728	1.068	0.388	1.090	0.959	0.181	1.108	0.670
29	0.503	1.048	1.132	0.276	1.105	0.983	0.587	1.101	0.305	0.943	0.456	0.354
30	1.045		1.060	1.324	1.435	0.572	1.139	0.999	0.376	1.112	0.520	0.222
31	1.142		0.534		1.307		0.934	1.021		1.148		0.807

Table 6-4b. Monthly flow totals for sanitary sewer effluent in megaliters (ML), 1996.

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All days												
Total	32.7	27.9	28.4	30.3	31.1	30.2	29.3	30.8	25.4	29.7	26.4	23.2
Minimum	0.248	0.297	0.203	0.276	0.324	0.370	0.228	0.429	0.283	0.181	0.158	0.171
Maximum	2.008	1.393	1.708	1.522	1.720	2.635	2.165	1.615	1.303	2.698	1.815	1.406
Average	1.05	0.96	0.92	1.01	1.00	1.01	0.94	0.99	0.85	0.96	0.88	0.75
Weekdays												
Total	24.6	22.8	25.1	25.1	26.4	25.6	24.6	26.5	20.6	26.7	22.0	19.0
Minimum	1.045	0.689	0.935	0.977	0.833	0.576	0.701	0.999	0.869	0.741	0.766	0.548
Maximum	2.008	1.393	1.708	1.522	1.72	2.635	2.165	1.615	1.303	2.698	1.815	1.406
Average	1.30	1.14	1.14	1.26	1.20	1.22	1.17	1.15	1.08	1.16	1.10	1.00
Weekend days and holidays												
Total	8.0	5.0	3.3	5.2	4.7	4.6	4.7	4.2	4.8	3.0	4.3	4.3
Minimum	0.248	0.297	0.203	0.276	0.324	0.370	0.228	0.429	0.283	0.181	0.158	0.171
Maximum	1.250	0.711	0.534	0.840	0.728	0.887	0.996	0.778	0.592	0.589	0.909	0.656
Average	0.67	0.56	0.36	0.52	0.52	0.51	0.47	0.53	0.44	0.37	0.43	0.36

Table 6-5a. Ground water monitoring data for total toxic organic compounds using method EPA 601, 1996.

Analyte (μg/L)	Discharge date										
	4/12	4/23	4/25	4/30	5/1	5/7	5/14	6/4	6/5	6/6	6/7
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethene (total)	<0.5	<1	<1	<1	<1	<1					
1,2-Dichloropropane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chloroethylvinylether	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbon tetrachloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-Dichloropropene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dichlorodifluoromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylene Dibromide											
Freon 113	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethene		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 6-5a. Ground water monitoring data for total toxic organic compounds using method EPA 601, 1996 (concluded).

Analyte (μg/L)	Discharge date										
	6/18	6/20	6/25	6/26	6/27	6/28	9/10	10/8	10/15	10/22	11/5
1,1,1-Trichloroethane	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethene (total)											
1,2-Dichloropropane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chloroethylvinylether	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromoform	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbon tetrachloride	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorobenzene	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloromethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethene	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,3-Dichloropropene	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dichlorodifluoromethane	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylene Dibromide		<0.4			<0.4						
Freon 113	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Methylene chloride	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethene	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	<0.5	<0.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 6-5b. Ground water monitoring data for total toxic organic compounds using method EPA 602, 1996.

Analyte (μg/L)	Discharge date				
	6/27	6/6	7/10	6/20	6/23
1,2-Dichlorobenzene	<0.3	<0.3	<0.3		
1,3-Dichlorobenzene	<0.3	<0.3	<0.3		
1,4-Dichlorobenzene	<0.3	<0.3	<0.3		
Benzene	<0.3	<0.3	<0.3		1
Chlorobenzene	<0.3	<0.3	<0.3		
Ethylbenzene	<0.3	<0.3	<0.3	<0.2	2
m- and *p*-Xylene Isomers				<0.2	4
o-Xylene				<0.2	1.8
Toluene	<0.3	<0.3	<0.3	<0.2	2.8
Total xylene isomers	<0.5	<0.5	<0.5	<0.4	5.8
Trichloroethylene	2.4	<0.5	<0.5	<0.5	<0.5

Table 6-5c. Ground water monitoring data for total toxic organic compounds using method EPA 624, 1996.

Analyte (μg/L)	Discharge date		
	3/22	4/11	6/20
1,1,1-Trichloroethane	<1	<1	<1
1,1,2,2-Tetrachloroethane	2	<1	<1
1,1,2-Trichloroethane	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1
1,1-Dichloroethene	<1	<1	<1
1,2-Dichlorobenzene	1	<1	<1
1,2-Dichloroethane	<1	<1	<1
1,2-Dichloroethene (total)	<2	<2	<1
1,2-Dichloropropane	<1	<1	<1
1,3-Dichlorobenzene	<1	<1	<1
1,4-Dichlorobenzene	<1	<1	<1
2-Butanone			<40
2-Chloroethylvinylether	<1	<1	<40
2-Hexanone			<10
4-Methyl-2-pentanone			<10
Acetone			<40
Benzene	<1	<1	<1
Bromodichloromethane	<1	<1	<1
Bromoform	<1	<1	<1
Bromomethane	<1	<1	<2
Carbon disulfide			<1
Carbon tetrachloride	<1	<1	<1
Chlorobenzene	<1	<1	<1
Chloroethane	<1	<1	<2
Chloroform	<1	<1	<1
Chloromethane	<1	<1	<2
cis-1,2-Dichloroethene	<1	<1	
cis-1,3-Dichloropropene	<1	<1	<1
Dibromochloromethane	<1	<1	<1
Dibromomethane			<1
Dichlorodifluoromethane			<2
Ethylbenzene	<1	<1	<1
Freon 113	<1	<1	<1
m- and *p*-Xylene Isomers	<1	<1	
Methylene chloride	2	<1	<1
o-Xylene	<1	<1	

Table 6-5c. Ground water monitoring data for total toxic organic compounds using method EPA 624, 1996. (concluded).

Analyte (μg/L)	Discharge date		
	3/22	4/11	6/20
Styrene			<1
Tetrachloroethene	<1	<1	<1
Toluene	<1	<1	<1
Total xylene isomers	<2	<2	<2
trans-1,2-Dichloroethene	<1	<1	
trans-1,3-Dichloropropene	<1	<1	<1
Trichloroethene	<1	<1	<0.5
Trichlorofluoromethane	<1	<1	<1
Vinyl acetate			<10
Vinyl chloride	<1	<1	<2

Table 6-5d. Ground water monitoring data for total toxic organic compounds using method EPA 625, 1996.

Analyte μg/L)	Discharge date	
	4/11	6/20
1,2,4-Trichlorobenzene	<5	<5
1,2-Dichlorobenzene	<5	<5
1,3-Dichlorobenzene	<5	<5
1,4-Dichlorobenzene	<5	<5
2,4,5-Trichlorophenol		<5
2,4,6-Trichlorophenol	<5	<5
2,4-Dichlorophenol	<5	<5
2,4-Dimethylphenol	<5	<5
2,4-Dinitrophenol	<5	<25
2,4-Dinitrotoluene	<5	<5
2,6-Dinitrotoluene	<5	<5
2-Chloronaphthalene	<5	<5
2-Chlorophenol	<5	<5
2-Methyl-4,6-dinitrophenol	<5	<25
2-Methylnaphthalene		<5
2-Nitroaniline		<25
2-Nitrophenol	<5	<5
3,3'-Dichlorobenzidine	<5	<10
3-Nitroaniline		<25
4-Bromophenyl ether	<5	
4-Bromophenylphenylether		<5
4-Chloro-3-methylphenol	<5	<10
4-Chloroaniline		<10
4-Chlorophenylphenylether	<5	<5
4-Nitroaniline		<25
4-Nitrophenol	<5	<25
Acenaphthene	<5	<5
Acenaphthylene	<5	<5
Anthracene	<5	<5

Table 6-5d. Ground water monitoring data for total toxic organic compounds using method EPA 625, 1996 (continued).

Analyte μg/L)	Discharge date	
	4/11	6/20
Benzidine	<5	
Benzo(a)anthracene	<5	<5
Benzo(a)pyrene	<5	<5
Benzo(b)fluoranthene	<5	<5
Benzo(g,h,i)perylene	<5	<5
Benzo(k)fluoranthene	<5	<5
Benzoic acid		<25
Benzyl alcohol		<10
Bis(2-chloroethoxy)methane	<5	<5
Bis(2-chloroethyl)ether	<5	<5
Bis(2-chloroisopropyl)ether	<5	<5
Bis(2-ethylhexyl)phthalate	<5	<5
Butylbenzylphthalate	<5	<5
Chrysene	<5	<5
Di-*n*-butylphthalate	<5	<5
Di-*n*-octylphthalate	<5	<5
Dibenzo(a,h)anthracene	<5	<5
Dibenzofuran	<5	<5
Diethylphthalate	<5	<5
Dimethylphthalate	<5	<5
Fluoranthene	<5	<5
Fluorene	<5	<5
Hexachlorobenzene	<5	<5
Hexachlorobutadiene	<5	<5
Hexachlorocyclopentadiene	<5	<5
Hexachloroethane	<5	<5
Indeno(1,2,3-c,d)pyrene	<5	<5
Isophorone	<5	<5

Table 6-5d. Ground water monitoring data for total toxic organic compounds using method EPA 625, 1996 (concluded).

Analyte μg/L)	Discharge date	
	4/11	6/20
m- and *p*-Cresol		<5
N-Nitrosodi-*n*-propylamine	<5	<5
N-Nitrosodiphenylamine	<5	<5
Naphthalene	<5	<5
Nitrobenzene	<5	<5
o-Cresol		<5
Pentachlorophenol	<5	<25
Phenanthrene	<5	<5
Phenol	<5	<5
Pyrene	<5	<5

Table 6-6. Ground water monitoring data for metals and cyanide discharged under permit 1510. Nonregulated metals are also included in this table.

Analyte (mg/L)	Sample location and discharge date					
	GWP-1004 6/27	GWP-1005 6/6	GWP-1005 7/10	PTU1-E 3/22	PTU1-E 4/23	PTU1-E 4/25
Aluminum	0.21	12	4.2	<0.05	<0.05	<0.05
LOS[a]	0.2	0.2	0.2	0.05	0.05	0.05
Antimony	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
LOS	0.005	0.005	0.005	0.005	0.005	0.005
Arsenic	<0.002	0.0032	<0.002	<0.002	<0.002	<0.002
LOS	0.002	0.002	0.002	0.002	0.002	0.002
Barium	0.089	0.15	0.11	0.2	0.13	0.19
LOS	0.025	0.025	0.025	0.01	0.01	0.01
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
LOS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron	1.6	1.6	0.64	0.82	0.47	0.6
LOS	0.1	0.1	0.1	0.05	0.05	0.05
Cadmium	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002
LOS	0.0005	0.0005	0.0005	0.0002	0.0002	0.0002
Chromium	0.010	0.029	0.028	0.005	0.009	0.008
LOS	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	<0.05	<0.05	<0.05	<0.005	<0.005	<0.005
LOS	0.05	0.05	0.05	0.005	0.005	0.005
Copper	<0.01	0.023	0.015	0.002	0.008	0.011
LOS	0.01	0.01	0.01	0.001	0.001	0.001
Chromium(VI)	0.011	NA	0.21	<0.005	0.013	0.006
LOS	0.002	0.002	0.01	0.005	0.002	0.002
Iron	0.12	9.2	4.4	<0.01	<0.01	<0.01
LOS	0.1	0.1	0.1	0.01	0.01	0.01
Lead	0.0033	0.0065	0.0058	<0.002	<0.002	<0.002
LOS	0.002	0.002	0.002	0.002	0.002	0.002
Manganese	<0.03	0.17	0.075	<0.005	0.007	<0.005
LOS	0.03	0.03	0.03	0.005	0.005	0.005
Mercury	<0.0002	<0.0002	0.0068	<0.0002	<0.0002	0.0007
LOS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Molybdenum	<0.05	<0.05	<0.05	<0.005	<0.005	<0.005
LOS	0.05	0.05	0.05	0.005	0.005	0.005
Nickel	<0.005	0.031	0.020	<0.002	<0.002	<0.002
LOS	0.005	0.005	0.005	0.002	0.002	0.002

Table 6-6. Ground water monitoring data for metals and cyanide discharged under permit 1510. Nonregulated metals are also included in this table (continued).

Analyte (mg/L)	Sample location and discharge date					
	PTU1-E 6/4	PTU1-E 6/25	GWP-1005 9/10	PTU1-E 10/8	PTU1-E 10/15	PTU2-E 4/11
Aluminum	<0.2	<0.2	2	<0.2	<0.2	<0.2
LOS	0.2	0.2	0.05	0.25	0.25	0.2
Antimony	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
LOS	0.005	0.005	0.005	0.005	0.005	0.005
Arsenic	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
LOS	0.002	0.002	0.002	0.002	0.002	0.002
Barium	0.36	0.085	0.12	0.051	0.038	0.13
LOS	0.025	0.025	0.01	0.025	0.025	0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
LOS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Boron	0.54	1.9	0.71	1.2	1.6	0.54
LOS	0.1	0.1	0.05	0.1	0.1	0.01
Cadmium	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005
LOS	0.0005	0.0005	0.0002	0.0005	0.0005	0.0005
Chromium	0.0071	0.014	0.040	0.008	0.010	0.005
LOS	0.001	0.001	0.001	0.001	0.001	0.001
Cobalt	<0.05	<0.05	<0.005	<0.05	<0.05	<0.05
LOS	0.05	0.05	0.005	0.05	0.05	0.05
Copper	<0.01	<0.01	0.023	0.010	0.01	<0.01
LOS	0.01	0.01	0.001	0.01	0.01	0.01
Chromium(VI)	0.0064	0.014	0.025	<0.01	0.015	<0.002
LOS	0.002	0.002	0.002	0.002	0.002	0.002
Iron	<0.1	<0.1	1.9	<0.1	0.1	<0.1
LOS	0.1	0.1	0.01	0.1	0.1	0.1
Lead	<0.0029	<0.002	<0.002	<0.002	<0.002	<0.002
LOS	0.002	0.002	0.002	0.002	0.002	0.002
Manganese	<0.03	<0.03	0.031	<0.03	<0.03	<0.035
LOS	0.03	0.03	0.005	0.03	0.03	0.035
Mercury	<0.0002	<0.0002	<0.002	0.00021	<0.0002	<0.0002
LOS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Molybdenum	<0.05	<0.05	<0.005	<0.05	<0.05	<0.05
LOS	0.05	0.05	0.005	0.05	0.05	0.05
Nickel	<0.005	<0.005	0.003	<0.005	<0.005	0.002
LOS	0.005	0.005	0.002	0.005	0.005	0.005

Table 6-6. Ground water monitoring data for metals and cyanide discharged under permit 1510. Nonregulated metals are also included in this table (continued).

Analyte (mg/L)	Sample location and discharge date					
	GWP-1004 6/27	GWP-1005 6/6	GWP-1005 7/10	PTU1-E 3/22	PTU1-E 4/23	PTU1-E 4/25
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
LOS	0.002	0.002	0.002	0.002	0.002	0.002
Silver	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
LOS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Thallium	0.0027	<0.001	<0.001	<0.001	NA[b]	NA
LOS	0.001	0.001	0.001	0.001		
Vanadium	<0.05	<0.05	<0.05	<0.05	NA	NA
LOS	0.05	0.05	0.05	0.05		
Zinc	<0.02	0.022	<0.02	<0.02	NA	NA
LOS	0.02	0.02	0.02	0.02		
Cyanide	NA	NA	NA	<0.02	<0.02	<0.02
LOS				0.02	0.02	0.02

Table 6-6. Ground water monitoring data for metals and cyanide discharged under permit 1510. Nonregulated metals are also included in this table (concluded).

Analyte (mg/L)	Sample location and discharge date					
	PTU1-E 6/4	PTU1-E 6/25	GWP-1005 9/10	PTU1-E 10/8	PTU1-E 10/15	PTU2-E 4/11
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
LOS	0.002	0.002	0.002	0.002	0.002	0.002
Silver	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
LOS	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
LOS	0.001	0.001	0.001	0.001	0.001	0.001
Vanadium	<0.05	<0.05	<0.011	<0.05	<0.05	<0.005
LOS	0.05	0.05	0.005	0.05	0.05	0.005
Zinc	<0.02	<0.02	<0.04	<0.02	<0.02	<0.01
LOS	0.02	0.02	0.01	0.02	0.02	0.01
Cyanide	NA	NA	NA	NA	NA	<0.02
LOS						0.02

[a] LOS = Limit of sensitivity.

[b] NA = Not analyzed.

Table 6-7. Weekly composite results for tritium (in mBq/mL) for the LWRP effluent, 1996.

Composite Dates	Activity[a]	LOS[b]
1/1–7	1.52	10.7
1/8–14	–1.61	11.1
1/15–21	2.28	10.8
1/22–28	–1.13	11.0
1/29–2/4	–4.11	11.1
2/5–11	–2.26	11.0
2/12–18	–1.41	10.7
2/19–25	9.36	10.2
2/26–3/3	–2.41	11.0
3/4–10	1.79	11.2
3/11–17	–2.46	13.7
3/18–24	–1.35	11.2
3/25–31	4.66	11.2
4/1–7	1.45	10.6
4/8–14	4.26	11.0
4/15–21	–6.33	13.6
4/22–28	1.00	11.0
4/29–5/5	5.07	10.7
5/6–12	3.85	10.8
5/13–19	–4.48	11.4
5/20–26	–2.23	10.8
5/27–6/2	–2.03	10.9
6/3–9	2.82	10.6
6/10–16	0.925	10.7
6/17–23	0.0633	10.8
6/24–30	3.85	8.62
7/1–7	–0.455	8.88
7/8–14	–1.00	10.8
7/15–21	3.53	10.2
7/22–28	1.43	10.8
7/29–8/4	2.18	10.7
8/5–11	4.22	10.8
8/12–18	4.40	10.5
8/19–25	3.68	10.4
8/26–9/1	5.77	10.8
9/2–8	5.03	10.8
9/9–15	3.85	10.7
9/16–22	–0.470	10.9
9/23–29	–3.22	11.2
9/30–10/6	1.69	10.3
10/7–13	2.48	10.7
10/14–20	–0.755	11.0
10/21–27	2.32	10.5
10/28–11/3	3.57	10.8
11/4–10	1.87	10.9
11/11–17	–3.96	10.9
11/18–24	4.00	10.9
11/25–12/1	11.2 ± 6.4	10.4
12/2–8	–0.511	10.7
12/9–15	0.366	10.8
12/16–22	2.72	10.6
12/23–29	3.92	10.7
12/30, 1996–1/5, 1997	–6.85	10.8

[a] Ranges are only listed for activities that are above the limit of sensitivity.

[b] LOS = Limit of sensitivity.

7

Surface Water

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Introduction

Lawrence Livermore National Laboratory monitors surface water 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. Samples of this water are analyzed for radionuclides, high explosives (HE), 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 1996, 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. This chapter also 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 the Surface Water Monitoring Chapter (Chapter 7) of Volume 1.

Storm Water

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 1000-mL polyethylene bottles. Sample results for Livermore site tritium, gross alpha and gross beta are presented in **Table 7-1**. Results for nonradiological constituents at the Livermore site are presented in **Table 7-2**. **Table 7-3** summarizes results for constituents for which analyses were conducted, but which were never detected.

Rainfall

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 and analyzed for tritium. Results are presented in **Table 7-4**.

Drainage Retention Basin

Sampling locations at the Drainage Retention Basin (DRB) used to monitor compliance with the Livermore site Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Record of Decision are shown in Figure 7-1, Volume 1. Figure 7-12, 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 7-12. Weekly turbidity measurements and monthly, quarterly, semiannual, and annual samples are collected at sample location CDBE. **Table 7-5** shows the compliance monitoring data for samples collected at sample location CDBX from two releases occurring from the Drainage Retention Basin on January 16 and November 19, 1996. This table also shows data for samples collected concurrently at WPDC (one of the Livermore site storm water discharge sample locations). Monthly, quarterly, semiannual, and yearly maintenance monitoring data for 1995, that were collected at sample location CDBE are shown in **Tables 7-6a**,**b**, and **c**. **Table 7-7** provides the weekly field measurements collected from sample locations CDBA, CDBC, CDBD, CDBE, CDBF, CDBJ, CDBK, and CDBL.

Other Waters

LLNL technicians sample surface and drinking water near the Livermore site and in the Livermore Valley using a tethered pail to collect water 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. Results are presented in **Table 7-8**.

Table 7-1. Radioactivity in storm water runoff (Bq/L) at Livermore site, 1996.

Location	Date	Tritium	Gross alpha	Gross beta
ALPE	Jan 16	2.2459 ± 2.2459	0.4662 ± 0.2812	0.5365 ± 0.2553
	Apr 01	1.6391 ± 1.6391	0.111 ± 0.074	0.0333 ± 0.148
	May 15	6.882 ± 2.002662	0.027528 ± 0.0259	0.12358 ± 0.0666
	Oct 29	1.9721 ± 1.9721	0.10101 ± 0.0481	0.22015 ± 0.1258
ALPO	Jan 16	2.2015 ± 2.2015	0.1221 ± 0.111	0.2072 ± 0.1221
	Apr 01	1.6761 ± 1.6761	0.074 ± 0.111	0.111 ± 0.148
	May 15	1.8019 ± 1.8019	0.20128 ± 0.0925	0.6549 ± 0.185
	Oct 29	2.0128 ± 2.0128	0.07067 ± 0.074	0.27269 ± 0.1406
ASS2	Jan 16	2.2163 ± 2.2163	0.04255 ± 0.03071	0.0814 ± 0.0518
	Apr 01	1.6391 ± 1.6391	0.037 ± 0.037	0.0222 ± 0.148
	May 15	1.7501 ± 1.7501	0.06401 ± 0.03293	0.13505 ± 0.0851
	Oct 29	1.9499 ± 1.9499	0.0296 ± 0.03589	0.20498 ± 0.1221
ASW	Jan 16	2.2385 ± 2.2385	0.01924 ± 0.02294	0.1369 ± 0.0518
	Apr 01	1.6761 ± 1.6761	0.074 ± 0.037	0.0185 ± 0.148
	May 15	1.8093 ± 1.8093	0.012136 ± 0.02072	0.17131 ± 0.0629
	Oct 29	4.255 ± 2.14452	0.06364 ± 0.0444	0.4218 ± 0.1517
CDB	Jan 16	5.513 ± 2.376103	0.1073 ± 0.0518	0.2072 ± 0.0592
	Apr 01	1.7612 ± 1.7612	0.037 ± 0.037	0.074 ± 0.148
	May 15	24.901 ± 2.564803	0.0444 ± 0.02849	0.14171 ± 0.0666
	Oct 29	25.752 ± 2.83272	0.012617 ± 0.03663	0.29563 ± 0.1295
CDB2	Jan 16	16.354 ± 2.69841	0.0814 ± 0.0481	0.222 ± 0.0592
	Apr 01	139.12 ± 4.45184	0.074 ± 0.037	0.111 ± 0.148
	May 15	109.52 ± 4.16176	0.019425 ± 0.02405	0.21053 ± 0.0629
	Oct 29	2.0091 ± 2.0091	0.04736 ± 0.037	0.12802 ± 0.1332
GRNE	Jan 16	4.366 ± 2.33581	0.0481 ± 0.0444	0.185 ± 0.0555
	Apr 01	1.6909 ± 1.6909	0.037 ± 0.037	0.111 ± 0.148
	May 15	1.8167 ± 1.8167	0.04403 ± 0.03367	0 ± 0.0629
	Oct 29	9.176 ± 2.312352	0.3737 ± 0.0851	0.4144 ± 0.148
WPDC	Jan 16	4.107 ± 2.332776	0.0962 ± 0.0518	0.2072 ± 0.0592
	Apr 01	3.404 ± 1.994744	0.074 ± 0.037	0.148 ± 0.148
	May 15	3.5816 ± 1.9018296	0.00016206 ± 0.02146	0.074 ± 0.0703
	Oct 29	20.572 ± 2.67436	0.013172 ± 0.0407	0.2516 ± 0.1295

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996.

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L)					
Aluminum	1/16	<0.2	0.26	0.87	0.53
	4/1	73	7.3	9.2	8.1
	4/1	65	6.2	8.7	8.8
	5/15	10	5.4	5.7	4.2
	5/15	<0.2	<0.2	<0.2	<0.2
	10/29	3.1	5.5	5.6	13
	10/29	4.7	4.4	3.6	20
Antimony	1/16	<0.06	<0.06	<0.06	<0.06
	4/1	<0.005	<0.005	<0.005	<0.005
	5/15	<0.005	<0.005	<0.005	<0.005
	10/29	<0.004	<0.004	<0.004	<0.004
Arsenic	1/16	0.0064	0.0055	<0.002	<0.002
	4/1	<0.002	<0.002	<0.002	<0.002
	5/15	0.0024	0.0088	0.0023	0.0033
	10/29	<0.002	0.0058	<0.002	0.0069
Barium	1/16	0.4	0.18	0.032	0.04
	4/1	0.99	0.2	0.12	0.1
	5/15	0.14	0.17	0.087	0.069
	10/29	0.089	0.17	0.068	0.31
Beryllium	1/16	0.0007	<0.0005	<0.0005	<0.0005
	4/1	<0.0005	<0.0005	<0.0005	<0.0005
	5/15	<0.0005	<0.0005	<0.0005	<0.0005
	10/29	<0.0002	0.0033	<0.0002	<0.0002
Bicarbonate alkalinity (as $CaCO_3$)	1/16	160	100	15	20
	4/1	35	47	9	20
	5/15	39	36	28	21
	10/29	29.2	191	9.9	46.2
	10/29	27.8	192	11.3	44.9
Boron	1/16	5	1	<0.1	0.1
	4/1	0.41	4.7	0.13	0.09
	5/15	0.28	5.8	0.16	0.12
	10/29	0.061	1.96	<0.05	0.14
Bromide	4/1	<0.05	1	<0.05	<0.05
	5/15	<0.5	<0.5	<0.5	<0.5
	10/29	<0.05	0.65	<0.05	<0.05

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L)					
Aluminum	1/16	0.59	0.59	0.25	1.7
	4/1	6.4	52	29	32
	4/1	8.6	38	28	31
	5/15	5.4	8.9	14	33
	5/15	0.54	<0.2	<0.2	<0.2
	10/29	4.4	4.6	36	5.4
	10/29	5.1	5.2	82	2.5
Antimony	1/16	<0.06	<0.06	<0.06	<0.06
	4/1	<0.005	<0.005	<0.005	<0.005
	5/15	0.0053	0.013	<0.005	<0.005
	10/29	0.0058	<0.004	<0.004	<0.004
Arsenic	1/16	0.0031	0.0039	0.002	0.0043
	4/1	<0.002	<0.002	<0.002	<0.002
	5/15	0.0037	0.0046	0.0038	0.0077
	10/29	<0.002	0.004	<0.002	<0.004
Barium	1/16	0.094	0.077	0.1	0.15
	4/1	0.08	0.53	0.38	0.37
	5/15	0.082	0.13	0.18	0.41
	10/29	0.12	0.11	1.2	0.096
Beryllium	1/16	<0.0005	<0.0005	<0.0005	0.0006
	4/1	<0.0005	<0.0005	<0.0005	<0.0005
	5/15	<0.0005	<0.0005	<0.0005	0.0012
	10/29	<0.0002	<0.0002	<0.0002	0.0002
Bicarbonate alkalinity (as $CaCO_3$)	1/16	7.5	14	30	22
	4/1	8	14	30	45
	5/15	<1	19	34	46
	10/29	26.3	14.2	22.7	44.8
	10/29	19.9	13.5	22.1	39.9
Boron	1/16	<0.1	<0.1	0.15	0.26
	4/1	<0.05	0.06	0.1	0.56
	5/15	<0.1	0.16	0.41	0.71
	10/29	0.083	0.063	0.24	0.35
Bromide	4/1	<0.05	<0.05	<0.05	0.12
	5/15	<0.5	<0.5	<0.5	<0.5
	10/29	<0.05	<0.05	<0.05	0.08

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Cadmium	1/16	<0.0005	<0.0005	<0.0005	<0.0005
	4/1	<0.0002	<0.0002	<0.0002	<0.0002
	5/15	<0.0005	<0.0005	<0.0005	<0.0005
	10/29	<0.0005	<0.0005	<0.0005	0.0005
Calcium	1/16	41	24	5.5	4.3
	4/1	32	100	8.1	6.6
	5/15	9.8	13	6.8	5.6
	10/29	15.3	57	4	16.3
Chemical oxygen demand	1/16	110	36	35	36
	4/1	25	16	10	10
	5/15	60	86	110	80
	10/29	276	70	90.8	419
Chloride	1/16	230	63	0.92	1.1
	4/1	15	300	2.1	3.4
	4/1	12	300	2	3.4
	5/15	3.2	11	2.2	1.7
	10/29	4.1	178	1.2	8.6
	10/29	5.8	176	1.1	5.9
Chromium	1/16	0.062	0.012	<0.01	<0.01
	4/1	0.16	0.008	0.02	0.018
	5/15	0.029	0.0074	0.011	0.012
	10/29	0.014	0.011	0.013	0.059
Cobalt	4/1	0.039	<0.005	<0.005	<0.005
	5/15	<0.05	<0.05	<0.05	<0.05
	10/29	<0.05	<0.05	<0.05	<0.05
Copper	1/16	0.025	0.019	0.0058	0.01
	1/16	<0.05	<0.05	<0.05	<0.05
	4/1	0.081	0.02	0.015	0.014
	4/1	0.082	0.018	0.014	0.014
	5/15	0.019	0.023	0.02	0.031
	5/15	<0.05	<0.05	<0.05	<0.05
	10/29	0.025	0.016	0.023	0.64
	10/29	0.023	0.011	<0.001	0.076

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Cadmium	1/16	<0.0005	<0.0005	<0.0005	<0.0005
	4/1	<0.0002	<0.0002	<0.0002	<0.0002
	5/15	0.0007	0.0019	<0.0005	0.0011
	10/29	0.0022	0.0017	0.0006	0.0011
Calcium	1/16	3.6	4.6	8.5	7.7
	4/1	3.5	11	13	23
	5/15	4.8	6.6	13	14
	10/29	12.1	6.9	5	22
Chemical oxygen demand	1/16	34	41	25	43
	4/1	13	28	16	22
	5/15	89	99	45	110
	10/29	262	150	105	190
Chloride	1/16	0.86	1.5	4.4	8.6
	4/1	0.7	1.2	2.9	30
	4/1	0.6	1.1	2.6	32
	5/15	62	19	21	15
	10/29	6	2.4	2.2	27.8
	10/29	4.7	2.3	2	27.7
Chromium	1/16	0.018	0.019	0.012	0.022
	4/1	0.017	0.11	0.065	0.065
	5/15	0.011	0.026	0.015	0.062
	10/29	0.02	0.022	0.18	0.012
Cobalt	4/1	<0.005	0.022	0.013	0.011
	5/15	<0.05	<0.05	<0.05	<0.05
	10/29	<0.05	<0.05	<0.05	<0.05
Copper	1/16	0.01	0.02	0.0084	0.018
	1/16	<0.05	<0.05	<0.05	<0.05
	4/1	0.01	0.063	0.037	0.042
	4/1	0.012	0.049	0.028	0.035
	5/15	0.021	0.044	0.015	0.054
	5/15	<0.05	<0.05	<0.05	<0.05
	10/29	0.043	0.03	0.037	0.035
	10/29	0.045	0.039	0.086	0.037

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Fluoride	1/16	0.69	0.44	<0.05	<0.05
	4/1	0.06	1.7	<0.05	<0.05
	4/1	0.07	1.7	<0.05	0.05
	5/15	0.056	0.13	0.055	0.05
	10/29	0.05	0.8	<0.05	0.12
	10/29	0.06	0.84	<0.05	0.12
Chromium(VI)	1/16	0.093	<0.01	<0.01	<0.01
	4/1	<0.005	<0.005	<0.005	<0.005
	10/29	0.004	0.002	<0.002	0.003
Iron	1/16	24	7	1.8	2.3
	1/16	<0.1	0.23	0.63	0.4
	4/1	78	5.6	8.2	7.1
	4/1	72	5.4	8.3	7.6
	5/15	11	4.1	6.1	4.8
	5/15	<0.1	<0.1	0.12	0.1
	10/29	4.3	4.9	7	15
	10/29	5.7	4.1	4.6	24
Lead	1/16	0.0064	0.0052	0.0024	0.0039
	4/1	<0.002	<0.002	<0.002	<0.002
	5/15	0.016	0.0028	0.0071	0.006
	10/29	0.0086	<0.005	0.006	0.018
Magnesium	1/16	19	8.7	2.1	1.3
	4/1	23	37	5.1	4.2
	5/15	2.2	2.9	1.6	1.5
	10/29	2.8	24	1.1	6.5
Manganese	1/16	0.44	0.17	<0.03	0.036
	1/16	<0.03	<0.03	<0.03	<0.03
	4/1	1.7	0.15	0.17	0.13
	4/1	1.6	0.13	0.17	0.14
	5/15	0.25	0.091	0.14	0.12
	5/15	0.078	0.078	0.048	0.069
	10/29	0.31	0.13	0.19	0.51
	10/29	0.32	0.12	0.15	0.64

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Fluoride	1/16	<0.05	<0.05	0.079	0.06
	4/1	<0.05	0.06	0.06	0.11
	4/1	0.06	0.1	0.08	0.13
	5/15	<0.05	0.057	0.15	0.091
	10/29	0.06	0.06	0.1	0.12
	10/29	0.06	0.06	0.1	0.13
Chromium(VI)	1/16	0.01	<0.01	<0.01	0.014
	4/1	0.005	<0.005	<0.005	<0.005
	10/29	<0.002	0.002	<0.002	0.002
Iron	1/16	7.6	5.9	6.1	9.7
	1/16	0.43	0.43	0.21	0.44
	4/1	5.5	45	27	26
	4/1	7.3	38	26	27
	5/15	5.3	7.8	10	30
	5/15	0.69	0.1	<0.1	0.11
	10/29	5.3	5	37	6.2
	10/29	6.2	5.8	84	3
Lead	1/16	0.0087	0.0073	0.0031	0.0077
	4/1	0.004	0.003	<0.002	<0.002
	5/15	0.0092	0.021	0.0038	0.0025
	10/29	0.022	0.013	0.042	0.011
Magnesium	1/16	1.1	1.2	1.9	1.9
	4/1	2.7	11	9.5	13
	5/15	1.4	1.9	3.8	4.9
	10/29	3.2	2.2	2.5	6.7
Manganese	1/16	0.15	0.09	0.093	0.18
	1/16	<0.03	<0.03	<0.03	<0.03
	4/1	0.11	0.85	0.58	0.45
	4/1	0.15	0.75	0.55	0.46
	5/15	0.18	0.2	0.17	0.6
	5/15	0.19	0.12	<0.03	0.14
	10/29	0.37	0.18	0.72	0.28
	10/29	0.37	0.22	1.9	0.31

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Mercury	1/16	<0.0002	<0.0002	<0.0002	<0.0002
	4/1	<0.0002	<0.0002	<0.0002	<0.0002
	5/15	<0.0002	<0.0002	<0.0002	<0.0002
	10/29	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	4/1	<0.005	0.008	<0.005	0.01
	5/15	<0.05	<0.05	<0.05	<0.05
	10/29	<0.025	<0.025	<0.025	0.069
Nickel	1/16	0.05	0.012	0.0054	0.0067
	1/16	<0.1	<0.1	<0.1	<0.1
	4/1	0.18	0.15	0.016	0.015
	4/1	0.16	0.009	0.02	0.017
	5/15	0.036	0.0066	0.014	0.012
	5/15	<0.1	<0.1	<0.1	<0.1
	10/29	<0.05	<0.05	<0.05	<0.05
	10/29	<0.002	0.01	0.014	0.063
Nitrate (as N)	4/1	2.1	0.85	0.25	0.31
	4/1	2	0.83	0.25	0.32
	5/15	0.98	1.9	<0.5	0.56
	10/29	0.9	1.1	0.5	4.1
	10/29	1.2	1.1	0.6	4.1
Nitrate (as NO_3)	1/16	5.5	2.1	1.2	1.1
	4/1	9.4	3.7	1.1	1.4
	4/1	9	3.7	1.1	1.4
	5/15	4.3	8.3	2.1	2.5
	10/29	4	4.9	2.2	18.2
	10/29	5.3	4.9	2.7	18.2
Nitrite (as N)	4/1	<0.05	<0.05	<0.05	<0.05
	4/1	<0.05	<0.05	<0.05	<0.05
	5/15	<0.5	<0.5	<0.5	<0.5
	10/29	<0.1	0.1	<0.1	0.1
	10/29	<0.1	0.1	<0.1	0.1
Nitrite (as NO_2)	4/1	<0.3	<0.3	<0.3	<0.3
	10/29	0.2	0.3	0.2	0.3

