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RLWTF Annual Report For 2004

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Acronyms and Abbreviations

Ci	curie (3.7 x 10^{10} disintegrations per second)
COD	chemical oxygen demand
CY	calendar year
DCG	derived concentration guidelines
DOE	United States Department of Energy
EDR	electrodialysis reversal
EPA	United States Environmental Protection Agency
Final50	composite sample of effluent from the RLWTF
IX	ion exchange
Kg	kilogram
L	liter
LANL	Los Alamos National Laboratory
LDL	less than detection limit
meq/L	milliequivalents per liter
mg/L	milligram per liter
mrem	millirem (10^{-3} rem)
nCi/L	nanocuries per liter (10^{-9} curies per liter)
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commision
NPDES	National Pollutant Discharge Elimination System
pCi/L	picocuries per liter (10^{-12} curies per liter)
Pu-239	plutonium isotope with atomic weight of 239
Raw50	composite sample of daily influent to RLWTF via the RLWCS
RLW	radioactive liquid waste
RLWCS	radioactive liquid waste collection system
RLWTF	radioactive liquid waste treatment facility
RO	reverse osmosis
SVOC	semi-volatile organic chemical(s)
TA	technical area
TDS	total dissolved solids
TSS	total suspended solids
TUF	tubular ultrafilter
VOC	volatile organic chemical(s)
µS/cm	microSiemens per centimeter
µg/L	microgram per liter

1. Overview of Facilities and Operations

1.1 TA-50 RLWTF

The facility at TA-50 receives and treats radioactive liquid wastes from more than 1000 generating points at LANL. RLW are sent from generator facilities to TA-50 via an underground collection system. This system has about four miles of double-walled collection pipes. Treated waters are discharged to the environment through an outfall in Mortandad Canyon. One state and two federal agencies monitor the quality of these treated waters.

Primary structures at the TA-50 RLWTF are Building 50-01, 50-02, 50-66, 50-248, 50-90, and a trailer-based evaporator. These structures, with a combined area of approximately 55,000 square feet, house process areas, operations support areas, analytical laboratories, and offices (Del Signore, 07/19/01). The TA-50 facility has pre-treatment operations for two small waste streams from TA-55, a main treatment process with five unit operations, and four unit operations for the treatment of secondary wastes. The facility has been designated a Hazard Category 2 nuclear facility.

The TA-50 RLWTF is now 42 years old. Because of its age, and because of changing regulations, this facility has undergone significant modifications. The infusion of capital into the TA-50 facility for repairs and upgrades has exceeded $15 million since 1997, including projects for stack consolidation, repair of tanks and equipment, and the installation of new processes to address more stringent discharge standards. Significant additional facility modifications continue at present, including startup of additional underground transfer lines between TA-55 and TA-50, replacement of vessels and equipment for processing transuranic RLW from TA-55, and installation of 300,000 gallons of new influent storage capacity.

1.2 TA-21 RLWTF

The facility at TA-21 pre-treats RLW from tritium research at TA-21 using a clarifier and a gravity filter. The facility is small (4200 ft^2) and is 38 years old (LANL, 09/30/03, p.B-3). Process equipment is smaller than that at the TA-50 RLWTF because volumes are smaller. For example, the TA-21 clarifier has a capacity of 4,000 gallons, while that at TA-50 can hold 28,000 gallons. Associated with the facility are an office trailer and a number of above-ground and below-grade storage tanks. The TA-21 RLWTF is not categorized as a nuclear facility.

From 1966 through 2000, effluent from this facility was transferred via underground piping to TA-50. In 2000, use of the cross-country was discontinued due to environmental concerns and shrinking water volumes. Beginning in 2001, TA-21 waters have been transferred to TA-50 by truck.

1.3 TA-53 RLWTF

The facility at TA-53 treats RLW from accelerator research at the Los Alamos Neutron Science Center through water storage, to allow radioisotope decay, and solar evaporation. The TA-53 facility started operation in December 1999, and is not categorized as a nuclear facility.

Water flows by gravity into lift stations adjacent to Experimental Area A and the Lujan center. The RLW is pumped from the lift stations through double-walled underground piping to one of three 30,000-gallon tanks inside the RLWTF, Building 53-945, at the east end of TA-53. The tanks allow decay of radioisotopes generated by operation of the LANSCE accelerator beam, most of which have short half-lives. After aging, the RLW is pumped to one of two evaporator basins, each with a capacity of 125,000 gallons.

Tritiated waters are occasionally trucked directly to the TA-53 basins for evaporation. Typically, the waters have been treated at the TA-50 RLWTF and meet NPDES, NMED, and DOE discharge standards, but fail to meet the voluntary commitment to discharge at 20,000 nanocuries per liter (i.e., at 1% of the DOE limit for tritium).

2. TA-50 Operations Summary for 2004

2.1 Effluent Quality

Two federal and one state agency monitor the quality of treated waters discharged from the TA-50 RLWTF into Mortandad Canyon. The United States Environmental Protection Agency (USEPA) regulates discharges via NPDES permit number #NM0028355 under the National Pollutant Discharge Elimination System (NPDES). The permit stipulates sampling method, sampling frequency, and water quality requirements (i.e., discharge limits) for 21 water parameters. (EPA, 12/29/00) Additionally, the TA-50 RLWTF effluent must meet the guidelines of the United States Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and the Environment". (DOE, 01/17/93)

LANL also has voluntary commitments (a) to the New Mexico Environment Department (NMED) to meet groundwater standards set by the New Mexico Water Quality Control Commission (NMWQCC) for fluoride, nitrate-nitrogen and total dissolved solids (TDS), (b) to the NMED to meet the proposed EPA discharge standard for perchlorates, and (c) to the DOE to discharge at less than 1% of the DCG for tritium.

During calendar year 2004, TA-50 RLWTF effluent:

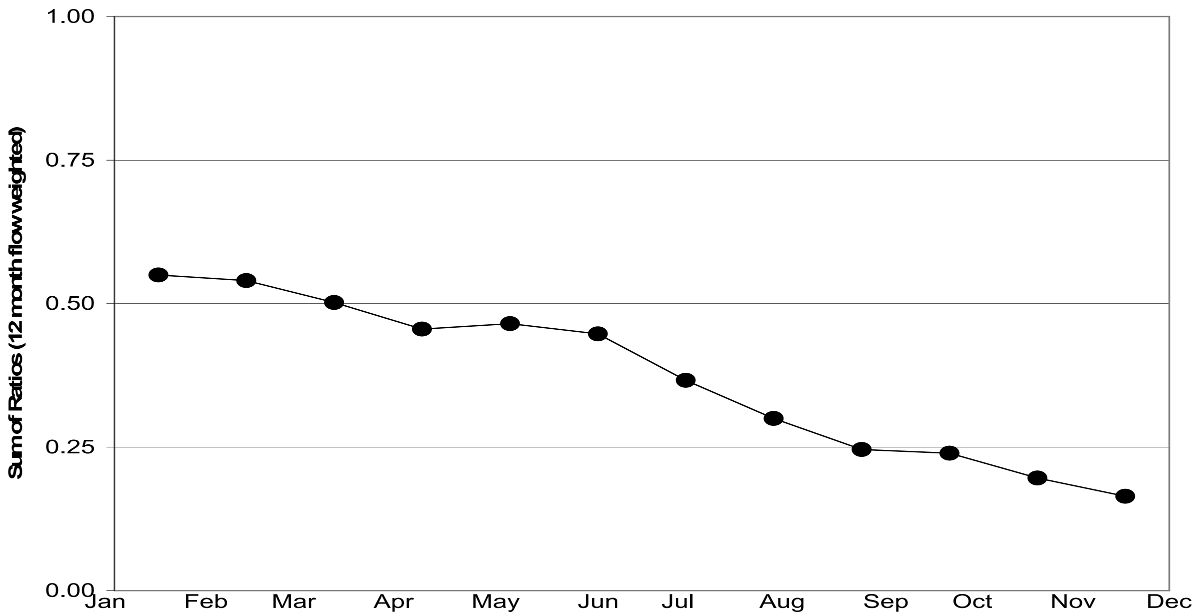
- met all DOE standards set forth in Order 5400.5 for radiological discharges, and has now done so for five consecutive years;
- was in compliance with all twenty-one (21) NPDES water quality parameters, also for the fifth consecutive year; and
- met NMED ground water standards for fluoride, nitrate, and TDS, and has now met these voluntary standards for all but two weeks of the last five years[1].

Effluent radiological quality during 2004 is illustrated in Figure 4-1 by plotting the sum-of-ratios for each month. The Derived Concentration Guideline, or DCG, set forth in DOE Order 5400.1, is that the sum-of-ratios must be less than 1.0. The steadily declining sum-of-ratios primarily reflects the operations policy change made in 2003 to process all waters through reverse osmosis. The sum was 0.58 at the beginning of 2004, but had declined to 0.17 by the end of the year.

Effluent quality versus NPDES discharge limits and NMED groundwater standards is summarized in Table 2-1. The table lists the 21 EPA parameters and their discharge standards, the three NMED parameters and their groundwater standards, and the average concentration of each parameter in RLWTF effluent during 2004.

[1] Two weekly composite samples of RLWTF effluent slightly exceeded the groundwater standard for fluoride during 2003. Sample values of 2.07 mg/L and 1.64 mg/L were obtained, versus the groundwater standard of 1.6 mg/L. (Watkins and Worland, March 2004, p. 30.)

Figure 2-1
Sum-of-Ratios in Effluent from
the TA-50 RLWTF During 2004



2.2 Flows and Quantities

The TA-50 RLWTF received 8,418,000 liters of influent during 2004, and discharged 8,170,000 liters to Mortandad Canyon (Del Signore, 04/11/05). Influent consisted primarily of water brought to the RLWTF via the underground collection system, but included 256,600 liters of water transported from generator facilities via truck. No influent was received during 2004 from the TA-21 facility. Effluent consisted entirely of permeate solutions from the reverse osmosis unit. Whereas distillate from evaporator operations had been discharged to Mortandad Canyon in the past, 100% of the distillate generated during 2004 was re-processed through the TUF and/or reverse osmosis units.

The influent brought with it 0.80 curie of radioactivity in 1.53 kilograms of radioactive materials. Uranium-238 accounted for nearly all of the radioactive mass, while plutonium and americium isotopes accounted for 88% of the radioactivity in the influent. Effluent contained just 0.09 curie in less than one gram of radioactive materials. More than 99% of the radioactivity in the effluent was due to the presence of tritium, which cannot be removed by RLWTF processes.

A total of 2,890 kilograms of impurities entered the plant in the form of suspended solids (187 kilograms) and dissolved solids (2700 kilograms). A total of 613 kilograms of dissolved solids were discharged with effluent into Mortandad Canyon, an 80% reduction. Sodium accounted for two-thirds of the dissolved solids in the effluent.

Table 2-1
TA-50 Effluent During 2004 Compared to NPDES and NMED Standards

Regulator	Regulated Parameter	Units	Standard	FINAL Avg.
NPDES	ALUMINUM	µg/L	5,000	15
NPDES	ARSENIC	µg/L	368	4
NPDES	BORON	µg/L	5,000	138
NPDES	CADMIUM	µg/L	50	0.7
NPDES	COBALT	µg/L	1,000	*
NPDES	COD	mg/L	125	14
NPDES	COPPER	µg/L	1,400	8
NPDES	IRON	µg/L	Report Only	46
NPDES	LEAD	µg/L	423	*
NPDES	MERCURY	µg/L	0.77	0.03
NPDES	NICKEL	µg/L	Report Only	*
NPDES	PERCHLORATE	µg/L	Report Only	*
NPDES	RADIUM*	pCi/L	30. E0*	*
NPDES	SELENIUM	µg/L	5	5
NPDES	TOTAL CHROMIUM	µg/L	1,300	*
NPDES	TOXIC ORGANICS**	µg/L	1,000	139
NPDES	TSS	mg/L	30	*
NPDES	VANADIUM	µg/L	100	3
NPDES	ZINC	µg/L	4,400	17
NPDES	pH	s.u.	9.0	7.5
NMED	FLUORIDE	µg/L	1,600	187
NMED	NITRATE-N	mg/L	10	3
NMED	TDS	mg/L	1,000	75

FINAL Avg. = Flow-weighted average concentration in effluent.
* Less than detection limit

Treating these waters produced solid wastes, which result from removal of solids from the influent during water treatment, from the addition of chemicals needed to treat the influent, from facility maintenance, and from day-to-day operational activities. During 2004, a total of 44,100 kilograms of chemical and radioactive wastes were generated by RLWTF activities. Another 130,600 kilograms of low-level radioactive wastes (contaminated asphalt and soil) resulted from construction work for the new influent pump house and storage tanks.

Table 2-2
Flow Summary for the TA-50 RLWTF During 2004

Date	Influent*	TA-21 Transfer	Discharged
Jan-04	0.627	0	0.654
Feb-04	0.558	0	0.504
Mar-04	0.957	0	0.800
Apr-04	0.835	0	0.945
May-04	0.895	0	0.894
Jun-04	0.865	0	0.806
Jul-04	0.761	0	0.663
Aug-04	0.638	0	0.738
Sep-04	0.559	0	0.513
Oct-04	0.608	0	0.514
Nov-04	0.53	0	0.489
Dec-04	0.677	0	0.65
Total	8.418	0	8.170

* All figures reported in megaliters.

2.3 Facility and Process Modifications

Although construction for a major facility and process modification started, and planning was laid for modifications, no significant facility modifications or process modifications were completed during 2004.