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Mercury	1/16	<0.0002	<0.0002	<0.0002	<0.0002
	4/1	0.0004	<0.0002	<0.0002	<0.0002
	5/15	<0.0002	<0.0002	<0.0002	<0.0002
	10/29	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	4/1	<0.005	<0.005	<0.005	0.007
	5/15	<0.05	<0.05	<0.05	<0.05
	10/29	<0.025	<0.025	<0.025	0.13
Nickel	1/16	0.02	0.016	0.014	0.021
	1/16	<0.1	<0.1	<0.1	<0.1
	4/1	0.014	0.12	0.49	0.6
	4/1	0.018	0.099	0.051	0.056
	5/15	0.014	0.026	0.014	0.055
	5/15	<0.1	<0.1	<0.1	<0.1
	10/29	<0.05	<0.05	0.066	<0.05
	10/29	0.029	0.024	0.19	0.018
Nitrate (as N)	4/1	0.2	0.21	0.94	0.7
	4/1	0.29	0.36	0.95	0.74
	5/15	1.6	0.88	4.8	0.88
	10/29	2.9	1.2	1.2	3.4
	10/29	3.1	1.2	1	1.9
Nitrate (as NO_3)	1/16	1.3	1.5	6.5	1.8
	4/1	0.9	0.9	4.2	3.1
	4/1	1.3	1.6	4.2	3.3
	5/15	7.2	3.9	21	3.9
	10/29	12.8	5.3	5.3	15.1
	10/29	13.7	5.3	4.4	8.4
Nitrite (as N)	4/1	<0.05	<0.05	<0.05	<0.05
	4/1	<0.05	<0.05	<0.05	<0.05
	5/15	<2.5	<0.5	<0.5	<0.5
	10/29	<0.1	<0.1	<0.1	0.1
	10/29	<0.1	<0.1	<0.1	0.1
Nitrite (as NO_2)	4/1	<0.3	<0.3	<0.3	<0.3
	10/29	0.3	0.2	<0.2	0.5

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Nonvolatile organic carbon	10/29	50	11.3	15.9	106
Oil and grease	1/16	<5	<5	<5	<5
	4/1	<5	<5	<5	<5
	5/15	<5	<5	<5	<5
	10/29	3	<1	1.7	2.7
Orthophosphate	4/1	<0.02	<0.02	<0.02	<0.02
	4/1	<0.1	<0.1	<0.1	<0.1
	5/15	0.15	0.26	0.13	0.12
	10/29	0.46	0.57	0.54	2.7
	10/29	0.58	0.6	0.56	2.7
Potassium	1/16	7	2.1	1.1	1.2
	4/1	12	5	3.2	3.1
	5/15	1.9	2.8	2.7	2.5
	10/29	2.6	8	2.5	10
Selenium	1/16	<0.002	0.003	0.0025	<0.002
	4/1	<0.002	<0.002	<0.002	<0.002
	5/15	<0.002	<0.002	<0.002	<0.002
	10/29	<0.002	<0.002	<0.002	<0.002
Sodium	1/16	180	64	9.5	3.6
	4/1	16	240	6	4.3
	5/15	3.6	13	3.3	2.7
	10/29	7.2	160	2.1	9.4
Sulfate	1/16	41	44	1.2	1.2
	4/1	13	250	3.6	6.7
	4/1	11	250	3.5	6.7
	5/15	3.3	8.1	3.4	2.6
	10/29	5.7	146	1.7	12.2
	10/29	6.5	146	1.5	10.7
Surfactants	1/16	<0.5	<0.5	<0.5	<0.5
	4/1	<0.02	<0.02	<0.02	<0.02
	5/15	<0.5	<0.5	0.55	0.58
	10/29	3	0.12	0.51	1.5

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Nonvolatile organic carbon	10/29	73	28	7.9	52
Oil and grease	1/16	<5	24	7.6	10
	4/1	<5	<5	<5	<5
	5/15	<5	<5	<5	<5
	10/29	2.7	2.4	<1	2.9
Orthophosphate	4/1	<0.02	<0.02	0.07	0.06
	4/1	<0.1	<0.1	<0.1	<0.1
	5/15	0.06	0.072	0.3	0.056
	10/29	1.2	0.62	0.35	1.2
	10/29	1.2	0.71	0.39	1
Potassium	1/16	<1	1	1.9	1.7
	4/1	2.8	7.6	6.4	6.7
	5/15	2.3	2.3	2.4	3.1
	10/29	5.8	2.8	2.1	7.2
Selenium	1/16	0.0024	<0.002	0.0023	0.0032
	4/1	<0.002	<0.002	<0.002	<0.002
	5/15	<0.002	<0.002	<0.002	<0.002
	10/29	<0.002	<0.002	<0.002	<0.002
Sodium	1/16	2.9	3	7.4	8.9
	4/1	1.3	2.6	5	30
	5/15	2.1	5.1	14	16
	10/29	5.9	4.2	6.3	23
Sulfate	1/16	<1	2	4	5.8
	4/1	0.8	1.6	3	26
	4/1	<0.1	0.2	2.9	28
	5/15	17	5.3	45	13
	10/29	9	6.5	2.1	28.3
	10/29	8.9	6.6	1.7	31.2
Surfactants	1/16	<0.5	<0.5	<0.5	<0.5
	4/1	<0.02	<0.02	<0.02	<0.02
	5/15	<0.5	0.64	<0.5	<0.5
	10/29	1.8	0.79	0.23	1.2

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Thallium	1/16	<0.001	<0.001	<0.001	<0.001
	4/1	<0.001	<0.001	<0.001	<0.001
	5/15	<0.001	<0.001	<0.001	<0.001
	10/29	<0.001	<0.001	<0.001	<0.001
Total alkalinity (as $CaCO_3$)	1/16	160	100	15	20
	4/1	35	47	9	20
	5/15	39	36	28	21
	10/29	29.2	191	9.9	46.2
	10/29	27.8	192	11.3	44.9
Total dissolved solids (TDS)	1/16	800	340	59	47
	4/1	120	1100	70	50
	5/15	110	190	94	81
	10/29	220	775	62	290
Total hardness (as $CaCO_3$)	1/16	180	96	22	16
	4/1	170	400	41	34
	5/15	33	44	24	20
	10/29	49.7	241	14.5	67.5
Total organic carbon (TOC)	1/16	17	<0.5	—[a]	5.6
	4/1	10	9	5	6
	5/15	25	18	25	23
Total phosphorus (as PO_4)	4/1	0.21	0.09	0.14	0.17
	5/15	<0.05	0.23	0.39	0.44
	10/29	0.58	0.5	0.63	1.9
Total suspended solids (TSS)	4/1	500	230	130	150
	5/15	540	640	660	220
	10/29	143	161	296	480
Vanadium	4/1	0.17	0.027	0.021	0.018
	5/15	<0.05	<0.05	<0.05	<0.05
	10/29	0.024	0.014	0.016	0.053

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Thallium	1/16	<0.001	<0.001	<0.001	<0.001
	4/1	<0.001	<0.001	<0.001	<0.001
	5/15	<0.001	<0.001	<0.001	<0.001
	10/29	<0.001	<0.001	0.0024	<0.001
Total alkalinity (as $CaCO_3$)	1/16	7.5	14	30	22
	4/1	8	14	30	45
	5/15	<1	19	34	46
	10/29	26.3	14.2	22.7	44.8
	10/29	19.9	13.5	22.1	39.9
Total dissolved solids (TDS)	1/16	64	68	100	140
	4/1	60	60	90	190
	5/15	92	130	150	150
	10/29	195	102	74	280
Total hardness (as $CaCO_3$)	1/16	14	16	29	27
	4/1	20	73	72	110
	5/15	18	25	48	55
	10/29	43.4	26.3	22.8	82.5
Total organic carbon (TOC)	1/16	5	5	3.8	—[a]
	4/1	6	11	3	7
	5/15	26	35	14	36
Total phosphorus (as PO_4)	4/1	0.1	0.17	0.39	0.2
	5/15	0.48	0.44	0.55	0.23
	10/29	0.87	0.56	1.4	0.63
Total suspended solids (TSS)	4/1	340	440	380	650
	5/15	1300	1100	700	620
	10/29	120	186	2160	75
Vanadium	4/1	0.014	0.11	0.065	0.062
	5/15	<0.05	<0.05	<0.05	0.065
	10/29	0.016	0.016	0.18	0.014

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (continued).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Zinc	1/16	0.074	0.026	0.095	0.068
	1/16	<0.05	<0.05	<0.05	<0.05
	4/1	0.39	0.02	0.27	0.09
	4/1	0.37	0.02	0.28	0.1
	5/15	0.081	0.028	0.24	0.16
	5/15	<0.05	<0.05	0.52	0.13
	10/29	0.16	0.056	0.45	0.31
	10/29	0.17	0.055	0.38	0.35
General indicator parameters					
pH	1/16	7.9	7.7	6.9	6.9
	4/1	7.3	7.4	7	6.9
	5/15	6.6	6.6	6.2	5.9
	10/29	6.82	8.02	6.7	6.44
Specific conductance (µmho/cm)	1/16	1200	520	40	39
	4/1	200	1800	210	88
	5/15	68	130	58	44
	10/29	131	1210	44	201
Bioassay (%)					
Aquatic bioassay, survival	10/29	100	100	—[b]	—[b]
EPA Method 507 (µg/L)					
Bromacil	10/29	—[b]	—[b]	—[b]	<1
Simazine	10/29	—[b]	—[b]	—[b]	9.3
EPA Method 615 (µg/L)					
2,4-D	1/16	<1	<1	<1	<1
	4/1	2	<1	<1	<1
EPA Method 625 (µg/L)					
Bis(2-ethylhexyl)phthalate	1/16	<10	<10	<10	<10
	4/1	<5	<5	<5	<5
	5/15	<5	<5	5.2	<5

Table 7-2. Storm water runoff, detected nonradioactive parameters, Livermore site, 1996 (concluded).

Parameter	Storm date	ALPE	ALPO	ASS2	ASW
Metals and minerals and others (mg/L) (continued)					
Zinc	1/16	0.11	0.068	0.054	0.13
	1/16	<0.05	<0.05	<0.05	<0.05
	4/1	0.09	0.25	0.16	0.26
	4/1	0.11	0.21	0.15	0.26
	5/15	0.26	0.29	0.11	0.6
	5/15	0.35	0.23	<0.05	1.1
	10/29	0.9	0.34	0.11	0.4
	10/29	0.9	0.42	0.25	0.58
General indicator parameters					
pH	1/16	6.6	6.8	7.3	7
	4/1	6.8	6.9	7.4	7.2
	5/15	5.6	5.8	6.7	6.6
	10/29	6.13	6.53	7.54	6.67
Specific conductance (μmho/cm)	1/16	27	42	92	87
	4/1	28	49	97	270
	5/15	37	64	140	130
	10/29	142	81	64	309
Bioassay (%)					
Aquatic bioassay, survival	10/29	—[b]	—[b]	95	95
EPA Method 507 (μg/L)					
Bromacil	10/29	—[b]	—[b]	—[b]	1.6
Simazine	10/29	—[b]	—[b]	—[b]	0.83
EPA Method 615 (μg/L)					
2,4-D	1/16	<1	<1	<1	<1
	4/1	<1	<1	72	7
EPA Method 625 (μg/L)					
Bis(2-ethylhexyl)phthalate	1/16	<10	<10	<10	<10
	4/1	<5	<5	<5	<5
	5/15	<5	<5	<5	<5

a Analysis requested, but not performed by analytical laboratory.

b Not available.

Table 7-3. 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)		
Carbonate alkalinity (as $CaCO_3$)	40	<1
Hydroxide alkalinity (as $CaCO_3$)	40	<1
Silver	32	<0.001
EPA Method 507 (μg/L)		
Acenaphthylene	2	<0.1
Alachlor	2	<0.2
Aldrin	2	<0.5
Anthracene	2	<0.3
Atraton	2	<1
Atrazine	2	<0.2
Benzo(a)anthracene	2	<0.3
Benzo(a)pyrene	2	<0.1
Benzo(b)fluoranthene	2	<0.3
Benzo(g,h,i)perylene	2	<0.3
Benzo(k)fluoranthene	2	<0.3
BHC, delta isomer	2	<0.2
BHC, gamma isomer (Lindane)	2	<0.1
Butachlor	2	<1
Butylbenzylphthalate	2	<1
Chlordane	2	<2
Chrysene	2	<0.3
Di (2-ethylhexyl) adipate	2	<1
Diazinon	2	<0.2
Dibenzo(a,h)anthracene	2	<0.3
Dibutylphthalate	2	<1
Diethylphthalate	2	<3
Diiethylhexylphthalate	2	<3
Dimethoate	2	<1
Dimethylphthalate	2	<1
Endrin	2	<0.2
Fluorene	2	<0.1
Heptachlor	2	<0.1
Heptachlor epoxide	2	<0.1
Hexachlorobenzene	2	<0.5

Table 7-3. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (continued).

Parameter	Number of samples	Detection limit
EPA Method 507 (μg/L) (continued)		
Hexachlorocyclopentadiene	2	<1
Indeno(1,2,3-c,d)pyrene	2	<3
Methoxychlor	2	<0.5
Metolachlor	2	<1
Metribuzin	2	<1
Molinate	2	<1
Pentachlorophenol	2	<1
Phenanthrene	2	<0.3
Prometon	2	<1
Prometryne	2	<1
Propachlor	2	<1
Pyrene	2	<0.1
Secbumeton	2	<1
Terbutryn	2	<1
Thiobencarb	2	<1
Toxaphene	2	<5
EPA Method 547 (μg/L)		
Glyphosate	2	<20
EPA Method 608 (μg/L)		
2,4,5-TP (Silvex)	8	<10
2,4-D	8	<50
Aldrin	24	<0.05
BHC, alpha isomer	16	<0.05
BHC, beta isomer	16	<0.05
BHC, delta isomer	16	<0.05
BHC, gamma isomer (Lindane)	24	<0.05
Chlordane	16	<0.5
Dieldrin	16	<0.1
Endosulfan I	16	<0.05
Endosulfan II	16	<0.1
Endosulfan sulfate	16	<0.1
Endrin	24	<0.1
Endrin aldehyde	16	<0.1
Heptachlor	16	<0.05
Heptachlor epoxide	16	<0.05

Table 7-3. 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)		
Methoxychlor	24	<0.5
p,p'-DDD	16	<0.1
p,p'-DDE	16	<0.1
p,p'-DDT	16	<0.1
PCB 1016	8	<0.5
PCB 1221	8	<0.5
PCB 1232	8	<0.5
PCB 1242	8	<0.5
PCB 1248	8	<0.5
PCB 1254	8	<0.5
PCB 1260	8	<0.5
Toxaphene	24	<1
EPA Method 615 (μg/L)		
2,4,5-T	16	<0.5
2,4,5-TP (Silvex)	16	<0.2
4-(2,4-Dichlorophenoxy)butyric acid	16	<2
Dalapon	16	<2
Dicamba	16	<1
Dichloroprop	16	<2
Dinoseb	16	<1
MCPA	16	<300
MCPP	16	<300
EPA Method 624 (μg/L)		
1,1,1-Trichloroethane	24	<1
1,1,2,2-Tetrachloroethane	24	<1
1,1,2-Trichloroethane	24	<1
1,1-Dichloroethane	24	<1
1,1-Dichloroethene	24	<1
1,2-Dichlorobenzene	24	<1
1,2-Dichloroethane	24	<1
1,2-Dichloroethene (total)	24	<2
1,2-Dichloropropane	24	<1
1,3-Dichlorobenzene	24	<1
1,4-Dichlorobenzene	24	<1
2-Butanone	16	<40

Table 7-3. 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)		
2-Chloroethylvinylether	24	<40
2-Hexanone	16	<10
4-Methyl-2-pentanone	16	<10
Acetone	16	<40
Benzene	24	<1
Bromodichloromethane	24	<1
Bromoform	24	<1
Bromomethane	24	<2
Carbon disulfide	16	<1
Carbon tetrachloride	24	<1
Chlorobenzene	24	<1
Chloroethane	24	<2
Chloroform	24	<1
Chloromethane	24	<2
cis-1,2-Dichloroethene	8	<1
cis-1,3-Dichloropropene	24	<1
Dibromochloromethane	24	<1
Dibromomethane	16	<1
Dichlorodifluoromethane	16	<2
Ethylbenzene	24	<1
Freon 113	24	<1
m- and *p*-Xylene isomers	8	<1
Methylene chloride	24	<1
o-Xylene	8	<1
Styrene	16	<1
Tetrachloroethene	24	<1
Toluene	24	<1
Total xylene isomers	24	<2
trans-1,2-Dichloroethene	8	<1
trans-1,3-Dichloropropene	24	<1
Trichloroethene	24	<1
Trichlorofluoromethane	24	<1
Vinyl acetate	16	<10
Vinyl chloride	24	<2

Table 7-3. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (continued).

Parameter	Number of samples	Detection limit
EPA Method 625 (μg/L)		
1,2,4-Trichlorobenzene	24	<10
1,2-Dichlorobenzene	24	<10
1,3-Dichlorobenzene	24	<10
1,4-Dichlorobenzene	24	<10
2,4,5-Trichlorophenol	16	<10
2,4,6-Trichlorophenol	24	<10
2,4-Dichlorophenol	24	<10
2,4-Dimethylphenol	24	<10
2,4-Dinitrophenol	24	<50
2,4-Dinitrotoluene	24	<10
2,6-Dinitrotoluene	24	<10
2-Chloronaphthalene	24	<10
2-Chlorophenol	24	<10
2-Methyl phenol	16	<10
2-Methyl-4,6-dinitrophenol	24	<50
2-Methylnaphthalene	16	<10
2-Nitroaniline	16	<50
2-Nitrophenol	24	<10
3,3'-Dichlorobenzidine	24	<20
3-Nitroaniline	16	<50
4-Bromophenyl ether	8	<5
4-Bromophenylphenylether	16	<10
4-Chloro-3-methylphenol	24	<20
4-Chloroaniline	16	<20
4-Chlorophenylphenylether	24	<10
4-Nitroaniline	16	<50
4-Nitrophenol	24	<50
Acenaphthene	24	<10
Acenaphthylene	24	<10
Anthracene	24	<10
Benzidine	8	<5
Benzo(a)anthracene	24	<10
Benzo(a)pyrene	24	<10
Benzo(b)fluoranthene	24	<10
Benzo(g,h,i)perylene	24	<10

Table 7-3. Summary of nondetects in storm water runoff, for Livermore site nonradioactive parameters (concluded).

Parameter	Number of samples	Detection limit
EPA Method 625 (μg/L)		
Benzo(k)fluoranthene	24	<10
Benzoic acid	16	<50
Benzyl alcohol	16	<10
Bis(2-chloroethoxy)methane	24	<10
Bis(2-chloroethyl)ether	24	<10
Bis(2-chloroisopropyl)ether	24	<10
Butylbenzylphthalate	24	<10
Chrysene	24	<10
Di-*n*-butylphthalate	24	<10
Di-*n*-octylphthalate	24	<10
Dibenzo(a,h)anthracene	24	<10
Dibenzofuran	24	<10
Diethylphthalate	24	<10
Dimethylphthalate	24	<10
Fluoranthene	24	<10
Fluorene	24	<10
Hexachlorobenzene	24	<10
Hexachlorobutadiene	24	<10
Hexachlorocyclopentadiene	24	<10
Hexachloroethane	24	<10
Indeno(1,2,3-c,d)pyrene	24	<10
Isophorone	24	<10
m- and *p*-Cresol	16	<10
N-Nitrosodi-n-propylamine	24	<10
N-Nitrosodiphenylamine	24	<10
Naphthalene	24	<10
Nitrobenzene	24	<10
Pentachlorophenol	24	<50
Phenanthrene	24	<10
Phenol	24	<10
Pyrene	24	<10
EPA Method 632 (μg/L)		
Diuron	2	<1

Table 7-4. Tritium in rain (Bq/L), Livermore site and Livermore Valley.

Location	Date				
	1/17/96	4/1/96 and 4/2/96	4/18/96	5/16/96	10/29/96
On site					
B343	27.2 ± 2.77	5.48 ± 1.87	19.4 ± 2.19	30.2 ± 2.66	170 ± 5.44
B291	14.5 ± 2.41	3.16 ± 1.79	7.40 ± 1.81	6.88 ± 2.00	14.3 ± 2.43
CDB	12.4 ± 2.36	5.18 ± 1.85	14.0 ± 2.01	8.99 ± 2.06	1.97 ± 1.97
VIS	8.21 ± 2.22	2.24 ± 1.76	10.8 ± 1.92	6.03 ± 1.97	1.97 ± 1.97
COW	6.77 ± 2.16	1.99 ± 1.75	3.85 ± 1.66	2.36 ± 1.83	2.00 ± 2.00
SALV	4.18 ± 2.08	1.72 ± 1.72	18.5 ± 2.16	9.55 ± 2.09	1.91 ± 1.91
MET	1.99 ± 1.99	2.00 ± 1.74	1.58 ± 1.58	1.80 ± 1.80	6.99 ± 2.20
Off site					
ESAN	2.46 ± 2.02	1.73 ± 1.73	6.18 ± 1.76	1.81 ± 1.81	1.99 ± 1.99
ZON7	2.25 ± 2.00	3.57 ± 1.80	5.96 ± 1.74	1.80 ± 1.80	1.95 ± 1.95
AQUE	1.99 ± 1.99	2.30 ± 1.75	9.25 ± 1.88	1.81 ± 1.81	1.95 ± 1.95
SLST	1.95 ± 1.95	1.69 ± 1.69	3.03 ± 1.63	1.78 ± 1.78	2.01 ± 2.01
GTES	5.11 ± 2.39	1.67 ± 1.67	2.84 ± 1.91	1.78 ± 1.78	2.11 ± 2.11
VINE	3.40 ± 2.33	1.67 ± 1.67	2.36 ± 1.89	1.78 ± 1.78	2.04 ± 2.04
BVA	5.51 ± 2.38	1.68 ± 1.68	2.22 ± 1.89	1.77 ± 1.77	2.01 ± 2.01
VET	1.99 ± 1.99	1.71 ± 1.71	2.58 ± 1.63	1.78 ± 1.78	1.99 ± 1.99

Table 7-5. Compliance monitoring data for the two releases from the DRB sampled in 1996.

Analyte	CDBX		WPDC	
	1/16/96	11/19/96	1/16/96	11/19/96
General minerals (mg/L)				
Aluminum	0.2	5	1.7	3.2
Bicarbonate alkalinity (as $CaCO_3$)	30	43.4	22	147
Calcium	9.3	11.4	7.7	38
Carbonate alkalinity (as $CaCO_3$)	<1	<1	<1	7.1
Chloride	3.3	8.9	8.6	75
Copper	<0.05	<0.01	<0.05	<0.01
Fluoride	0.05	0.09	0.06	0.25
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1
Iron	0.16	4.5	0.44	3
Magnesium	1.9	4.2	1.9	16.4
Manganese	<0.03	0.068	<0.03	0.059
Nickel	<0.1	<0.05	<0.1	<0.05
Nitrate (as N)	na[(a)]	0.5	na	2.6
Nitrate (as NO_3)	1.5	2.2	1.8	11.5
Nitrite (as N)	na	<0.1	na	<0.1
Orthophosphate	na	0.31	na	0.3
Potassium	1.5	3.3	1.7	3.2
Sodium	4.8	11.1	8.9	65
Sulfate	3.5	8	5.8	35
Surfactants	<0.5	0.1	<0.5	0.1
Total alkalinity (as $CaCO_3$)	30	43.4	22	154
Total dissolved solids (TDS)	110	100	140	345
Total hardness (as $CaCO_3$)	31	45.8	27	162
Total phosphorus (as P)	na	0.28	na	0.23
Total suspended solids (TSS)	na	9.5	na	1.8
Zinc	<0.05	0.065	<0.05	0.056
pH	7.1	7.85	7	8.48
Specific conductance (µmho/cm)	88	151	87	632
Metals (mg/L)				
Aluminum	na	4.2	na	2.9
Antimony	<0.06	<0.004	<0.06	<0.004
Arsenic	0.0025	0.0057	0.0043	0.0047
Barium	0.071	0.086	0.15	0.133
Beryllium	<0.0005	<0.0002	0.00055	<0.0002
Boron	<0.1	0.21	0.26	0.87

Table 7-5. Compliance monitoring data for the two releases from the DRB sampled in 1996 (continued).

Analyte	CDBX		WPDC	
	1/16/96	11/19/96	1/16/96	11/19/96
Metals (mg/L) (continued)				
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	0.012	0.022	0.013
Cobalt	na	<0.05	na	<0.05
Copper	0.0076	0.0077	0.018	0.0073
Chromium(VI)	<0.01	0.008	0.014	0.007
Iron	3.2	3.9	9.7	2.9
Lead	0.0041	<0.005	0.0077	<0.005
Manganese	0.047	0.059	0.18	0.053
Mercury	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	na	<0.025	na	<0.025
Nickel	0.0097	0.013	0.021	<0.002
Selenium	<0.002	<0.002	0.0032	<0.002
Silver	0.0016	<0.001	<0.0005	<0.001
Thallium	<0.001	<0.001	<0.001	<0.001
Vanadium	na	0.011	na	<0.01
Zinc	0.051	0.11	0.13	0.096
Miscellaneous organics (mg/L)				
Chemical oxygen demand	25	30.1	43	23
Oil and grease	17	<1	10	2
Total organic carbon (TOC)	4.8	6.7	na	5
Total petroleum hydrocarbons (μg/L)				
Diesel fuel	na	68	na	54
Gasoline fingerprint	na	<50	na	<50
Ethylene dibromide	na	<0.01	na	<0.01
Volatile organic compounds (μg/L)				
1,1,1-Trichloroethane	<1	<0.5	<1	<0.5
1,1,2,2-Tetrachloroethane	<1	<0.5	<1	<0.5
1,1,2-Trichloroethane	<1	<0.5	<1	<0.5
1,1-Dichloroethane	<1	<0.5	<1	<0.5
1,1-Dichloroethene	<1	<0.5	<1	<0.5
1,2-Dichlorobenzene	<1	<0.5	<1	<0.5
1,2-Dichloroethane	<1	<0.5	<1	<0.5
1,2-Dichloroethene (total)	<1	na	<1	na
1,2-Dichloropropane	<1	<0.5	<1	<0.5
1,2-Dichlorobenzene	na	<0.5	<1	<0.5

Table 7-5. Compliance monitoring data for the two releases from the DRB sampled in 1996 (continued).

Analyte	CDBX		WPDC	
	1/16/96	11/19/96	1/16/96	11/19/96
Volatile organic compounds (μg/L) (continued)				
1,3-Dichlorobenzene	<1	<0.5	<1	<0.5
1,4-Dichlorobenzene	<1	<0.5	<1	<0.5
2-Butanone	<40	na	<40	na
2-Chloroethylvinylether	<40	na	<40	na
2-Hexanone	<10	na	<10	na
4-Methyl-2-pentanone	<10	na	<10	na
Acetone	<40	na	<40	na
Benzene	<1	<0.5	<1	<0.5
Bromodichloromethane	<1	<0.5	<1	<0.5
Bromoform	<1	<0.5	<1	<0.5
Bromomethane	<2	<0.5	<2	<0.5
Carbon disulfide	<1	na	<1	<0.5
Carbon tetrachloride	<1	<0.5	<1	<0.5
Chlorobenzene	<1	<0.5	<1	na
Chloroethane	<2	<0.5	<2	<0.5
Chloroform	<1	<0.5	<1	<0.5
Chloromethane	<2	<0.5	<2	<0.5
cis-1,2-Dichloroethene	na	<0.5	na	<0.5
cis-1,3-Dichloropropene	<1	<0.5	<1	<0.5
Dibromochloromethane	<1	<0.5	<1	<0.5
Dibromomethane	<1	na	<1	<0.5
Dichlorodifluoromethane	<2	<0.5	<2	<0.5
Ethylbenzene	<1	<0.5	<1	na
Freon 113	<1	<0.5	<1	<0.5
Methylene chloride	<1	<1	<1	<1
Styrene	<1	na	<1	na
Tetrachloroethene	<1	<0.5	<1	<0.5
Toluene	<1	<0.5	<1	<0.5
Total trihalomethanes	na	<2	na	<2
Total xylene isomers	<2	<1	<2	<1
trans-1,2-Dichloroethene	na	<0.5	na	<0.5
trans-1,3-Dichloropropene	<1	<0.5	<1	<0.5
Trichloroethene	<0.5	<0.5	<0.5	<0.5
Trichlorofluoromethane	<1	<0.5	<1	<0.5

Table 7-5. Compliance monitoring data for the two releases from the DRB sampled in 1996 (continued).

Analyte	CDBX		WPDC	
	1/16/96	11/19/96	1/16/96	11/19/96
Volatile organic compounds (μg/L) (continued)				
Vinyl acetate	<10	na	<10	na
Vinyl chloride	<2	<0.5	<2	<0.5
Semivolatile organics (μg/L)				
1,2,4-Trichlorobenzene	<10	<2	<10	<2
1,2-Dichlorobenzene	<10	<2	<10	<2
1,2-Diphenylhydrazine	na	<2	na	<2
1,3-Dichlorobenzene	<10	<2	<10	<2
1,4-Dichlorobenzene	<10	<2	<10	<2
2,4,5-Trichlorophenol	<10	<5	<10	<5
2,4,6-Trichlorophenol	<10	<5	<10	<5
2,4-Dichlorophenol	<10	<2	<10	<2
2,4-Dimethylphenol	<10	<2	<10	<2
2,4-Dinitrophenol	<50	<10	<50	<10
2,4-Dinitrotoluene	<10	<2	<10	<2
2,6-Dinitrotoluene	<10	<2	<10	<2
2-Chloronaphthalene	<10	<2	<10	<2
2-Chlorophenol	<10	<2	<10	<2
2-Methyl Phenol	<10	<2	<10	<2
2-Methyl-4,6-dinitrophenol	<50	<10	<50	<10
2-Methylnaphthalene	<10	<2	<10	<2
2-Naphthylamine	na	<20	na	<20
2-Nitroaniline	<50	<2	<50	<2
2-Nitrophenol	<10	<2	<10	<2
3,3'-Dichlorobenzidine	<20	<5	<20	<5
3-Nitroaniline	<50	<2	<50	<2
4-Bromophenylphenylether	<10	<2	<10	<2
4-Chloro-3-methylphenol	<20	<5	<20	<5
4-Chloroaniline	<20	<2	<20	<2
4-Chlorophenylphenylether	<10	<2	<10	<2
4-Methylphenol	na	<2	na	<2
4-Nitroaniline	<50	<5	<50	<5
4-Nitrophenol	<50	<5	<50	<5
Acenaphthene	<10	<2	<10	<2
Acenaphthylene	<10	<2	<10	<2

Table 7-5. Compliance monitoring data for the two releases from the DRB sampled in 1996 (continued).

Analyte	CDBX		WPDC	
	1/16/96	11/19/96	1/16/96	11/19/96
Semivolatile organics (μg/L) (continued)				
Aniline	na	<5	na	<5
Anthracene	<10	<2	<10	<2
Benzidine	na	<20	na	<20
Benzo(a)anthracene	<10	<2	<10	<2
Benzo(a)pyrene	<10	<2	<10	<2
Benzo(b)fluoranthene	<10	<2	<10	<2
Benzo(g,h,i)perylene	<10	<2	<10	<2
Benzo(k)fluoranthene	<10	<2	<10	<2
Benzoic acid	<50	<10	<50	<10
Benzyl alcohol	<20	<2	<20	<2
Bis(2-chloroethoxy)methane	<10	<2	<10	<2
Bis(2-chloroethyl)ether	<10	<2	<10	<2
Bis(2-chloroisopropyl)ether	<10	<2	<10	<2
Bis(2-ethylhexyl)phthalate	<10	<5	<10	14
Butylbenzylphthalate	<10	<2	<10	<2
Chrysene	<10	<2	<10	<2
Di-*n*-butylphthalate	<10	na	<10	na
Di-*n*-octylphthalate	<10	<2	<10	<2
Dibenzo(a,h)anthracene	<10	<3	<10	<3
Dibenzofuran	<10	<2	<10	<2
Dibutylphthalate	na	<2	na	<2
Diethylphthalate	<10	<2	<10	<2
Dimethylphthalate	<10	<2	<10	<2
Fluoranthene	<10	<2	<10	<2
Fluorene	<10	<2	<10	<2
Hexachlorobenzene	<10	<2	<10	<2
Hexachlorobutadiene	<10	<2	<10	<2
Hexachlorocyclopentadiene	<10	<2	<10	<2
Hexachloroethane	<10	<2	<10	<2
Indeno(1,2,3-c,d)pyrene	<10	<2	<10	<2
Isophorone	<10	<2	<10	<2
m- and *p*-Cresol	<10	na	<10	na
N-Nitrosodi-*n*-propylamine	<10	<2	<10	<2
N-Nitrosodimethylamine	<10	<2	<10	<2

Table 7-5. Compliance monitoring data for the two releases from the DRB sampled in 1996 (continued).

Analyte	CDBX		WPDC	
	1/16/96	11/19/96	1/16/96	11/19/96
Semivolatile organics (μg/L) (continued)				
N-Nitrosodiphenylamine	na	<2	na	<2
Naphthalene	<10	<2	<10	<2
Nitrobenzene	<10	<2	<10	<2
Pentachlorophenol	<50	<10	<50	<10
Phenanthrene	<10	<2	<10	<2
Phenol	<10	<2	<10	<2
Pyrene	<10	<2	<10	<2
Pesticides (μg/L)				
Aldrin	<0.05	<2	<0.05	<2
BHC, alpha isomer	<0.05	<2	<0.05	<2
BHC, beta isomer	<0.05	<2	<0.05	<2
BHC, delta isomer	<0.05	<2	<0.05	<2
BHC, gamma isomer (Lindane)	<0.05	<2	<0.05	<2
Chlordane	<0.5	na	<0.5	na
Dieldrin	<0.1	<3	<0.1	<3
Endosulfan I	<0.05	<10	<0.05	<10
Endosulfan II	<0.1	<10	<0.1	<10
Endosulfan sulfate	<0.1	<3	<0.1	<3
Endrin	<0.1	<2	<0.1	<2
Endrin aldehyde	<0.1	<2	<0.1	<2
Heptachlor	<0.05	<2	<0.05	<2
Heptachlor epoxide	<0.05	<2	<0.05	<2
Methoxychlor	<0.5	na	<0.5	na
4,4'-DDD	<0.1	<2	<0.1	<2
4,4'-DDE	<0.1	<3	<0.1	<3
4,4'-DDT	<0.1	<2	<0.1	<2
Toxaphene	<1	na	<1	na
2,4,5-T	<0.5	na	<0.5	na
2,4,5-TP (Silvex)	<0.2	na	<0.2	na
2,4-D	<1	na	<1	na
4-(2,4-Dichlorophenoxy)butyric acid	<2	na	<2	na
Dalapon	<2	na	<2	na
Dicamba	<1	na	<1	na
Dichloroprop	<2	na	<2	na

Table 7-5. Compliance monitoring data for the two releases from the DRB sampled in 1996 (concluded).

Analyte	CDBX		WPDC	
	1/16/96	11/19/96	1/16/96	11/19/96
Pesticides (μg/L) (continued)				
Dinoseb	<1	na	<1	na
MCPA	<250	na	<250	na
MCPP	<250	na	<250	na
Toxicity				
Aquatic bioassay, survival (%)	not required	100	not required	100
Radioactivity (Bq/L)				
Gross alpha	0.06	0.05	0.10	0.08
Gross beta	0.09	0.18	0.21	0.15
Tritium	12.2	42.6	4.11	23.8

[a] na = Not analyzed.

Table 7-6a. Monthly analyses of water samples from the Drainage Retention Basin taken at sample location CDBE.

Parameter	1/4	2/6	2/14	2/23	3/7	4/12	5/23	6/19	7/25	8/8
General minerals (mg/L)										
Aluminum	2.6	3	0.34	0.35	9.7	6.5	<0.2	7.5	4.35	3.44
Bicarbonate alkalinity (as $CaCO_3$)	44	40	30	27	29	24	29	38	39.2	41.3
Calcium	13	12	7.8	8	9.7	7.9	9.3	12	10.6	10.5
Carbonate alkalinity (as CaCO3)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	3.6	3.5	2.6	2.1	2.4	2.3	3	3.1	2	2.2
Copper	<0.05	<0.05	<0.05	<0.05	0.009	0.008	<0.05	<0.05	<0.05	<0.05
Fluoride	0.061	0.053	0.065	<0.05	<0.05	<0.05	<0.05	0.12	0.07	0.07
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Iron	1.7	2	0.23	0.22	7.8	4.9	<0.1	5.1	4.06	3.37
Magnesium	3.6	4.1	2.5	2.2	4.4	3.1	2.9	3.9	3.4	3.7
Manganese	<0.03	<0.03	<0.03	<0.03	0.1	0.054	<0.03	<0.03	0.041	0.04
Nickel	<0.1	<0.1	<0.1	<0.1	0.018	0.013	<0.1	<0.1	<0.1	<0.1
Nitrate (as N)	na[a]	na	na	na	0.45	0.41	<0.5	0.5	0.5	0.4
Nitrate (as NO_3)	1.5	2.8	1.7	1.6	2	1.8	2.2	1.9	2.2	1.8
Nitrite (as N)	na	na	na	na	<0.05	<0.05	<0.5	<0.5	<0.1	<0.1
Nitrite (as NO_2)	na	na	na	na	<0.3	<0.3	<0.5	<0.5	na	<0.2
Orthophosphate	na	na	na	na	0.15	<0.02	0.23	0.12	0.53	0.46
Potassium	3.4	2.5	2.2	2.3	3.8	3	2.3	2	2.8	3.5
Sodium	6.7	7	3.8	5.7	3.3	3	6.1	3.5	3.2	4.2
Sulfate	3.7	4.9	2.5	2.2	2	2	2.5	2.9	2.4	2.7
Surfactant	<0.5	<0.5	<0.5	<0.5	<0.02	<0.02	<0.5	<0.5	<0.05	0.05
Total alkalinity (as $CaCO_3$)	44	40	30	27	29	24	29	38	39.2	41.3
Total dissolved solids (TDS)	91	110	120	93	90	100	120	280	60	80
Total hardness (as $CaCO_3$)	46	47	34	29	42	32	35	36	40.5	41.4
Total Kjeldahl nitrogen	na	na	na	na	1	0.4	0.67	<0.5	na	0.3
Total phosphorus (as P)	0.23	<0.05	0.16	na	0.25	na	na	na	0.24	0.24
Total phosphorus (as PO_4)	na	na	na	na	na	0.19	0.21	0.2	na	na
Total suspended solids (TSS)	6	26	21		130	30	74	<1	103	66.7
Zinc	<0.05	<0.05	<0.05	<0.05	0.06	0.04	<0.05	<0.05	0.072	0.052
pH	6.9	6.7	6.9	7	7.6	7.4	7.1	7.1	7.2	7.9
Specific conductance (μmho/cm)	100	74	70	66	77	81	81	86	105	106

Table 7-6a. Monthly analyses of water samples from the Drainage Retention Basin taken at sample location CDBE (continued).

Parameter	9/10	10/2	11/11	12/9	Min	Max	Median	Inter-quartile range	Number of samples
General minerals, (mg/L)									
Aluminum	0.65	3.4	2.82	2.5	<0.2	9.7	2.91	4.575	12
Bicarbonate alkalinity (as $CaCO_3$)	100	47.8	46.3	41.3	24	100	39.6	13.55	12
Calcium	15	11.6	12.8	11.6	7.8	15	11.1	2.725	12
Carbonate alkalinity (as CaCO3)	<1	<1	<1	<1	<1	<1	<1	0	12
Chloride	1.7	2.6	2.5	9	1.7	9	2.5	0.525	12
Copper	<0.05	<0.01	<0.01	<0.01	0.008	<0.05	<0.05	0.04	12
Fluoride	0.097	0.07	0.08	0.08	<0.05	0.12	0.07	0.03	12
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1	<1	<1	<1	0	12
Iron	0.38	3	2.6	2.2	<0.1	7.8	2.4	3.9275	12
Magnesium	3.6	4.2	3.9	4	2.2	4.4	3.6	0.875	12
Manganese	<0.03	0.03	0.026	0.024	0.024	0.1	0.03	0.01025	12
Nickel	<0.1	<0.05	<0.05	<0.05	0.013	<0.1	<0.1	0.05	12
Nitrate (as N)	<0.5	<0.2	0.4	0.6	<0.2	0.6	0.48	0.0975	10
Nitrate (as NO_3)	1.2	0.9	1.8	2.7	0.9	2.8	1.8	0.525	12
Nitrite (as N)	<0.5	<0.1	<0.1	<0.1	<0.05	<0.5	<0.1	0.3	10
Nitrite (as NO_2)	na	na	na	na	<0.3	<0.3	<0.3	0	1
Orthophosphate	0.13	0.37	0.38	0.32	<0.02	0.53	0.28	0.2425	10
Potassium	3	3.4	3.5	3.2	2	3.8	3	1.125	12
Sodium	4.9	4.9	4.8	11.5	3	11.5	4.8	1.65	12
Sulfate	1.2	3.4	3.6	7.8	1.2	7.8	2.6	0.875	12
Surfactant	<0.5	<0.05	0.1	0.11	<0.02	0.5	<0.30	0.45	12
Total alkalinity (as $CaCO_3$)	100	47.8	46.3	41.3	24	100	39.6	13.55	12
Total dissolved solids (TDS)	130	105	110	100	60	280	102	27.75	12
Total hardness (as $CaCO_3$)	52	46.3	48	45.4	29	52	41.7	10.875	12
Total Kjeldahl nitrogen	na	na	0.7	na	0.7	1	0.85	0.15	2
Total phosphorus (as P)	na	0.24	0.22	0.19	0.19	0.25	0.24	0.035	7
Total phosphorus (as PO_4)	0.22	0.62	na	na	0.2	0.62	0.215	0.1125	4
Total suspended solids (TSS)	1	2.3	2.8	15	1	130	21	67.8	11
Zinc	<0.05	0.038	0.063	<0.05	0.038	0.072	<0.05	0.004	12
pH	7.4	7.83	7.92	7.79	6.7	7.92	7.3	0.7	12
Specific conductance (µmho/cm)	84	121	121	151	66	151	85	29.75	12

Table 7-6a. Monthly analyses of water samples from the Drainage Retention Basin taken at sample location CDBE (continued).

Parameter	1/4	2/6	2/14	2/23	3/7	4/12	5/23	6/19	7/25	8/8
Nutrients (mg/L)										
Ammonia nitrogen (as N)	0.18	3.9	na	na	na	<0.05	0.3	0.2	<0.5	<0.02
Nitrate (as N)	na	na	na	na	na	0.41	<0.5	0.5	0.4	0.4
Nitrate (as NO_3)	na	na	na	na	na	1.8	2.2	2.2	2	1.8
Nitrite (as N)	na	na	na	na	na	<0.05	<0.5	<0.5	<0.1	<0.1
Nitrite (as NO_2)	<0.5	<0.5	na	na	na	<0.3	<0.5	<0.5	<0.3	<0.2
Orthophosphate	0.076	0.092	0.092	na	na	na	na	na	na	na
Total Kjeldahl nitrogen	0.5	1.9	na	na	na	0.4	0.67	<0.5	0.9	0.3
Total phosphorus (as P)	0.23	<0.05	0.16	na	na	na	na	na	na	na
Metals (mg/L)										
Aluminum	na	na	na	na	12	6.6	6.3	6.8	4.25	3.5
Antimony	<0.06	<0.06	na	na	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Arsenic	0.0039	0.021	na	na	<0.002	<0.002	0.0027	0.0021	0.003	<0.002
Barium	0.066	0.1	na	na	0.15	0.09	0.084	0.096	0.082	0.078
Beryllium	<0.0005	<0.0005	na	na	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	<0.1	<0.1	na	na	<0.05	<0.05	0.34	0.3	0.069	0.059
Cadmium	<0.0005	<0.0005	na	na	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<0.01	0.014	na	na	0.006	0.016	0.01	0.013	0.013	0.0015
Cobalt	na	na	na	na	<0.005	<0.005	<0.05	<0.05	<0.05	<0.05
Copper	0.0091	0.018	na	na	0.005	0.005	<0.01	<0.01	<0.01	<0.01
Chromium(VI)	na	na	na	na	<0.002	<0.002	0.002	0.012	<0.002	<0.002
Iron	2.1	6	na	na	10	5.1	4.4	4.5	4.08	3.46
Lead	0.0026	0.0034	na	na	0.003	<0.002	0.0028	0.0027	<0.005	<0.005
Manganese	<0.03	0.082	na	na	0.15	0.055	0.043	0.044	0.043	0.04
Mercury	<0.0002	<0.0002	na	na	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	na	na	na	na	<0.005	<0.005	<0.05	<0.05	<0.025	<0.025
Nickel	0.0077	0.016	na	na	0.012	0.005	0.0087	0.012	0.01	0.012
Selenium	<0.002	0.0021	na	na	<0.002	<0.002	<0.002	<0.002	<0.002	0.003
Silver	<0.0005	<0.0005	na	na	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001
Thallium	<0.001	<0.001	na	na	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001
Vanadium	na	na	na	na	0.021	0.014	<0.05	<0.05	<0.02	<0.02
Zinc	0.047	0.058	na	na	0.07	0.05	0.054	0.049	0.066	0.062

Table 7-6a. Monthly analyses of water samples from the Drainage Retention Basin taken at sample location CDBE (continued).

Parameter	9/10	10/2	11/11	12/9	Min	Max	Median	Inter-quartile range	Number of samples
Nutrients (mg/L)									
Ammonia nitrogen (as N)	0.2	<0.02	0.27	0.02	<0.02	3.9	0.2	0.25	9
Nitrate (as N)	<0.5	0.2	<0.5	0.6	0.2	0.6	0.5	0.1	9
Nitrate (as NO_3)	1.2	0.9	1.9	2.7	0.9	2.7	1.9	0.4	9
Nitrite (as N)	<0.5	<0.1	<0.5	<0.1	<0.05	<0.5	<0.1	0.4	9
Nitrite (as NO_2)	<0.5	<0.2	<0.5	<0.2	<0.2	<0.5	<0.5	0.3	9
Orthophosphate	na	na	na	na	0.076	0.092	0.092	0	1
Total Kjeldahl nitrogen	0.88	0.5	1.3	0.7	0.3	1.9	0.67	0.38	9
Total phosphorus (as P)	na	na	na	na	<0.05	0.23	0.16	0	1
Metals (mg/L)									
Aluminum	5.6	3.3	2.5	2.7	2.5	12	4.925	3.175	10
Antimony	<0.005	<0.004	<0.004	<0.004	<0.004	<0.06	<0.005	0.00075	10
Arsenic	<0.002	0.0033	0.0035	0.0022	<0.002	0.021	0.0024	0.000925	10
Barium	<0.025	0.076	0.071	0.074	<0.025	0.15	0.08	0.014	10
Beryllium	<0.0005	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	0	10
Boron	<0.1	0.07	0.072	0.25	<0.05	0.34	0.086	0.151	10
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0005	<0.0005	0	10
Chromium	0.012	0.0093	0.0087	0.0054	0.0015	0.016	0.01	0.006075	10
Cobalt	<0.05	<0.05	<0.05	<0.05	<0.005	<0.05	<0.05	0	10
Copper	<0.01	0.0076	0.0072	0.0069	<0.005	0.018	0.0096	0.003025	10
Chromium(VI)	<0.002	0.002	<0.002	<0.002	<0.002	0.012	0.002	0	10
Iron	3.9	3.2	2.39	2.3	2.1	10	3.99	1.21	10
Lead	0.0042	<0.005	<0.005	<0.005	<0.002	<0.005	0.0038	0.00215	10
Manganese	<0.03	0.032	0.024	0.024	0.024	0.15	0.0415	0.01325	10
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0	10
Molybdenum	<0.05	<0.025	<0.025	<0.025	<0.005	<0.05	<0.025	0.01875	10
Nickel	0.01	0.022	0.008	0.007	0.005	0.022	0.01	0.003825	10
Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.003	<0.002	0	10
Silver	<0.0005	<0.001	<0.001	<0.001	<0.0005	<0.001	<0.0005	0.0005	10
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.005	<0.001	0	10
Vanadium	<0.05	0.011	0.012	<0.01	<0.01	<0.05	<0.02	0.03025	10
Zinc	<0.02	0.041	0.063	<0.047	<0.02	0.07	0.052	0.01525	10

Table 7-6a. Monthly analyses of water samples from the Drainage Retention Basin taken at sample location CDBE (continued).

Parameter	1/4	2/6	2/14	2/23	3/7	4/12	5/30	6/19	7/25	8/8
Organics										
Chemical oxygen demand (mg/L)	21	na	na	na	na	17	na	na	18.5	na
Oil and grease	5	na	na	na	na	<5	na	na	3	na
Chlorophyll a (μg/L)	1.4	<1	na	na	<10	<10	3	1.6	na	11.8
Fecal coliform (MPN/100 mL)	4	na	na	na	na	5	na	na	11	na
Total coliform (MPN/100 mL)	680	na	na	na	na	23	na	na	30	na

Table 7-6a. Monthly analyses of water samples from the Drainage Retention Basin taken at sample location CDBE (concluded).

Parameter	9/10	10/2	11/11	12/9	Min	Max	Median	Inter-quartile range	Number of samples
Organics									
Chemical oxygen demand (mg/L)	na	14.9	na	na	14.9	21	17.75	1.8	3
Oil and grease	na	<1	na	na	<1	<5	4	2	3
Chlorophyll a (μg/L)	4.4	3	1.2	0.96	0.96	11.8	<3	8.4	9
Fecal coliform (MPN/100 mL)	na	<2	na	na	<2	11	4.5	4.5	3
Total coliform (MPN/100 mL)	na	22	na	na	22	680	26.5	4	3

[a] na = Not analyzed

Table 7-6b. Semiannual analyses of water samples from the Drainage Retention Basin taken at sample location CDBE.

Description	4/12	9/10
Miscellaneous organics		
1,2-Dibromo-3-chloropropane (μg/L)		<0.01
Ethylene dibromide (μg/L)	<0.01	<0.02
Total organic carbon (TOC) (mg/L)	4	4.9
Total petroleum hydrocarbons (μg/L)		
Diesel fuel	<50	<50
Gasoline fingerprint	<50	<50
Volatile organic compounds (μg/L)		
1,1,1-Trichloroethane	<0.5	<0.5
1,1,2,2-Tetrachloroethane	<0.5	<0.5
1,1,2-Trichloroethane	<0.5	<0.5
1,1-Dichloroethane	<0.5	<0.5
1,1-Dichloroethene	<0.5	<0.5
1,2-Dichlorobenzene	<0.3	<0.3
1,2-Dichloroethane	<0.5	<0.5
1,2-Dichloroethene (total)	<1	
1,2-Dichloropropane	<0.5	<0.5
1,3-Dichlorobenzene	<0.3	<0.3
1,4-Dichlorobenzene	<0.3	<0.3
2-Chloroethylvinylether	<0.5	<0.5
Benzene	<0.3	<0.3
Bromodichloromethane	<0.5	<0.5
Bromoform	<0.5	<0.5
Bromomethane	<0.5	<0.5
Carbon tetrachloride	<0.5	<0.5
Chlorobenzene	<0.3	<0.3
Chloroethane	<0.5	<0.5
Chloroform	<0.5	<0.5
Chloromethane	<0.5	<0.5
cis-1,2-Dichloroethene	<0.5	<0.5
cis-1,3-Dichloropropene	<0.5	<0.5
Dibromochloromethane	<0.5	<0.5
Dichlorodifluoromethane	<0.5	<0.5
Ethylbenzene	<0.3	<0.3
Freon 113	<0.5	<0.5

Table 7-6b. Semiannual analyses of water samples from the Drainage Retention Basin taken at sample location CDBE (continued).

Description	4/12	9/10
Volatile organic compounds (μg/L) (continued)		
Methylene chloride	<0.5	<0.5
m- and *p*-Xylene Isomers	<0.3	
o-Xylene	<0.3	
Tetrachloroethene	<0.5	<0.5
Toluene	<0.3	<0.3
Total xylene isomers	<0.6	<0.5
trans-1,2-Dichloroethene	<0.5	<0.5
trans-1,3-Dichloropropene	<0.5	<0.5
Trichloroethene	<0.5	<0.5
Trichlorofluoromethane	<0.5	<0.5
Vinyl chloride	<0.5	<0.5
Semivolatile organic compounds (μg/L)		
1,2,4-Trichlorobenzene	<5	<5
1,2-Dichlorobenzene	<5	<5
1,3-Dichlorobenzene	<5	<5
1,4-Dichlorobenzene	<5	<5
2,4,5-Trichlorophenol		<5
2,4,6-Trichlorophenol	<5	<5
2,4-Dichlorophenol	<5	<5
2,4-Dimethylphenol	<5	<5
2,4-Dinitrophenol	<5	<25
2,4-Dinitrotoluene	<5	<5
2,6-Dinitrotoluene	<5	<5
2-Chloronaphthalene	<5	<5
2-Chlorophenol	<5	<5
2-Methyl Phenol		<5
2-Methyl-4,6-dinitrophenol	<5	<25
2-Methylnaphthalene		<5
2-Nitroaniline		<25
2-Nitrophenol	<5	<5
3,3'-Dichlorobenzidine	<5	<10
3-Nitroaniline		<25
4-Bromophenyl ether	<5	

Table 7-6b. Semiannual analyses of water samples from the Drainage Retention Basin taken at sample location CDBE (continued).

Description	4/12	9/10
Semivolatile organic compounds (μg/L) (continued)		
4-Bromophenylphenylether		<5
4-Chloro-3-methylphenol	<5	<10
4-Chloroaniline		<10
4-Chlorophenylphenylether	<5	<5
4-Nitroaniline		<25
4-Nitrophenol	<5	<25
Acenaphthene	<5	<5
Acenaphthylene	<5	<5
Anthracene	<5	<5
Benzidine	<5	
Benzo(a)anthracene	<5	<5
Benzo(a)pyrene	<5	<5
Benzo(b)fluoranthene	<5	<5
Benzo(g,h,i)perylene	<5	<5
Benzo(k)fluoranthene	<5	<5
Benzoic acid		<25
Benzyl alcohol		<10
Bis(2-chloroethoxy)methane	<5	<5
Bis(2-chloroethyl)ether	<5	<5
Bis(2-chloroisopropyl)ether	<5	<5
Bis(2-ethylhexyl)phthalate	<5	<5
Butylbenzylphthalate	<5	<5
Chrysene	<5	<5
Di-n-butylphthalate	<5	<5
Di-n-octylphthalate	<5	<5
Dibenzo(a,h)anthracene	<5	<5
Dibenzofuran	<5	<5
Diethylphthalate	<5	<5
Dimethylphthalate	<5	<5
Fluoranthene	<5	<5
Fluorene	<5	<5
Hexachlorobenzene	<5	<5
Hexachlorobutadiene	<5	<5

Table 7-6b. Semiannual analyses of water samples from the Drainage Retention Basin taken at sample location CDBE (concluded).

Description	4/12	9/10
Semivolatile organic compounds (μg/L) (continued)		
Hexachlorocyclopentadiene	<5	<5
Hexachloroethane	<5	<5
Indeno(1,2,3-c,d)pyrene	<5	<5
Isophorone	<5	<5
m- and *p*-Cresol		<5
N-Nitroso-di-n-propylamine	<5	<5
N-Nitroso-diphenylamine	<5	<5
Naphthalene	<5	<5
Nitrobenzene	<5	<5
Pentachlorophenol	<5	<25
Phenanthrene	<5	<5
Phenol	<5	<5
Pyrene	<5	<5
Radioactivity (Bq/L)		
Gross alpha	<0.0444	<0.0666
Gross beta	<0.1184	<0.2183
Tritium	43.66	41.81

Table 7-6c. Pesticide analyses of water collected at the Drainage Retention Basin sample location CDBE.

Description	3/27	7/25	10/2	Min	Max	Median	Inter-quartile range	Number of samples
Pesticide (μg/L)								
4-(2,4-Dichlorophenoxy)butyric acid	<0.2	<0.2	<0.5	<0.2	<0.5	<0.2	0.15	3
2,4-D	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0	3
2,4,5-T	<0.2	<0.2	<0.05	<0.05	<0.2	<0.2	0.075	3
2,4,5-TP (Silvex)	<0.2	<0.2	<0.05	<0.05	<0.2	<0.2	0.075	3
Atrazine	<1	<1	<1	<1	<1	<1	0	3
Bromacil	15	16	13	13	16	15	1.5	3
Butachlor	<1	<1	<1	<1	<1	<1	0	3
Dalapon	<0.2	<0.2	<10	<0.2	<10	<0.2	4.9	3
Diazinon	<2	<2	<2	<2	<2	<2	0	3
Dicamba	<0.2	<0.2	<0.05	<0.05	<0.2	<0.2	0.075	3
Dichloroprop	<0.2	<0.2	<0.5	<0.2	<0.5	<0.2	0.15	3
Dimethoate	<2	<2	<2	<2	<2	<2	0	3
Dinoseb	<0.2	<0.2	<0.1	<0.1	<0.2	<0.2	0.05	3
Diuron	17	10	7	7	17	10	5	3
Glyphosate	<20	<20	<20	<20	<20	<20	0	3
MCPA	—[a]	—[a]	<1	<1	<1	<1	0	1
MCPP	—[a]	—[a]	<1	<1	<1	<1	0	1
Metolachlor	<1	<1	<1	<1	<1	<1	0	3
Metribuzin	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0	3
Molinate	<2	<2	<2	<2	<2	<2	0	3
Prometryne	<2	<2	<2	<2	<2	<2	0	3
Propachlor	<1	<1	<1	<1	<1	<1	0	3
Simazine	<2	<2	<2	<2	<2	<2	0	3
Thiobencarb	<1	<1	<1	<1	<1	<1	0	3

[a] No measurement taken.

Table 7-7. Field data collected from Drainage Retention Basin locations.

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
1/4/96	Dissolved oxygen (mg/L)	—[a]	—[a]	7.1	7	6.5	5.1	4.8	4.7
	Temperature (°C)	—[a]	—[a]	11.4	11.4	11	12.3	11.9	11.7
	Turbidity (m)				0.46				
1/10/96	Dissolved oxygen (mg/L)	8	8.7	8.5	8.5	8.4	8.4	8.2	8.2
	Temperature (°C)	11.9	12.2	12	12	12.1	12.4	12.3	12.4
	Turbidity (m)				0.39				
1/18/96	Dissolved oxygen (mg/L)	9	9	8.9	8.8	8.3	8.9	8.8	8.7
	Temperature (°C)	11	11.1	11.2	11.2	11.2	11.3	11.3	11.3
	Turbidity (m)				0.38				
1/26/96	Dissolved oxygen (mg/L)	8.5	9	8.9	8.8	8.9	9	9	8.9
	Temperature (°C)	10.9	11.3	11.2	10.9	10.9	11.3	11.2	11.2
	Turbidity (m)				0.38				
2/6/96	Dissolved oxygen (mg/L)	7.1	7.7	7.6	7.6	7.7	7.3	7.2	7.2
	Temperature (°C)	13.9	14.4	13.8	13.9	13.9	14.4	14	14.1
	Turbidity (m)				0.18				
2/14/96	Dissolved oxygen (mg/L)	8.4	9.7	9.8	9.4	9	10.2	9.9	9.2
	Temperature (°C)	24	25.6	23.3	23.3	23.4	24.2	23.5	23.8
	Turbidity (m)				0.15				
2/23/96	Dissolved oxygen (mg/L)	7.8	7.4	7.5	6.6	6.1	5.7	5.7	5.6
	Temperature (°C)	14.8	12.3	12	11.9	12	12.6	12.4	12.7
	Turbidity (m)				0.20				
3/1/96	Dissolved oxygen (mg/L)	7.2	8.6	6.6	6.1	5.6	5.7	6	6
	Temperature (°C)	11.1	12.2	11.3	11.3	11.3	11.5	11.4	11.4
	Turbidity (m)				0.18				
3/7/96	Dissolved oxygen (mg/L)	7.5	8.9	8.4	8	7.8	7.5	7.3	6.9
	Temperature (°C)	12.3	13.3	13.7	12.9	12.9	12.8	12.6	12.5
	Turbidity (m)				0.08				
3/15/96	Dissolved oxygen (mg/L)	9.5	8.9	8.9	8.9	8.8	9	8.8	9
	Temperature (°C)	14.7	14.4	13.7	13.5	13.5	13.7	13.6	13.5
	Turbidity (m)				0.13				
3/22/96	Dissolved oxygen (mg/L)	9.2	9.6	9.5	9.5	9.5	10.1	10	9.8
	Temperature (°C)	14.8	14.7	14.3	14.3	14.2	14.7	14.6	14.5
	Turbidity (m)				0.20				
4/5/96	Dissolved oxygen (mg/L)	9.67	9.08	8.67	9	8.75	9.42	9.5	9.5
	Temperature (°C)	16.75	23.42	17.08	16.16	16.08	16.67	16.08	16.08
	Turbidity (m)				0.13				

Table 7-7. Field data collected from Drainage Retention Basin locations (continued).

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
4/12/96	Dissolved oxygen (mg/L)	11.08	10.33	10.42	10.25	10.08	10.25	10.16	10.08
	Temperature (°C)	19.3	18.5	16.4	16.4	16.3	16.8	16.6	16.5
	Turbidity (m)				0.13				
4/19/96	Dissolved oxygen (mg/L)	9.42	10.25	10.16	10.25	10.16	9.58	9.67	9.5
	Temperature (°C)	15.2	15.5	15.3	15.3	15.3	15.6	15.4	15.4
	Turbidity (m)				0.20				
4/25/96	Dissolved oxygen (mg/L)	9.42	9.67	9.5	9.42	9.33	9.42	9.42	9.16
	Temperature (°C)	18.1	18.8	17.3	17.3	17.3	17.5	17.3	17.3
	Turbidity (m)				0.28				
5/10/96	Dissolved oxygen (mg/L)	8.5	8.33	9.08	8.5	8.58	8.5	8.33	8.16
	Temperature (°C)	21.8	24.2	18.2	18.3	18.3	19.0	18.3	18.4
	Turbidity (m)				0.28				
5/17/96	Dissolved oxygen (mg/L)	8.33	8.75	8.5	8.42	8.42	8.42	8.5	8.42
	Temperature (°C)	19.4	19.6	19.4	19.6	19.7	19.7	19.6	19.6
	Turbidity (m)				0.25				
5/23/96	Dissolved oxygen (mg/L)	9.58	9.58	10.16	9.67	9.5	9.75	9.42	9.33
	Temperature (°C)	19.2	20.1	19.4	19.0	18.8	20.8	19.3	19.3
	Turbidity (m)				0.29				
6/7/96	Dissolved oxygen (mg/L)	13.25	12.42	12.67	12.58	12.5	12.58	12.58	12.75
	Temperature (°C)	27.8	23.8	23.8	23.5	23.4	24.7	23.6	23.3
	Turbidity (m)				0.24				
6/14/96	Dissolved oxygen (mg/L)	8	8	7.67	7.67	7.67	7.75	7.58	7.58
	Temperature (°C)	26.7	23.0	27.6	22.1	22.1	24.4	22.2	22.2
	Turbidity (m)				0.32				
6/19/96	Dissolved oxygen (mg/L)	7.5	7.5	7.25	7.16	7.16	7.33	7.08	7.08
	Temperature (°C)	25.4	23.4	22.0	21.6	21.5	22.3	21.5	21.5
	Turbidity (m)				0.29				
6/28/96	Dissolved oxygen (mg/L)	7.42	7.5	7.67	7.33	7.33	7.75	7.16	7.5
	Temperature (°C)	21.0	24.7	21.2	20.2	20.0	21.0	20.3	20.2
	Turbidity (m)				0.38				
7/3/96	Dissolved oxygen (mg/L)	7.7	7.3	7	6.8	6.8	7.5	6.9	6.8
	Temperature (°C)	26.8	24.1	23.9	23.4	23.4	25.5	23.6	23.4
	Turbidity (m)				0.36				
7/12/96	Dissolved oxygen (mg/L)	6.8	7.2	6.6	6.5	6.5	6.7	6.5	6.4
	Temperature (°C)	24.6	24.3	23.9	23.8	23.7	24.1	23.8	23.8
	Turbidity (m)				0.34				

Table 7-7. Field data collected from Drainage Retention Basin locations (continued).

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
7/25/96	Dissolved oxygen (mg/L)	8	8.2	7.3	7.1	7.3	7.4	7.3	7.3
	Temperature (°C)	24.6	24.5	24	23.7	23.6	23.9	23.8	23.7
	Turbidity (m)				0.38				
08/2/96	Dissolved oxygen (mg/L)	8.1	7.4	6.8	6.8	6.8	7	6.7	6.7
	Temperature (°C)	27	26.9	24.9	24.5	24.5	27	24.4	24.4
	Turbidity (m)				0.41				
	Bicarbonate (mg/L)				85				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				85				
8/8/96	Dissolved oxygen (mg/L)	7.1	7.1	7.3	7.2	7.1	7.9	7.3	7.2
	Temperature (°C)	28.4	27.8	23.3	23.3	23.3	25.8	23.3	23.1
	Turbidity (m)				0.30				
	Bicarbonate (mg/L)				68				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				68				
8/29/96	Dissolved oxygen (mg/L)	9	9	8.3	8.4	8.4	8.5	8.6	8.8
	Temperature (°C)	23.8	25.2	23.7	22.7	22.6	23.7	22.6	22.5
	Turbidity (m)				0.33				
	Bicarbonate (mg/L)				51				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				51				
9/10/96	Dissolved oxygen (mg/L)	7.9	7.45	7.8	8	7.5	7.6	7.4	7.5
	Temperature (°C)	27.6	23.3	22.4	22.2	22.3	23.9	22.5	22.5
	Turbidity (m)				0.39				
	Bicarbonate (mg/L)				68				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				68				
9/20/96	Dissolved oxygen (mg/L)	8.2	8.3	7.9	7.8	7.8	7.8	7.7	7.7
	Temperature (°C)	22.5	21.9	20.9	20.1	20.1	21.7	20.4	20.4
	Turbidity (m)				0.33				
	Bicarbonate (mg/L)				85				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				85				

Table 7-7. Field data collected from Drainage Retention Basin locations (continued).

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
9/27/96	Dissolved oxygen (mg/L)	5.7	6	6	6	6.1	6.5	6.4	6.7
	Temperature (°C)	20.4	19.7	19.5	19.5	19.5	19.6	19.3	19.2
	Turbidity (m)				0.34				
	Bicarbonate (mg/L)				119				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				119				
10/2/96	Dissolved oxygen (mg/L)	4.3	4.5	4.9	4.8	4.8	5.1	5.1	5.2
	Temperature (°C)	18.4	18.7	18.7	18.7	18.6	18.7	18.7	18.6
	Turbidity (m)				0.43				
	Bicarbonate (mg/L)				—[a]				
	Carbonate alkalinity (mg/L)				—[a]				
	Hydroxide alkalinity (mg/L)				—[a]				
	Total alkalinity (mg/L)				—[a]				
10/10/96	Dissolved oxygen (mg/L)	8.2	8	8	8	8	8.1	7.9	7.9
	Temperature (°C)	22.4	20.8	20.6	20.5	20.4	21	20.6	20.4
	Turbidity (m)				0.43				
	Bicarbonate (mg/L)				136				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				136				
10/18/96	Dissolved oxygen (mg/L)	9.1	8.4	8.3	8.3	8.3	8.2	8.2	8.1
	Temperature (°C)	17.5	16.9	16.9	16.9	16.9	17.1	17.1	17
	Turbidity (m)				0.36				
	Bicarbonate (mg/L)				119				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				119				
11/8/96	Dissolved oxygen (mg/L)	6.9	7.3	7.3	7.4	7.1	7	6.9	6.9
	Temperature (°C)	12.1	12.8	12.4	12.3	12.2	12.3	12.2	12.2
	Turbidity (m)				0.41				
	Bicarbonate (mg/L)				119				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				119				

Table 7-7. Field data collected from Drainage Retention Basin locations (continued).

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
11/11/96	Dissolved oxygen (mg/L)	5.7	6	6	5.9	5.7	5.7	5.6	5.5
	Temperature (°C)	14.4	14.4	13	12.8	12.9	13.3	12.7	12.6
	Turbidity (m)				0.36				
	Bicarbonate (mg/L)				119				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				119				
11/27/96	Dissolved oxygen (mg/L)	3.1	3.9	3.4	3.3	3.2	2.3	2.3	2.3
	Temperature (°C)	12.6	12.3	12.2	12	11.9	12.1	12	12.3
	Turbidity (m)				—[a]				
	Bicarbonate (mg/L)				—[a]				
	Carbonate alkalinity (mg/L)				—[a]				
	Hydroxide alkalinity (mg/L)				—[a]				
	Total alkalinity (mg/L)				—[a]				
12/6/96	Dissolved oxygen (mg/L)	10.5	10.1	10.1	10	10.1	9.6	9.5	9.3
	Temperature (°C)	12.5	12.3	12	11.9	11.9	12.2	12.1	11.9
	Turbidity (m)				0.56				
	Bicarbonate (mg/L)				40.8				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				40.8				
12/9/96	Dissolved oxygen (mg/L)	10.9	11.2	10.8	10.4	10.5	10.2	10	9.9
	Temperature (°C)	12.6	12.4	12.2	12.2	12.2	12.3	12.3	12.4
	Turbidity (m)				0.46				
	Bicarbonate (mg/L)				40.8				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				40.8				
12/20/96	Dissolved oxygen (mg/L)	12.4	12	12.7	12.5	12.2	11.9	11.7	11.4
	Temperature (°C)	10.3	10	10	9.9	9.9	10.2	10	9.9
	Turbidity (m)				0.41				
	Bicarbonate (mg/L)				40.8				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				40.8				

Table 7-7. Field data collected from Drainage Retention Basin locations (concluded).

Date	Analysis	CDBA	CDBC	CDBD	CDBE	CDBF	CDBJ	CDBK	CDBL
Minimum	Dissolved oxygen (mg/L)	3.1	3.9	3.4	3.3	3.2	2.3	2.3	2.3
	Temperature (°C)	10.3	10	10	9.9	9.9	10.2	10	9.9
	Turbidity (m)				0.08				
	Bicarbonate (mg/L)				40.8				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				40.8				
Maximum	Dissolved oxygen (mg/L)	13.25	12.42	12.7	12.58	12.5	12.58	12.58	12.75
	Temperature (°C)	28.4	27.8	27.6	24.5	24.5	27	24.4	24.4
	Turbidity (m)				0.56				
	Bicarbonate (mg/L)				136				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				136				
Median	Dissolved oxygen (mg/L)	8.2	8.4	8.15	8	7.9	8	7.8	7.8
	Temperature (°C)	18.4	18.8	17.2	17.1	17.1	17.3	17.2	17.1
	Turbidity (m)				0.33				
	Bicarbonate (mg/L)				85				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				85				
Interquartile range	Dissolved oxygen (mg/L)	1.85	1.93	1.8975	2.025	1.9	2.195	2.52	2.295
	Temperature (°C)	10.7	10.5	9.8	9.4	9.5	10.1	9.3	9.2
	Turbidity (m)				0.16				
	Bicarbonate (mg/L)				68				
	Carbonate alkalinity (mg/L)				0				
	Hydroxide alkalinity (mg/L)				0				
	Total alkalinity (mg/L)				68				
Number of samples	Dissolved oxygen (mg/L)	39	39	40	40	40	40	40	40
	Temperature (°C)	39	39	40	40	40	40	40	40
	Turbidity (m)				13				
	Bicarbonate (mg/L)				13				
	Carbonate alkalinity (mg/L)				13				
	Hydroxide alkalinity (mg/L)				13				
	Total alkalinity (mg/L)				40				

[a] no measurement taken

Table 7-8. Radioactivity in surface and drinking waters (Bq/L), Livermore Valley, 1996.

Location	Date	Tritium	Gross alpha	Gross beta
Drinking waters				
BELL	1/22/96	2.4013 ± 0.0577	0.0111 ± 0.0518	0.0814 ± 0.052
	7/18/96	1.7094 ± 0.0292	0 ± 0.0352	0.03848 ± 0.133
GAS	1/22/96	2.3273 ± 0.0542	0.0481 ± 0.0518	0.0629 ± 0.056
	7/18/96	2.4272 ± 0.0589	0.04773 ± 0.0518	0 ± 0.133
PALM	1/22/96	2.1571 ± 0.0465	0.0111 ± 0.0592	0.1369 ± 0.093
	7/18/96	1.6243 ± 0.0264	0.0032375 ± 0.0407	0 ± 0.13
ORCH	1/22/96	2.4272 ± 0.0589	0.0555 ± 0.1517	0.5809 ± 0.181
	7/18/96	1.7205 ± 0.0296	0.04366 ± 0.0703	0.74 ± 0.163
TAP	1/22/96	2.1386 ± 0.0457	0.00999 ± 0.0204	0.0111 ± 0.044
	7/19/96	1.6317 ± 0.0266	0.06216 ± 0.0444	0.07918 ± 0.126
Surface waters				
CAL	1/22/96	2.1571 ± 0.0465	0.0629 ± 0.0444	0.0888 ± 0.052
	7/18/96	1.6613 ± 0.0276	0.06549 ± 0.0481	0.08621 ± 0.13
DEL	1/22/96	2.2385 ± 0.0501	0.0444 ± 0.0518	0.1258 ± 0.056
	7/18/96	3.996 ± 0.1597	0 ± 0.0444	0.10841 ± 0.133
DUCK	1/22/96	2.1497 ± 0.0462	0.1739 ± 0.2664	0.333 ± 0.281
	7/18/96	1.6946 ± 0.0287	0.05883 ± 0.1998	0.5032 ± 0.278
ALAG	1/22/96	2.2348 ± 0.0499	0.4292 ± 0.1702	0.2183 ± 0.118
	7/18/96	2.8564 ± 0.0816	0.07511 ± 0.0703	0 ± 0.133
SHAD	1/22/96	2.4605 ± 0.0605	0.0518 ± 0.0999	0.0851 ± 0.122
	7/18/96	2.4568 ± 0.0604	0.1036 ± 0.0666	0.04958 ± 0.137
ZON7	1/22/96	2.1386 ± 0.0457	0.0777 ± 0.0518	0.0962 ± 0.052
	7/18/96	1.7908 ± 0.0321	0.036038 ± 0.0444	0.22496 ± 0.141
On-site pool				
POOL	1/22/96	5.217 ± 0.2722	0.2886 ± 0.1887	0.1961 ± 0.159
	2/20/96	5.4279 ± 0.2946		
	3/20/96	5.291 ± 0.2799		
	4/25/96	5.513 ± 0.3039		
	5/16/96	3.3966 ± 0.1154		
	6/26/96	2.0942 ± 0.0439		
	7/19/96	1.6761 ± 0.0281	0.03959 ± 0.0518	0.05402 ± 0.137
	8/20/96	3.2301 ± 0.1043		
	9/17/96	2.2089 ± 0.0488		
	10/16/96	4.81 ± 0.2314		
	11/19/96	2.2829 ± 0.0521		
	12/17/96	1.6206 ± 0.0263		
Median		**2.2367**	**0.04995**	**0.08751**
Minimum		**1.6206**	**0**	**0**
Maximum		**5.513**	**0.4292**	**0.74**
Interquartile range		**0.8908**	**0.0380915**	**0.14874**

8

Ground Water

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Methods

Representative samples of ground water from monitoring wells were obtained by following the written protocols contained in the LLNL Environmental Restoration Project Standard Operating Procedures (Dibley and Depue 1996). The protocols cover sampling techniques and specific information for the analytes that are routinely searched for in ground water. Different sampling techniques were applied to different wells depending whether they were fitted with submersible pumps, 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 collected water samples. They wore disposable vinyl gloves to prevent accidental contamination during sampling and 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 on site in a laboratory dedicated to that purpose.

The ground water radioactivity data include some small negative values (in Bq/L). They occur when a correction for background radioactivity is subtracted from measurements of ground waters that contain little or no radioactive material.

Livermore Site

Tables 8-1 through **8-9** contain analytical data obtained from nine monitoring wells on and near the Livermore site. **Table 8-10** shows tritium activity in 21 ground water monitoring wells in the Livermore Valley.