Construction got underway for the new pump house and influent storage facility. This construction, in fact, generated a one-time, very large volume of solid low-level radioactive wastes as mentioned in Section 2.2 above. Design and project planning started for a number of facility modifications that will occur over the next 2-3 years, including a replacement storage tank for caustic wastes from TA-55 and activation of a new set of underground transfer piping between TA-55 and TA-50.

3. Radiological Nature of the CY 2003 TA-50 RLWTF Waters

3.1 Radionuclides Detected

The influent wastewater to the TA-50 RLWTF is radioactive due to the presence of radionuclides that emit alpha and beta particles, gamma rays and neutrons. RLWTF influent and effluent samples are analyzed for thirty-eight (38) such radionuclides which, from past experience, are probable in LANL radioactive liquid wastes. Fifteen (15) of these radionuclides were detected in the RLWTF influent and eleven (11) were detected at very low activities in the RLWTF effluent during 2004. Table 3-2, shown on the next page, summarizes the radionuclides for which analyses are performed and also which radionuclides were detected in the RLWTF influent and effluent.

3.2 Radionuclide Removal

Table 3-1 shows the mass of the nine alpha-emitting radionuclides analyzed for in the RLWTF influent and effluent from the RLWTF in 2004. The table indicates that uranium-238 comprises 98% of the mass of these radionuclides in RLWTF influent, and shows that the treatment processes removed 99.90% of the mass of these alpha emitters from the wastewater stream (1530 grams in, 1.6 grams out).

Table 3-1
Mass of Alpha Emitting Radionuclides in RLWTF Influent and Effluent During 2004

Alpha Particle Emitting Radionuclide	Mass in Influent (grams)	Mass in Effluent (grams)
Am-241	102 E-3	3.9 E-6
Np-237	*	*
Ra-226	142 E-6	*
Pu-238	10.1 E-3	1.0 E-6
Pu-239	3.4 E0	179 E-6
Th-232	21.6 E0	1.3 E0
U-234	559 E-3	824 E-6
U-235	4.4 E0	1.7 E-3
U-238	1.5 E3	271 E-3
Totals	1.5 E3	1.57 E0

* Less than Detection Limit

Table 3-2
Radionuclide Analyses of the RLWTF Influent and Effluent in CY 2004

Radionuclides Analyzed for in the RLWTF Influent and Effluent	Radionuclides Present in RLWTF Influent	Radionuclides Detected in RLWTF Effluent
Alpha Particle Emitters		
Am-241	X	X
Np-237		
Ra-226	X	
Pu-238	X	X
Pu-239	X	X
U-234	X	X
U-235	X	X
U-238	X	X
Th-232	X	X
Beta Particle Emitters		
As-74		
Ba-133		
Be-7		
Ce-141		
Co-56,Co-57, Co-58 and Co-60		
Cs-134		
Cs-137	X	X
Eu-152		
H-3	X	X
I-133, Mn-52 and Mn-54		
Na-22		
Ra-228		
Rb-83	X	X
Rb-84	X	
Sc-46, Sc-48 and Se-75		
Sn-113		
Sr-85	X	
Sr-89	X	
Sr-90	X	
V-48		
Y-88		
Zn-65		X
38 Total	**15 Total**	**11 Total**

Removal of alpha *radioactivity* is even higher than removal of the *mass* of alpha-emitting particles, however. As shown in Table 3-3, the treatment process at the RLWTF removed 99.994% of the radioactivity of the alpha emitters from the wastewater stream (0.74 curie in, 47 microcuries out).

Table 3-3
Removal of Alpha Radioactivity
From RLWTF Influent During 2004

Date	Raw (Ci)	Final (Ci)	Removal Factor 100X(INF - EFF)/INF
Jan-04	37.2 E-3	2.3 E-6	99.994
Feb-04	64.5 E-3	3.6 E-6	99.994
Mar-04	141.2 E-3	3.3 E-6	99.998
Apr-04	67.7 E-3	2.9 E-6	99.996
May-04	62.2 E-3	10.7 E-6	99.983
Jun-04	62.5 E-3	5. E-6	99.992
Jul-04	153.8 E-3	1.6 E-6	99.999
Aug-04	14.2 E-3	3. E-6	99.979
Sep-04	10.8 E-3	3.7 E-6	99.966
Oct-04	9.7 E-3	3.2 E-6	99.967
Nov-04	10.5 E-3	4.4 E-6	99.958
Dec-04	102.3 E-3	3.6 E-6	99.996
Total	**737 E-3**	**47.3 E-6**	**99.994**
Volume of Flow: Influent = 8,417,800 liters Final = 8,169,700 liters			

Removal of the two beta-emitting radioactivity was less remarkable. About 97% of the mass and radioactivity of cesium-137 was removed (0.003 curie in, 85 microcuries out). With a valence state of +1, cesium is soluble in water and, as such, is largely removed only by the reverse osmosis unit. Tritium is the other beta emitter detected in RLWTF waters during 2004. Tritium is present *as* water, and the RLWTF is not equipped to treat or remove tritium. Hence, the quantities entering and leaving the plant are the same (0.087 curie).

Although treatment for and removal of beta-emitting radioisotopes is not as effective as for alpha-emitting radioisotopes, the quantities encountered are much smaller. This is illustrated in Table 3-4, which summarizes radioactivity (curies) into and out of the RLWTF for 2004.

Table 3-4
TA-50 RLWTF Radionuclide Summary For 2004

	RAW Avg (nCi/L)	Maximum (nCi/L)	Minimum (nCi/L)	Number Of Samples	Total (Ci)	FINAL Avg (pCi/L)	Maximum (pCi/L)	Minimum (pCi/L)	Number Of Samples	Total (Ci)
ALPHA	79. E0	190. E0	12. E0	12	665. E-3	2.3 E0	8.7 E0	4.7 E0	12	19. E-6
Am-241	40. E0	96. E0	3.1 E0	12	336.7 E-3	1.6 E0	5.4 E0	640. E-3	12	13.4 E-6
As-74	0	*	*	12	0	0	*	*	12	0
BETA	39.7 E-3	630. E-3	630. E-3	12	333.9 E-6	1.1 E0	18. E0	18. E0	12	9.1 E-6
Be-7	0	*	*	12	0	0	*	*	12	0
Ce-141	0	*	*	12	0	0	*	*	12	0
Co-56	0	*	*	12	0	0	*	*	12	0
Co-57	0	*	*	12	0	0	*	*	12	0
Co-58	0	*	*	12	0	0	*	*	12	0
Co-60	0	*	*	12	0	0	*	*	12	0
Cs-134	0	*	*	12	0	0	*	*	12	0
Cs-137	340.3 E-3	900. E-3	130. E-3	12	2.9 E-3	10.4 E0	19. E0	5. E0	12	84.6 E-6
Eu-152	0	*	*	12	0	0	*	*	12	0
I-133	0	*	*	12	0	0	*	*	12	0
Mn-52	0	*	*	12	0	0	*	*	12	0
Mn-54	0	*	*	12	0	0	*	*	12	0
Na-22	0	*	*	12	0	0	*	*	12	0
Np-237	0	*	*	12	0	0	*	*	12	0
Pu-238	19.7 E0	59. E0	3.8 E0	12	165.6 E-3	2.2 E0	4.5 E0	1.3 E0	12	17.7 E-6
Pu-239	24.1 E0	83. E0	5.8 E0	12	202.9 E-3	1.4 E0	2.3 E0	870. E-3	12	11.1 E-6
Ra-226	14.5 E-3	230. E-3	230. E-3	12	121.9 E-6	0	*	*	12	0
Ra-228	0	*	*	12	0	0	*	*	12	0
Rb-83	27.7 E-3	260. E-3	260. E-3	12	232.8 E-6	700.7 E-3	6.4 E0	6.4 E0	12	5.7 E-6
Rb-84	29.8 E-3	280. E-3	280. E-3	12	250.7 E-6	0	*	*	12	0
Sc-46	0	*	*	12	0	0	*	*	12	0
Sc-48	0	*	*	12	0	0	*	*	12	0
Se-75	0	*	*	12	0	0	*	*	12	0
Sn-113	0	*	*	12	0	0	*	*	12	0
Sr-85	50.7 E-3	190. E-3	50. E-3	12	427.2 E-6	0	*	*	12	0
Sr-89	48.5 E-3	380. E-3	28. E-3	12	408.3 E-6	0	*	*	12	0
Sr-90	5.6 E-3	56. E-3	56. E-3	12	46.7 E-6	0	*	*	12	0
TRITIUM				0	0	10.6 E3	19. E3	4.3 E3	12	86.5 E-3
Th-232	270. E-6	910. E-6	16. E-6	12	2.3 E-6	17.3 E-3	80. E-3	50. E-3	12	141.5 E-9
U-234	382.9 E-3	2.1 E0	23. E-3	12	3.2 E-3	623.6 E-3	5.1 E0	4. E0	12	5.1 E-6
U-235	1.1 E-3	3.2 E-3	80. E-6	12	9. E-6	448.3 E-6	3.9 E-3	2.7 E-3	12	3.7 E-9
U-238	58.4 E-3	186. E-3	4.6 E-3	12	491.7 E-6	11.2 E-3	80. E-3	80. E-3	12	91.1 E-9
V-48	0	*	*	12	0	0	*	*	12	0
Y-88	0	*	*	12	0	0	*	*	12	0
Zn-65	0	*	*	12	0	289.1 E-3	3.2 E0	3.2 E0	12	2.4 E-6

Volume of Flow: Influent = 8,417,800 liters Final = 8,169,700 liters
* Less than Detection Limit

3.3 Regulatory Performance

In 1990 DOE issued Order 5400.5, Radiation Protection of the Public and the Environment, which established revised guidelines for the effluent waters from DOE facilities. The Order identifies Derived Concentration Guidelines (DCGs) for all radionuclides discharged from DOE facilities. The concentration of each radionuclide divided by its particular DCG value results in a ratio. For waters containing more than one radionuclide, a ratio is to be found for each radionuclide, and these ratios are to be summed. To be in compliance with Order 5400.5, the sum of the ratios cannot exceed 1.0.

Compliance with Order 5400.5 insures that the yearly dose will be less than 100 millirem to a person drinking two liters of water (i.e., effluent) per day. The *millirem* is a unit for measuring the biological effects of radiation on the human body. For comparison to the 100 millirem standard, the average annual radiation dose received by a member of the general population in the United Sates is about 360 millirem, from both natural (296 mrem) and man-made (65 mrem) radiation sources.

Table 3-5 provides flow-weighted sum-of-the-ratios for individual isotopes, and shows that the average for all of 2004 was 0.165. Figure 2-1 also demonstrated that RLWTF effluent was in compliance with DOE Order 5400.5 during 2004. Note that the isotopes Pu-238 and Pu-239 account for more than 90% of the sum of the ratios in the RLWTF effluent during 2004.

3.4 Graphs of Radiological Data

Following Table 3-5 are a series of figures that illustrate significant information about the radiological nature of the TA-50 RLWTF influent and effluent during 2004.

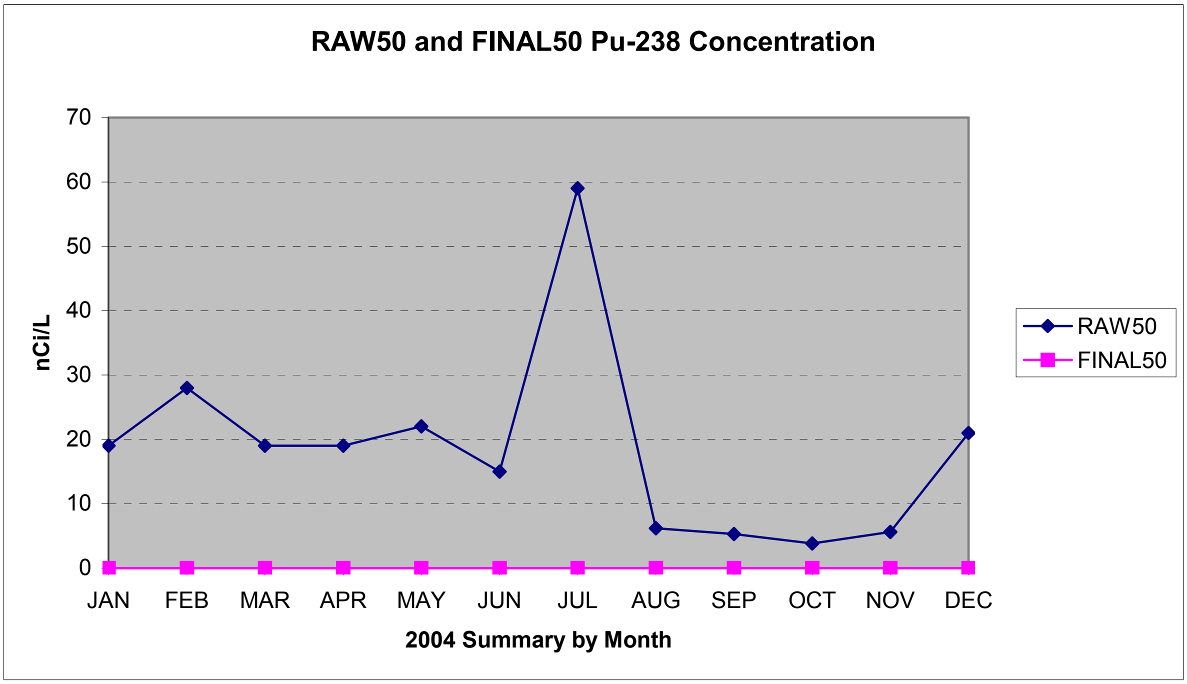
Figures 3-1, 3-2, and 3-3 chart average concentrations in RLWTF influent and effluent for each month of 2004 for the three major radionuclides of concern: Pu-238, Pu-239, and Am-241. It is important to note that the ordinate of the upper graphs are scaled in nanocuries per liter while the lower graphs are scaled in picocuries per liter, a factor of 1,000 times different. The graphs show that the decontamination factor for each of these radioisotopes is four orders of magnitude (i.e., 10,000) or more, and that effluent concentrations are well within the Derived Concentration Guidleines set forth in DOE Order 5400.5. Effluent concentrations for any of the three typically were less than 10% DCG.