Site 300

Tables 8-11 and **8-12** list the constituents of concern in ground and the Environmental Protection Agency (EPA) methods used to measure them. Data from Site 300

monitoring wells (Pits 6, 2, and 9; Elk Ravine; standby supply; water supply; and off site) are included in **Tables 8-13** through **8-44**. Data from wells monitored annually are in **Table 8-45**.

Tables 8-46 and **8-47** contain Pit 1 data pertaining to WDR 93-100 and Post Closure Plan COCs and statistical limits. **Tables 8-48** and **8-49** have similar data for Pit 7 monitoring wells. Constituents of concern that have statistical evidence of being released to ground water are listed in **Table 8-50**.

Data pertaining to water in surface impoundments in the Explosives Process Area are found in **Tables 8-51** to **8-57**. **Tables 8-54** to **8-56** contain data obtained from effluent monitoring of photographic and chemical process wastewater. Fourth quarter ground water data for constituents listed under WDR 96-248 are contained in **Tables 8-57** to **8-58**.

Table 8-1. Livermore site upgradient Well W-008.

	1st Quarter[a]	2nd Quarter[b]	3rd Quarter[c]	4th Quarter[d]
General indicator parameters				
pH	7.2	7.3	7	7.1
Specific conductance (μmho/cm)	2200	2300	1700	2500
Total dissolved solids (TDS) (mg/L)	1600	1600	1600	1500
Field temperature (°C)	19.7	19.8	19.9	19.6
Metals and minerals (mg/L)				
Bicarbonate alkalinity (as $CaCO_3$)	230	230	230	250
Carbonate alkalinity (as $CaCO_3$)	<1	<1	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1
Total alkalinity (as $CaCO_3$)	230	230	230	250
Aluminum	<0.2	<0.2	<0.2	<0.2
Antimony	<0.005	<0.005	<0.005	<0.005
Arsenic	<0.002	<0.002	<0.002	<0.002
Barium	<0.025	<0.025	<0.025	<0.025
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Boron	7.5	19.	8.7	8.6
Bromide	1.3	1.1	0.5	1.6
Cadmium	<0.0005	0.0015	0.0011	<0.0005
Calcium	100	120	120	97
Chloride	530	580	680	500
Chromium	0.0064	0.0045	0.0046	0.007
Cobalt	<0.05	<0.05	<0.05	<0.05
Copper	<0.05	<0.05	<0.05	<0.05
	<0.01	<0.01	0.011	<0.01
Cyanide	<0.02	<0.02	0.02	<0.02
Fluoride	1.3	2	0.99	1.3
Total hardness (as $CaCO_3$)	450	500	540	410
Chromium(VI)	0.0056	0.0051	0.006	0.0079
Iron	<0.1	<0.1	<0.1	0.2
Lead	<0.002	<0.002	<0.002	<0.002
Magnesium	48	50	58	50
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002

Table 8-1. Livermore site upgradient Well W-008 (continued).

	1st Quarter[a]	2nd Quarter[b]	3rd Quarter[c]	4th Quarter[d]
Metals and minerals (mg/L) (continued)				
Molybdenum	<0.05	<0.05	<0.05	<0.05
Nickel	<0.1	<0.1	<0.1	<0.1
	<0.005	<0.005	<0.005	<0.005
Nitrate (as NO_3)	16	16	19	18
Orthophosphate	<0.05	<0.05	<0.05	0.1
Total phosphorus (as PO_4)	0.12	<0.05	0.2	0.19
Potassium	2.1	1.8	2	1.7
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.0005	<0.0005
Sodium	360	330	390	350
Sulfate	300	350	390	290
Surfactant	<0.5	<0.5	<0.5	<0.5
Thallium	<0.001	<0.001	<0.001	<0.001
Vanadium	<0.05	<0.05	<0.05	<0.05
Zinc	<0.05	<0.05	<0.05	<0.05
	<0.02	<0.02	<0.02	<0.02
Semivolatile organic compounds (μg/L)	nd[e]	nd	na[f]	na
Organochlorine pesticides (μg/L)	nd	nd	na	na
Nitrogen-based herbicides (μg/L)	na	na	nd	nd
Glyphosate (Roundup) (μg/L)	na	na	nd	nd
Diuron (μg/L)	na	na	nd	nd
Other parameters				
Field pH	7.29	6.92	8.06	7.22
Field specific conductance (μmho/cm)	2630	2350	2330	2310
Nitrite (as N)	<2.5	5	<5	<0.5
Nitrate (as N)	3.7	3.7	4.3	4.1
Radioactivity (Bq/L)				
Gross alpha	0.407	0.148	0.259	0.37
Gross beta	<0.518	0.111	0.703	0.222

Table 8-1. Livermore site upgradient Well W-008 (concluded).

	1st Quarter[a]	2nd Quarter[b]	3rd Quarter[c]	4th Quarter[d]
Radioisotopes (Bq/L)				
Radium-226	0.0022	<0.0137	<0.0178	<0.0222
Radium-228	<0.111	0.148	0.037	<0.0999
Total radium	<0.113	<0.162	<0.055	<0.1221
Uranium-234 and uranium-233	0.1084	0.149	0.1276	0.113
Uranium-235 and uranium-236	0.0037	0.0067	0.0046	<0.002
Uranium-238	0.077	0.117	0.094	0.074
Total uranium	0.1891	0.2727	0.2262	<0.189
Tritium	<1.6909	<2.1719	<2.135	<1.19
Radon 222	na	7.03	4.07	1.11

a First quarter samples collected on 3/19/96.

b Second quarter samples collected on 6/18/96.

c Third quarter samples collected on 9/3/96.

d Fourth quarter samples collected on 12/12/96.

e nd = Not detected.

f na = Not analyzed.

Table 8-2. Livermore site upgradient Well W-221.

	1st Quarter[a]	2nd Quarter[b]	3rd Quarter[c]	4th Quarter[d]
General indicator parameters				
pH	7.1	7.2	6.9	7.1
Specific conductance (μmho/cm)	1500	1400	1100	1600
Total dissolved solids (TDS) (mg/L)	950	970	920	930
Field temperature (°C)	20.3	21.2	22.4	20.6
Metals and minerals (mg/L)				
Bicarbonate alkalinity (as $CaCO_3$)	320	270	330	320
Carbonate alkalinity (as $CaCO_3$)	<1	<1	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1
Total alkalinity (as $CaCO_3$)	320	270	330	320
Aluminum	<0.2	<0.2	<0.2	<0.2
Antimony	<0.005	<0.005	<0.005	<0.005
Arsenic	<0.002	<0.002	<0.002	<0.002
Barium	0.1	0.097	0.079	0.1
Beryllium	<0.0005	<0.0005	<0.0005	<0.0005
Boron	1.8	4.9	2.2	2.3
Bromide	0.71	0.95	<0.5	0.97
Cadmium	<0.0005	0.0005	<0.0005	<0.0005
Calcium	120	130	130	120
Chloride	310	320	720	120
Chromium	0.0057	0.0034	0.0041	0.0061
Cobalt	<0.05	<0.05	<0.05	<0.05
Copper	<0.05	<0.05	<0.05	<0.05
	<0.01	<0.01	<0.01	<0.01
Cyanide	<0.02	<0.02	<0.02	<0.02
Fluoride	0.74	1.2	0.75	0.75
Total hardness (as $CaCO_3$)	480	510	520	340
Chromium(VI)	0.0066	0.0078	0.006	0.0034
Iron	<0.1	<0.1	<0.1	<0.1
Lead	<0.002	<0.002	<0.002	<0.002
Magnesium	41	42	44	41
Manganese	<0.03	<0.03	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002	<0.0002

Table 8-2. Livermore site upgradient Well W-221 (continued).

	1st Quarter[a]	2nd Quarter[b]	3rd Quarter[c]	4th Quarter[d]
Metals and minerals (mg/L) (continued)				
Molybdenum	<0.05	<0.05	<0.05	<0.05
Nickel	<0.1	<0.1	<0.1	<0.1
	0.011	0.024	0.011	0.035
Nitrate (as NO_3)	21	23	28	21
Orthophosphate	<0.05	<0.05	<0.05	0.057
Total phosphorus (as PO_4)	0.39	<0.05	0.39	0.7
Potassium	2.4	1.8	1.9	1.6
Selenium	<0.002	<0.002	<0.002	<0.002
Silver	<0.0005	<0.0005	<0.0005	<0.0005
Sodium	140	140	140	140
Sulfate	68	83	84	40
Surfactant	<0.5	<0.5	<0.5	<0.5
Thallium	<0.001	<0.001	<0.001	<0.001
Vanadium	<0.05	<0.05	<0.05	<0.05
Zinc	<0.05	<0.05	<0.05	<0.05
	<0.02	<0.02	<0.02	<0.02
Semivolatile organic compounds (µg/L)	nd[e]	nd	na[f]	(nd, except for 230 µg/L benzoic acid)[e]
Organochlorine pesticides (µg/L)	nd	nd	na	na
Nitrogen-based herbicides (µg/L)	na	na	nd	nd
Glyphosate (Roundup) (µg/L)	na	na	nd	nd
Diuron (µg/L)	na	na	nd	nd
Other parameters				
Field pH	7.19	6.87	7.7	7.16
Field specific conductance (µmho/cm)	1710	1520	1360	1420
Nitrite (as N)	<2.5	<2.5	<5	<0.5
Nitrate (as N)	4.7	5.3	6.4	4.8
Radioactivity (Bq/L)				
Gross alpha	0.444	0.37	0.296	0.222
Gross beta	<0.074	0.111	<0.148	<0.185

Table 8-2. Livermore site upgradient Well W-221 (concluded).

	1st Quarter[a]	2nd Quarter[b]	3rd Quarter[c]	4th Quarter[d]
Radioisotopes (Bq/L)				
Radium-226	<0.0089	0.004	<0.0178	<0.0222
Radium-228	0.481	0.074	<0.0407	<0.0999
Total radium	<0.49	0.078	<0.0585	<0.1221
Uranium-234 and uranium-233	0.1806	0.165	0.1794	0.183
Uranium-235 and uranium-236	0.0067	0.007	0.0115	0.004
Uranium-238	0.1473	0.124	0.1397	0.132
Total uranium	0.3346	0.296	0.3306	0.319
Tritium	0.00289	2.675	<2.2015	<1.2654
Radon-222	na[f]	7.03	2.22	<0.74

a First quarter samples collected on 3/19/96.

b Second quarter samples collected on 6/18/96.

c Third quarter samples collected on 9/3/96.

d Fourth quarter samples collected on 12/12/96.

e nd = Not detected.

f na = Not analyzed.

Table 8-3. Livermore site downgradient Well 14B1 (near TFA).

	1st Quarter[a]	3rd Quarter[b]
General indicator parameters		
pH	7.6	7.2
Specific conductance (μmho/cm)	610	660
Total dissolved solids (TDS) (mg/L)	500	470
Field temperature (°C)	na[c]	na
Metals and minerals (mg/L)		
Bicarbonate alkalinity (as $CaCO_3$)	250	220
Carbonate alkalinity (as $CaCO_3$)	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1
Total alkalinity (as $CaCO_3$)	250	220
Aluminum	<0.2	<0.2
Antimony	<0.005	<0.005
Arsenic	<0.002	<0.002
Barium	0.099	0.086
Beryllium	<0.0005	<0.0005
Boron	0.61	0.75
Bromide	<0.5	<0.5
Cadmium	<0.0005	<0.0005
Calcium	56	110
Chloride	76	100
Chromium	0.013	0.0099
Cobalt	<0.05	<0.05
Copper	<0.05	<0.05
	<0.01	<0.01
Cyanide	<0.02	<0.02
Fluoride	0.44	0.29
Total hardness (as $CaCO_3$)	270	420
Chromium(VI)	0.012	0.0091
Iron	<0.1	<0.1
Lead	<0.002	<0.002
Magnesium	31	37
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002

Table 8-3. Livermore site downgradient Well 14B1 (near TFA) (continued).

	1st Quarter[a]	3rd Quarter[b]
Metals and minerals (mg/L) (continued)		
Molybdenum	<0.05	<0.05
Nickel	<0.1	<0.1
	<0.005	<0.005
Nitrate (as NO_3)	32	33
Orthophosphate	0.098	0.075
Total phosphorus (as PO_4)	<0.05	<0.05
Potassium	2.1	3.3
Selenium	<0.002	<0.002
Silver	<0.0005	<0.0005
Sodium	62	85
Sulfate	49	48
Surfactant	<0.5	<0.5
Thallium	<0.001	<0.001
Vanadium	<0.05	<0.05
Zinc	<0.05	<0.05
	0.037	0.033
Semivolatile organic compounds (μg/L)	nd[d]	na
Organochlorine pesticides (μg/L)	nd	na
Nitrogen-based herbicides (μg/L)	na	nd
Glyphosate (Roundup) (μg/L)	na	nd
Diuron (μg/L)	na	nd
Other parameters		
Field pH	na	na
Field specific conductance (μmho/cm)	na	na
Nitrite (as N)	na	na
Nitrate (as N)	na	na
Radioactivity (Bq/L)		
Gross alpha	0.111	0.148
Gross beta	0.185	0.185

Table 8-3. Livermore site downgradient Well 14B1 (near TFA) (concluded).

	1st Quarter[a]	3rd Quarter[b]
Radioisotopes (Bq/L)		
Radium-226	0.111	<0.0178
Radium-228	<0.111	<0.0407
Total radium	<0.222	<0.0585
Uranium-234 and uranium-233	0.0389	0.0356
Uranium-235 and uranium-236	0.0026	<0.0044
Uranium-238	0.0292	0.0278
Total uranium	0.0707	<0.0678
Tritium	1.983	4.625
Radon-222	na	7.77

a First quarter samples collected on 3/18/96.

b Third quarter samples collected on 8/26/96.

c na = Not analyzed.

d nd = Not detected.

Table 8-4. Livermore site downgradient Well W-1012 (near TFB).

	1st Quarter[a]	3rd Quarter[b]
General indicator parameters		
pH	7.4	7.1
Specific conductance (μmho/cm)	1000	810
Total dissolved solids (TDS) (mg/L)	580	640
Field temperature (°C)	19.2	19.4
Metals and minerals (mg/L)		
Bicarbonate alkalinity (as $CaCO_3$)	240	250
Carbonate alkalinity (as $CaCO_3$)	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1
Total alkalinity (as $CaCO_3$)	240	250
Aluminum	<0.2	<0.2
Antimony	<0.005	<0.005
Arsenic	<0.002	<0.002
Barium	0.098	0.12
Beryllium	<0.0005	<0.0005
Boron	0.52	0.67
Bromide	<0.5	<0.5
Cadmium	<0.0005	<0.0005
Calcium	90	98
Chloride	120	160
Chromium	0.014	0.015
Cobalt	<0.05	<0.05
Copper	<0.05	<0.05
	<0.01	<0.01
Cyanide	<0.02	<0.02
Fluoride	0.25	0.23
Total hardness (as $CaCO_3$)	350	380
Chromium(VI)	0.016	0.017
Iron	<0.1	<0.1
Lead	<0.002	<0.002
Magnesium	31	33
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002

Table 8-4. Livermore site downgradient Well W-1012 (near TFB) (continued).

	1st Quarter[a]	3rd Quarter[b]
Metals and minerals (mg/L) (continued)		
Molybdenum	<0.05	<0.05
Nickel	<0.1	<0.1
	<0.005	<0.005
Nitrate (as NO_3)[c]	75	80
Orthophosphate	<0.05	<0.05
Total phosphorus (as PO_4)	<0.05	<0.05
Potassium	2.9	2.9
Selenium	<0.002	0.0024
Silver	<0.0005	<0.0005
Sodium	88	77
Sulfate	37	29
Surfactant	<0.5	<0.5
Thallium	<0.001	<0.001
Vanadium	<0.05	<0.05
Zinc	<0.05	<0.05
	<0.02	<0.02
Semivolatile organic compounds (µg/L)	(nd[d], except for DEHP[e] detected at 21 µg/L)	nd[d]
Organochlorine pesticides (µg/L)	nd	na[f]
Nitrogen-based herbicides (µg/L)	na	nd
Glyphosate (Roundup) (µg/L)	na	nd
Diuron (µg/L)	na	nd
Other parameters		
Field pH	7.25	8.34
Field specific conductance (µmho/cm)	782	636
Radioactivity (Bq/L)		
Gross alpha	0.0259	0.111
Gross beta	0.111	0.222

Table 8-4. Livermore site downgradient Well W-1012 (near TFB) (concluded).

	1st Quarter[a]	3rd Quarter[b]
Radioisotopes (Bq/L)		
Radium-226	0.005	<0.0178
Radium-228	0.148	<0.0407
Total radium	0.153	<0.0585
Uranium-234 and uranium-233	0.0492	0.0587
Uranium-235 and uranium-236	0.0022	0.0046
Uranium-238	0.0355	0.0492
Total uranium	0.0869	0.1125
Tritium	<1.661	<2.120
Radon-222	na	na

a First quarter samples collected on 3/18/96.

b Third quarter samples collected on 9/4/96.

c Downgradient wells were sampled and analyzed semiannually, except for W-1012, which was sampled and analyzed for nitrates again in the Fourth Quarter, at which time 68 mg/L of nitrate (as NO_3) was found.

d nd = Not detected.

e DEHP = Bis(2-ethylhexyl)phthalate.

f na = Not analyzed.

Table 8-5. Livermore site downgradient Well W-121 (near TFA).

	1st Quarter[a]	3rd Quarter[b]
General indicator parameters		
pH	7.8	7.6
Specific conductance (μmho/cm)	740	580
Total dissolved solids (TDS) (mg/L)	450	430
Field temperature (°C)	19.7	19.7
Metals and minerals (mg/L)		
Bicarbonate alkalinity (as $CaCO_3$)	200	180
Carbonate alkalinity (as $CaCO_3$)	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1
Total alkalinity (as $CaCO_3$)	200	180
Aluminum	<0.2	<0.2
Antimony	<0.005	<0.005
Arsenic	<0.002	<0.002
Barium	0.056	0.044
Beryllium	<0.0005	<0.0005
Boron	0.68	0.91
Bromide	<0.5	<0.5
Cadmium	<0.0005	<0.0005
Calcium	43	46
Chloride	80	120
Chromium	0.01	0.01
Cobalt	<0.05	<0.05
Copper	<0.05	<0.05
	<0.01	<0.01
Cyanide	<0.02	<0.02
Fluoride	0.3	0.33
Total hardness (as $CaCO_3$)	240	260
Chromium(VI)	0.012	0.01
Iron	<0.1	<0.1
Lead	<0.002	<0.002
Magnesium	32	35
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002

Table 8-5. Livermore site downgradient Well W-121 (near TFA) (continued).

	1st Quarter[a]	3rd Quarter[b]
Metals and minerals (mg/L)		
Molybdenum	<0.05	<0.05
Nickel	<0.1	<0.1
	<0.005	<0.005
Nitrate (as NO_3)	36	37
Orthophosphate	0.069	0.072
Total phosphorus (as PO_4)	<0.05	0.11
Potassium	1.8	2
Selenium	<0.002	<0.002
Silver	<0.0005	<0.0005
Sodium	81	77
Sulfate	49	43
Surfactant	<0.5	<0.5
Thallium	<0.001	<0.001
Vanadium	<0.05	<0.05
Zinc	<0.05	<0.05
	<0.02	<0.02
Semivolatile organic compounds (μg/L)	nd[c]	nd
Organochlorine pesticides (μg/L)	nd	na[d]
Nitrogen-based herbicides (μg/L)	na	nd
Glyphosate (Roundup) (μg/L)	na	nd
Diuron (μg/L)	na	nd
Other parameters		
Field pH	7.85	7.99
Field specific conductance (μmho/cm)	659	188
Radioactivity (Bq/L)		
Gross alpha	<0.100	<0.229
Gross beta	<0.181	<0.155

Table 8-5. Livermore site downgradient Well W-121 (near TFA) (concluded).

	1st Quarter[a]	3rd Quarter[b]
Radioisotopes (Bq/L)		
Radium-226	0.0048	<0.0178
Radium-228	<0.111	0.0407
Total radium	<0.125	<0.0585
Uranium-234 and uranium-233	0.137	0.0188
Uranium-235 and uranium-236	0.0011	0.0011
Uranium-238	0.0093	0.0056
Total uranium	<0.1474	0.0255
Tritium	<1.739	<2.3162
Radon-222	na	0.007

a First quarter samples collected on 3/19/96.

b Third quarter samples collected on 9/4/96.

c na = Not detected.

d nd = Not analyzed.

Table 8-6. Livermore site downgradient Well W-151 (near TFA).

	1st Quarter[a]	3rd Quarter[b]
General indicator parameters		
pH	7.6	7.3
Specific conductance (µmho/cm)	840	630
Total dissolved solids (TDS) (mg/L)	510	510
Field temperature (°C)	19.3	19.2
Metals and minerals (mg/L)		
Bicarbonate alkalinity (as $CaCO_3$)	240	240
Carbonate alkalinity (as $CaCO_3$)	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1
Total alkalinity (as $CaCO_3$)	240	240
Aluminum	<0.2	<0.2
Antimony	<0.005	<0.005
Arsenic	<0.002	0.0022
Barium	0.071	0.068
Beryllium	<0.0005	<0.0005
Boron	0.61	0.83
Bromide	<0.5	<0.5
Cadmium	<0.0005	<0.0005
Calcium	57	63
Chloride	80	110
Chromium	0.016	0.016
Cobalt	<0.05	<0.05
Copper	<0.05	<0.05
	<0.01	<0.01
Cyanide	<0.02	<0.02
Fluoride	0.29	0.31
Total hardness (as $CaCO_3$)	300	330
Chromium(VI)	0.017	0.015
Iron	<0.1	<0.1
Lead	<0.002	<0.002
Magnesium	38	43

Table 8-6. Livermore site downgradient Well W-151 (near TFA) (continued).

	1st Quarter[a]	3rd Quarter[b]
Metals and minerals (mg/L) (continued)		
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002
Molybdenum	<0.05	<0.05
Nickel	<0.1	<0.1
	<0.005	<0.005
Nitrate (as NO_3)	40	43
Orthophosphate	0.082	0.075
Total phosphorus (as PO_4)	<0.05	<0.05
Potassium	1.9	2
Selenium	<0.002	<0.002
Silver	<0.0005	<0.0005
Sodium	74	77
Sulfate	55	40
Surfactant	<0.5	<0.5
Thallium	<0.001	<0.001
Vanadium	<0.05	<0.05
Zinc	<0.05	<0.05
	<0.02	<0.02
Semivolatile organic compounds (μg/L)	nd[c]	nd
Organochlorine pesticides (μg/L)	nd	na[d]
Nitrogen-based herbicides (μg/L)	na	nd
Glyphosate (Roundup) (μg/L)	na	nd
Diuron (μg/L)	na	nd
Other parameters		
Field pH	7.46	7.71
Field specific conductance (μmho/cm)	845	598
Radioactivity (Bq/L)		
Gross alpha	0.037	0.015
Gross beta	0.074	0.074

Table 8-6. Livermore site downgradient Well W-151 (near TFA) (concluded).

	1st Quarter[a]	3rd Quarter[b]
Radioisotopes (Bq/L)		
Radium-226	0.0007	<0.0178
Radium-228	<0.111	<0.0407
Total radium	<0.1117	<0.0585
Uranium-234 and uranium-233	0.0255	0.036
Uranium-235 and uranium-236	0.0004	0.0019
Uranium-238	0.0233	0.0232
Total uranium	0.0492	0.0611
Tritium	3.848	<2.327
Radon-222	na	<0.74

a First quarter samples collected on 3/19/96.

b Third quarter samples collected on 9/4/96.

c na = Not detected.

d nd = Not analyzed.

Table 8-7. Livermore site downgradient Well W-373 (near TFC).

	1st Quarter[a]	3rd Quarter[b]
General indicator parameters		
pH	7.4	7.3
Specific conductance (μmho/cm)	900	840
Total dissolved solids (TDS) (mg/L)	530	510
Field temperature (°C)	18.9	19.4
Metals and minerals (mg/L)		
Bicarbonate alkalinity (as $CaCO_3$)	200	200
Carbonate alkalinity (as $CaCO_3$)	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1
Total alkalinity (as $CaCO_3$)	200	200
Aluminum	<0.2	<0.2
Antimony	<0.005	<0.005
Arsenic	0.053	<0.002
Barium	0.045	<0.025
Beryllium	<0.0005	<0.0005
Boron	1.7	1.8
Bromide	0.62	<0.5
Cadmium	<0.0005	<0.0005
Calcium	57	62
Chloride	110	130
Chromium	0.083	0.076
Cobalt	<0.05	<0.05
Copper	<0.05	<0.05
	<0.01	<0.01
Cyanide	<0.02	<0.02
Fluoride	0.95	0.52
Total hardness (as $CaCO_3$)	200	240
Chromium(VI)	0.076	0.056
Iron	<0.1	<0.1
Lead	0.0032	<0.002
Magnesium	19	21
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002

Table 8-7. Livermore site downgradient Well W-373 (near TFC) (continued).

	1st Quarter[a]	3rd Quarter[b]
Metals and minerals (mg/L) (continued)		
Molybdenum	<0.05	<0.05
Nickel	<0.1	<0.1
	<0.005	<0.005
Nitrate (as NO_3)	12	12
Orthophosphate	<0.05	<0.05
Total phosphorus (as PO_4)	0.12	<0.05
Potassium	1.8	1.3
Selenium	0.0053	<0.002
Silver	<0.0005	<0.0005
Sodium	110	120
Sulfate	88	59
Surfactant	<0.5	<0.5
Thallium	<0.001	<0.001
Vanadium	<0.05	<0.05
Zinc	<0.05	<0.05
	<0.02	<0.02
Semivolatile organic compounds (µg/L)	(nd[c], except for DEP detected at 17 µg/L)	na[d]
Organochlorine pesticides (µg/L)	nd	na
Nitrogen-based herbicides (µg/L)	na	nd
Glyphosate (Roundup) (µg/L)	na	nd
Diuron (µg/L)	na	nd
Other parameters		
Field pH	7.45	7.78
Field specific conductance (µmho/cm)	924	611
Radioactivity (Bq/L)		
Gross alpha	0.148	<0.078
Gross beta	0.074	0.037

Table 8-7. Livermore site downgradient Well W-373 (near TFC) (concluded).

	1st Quarter[a]	3rd Quarter[b]
Radioisotopes (Bq/L)		
Radium 226	<0.037	<0.0178
Radium-228	<0.111	<0.0407
Total radium	<0.148	<0.588
Uranium-234 and uranium-233	0.0418	0.0411
Uranium-235 and uranium-236	<0.0004	0.0018
Uranium-238	0.0315	0.037
Total uranium	0.0737	0.0799
Tritium	11.99	11.5
Radon-222	na	na

Downgradient wells were sampled and analyzed semiannually, not quarterly.

a First quarter samples collected on 3/19/96.

b Third quarter samples collected on 9/4/96.

c na = Not detected.

d nd = Not analyzed.

DEP = Diethylphthalate.

Table 8-8. Livermore site downgradient Well W-556 (near TFC).

	1st Quarter[a]	3rd Quarter[b]
General indicator parameters		
pH	7.3	7.2
Specific conductance (μmho/cm)	910	860
Total dissolved solids (TDS) (mg/L)	530	530
Field temperature (°C)	18.3	18.4
Metals and minerals (mg/L)		
Bicarbonate alkalinity (as $CaCO_3$)	240	260
Carbonate alkalinity (as $CaCO_3$)	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1
Total alkalinity (as $CaCO_3$)	240	260
Aluminum	0.32	<0.2
Antimony	<0.005	<0.005
Arsenic	<0.002	<0.002
Barium	0.078	0.052
Beryllium	<0.0005	<0.0005
Boron	1.1	1.1
Bromide	<0.5	<0.5
Cadmium	<0.0005	<0.0005
Calcium	64	69
Chloride	160	130
Chromium	0.031	0.027
Cobalt	<0.05	<0.05
Copper	<0.05	<0.05
	<0.01	<0.01
Cyanide	<0.02	<0.02
Fluoride	0.63	0.32
Total hardness (as $CaCO_3$)	270	270
Chromium(VI)	0.027	0.025
Iron	0.27	<0.1
Lead	<0.002	<0.002
Magnesium	22	23
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002

Table 8-8. Livermore site downgradient Well W-556 (near TFC) (continued).

	1st Quarter[a]	3rd Quarter[b]
Metals and minerals (mg/L) (continued)		
Molybdenum	<0.05	<0.05
Nickel	<0.1	<0.1
	<0.005	<0.005
Nitrate (as NO_3)	27	29
Orthophosphate	0.059	<0.05
Total phosphorus (as PO_4)	0.16	0.056
Potassium	2.3	1.6
Selenium	<0.002	<0.002
Silver	<0.0005	<0.0005
Sodium	120	110
Sulfate	53	38
Surfactant	<0.5	<0.5
Thallium	<0.001	<0.001
Vanadium	<0.05	<0.05
Zinc	<0.05	<0.05
	<0.02	<0.02
Semivolatile organic compounds (µg/L)	(nd[c], except for DEP detected at 15 µg/L)	nd
Organochlorine pesticides (µg/L)	nd	na[d]
Nitrogen-based herbicides (µg/L)	na	nd
Glyphosate (Roundup) (µg/L)	na	nd
Diuron (µg/L)	na	nd
Other parameters		
Field pH	7.37	7.74
Field specific conductance (µmho/cm)	761	684
Radioactivity (Bq/L)		
Gross alpha	0.148	0.185
Gross beta	<0.163	0.074

Table 8-8. Livermore site downgradient Well W-556 (near TFC) (concluded).

	1st Quarter[a]	3rd Quarter[b]
Radioisotopes (Bq/L) (continued)		
Radium 226	<0.037	<0.018
Radium-228	0.111	<0.0407
Total radium	0.148	<0.0585
Uranium-234 and uranium-233	0.0485	0.0555
Uranium-235 and uranium-236	0.0015	0.001
Uranium-238	0.0344	0.0411
Total uranium	0.0844	0.0976
Tritium	1.82	<2.272
Radon-222	na	na

Downgradient wells were sampled and analyzed semiannually, not quarterly.

a First quarter samples collected on 3/19/96.

b Third quarter samples collected on 9/4/96.

c na = Not detected.

d nd = Not analyzed.

DEP = Diethylphthalate.

Table 8-9. Livermore site downgradient Well W-571 (near TFB).

	1st Quarter[a]	3rd Quarter[b]
General indicator parameters		
pH	7.5	7.3
Specific conductance (μmho/cm)	810	640
Total dissolved solids (TDS) (mg/L)	480	470
Field temperature (°C)	19.2	18.9
Metals and minerals (mg/L)		
Bicarbonate alkalinity (as $CaCO_3$)	240	240
Carbonate alkalinity (as $CaCO_3$)	<1	<1
Hydroxide alkalinity (as $CaCO_3$)	<1	<1
Total alkalinity (as $CaCO_3$)	240	240
Aluminum	<0.2	<0.2
Antimony	<0.005	<0.005
Arsenic	<0.002	0.0031
Barium	0.079	0.07
Beryllium	<0.0005	<0.0005
Boron	0.53	0.64
Bromide	<0.50	<0.5
Cadmium	<0.0005	<0.0005
Calcium	67	75
Chloride	79	120
Chromium	0.02	0.019
Cobalt	<0.05	<0.05
Copper	<0.05	<0.05
	<0.01	<0.01
Cyanide	<0.02	<0.02
Fluoride	0.33	0.35
Total hardness (as $CaCO_3$)	270	300
Chromium(VI)	0.021	0.019
Iron	<0.1	<0.1
Lead	<0.002	<0.002
Magnesium	25	28
Manganese	<0.03	<0.03
Mercury	<0.0002	<0.0002

Table 8-9. Livermore site downgradient Well W-571 (near TFB) (continued).

	1st Quarter[a]	3rd Quarter[b]
Metals and minerals (mg/L) (continued)		
Molybdenum	<0.05	<0.05
Nickel	<0.1	<0.1
	<0.005	<0.005
Nitrate (as NO_3)	39	42
Orthophosphate	0.064	0.062
Total phosphorus (as PO_4)	<0.05	<0.2
Potassium	2.4	2.7
Selenium	<0.002	<0.002
Silver	<0.0005	<0.0005
Sodium	76	80
Sulfate	43	37
Surfactant	<0.5	<0.5
Thallium	<0.001	<0.001
Vanadium	<0.05	<0.05
Zinc	<0.05	<0.05
	<0.02	<0.02
Semivolatile organic compounds (μg/L)	(nd[c], except for DEHP detected at 19 μg/L)	(nd, except for DEHP detected at 14 μg/L)
Organochlorine pesticides (μg/L)	nd	na[d]
Nitrogen-based herbicides (μg/L)	na	nd
Glyphosate (Roundup) (μg/L)	na	nd
Diuron (μg/L)	na	nd
Other parameters		
Field pH	7.35	7.68
Field specific conductance (μmho/cm)	795	511
Radioactivity (Bq/L)		
Gross alpha	0.148	0.074
Gross beta	0.074	0.037

Table 8-9. Livermore site downgradient Well W-571 (near TFB) (concluded).

	1st Quarter[a]	3rd Quarter[b]
Radioisotopes (Bq/L) (continued)		
Radium 226	0.004	0.007
Radium-228	0.0148	<0.041
Total radium	0.0188	<0.037
Uranium-234 and uranium-233	0.0551	0.0588
Uranium-235 and uranium-236	0.003	0.0037
Uranium-238	0.0363	0.04255
Total uranium	0.0944	0.105
Tritium	2.58	2.43
Radon-222	na	na

a First quarter samples collected on 3/19/96.

b Third quarter samples collected on 9/4/96.

c na = Not detected.

d nd = Not analyzed.

DEHP = Bis(2-ethylhexyl)phthalate.

Table 8-10. Tritium activity in Livermore Valley wells, 1996.

Location	Sampling date	Tritium activity (Bq/L)
11B1	9/25	13.9 ± 2.61
12A2	9/25	3.3 ± 2.29
12D2	9/25	9.18 ± 2.44
12G1	9/25	10.7 ± 2.52
16L5	7/16	2.82 ± 2.26
16L7	7/16	<2.15
17D2	7/9	<2.18
18A1	7/9	<2.18
1H3	9/25	<2.19
1P2	9/25	4.44 ± 2.33
1R2	9/25	2.39 ± 2.26
2R1	9/25	<2.26
004	9/25	8.77 ± 2.45
9M2	7/9	<2.18
9M3	7/9	<2.07
16B1	7/10	3.85 ± 2.31
7C2	9/25	4.03 ± 2.31
7P3	7/10	2.32 ± 2.25
8F1	7/10	2.92 ± 2.27
8P1	7/10	2.78 ± 2.28
9Q1	7/10	<2.22

Table 8-11. List of ground water analyses showing constituent, standard measurement method used, and typical reporting limit used by analytical laboratory.

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 204.2	0.005
Arsenic	EPA 206.2	0.002
Barium	EPA 200.7	0.025
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	0.001
Cobalt	EPA 200.7	0.025
Copper	EPA 200.7	0.01
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 245.2	0.0002
Molybdenum	EPA 200.7	0.025
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	0.0005
Sodium	EPA 200.7	1
Sulfate	EPA 300.0	1
Surfactants	EPA 425.1	0.5
Thallium	EPA 279.2	0.001
Total dissolved solids	EPA 160.1	1
Total Kjeldahl nitrogen	EPA 351.4	0.2
Total suspended solids	EPA 160.2	1

Table 8-11. List of ground water analyses showing constituent, standard measurement method used, and typical reporting limit used by analytical laboratory (concluded).

Constituent	Method	Reporting limit
Metals and minerals (mg/L) (continued)		
Vanadium	EPA 200.7	0.025
Zinc	EPA 200.7	0.02
Phenolics (mg/L)		
Phenolics	EPA 420.1	0.005
General indicator parameters		
pH	EPA 150.1	none
Specific conductance (µmho/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	0.1
Gross beta	EPA 900	0.1
Radioisotopes (Bq/L)		
Radon-222	EPA 913	0.4
Radium-226	EPA 903	0.1
Thorium-228	U-NAS-NS-3050	0.1
Thorium-232	U-NAS-NS-3050	0.1
Tritium	LLNL-RAS-011	1
Uranium-234	U-NAS-NS-3050	0.1
Uranium-235	U-NAS-NS-3050	0.1
Uranium-238	U-NAS-NS-3050	0.1

Table 8-12. List of ground water analyses for organic constituents by EPA Method.

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
Nitrogen-based herbicides	
Atrazine	1
Bromocil	2

Table 8-12. List of ground water analyses for organic constituents by EPA Method (continued).

Constituent	Reporting limit (μg/L)
Nitrogen-based herbicides (continued)	
Butachlor	1
Diazinon	2
Dimethoate	2
Metolachlor	1
Metribuzin	0.5
Molinate	2
Prometryne	2
Propachlor	1
Simazine	2
Thiobencarb	1
EPA Method 524.2	
1,1,1,2-Tetrachloroethane	1
1,1,1-Trichloroethane	1
1,1,2,2-Tetrachloroethane	1
1,1,2-Trichloroethane	1
1,1-Dichloroethane	1
1,1-Dichloroethene	1
1,1-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

Table 8-12. List of ground water analyses for organic constituents by EPA Method (continued).

Constituent	Reporting limit (μg/L)
EPA Method 524.2 (continued)	
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
Glyphosate (Roundup)	
Glyphosate	20
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
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
EPA Method 602	
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
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

Table 8-12. List of ground water analyses for organic constituents by EPA Method (continued).

Constituent	Reporting limit (μg/L)
EPA Method 608 (continued)	
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
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

Constituent	Reporting limit (μg/L)
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
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

Table 8-12. List of ground water analyses for organic constituents by EPA Method (continued).

Constituent	Reporting limit (μg/L)
EPA Method 624 (continued)	
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
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
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

Table 8-12. List of ground water analyses for organic constituents by EPA Method (concluded).

Constituent	Reporting limit (μg/L)
EPA Method 625 (continued)	
Isophorone	10
m- and *p*-Cresol	10
N-Nitroso-di-*n*-propylamine	10
N-Nitrosodiphenylamine	10
Naphthalene	10
Nitrobenzene	10
Pentachlorophenol	50
Phenanthrene	10
Phenol	10
Pyrene	10
Diuron	0.1

Table 8-13. Analyses for Pit 6 Well K6-01.

Constituent of concern	Sampled	
	5/29/96	12/3/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	13	17
Barium	38	33
Beryllium	<0.5	<0.5
Cadmium	0.95	<0.5
Chromium	1.2	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	3.5	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	26
Nickel	—[a]	<5
Selenium	<2	<2
Silver	0.77	<0.5
Thallium	<1	<1
Vanadium	<25	<25
Zinc	—[a]	<20
Inorganic compounds (mg/L)		
Nitrate	<0.5	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds (μg/L)[b]		
Volatile (EPA Method 601)	nd[c] except for:	nd
cis-1,2-Dichloroethene	0.64	nd
Pesticides (EPA Method 608)	—[a]	nd
Radioactivity (Bq/L)		
Gross alpha	0.09	0.06
Gross beta	0.25	0.33
Radioisotopes (Bq/L)		
Tritium	–1.99	–0.38

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-14. Analyses for Pit 6 Well K6-03.

Constituent of concern	Sampled	
	5/29/96	12/3/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	16	23
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	1.1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	3.2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	36
Nickel	—[a]	<5
Selenium	<2	<2
Silver	0.55	<0.5
Thallium	<1	<1
Vanadium	<25	<25
Zinc	—[a]	<20
Inorganic compounds (mg/L)		
Nitrate	<0.5	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Pesticides (EPA Method 608)	—[a]	nd
Radioactivity (Bq/L)		
Gross alpha	0.00	0.08
Gross beta	0.17	0.27
Radioisotopes (Bq/L)		
Tritium	–1.25	0.31

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-15. Analyses for Pit 6 Well K6-04.

Constituent of concern	Sampled	
	5/29/96	12/3/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	13	17
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	1.1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	3.5	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<40
Nickel	—[a]	<5
Selenium	<2	<2
Silver	0.5	<0.5
Thallium	<1	<1
Vanadium	<25	<25
Zinc	—[a]	<20
Inorganic compounds (mg/L)		
Nitrate	6.2	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Pesticides (EPA Method 608)	—[a]	nd
Radioactivity (Bq/L)		
Gross alpha	0.04	0.09
Gross beta	0.32	0.27
Radioisotopes (Bq/L)		
Tritium	–1.90	–0.40

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-16. Analyses for Pit 6 Well EP6-07.

Constituent of concern	Sampled	
	5/31/96	12/4/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	24	22
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	6.4	<2
Mercury	<0.2	0.5
Molybdenum	—[a]	27
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	<25	<25
Zinc	—[a]	<20
Inorganic compounds (mg/L)		
Nitrate	<0.5	—[a]
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Pesticides (EPA Method 608)	—[a]	nd
HE compounds (μg/L)		
HMX, RDX	<5	<5
Radioactivity (Bq/L)		
Gross alpha	–0.01	0.04
Gross beta	0.30	0.32
Radioisotopes (Bq/L)		
Tritium	0.97	–0.49

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-17. Analyses for Pit 6 Well EP6-08.

Constituent of concern	Sampled	
	5/31/96	12/4/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	19	17
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	6.1	<2
Mercury	<0.2	0.5
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	<25	<25
Zinc	—[a]	30
Inorganic compounds (mg/L)		
Nitrate	2.7	—[a]
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Pesticides (EPA Method 608)	—[a]	nd
HE compounds (μg/L)		
HMX, RDX	<5	<5
Radioactivity (Bq/L)		
Gross alpha	–0.02	0.08
Gross beta	0.38	0.37
Radioisotopes (Bq/L)		
Tritium	–0.67	–1.63

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-18. Analyses for Pit 6 Well EP6-09.

Constituent of concern	Sampled	
	5/3/96	12/3/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	15	17
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	33
Nickel	—[a]	<5
Selenium	3.2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	<25	<25
Zinc	—[a]	<20
Inorganic compounds (mg/L)		
Nitrate	4	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds (μg/L)[b]		
Volatile (EPA Method 601)	nd[c] except for:	nd except for:
Trichloroethene (TCE)	13	14
Pesticides (EPA Method 608)	—[a]	nd
Radioactivity (Bq/L)		
Gross alpha	0.03	0.14
Gross beta	0.26	0.36
Radioisotopes (Bq/L)		
Tritium	0.56	–0.12

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-19. Analyses for Pit 2 Well K1-01 Barcad A.

Constituent of concern	Sampled	
	5/23/96	11/7/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	9.2	8
Barium	47	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<50	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	—[a]	<1
Vanadium	<50	<25
Zinc	—[a]	<20
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	—[a]
Radioactivity (Bq/L)		
Gross alpha	0.11	0.07
Gross beta	0.17	0.21
Radioisotopes (Bq/L)		
Tritium	–1.83	–1.58

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-20. Analyses for Pit 2 Well K1-01 Barcad B.

Constituent of concern	Sampled	
	5/23/96	11/7/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	11	13
Barium	31	46
Beryllium	<0.5	<0.5
Cadmium	1.3	<0.5
Chromium	<1	<1
Cobalt	<50	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	1.9	<0.5
Thallium	—[a]	<1
Vanadium	<50	<25
Zinc	—[a]	<20
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	—[a]
Radioactivity (Bq/L)		
Gross alpha	–0.01	0.00
Gross beta	0.39	0.13
Radioisotopes (Bq/L)		
Tritium	–0.65	1.29

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-21. Analyses for Pit 2 Well K1-02 Barcad A.

Constituent of concern	Sampled	
	5/23/96	11/7/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	13	16
Barium	33	33
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<50	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	0.5	<0.5
Thallium	—[a]	<1
Vanadium	<50	<25
Zinc	—[a]	<20
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	—[a]
Radioactivity (Bq/L)		
Gross alpha	0.06	0.06
Gross beta	0.19	0.17
Radioisotopes (Bq/L)		
Tritium	–2.47	1.19

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-22. Analyses for Pit 2 Well K2-01 Barcad A.

Constituent of concern	Sampled	
	5/22/96	11/7/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	<2	<2
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<50	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	—[a]	<1
Vanadium	<50	<25
Zinc	—[a]	<20
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	—[a]
Radioactivity (Bq/L)		
Gross alpha	0.06	0.05
Gross beta	0.14	0.19
Radioisotopes (Bq/L)		
Tritium	–2.17	–0.26

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-23. Analyses for Pit 2 Well K2-01 Barcad B.

Constituent of concern	Sampled	
	5/22/96	11/7/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	24	22
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	1.2	<1
Cobalt	<50	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	—[a]	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	0.52	<0.5
Thallium	—[a]	<1
Vanadium	<50	<25
Zinc	—[a]	<20
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	—[a]
Radioactivity (Bq/L)		
Gross alpha	0.21	0.10
Gross beta	0.21	0.20
Radioisotopes (Bq/L)		
Tritium	3.00	7.92

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-24. Analyses for Pit 2 Well K2-02 Barcad A.

Constituent of concern	Sampled	
	5/22/96	11/7/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	40	44
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<50	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	—[a]	<1
Vanadium	<50	<25
Zinc	—[a]	<20
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	—[a]
Radioactivity (Bq/L)		
Gross alpha	0.25	0.17
Gross beta	0.12	0.16
Radioisotopes (Bq/L)		
Tritium	–0.18	–0.05

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-25. Analyses for Pit 2 Well K2-02 Barcad B.

Constituent of concern	Sampled	
	5/22/96	11/7/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	<2	<2
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<50	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	—[a]	<1
Vanadium	<50	<25
Zinc	—[a]	<20
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	—[a]
HE compounds (μg/L)		
HMX, RDX	<5	—[a]
Radioactivity (Bq/L)		
Gross alpha	0.00	0.02
Gross beta	0.23	0.10
Radioisotopes (Bq/L)		
Tritium	–1.39	1.46

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-26. Analyses for Pit 9 Wells.

Constituent of concern	K9-01	K9-02	K9-03	K9-04
	Sampled			
	8/8/96	8/8/96	8/8/96	8/12/96
Elements (μg/L)				
Antimony	<5	<5	<5	<5
Arsenic	5	30	12	<2
Barium	<25	<25	<25	<25
Beryllium	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5
Chromium	<1	<1	<1	<1
Cobalt	<25	<25	<25	<25
Copper	<1	<1	<1	15
Lead	<2	<2	<2	<2
Mercury	<0.2	<0.2	<0.2	<0.2
Molybdenum	<50	<50	<50	<50
Nickel	<5	<5	14	<5
Selenium	<2	<2	<2	<2
Silver	0.6	0.5	0.8	0.6
Thallium	<1	<1	<1	<1
Vanadium	<25	<25	<25	<25
Zinc	<20	<20	<20	<20
Inorganic compounds (mg/L)				
Nitrate	<0.5	<0.5	<0.5	<0.5
HE compounds (μg/L)				
HMX, RDX	<5	<5	<5	<5
Organic compounds[a]				
Volatile (EPA Method 601)	nd[b]	nd	nd	nd
Radioactivity (Bq/L)				
Gross alpha	–0.05	–0.08	–0.02	–0.04
Gross beta	0.18	0.49	0.46	0.67
Radioisotopes (Bq/L)				
Tritium	0.20	0.73	–1.45	1.92

a See **Table 8-12** for method constituents and their reporting limits.

b nd = Not detected above reporting limits.

Table 8-27. Analyses for Elk Ravine Well K7-07.

Constituent of concern	Sampled	
	5/20/96	11/19/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	15	13
Barium	66	76
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	1.1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	2.1	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	33	30
Zinc	—[a]	<20
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.26	0.12
Gross beta	0.37	0.12
Radioisotopes (Bq/L)		
Tritium	238	139

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-28. Analyses for Elk Ravine Well NC7-61.

Constituent of concern	Sampled	
	5/20/96	11/21/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	11	14
Barium	140	120
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	2.8	2.8
Cobalt	<25	<25
Copper	—[a]	<10
Lead	3.1	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	92	90
Zinc	—[a]	<20
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.54	0.30
Gross beta	0.32	0.28
Radioisotopes (Bq/L)		
Tritium	6327	6549

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-29. Analyses for Elk Ravine Well NC7-69.

Constituent of concern	Sampled	
	5/20/96	11/20/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	<2	<2
Barium	49	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	2.2	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	38
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	37	<25
Zinc	—[a]	<20
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.13	0.02
Gross beta	0.27	0.17
Radioisotopes (Bq/L)		
Tritium	–1.40	0.35

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-30. Analyses for Elk Ravine Well K2-04D.

Constituent of concern	Sampled	
	5/21/96	11/20/96
Elements (μg/L)		
Antimony	—[a]	10
Arsenic	9	11
Barium	40	34
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	3.4	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	34
Nickel	—[a]	<5
Selenium	<2	2.2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	57	56
Zinc	—[a]	<20
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.12	0.09
Gross beta	0.20	0.14
Radioisotopes (Bq/L)		
Tritium	400	156

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-31. Analyses for Elk Ravine Well K2-04S.

Constituent of concern	Sampled	
	5/21/96	11/19/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	10	14
Barium	62	64
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	1.1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	2.4	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	29
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	53	58
Zinc	—[a]	<20
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.23	0.16
Gross beta	0.13	0.16
Radioisotopes (Bq/L)		
Tritium	1202	1310

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-32. Analyses for Elk Ravine Well K2-01C.

Constituent of concern	Sampled	
	5/21/96	11/20/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	<2	42
Barium	210	34
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	3.8	<2
Mercury	<0.2	<0.2
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	0.5
Thallium	<1	<1
Vanadium	89	36
Zinc	—[a]	<20
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.46	0.19
Gross beta	0.39	0.26
Radioisotopes (Bq/L)		
Tritium	305	463

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-33. Analyses for Elk Ravine Well NC2-11D.

Constituent of concern	Sampled	
	5/7/96	11/25/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	14	13
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	0.5
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	2	2.9
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	47	50
Zinc	—[a]	<20
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.14	—[a]
Gross beta	0.20	—[a]
Radioisotopes (Bq/L)		
Tritium	94	106

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-34. Analyses for Elk Ravine Well NC2-12D.

Constituent of concern	Sampled	
	5/7/96	12/17/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	13	10
Barium	<25	<25
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	2.9	2.1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	<2	<2
Molybdenum	—[a]	<25
Mercury	<0.2	<0.2
Nickel	—[a]	<5
Selenium	<2	3.6
Silver	<0.5	<0.5
Thallium	<1	1
Vanadium	45	37
Zinc	—[a]	34
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.16	—[a]
Gross beta	0.19	—[a]
Radioisotopes (Bq/L)		
Tritium	199	233

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-35. Analyses for Elk Ravine Spring 812CRK.

Constituent of concern	Sampled	
	5/8/96[a]	11/19/96
Elements (μg/L)		
Antimony	<5	<5
Arsenic	31	23
Barium	<25	91
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	<10	<10
Lead	<2	<2
Mercury	<0.2	<0.2
Molybdenum	<25	<25
Nickel	<5	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	32	51
Zinc	<20	<20
HE compounds (μg/L)		
HMX, RDX	—[b]	<5
Organic compounds[c]		
Volatile (EPA Method 601)	nd[d]	nd
Radioactivity (Bq/L)		
Gross alpha	0.36	0.23
Gross beta	0.26	0.36
Radioisotopes (Bq/L)		
Tritium	0.16	0.97
Uranium (total)	0.23	0.21

a Elements sampled 9/16/96.

b Analysis not planned.

c See **Table 8-12** for method constituents and their reporting limits.

d nd = Not detected above reporting limits.

Table 8-36. Analyses for Elk Ravine Well NC2-07.

Constituent of concern	Sampled	
	5/8/96	11/25/96
Elements (μg/L)		
Antimony	—[a]	<5
Arsenic	35	36
Barium	27	34
Beryllium	<0.5	<0.5
Cadmium	<0.5	<0.5
Chromium	<1	<1
Cobalt	<25	<25
Copper	—[a]	<10
Lead	<2	<2
Mercury	<0.2	0.36
Molybdenum	—[a]	<25
Nickel	—[a]	<5
Selenium	<2	<2
Silver	<0.5	<0.5
Thallium	<1	<1
Vanadium	52	51
Zinc	—[a]	<20
HE compounds (μg/L)		
HMX, RDX	<5	<5
Organic compounds[b]		
Volatile (EPA Method 601)	nd[c]	nd
Radioactivity (Bq/L)		
Gross alpha	0.30	—[a]
Gross beta	0.39	—[a]
Radioisotopes (Bq/L)		
Tritium	–0.22	0.74

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-37. Analyses for standby supply Well 18.

Constituent of concern	Sampled			
	1/17/96	4/17/96	7/17/96	10/16/96
Organic compounds[a]				
Volatile (EPA Method 502.2)	nd[b]	nd	nd	nd
Radioactivity (Bq/L)				
Gross alpha	0.35	0.22	0.00	0.31
Gross beta	0.32	0.30	0.15	0.29
Radioisotopes (Bq/L)				
Tritium	0.41	0.90	–0.79	–1.75

a See **Table 8-12** for method constituents and their reporting limits.

b nd = Not detected above reporting limits.

Table 8-38. Analyses for water supply Well 20.

Constituent of concern	Sampled			
	1/29/96	4/19/96	7/12/96	10/30/96
Elements (μg/L)				
Antimony	—[a]	—[a]	<5	<5
Arsenic	<2	<2	<2	<2
Barium	—[a]	<25	<25	<25
Beryllium	<0.5	<0.5	<0.5	<0.5
Cadmium	—[a]	<0.5	<0.5	<0.5
Chromium	<10	<1	<1	<1
Cobalt	—[a]	—[a]	<25	<25
Copper	<50	—[a]	<1	<10
Lead	<2	<2	<2	<2
Mercury	<0.2	<0.2	<0.2	<0.2
Molybdenum	—[a]	—[a]	<50	34
Nickel	<100	<0.1	<5	<5
Selenium	<2	<2	<2	<2
Silver	—[a]	<0.5	<0.5	<0.5
Thallium	—[a]	—[a]	<1	<1
Vanadium	—[a]	—[a]	<25	<25
Zinc	<50	—[a]	<20	<20
Inorganic compounds				
Nitrate (mg/L)	<0.5	—[a]	<0.5	—[a]
HE compounds (μg/L)				
HMX, RDX	—[a]	—[a]	<5	<5
Organic compounds[b]				
Volatile (EPA Method 502.2)	nd[c]	nd	nd	nd
Radioactivity (Bq/L)				
Gross alpha	0.00	–0.04	–0.01	0.00
Gross beta	0.39	0.37	0.29	0.33
Radioisotopes (Bq/L)				
Tritium	–0.70	–3.02	–1.80	–1.05

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-39. Analysis for off-site Well CARNRW1.

Constituent of concern	Sampled			
	1/26/96	4/18/96	7/16/96	10/30/96
Organic compounds[a]				
Volatile (EPA Method 601)	nd[b]	nd	nd	nd

a See **Table 8-12** for method constituents and their reporting limits.

b nd = Not detected above reporting limits.

Table 8-40. Analyses for off-site Well CDF1.

Constituent of concern	Sampled			
	1/30/96	4/18/96	7/11/96	10/28/96
Elements (μg/L)				
Antimony	—[a]	—[a]	<5	<5
Arsenic	<2	<2	5.6	5.4
Barium	<25	26	28	28
Beryllium	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5
Chromium	<10	<1	<1	<1
Cobalt	—[a]	<50	<25	<25
Copper	<50	—[a]	6	<10
Lead	<2	2.7	<2	<2
Mercury	<0.2	<0.2	<0.2	<0.2
Molybdenum	—[a]	—[a]	<50	<25
Nickel	<100	—[a]	<5	<5
Selenium	<2	<2	<2	<2
Silver	<0.5	<0.5	<0.5	<10
Thallium	—[a]	—[a]	<1	<1
Vanadium	—[a]	<20	<25	<25
Zinc	<50	—[a]	<20	<20
General parameters				
Specific conductance (μmho/cm)	1000	—[a]	—[a]	—[a]
Total dissolved solids (mg/L)	750	—[a]	—[a]	—[a]
Explosive compounds (μg/L)				
HMX, RDX	<5	<5	<5	<5
Organic compounds[b]				
Volatile (EPA Method 502.2)	nd[c]	nd	nd	nd
Pesticides (EPA Method 608)	nd	—[a]	—[a]	—[a]
Herbicides (EPA Method 615)	nd	—[a]	—[a]	—[a]
Inorganic compounds				
Nitrate (mg/L)	1.6	—[a]	3.3	—[a]
Sulfate (mg/L)	190	—[a]	—[a]	—[a]

Table 8-40. Analyses for off-site Well CDF1 (concluded).

Constituent of concern	Sampled			
	1/30/96	4/18/96	7/11/96	10/28/96
Radioactivity (Bq/L)				
Gross alpha	–0.04	0.00	0.08	0.03
Gross beta	0.25	0.21	0.17	0.30
Radioisotopes (Bq/L)				
Tritium	0.34	–0.55	–0.95	–1.08

[a] Analysis not planned.

[b] See **Table 8-12** for method constituents and their reporting limits.

[c] nd = Not detected above reporting limits.

Table 8-41. Analyses for off-site Well CON1.

Constituent of concern	Sampled			
	1/26/96	4/18/96	7/11/96	10/29/96
Elements (μg/L)				
Antimony	—[a]	—[a]	<5	<5
Arsenic	<2	28	<2	<2
Barium	77	<25	<25	<25
Beryllium	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5
Chromium	<10	<1	<1	<1
Cobalt	—[a]	<50	<25	<25
Copper	<50	—[a]	<1	<10
Lead	<2	<2	<2	<2
Mercury	<0.2	<0.2	<0.2	<0.2
Molybdenum	—[a]	—[a]	<50	<25
Nickel	—[a]	—[a]	<5	<5
Selenium	<2	<2	<2	<2
Silver	<0.5	<0.5	<0.5	<0.5
Thallium	—[a]	—[a]	<1	<1
Vanadium	—[a]	<20	<25	<25
Zinc	<50	—[a]	<20	<20
General parameters				
Specific conductance (μmho/cm)	1900	—[a]	—[a]	—[a]
Total dissolved solids (mg/L)	1400	—[a]	—[a]	—[a]
HE compounds (μg/L)				
HMX, RDX	<5	<5	<5	<5
Organic compounds[b]				
Volatile (EPA Method 502.2)	nd[c]	nd	nd	nd
Pesticides (EPA Method 608)	nd	—[a]	—[a]	—[a]
Herbicides (EPA Method 615)	nd	—[a]	—[a]	—[a]
Inorganic compounds				
Nitrate (mg/L)	<0.5		<0.5	<0.5
Sulfate (mg/L)	600	—[a]	—[a]	—[a]

Table 8-41. Analyses for off-site Well CON1 (concluded).

Constituent of concern	Sampled			
	1/26/96	4/18/96	7/11/96	10/29/96
Radioactivity (Bq/L)				
Gross alpha	–0.07	–0.06	0.05	–0.16
Gross beta	0.33	0.41	0.37	0.41
Radioisotopes (Bq/L)				
Tritium	0.10	0.11	–1.33	0.38

[a] Analysis not planned.

[b] See **Table 8-12** for method constituents and their reporting limits.

[c] nd = Not detected above reporting limits.

Table 8-42. Analyses for off-site Well GALLO1.

Constituent of concern	Sampled			
	1/26/96	4/19/96	7/12/96	10/29/96
Elements (μg/L)				
Antimony	—[a]	—[a]	<5	<5
Arsenic	3.3	4.3	2.1	3.0
Barium	<25	<25	<25	<25
Beryllium	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5
Chromium	<10	<1	<1	<1
Cobalt	—[a]	<50	<25	<25
Copper	<50.	(b)	<1	<10
Lead	<2	<2	<2	<2
Manganese	<30	—[a]	—[a]	—[a]
Mercury	<0.2	<0.2	<0.2	<0.2
Molybdenum	—[a]	—[a]	<50	41
Nickel	<100	—[a]	<5	<5
Selenium	<2	<2	<2	<2
Silver	<0.5	<0.5	<0.5	<0.5
Thallium	—[a]	—[a]	<1	<1
Vanadium	—[a]	<20	<25	<25
Zinc	<50	—[a]	<20	<20
General parameters				
Specific conductance (μmho/cm)	1400	—[a]	—[a]	—[a]
Total dissolved solids (mg/L)	850	—[a]	—[a]	—[a]
HE compounds (μg/L)				
HMX, RDX	<5	<5	<5	<5
Organic compounds[b]				
Volatile (EPA Method 502.2)	nd[c] except for:	nd except for:	nd except for:	nd
trichloroethene (TCE; μg/L)	0.3	0.3	0.3	<0.2
Pesticides (EPA Method 608)	nd	—[a]	—[a]	—[a]
Herbicides (EPA Method 615)	nd	—[a]	—[a]	—[a]

Table 8-42. Analyses for off-site Well GALLO1 (concluded).

Constituent of concern	Sampled			
	1/26/96	4/19/96	7/12/96	10/29/96
Inorganic compounds (mg/L)				
Nitrate (mg/L)	<0.5	—[a]	<0.5	<0.5
Sulfate (mg/L)	170	—[a]	—[a]	—[a]
Radioactivity (Bq/L)				
Gross alpha	–0.03	0.01	–0.16	0.02
Gross beta	0.22	0.24	0.14	0.37
Radioisotopes (Bq/L)				
Tritium	1.59	–1.79	–2.24	1.02

[a] Analysis not planned.

[b] See **Table 8-12** for method constituents and their reporting limits.

[c] nd = Not detected above reporting limits.

Table 8-43. Analyses for off-site Well CARNRW2.

Constituent of concern	Sampled			
	1/26/96	4/18/96	7/16/96	10/30/96
Elements (μg/L)				
Antimony	—[a]	—[a]	<5	<5
Arsenic	<2	<2	3.1	<2
Barium	<25	<25	<25	<25
Beryllium	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5
Chromium	<10	<1	<1	<1
Cobalt	—[a]	<50	<25	<25
Copper	<50	—[a]	<1	<10
Lead	<2	<2	<2	<2
Mercury	<0.2	<0.2	<0.2	<0.2
Molybdenum	—[a]	—[a]	<50	47
Nickel	<100	—[a]	<5	<5
Selenium	<2	2.4	<2	<2
Silver	<0.5	<0.5	<0.5	<0.5
Thallium	—[a]	—[a]	<1	<1
Vanadium	—[a]	<20	<25	<25
Zinc	<50	—[a]	<20	<20
General parameters				
Specific conductance (μmho/cm)	1100	—[a]	—[a]	—[a]
Total dissolved solids (mg/L)	730	—[a]	—[a]	—[a]
HE compounds (μg/L)				
HMX, RDX	<5	<5	<5	<5
Organic compounds (μg/L)[b]				
Volatile (EPA Method 502.2)	nd[c] except for:	nd except for:	nd	nd
bromodichloromethane	6.5			
bromoform	9.2	1.1		
chloroform	3.7	2.7		
dibromochloromethane	9.0	1.2		
Pesticides (EPA Method 608)	nd	—[a]	—[a]	—[a]
Herbicides (EPA Method 615)	nd	—[a]	—[a]	—[a]

Table 8-43. Analyses for off-site Well CARNRW2 (concluded).

Constituent of concern	Sampled			
	1/26/96	4/18/96	7/16/96	10/30/96
Inorganic compounds				
Nitrate (mg/L)	<0.5	—[a]	<0.5	—[a]
Radioactivity (Bq/L)				
Gross alpha	0.00	0.05	-0.06	0.03
Gross beta	0.35	0.34	0.27	0.51
Radioisotopes (Bq/L)				
Tritium	0.99	–1.69	3.47	–0.59

a Analysis not planned.

b See **Table 8-12** for method constituents and their reporting limits.

c nd = Not detected above reporting limits.

Table 8-44. Analysis for off-site Well CON2.

Constituent of concern	Sampled			
	1/26/96	4/18/96	7/11/96	10/29/96
Organic compounds[a]				
Volatile (EPA Method 601)	nd[b]	nd	nd	nd

a See **Table 8-12** for method constituents.

b nd = Not detected above reporting limits.

Table 8-45. Annually monitored off-site surveillance wells.

Constituent of concern	Well					
	MUL1	MUL2	VIE1	VIE2	STN	W35A-04
	Sampling date					
	9/6/96	9/6/96	9/6/96	9/9/96	9/23/96	9/16/96
Elements (μg/L)						
Antimony	<5	<5	<5	<5	<5	<5
Arsenic	4.1	<2.0	9.8	<2.0	<2.0	3.1
Barium	27	28	41	26	27	<25
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	<1	<1	<1	<1	<1	<1
Cobalt	<25	<25	<25	<25	<25	<25
Copper	<1	<1	<1	2	1	6
Lead	<2	<2	<2	<2	<2	4
Mercury	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Molybdenum	<50	<50	<50	<50	<50	<50
Nickel	<5	<5	<5	<5	<5	<5
Selenium	<2	<2	<2	2	<2	<2
Silver	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	<1	<1	<1	<1	<1	<1
Vanadium	<25	<25	<25	<25	<25	<25
Zinc	<20	<20	<20	<20	35	<20
Inorganic compounds (mg/L)						
Nitrate	2.7	4.8	8.6	19	—[a]	10
Organic compounds (μg/L)[b]						
Volatile (EPA Method 502.2)	nd[c]	nd	nd	nd	nd	nd except for:
chloroform						0.99
bromodichloromethane						0.69
dibromochloromethane						0.51

Table 8-45. Annually monitored off-site surveillance wells (concluded).

Constituent of concern	Well					
	MUL1	MUL2	VIE1	VIE2	STN	W35A-04
	Sampling date					
	9/6/96	9/6/96	9/6/96	9/9/96	9/23/96	9/16/96
HE compounds (μg/L)						
HMX	<5	<5	<5	—[a]	<5	<5
RDX	<5	<5	<5	—[a]	<5	<5
Radioactivity (Bq/L)						
Gross alpha	0.08	0.03	0.10	0.09	0.27	0.09
Gross beta	0.29	0.23	0.39	0.26	0.36	0.18
Radioisotopes						
Tritium	1.26	–0.66	–0.48	–0.40	0.61	0.97
Uranium (total)	—[a]	0.04	—[a]	—[a]	0.23	—[a]

[a] Analysis not planned.

[b] See **Table 8-12** for method constituents and their reporting limits.

[c] nd = Not detected above reporting limits.

Table 8-46. Pit 1 Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and analytical results for 1996.

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Jan 17–18	Apr 10–12	Jul 30–31	Oct 9–11
Arsenic (µg/L)	K1-01C	—[a]	12	<2	13	10
	K1-07	—[a]	14	16	23	12
	K1-02B	16	13	10	11	10
	K1-03	18	16	11	14	11
	K1-04	14	14	10	11	3
	K1-05	27	16	19	23	14
	K1-08	18	15	17	17	12
	K1-09	18	16	13	17	11
Barium (µg/L)	K1-01C	—[a]	<25	<25	<25	<25
	K1-07	—[a]	<25	25	<25	<25
	K1-02B	25	<25	<25	<25	<25
	K1-03	25	<25	<25	<25	<25
	K1-04	25	<25	28	<25	<25
	K1-05	34	26	32	31	33
	K1-08	45	31	36	33	37
	K1-09	38	32	33	32	35
Beryllium (µg/L)	K1-01C	—[a]	<0.5	<0.5	<0.5	<0.5
	K1-07	—[a]	<0.5	<0.5	<0.5	<0.5
	K1-02B	0.5	<0.5	<0.5	<0.5	<0.5
	K1-03	0.5	<0.5	<0.5	<0.5	<0.5
	K1-04	0.5	<0.5	<0.5	<0.5	<0.5
	K1-05	0.5	<0.5	<0.5	<0.5	<0.5
	K1-08	0.5	<0.5	<0.5	<0.5	<0.5
	K1-09	0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (µg/L)	K1-01C	—[a]	<0.5	<0.5	<0.5	<0.5
	K1-07	—[a]	<0.5	<0.5	<0.5	<0.5
	K1-02B	0.5	<0.5	<0.5	<0.5	<0.5
	K1-03	0.5	<0.5	<0.5	<0.5	<0.5
	K1-04	0.5	<0.5	<0.5	<0.5	<0.5
	K1-05	0.5	<0.5	<0.5	<0.5	<0.5
	K1-08	0.5	<0.5	<0.5	<0.5	<0.5
	K1-09	0.5	<0.5	<0.5	<0.5	<0.5
Cobalt (µg/L)	K1-01C	—[a]	<25	<25	<25	<25
	K1-07	—[a]	<25	<25	<25	<25
	K1-02B	50	<25	<25	<25	<25

Table 8-46. Pit 1 Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and analytical results for 1996 (continued).

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Jan 17–18	Apr 10–12	Jul 30–31	Oct 9–11
Cobalt (µg/L) (continued)	K1-03	50	<25	<25	<25	<25
	K1-04	50	<25	<25	<25	<25
	K1-05	50	<25	<25	<25	<25
	K1-08	50	<25	34	<25	<25
	K1-09	50	<25	<25	<25	<25
Copper (µg/L)	K1-01C	—[a]	<50	25	16	23
	K1-07	—[a]	<50	<10	2.7	<10
	K1-02B	70	<50	18	8.3	25
	K1-03	70	<50	<10	1.9	<10
	K1-04	70	<50	<10	<10	<10
	K1-05	70	<50	11	6.7	<10
	K1-08	70	<50	<10	2.7	<10
	K1-09	70	<50	<10	2.8	<10
Lead (µg/L)	K1-01C	—[a]	<2	<2	<2	<2
	K1-07	—[a]	<2	<2	<2	<2
	K1-02B	6	<2	<2	<2	<2
	K1-03	6	<2	<2	<2	<2
	K1-04	6	<2	<2	<2	<2
	K1-05	6	<2	<2	<2	<2
	K1-08	6	<2	<2	<2	<2
	K1-09	6	<2	<2	<2	<2
Nickel (µg/L)	K1-01C	—[a]	<100	<5	<5	<5
	K1-07	—[a]	<100	<5	<5	<5
	K1-02B	100	<100	<5	<5	<5
	K1-03	100	<100	<5	<5	<5
	K1-04	100	<100	<5	<5	<5
	K1-05	100	<100	<5	<5	<5
	K1-08	100	<100	7	<5	<5
	K1-09	100	<100	<5	<5	<5
Vanadium (µg/L)	K1-01C	—[a]	39	71	56	72
	K1-07	—[a]	77	72	85	79
	K1-02B	103	34	59	29	52
	K1-03	103	57	50	41	50
	K1-04	103	38	31	32	35
	K1-05	103	78	74	79	74

Table 8-46. Pit 1 Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and analytical results for 1996 (continued).

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Jan 17–18	Apr 10–12	Jul 30–31	Oct 9–11
Vanadium (µg/L) (continued)	K1-08	103	69	90	70	67
	K1-09	103	64	62	68	58
Zinc (µg/L)	K1-01C	—[a]	<50	20	<20	30
	K1-07	—[a]	<50	23	<20	<20
	K1-02B	91	<50	30	<20	33
	K1-03	91	<50	<20	<20	<20
	K1-04	91	<50	21	<20	<20
	K1-05	91	<50	23	<20	<20
	K1-08	91	<50	27	<20	<20
	K1-09	91	<50	20	<20	<20
Radium-226 (Bq/L)	K1-01C	—[a]	0.04	0.01	0.00	0.00
	K1-07	—[a]	0.03	0.00	0.00	0.00
	K1-02B	0.05	0.01	0.01	0.00	0.01
	K1-03	0.05	0.00	0.04	0.00	0.00
	K1-04	0.05	0.01	0.00	0.00	0.01
	K1-05	0.05	0.01	0.00	0.01	0.01
	K1-08	0.05	0.01	0.01	0.01	0.00
	K1-09	0.05	0.01	0.00	0.02	0.01
Tritium (Bq/L)	K1-01C	—[a]	11.4	12.9	16.6	14.7
	K1-07	—[a]	2.1	–1.5	–2.0	–1.3
	K1-02B	—[b]	163	117	150	131
	K1-03	11.4	10.6	11.0	16.6	15.0
	K1-04	6.1	1.1	0.0	2.1	0.3
	K1-05	6.9	1.3	0.9	–0.8	–0.2
	K1-08	5.2	–0.9	–0.2	–0.3	–2.3
	K1-09	5.5	4.0	–1.4	0.1	–1.1
Uranium (total; Bq/L)	K1-01C	—[a]	0.22	0.18	0.17	0.14
	K1-07	—[a]	0.11	0.07	0.08	0.08
	K1-02B	0.13	0.14	0.09	0.23	0.12
	K1-03	0.13	0.06	0.05	0.08	0.06
	K1-04	0.13	0.07	0.01	0.07	0.07
	K1-05	0.13	0.08	0.08	0.08	0.09
	K1-08	0.13	0.10	0.09	0.07	0.09
	K1-09	0.13	0.07	0.06	0.07	0.07

Table 8-46. Pit 1 Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and analytical results for 1996 (concluded).

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Jan 17–18	Apr 10–12	Jul 30–31	Oct 9–11
Thorium-228 (Bq/L)	K1-01C	—[a]	0.00	0.00	0.00	0.00
	K1-07	—[a]	0.00	–0.01	0.00	0.00
	K1-02B	0.04	0.00	0.00	0.00	0.00
	K1-03	0.04	0.00	0.00	0.00	0.00
	K1-04	0.04	–0.01	0.00	0.00	0.00
	K1-05	0.04	0.00	0.00	0.00	0.00
	K1-08	0.04	–0.01	0.00	0.00	0.00
	K1-09	0.04	0.00	0.00	0.00	0.00
Thorium-232 (Bq/L)	K1-01C	—[a]	0.00	0.00	0.00	0.00
	K1-07	—[a]	0.01	0.00	0.00	0.00
	K1-02B	0.02	0.00	0.00	0.00	0.00
	K1-03	0.02	0.00	0.00	0.00	0.00
	K1-04	0.02	0.00	0.00	0.00	0.00
	K1-05	0.02	0.00	0.00	0.00	0.00
	K1-08	0.02	0.00	0.00	0.00	0.00
	K1-09	0.02	0.00	0.00	0.00	0.00
HMX (µg/L)	K1-01C	—[a]	<5	<5	<5	<5
	K1-07	—[a]	<5	<5	<5	<5
	K1-02B	20	<5	<5	<5	<5
	K1-03	20	<5	<5	<5	<5
	K1-04	20	<5	<5	<5	<5
	K1-05	20	<5	<5	<5	<5
	K1-08	20	<5	<5	<5	<5
	K1-09	20	<5	<5	<5	<5
RDX (µg/L)	K1-01C	—[a]	<5	<5	<5	<5
	K1-07	—[a]	<5	<5	<5	<5
	K1-02B	30	<5	<5	<5	<5
	K1-03	30	<5	<5	<5	<5
	K1-04	30	<5	<5	<5	<5
	K1-05	30	<5	<5	<5	<5
	K1-08	30	<5	<5	<5	<5
	K1-09	30	<5	<5	<5	<5

[a] Upgradient well.

[b] Exempt well (insensitive to further detection of tritium releases).

Table 8-47. Pit 1 Area; additional Post-Closure Plan constituents of concern, monitor wells, and analytical results for 1996.