Figure 3-4 charts average concentrations by month, in picocuries per liter, of tritium and gross alpha in RLWTF effluent during 2004. While more than 90% of gross alpha is attributable to the radionuclides Pu-238, Pu-239, and Am-241, the graph in Figure 3-4 does not seem to represent the sum of the lower graphs in Figures 3-1, 3-2, and 3-3. The reason for this is that the analytical procedure for gross alpha is not as accurate as that for the individual radionuclides. The lower chart shows that tritium concentrations in RLWTF effluent were less than 10% of the Guideline in DOE Order 5400.5 every month of the year.

Table 3-5
TA-50 RLWTF Effluent Compared With DOE Order 5400.5

Radioactive Isotopes	Mean Concentration (picoCi/L)	DCG 5400.5 (picoCi/L)	Percent of DCG
Am-241	1.6 E0	30	5.5
As-74	*	40,000	*
Be-7	*	1,000,000	*
Ce-141	*	50,000	*
Co-56	*	10,000	*
Co-57	*	100,000	*
Co-58	*	40,000	*
Co-60	*	5,000	*
Cs-134	*	2,000	*
Cs-137	10.4 E0	3,000	0.4
Eu-152	*	20,000	*
I-133	*	10,000	*
Mn-52	*	20,000	*
Mn-54	*	50,000	*
Na-22	*	10,000	*
Np-237	*	30	*
Pu-238	2.2 E0	40	5.4
Pu-239	1.4 E0	30	4.5
Ra-226	*	100	*
Ra-228	*	100	*
Rb-83	700.7 E-3	20,000	4. E-3
Rb-84	*	10,000	*
Sc-46	*	20,000	*
Sc-48	*	20,000	*
Se-75	*	20,000	*
Sn-113	*	50,000	*
Sr-85	*	70,000	*
Sr-89	*	20,000	*
Sr-90	*	1,000	*
TRITIUM	10.6 E3	2,000,000	0.5
Th-232	17.3 E-3	50	0.03
U-234	623.6 E-3	500	0.1
U-235	448.3 E-6	600	7 E-5
U-238	11.2 E-3	600	2 E-4
V-48	*	30,000	*
Y-88	*	30,000	*
Zn-65	289.1 E-3	9,000	3 E-3
Sum of Ratios = 0.165			
* Less than Detection Limit			

Figure 3-1
Pu-238 in RLWTF Influent and Effluent During 2004



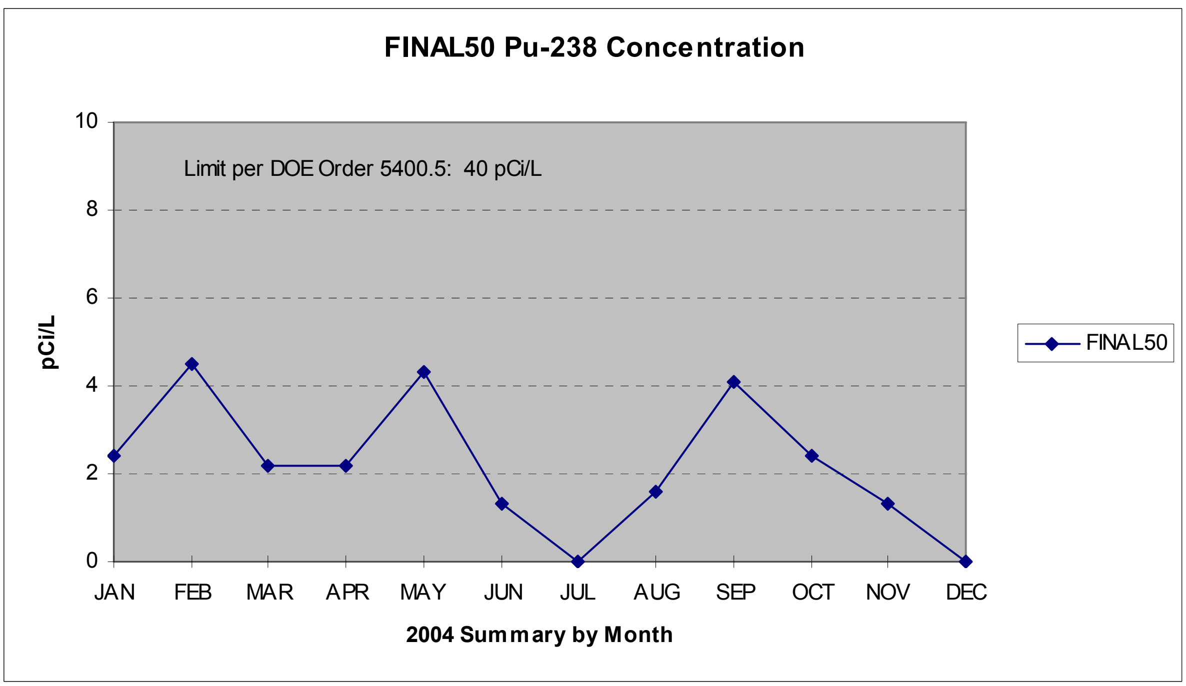
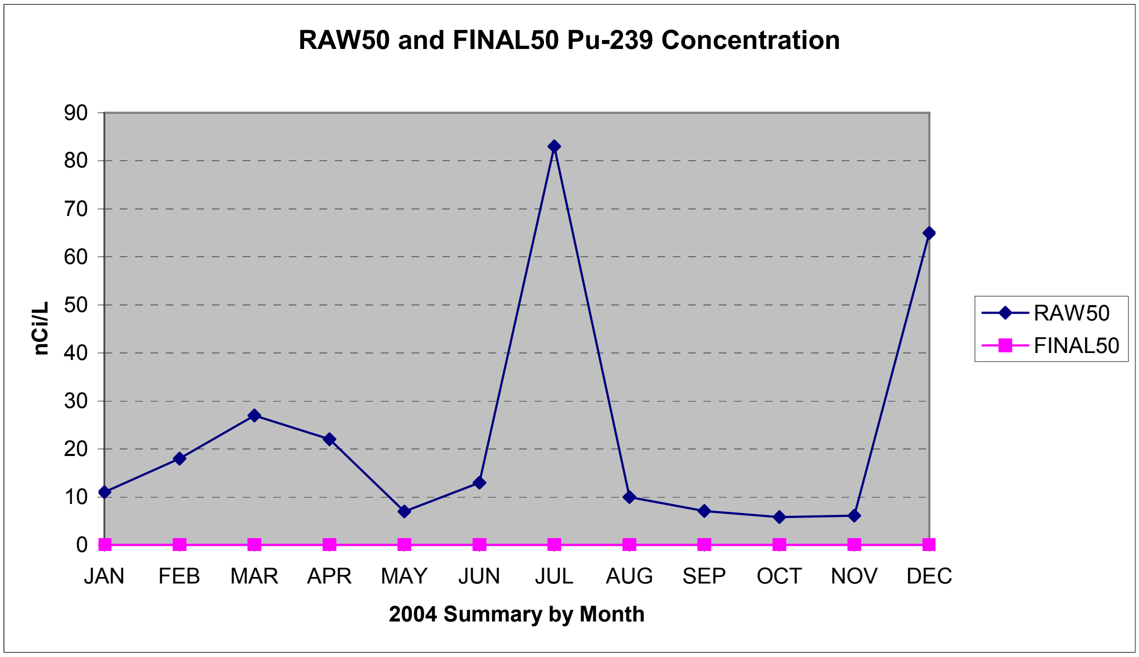


Figure 3-2
Pu-239 in RLWTF Influent and Effluent During 2004



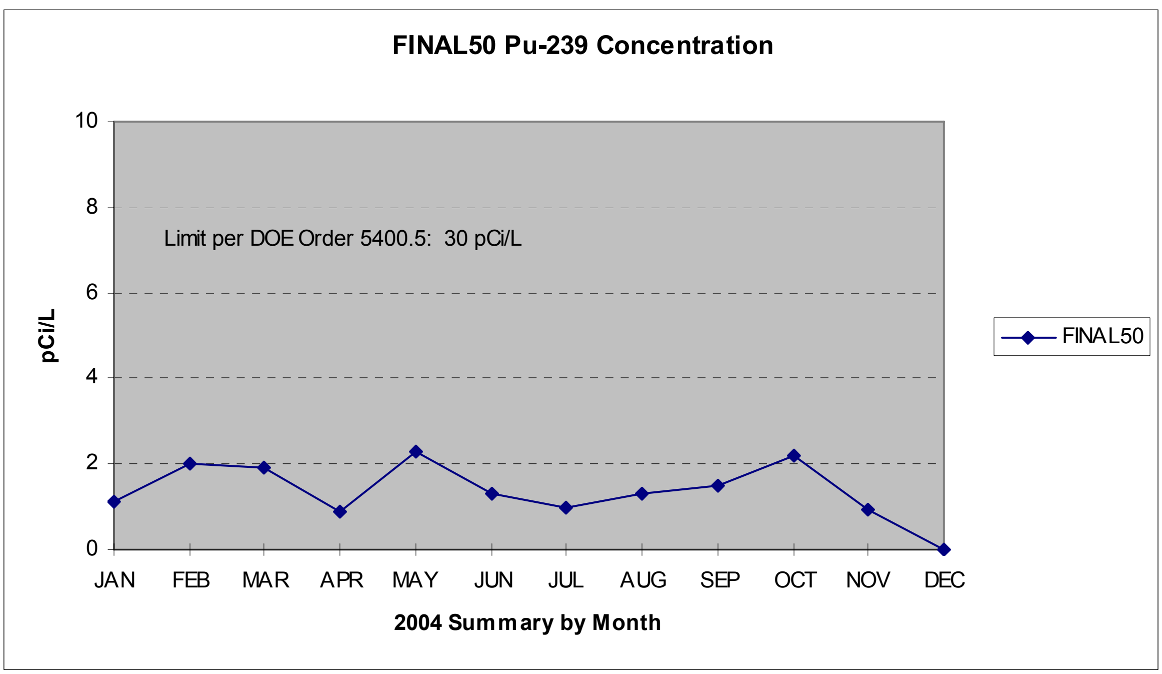
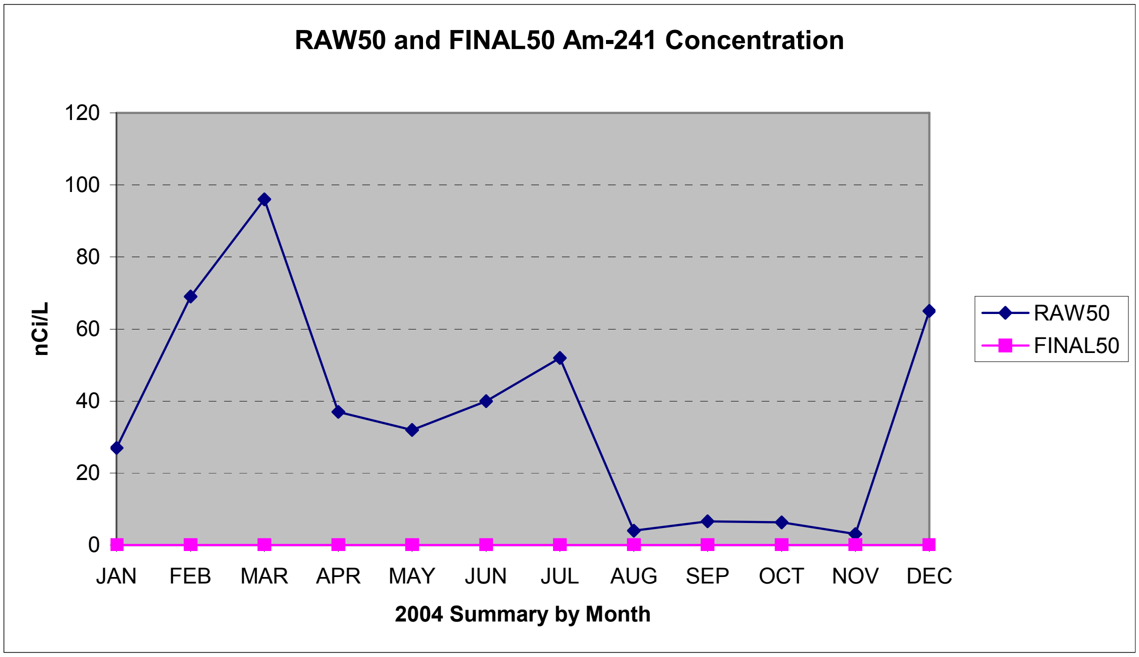


Figure 3-3
Am-241 in RLWTF Influent and Effluent During 2004



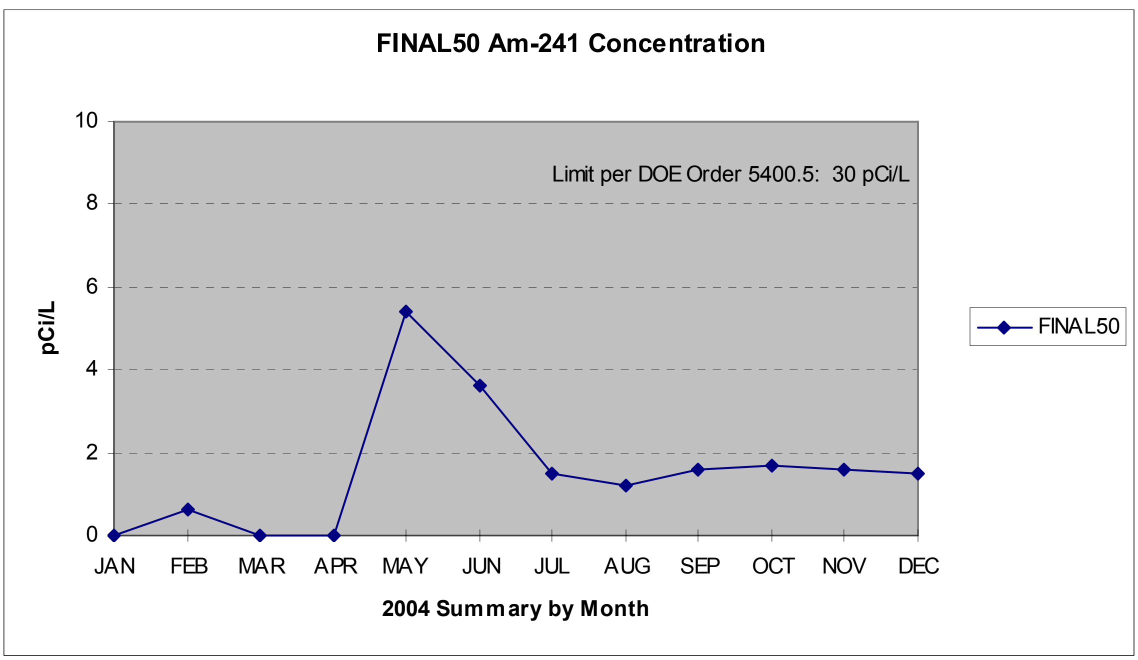
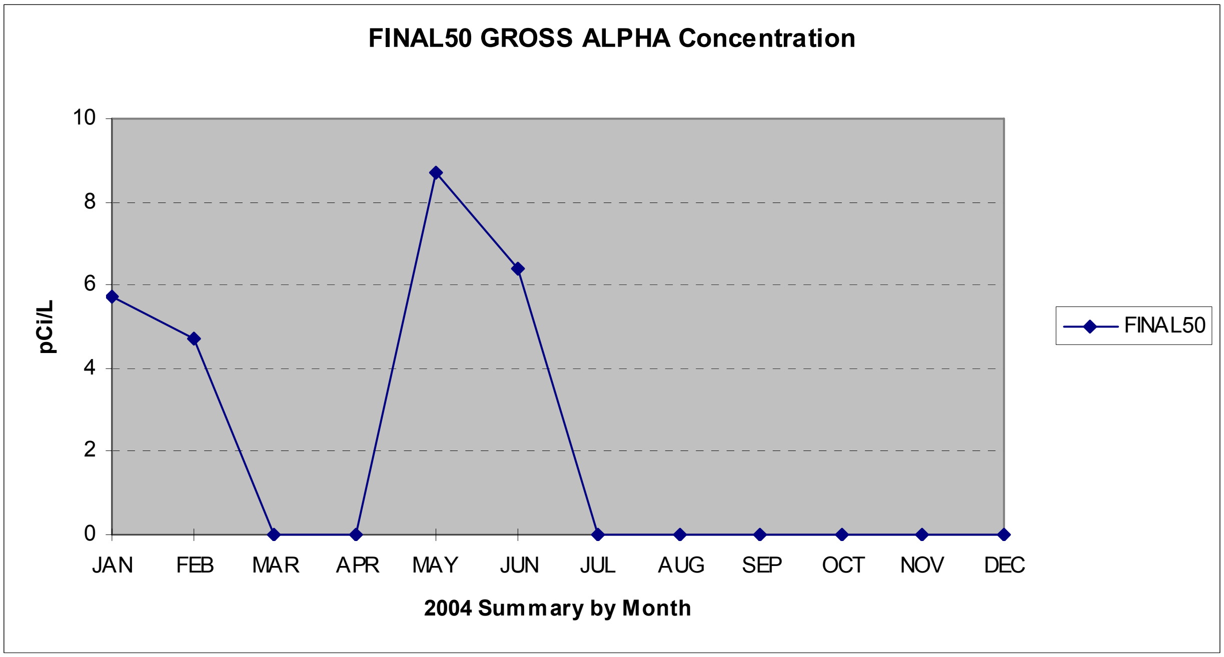
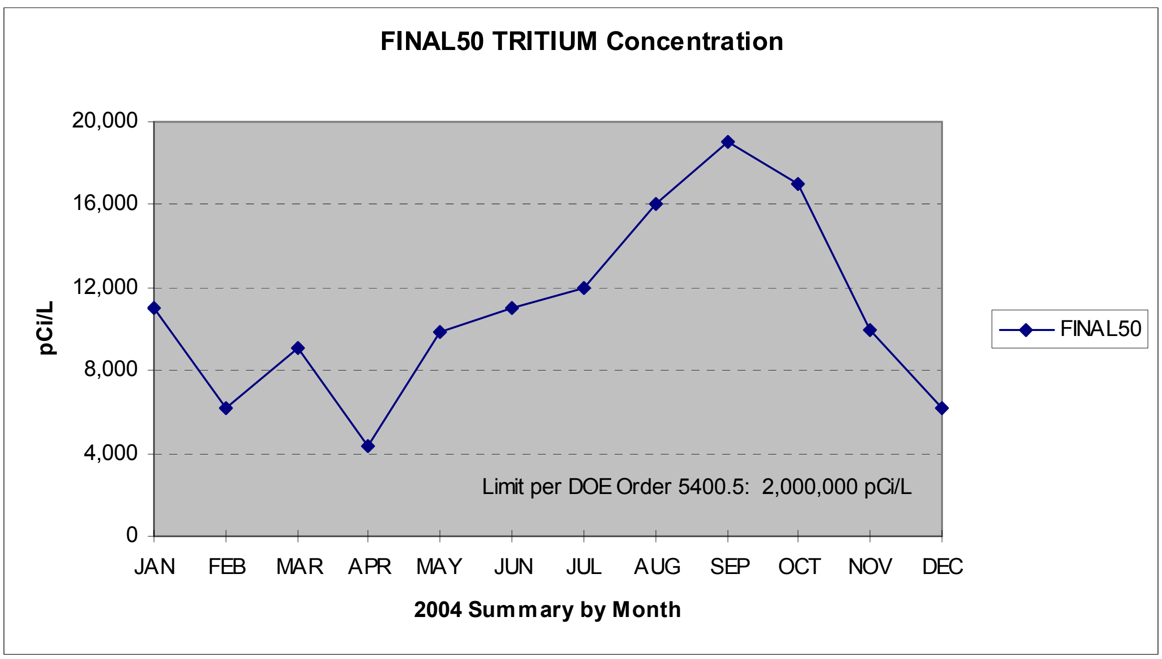


Figure 3-4
Tritium and Gross Alpha Activity in RLWTF Effluent During 2004





4. Non-Radiological Nature of the CY 2003 TA-50 RLWTF Waters

4.1 Minerals Detected

RLWTF influent samples are analyzed for 42 water quality parameters; effluent samples are analyzed for the same 42 parameters and for total toxic organics. (Non-radiological parameters are also referred to as "minerals".). Samples are also analyzed for volatile and semi-volatile organic compounds, which are discussed in Section 4.5.

These non-radiological analyses can be aggregated into five categories:

(a) eight traditional water quality measures – chemical oxygen demand, conductivity, hardness, pH, total dissolved solids, total suspended solids, and two measurements for alkalinity.
(b) a total of 25 cation (metals) measurements, including total cations.
(c) five anions: chloride, fluoride, cyanide, sulfate, and perchlorate
(d) four nitrogen measurements – nitrogen as nitrates, nitrogen as ammonia, nitrogen as nitrites, and total Kjedahl nitrogen
(e) total toxic organics (effluent only)

All 42 non-radiological parameters were detected in the RLWTF influent, but only 33 were detected in the RLWTF effluent during 2004.

4.2 Removal of Inorganic Chemicals

Table 4.3 provides a summary of mineral concentrations and quantities received by (influent) and discharged from (effluent) the RLWTF during 2004. The information shows that 2,890 kilograms of contaminants entered the facility in the form of suspended solids (190 kilograms) and dissolved solids (2700 kilograms).

In treating the influent, RLWTF personnel added lime (an estimated 1,800 kilograms) at the clarifier to soften the water, ferric sulfate at the clarifier to precipitate radionuclides, and potassium permanganate at the neutralization chamber to adjust pH. Small amounts of other chemicals, including sodium hydroxide and hydrochloric acid were used to clean the TUF and RO membranes. In total, the sum of non-radiological chemicals added during and as part of treatment operations approximated the quantity of non-radiological chemicals and minerals that entered the RLWTF with the influent.

As shown in the final column of Table 4-1, the total amount of chemicals leaving the facility with the effluent is 613 kilograms, the sum of total dissolved solids and total suspended solids, or about 10% of the total quantity entering as influent or added to treatment processes. The remainder left the facility as solid wastes, which are discussed in Section 5.

Table 4-1
TA-50 RLWTF Mineral Summary For 2004

	RAW Average	Maxi mum	Mini mum	No. Samp.	Total In (Kg)	FINAL Average	Maxi mum	Mini mum	No. Samp.	Total Out (Kg)
ALKALINITY-MO**	123.3 E0	419. E0	36. E0	12	1. E3	91.1 E0	159. E0	64.5 E0	12	744. E0
ALKALINITY-P**	48.7 E0	267. E0	209. E0	12	410. E0	*	*	*	12	*
ALUMINUM	643.7 E-3	1.8 E0	120. E-3	12	5.4 E0	14.9 E-3	30. E-3	6. E-3	12	121.7 E-3
AMMONIA-N	6. E0	10. E0	560. E-3	12	50.6 E0	4.8 E0	10.7 E0	2.1 E0	12	39.1 E0
ARSENIC	1.5 E-3	14. E-3	14. E-3	12	12.5 E-3	3.8 E-3	35. E-3	35. E-3	12	31.3 E-3
BARIUM	33.3 E-3	46. E-3	14. E-3	12	280.6 E-3	*	*	*	12	*
BERYLLIUM	1.7 E-3	5. E-3	2. E-3	12	14.7 E-3	*	*	*	12	*
BORON	86.5 E-3	200. E-3	34. E-3	12	728.4 E-3	137.5 E-3	380. E-3	40. E-3	12	1.1 E0
CADMIUM	4.2 E-3	6. E-3	3. E-3	12	35.2 E-3	714. E-6	4. E-3	4. E-3	12	5.8 E-3
CALCIUM	9.3 E0	17. E0	5. E0	12	78.1 E0	1.2 E0	4. E0	140. E-3	12	9.7 E0
CHLORIDE	38.1 E0	130. E0	3.8 E0	12	320.9 E0	6.9 E0	11. E0	2.7 E0	12	56.4 E0
COBALT	909.5 E-6	5. E-3	1. E-3	12	7.7 E-3	*	*	*	12	*
COD	136.8 E0	213. E0	32. E0	12	1.2 E3	14.4 E0	57. E0	9. E0	12	117.7 E0
CONDUCTIVITY**	588.3 E0	1.3 E3	130. E0	12	5. E3	250.8 E0	383. E0	168. E0	12	2. E3
COPPER	481.9 E-3	1.3 E0	210. E-3	12	4.1 E0	7.7 E-3	20. E-3	5. E-3	12	63.2 E-3
CYANIDE	2.7 E-3	10. E-3	2. E-3	12	22.6 E-3	1.8 E-3	7. E-3	2. E-3	12	14.4 E-3
FLUORIDE	1.2 E0	4. E0	220. E-3	12	10.5 E0	186.7 E-3	350. E-3	100. E-3	12	1.5 E0
HARDNESS**	34. E0	57.3 E0	19.9 E0	12	286.2 E0	3.2 E0	10.8 E0	390.8 E-3	12	26.4 E0
IRON	2.5 E0	5.2 E0	620. E-3	12	20.6 E0	45.9 E-3	80. E-3	9. E-3	12	374.6 E-3
LEAD	1.9 E-3	30. E-3	30. E-3	1	15.9 E-3	*	*	*	12	*
MAGNESIUM	2.6 E0	3.6 E0	1.4 E0	12	22.2 E0	60.9 E-3	220. E-3	10. E-3	12	497.9 E-3
MERCURY	2.9 E-3	6.1 E-3	310. E-6	12	24.2 E-3	25.4 E-6	200. E-6	20. E-6	12	207.7 E-6
NICKEL	76.9 E-3	340. E-3	8. E-3	12	647. E-3	*	*	*	12	*
NITRATE-N	9.7 E0	34.3 E0	450. E-3	12	81.5 E0	3. E0	7.2 E0	50. E-3	12	24.6 E0
NITRITE-N	774. E-3	2.8 E0	140. E-3	12	6.5 E0	1.5 E0	2.8 E0	670. E-3	12	12.1 E0
PERCHLORATE	140.1 E-3	530. E-3	9. E-3	10	1.2 E0	*	*	*	10	*
PHOSPHORUS	2.9 E0	8.5 E0	390. E-3	12	24. E0	11.7 E-3	140. E-3	30. E-3	12	96. E-3
POTASSIUM	5.4 E0	26. E0	200. E-3	12	45.3 E0	1.1 E0	4. E0	100. E-3	12	9.2 E0
SELENIUM	11.5 E-3	60. E-3	1.5 E-3	12	96.5 E-3	4.9 E-3	50. E-3	430. E-6	12	40.2 E-3
SILICON	21.4 E0	31. E0	6. E0	12	180.4 E0	1.6 E0	4. E0	1.3 E0	12	13.2 E0
SILVER	9.7 E-3	50. E-3	1. E-3	12	82.1 E-3	*	*	*	12	*
SODIUM	75.3 E0	178. E0	13. E0	12	634.2 E0	47.7 E0	73. E0	29. E0	12	389.5 E0
SULFATE	27.2 E0	164. E0	3.4 E0	12	229.3 E0	7.4 E0	13.5 E0	4.6 E0	12	60.6 E0
TDS	318.7 E0	678. E0	152. E0	12	2.7 E3	75.1 E0	200. E0	140. E0	12	613.2 E0
TKN	7.4 E0	13. E0	1.2 E0	12	62.3 E0	3.6 E0	6.7 E0	1.5 E0	12	29.5 E0
TOTAL CATIONS**	5.1 E0	10.2 E0	1.3 E0	12	42.6 E0	2.5 E0	4. E0	1.8 E0	12	20.7 E0
TOTAL CHROMIUM	103.7 E-3	650. E-3	8. E-3	12	873.3 E-3	*	*	*	12	*
TOXIC ORGANICS**	n.m.	n.m	n.m.	n.m	n.m.	138.6 E0	2.2 E3	1.1 E0	12	1.1 E3
TSS	22.3 E0	61. E0	4.4 E0	12	187.4 E0	*	*	*	12	*
URANIUM	174. E-3	552. E-3	13.9 E-3	12	1.5 E0	28.7 E-6	240. E-6	180. E-6	12	234.4 E-6
VANADIUM	9.4 E-3	20. E-3	10. E-3	12	79.5 E-3	2.6 E-3	10. E-3	9. E-3	12	21.4 E-3
ZINC	130.8 E-3	200. E-3	50. E-3	12	1.1 E0	17.1 E-3	160. E-3	40. E-3	12	139.8 E-3
pH	7.4 E0	11.2 E0	4.7 E0	12	----	7.5 E0	8.4 E0	7.2 E0	12	----
Volume of Flow: Influent = 8,417,800 liters Final = 8,169,700 liters										
Units: All figures in mg/L except: Alkalinities and hardness as mg CaCO3/l; Conductivity as uS/cm; Total Cations as meq/l; and Toxic Organics as ug/l.										
* Less than Detection Limit n.m.: Not measured										