Constituent	Q[a]	Monitor well			
		K1-01C[b]	K1-02B	K1-03	K1-04
pH	1	7.3	7.5	7.4	7.5
	3	8.2	7.9	8.1	8.0
Specific conductance (µmho/cm)	1	630	490	440	480
	3	520	640	520	490
Water table elevation (ft)	1	972.8	970.2	968.6	964.9
	3	976.3	973.2	971.3	967.2
Water temperature (°C)	1	21.0	18.7	19.3	17.8
	3	23.3	22.2	22.2	24.7
Chromium (µg/L)	1	<1	<1	6.6	8.6
	3	<1	<1	<1	<1
Iron (mg/L)	1	<0.1	<0.1	<0.1	<0.1
	3	<0.1	<0.1	<0.1	<0.1
Manganese (µg/L)	1	<30	<30	<30	<30
	3	<30	<30	<30	<30
Mercury (µg/L)	1	<0.2	<0.2	<0.2	<0.2
	2	<0.2	<0.2	<0.2	<0.2
Nitrate (mg/L)	1	27	28	29	24
	3	35	29	27	20
Selenium (µg/L)	1	<2	<2	<2	<2
	3	<2	<2	<2	<2
Silver (µg/L)	1	<0.5	<0.5	<0.5	<0.5
	3	<0.5	<0.5	<0.5	<0.5
Sodium (mg/L)	1	34	41	40	47
	3	30	38	32	35
Gross alpha (Bq/L)	1	0.14	0.14	0.04	0.02
	3	0.02	0.04	0.03	0.03
Gross beta (Bq/L)	1	0.15	0.18	0.06	0.16
	3	0.15	0.11	0.10	0.06
Chloride (mg/L)	4	37	55	36	34
Sulfate (mg/L)	4	34	62	34	40

Table 8-47. Pit 1 Area; additional Post-Closure Plan constituents of concern, monitor wells, and analytical results for 1996 (continued).

Constituent	Q[a]	Monitor well			
		K1-05	K1-07[b]	K1-08	K1-09
pH	1	7.5	7.5	7.5	7.5
	3	7.7	7.6	7.7	7.7
Specific conductance (µmho/cm)	1	490	480	500	520
	3	500	480	530	510
Water table elevation (ft)	1	958.4	967.8	967.9	965.2
	3	960.4	970.3	971.1	968.3
Water temperature (°C)	1	20.0	19.3	20.2	18.0
	3	22.1	22.7	22.3	21.9
Chromium (µg/L)	1	5.2	7.3	10.0	6.0
	3	<1	1.3	2.5	1.2
Iron (mg/L)	1	<0.1	<0.1	<0.1	0.11
	3	<0.1	<0.1	<0.1	<0.1
Manganese (µg/L)	1	<30	<30	<30	<30
	3	<30	<30	<30	<30
Mercury (µg/L)	1	<0.2	<0.2	<0.2	<0.2
	2	<0.2	<0.2	<0.2	<0.2
Nitrate (mg/L)	1	29	32	28	12
	3	35	30	36	35
Selenium (µg/L)	1	<2	<2	<2	<2
	3	<2	<2	<2	<2
Silver (µg/L)	1	<0.5	<0.5	<0.5	<0.5
	3	<0.5	<0.5	<0.5	<0.5
Sodium (mg/L)	1	49	48	50	50
	3	40	39	42	41
Gross alpha (Bq/L)	1	0.14	0.06	0.03	0.09
	3	0.08	0.08	0.06	0.09
Gross beta (Bq/L)	1	0.12	0.11	0.11	0.08
	3	0.10	0.10	0.10	0.09
Chloride (mg/L)	4	40	34	42	40
Sulfate (mg/L)	4	39	46	46	43

Table 8-47. Pit 1 Area; additional Post-Closure Plan constituents of concern, monitor wells, and analytical results for 1996 (continued).

Constituent	Q[a]	Monitor well			
		K1-01C[b]	K1-02B	K1-03	K1-04
Organic compounds	4				
Volatile (EPA Method 624)		nd[c]	nd	nd	nd
Semivolatile (EPA Method 625)		nd	nd	nd	nd
Pesticides (EPA Method 608)		nd	nd	nd	nd
Total organic halides (µg/L)		<20	<20	<20	<20
Total organic carbon (mg/L)		<2	<2	<2	<2

Table 8-47. Pit 1 Area; additional Post-Closure Plan constituents of concern, monitor wells, and analytical results for 1996 (concluded).

Constituent	Q[a]	Monitor Well			
		K1-05	K1-07[b]	K1-08	K1-09
Organic compounds	4				
Volatile (EPA Method 624)		nd except for:	nd	nd except for:	nd except for:
Freon 113 (µg/L)		41	nd	98	150
Semivolatile (EPA Method 625)		nd	nd	nd except for:	nd
Benzoic acid (µg/L)		nd	nd	93	nd
Pesticides (EPA Method 608)		nd	nd	nd	nd
Total organic halides (µg/L)		<20	<20	27	51
Total organic carbon (mg/L)		<2	<2	15	<2

a Sample date (quarter-year division). 1 = Jan 18; 3 = Jul 30-31; 4 = Oct 9–11.

b Upgradient well.

c nd = Not detected above reporting limits.

Table 8-48. Pit 7 Complex Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and quarterly analytical results for 1996.

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Feb 7–16	Apr 19–30	Jul 24–30	Oct 18–25
Arsenic (µg/L)	K7-06	—[a]	16.0	16.0	17.0	16.0
	K7-01	14.0	5.8	7.4	8.5	8.4
	K7-03	6.4	<2.0	<2.0	2.8	<2.0
	K7-09	2.0	<2.0	<2.0	<2.0	<2.0
	K7-10	8.6	<2.0	3.4	2.1	2.5
	NC7-25	8.9	5.7	6.3	3.2	5.5
	NC7-26	13.0	<2.0	3.3	2.3	<2.0
	NC7-47	21.0	11.0	16.0	12.0	13.0
	NC7-48	14.0	5.5	7.6	4.1	6.0
Barium (µg/L)	K7-06	—[a]	72	84	62	86
	K7-01	210	160	170	140	220
	K7-03	79	61	72	44	71
	K7-09	50	<25	<25	<25	<25
	K7-10	92	66	40	<25	61
	NC7-25	70	59	67	27	67
	NC7-26	50	31	29	<25	<25
	NC7-47	62	43	42	<25	48
	NC7-48	290	94	110	81	120
Beryllium (µg/L)	K7-06	[a]	<0.5	<0.5	<0.5	<0.5
	K7-01	0.5	<0.5	<0.5	<0.5	<0.5
	K7-03	0.5	<0.5	<0.5	<0.5	<0.5
	K7-09	0.5	<0.5	<0.5	<0.5	<0.5
	K7-10	0.5	<0.5	<0.5	<0.5	<0.5
	NC7-25	0.5	<0.5	<0.5	<0.5	<0.5
	NC7-26	0.5	<0.5	<0.5	<0.5	<0.5
	NC7-47	0.5	<0.5	<0.5	<0.5	<0.5
	NC7-48	0.5	<0.5	<0.5	<0.5	<0.5
Cadmium (µg/L)	K7-06	—[a]	<0.5	<0.5	<0.5	<0.5
	K7-01	0.5	<0.5	<0.5	<0.5	<0.5
	K7-03	0.5	<0.5	<0.5	<0.5	<0.5
	K7-09	0.5	<0.5	<0.5	<0.5	<0.5
	K7-10	1.6	<0.5	<0.5	<0.5	<0.5

Table 8-48. Pit 7 Complex Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and quarterly analytical results for 1996 (continued).

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Feb 7–16	Apr 19–30	Jul 24–30	Oct 18–25
Cadmium (µg/L) (continued)	NC7-25	0.6	<0.5	<0.5	<0.5	<0.5
	NC7-26	0.5	<0.5	<0.5	<0.5	<0.5
	NC7-47	1.5	<0.5	<0.5	<0.5	<0.5
	NC7-48	1.5	<0.5	<0.5	<0.5	<0.5
Cobalt (µg/L)	K7-06	—[a]	<25	<25	<25	<25
	K7-01	25	<25	<25	<25	<25
	K7-03	25	<25	<25	<25	<25
	K7-09	25	<25	<25	<25	<25
	K7-10	25	<25	<25	<25	<25
	NC7-25	25	<25	<25	<25	<25
	NC7-26	25	<25	<25	<25	<25
	NC7-47	25	<25	<25	<25	<25
	NC7-48	25	<25	<25	<25	<25
Copper (µg/L)	K7-06	—[a]	24	<10	10	<10
	K7-01	47	17	16	11	14
	K7-03	140	120	83	260	72
	K7-09	10	<10	<10	2.5	<10
	K7-10	10	<10	<10	<1	<10
	NC7-25	10	<10	<10	3.8	<10
	NC7-26	10	<10	<10	<1	<10
	NC7-47	10	<10	<10	<1	<10
	NC7-48	10	<10	<10	<1	<10
Lead (µg/L)	K7-06	—[a]	4	<2	<2	<2
	K7-01	6.0	<2	2.2	<2	<2
	K7-03	6.1	<2	<2	<2	<2
	K7-09	5.9	<2	<2	2.4	<2
	K7-10	2.0	<2	<2	<2	<2
	NC7-25	2.0	<2	<2	<2	<2
	NC7-26	5.1	<2	<2	<2	<2
	NC7-47	7.6	<2	<2	<2	<2
	NC7-48	2.0	<2	<2	<2	<2

Table 8-48. Pit 7 Complex Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and quarterly analytical results for 1996 (continued).

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Feb 7–16	Apr 19–30	Jul 24–30	Oct 18–25
Nickel (µg/L)	K7-06	—[a]	<5	<5	<5	<5
	K7-01	12	12	9	<5	<5
	K7-03	21	8	6	<5	<5
	K7-09	5	5.6	<5	<5	<5
	K7-10	37	<5	<5	<5	<5
	NC7-25	23	<5	9	<5	<5
	NC7-26	5	<5	<5	<5	<5
	NC7-47	14	<5	<5	<5	<5
	NC7-48	65	<5	<5	<5	<5
Vanadium (µg/L)	K7-06	—[a]	42	43	30	37
	K7-01	50	<25	<25	<25	<25
	K7-03	50	<25	<25	<25	<25
	K7-09	50	<25	<25	<25	<25
	K7-10	50	<25	<25	<25	<25
	NC7-25	50	<25	<25	<25	<25
	NC7-26	50	<25	<25	<25	<25
	NC7-47	77	54	57	39	62
	NC7-48	140	25	<25	<25	<25
Zinc (µg/L)	K7-06	—[a]	40	55	<20	<20
	K7-01	54	<20	37	<20	<20
	K7-03	70	36	54	54	51
	K7-09	20	<20	<20	<20	<20
	K7-10	20	<20	<20	<20	<20
	NC7-25	36	<20	66	<20	<20
	NC7-26	20	<20	<20	<20	<20
	NC7-47	27	63	<20	<20	<20
	NC7-48	71	50	<20	<20	<20
Radium-226 (Bq/L)	K7-06	—[a]	0.01	0.01	0.05	0.01
	K7-01	0.10	0.03	0.04	0.03	0.03
	K7-03	0.04	0.00	0.01	0.00	0.01
	K7-09	0.02	0.01	0.01	0.01	0.00
	K7-10	0.03	0.02	0.01	0.00	0.00

Table 8-48. Pit 7 Complex Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and quarterly analytical results for 1996 (continued).

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Feb 7–16	Apr 19–30	Jul 24–30	Oct 18–25
Radium-226 (Bq/L) (continued)	NC7-25	0.05	0.02	0.01	0.02	0.01
	NC7-26	0.03	0.02	0.02	0.02	0.01
	NC7-47	0.03	0.00	0.01	0.00	0.00
	NC7-48	1.10	0.01	0.01	0.01	0.01
Tritium (Bq/L)	K7-06	—[a]	0.9	0.4	–0.4	–0.7
	K7-01	—[b]	905	1060	1070	1060
	K7-03	—[b]	5600	5940	5880	6290
	K7-09	13.8	0.3	0.0	–0.9	0.1
	K7-10	13.8	1.3	0.1	0.2	1.7
	NC7-25	—[b]	10100	11900	13900	12900
	NC7-26	—[b]	76	114	248	122
	NC7-47	13.8	1.7	–1.0	–0.6	–0.7
	NC7-48	13.8	4.7	11.2	11.2	8.7
Uranium (total; Bq/L)	K7-06	—[a]	0.05	0.05	0.06	0.06
	K7-01	0.59	0.33	0.36	0.41	0.40
	K7-03	0.23	0.14	0.13	0.13	0.14
	K7-09	0.04	0.02	0.02	0.01	0.00
	K7-10	0.08	0.03	0.03	0.02	0.03
	NC7-25	1.22	0.80	0.77	0.96	0.92
	NC7-26	0.03	0.01	0.02	0.03	0.01
	NC7-47	0.12	0.08	0.08	0.08	0.07
	NC7-48	2.22	0.55	0.87	0.72	0.65
Thorium-228 (Bq/L)	K7-06	—[a]	0.00	0.00	0.00	0.00
	K7-01	0.03	0.00	0.00	0.00	0.00
	K7-03	0.03	0.00	0.00	0.00	0.00
	K7-09	0.03	0.00	0.00	0.00	0.00
	K7-10	0.03	–0.01	0.00	0.00	0.00
	NC7-25	0.03	0.01	0.00	0.00	0.00
	NC7-26	0.03	0.00	0.00	0.00	0.00
	NC7-47	0.03	0.00	0.00	0.00	0.00
	NC7-48	0.03	0.00	0.00	0.00	0.00

Table 8-48. Pit 7 Complex Area; WDR 93-100 constituents of concern, monitor wells, statistical limits, and quarterly analytical results for 1996 (concluded).

Constituent of concern	Monitor well	Statistical limit	Quarterly sample dates			
			Feb 7–16	Apr 19–30	Jul 24–30	Oct 18–25
Thorium-232 (Bq/L)	K7-06	—[a]	0.00	0.00	0.00	0.00
	K7-01	0.05	0.00	0.00	0.00	0.00
	K7-03	0.05	0.00	0.00	0.00	0.00
	K7-09	0.05	0.00	0.00	0.00	0.00
	K7-10	0.05	0.00	0.00	0.00	0.00
	NC7-25	0.05	0.00	0.00	0.00	0.00
	NC7-26	0.05	0.00	0.00	0.00	0.00
	NC7-47	0.05	0.00	0.00	0.00	0.00
	NC7-48	0.05	0.00	0.00	0.00	0.00
HMX (µg/L)	K7-06	—[a]	<5	<5	<5	<5
	K7-01	20	<5	<5	<5	<5
	K7-03	20	<5	<5	<5	<5
	K7-09	20	<5	<5	<5	<5
	K7-10	20	<5	<5	<5	<5
	NC7-25	20	<5	<5	<5	<5
	NC7-26	20	<5	<5	<5	<5
	NC7-47	20	<5	<5	<5	<5
	NC7-48	20	<5	<5	<5	<5
RDX (µg/L)	K7-06	—[a]	<5	<5	<5	<5
	K7-01	30	<5	<5	<5	<5
	K7-03	30	<5	<5	<5	<5
	K7-09	30	<5	<5	<5	<5
	K7-10	30	<5	<5	<5	<5
	NC7-25	30	<5	<5	<5	<5
	NC7-26	30	<5	<5	<5	<5
	NC7-47	30	<5	<5	<5	<5
	NC7-48	30	<5	<5	<5	<5

[a] Upgradient well.

[b] Exempt well (insensitive to further detection of tritium releases).

Table 8-49. Pit 7 Complex Area; additional Post-Closure Plan constituents of concern, monitor wells, and analytical results for 1996.

Constituent of concern	Monitor well	Quarterly sample dates			
		Feb 7–16	Apr 19–30	Jul 24–30	Oct 18–25
Ground water elevation (ft)	K7-06[a]	1392.8	1391.1	1389.9	1389.4
	K7-01	1296.8	1300.5	1298.2	1298.4
	K7-03	1316.9	1318.6	1318.3	1316.6
	K7-09	1298.6	1299.8	1300.4	1300.0
	K7-10	1311.3	1309.4	1308.9	1308.7
	NC7-25	1301.1	1301.7	1301.8	1301.3
	NC7-26	1258.3	1260.3	1260.0	1259.4
	NC7-47	1205.2	1203.5	1205.5	1205.4
	NC7-48	1352.0	1351.7	1348.8	1348.2
Organic compound (µg/L)[b]	K7-06[a]	nd[c]	nd	nd	nd
Volatile (EPA Method 601)					
TCE	K7-01	2.4	2.3	1.8	2.4
	K7-03	3.1	3.2	1.6	2.6
	K7-09	nd	nd	nd	nd
	K7-10	nd	nd	nd	nd
	NC7-25	nd	nd	nd	nd
	NC7-26	nd	nd	nd	nd
	NC7-47	nd	nd	nd	nd
	NC7-48	nd	nd	nd	nd
1,1-DCE	K7-06[a]	nd	nd	nd	nd
	K7-01	nd	nd	nd	nd
	K7-03	0.9	0.7	nd	0.5
	K7-09	nd	nd	nd	nd
	K7-10	nd	nd	nd	nd
	NC7-25	nd	nd	nd	nd
	NC7-26	nd	nd	nd	nd
	NC7-47	nd	nd	nd	nd
	NC7-48	nd	nd	nd	nd
Freon 11	K7-06[a]	nd	nd	nd	nd
	K7-01	nd	nd	nd	nd
	K7-03	nd	nd	nd	nd
	K7-09	nd	nd	nd	nd

Table 8-49. Pit 7 Complex Area; additional Post-Closure Plan constituents of concern, monitor wells, and analytical results for 1996 (concluded).

Constituent of concern	Monitor well	Quarterly sample dates			
		Feb 7–16	Apr 19–30	Jul 24–30	Oct 18–25
Freon 11 (continued)	K7-10	nd	nd	nd	nd
	NC7-25	nd	nd	nd	nd
	NC7-26	nd	nd	nd	nd
	NC7-47	nd	nd	nd	nd
	NC7-48	1.1	1.1	1.0	1.0
Gross alpha (Bq/L)	K7-06[(a)]	0.04	0.05	0.00	0.04
	K7-01	0.24	0.20	0.18	0.30
	K7-03	0.01	0.04	0.10	0.09
	K7-09	0.02	0.02	0.04	0.11
	K7-10	0.04	0.03	0.00	–0.01
	NC7-25	0.58	0.39	0.60	0.88
	NC7-26	–0.02	–0.03	0.07	0.05
	NC7-47	0.07	0.08	0.06	0.04
	NC7-48	0.19	0.41	0.42	0.53
Gross beta (Bq/L)	K7-06[(a)]	0.12	0.13	0.08	0.10
	K7-01	0.19	0.20	0.28	0.23
	K7-03	0.11	0.13	0.10	0.18
	K7-09	2.13	0.57	0.36	0.10
	K7-10	0.39	0.24	0.27	0.19
	NC7-25	0.21	0.43	0.27	0.13
	NC7-26	0.12	0.13	0.16	0.09
	NC7-47	0.24	0.17	0.10	0.07
	NC7-48	0.16	0.56	0.08	0.23

[a] Upgradient well.

[b] Only detected compounds are shown (volatile organics by EPA Method 601).

[c] nd = Not detected above reporting limits (0.5 µg/L for EPA 601).

Table 8-50. Site 300 constituents of concern (COCs) that have shown "statistical evidence of release" to ground water.

Constituent of concern	Area	Reported to RWQCB	Status of release investigation
Metals			
Arsenic	Pit 1	6/3/94	Transferred to CERCLA
Arsenic	Pit 7	10/17/95	Transferred to CERCLA
Barium	Pit 1	10/17/95	Transferred to CERCLA
Barium	Pit 1	6/14/96	Transferred to CERCLA
Barium	Pit 7	11/9/93	Completed
Cadmium	Pit 7	10/17/95	Transferred to CERCLA
Chloride	Explosives Process Area	2/21/97	Completed
Copper	Pit 7	10/21/96	Invalidated by retesting
Lead	Pit 7	2/17/94	Invalidated by retesting
Nickel	Pit 7	10/17/95	Transferred to CERCLA
Nickel	Pit 7	5/3/96	Transferred to CERCLA
Vanadium	Pit 7	6/3/94	Completed
Zinc	Pit 7	10/17/95	Transferred to CERCLA
Zinc	Explosives Process Area	1/17/97	Transferred to CERCLA
Radioisotopes			
Radium-226	Pit 7	10/17/95	Transferred to CERCLA
Tritium	Pit 7	11/9/93	Completed
Tritium	Pit 1	10/21/96	Transferred to CERCLA
Uranium	Pit 1	2/17/94	Completed
Uranium	Pit 1	10/21/96	Transferred to CERCLA
Uranium	Pit 7	9/10/93	Completed

Table 8-51. Monitoring parameters and concentration limits for the Explosives Process Area surface impoundments in WDR Order No. 96-248.

Constituent of concern	Well	Statistical limit
Halocarbons (μg/L)		
1,1,1 Trichloroethane	all	1.0
Bromoform	all	1.0
Chlorobenzene	all	1.0
Ethylene dichloride (1,2 DCA)	all	1.0
Methylene chloride	all	1.0
Tetrachloroethene	all	1.0
Trichlorotrifluoroethane	all	1.0
Hydrocarbons (μg/L)		
DMSO	all	10
Napthalene	all	5.0
Toluene	all	1.0
Metals (mg/L)		
Aluminum	all	0.2
Arsenic	all	variable
Barium	all	0.05
Cadmium	all	0.0042
Chromium	all	0.0098
Cobalt	all	0.05
Copper	all	0.099
Lead	all	0.0067
Manganese	all	0.042
Molybdenum	all	0.093
Nickel	all	0.044
Potassium	W-817-02	16.2
	W-817-03	14.1
	W-817-04	14.1
Silver	all	0.0083
Zinc	all	0.076
Photographic chemicals (μg/L)		
m-Cresol	all	5.0

Table 8-51. Monitoring parameters and concentration limits for the Explosives Process Area surface impoundments in WDR Order No. 96-248 (concluded).

Constituent of concern	Well	Statistical limit
Salts (mg/L)		
Ammonia (as N)	all	to be determined
Bicarbonate	all	277
Bromide	all	to be determined
Chloride	W-817-02	356
	W-817-03	271
	W-817-04	283
Nitrate	W-817-02	107
	W-817-03	107
	W-817-04	107
Ortho-phosphate	all	to be determined
Sulfate	W-817-02	442
	W-817-03	233
	W-817-04	275
Volatile/semivolatile compounds (μg/L)		
Acetone	all	40
Methyl ethyl ketone (2-butanone)	all	40
Energetic materials (μg/L)		
HMX	all	5
PETN	all	1.3
RDX	all	9.1
TATB	all	to be determined
TNT	all	5
Additives to energetic materials (μg/L)		
di-*n*-octyl phthalate	all	2.0
Unreactive polymers (μg/L)		
Vinyl chloride	all	1.0
Styrene	all	1.0

Table 8-52. Constituents and discharge limits for discharges going into the surface impoundments.

Constituent of concern	Process generating discharge	Discharge limit (mg/L)
Acid and bases	Photographic processes wastewater	550 and pH greater than 2 or less than 12.5
Halocarbons	Chemistry Area wastewater	
1,1,1-Trichloroethane	Explosives Process Area wastewater	100
Bromoform		100
Chlorobenzene		100
Ethylene dichloride (1,2 DCA)		0.5
Methylene chloride		100
Tetrachloroethene		0.7
Trichlorotrifluoroethane		100
Hydrocarbons	Chemistry Area wastewater	
DMSO	Explosives Process Area wastewater	1000
Napthalene		200
Toluene		200
Metals	Photographic processes wastewater	
Aluminum	Explosives Process Area wastewater	none
Arsenic		5
Barium		100
Cadmium		1
Chromium		5
Cobalt		80
Copper		25
Lead		5
Manganese		none
Molybdenum		350
Nickel		20
Potassium		none
Silver		5
Zinc		250
Photographic chemicals	Photographic processes wastewater	
m-Cresol		50

Table 8-52. Constituents and discharge limits for discharges going into the surface impoundments (concluded).

Constituent of concern	Process generating discharge	Discharge limit (mg/L)
Salts	Photographic processes wastewater	
Ammonia (as N)		none
Bicarbonate		none
Bromide		none
Chloride		none
Nitrate		none
Orthophosphate		none
Silver thiosulfate		5
Sulfate		none
Volatile/semivolatile compounds	Chemistry Area wastewater	
Acetone	Explosives Process Area wastewater	1000
Methyl ethyl ketone (2-butanone)		200
Energetic materials	Chemistry Area wastewater	
HMX	Explosives Process Area wastewater	none
PETN		none
RDX		none
TATB		none
TNT		none
Additives to energetic materials	Chemistry Area wastewater	
di-*n*-octyl phthalate	Explosives Process Area wastewater	none
Unreactive polymers	Chemistry Area wastewater	
Vinyl chloride	Explosives Process Area wastewater	0.2
Styrene		none

Note: Any other constituent with hazardous waste regulatory limits will not be discharged in excess of its limit into the surface impoundments.

Table 8-53. Monitoring program for influent to surface impoundments.

Analyte	EPA method
Photographic processing (B801,[a] B823,[b] B850,[a] B851[a]) wastewater	
Antimony	204.2
Barium	200.7
Beryllium	210.2
Cadmium	213.2
Chromium	218.2
Cobalt	200.7
Copper	220.2 or 200.7
Lead	239.2
Manganese	200.7
Molybdenum	200.7
Nickel	249.2 or 200.7
Silver	272.2
Thallium	279.2
Vanadium	200.7
Zinc	200.7
Chemistry Area (B825,[a] B826,[a] B827A,[a] B827C,[a] B827E[a])	
DMSO	625
RDX and HMX	8330
TATB[c]	Ion chromatography
Volatiles	8021, 8260 or 624
Explosives Process Area (B806/807,[d] B809,[d] B817[d])	
Aluminum	200.7
Arsenic	206.2
Barium	200.7
Cadmium	213.2
Chromium	218.2
Cobalt	200.7
Copper	220.2 or 200.7
Lead	239.2
Manganese	200.7
Molybdenum	200.7
Nickel	249.2 or 200.7

Table 8-53. Monitoring program for influent to surface impoundments (concluded).

Analyte	EPA method
Explosives Process Area (B806/807,[d] B809,[d] B817[d]) (continued)	
PETN	8330
RDX and HMX	8330
Semivolatiles	625
Silver	272.2
TATB	Ion chromatography
TNT	8330
Volatiles	8260 or 624
Zinc	200.7

a Each batch.

b Quarterly.

c There is no standard analytical method to analyze for TATB. LAS Laboratories, Inc. is using Ion chromatography.

d Annually.

Table 8-54. Photographic process wastewater effluent monitoring, 1996.

Analyte	MDL (mg/L)	WDR effluent limits[a] (mg/L)	Location and date					
			801-R301 4/01/96		823-R1U1 4/16/96		823-R1U1 12/20/96	
			Result (mg/L)	Reporting limit (mg/L)	Result (mg/L)	Reporting limit (mg/L)	Result[b] (mg/L)	Reporting limit (mg/L)
Metals								
Aluminum	0.04	na[c]	na	na	na	na	0.080	0.05
Antimony	0.00063	15[d]	0.1	0.1	1	1	0.001	0.005
Arsenic	0.00069	5	0.2	0.2	2	2	<0.002	0.002
Barium	0.002	100	0.01	0.004	0.3	0.04	0.008[f]	0.025
Beryllium	0.00008	0.75[d]	0.002	0.002	0.02	0.02	<0.0002	0.0002
Boron	0.08	na	na	na	na	na	0.925	0.05
Cadmium	0.00005	1	0.05	0.01	0.1	0.1	0.0017	0.0005
Chromium	0.00003	5	0.01	0.01	0.1	0.1	0.0009[f]	0.001
Cobalt	0.003	80	0.01	0.01	0.1	0.1	<0.05	0.05
Copper	0.00008	25	0.5	0.01	0.1	0.1	0.033	0.001
Iron	0.03	na	na	na	na	na	0.205	0.05
Lead	0.00033	5	0.1	0.04	0.4	0.4	0.011	0.005
Manganese	0.01	na	na	na	na	na	0.003[f]	0.01
Mercury	0.0001	0.2[d]	na	na	na	na	<0.0002	0.0002
Molybdenum	0.008	350	0.02	0.02	0.2	0.2	0.019[f]	0.025
Nickel	0.00056	20	0.04	0.04	0.4	0.4	0.0043	0.002
Potassium	0.057	na	8.3	0.4	20	4	<7.2	1
Selenium	0.00058	1[d]	0.1	0.1	1	1	0.01	0.01
Silver	0.00021	5	0.07	0.02	0.2	0.2	0.035	0.001
Thallium	0.00026	7[d]	0.2	0.2	2	2	<0.001	0.001
Vanadium	0.005	24[d]	0.04	0.04	0.4	0.4	<0.01	0.01
Zinc	0.008	250	3	0.02	1	0.2	0.080	0.02
Semivolatile organics[e]								
Bis(2-ethylhexyl) phthalate	0.000673	1000	na	na	na	na	0.0017[f]	0.005
o-Cresol	0.000414	200	na	na	na	na	<0.002	0.002
Cresol	0.000379	200	na	na	na	na	<0.002	0.002
Di-*n*-octylphthalate	0.000635	na	na	na	na	na	<0.002	0.002
Naphthalene	0.000394	200	na	na	na	na	<0.002	0.002
pH	0.1	<12.5	na	na	7.4	0.1	7.0	0.1

a These discharge limits come from either WDR No. 96-248, adopted on September 20, 1996, or from Appendix C of the *Amended Report of Waste Discharge* (1995).

b These data are under the requirements of WDR 96-248.

c na = Not analyzed or not available.

d California soluble threshold limit concentration (STLC), i.e. hazardous waste limit not noted in WDR 96-248.

e No semivolatile organic analytes were detected.

f Values between the method detection limit (MDL) and reporting limit can only be estimated.

Table 8-55. Chemistry process wastewater effluent monitoring, 1996.

Parameter	WDR Effluent limits[a]	Location and date					
		826-R1A1 3/20/96		827A-R1A1 6/5/96		827E-R2A1 6/5/96	
		Result	Reporting limit	Result	Reporting limit	Result	Reporting limit
Metals (mg/L)							
Antimony	15[b]	na[c]	na	<0.1	0.1	na	na
Arsenic	5	na	na	<0.2	0.2	na	na
Barium	100	na	na	0.005	0.004	na	na
Beryllium	0.75[b]	na	na	0.005	0.002	na	na
Cadmium	1	na	na	<0.01	0.01	na	na
Chromium	5	na	na	<0.01	0.01	na	na
Cobalt	80	na	na	0.06	0.01	na	na
Copper	25	na	na	0.03	0.01	na	na
Lead	5	na	na	<0.04	0.04	na	na
Manganese	na	na	na	na	na	na	na
Molybdenum	350	na	na	0.03	0.02	na	na
Nickel	20	na	na	<0.04	0.04	na	na
Potassium	na	na	na	9.1	0.4	na	na
Selenium	1[b]	na	na	<0.1	0.1	na	na
Silver	5	na	na	<0.02	0.02	na	na
Thallium	7[b]	na	na	<0.2	0.2	na	na
Uranium	na	na	na	<0.6	0.6	na	na
Vanadium	24[b]	na	na	<0.04	0.04	na	na
Zinc	250	na	na	0.28	0.02	na	na
Volatile organic compounds[d] (mg/L)							
1,1,1-Trichloroethane	1000	<0.05	0.05	<0.001	0.001	<0.001	0.001
1,1-Dichloroethene	0.7[e]	<0.01	0.01	<0.001	0.001	<0.001	0.001
1,2-Dichloroethane	0.5	<0.01	0.01	<0.002	0.002	<0.002	0.002
2-Butanone	200	<0.05	0.05	<0.01	0.01	<0.01	0.01
Acetone	1000	<0.1	0.1	0.15	0.01	<0.01	0.01
Bromoform	1000	<0.01	0.01	<0.005	0.005	<0.005	0.005
Bromomethane	1000	<0.05	0.05	<0.001	0.001	<0.001	0.001
Carbon disulfide	1000	<0.01	0.01	<0.005	0.005	<0.005	0.005
Chlorobenzene	100[e]	<0.01	0.01	<0.001	0.001	<0.001	0.001
Chloromethane	1000	<0.1	0.1	<0.001	0.001	<0.001	0.001
Freon 113	1000	<0.01	0.01	<0.001	0.001	na	na
Methylene chloride	1000	<0.01	0.01	<0.002	0.002	<0.002	0.002

Table 8-55. Chemistry process wastewater effluent monitoring, 1996 (concluded).

Parameter	WDR Effluent limits[a]	Location and date					
		826-R1A1 3/20/96		827A-R1A1 6/5/96		827E-R2A1 6/5/96	
		Result	Reporting limit	Result	Reporting limit	Result	Reporting limit
Volatile organic compounds (mg/L) (continued)							
Naphthalene	1000	<0.01	0.01	<0.01	0.01	<0.01	0.01
Styrene	1000	<0.01	0.01	<0.001	0.001	<0.001	0.001
Tetrachloroethene	0.7	<0.01	0.01	<0.001	0.001	<0.001	0.001
Toluene	1000	<0.01	0.01	<0.001	0.001	<0.001	0.001
Vinyl chloride	0.2	<0.05	0.05	<0.001	0.001	<0.001	0.001
General (mg/L)							
Dimethyl sulfoxide (DMSO)	1000	<5.0	5.0	na	na	<5.0	5.0
HMX	na	0.33	0.02	na	na	<2.0	2.0
RDX	na	na	na	na	na	na	na
TATB	na	<0.01	0.01	na	na	<0.01	0.01
pH	<12.5	8.6	0.0	10.3	0.0	na	na

[a] These discharge limits come from either Monitoring and Reporting Program No. 96-248 accompanying WDR No. 96-248, or from Appendix C of the *Amended Report of Waste Discharge* (1995).

[b] California soluble threshold limit concentration (STLC), i.e. hazardous waste limit not noted in WDR 96-248.

[c] na = Not analyzed or not available.

[d] There were no other detections of any volatile organic compounds, using EPA Method 8260.

[e] EPA Toxicity Characteristic Leaching Procedure (TCLP) hazardous waste limit.

Table 8-56. Analysis of chemistry process wastewater effluent discharged and sampled from four drums, October 2,1996.

Parameter	WDR effluent limits[a]	Reporting limit	Drum 1	Drum 2	Drum 3	Drum 4
General (mg/L)						
HMX	na[b]	0.02	2.7	3	2.9	1.8
RDX	na	2	9.4	8.2	8.4	7.6
TNT	na	0.02	<0.02	<0.02	<0.02	<0.02
Ethanol	1000	400	<400	<400	<400	<400
Volume of discharge (L)	none	0	208	208	208	208

[a] These discharge limits come from either Monitoring and Reporting Program No. 96-248 accompanying WDR No. 96-248, adopted on September 20, 1996, or from Appendix C of the *Amended Report of Waste Discharge* (1995).

[b] na = Not available.

Table 8-57. Fourth quarter ground water analytical results for the Explosives Process Area. Samples were taken between October 1 and 21, 1996, and analyzed for constituents listed in Monitoring and Reporting Program 96-248.

Parameters	MDL[a]	Reporting limit	Location				Statistical limit[b]	Statistical method[b]
			W-817-01	W-817-02	W-817-03	W-817-04		
General								
Ground water elevation (m above MSL)								
Oct-96	na[d]	0.003	194.56	180.42	175.53	186.04	na	na
Field pH	na	na	7.85	7.50	7.78	7.69	na	na
Specific conductance (µmho/cm)	0.58	1.0	1200	1200	1400	1500		
Field specific conductance (µmho/cm)	na	na	1500	2200	1800	1900		
Total dissolved solids (mg/L)	na	1.0	1200	1900	1400	1500		
Water temperature (°C)	na	na	23.6	23.4	20.1	23.4	na	na
Nitrite (as N) (mg/L)	0.01	0.5	<0.5	<0.5	<0.5	<0.5		
Nitrate (as N) (mg/L)	0.01	15	18	18	28	27		
Total Kjeldahl nitrogen	na	0.5	0.5	<0.5	<0.5	<0.5		
Total phosphorus (as PO_4)	0.04	0.05	<0.05	<0.05	<0.05	<0.05		
pH	na	0.1	7.7	7.5	7.7	7.6	na	na
Surfactant	0.054	0.5	<0.5	<0.5	<0.5	<0.5		
Halocarbons (µg/L)								
1,1,1-Trichloroethane	1.39	1	<1	<1	<1	<1	1	PL[e]
Bromoform	0.83	1	<1	<1	<1	<1	1	PL
Chlorobenzene	1.3	1	<1	<1	<1	<1	1	PL
1,2-Dichloroethane (1,2-DCA)	0.83	1	<1	<1	<1	<1	1	PL
Freon 113	na	1	<1	<1	<1	<1	1	PL
Methylene chloride	3.44	1	<1	<1	<1	<1	1	PL
Tetrachloroethene (PCE)	1.66	1	<1	<1	<1	<1	1	PL
Hydrocarbons (µg/L)								
Toluene	1.32	1	<1	<1	<1	<1	1	PL
Naphthalene	5.33	5	<5	<5	<5	<5	5	PL
Dimethyl sulfoxide (DMSO)	na	5	<5	<5	<5	<5	10	PL
Photographic chemicals (µg/L)								
m- and *p*-Cresol	5.97	5	<5	<5	<5	<5	5	PL

Table 8-57. Fourth quarter ground water analytical results for the Explosives Process Area. Samples were taken between October 1 and 21, 1996, and analyzed for constituents listed in Monitoring and Reporting Program 96-248 (continued).