Eight inorganic chemicals comprise almost all of the chemicals in the effluent that is discharged into Mortandad Canyon. These are summarized in Table 4-2, along with percent removed from the RLWTF influent.

Table 4-2
Mass of Major Inorganic Minerals in RLWTF
Influent and Effluent During 2004

Mineral	Mass in Influent Kgs)	Mass in Effluent (Kgs)	Percent Removed
Sodium	634	390	38
Chloride	321	56	83
Sulfate	229	61	73
Silicon	180	13	93
Nitrate-Nitrogen	82	25	70
Calcium	78	10	87
Ammonia-Nitrogen	51	40	22
Potassium	45	9	80
Subtotal, Major Minerals	1,620	604	63
Total Solids*	2,890	613	79

*Total Dissolved Solids + Total Suspended Solids

4.3 Regulatory Performance

Twenty-one (21) parameters in the effluent from the RLWTF are regulated by the National Pollutant Discharge Elimination System in compliance with the Federal Clean Water Act (EPA, 12/29/00). LANL also has a voluntary commitment with the New Mexico Environment Department to not discharge effluent from the TA-50 RLWTF that exceeds groundwater standards set by the New Mexico Water Quality Control Commission (NMED, 04/20/05) for three water quality parameters: fluoride, nitrate-nitrogen and total dissolved solids. Table 4-3 identifies these 24 discharge parameters and indicates the frequency of sampling required for each parameter; Table 4-4 identifies the regulatory limits for these parameters.

During calendar year 2004, TA-50 RLWTF effluent, for the fifth consecutive year, was in compliance with all twenty-one (21) NPDES water quality parameters. TA-50 effluent also met NMED ground water standards for fluoride, nitrate, and TDS every month of the year, and has now met these voluntary standards for 258 of the last 260 weeks[2].

[2] Two weekly composite samples of RLWTF effluent slightly exceeded the groundwater standard for fluoride during 2003. Sample values of 2.07 mg/L and 1.64 mg/L were obtained, versus the groundwater standard of 1.6 mg/L. (Watkins and Worland, March 2004, p. 30.)

Table 4-3
NPDES and NMED Discharge Parameters and Required Sampling Frequencies

NPDES (21 parameters)			**NMED (3 parameters)**
pH[1]	Copper[1]	Selenium[3]	Fluoride[5]
Aluminum[3]	Iron[1]	Zinc[1]	Nitrate Nitrogen[5]
Arsenic[3]	Lead[1]	Chemical Oxygen Demand[1]	Total Dissolved Solids[5]
Boron[3]	Mercury[1]	Total Suspended Solids[1]	
Cadmium[1]	Nickel[2]	Total Toxic Organics[2]	
Chromium[1]	Perchlorate[3]	Tritium (accelerator produced)[3]	
Cobalt[3]	Radium-226 + Radium-228[3]	Flow[4]	

[1] weekly grab sample
[2] monthly grab sample
[3] yearly grab sample
[4] continuous record
[5] weekly composite sample

4.4 Graphs of Non-Radiological Data

The following series of graphs highlight significant information about non-radiological components of the TA-50 RLWTF influent and effluent. Some of the minerals are of regulatory concern. Mercury, for example, has an extremely low NPDES discharge limit of 0.77 microgram per liter. Some of the minerals present processing challenges; silicon and calcium, for example, can precipitate and plug process piping and pumps. Others have been selected because they are among the major inorganic minerals present in waters discharged to Mortandad Canyon. Each graph plots mineral concentration in RLWTF influent and effluent by month during 2004.

Figure 4-1 shows total dissolved solids and total suspended solids in RLWTF influent and effluent during 2004. these two parameters provide important general information about water purity since they represent the sum of all contaminants present. Both parameters also have regulatory discharge limits – 1000 mg/L for TDS and 30 mg/L for TSS. In the RLWTF treatment process, the gravity filter and ultrafilter remove essentially all suspended solids. Reverse osmosis removes varying percentages of dissolved solids, depending upon particle mass and size.

Figure 4-2 illustrates chemical oxygen demand and ammonia concentrations. COD is a conventional measure of water quality used universally to assess water treatment; it has an NPDES discharge limit of 125 mg/L. During 2004, in fact, a spike in influent COD caused extensive recycling and re-treatment of waters during a two-week period in July. Ammonia is a processing concern because of waste acceptance criteria on evaporator bottoms sent to Bear Creek, TN for solidification.

Table 4-4
Discharge Limits for NPDES and NMED Parameters in RLWTF Effluent

NPDES Parameters	Units	Monthly Average	Daily Max
Flow	----	Report	Report
pH	s.u.	6 – 9 su	6 – 9 su
Chemical Oxygen Demand	mg/L	125	125
Total Suspended Solids	mg/L	30	45
Total Cadmium	µg/L	50	50
Total Chromium	µg/L	1,340	2,680
Total Copper	µg/L	1,393	1,393
Total Iron	----	Report	Report
Total Lead	µg/L	423	524
Total Mercury	µg/L	0.77	0.77
Total Zinc	µg/L	4,370	8,750
Total Toxic Organics	µg/L	1,000	1,000
Total Arsenic	µg/L	368	368
Total Aluminum	µg/L	5,000	5,000
Total Boron	µg/L	5,000	5,000
Total Cobalt	µg/L	1,000	1,000
Total Selenium	µg/L	5	5
Total Vanadium	µg/L	100	100
Radium 226 + Radium 228	pCi/L	30	30
Tritium (accelerator produced)	pCi/L	20,000	20,000
Total Nickel		Report	Report
Perchlorate		Report	Report
NMED Parameters	**Per Discharge (mg/L)**		
Fluoride	1.6		
Nitrate-nitrogen	10		
Total Dissolved Solids	1,000		

Figure 4-3 charts concentrations for mercury and perchlorates, the two chemicals with the most restrictive discharge limits. The NPDES limit for mercury is just 0.77 µg/L (i.e., less than one part per billion). Perchlorate has a voluntary discharge limit of just four parts per billion, for which ion exchange treatment columns were installed in 2002. No perchlorate has been detected in effluent since the ion exchange columns were installed.

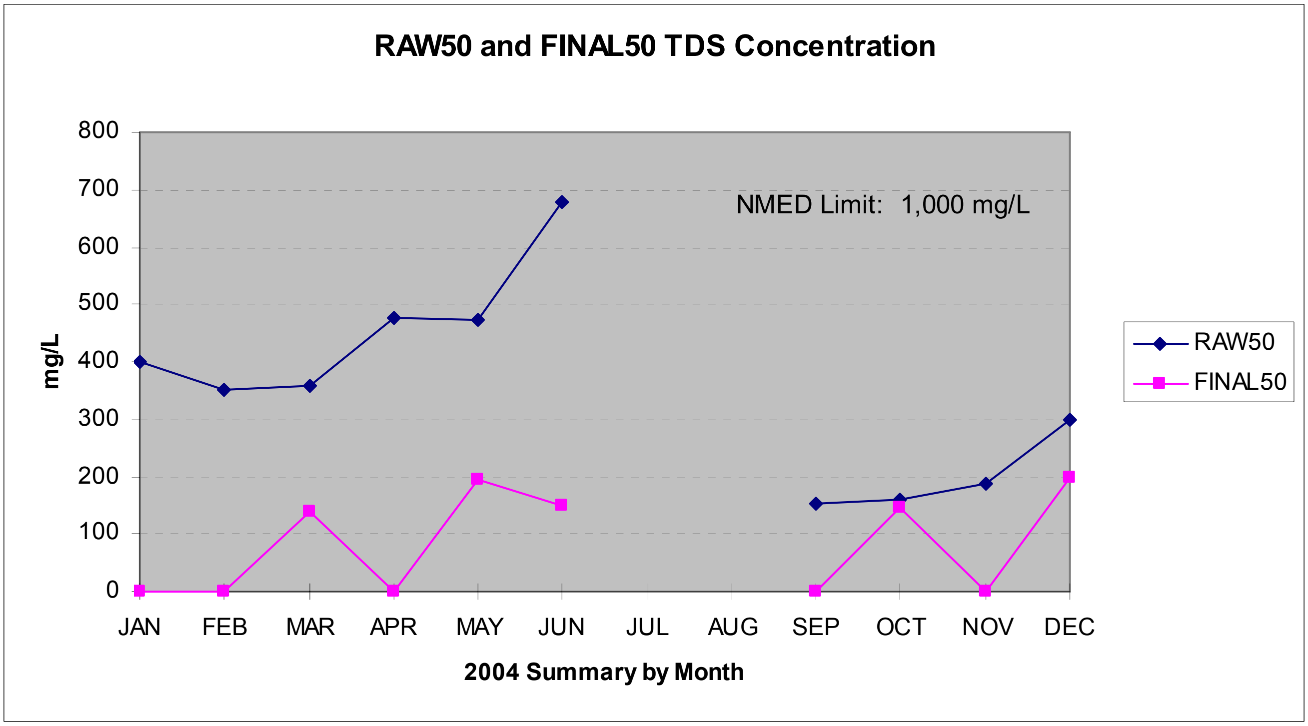
Figure 4-4 shows zinc and fluoride concentrations for 2004. Zinc remains on the list of minerals of concern because zinc discharges were the last NPDES violations experienced at the RLWTF, back in 1999. Fluoride has an NMED discharge limit of just 1.6 mg/L.

Figure 4-5 illustrates concentrations for two other parameters of regulatory concern, nitrates and cadmium. The NMED limit for nitrogen as nitrate, 10 mg/L, led to the installation of nitrate treatment equipment for a short while in 1999 and 2000. The equipment was retired when it was learned that administrative control of small-volume, high-concentration nitrate waste solutions was more cost effective than treatment. Cadmium is another contaminant with a restrictive discharge limit, 50 μg/L.

Figure 4-6 charts concentrations for two minerals of processing concern, calcium and silicon. These presented significant problems and downtime when the membrane processes were first installed.

Finally, Figure 4-7 shows influent and effluent concentrations sodium and chloride. As shown in Table 4-4, sodium is the chief constituent in waters discharged into Mortandad Canyon, and chloride is one of the major contaminants present in RLWTF influent. Both are soluble, and hence are not removed prior to treatment by reverse osmosis.

Figure 4-1
Dissolved and Suspended Solids in RLWTF Waters During 2004



TDS data not available for July and August.

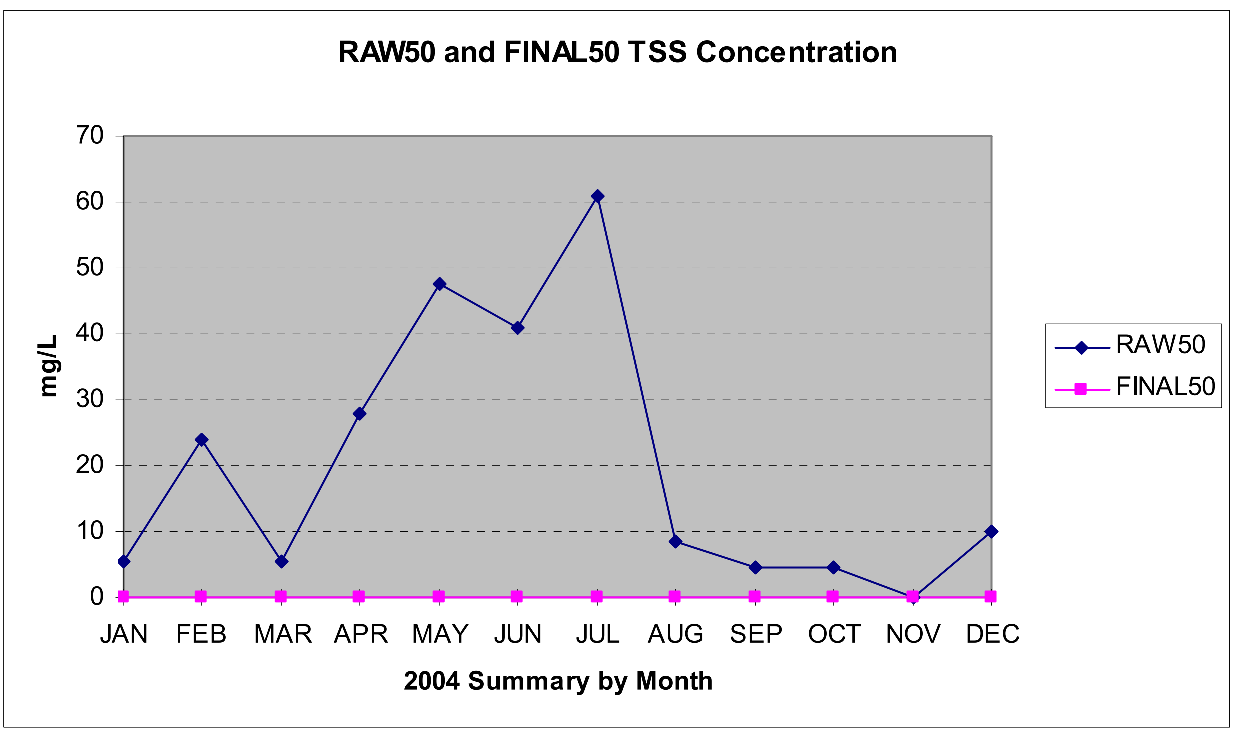
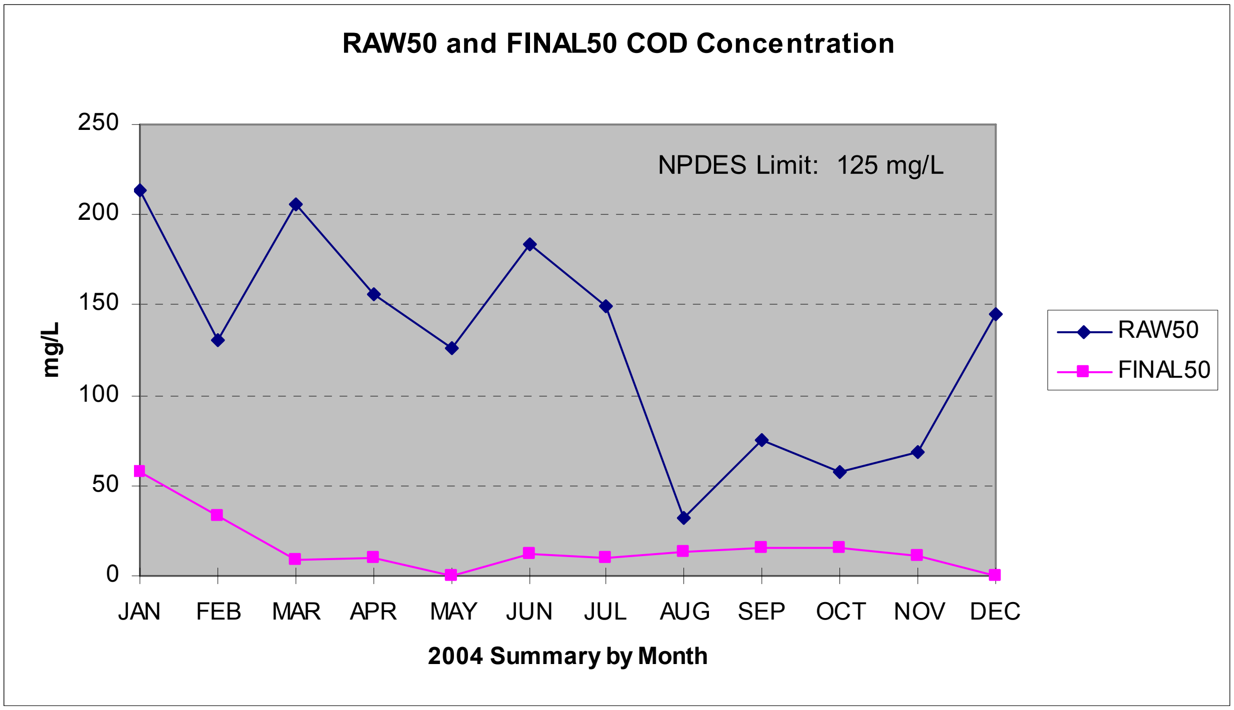


Figure 4-2
Chemical Oxygen Demand and Nitrogen as Ammonia in RLWTF Waters During 2004



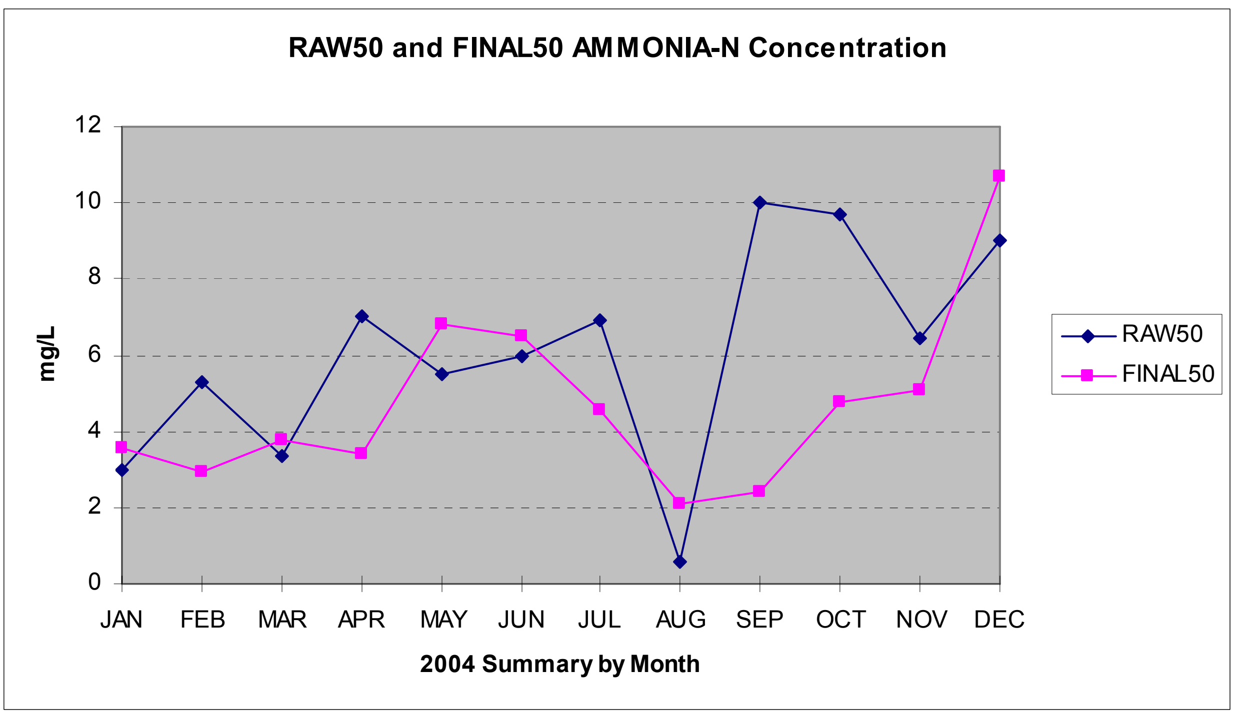
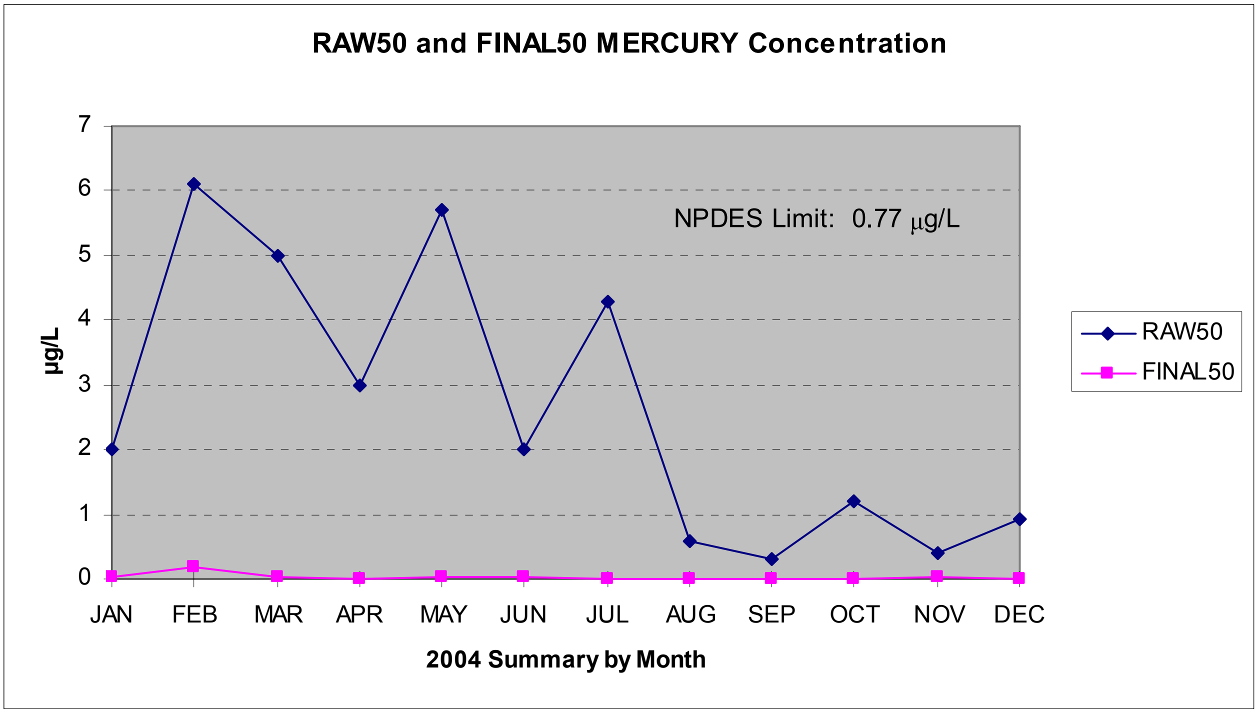