Parameters	MDL[a]	Reporting limit	Location				Statistical limit[b]	Statistical method[b]
			W-817-01	W-817-02	W-817-03	W-817-04		
Volatile/semivolatile compounds (μg/L)								
Acetone	5.3	40	<40	<40	<40	<40	40	PL
2-Butanone (methyl ethyl ketone)	4.58	40	<40	<40	<40	<40	40	PL
Additives to energetic compounds (μg/L)								
Di-*n*-octylphthalate	7.29	5	<5	<5	<5	<5	2[f]	PL
Unreactive polymers (μg/L)								
Styrene	0.9	1	<1	<1	<1	<1	1	PL
Vinyl chloride	2.58	2	<2	<2	<2	<2	1	PL
Metals (mg/L)								
Aluminum	0.032	0.2	<0.2	<0.2	<0.2	<0.2	0.2	PL
Antimony	0.0063	0.005	<0.005	<0.005	<0.005	<0.005		
Arsenic	0.00069	0.002	0.045	0.042	0.045	0.049	ANOVA[g]	ANOVA
	0.00069	0.002	0.032	0.038	0.04	0.04	ANOVA	ANOVA
	0.00069	0.002	0.051	0.048	0.056	0.057	ANOVA	ANOVA
	0.00069	0.002	0.047	0.053	0.053	0.063	ANOVA	ANOVA
Barium	0.0011	0.025	<0.025	<0.025	<0.025	<0.025	0.05	PL
Cadmium	0.00005	0.0005	<0.0005	0.0006	<0.0005	<0.0005	0.0042	PL
Calcium	0.014	0.5	16	40	23	21		
Chromium	0.00087	0.001	<0.001	<0.001	0.0015	0.0033	0.0098	PL
Chromium(VI)	0.00059	0.002	<0.002	<0.002	<0.002	<0.002		
Cobalt	0.0025	0.05	<0.05	<0.05	<0.05	<0.05	0.05	PL
Copper	0.0025	0.05	<0.05	<0.05	<0.05	<0.05	0.099	PL
	0.0014	0.01	0.012	<0.01	<0.01	<0.01	0.099	PL
Iron	0.01	0.1	<0.1	<0.1	<0.1	<0.1		
Lead	0.00033	0.002	<0.002	<0.002	<0.002	<0.002	0.0067	PL
Magnesium	0.011	0.5	6.7	19	11	10		
Manganese	0.00036	0.03	<0.03	<0.03	<0.03	<0.03	0.042	PL
Mercury	8.3×10^{-5}	0.0002	<0.0002	<0.0002	<0.0002	<0.0002		
Molybdenum	0.0056	0.05	<0.05	0.064	<0.05	<0.05	0.093	PL

Table 8-57. Fourth quarter ground water analytical results for the Explosives Process Area. Samples were taken between October 1 and 21, 1996, and analyzed for constituents listed in Monitoring and Reporting Program 96-248 (continued).

Parameters	MDL[a]	Reporting limit	Location				Statistical limit[b]	Statistical method[b]
			W-817-01	W-817-02	W-817-03	W-817-04		
Metals (mg/L) (continued)								
Nickel	0.00056	0.005	<0.005	<0.005	<0.005	0.024	0.044	PL
Potassium	0.057	1	9.6				none	
	0.057			14			16.2	CC[h]
	0.057				11		14.1	CC
	0.057					11	13.1	CC
Selenium	0.00058	0.002	<0.002	<0.002	<0.002	0.042		
Silver	0.00021	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0083	PL
Sodium	0.14	1	270	440	350	360		
Thallium	0.00026	0.001	<0.001	<0.001	<0.001	<0.001		
Vanadium	0.0019	0.05	0.13	0.13	0.13	0.13		
Zinc	0.0028	0.05	<0.05	<0.05	<0.05	<0.05	0.076	PL
	0.0028	0.02	<0.02	0.14	<0.02	<0.02	0.076	PL
Resampled Dec. 16	0.0028	0.02		0.12			0.076	PL
Resampled Dec. 20	0.0028	0.02		0.22			0.076	PL
Salts (mg/L)								
Ammonia nitrogen (as N)	0.0266	0.1	<0.1	<0.1	<0.1	<0.1	TBD[i]	TBD
Bicarbonate alkalinity (as $CaCO_3$)	0.56	1.0	260	240	250	260	277	PL
Bromide	0.04	0.5	0.73	<0.5	0.9	0.98	TBD	TBD
Chloride	0.01	0.5	150				none	CC
	0.01	0.5		270			356	CC
	0.01	0.5			280		271	CC
Resampled Jan. 6					222			
Resampled Feb. 10					224			
	0.01	0.5				260	283	CC
Nitrate (as NO_3)	0.045	0.5	80				none	CC
	0.045	0.5		80			107	CC
	0.045	0.5			120		107	CC
	0.045	0.5				120	107	CC
Resampled Dec. 16	0.045	0.5			79	84	107	CC
Resampled Dec. 20	0.045	0.5			88	88	107	CC

Table 8-57. Fourth quarter ground water analytical results for the Explosives Process Area. Samples were taken between October 1 and 21, 1996, and analyzed for constituents listed in Monitoring and Reporting Program 96-248 (continued).

Parameters	MDL[a]	Reporting limit	Location				Statistical limit[b]	Statistical method[b]
			W-817-01	W-817-02	W-817-03	W-817-04		
Salts (mg/L) (continued)								
Orthophosphate	0.01	1	<1	<1	<1	<1	TBD	TBD
	0.01	0.05	<0.05	<0.05	<0.05	<0.05	TBD	TBD
Sulfate	0.09	10	110				none	CC
	0.09	10		180			442	CC
	0.09	10			170		233	CC
	0.09	10				180	275	CC
Energetic materials (μg/L)								
HMX	0.06	1	18	<1	<1	<1	5	PL
	0.06	1	15		<1	<1	5	PL
RDX	0.1	0.85	53	<0.85	5.2	6.0	9.1	PL
	0.1	0.85	52		5.5	7.1	9.1	PL
TNT	0.09	0.26	<0.26	<0.26	<0.26	<0.26	5	PL
	0.09	0.26	<0.26		<0.26	<0.26	5	PL
TATB	na	50	<50	<50	<50	<50	TBD	TBD
PETN	na	1	<1	<1	<1	<1	1.3	PL
Minerals (mg/L)								
Hydroxide alkalinity (as $CaCO_3$)	0.56	1	<1	<1	<1	<1	na	na
Total alkalinity (as $CaCO_3$)	0.56	1	260	240	250	260	na	na
Fluoride	0.0234	0.05	0.92	1.0	1.2	1.2	na	na
Total hardness (as $CaCO_3$)	0.6	1.0	68	180	100	95	na	na
Volatile organic compounds (μg/L)								
1,1,2,2-Tetrachloroethane	1.07	1	<1	<1	<1	<1	na	na
1,1,2-Trichloroethane	0.97	1	<1	<1	<1	<1	na	na
1,1-Dichloroethane	1.36	1	<1	<1	<1	<1	na	na
1,1-Dichloroethene	2.02	1	<1	<1	<1	<1	na	na
1,2-Dichlorobenzene	0.98	1	<1	<1	<1	<1	na	na
1,2-Dichloroethene (total)	2.39	1	<1	<1	<1	<1	na	na
1,2-Dichloropropane	0.71	1	<1	<1	<1	<1	na	na
1,3-Dichlorobenzene	0.81	1	<1	<1	<1	<1	na	na
1,4-Dichlorobenzene	1.62	1	<1	<1	<1	<1	na	na

Table 8-57. Fourth quarter ground water analytical results for the Explosives Process Area. Samples were taken between October 1 and 21, 1996, and analyzed for constituents listed in Monitoring and Reporting Program 96-248 (continued).

Parameters	MDL[a]	Reporting limit	Location				Statistical limit[b]	Statistical method[b]
			W-817-01	W-817-02	W-817-03	W-817-04		
Volatile organic compounds (μg/L) (continued)								
2-Chloroethylvinylether	4.91	40	<40	<40	<40	<40	na	na
2-Hexanone	2.31	10	<10	<10	<10	<10	na	na
4-Methyl-2-pentanone	1.69	10	<10	<10	<10	<10	na	na
Benzene	0.89	1	<1	<1	<1	<1	na	na
Bromodichloromethane	0.35	1	<1	<1	<1	<1	na	na
Carbon disulfide	1.8	1	<1	<1	<1	<1	na	na
Carbon tetrachloride	1.49	1	<1	<1	<1	<1	na	na
Chloroethane	0.35	2	<2	<2	<2	<2	na	na
Chloroform	1.72	1	<1	<1	<1	<1	na	na
Chloromethane	1.84	2	<2	<2	<2	<2	na	na
Dibromochloromethane	0.95	1	<1	<1	<1	<1	na	na
Dibromomethane	na	1	<1	<1	<1	<1	na	na
Dichlorodifluoromethane	na	2	<2	<2	<2	<2	na	na
Ethylbenzene	1.87	1	<1	<1	<1	<1	na	na
Trichloroethene	1.57	0.5	<0.5	<0.5	11	8.9	na	na
Trichlorofluoromethane	1.81	1	<1	<1	<1	<1	na	na
Vinyl acetate	1.24	10	<10	<10	<10	<10	na	na
cis-1,3-Dichloropropene	0.45	1	<1	<1	<1	<1	na	na
trans-1,3-Dichloropropene	0.6	1	<1	<1	<1	<1	na	na
Semivolatile organic compounds (μg/L)								
1,2,4-Trichlorobenzene	4.86	5	<5	<5	<5	<5	na	na
1,2-Dichlorobenzene	5.25	5	<5	<5	<5	<5	na	na
1,3-Dichlorobenzene	5.25	5	<5	<5	<5	<5	na	na
1,4-Dichlorobenzene	6.26	5	<5	<5	<5	<5	na	na
2,4,5-Trichlorophenol	6.63	5	<5	<5	<5	<5	na	na
2,4,6-Trichlorophenol	6.74	5	<5	<5	<5	<5	na	na
2,4-Dichlorophenol	5.04	5	<5	<5	<5	<5	na	na
2,4-Dimethylphenol	4.98	5	<5	<5	<5	<5	na	na
2,4-Dinitrophenol	18.38	25	<25	<25	<25	<25	na	na
2,4-Dinitrotoluene	7.13	5	<5	<5	<5	<5	na	na
2,6-Dinitrotoluene	4.94	5	<5	<5	<5	<5	na	na

Table 8-57. Fourth quarter ground water analytical results for the Explosives Process Area. Samples were taken between October 1 and 21, 1996, and analyzed for constituents listed in Monitoring and Reporting Program 96-248 (continued).

Parameters	MDL[a]	Reporting limit	Location				Statistical limit[b]	Statistical method[b]
			W-817-01	W-817-02	W-817-03	W-817-04		
Semivolatile organic compounds (μg/L) (continued)								
2-Chloronaphthalene	5.81	5	<5	<5	<5	<5	na	na
2-Chlorophenol	4.71	5	<5	<5	<5	<5	na	na
2-Methyl-4,6-dinitrophenol	8.09	25	<25	<25	<25	<25	na	na
2-Methyl phenol	5.25	5	<5	<5	<5	<5	na	na
2-Methylnaphthalene	5.46	5	<5	<5	<5	<5	na	na
2-Nitroaniline	7.31	25	<25	<25	<25	<25	na	na
2-Nitrophenol	5.26	5	<5	<5	<5	<5	na	na
3,3'-Dichlorobenzidine	14.87	10	<10	<10	<10	<10	na	na
3-Nitroaniline	7.53	25	<25	<25	<25	<25	na	na
4-Bromophenylphenylether	5.42	5	<5	<5	<5	<5	na	na
4-Chloro-3-methylphenol	5.95	10	<10	<10	<10	<10	na	na
4-Chloroaniline	5.47	10	<10	<10	<10	<10	na	na
4-Chlorophenylphenylether	5.89	5	<5	<5	<5	<5	na	na
4-Nitroaniline	8.07	25	<25	<25	<25	<25	na	na
4-Nitrophenol	13.76	25	<25	<25	<25	<25	na	na
Acenaphthene	6.82	5	<5	<5	<5	<5	na	na
Acenaphthylene	5.36	5	<5	<5	<5	<5	na	na
Anthracene	6.16	5	<5	<5	<5	<5	na	na
Benzo(a)anthracene	9.23	5	<5	<5	<5	<5	na	na
Benzo(a)pyrene	8.5	5	<5	<5	<5	<5	na	na
Benzo(b)fluoranthene	10.09	5	<5	<5	<5	<5	na	na
Benzo(g,h,i)perylene	8.41	5	<5	<5	<5	<5	na	na
Benzo(k)fluoranthene	9.49	5	<5	<5	<5	<5	na	na
Benzoic acid	5.8	25	<25	<25	<25	<25	na	na
Benzyl alcohol	6.18	10	<10	<10	<10	<10	na	na
Bis(2-chloroethoxy)methane	5.3	5	<5	<5	<5	<5	na	na
Bis(2-chloroethyl)ether	5.07	5	<5	<5	<5	<5	na	na
Bis(2-chloroisopropyl)ether	5.21	5	<5	<5	<5	<5	na	na
Bis(2-ethylhexyl)phthalate	5.95	5	<5	<5	<5	<5	na	na
Butylbenzylphthalate	7.97	5	<5	<5	<5	<5	na	na
Chrysene	8.5	5	<5	<5	<5	<5	na	na

Table 8-57. Fourth quarter ground water analytical results for the Explosives Process Area. Samples were taken between October 1 and 21, 1996, and analyzed for constituents listed in Monitoring and Reporting Program 96-248 (continued).

Parameters	MDL[a]	Reporting limit	Location				Statistical limit[b]	Statistical method[b]
			W-817-01	W-817-02	W-817-03	W-817-04		
Semivolatile organic compounds (μg/L) (continued)								
Di-*n*-butylphthalate	5.47	5	<5	<5	<5	<5	na	na
Dibenzo(a,h)anthracene	9.26	5	<5	<5	<5	<5	na	na
Dibenzofuran	6.23	5	<5	<5	<5	<5	na	na
Diethylphthalate	6.29	5	<5	<5	<5	<5	na	na
Dimethylphthalate	7.16	5	<5	<5	<5	<5	na	na
Fluoranthene	5.42	5	<5	<5	<5	<5	na	na
Fluorene	5.69	5	<5	<5	<5	<5	na	na
Hexachlorobenzene	6.32	5	<5	<5	<5	<5	na	na
Hexachlorobutadiene	6.38	5	<5	<5	<5	<5	na	na
Hexachlorocyclopentadiene	6.56	5	<5	<5	<5	<5	na	na
Hexachloroethane	6.19	5	<5	<5	<5	<5	na	na
Indeno(1,2,3-c,d)pyrene	8.21	5	<5	<5	<5	<5	na	na
Isophorone	6.39	5	<5	<5	<5	<5	na	na
N-Nitrosodi-n-propylamine	6.23	5	<5	<5	<5	<5	na	na
N-Nitrosodiphenylamine	4.58	5	<5	<5	<5	<5	na	na
Nitrobenzene	5.5	5	<5	<5	<5	<5	na	na
Pentachlorophenol	6.87	25	<25	<25	<25	<25	na	na
Phenanthrene	6.12	5	<5	<5	<5	<5	na	na
Phenol	5.35	5	<5	<5	<5	<5	na	na
Pyrene	7.51	5	<5	<5	<5	<5	na	na
Energetic materials (μg/L)								
1,3,5-Trinitrobenzene	0.07	0.45	<0.45	<0.45	<0.45	<0.45	na	na
	0.07	0.45	<0.45		<0.45	<0.45	na	na
1,3-Dinitrobenzene	0.07	0.3	<0.3	<0.3	<0.3	<0.3	na	na
	0.07	0.3	<0.3		<0.3	<0.3	na	na
2,4-Dinitrotoluene	0.1	0.26	<0.26	<0.26	<0.26	<0.26	na	na
	0.1	0.26	<0.26		<0.26	<0.26	na	na
2,6-Dinitrotoluene	0.16	0.25	<0.25	<0.25	<0.25	<0.25	na	na
	0.16	0.25	<0.25		<0.25	<0.25	na	na
2-Amino-4,6-dinitrotoluene	0.1	0.26	<0.26	<0.26	<0.26	<0.26	na	na
	0.1	0.26	<0.26		<0.26	<0.26	na	na

Table 8-57. Fourth quarter ground water analytical results for the Explosives Process Area. Samples were taken between October 1 and 21, 1996, and analyzed for constituents listed in Monitoring and Reporting Program 96-248 (concluded).

Parameters	MDL[a]	Reporting limit	Location				Statistical limit[b]	Statistical method[b]
			W-817-01	W-817-02	W-817-03	W-817-04		
Energetic materials (μg/L) (continued)								
4-Amino-2,6-dinitrotoluene	0.12	0.26	12	<0.26	<0.26	0.53	na	na
	0.12	0.26	12		0.61	0.68	na	na
2-Nitrotoluene	0.17	0.25	<0.25	<0.25	<0.25	<0.25	na	na
	0.17	0.25	<0.25		<0.25	<0.25	na	na
3-Nitrotoluene	0.21	0.25	<0.25	<0.25	<0.25	<0.25	na	na
	0.21	0.25	<0.25		<0.25	<0.25	na	na
4-Nitrotoluene	0.2	0.25	<0.25	<0.25	<0.25	<0.25	na	na
	0.2	0.25	<0.25		<0.25	<0.25	na	na
Nitrobenzene	0.13	0.5	<0.5	<0.5	<0.5	<0.5	na	na
	0.13	0.5	<0.5		<0.5	<0.5	na	na
Tetryl	0.11	1	<1	<1	<1	<1	na	na
	0.11	1	<1		<1	<1	na	na

a MDL = Method Detection Limit.

b Statistical limit as listed in MRP 96-248, Table 5.

c Statistical method used to develop statistical limits.

d na = None available.

e PL = Statistical limit by the prediction interval method.

f Statistical limit should be 5 μg/L, not 2 μg/L.

g ANOVA = Analysis of variance statistical method.

h CC = Statistical limits by the control chart method.

i TBD = Statistical methods and statistical limits are to be determined by future monitoring results.

Table 8-58a. Fourth quarter ground water analytical results, Sewage Evaporation and Percolation Ponds. Monitoring for constituents listed in Monitoring and Reporting Program 96-248.

Constituent	W-25N-20	W-26R-01	W-26R-05	W-26R-11	W-35A-04
Specific conductance (μmho/cm)	1300	1000	1100	920	940
Nitrate (as NO_3)	7.2	29	2.5	8.4	9.3
pH	7.2	7.4	7.6	7.3	7.7
Coliform (MPN/100 mL)					
Total coliform	<2	<2	<2	2	<2
Fecal coliform	<2	<2	<2	<2	<2
Other metals and minerals (mg/L)					
Field pH	7.73	7.86	7.89	7.76	7.87
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2
Bicarbonate alkalinity (as $CaCO_3$)	290	280	210	290	300
Calcium	97	72	59	95	81
Carbonate alkalinity (as $CaCO_3$)	<1	<1	<1	<1	<1
Chloride	84	130	95	98	93
Copper	<0.05	0.05	<0.05	<0.05	<0.05
Copper					<0.01
Field temperature (°C)	23.1	21.8	20.4	23.5	20.5
Fluoride	0.36	0.35	0.44	0.36	0.41
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1	<1
Iron	<0.1	<0.1	<0.1	<0.1	0.14
Magnesium	43	26	21	42	41
Manganese	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate (as N)	1.6	6.5	0.56	1.9	2.1
Nitrite (as N)	<0.5	<0.5	<0.5	<0.5	<0.5
Orthophosphate	0.26	0.22	0.71	0.28	0.28
Potassium	5.1	11	9.5	5.7	4.7
Sodium	120	200	150	140	130
Sulfate	250	220	190	260	270
Surfactant	<0.5	<0.5	<0.5	<0.5	<0.5
Total alkalinity (as $CaCO_3$)	290	280	210	290	300
Total dissolved solids (TDS)	890	950	740	860	900
Total hardness (as $CaCO_3$)	420	290	240	410	370
Total phosphorus (as PO_4)	0.26	0.48	7.7	0.41	0.34
Zinc	<0.05	<0.05	<0.05	<0.05	<0.05
Field specific conductance	1400	1500	1200	1400	1400

Table 8-58a. Fourth quarter ground water analytical results, Sewage Evaporation and Percolation Ponds. Monitoring for constituents listed in Monitoring and Reporting Program 96-248 (concluded).

Constituent	W-7DS	W-7E	W-7ES	W-7PS	WDR 96-248 limit	MCL or SMCL[(a)]
Specific conductance (μmho/cm)	1300	1500	1300	970	na	900
Nitrate (as NO_3)	6.8	<0.5	7.2	14	na	45
pH	7.3	8.1	7.2	7.2	na	6.5–8.5
Coliform (MPN/100 mL)						
Total coliform	<2	<2	<2	<1.1	na	na
Fecal coliform	<2	<2	<2	<2	2.2	na
Other metals and minerals (mg/L)						
Field pH	7.8	8.74	7.78	7.74	na	6.5–8.5
Aluminum	<0.2	<0.2	<0.2	<0.2	na	1.0
Bicarbonate alkalinity (as $CaCO_3$)	290	270	300	310	na	na
Calcium	98	11	100	92	na	na
Carbonate alkalinity (as $CaCO_3$)	<1	<1	<1	<1	na	na
Chloride	84	160	84	100	na	250
Copper	<0.05	<0.05	<0.05	<0.05	na	1.3
Copper					na	1.3
Field temperature (°C)	22.7	21.7	23.6	22.1	na	na
Fluoride	0.36	0.47	0.33	0.35	na	1.4–2.4
Hydroxide alkalinity (as $CaCO_3$)	<1	<1	<1	<1	na	na
Iron	<0.1	<0.1	<0.1	<0.1	na	0.3
Magnesium	44.	1.5	45.	41	na	na
Manganese	<0.03	<0.03	<0.03	<0.03	na	0.05
Nickel	0.1	<0.1	<0.1	<0.1	na	0.1
Nitrate (as N)	1.5	<0.5	1.6	3.1	na	10
Nitrite (as N)	<0.5	<0.5	<0.5	<0.5	na	1
Orthophosphate	0.26	0.16	0.26	0.35	na	na
Potassium	5.2	7.2	5.3	6	na	na
Sodium	120	310	120	150	na	na
Sulfate	260	240	250	240	na	250
Surfactant	<0.5	<0.5	<0.5	<0.5	na	500
Total alkalinity (as $CaCO_3$)	290	270	300	310	na	na
Total dissolved solids	880	950	870	900	na	500
Total hardness (as $CaCO_3$)	430	33	440	400	na	na
Total phosphorus (as PO_4)	0.23	0.11	0.2	0.52	na	na
Zinc	<0.05	<0.05	<0.05	<0.05	na	5
Field specific conductance (μmho/cm)	1,00	1600	1400	1500	na	900

Table 8-58b. Fourth quarter ground water analytical results, Sewage Evaporation and Percolation Ponds. Monitoring for constituents not listed in Monitoring and Reporting Program 96-248.

Constituent	W-25N-20	W-26R-01	W-26R-05	W-26R-11	W-35A-04
EPA Method 601 (μg/L)					
Tetrachloroethene (PCE)	<0.5	0.97	<0.5	<0.5	<0.5
Trichloroethene (TCE)	<0.5	15	<0.5	2.1	<0.5

Table 8-58b. Fourth quarter ground water analytical results, Sewage Evaporation and Percolation Ponds. Monitoring for constituents not listed in Monitoring and Reporting Program 96-248 (concluded).

Constituent	W-7DS	W-7E	W-7ES	W-7PS	WDR 96-248 limit	MCL or SMCL[(a)]
EPA Method 601 (μg/L)						
Tetrachloroethene (PCE)	<0.5	<0.5	<0.5	<0.5	na	5
Trichloroethene (TCE)	<0.5	<0.5	<0.5	4.3	na	5

[a] MCL = Lower of either California of Federal Maximum Contaminant Level; SMCL = Lower of either California or Federal Secondary Maximum Contaminant Level.

[b] na = Not available.

9

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 1996 Livermore site soil samples were collected from the same locations as those in 1991 to 1995. The 1996 Site 300 soil samples were collected from the same 14 sampling locations as in 1990 to 1995. 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 Science 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 1994a, b, and c). 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 1996, samples were analyzed for radionuclides. A new monitoring program conducted in arroyo channels as part of the Ground Water Protection Management Plan was instituted in 1996 to determine if materials present in the channels could lead to contamination of the ground water by nonradiological materials (see Chapter 8).

Sediment was sampled from six Livermore site drainages. Location ASS2 was inaccessible; the appropriateness of this location will be evaluated. 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 9-1 presents the analytical data for radionuclides and beryllium for soils and sediments samples collected in 1996. 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 9-1. Radionuclides and beryllium in soils and sediments, 1996.

	Plutonium-239 10^{-3} Bq/dry g	Americium-241[a] 10^{-3} 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	0.48 ± 0.03	__[a]	__[b]	3.2 ± 0.3	0.585 ± 0.013
L-CAFE-SO	0.61 ± 0.04	__[a]	__[b]	3.1 ± 0.2	0.414 ± 0.017
L-COW-SO	0.10 ± 0.01	__[a]	__[b]	2.9 ± 0.2	0.522 ± 0.020
L-ERCH-SO	0.057 ± 0.008	__[a]	__[b]	1.9 ± 0.2	0.381 ± 0.011
L-FCC-SO	0.094 ± 0.010	__[a]	__[b]	3.0 ± 0.2	0.444 ± 0.013
L-HOSP-SO	0.042 ± 0.007	__[a]	__[b]	1.7 ± 0.2	0.566 ± 0.015
L-MESQ-SO	0.037 ± 0.006	__[a]	__[b]	1.2 ± 0.2	0.577 ± 0.017
L-MET-SO	0.056 ± 0.007	__[a]	__[b]	1.6 ± 0.2	0.555 ± 0.016
L-NEP-SO	0.11 ± 0.01	__[a]	__[b]	3.6 ± 0.2	0.488 ± 0.018
L-PATT-SO	0.028 ± 0.005	__[a]	__[b]	0.88 ± 0.23	0.522 ± 0.017
L-RRCH-SO	0.21 ± 0.02	__[a]	__[b]	7.1 ± 0.5	0.466 ± 0.012
L-SALV-SO	0.31 ± 0.02	__[a]	__[b]	4.5 ± 0.3	0.470 ± 0.019
L-TANK-SO	0.12 ± 0.01	__[a]	__[b]	4.4 ± 0.2	0.381 ± 0.014
L-VIS-SO	0.37 ± 0.02	__[a]	__[b]	3.2 ± 0.2	0.369 ± 0.018
L-ZON7-SO	0.29 ± 0.02	__[a]	__[b]	3.3 ± 2.1	0.414 ± 0.015
Median	**0.11**			**3.1**	**0.470**
Interquartile range	**0.25**			**1.7**	**0.124**
Maximum	**0.61**			**7.1**	**0.585**
LWRP soils					
L-WRP1-SO	12 ± 1	2.3 ± 0.5	<0.077	8.2 ± 0.3	0.444 ± 0.016
L-WRP2-SO	4.7 ± 0.2	2.5 ± 1.3	0.25 ± 0.15	4.6 ± 0.3	0.429 ± 0.020
L-WRP3-SO	2.2 ± 0.1	<5.1	<0.099	2.5 ± 0.2	0.503 ± 0.016
L-WRP4-SO	0.38 ± 0.03	<0.47	<0.052	0.54 ± 0.14	0.385 ± 0.014
L-WRP5-SO	24 ± 1	4.5 ± 3.1	<0.067	3.0 ± 0.2	0.444 ± 0.014
L-WRP6-SO	2.2 ± 0.1	<2.6	<0.057	0.93 ± 0.14	0.407 ± 0.014
Median	**3.5**	**<2.6**	**<0.072**	**2.8**	**0.437**
Interquartile range	**8.0**	__[h]	__[h]	**2.9**	**0.031**
Maximum	**24**	**5.1**	**0.25**	**8.2**	**0.503**
Livermore site sediments					
L-ALPE-SD	0.016 ± 0.004	__[a]	__[b]	0.25 ± 0.14	0.411 ± 0.015
L-ASW-SD	0.019 ± 0.004	__[a]	__[b]	0.41 ± 0.14	0.525 ± 0.019
L-CDB-SD	1.7 ± 0.1	__[a]	__[b]	0.94 ± 0.21	0.492 ± 0.016
L-ESB-SD	2.2 ± 0.1	__[a]	__[b]	0.80 ± 0.33	0.451 ± 0.015
L-GRNE-SD	0.015 ± 0.004	__[a]	__[b]	0.39 ± 0.18	0.577 ± 0.023
L-WPDC-SD	0.038 ± 0.006	__[a]	__[b]	<.088	0.574 ± 0.015
Median	**0.029**			**0.40**	**0.509**
Interquartile range	**1.3**			**0.42**	**0.100**
Maximum	**2.2**			**0.94**	**0.577**

Table 9-1. Radionuclides and beryllium in soils and sediments, 1996 (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	8.6 ± 0.2	<0.022	<1.6	__[f]	__[g]
L-CAFE-SO	5.1 ± 0.2	0.021 ± 0.005	2.2 ± 1.1	__[f]	__[g]
L-COW-SO	7.0 ± 0.3	0.036 ± 0.014	<3.3	__[f]	__[g]
L-ERCH-SO	5.5 ± 0.2	0.020 ± 0.008	1.6 ± 1.4	__[f]	__[g]
L-FCC-SO	6.3 ± 0.2	0.018 ± 0.005	3.3 ± 2.6	__[f]	__[g]
L-HOSP-SO	3.4 ± 0.1	<0.015	<1.4	__[f]	__[g]
L-MESQ-SO	7.3 ± 0.3	<0.024	1.8 ± 0.7	__[f]	__[g]
L-MET-SO	6.2 ± 0.3	0.023 ± 0.006	2.0 ± 0.9	__[f]	__[g]
L-NEP-SO	6.2 ± 0.2	0.021 ± 0.007	1.3 ± 0.9	__[f]	__[g]
L-PATT-SO	7.2 ± 0.2	0.042 ± 0.015	3.8 ± 2.3	__[f]	__[g]
L-RRCH-SO	6.2 ± 0.2	<0.016	<1.	__[f]	__[g]
L-SALV-SO	7.2 ± 0.3	0.024 ± 0.007	2.1 ± 1.1	__[f]	__[g]
L-TANK-SO	6.0 ± 0.3	<0.019	1.9 ± 0.6	__[f]	__[g]
L-VIS-SO	6.0 ± 0.3	<0.022	<2.2	__[f]	__[g]
L-ZON7-SO	6.0 ± 0.3	0.025 ± 0.008	<1.6	__[f]	__[g]
Median	**6.2**	**<0.022**	**1.9**		
Interquartile range	**1.1**	__[h]	__[h]		
Maximum	**8.6**	**0.042**	**3.8**		
LWRP soils					
L-WRP1-SO	7.4 ± 0.2	0.026 ± 0.006	2.3 ± 0.637	__[f]	__[g]
L-WRP2-SO	6.6 ± 0.3	0.029 ± 0.006	2.2 ± 0.836	__[f]	__[g]
L-WRP3-SO	7.5 ± 0.2	0.024 ± 0.006	<1.7	__[f]	__[g]
L-WRP4-SO	7.0 ± 0.2	0.021 ± 0.005	1.7 ± 0.542	__[f]	__[g]
L-WRP5-SO	6.6 ± 0.2	0.025 ± 0.005	1.9 ± 0.791	__[f]	__[g]
L-WRP6-SO	5.5 ± 0.3	0.025 ± 0.006	2.2 ± 1.102	__[f]	__[g]
Median	**6.8**	**0.025**	**2.0**		
Interquartile range	**0.6**	**0.002**	**0.4**		
Maximum	**7.5**	**0.029**	**2.3**		
Livermore site sediments					
L-ALPE-SD	3.8 ± 0.2	0.012 ± 0.005	<1.1	11 ± 5	__[g]
L-ASW-SD	5.8 ± 0.4	0.022 ± 0.008	1.3 ± 0.9	<2.2	__[g]
L-CDB-SD	7.6 ± 0.3	0.026 ± 0.005	1.7 ± 1.2	40 ± 3	__[g]
L-ESB-SD	6.0 ± 0.2	0.020 ± 0.006	1.7 ± 1.6	100 ± 4	__[g]
L-GRNE-SD	4.6 ± 0.2	0.016 ± 0.016	<1.2	4.6 ± 2.1	__[g]
L-WPDC-SD	6.6 ± 0.3	0.022 ± 0.022	<0.12	8.0 ± 2.3	__[g]
Median	**5.9**	**0.021**	**<1.3**	**9.5**	
Interquartile range	**1.6**	**0.006**	__[h]	**27**	
Maximum	**7.6**	**0.026**	**1.7**	**100**	

Table 9-1. Radionuclides and beryllium in soils and sediments, 1996 (continued).

	Plutonium-239 10^{-3} Bq/dry g	Americium-241[a] 10^{-3} 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	0.049 ± 0.007	__[a]	__[b]	1.5 ± 0.2	0.429 ± 0.015
3-801N-SO	0.079 ± 0.009	__[a]	__[b]	2.5 ± 0.2	0.485 ± 0.014
3-801W-SO	0.078 ± 0.009	__[a]	__[b]	2.2 ± 0.3	0.537 ± 0.035
3-812N-SO	0.015 ± 0.004	__[a]	__[b]	0.68 ± 0.2	0.470 ± 0.016
3-812N-SO	__[i]	__[i]	__[i]	__[i]	__[i]
3-812N-SO	__[i]	__[i]	__[i]	__[i]	__[i]
3-812N-SO	__[i]	__[i]	__[i]	__[i]	__[i]
3-812N-SO	__[i]	__[i]	__[i]	__[i]	__[i]
3-834W-SO	0.081 ± 0.01	__[a]	__[b]	2.9 ± 0.3	0.477 ± 0.011
3-851N-SO	0.074 ± 0.008	__[a]	__[b]	2.6 ± 0.2	0.470 ± 0.011
3-856N-SO	0.12 ± 0.01	__[a]	__[b]	3.4 ± 0.2	0.381 ± 0.011
3-858S-SO	0.14 ± 0.01	__[a]	__[b]	5.6 ± 0.2	0.544 ± 0.016
3-DSW-SO	0.029 ± 0.005	__[a]	__[b]	1.1 ± 0.2	0.448 ± 0.016
3-EOBS-SO	0.021 ± 0.005	__[a]	__[b]	0.75 ± 0.17	0.555 ± 0.017
3-EVAP-SO	0.20 ± 0.02	__[a]	__[b]	1.4 ± 0.2	0.377 ± 0.014
3-GOLF-SO	0.053 ± 0.007	__[a]	__[b]	2.3 ± 0.2	0.622 ± 0.019
3-NPS-SO	0.096 ± 0.010	__[a]	__[b]	3.4 ± 0.2	0.592 ± 0.019
3-WOBS-SO	0.18 ± 0.01	__[a]	__[b]	6.4 ± 0.3	0.477 ± 0.017
Median	**0.079**			**2.4**	**0.477**
Interquartile range	**0.064**			**1.9**	**0.089**
Maximum	**0.20**			**6.4**	**0.622**

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

a Americium-241 only detected in LWRP samples.

b Cobalt-60 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 9-1. Radionuclides and beryllium in soils and sediments, 1996 (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	8.6 ± 0.2	0.024 ± 0.019	3.3 ± 1.7	__[f]	1.5
3-801N-SO	10 ± 0.4	0.038 ± 0.008	8.5 ± 1.6	__[f]	2.3
3-801W-SO	9.0 ± 0.4	0.031 ± 0.007	6.8 ± 2.3	__[f]	1.3
3-812N-SO	6.1 ± 0.3	0.074 ± 0.007	32 ± 2	__[f]	53
3-812N-SO	__[i]	0.070 ± 0.008	35 ± 4	__[f]	<0.5
3-812N-SO	__[i]	1.8 ± 0.1	840 ± 25	__[f]	27
3-812N-SO	__[i]	0.029 ± 0.006	6 ± 1	__[f]	7.7
3-812N-SO	__[i]	0.299 ± 0.019	140 ± 6	__[f]	<0.5
3-834W-SO	10 ± 0.2	<0.017	<1.4	__[f]	1.9
3-851N-SO	11 ± 0.3	<0.036	3.6 ± 1.3	__[f]	1.8
3-856N-SO	8.8 ± 0.4	0.024 ± 0.007	<2.0	__[f]	1.2
3-858S-SO	8.9 ± 0.4	0.031 ± 0.006	3.5 ± 1.4	__[f]	1.2
3-DSW-SO	8.5 ± 0.3	0.033 ± 0.005	5.8 ± 3.3	__[f]	1.2
3-EOBS-SO	9.3 ± 0.3	0.026 ± 0.008	2.0 ± 0.5	__[f]	1.6
3-EVAP-SO	5.8 ± 0.2	<0.019	<1.9	__[f]	0.62
3-GOLF-SO	8.2 ± 0.3	<0.024	2.8 ± 1.0	__[f]	1.2
3-NPS-SO	7.1 ± 0.2	<0.028	<1.3	__[f]	1
3-WOBS-SO	7.6 ± 0.2	0.020 ± 0.005	1.9 ± 1.3	__[f]	1.2
Median	**8.7**	**0.030**	**3.6**		**1.3**
Interquartile range	**1.5**	__[h]	**6.1**		**0.7**
Maximum	**11**	**1.8**	**840**		**53**

[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 (H-3) analysis is only conducted on sediment samples.

[g] Beryllium analysis is only conducted on soils sampled at Site 300; the analysis is a chemical, not a radiochemical analysis.

[h] Interquartile range could not be calculated.

[i] Resampling was conducted to investigate elevated levels of uranium and beryllium. See Volume 1, Chapter 10.

10

Vegetation and Foodstuff Monitoring

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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.

Sampling location NPER was added to the sampling network in the first quarter of 1996. It replaced location RAIL, which had become inaccessible. Sampling locations PIN1, PIN2, and PRIM were added in the fourth quarter of 1996. PIN1 and PIN2 were added to evaluate the emissions of tritium from a pine tree that is rooted in tritium contaminated soil (PIN2 is a tree located in a background location). PRIM is located off site and downwind of Site 300. See Figures 10-1 and 10-2 (in Volume 1 of this report) for maps of vegetation sampling locations.

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 1996, 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. In the third quarter, a stinging nettle plant (*Urtica dioica*) was sampled at location EVAP because no other vegetation was available. This plant caused the sampling technologists considerable discomfort, and will not be sampled in the future. 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 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 10-1. Tritium (in Bq/L) in vegetation, 1996.

	First quarter	Second quarter	Third quarter	Fourth quarter	Median	Inter-quartile	Dose (μSv/y)	
							Median	Maximum
Sampling locations near Livermore site								
AQUE	3.9 ± 1.7	7.9 ± 2.1	11 ± 2	87 ± 4	9.3	23	0.045	0.42
VIS	14 ± 2	5.8 ± 2.1	16 ± 2	62 ± 4	15	16	0.070	0.30
NPER	17 ± 2	3.6 ± 2.0	3.2 ± 2.0	4.7 ± 2.1	4.1	4.3	0.020	0.08
MET	6.1 ± 1.8	2.3 ± 2.0	3.8 ± 2.0	56 ± 4	5.0	15	0.024	0.27
MESQ	2.5 ± 1.7	<1.9	<1.9	14 ± 2	<2.2	—[a]	<0.011	0.068
GARD	5.2 ± 1.8	<1.9	<1.9	<2.0	<1.9	—[a]	<0.009	0.025
PIN1	—[b]	—[b]	—[b]	96 ± 4	96	—[a]	0.46	0.46
PIN2	—[b]	—[b]	—[b]	33 ± 3	33	—[a]	0.16	0.16
Sampling locations at an intermediate distance from Livermore site								
PATT	<1.6	<1.9	4.3 ± 2.0	3.0 ± 2.0	2.4	—[a]	0.012	0.021
ZON7	3.5 ± 1.7	2.8 ± 2.0	6.4 ± 2.1	8.1 ± 3.1	4.9	3.6	0.024	0.039
I580	3.8 ± 1.7	<1.9	2.5 ± 1.9	3.7 ± 2.1	3.1	1.4	0.015	0.019
TESW	<1.6	<1.9	5.0 ± 2.1	9.2 ± 2.3	3.4	—[a]	0.017	0.044
Sampling locations far from Livermore site								
FCC	<1.6	<1.9	<1.9	<2.0	<1.9	—[a]	<0.009	<0.009
CAL	<1.6	<1.8	<1.9	<1.9	<1.8	—[a]	<0.009	<0.009
PARK	<1.6	<1.8	<1.9	2.3 ± 2.0	<1.9	—[a]	<0.009	0.011
Sampling locations at Site 300								
CARN	<1.6	<1.8	<1.9	<1.9	<1.9	—[a]	<0.009	0.009
GOLF	<1.6	<1.8	2.0 ± 1.9	<1.9	<1.8	—[a]	<0.009	0.009
GEO	<1.6	<1.8	<1.9	<1.9	<1.9	—[a]	<0.009	0.009
DSW	3.5 ± 1.7	32 ± 3	3.7 ± 2.0	<2.0	3.6	7.7	0.017	0.15
801E	<1.6	<1.9	<1.9	<1.9	<1.9	—[a]	<0.009	0.009
EVAP	<1.6	<1.9	1360 ± 14	<1.9	<1.9	—[a]	<0.009	6.7
PRIM	—[b]	—[b]	—[b]	<1.9	<1.9	—[a]	<0.009	0.009

[a] Insufficient data to calculate interquartile range.

[b] Sampling location added in 4th Quarter 1996.

Table 10-2. Tritium (in Bq/L) in retail wine, 1996.[a]

Sample	Area of production		
	Livermore Valley	California	Europe
1	1.12 ± 0.21	0.38 ± 0.19	1.39 ± 0.23
2	1.41 ± 0.23	0.54 ± 0.19	1.43 ± 0.23
3	1.49 ± 0.24	0.55 ± 0.19	1.60 ± 0.24
4	1.54 ± 0.24	0.62 ± 0.20	1.92 ± 0.27
5	1.83 ± 0.26	0.77 ± 0.20	
6	3.08 ± 0.36	0.93 ± 0.21	
7	3.41 ± 0.39		
8	3.50 ± 0.40		
9	3.70 ± 0.41		
10	5.27 ± 0.56		
11	5.46 ± 0.58		
12	5.61 ± 0.59		
Median	**3.24**	**0.58**	**1.52**
Interquartile range	**2.56**	**0.19**	**0.26**
Mean	**3.12**	**0.63**	**1.59**
Standard deviation	**1.67**	**0.19**	**0.24**

Note: Radionuclide results are reported ± 2σ in Bq/L. See Chapter 13, Quality Assurance.

[a] Wines from a variety of vintages were purchased and analyzed during 1996. The concentrations shown are not decay-corrected to vintage year.

11

Environmental Radiation Monitoring

Barbara C. Fields

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, thermoluminescent dosimeters (TLDs) are exchanged, data are read and analyzed, and the doses are calculated. Thermoluminescent dosimeters are prepared for field deployment every quarter. The process involves heat sealing TLDs into a foil sample pouch 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. Hazards Control reports the raw data results to the EPD analyst, who reviews, calculates, and analyzes the data for reporting.

When a TLD is damaged or lost, the associated annual dose value is calculated from the 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. Such 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. Methods in our procedures and policies are to ensure that holding times are kept to a minimum so that we remain consistent with 90-day standard quarters. When the holding time exceeds the 90-day standard quarter, data are normalized (Struckmeyer 1994). Additionally, we participate in the National Intercomparison Laboratory Study for external gamma radiation measurements, and our processing complies with the DOE Environmental Measurement Laboratory standards.

Tables

Data tables for the 1996 gamma radiation monitoring network are presented below. **Table 11-1** presents the Livermore site perimeter data, **Table 11-2** presents the Livermore Valley data, **Table 11-3** presents the Site 300 perimeter, data, and **Table 11-4** presents Tracy and Site 300 off-site data. Summary data are discussed in detail in Volume 1 of this report.

Table 11-1. TLD environmental radiation measurements (in mSv), Livermore site perimeter, 1996.

Location	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	Total[a]
1	0.134	0.131	0.143	0.140	0.549
4	0.135	0.135	0.152	0.142	0.564
5	0.147	0.138	0.157	0.147	0.590
6	—[b]	0.146	0.155	0.148	0.598
11	0.118	0.108	0.124	0.112	0.461
14	—[b]	0.125	0.133	—[b]	0.514
16	—[b]	0.123	0.141	0.127	0.522
42	0.137	0.134	0.154	0.133	0.557
43	0.142	0.137	0.159	0.145	0.583
47	0.139	0.131	0.138	0.126	0.534
52	0.129	0.133	0.136	0.130	0.528
56	0.135	0.130	0.141	0.134	0.540
68	0.138	0.134	0.151	0.137	0.561
69	0.128	0.131	0.137	0.135	0.531
mSv					
Mean	**0.135**	**0.131**	**0.144**	**0.135**	**0.545**
Std. dev.	**0.008**	**0.009**	**0.011**	**0.010**	**0.035**
mrem					
Mean	**13.5**	**13.1**	**14.4**	**13.5**	**54.5**
Std. dev.	**0.8**	**0.9**	**1.1**	**1.0**	**3.5**

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

b Sample damaged or lost in the field.

Table 11-2. TLD environmental radiation measurements (in mSv), Livermore Valley, 1996.

Location	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	Total[a]
18	0.116	0.110	0.112	0.106	0.443
19	0.125	0.116	0.126	0.177	0.544
22	—[b]	0.137	0.157	0.147	0.588
24	0.138	0.131	0.147	—[b]	0.555
27	0.145	0.146	0.164	0.145	0.600
28	0.148	0.147	0.165	0.151	0.611
30	0.165	0.132	—[b]	0.139	0.581
32	—[b]	0.130	0.151	—[b]	0.563
33	0.141	—[b]	0.153	—[b]	0.589
35	0.137	0.131	0.152	—[b]	0.559
37	—[b]	—[b]	0.144	—[b]	0.576
45	0.128	0.127	0.134	0.130	0.518
57	—[b]	0.137	0.153	0.145	0.580
60	0.138	0.132	0.146	0.132	0.549
61	0.127	0.122	0.131	0.129	0.508
66	0.132	0.133	0.146	0.137	0.548
70	0.131	0.128	0.141	—[b]	0.533
72	0.190	0.150	0.166	0.153	0.659
73	0.147	0.131	0.149	0.143	0.571
74	0.124	0.121	0.131	0.125	0.500
75	0.108	0.110	0.115	0.114	0.448
76	0.112	0.110	0.118	—[b]	0.452
77	0.120	0.120	0.132	0.126	0.498
mSv					
Mean	**0.135**	**0.129**	**0.142**	**0.137**	**0.547**
Std. dev.	**0.019**	**0.012**	**0.016**	**0.017**	**0.054**
mrem					
Mean	**13.5**	**12.9**	**14.2**	**13.7**	**54.7**
Std. dev.	**1.9**	**1.2**	**1.6**	**1.7**	**5.4**

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

b Sample damaged or lost in the field.

Table 11-3. TLD environmental radiation measurements (in mSv), Site 300 perimeter location, 1996.

Location	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	Total[a]
78	0.132	0.135	0.157	0.138	0.562
81	0.169	0.172	0.196	0.174	0.712
82	0.153	0.154	—[b]	0.164	0.627
85	—[b]	—[b]	0.168	0.155	0.645
86	—[b]	—[b]	0.170	0.159	0.657
88	0.183	0.145	0.169	0.156	0.653
89	—[b]	0.159	0.180	0.165	0.672
91	—[b]	0.158	0.176	0.205	0.719
121	0.156	0.173	—[b]	0.177	0.675
mSv					
Mean	**0.159**	**0.157**	**0.174**	**0.166**	**0.658**
Std. dev.	**0.019**	**0.014**	**0.012**	**0.019**	**0.047**
mrem					
Mean	**15.9**	**15.7**	**17.4**	**16.6**	**65.8**
Std. dev.	**1.9**	**1.4**	**1.2**	**1.9**	**4.7**

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

b Sample damaged or lost in the field.

Table 11-4. TLD environmental radiation measurements (in mSv), Site 300 vicinity, 1996.

Location	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec	Total[a]
Tracy					
92	0.143	—[b]	0.278	0.143	0.753
93	0.124	0.121	0.123	0.129	0.497
mSv					
Mean	**0.134**	**—[c]**	**0.200**	**0.136**	**0.625**
Std. dev.	**0.014**	**—[c]**	**0.109**	**0.010**	**0.181**
mrem					
Mean	**13.4**	**—[c]**	**20.0**	**13.6**	**62.5**
Std. dev.	**1.4**	**—[c]**	**10.9**	**1.0**	**18.1**
Off site					
90	—[b]	0.155	0.183	0.167	0.674
94	0.195	0.207	0.195	0.180	0.777
96	0.205	0.174	0.231	0.291	0.901
99	0.143	0.146	0.160	0.150	0.599
120	0.143	0.150	0.166	0.152	0.612
mSv					
Mean	**0.171**	**0.167**	**0.187**	**0.188**	**0.712**
Std. dev.	**0.033**	**0.025**	**0.028**	**0.059**	**0.127**
mrem					
Mean	**17.1**	**16.7**	**18.7**	**18.8**	**71.2**
Std. dev.	**3.3**	**2.5**	**2.8**	**5.9**	**12.7**

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

b Sample damaged or lost in the field.

c Insufficient data for calculation of mean and standard deviation.

12

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

13

Quality Assurance

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Sampling Location Designators

As described in Chapter 13, Volume 1, the LLNL environmental monitoring program uses alpha-numeric location designator codes to define sampling locations. **Tables 13-1** and **13-2** decode sampling location designators used in 1996 and provide a cross-reference between current designators and those used in previous years. Changes to location designators made during 1996 are shown on those tables. **Table 13-3** decodes sampling location designators that were used prior to but not during 1996.

Participation in Laboratory Intercomparison Studies

The LLNL Chemistry and Materials Science Environmental Services Environmental Monitoring Radiation Laboratory (CES EMRL) and the Hazards Control Department's Analytical Laboratory (HCAL) participated in both the Environmental Protection Agency's (EPA) Environmental Monitoring Systems Laboratory (EMSL) intercomparison studies program and the DOE Environmental Monitoring Laboratory (EML) intercomparison studies program in 1996. The results of CES EMRL's participation in the EMSL studies are presented in **Table 13-4**. A review of these data indicates that 41 of 42 analyses fell within established acceptance control limits. The results of one analysis for natural uranium fell outside of the acceptance control limits. The cause of the unacceptable results is still under investigation.

The results of HCAL's participation in 1996 EMSL studies are presented in **Table 13-5**. A review of these data indicates that 7 of 8 sample results fell within the 3-σ acceptance control limits. The results for the March 8, 1996, tritium sample were unacceptably low. This sample was analyzed during a time when room temperature in the laboratory was fluctuating from 60 to 80°C because of an equipment failure. This resulted in unstable scintillation cocktail and unacceptable quality control results. These problems could not be resolved prior to the deadline for submitting the EMSL results, hence the results submitted were outside of the control limits. No routine analytical results based on the unstable cocktail were released. To prevent the occurrence of similar problems in the future, additional quality control (QC) checks for

scintillation cocktails have been added, and the cocktail has been replaced with a brand that can take a higher water load and therefore mitigate the temperature problem.

The results of CES EMRL's participation in the EML studies are presented in **Table 13-6**. Review of these results shows that 71 of 71 results were within the established acceptance control limits; there were no unacceptable results.

HCAL's results are presented in **Table 13-7**. 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 and Water Supply intercomparison studies for metals during 1996, as shown in **Table 13-8**. 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 72 of 73 samples fell within established acceptance control limits. One zinc sample fell slightly outside the control limits in the WP035 study (limit was 84.9, reported value was 85). The actual value measured by the HCAL was 84.5; however, it was rounded to 85 because the existing method detection limit was only specified to two significant figures. Future studies will be reported to three significant figures as recommended by the EPA.

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 13-1. Livermore site and Livermore Valley sampling location designators for 1996.

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	—	
FCC Station	L-FCC	90-08	
Firehouse (East Avenue)	L-FIRE	90-17	
Livermore VA Hospital	L-HOSP	90-10	
Livermore Water Reclamation Plant (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	
Livermore VA Hospital	L-HOSP	—	Added 11/96
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	

Table 13-1. Livermore site and Livermore Valley sampling location designators for 1996 (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 perimeter fence (LLNL)	L-NPER	—	Added in 1996
Tesla Road (west)	L-TESW	95-32	
Visitors Center (east perimeter)	L-VIS	—	
Zone 7	L-ZON7	95-15	
Building 292, pine tree	L-PIN1	—	Added fourth quarter 1996
Visitors Center, pine tree	L-PIN2	—	Added fourth quarter 1996
Arroyo Sediment			
Arroyo Seco South No. 2	L-ASS2	—	Replaced L-ASS, not sampled 1996
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	—	

Table 13-1. Livermore site and Livermore Valley sampling location designators for 1996 (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	—	
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	
Eastern influent to Drainage Retention Basin	L-CDB2	—	
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	—	
Drainage Retention Basin	L-CDB	—	
Cow barn (northeast of Building 592)	L-COW	—	
East of Sandia	L-ESAN	—	

Table 13-1. Livermore site and Livermore Valley sampling location designators for 1996 (concluded).

Medium/location	Current Designator	Previous Designator(s)	Notes
Rain (continued)			
Greenville and Tesla Roads	L-GTES	—	Reinstated in 1996
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 1996
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	—	
Bottom location	L-CDBF	—	
Surface water location	L-CDBJ	—	
Mid-depth location	L-CDBK	—	
Bottom location	L-CDBL	—	

Table 13-2. Site 300 sampling location designators for 1996.

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	
PRIMEX/Physics International	3-PRIM	—	Added fourth quarter 1996

Table 13-2. Site 300 sampling location designators for 1996 (concluded).

Medium/location	Current designator	Previous designator(s)	Notes
Water			
Monitoring well	3-W35A04		Replaced GALLO2
Well 1	3-WELL01	42-01	
Private well	3-CON1	42-07	
Private well	3-CON2	—	
Well 18	3-WELL18	42-22	
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 812	3-B812	—	
Building 836, Tower A	3-B836A	—	
Building 836, Tower D	3-B836D	—	
Building 865	3-B865	—	
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-CARW	—	Renamed from CARN in 1996
WDR-96-248			
B817 retention tank	#-817RT	—	Added fourth quarter 1996
S300 sewage pond effluent	3-ESWP	—	Added fourth quarter 1996
S300 sewage pond influent	3-ISWP	—	Added fourth quarter 1996

Table 13-3. Previously used sampling location designators not used in 1996.

Medium/location	Location designator	Previous designator(s)	Notes
Livermore site and Livermore Valley			
Air particulate			
Residence (Livermore)	L-ERCH	90-11	Abandoned 10/95
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 1996
Residence (Danville)	L-DAN	—	Abandoned prior to 1996
North of LLNL (railroad tracks)	L-RAIL	95-29	Abandoned prior to 1996
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

Table 13-3. Previously used sampling location designators not used in 1996 (continued).

Medium/location	Location designator	Previous designator(s)	Notes
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	
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 13-3. Previously used sampling location designators not used in 1996 (concluded).

Medium/location	Location designator	Previous designator(s)	Notes
Cooling Towers			
Building 805	3-B805	—	Removed from network in 1996
Building 809	3-B809	—	Removed from network in 1996
Building 810	3-B810	—	Removed from network in 1996
Building 815	3-B815	—	Removed from network in 1996
Building 817	3-B817	—	Removed from network in 1996
Building 826	3-B826	—	Removed from network in 1996
Building 827, Tower No. 1	3-B827-1	—	Removed from network in 1996
Building 827, Tower No. 2	3-B827-2	—	Removed from network in 1996
Building 828	3-B828	—	Removed from network in 1996
Building 851, Tower No. 1	3-B851-1	—	Removed from network in 1996
Building 851, Tower No. 2	3-B851-2	—	Removed from network in 1996
Building 854	3-B854	—	Removed from network in 1996

Table 13-4. LLNL Chemistry and Materials Science Environmental Services Environmental Monitoring Radiation Laboratory (CES EMRL) performance in the EPA Environmental Monitoring Systems Laboratory (EMSL) Intercomparison Studies Program for Water, 1996.

Analysis	Date	LLNL value (pCi/L)	Known value (pCi/L)	Control limits (3σ)	Warning limits (2σ)	Performance[a]
Ba-133	6/7/96	747.67	745.0	614.9–875.1	658.2–831.8	Acceptable
	11/8/96	61.67	64.0	53.6–74.4	57.1–70.9	Acceptable
Co-60	4/16/96	32.67	31.0	22.3–39.7	25.2–36.8	Acceptable
	6/7/96	99.67	99.0	90.3–107.7	93.2–104.8	Acceptable
	10/15/96	14.33	15.0	6.3–23.7	9.2–20.8	Acceptable
	11/8/96	42.67	44.0	35.3–52.7	38.2–49.8	Acceptable
Cs-134	4/16/96	47.00	46.0	37.3–54.7	40.2–51.8	Acceptable
	6/7/96	78.87	79.1	70.3–87.7	73.2–84.8	Acceptable
	10/15/96	20.00	20.0	11.3–28.7	14.2–25.8	Acceptable
	11/8/96	10.00	11.0	2.3–19.7	5.2–16.8	Acceptable
Cs-137	4/16/96	53.33	50.0	41.3–58.7	44.2–55.8	Acceptable
	6/7/96	204.33	197.0	179.7–214.3	185.4–208.6	Acceptable
	10/15/96	30.33	30.0	21.3–28.7	24.2–35.8	Acceptable
	11/8/96	20.33	19.0	10..3–27.7	13.2–24.8	Acceptable
Gross alpha	1/26	9.77	12.1	3.4–20.8	6.3–17.9	Acceptable
	4/16	58.20	74.8	42.4–107.2	53.2–96.4	Acceptable
	7/19	14.57	24.4	13.8–35.0	17.3–31.5	Warning
	10/15	40.87	59.1	33.4–84.8	42.0–76.2	Warning
	10/25	5.48	10.3	1.6–19.0	4.5–16.1	Acceptable
Gross beta	1/26	8.73	7.0	0.0–15.7	1.2–12.8	Acceptable
	4/16	179.33	166.9	123.5–210.3	138.0–195.8	Acceptable
	7/19	48.13	44.8	36.1–53.5	39.1–50.6	Acceptable
	10/15	112.67	111.8	82.7–140.9	92.4–131.2	Acceptable
	10/25	42.3	34.6	25.9–43.3	28.8–40.4	Warning
Ra-226	4/16/96	3.83	3.0	2.1–3.9	2.4–3.6	Warning
	9/27/96	16.2	14.0	10.4–17.6	11.6–16.4	Acceptable
	10/15/96	9.43	9.9	7.3–12.5	8.2–11.6	Acceptable
	12/6/96	17.63	20.1	14.9–25.3	16.6–23.6	Acceptable
Ra-228	4/16/96	5.93	5.0	2.7–7.3	3.5–6.5	Acceptable
	6/21/96	9.33	9.0	5.0–13.0	6.3–11.7	Acceptable
	9/27/96	4.95	4.1	2.6–6.8	3.3–6.1	Acceptable
	10/15/96	4.67	5.1	2.8–7.4	3.6–6.6	Acceptable
	12/6/96	8.30	10.2	5.7–14.7	7.2–13.2	Acceptable
Tritium	3/8/96	21604	22002	18185.1–25818.9	19455.3–24548.7	Acceptable
	8/9/96	10471	10879	8991.4–12766.6	9619.5–121138.5	Acceptable

Table 13-4. LLNL Chemistry and Materials Science Environmental Services Environmental Monitoring Radiation Laboratory (CES EMRL) performance in the EPA Environmental Monitoring Systems Laboratory (EMSL) Intercomparison Studies Program for Water, 1996 (concluded).

Analysis	Date	LLNL value (pCi/L)	Known value (pCi/L)	Control limits (3σ)	Warning limits (2σ)	Performance[a]
U-natural	4/16/96	56.33	58.4	48.3–68.5	51.7–65.1	Acceptable
	6/21/96	18.57	20.2	15.0–25.4	16.7–23.7	Acceptable
	9/27/96	6.84	10.1	4.9–15.3	6.6–13.6	Acceptable
	10/15/96	31.63	40.9	33.8–48.0	36.2–45.6	Not acceptable
	12/6/96	4.57	5.0	0–10.2	1.5–8.5	Acceptable
Zn-65	6/7/96	309.67	300.0	248.0–352.0	265.3–334.7	Acceptable
	11/8/96	35.00	35.0	26.3–43.7	29.2–40.8	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 13-5. LLNL Hazards Control Analytical Laboratory (HCAL) performance in the EPA Environmental Monitoring Systems Laboratory (EMSL) Intercomparison Program for Water, 1996.

Analysis	Date	LLNL value (pCi/L)	Known value (pCi/L)	Control limits (3σ)	Warning limits (2σ)	Performance[a]
Gross alpha	1/26/96	17.63	12.1	3.4–20.8	6.3–17.9	Acceptable
	7/19/96	28.77	24.4	13.8–35.0	17.3–31.5	Acceptable
	10/25/96	13.83	10.3	1.6–19.0	4.5–16.1	Acceptable
Gross beta	1/26/96	9.70	7.0	0.0–15.7	1.2–12.8	Acceptable
	7/19/96	43.67	44.8	36.1–53.5	39.1–50.6	Acceptable
	10/25/96	34.33	34.6	25.9–43.3	28.8–40.4	Acceptable
Tritium	3/8/96	17700.00	22002	18185.1–25818.9	19455.3–24548.7	Not acceptable
	8/9/96	10333.33	10471.33	8991.4–12766.6	9619.5–121138.5	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 13-6. 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, 1996.

Medium (units)	Analysis	Study	LLNL value	EML value	LLNL/ EML	Acceptable limits[a]	Warning limits[a]	Performance
Air filter (Bq/filter)	Am-241	QAP-45	0.251	0.222	1.13	0.68–2.01	0.84–1.40	Acceptable
	Ce-144	QAP-44	24.7	33.3	0.74	0.61–1.31	0.69–1.09	Acceptable
	Co-57	QAP-44	7.12	8.9	0.80	0.63–1.29	0.72–1.08	Acceptable
		QAP-45	16.4	14.8	1.11	0.62–1.22	0.69–1.03	Warning
	Co-60	QAP-44	28.7	29.5	0.97	0.74–1.25	0.83–1.10	Acceptable
		QAP-45	9.77	8.64	1.13	0.74–1.24	0.81–1.07	Warning
	Cs-134	QAP-44	15.8	14.7	1.08	0.70–1.21	0.80–1.08	Acceptable
		QAP-45	12.9	10.8	1.19	0.72–1.21	0.81–1.09	Warning
	Cs-137	QAP-44	6.32	6.64	0.95	0.72–1.32	0.84–1.13	Acceptable
		QAP-45	9.23	8.52	1.08	0.72–1.32	0.81–1.09	Acceptable
	Gross alpha	QAP-44	1.69	1.62	1.04	0.82–1.58	0.91–1.30	Acceptable
		QAP-45	1.11	1.15	0.97	0.83–1.55	0.93–1.35	Acceptable
	Gross beta	QAP-44	2.31	1.77	1.31	0.75–1.94	0.89–1.61	Acceptable
		QAP-45	0.894	0.50	1.79	0.73–1.84	0.89–1.49	Warning
	Mn-54	QAP-44	3.13	3.44	0.91	0.76–1.33	0.85–1.12	Acceptable
		QAP-45	7.06	6.35	1.11	0.75–1.27	0.82–1.07	Warning
	Pu-238	QAP-44	0.098	0.096	1.02	0.61–1.55	0.82–1.15	Acceptable
		QAP-45	0.124	0.118	1.05	0.62–1.46	0.83–1.14	Acceptable
	Pu-239	QAP-44	0.098	0.093	1.06	0.67–1.58	0.86–1.16	Acceptable
	Ru-106	QAP-44	14.7	11.6	1.27	0.54–1.59	0.64–1.16	Warning
		QAP-45	13.7	10.8	1.27	0.58–1.30	0.71–1.08	Warning
	Sb-125	QAP-44	9.81	9.78	1.00	0.35–1.40	0.66–1.12	Acceptable
		QAP-45	12.9	10.8	1.19	0.60–1.39	0.80–1.11	Warning
	U-234	QAP-45	0.087	0.080	1.09	0.80–2.06	0.90–1.44	Acceptable
	U-238	QAP-44	0.053	0.053	1.00	0.80–2.63	0.89–1.37	Acceptable
		QAP-45	0.078	0.078	1.00	0.78–3.00	0.89–1.49	Acceptable
	U (µg)	QAP-44	4.33	4.31	1.00	0.54–1.76	1.84–1.26	Acceptable
		QAP-45	6.33	6.398	0.99	0.53–1.88	0.84–1.30	Acceptable

Table 13-6. LLNL's Chemistry and Materials Science Environmental Services Environmental Monitoring Radiation Laboratory's results from the DOE Environmental Measurements Laboratory (EML) Quality Assurance Program, 1996 (continued).

Medium (units)	Analysis	Study	LLNL value	EML value	LLNL/ EML	Acceptable limits[a]	Warning limits[a]	Performance
Soil (Bq/kg)	Am-241	QAP-45	25.2	13.5	1.87	0.52–2.65	0.75–1.52	Warning
	Co-60	QAP-45	2.73	2.92	0.94	0.50–1.50	0.80–1.20	Acceptable
	Cs-137	QAP-44	400	359	1.11	0.74–1.40	0.88–1.23	Acceptable
		QAP-45	1800	1550	1.16	0.81–1.34	0.65–1.23	Acceptable
	K-40	QAP-44	496	465	1.07	0.10–1.59	0.84–1.23	Acceptable
		QAP-45	308	300	1.03	0.73–1.67	0.89–1.27	Acceptable
	Pu-238	QAP-44	44.7	43.0	1.04	0.22–1.99	0.62–1.19	Acceptable
		QAP-45	1.00	1.13	0.89	0.40–1.90	0.73–1.16	Acceptable
	Pu-239	QAP-44	9.66	9.23	1.05	0.62–1.99	0.84–1.28	Acceptable
		QAP-45	24.5	21.8	1.12	0.66–1.93	0.87–1.26	Acceptable
	U-234	QAP-45	39.1	39.2	1.00	0.38–1.26	0.63–1.08	Acceptable
	U-238	QAP-45	41.2	41.6	0.99	0.35–1.55	0.61–1.08	Acceptable
	U (µg/Kg)	QAP-45	3.33	3.36	0.99	0.34–1.27	0.53–1.07	Acceptable
Vegetation (Bq/kg)	Co-60	QAP-44	64.0	59.7	1.07	0.64–1.49	0.82–1.23	Acceptable
		QAP-45	10.6	10.9	0.97	0.62–1.42	0.81–1.20	Acceptable
	Cs-137	QAP-44	1140	944	1.21	0.75–1.48	0.92–1.25	Acceptable
		QAP-45	233	190	1.23	0.81–1.45	1.95–1.25	Acceptable
	K-40	QAP-44	1130	1030	1.10	0.45–1.51	0.81–1.20	Acceptable
		QAP-45	1100	9921	1.11	0.79–1.50	0.93–1.24	Acceptable
	Pu-239	QAP-44	9.48	9.82	0.97	0.56–2.76	0.82–1.63	Acceptable
		QAP-45	2.25	1.93	1.15	0.65–1.95	1.85–1.32	Acceptable
Water (Bq/L)	Am-241	QAP-45	1.14	1.08	1.06	0.64–1.73	0.87–1.23	Acceptable
	Co-60	QAP-44	30.8	32.8	0.94	0.87–1.17	0.95–1.11	Warning
		QAP-45	60.2	61.1	0.99	0.92–1.18	0.99–1.12	Acceptable
	Cs-137	QAP-44	40.2	38.3	1.05	0.90–1.25	0.97–1.15	Acceptable
		QAP-45	97.5	89.5	1.09	0.90–1.28	0.95–1.18	Acceptable
	Gross alpha	QAP-44	2420	1850	1.31	0.55–1.31	0.80–1.22	Warning
		QAP-45	1400	1210	1.16	0.50–1.26	0.82–1.16	Acceptable

Table 13-6. LLNL's Chemistry and Materials Science Environmental Service's Environmental Monitoring Radiation Laboratory's results from the DOE Environmental Measurements Laboratory (EML) Quality Assurance Program, 1996 (concluded).

Medium (units)	Analysis	Study	LLNL value	EML value	LLNL/ EML	Acceptable limits[a]	Warning limits[a]	Performance
Water (Bq/L) (continued)	Gross beta	QAP-44	1000	744	1.34	0.75–1.65	0.93–1.52	Acceptable
		QAP-45	703	540	1.30	0.60–1.64	0.73–1.43	Acceptable
	Mn-54	QAP-44	42.0	38.4	1.09	0.88–1.21	0.95–1.13	Acceptable
		QAP-45	63.8	60.5	1.05	0.87–1.22	0.95–1.15	Acceptable
	Pu-238	QAP-44	1.04	0.982	1.06	0.68–1.33	0.91–1.14	Acceptable
		QAP-45	2.05	1.91	1.07	0.74–1.27	0.90–1.12	Acceptable
	Pu-239	QAP-44	0.840	0.772	1.09	0.62–1.38	0.78–1.16	Acceptable
		QAP-45	0.922	0.840	1.10	0.78–1.42	0.91–1.17	Acceptable
	Tritium	QAP-44	217	251	0.87	0.69–1.91	0.84–1.20	Acceptable
		QAP-45	485	587	0.83	0.65–1.91	0.81–1.24	Acceptable
	U-234	QAP-45	0.536	0.480	1.12	0.77–1.53	0.91–1.21	Acceptable
	U-238	QAP-44	0.276	0.275	1.00	0.78–1.40	0.91–1.14	Acceptable
		QAP-45	0.532	1.48	1.11	0.77–1.35	0.90–1.16	Acceptable
	U (μg)	QAP-44	0.022	0.022	1.02	0.73–1.35	0.89–1.15	Acceptable
		QAP-45	0.043	0.039	1.10	0.65–1.34	0.89–1.17	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 13-7. LLNL's Hazards Control Analytical Laboratory results from the DOE Environmental Measurements Laboratory (EML) Quality Assurance Program, 1996.

Medium (units)	Analysis	Study	LLNL value	EML value	LLNL/ EML	Acceptable limits[a]	Warning limits[a]	Performance
Air filters (Bq/filter)	Gross alpha	QAP-44	1.82	1.62	1.120	0.82–1.58	0.91–1.30	Acceptable
		QAP-45	0.966	1.15	0.840	0.83–1.55	0.93–1.35	Acceptable
	Gross beta	QAP-44	1.71	1.77	0.970	0.75–1.94	0.89–1.61	Acceptable
		QAP-45	0.523	0.500	1.05	0.73–1.84	0.89–1.49	Acceptable
Water (Bq/L)	Gross alpha	QAP-44	1900	1850	1.030	0.55–1.31	0.80–1.22	Acceptable
		QAP-45	1160	1210	0.96	0.50–1.26	0.82–1.16	Acceptable
	Gross beta	QAP-44	805	744	1.08	0.75–1.65	0.93–1.52	Acceptable
		QAP-45	586	540	1.09	0.60–1.64	0.73–1.43	Acceptable
	Tritium	QAP-44	206	251	0.82	0.69–1.91	0.84–1.20	Warning
		QAP-45	485	587	0.83	0.65–1.91	0.81–1.24	Warning

[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 13-8. Hazards Control Department Analytical Laboratory results from the Environmental Protection Agency (EPA) Water Pollution and Water Supply Studies.[a]

Analysis	Study	Sample	LLNL value[a] (μg/L)	True value[a] (μg/L)	Acceptable limits[b] (μg/L)	Warning limits[b] (μg/L)	Performance
Aluminum	WP035	01	333	321	261–382	276–367	Acceptable
	WP035	02	1500	1500	1270–1700	1330–1640	Acceptable
	WP036	01	3280	3609	3130–4040.	3250–3290	Acceptable
	WS037	001	50.0	49.3	41.9–56.3	not provided	Acceptable
Arsenic	WP035	01	197	193	167–231	175–223	Acceptable
	WP035	02	580	571	492–676	515–653	Acceptable
	WP036	01	244	250	210–292	220–282	Acceptable
	WS038	001	82.4	83.1	71.7–88.4	not provided	Acceptable
Beryllium	WP035	01	183	190	165–209	170–204	Acceptable
	WP035	02	550	541	480–597	498–583	Acceptable
	WP036	01	47.2	51.1	39.9–62.9	42.8–60	Acceptable
	WS037	001	4.15	4.26	3.62–4.9	not provided	Acceptable
	WS038	001	9.60	10.1	8.59–11.6	not provided	Acceptable
Cadmium	WP035	01	52	52.6	44.5–60.7	46.5–58.7	Acceptable
	WP035	02	397	401	345–454	359–440	Acceptable
	WP036	01	128	131	113–148	117–144	Acceptable
	WS037	001	10.0	10.2	8.16–12.2	not provided	Acceptable
	WS038	001	2.06	2.12	1.7–2.54	not provided	Acceptable
Chromium	WP035	01	15	17.0	13–20.5	13.9–19.5	Acceptable
	WP035	02	880	880	767–985	794–958	Acceptable
	WP036	01	249	250	218–289	227–280	Acceptable
	WS037	001	73.0	72.9	62–83.8	not provided	Acceptable
	WS038	001	143	148	126–170	not provided	Acceptable
Copper	WP035	01	82	86.7	75.5–96.9	78.2–94.2	Acceptable
	WP035	02	364	370	334–409	344–399	Acceptable
	WP036	01	540	552	515–618	528–605	Acceptable
	WS037	001	52.5	55.7	50.1–61.3	not provided	Acceptable
	WS038	001	1120	1203	1080–1320	not provided	Acceptable
Iron	WP035	01	40	30.4	18.8–42.6	21.8–39.6	Warning
	WP035	02	473	464	441–519	451–509	Acceptable
	WP036	01	790	790	715–934	742–906	Acceptable
Lead	WP035	01	305	297	259–334	269–325	Acceptable
	WP035	02	412	399	356–446	367–435	Acceptable
	WP036	01	342	375	332–429	344–417	Warning
	WS037	001	12.1	13.8	9.66–17.9	not provided	Acceptable
	WS038	001	55.0	56.2	39.3–73.1	not provided	Acceptable
Mercury	WP035	01	3.2	3.10	2.03–4.07	2.29–3.81	Acceptable
	WP035	02	11.9	11.6	8.65–14.7	9.41–13.9	Acceptable
	WP036	01	5.0	4.70	3.53–5.91	3.88–5.61	Acceptable
	WS037	001	8.10	8.16	5.71–10.6	not provided	Acceptable
	WS038	001	6.04	6.39	4.47–8.31	not provided	Acceptable

Table 13-8. Hazards Control Department Analytical Laboratory results from the Environmental Protection Agency (EPA) Water Pollution and Water Supply Studies[a] (concluded).

Analysis	Study	Sample	LLNL value[a] (μg/L)	True value[a] (μg/L)	Acceptable limits[b] (μg/L)	Warning limits[b] (μg/L)	Performance
Nickel	WP035	01	505	496	453–560	466–547	Acceptable
	WP035	02	630	611	557–698	574–680	Acceptable
	WP036	01	1800	1812	1660–2030	1710–1990	Acceptable
	WS037	001	54.5	55.0	46.8–63.3	not provided	Acceptable
	WS038	001	220	240	204–276	not provided	Acceptable
Silver	WP035	03	183	180	153–207	474–633	Acceptable
	WP035	04	371	340	298–391		Acceptable
	WP036	02	545	573	448–659		Acceptable
Zinc	WP035	01	85	71.9	62.7–84.9	65.5–82.2	Not Acceptable
	WP035	02	1870	1800	1610–2030	1660–1980	Acceptable
	WP036	01	1200	1203	1100–1370	1140–1340	Acceptable
	WS037	001	600	600	536–652	not provided	Acceptable
	WS038	001	2750	2914	2620–3081	not provided	Acceptable

a All results reported in μg/L. Based upon theoretical calculations or a reference value when necessary.

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 are not necessarily considered unacceptable.

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