Figure 4-3
Mercury and Perchlorate in RLWTF Waters During 2004



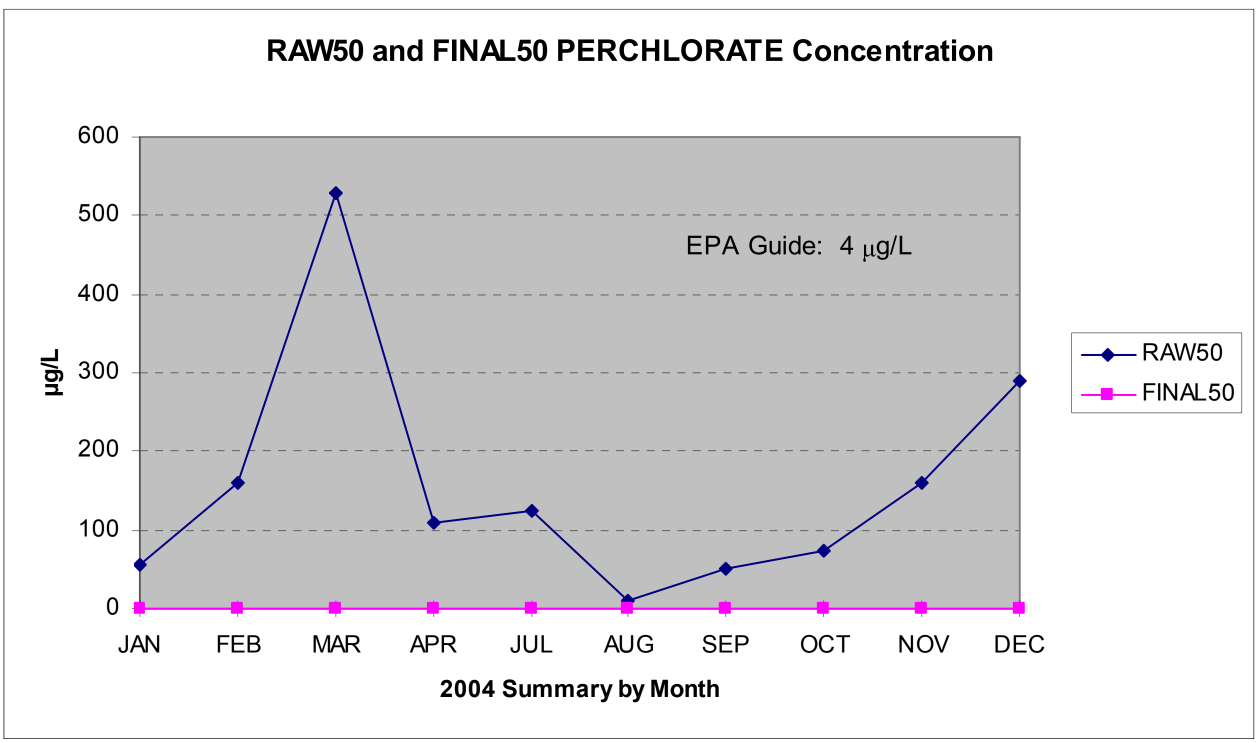
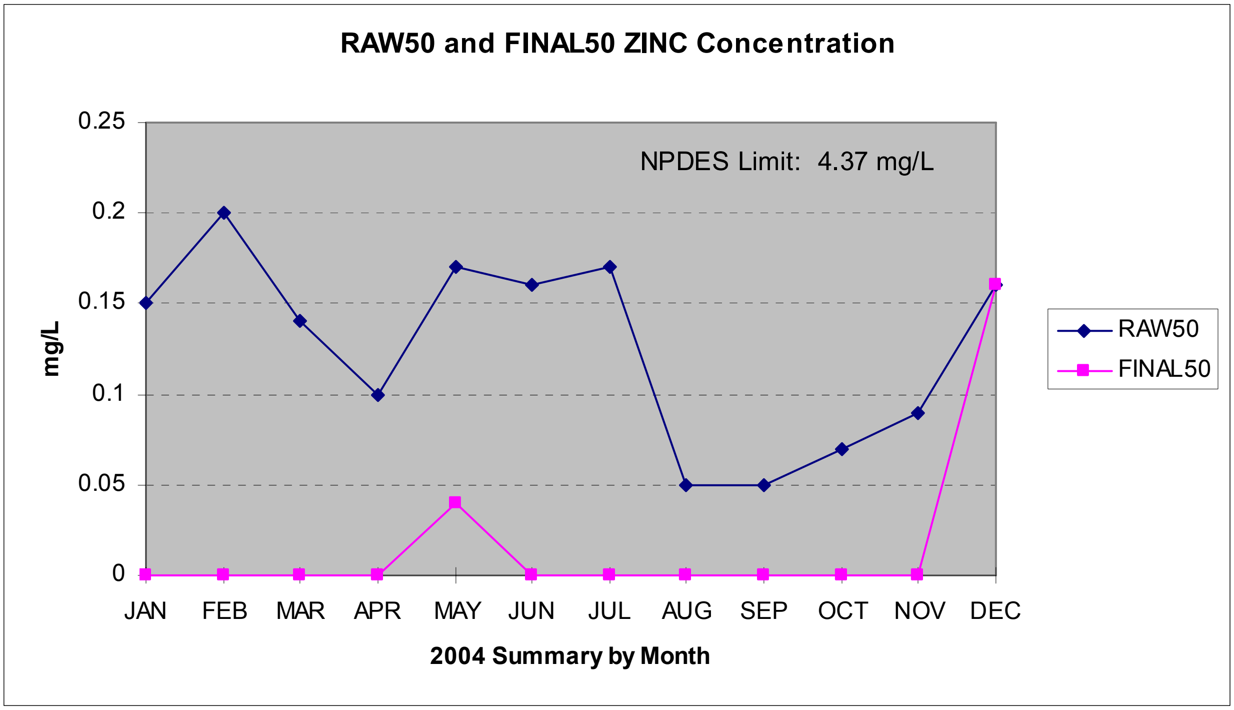


Figure 4-4
Zinc and Fluoride in RLWTF Waters During 2004



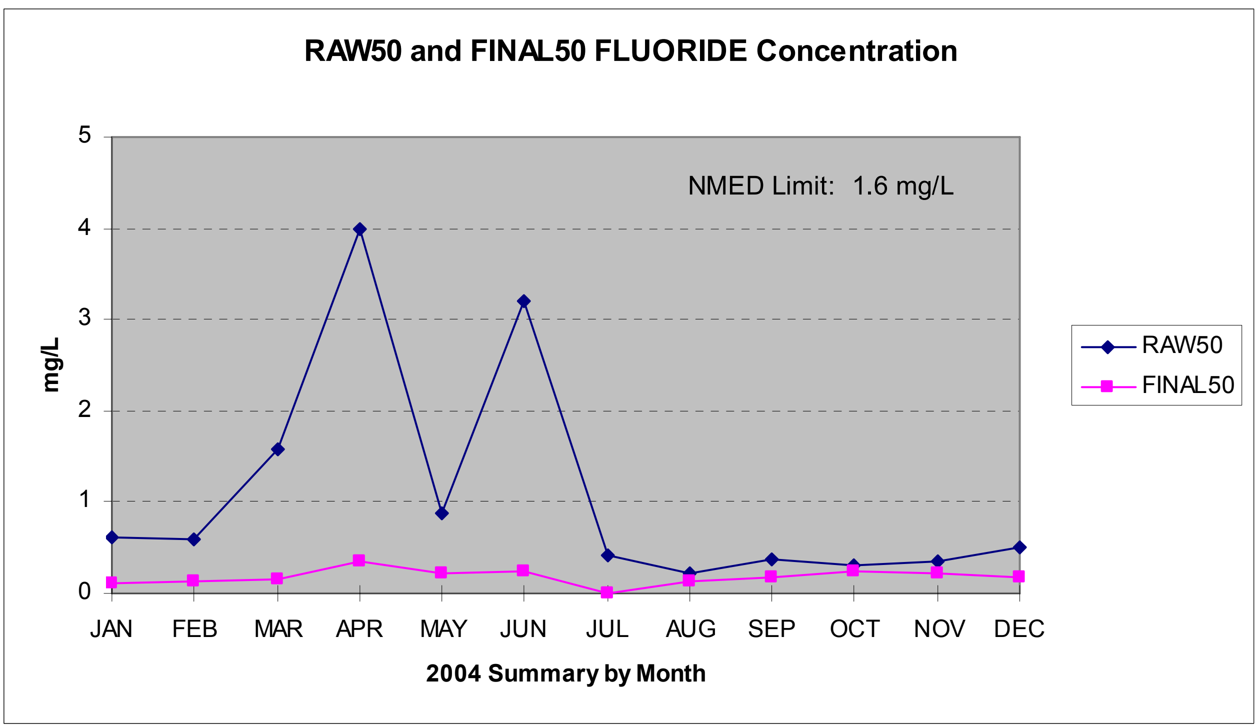
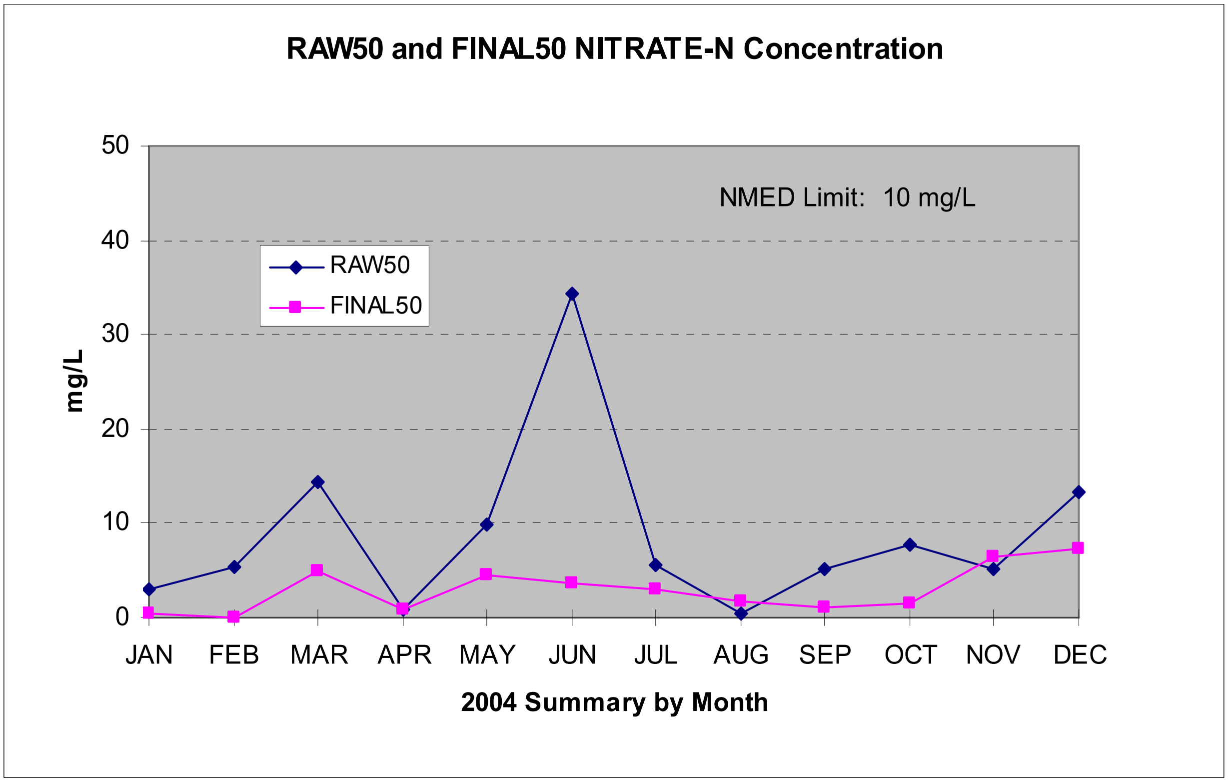


Figure 4-5
Cadmium and Nitrogen as Nitrates in RLWTF Waters During 2004



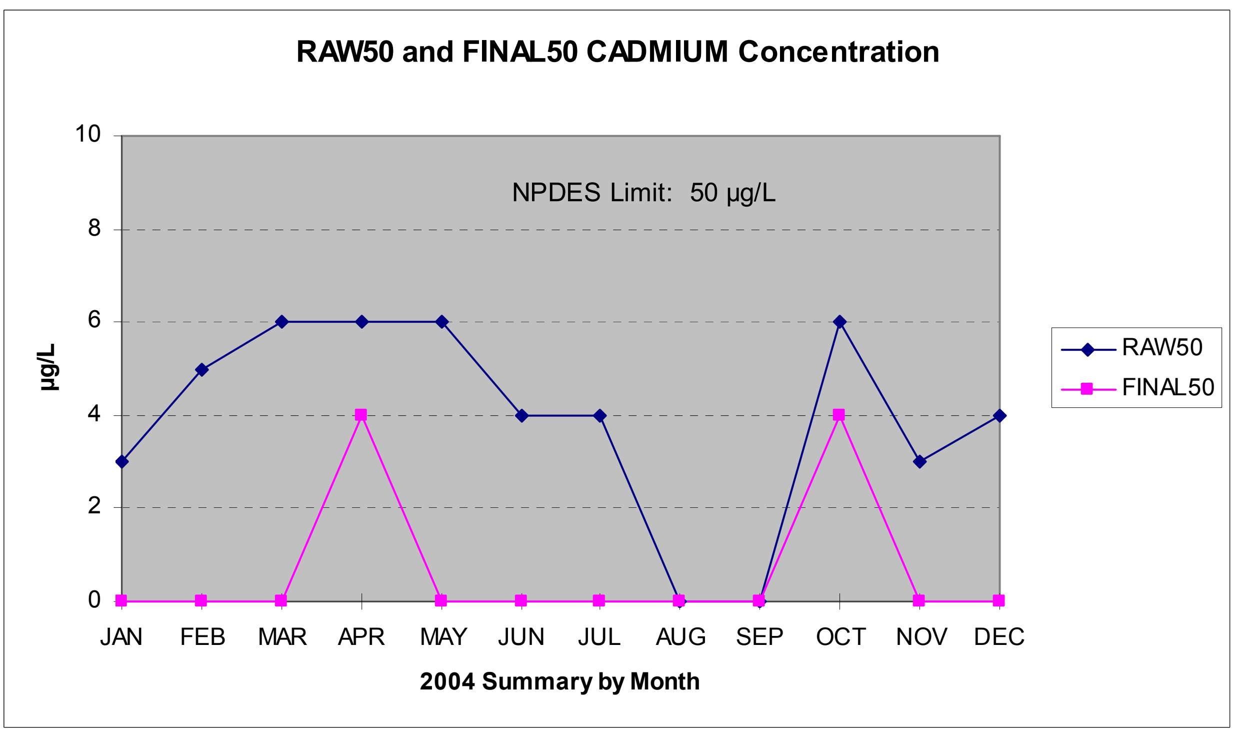
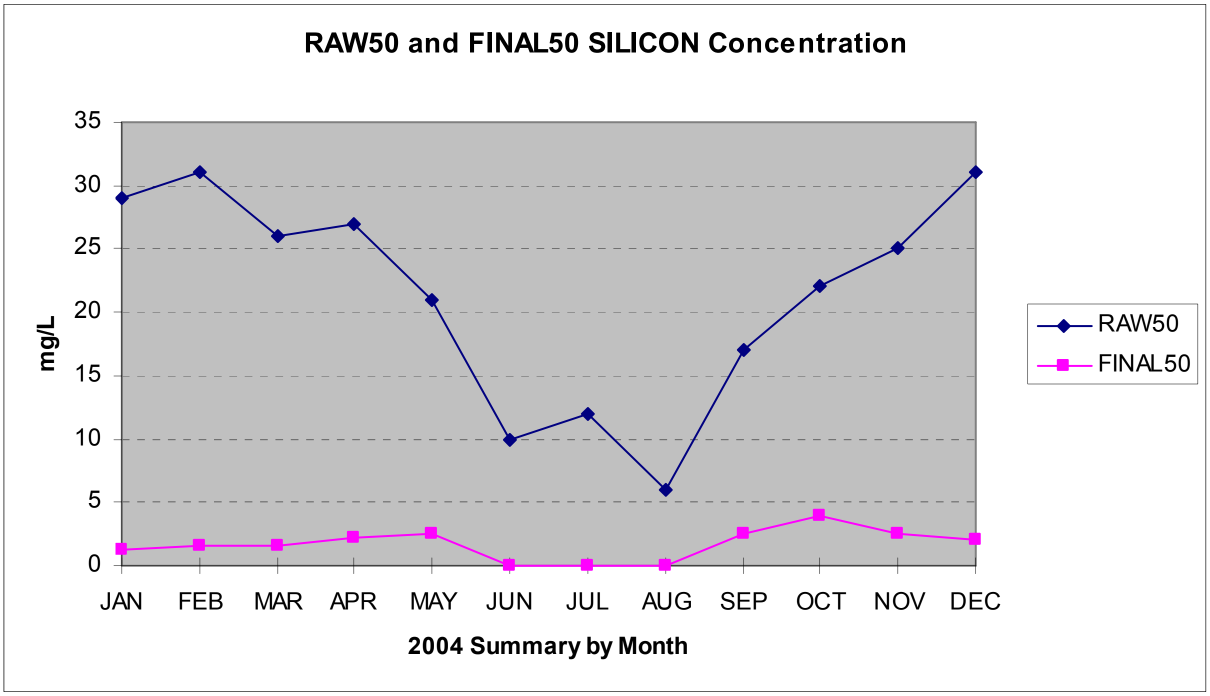


Figure 4-6
Silicon and Calcium in RLWTF Waters During 2004



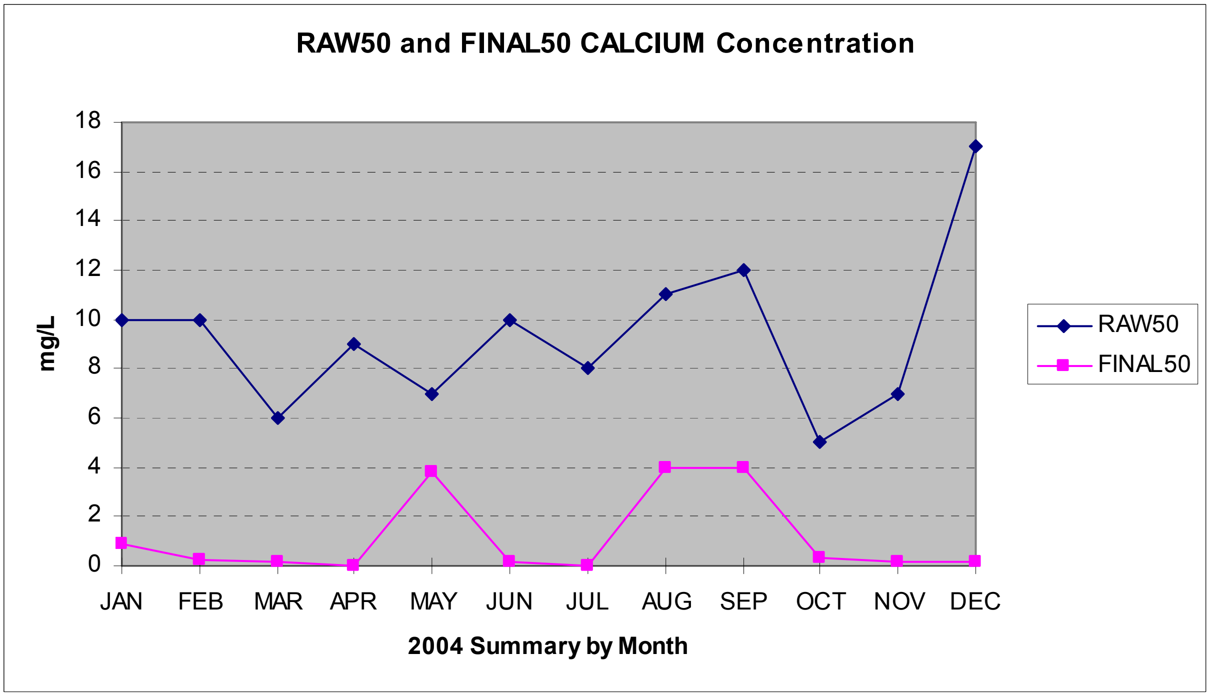
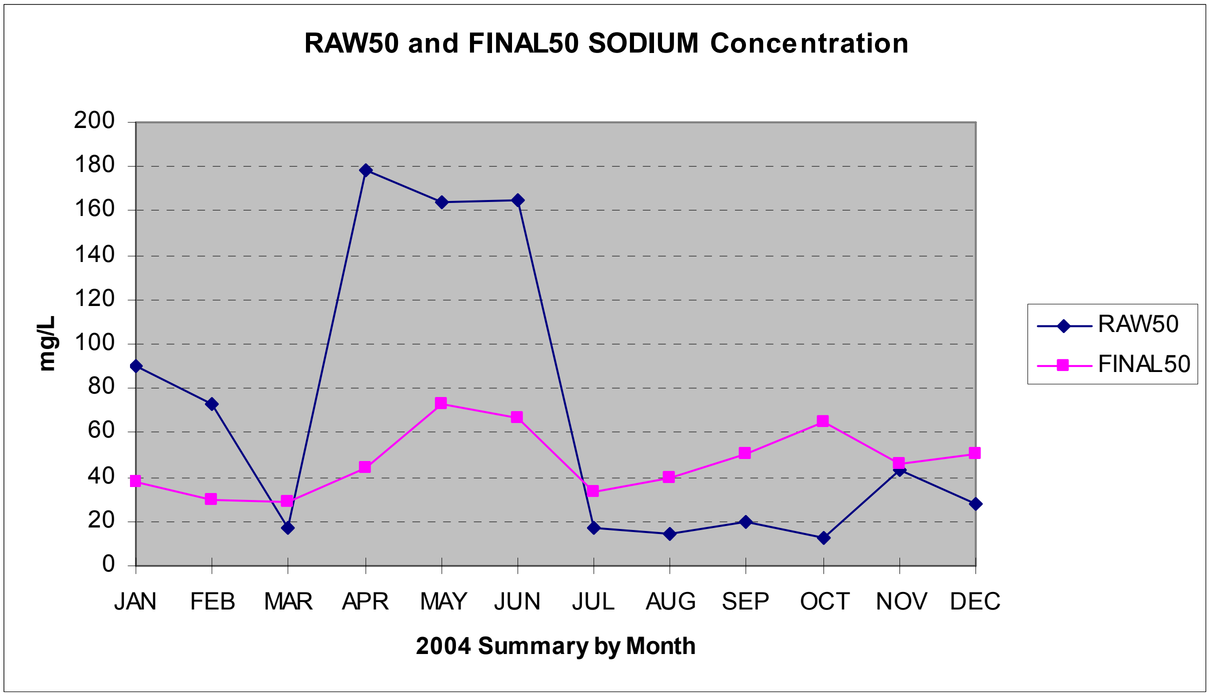
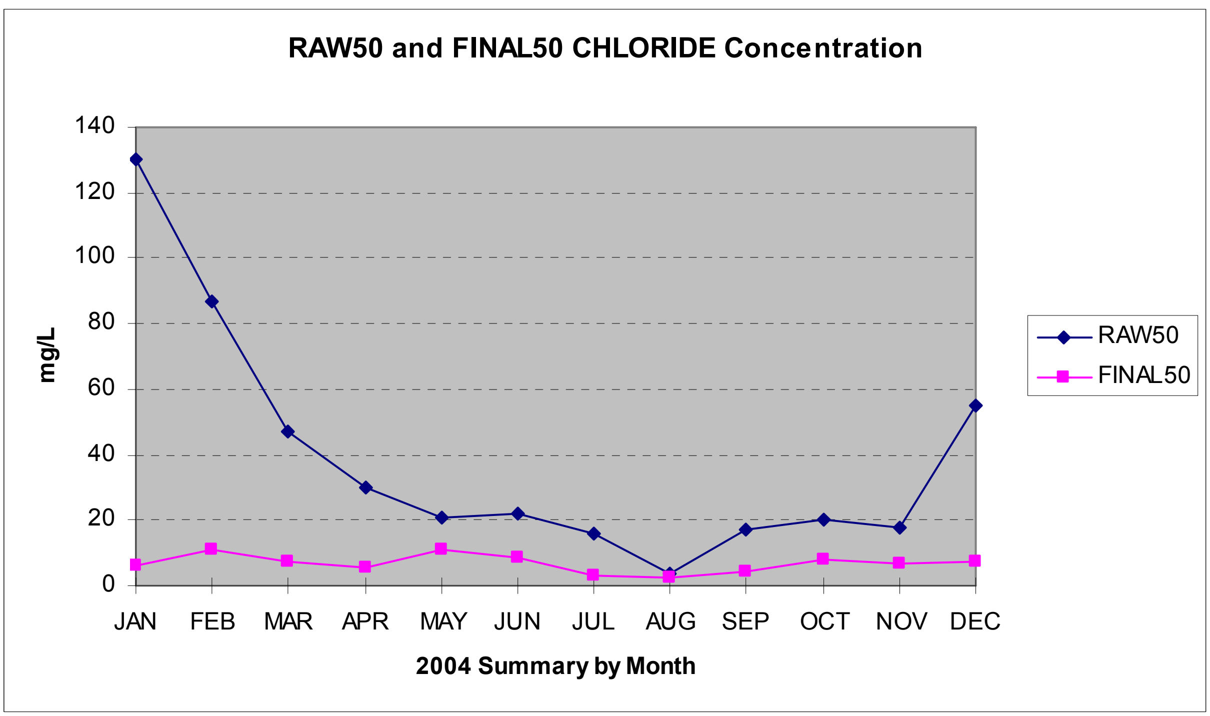


Figure 4-7
Sodium and Chloride in RLWTF Waters During 2004





4.5 Organic Chemicals

Volatile organic chemicals (VOC) and semi-volatile organic chemicals (SVOC) are also analyzed for in the TA-50 RLWTF influent wastewaters, treated effluent waters and in the chemical sludge produced by the clarification process. A grab sample of influent water is analyzed for VOC and SVOC on a weekly basis. A monthly grab sample of effluent water is analyzed for VOC and SVOC. Additionally, individual batches of sludge are also analyzed for VOC and SVOC. These analyses are performed according to EPA approved methods 624 for VOC, and 625A and 625B for SVOC by an external EPA certified laboratory.

Table 4-5 summarizes the VOC detected in the RLWTF effluent during CY 2004 and the concentration range of these chemicals. The "months" column in Table 4-5 indicates the number of monthly samples in which a particular chemical was detected. For example, the VOC chemical, chloroform, was detected in very small concentrations in two of the twelve monthly effluent samples. No SVOC were detected in effluent.

Tables 4-6 and 4-7 show the VOC and SVOC, respectively, detected in the RLWTF influent and the number of weeks in which that chemical was detected during CY 2004. More information pertaining to VOC and SVOC in the RLWTF influent is given in Appendix F.

Table 4-5
VOC Detected in Monthly Samples of 2004 RLWTF Effluent

VOC (Method 624)	Months	Low (ug/L)	High (ug/L)
Chloroform	2	1.1 E0	2.2 E3
Methylene Chloride	1	26. E0	26. E0
Toluene	2	1.1 E0	1.5 E0

Table 4-6
VOC Detected in Weekly Samples of 2004 RLWTF Influent

VOC (Method 624)	Weeks	Low (mg/L)	High (mg/L)
1,1,2,2-TETRACHLOROETHANE	1	930. E-6	930. E-6
1,1,2-TRICHLOROETHANE	1	290. E-6	290. E-6
1,1-DICHLOROETHENE	1	1.1 E-3	1.1 E-3
1,1-DICHLOROPROPENE	1	720. E-6	720. E-6
1,2,3-TRICHLOROBENZENE	2	2.7 E-3	5.1 E-3
1,2,4-TRICHLOROBENZENE	2	1.9 E-3	3.8 E-3
1,2,4-TRIMETHYLBENZENE	7	420. E-6	10. E-3
1,2-DIBROMO-3-CHLOROPROPANE	1	2.2 E-3	2.2 E-3
1,2-DIBROMOETHANE	1	510. E-6	510. E-6
1,2-DICHLOROBENZENE	6	270. E-6	1.5 E-3
1,2-XYLENE	1	530. E-6	530. E-6
1,3-DICHLOROBENZENE	4	310. E-6	1. E-3
1,4-DICHLOROBENZENE	4	520. E-6	1.2 E-3
2-BUTANONE	12	310. E-6	23. E-3
4-CHLOROTOLUENE	1	270. E-6	270. E-6
4-ISOPROPYLTOLUENE	1	520. E-6	520. E-6
4-METHYL-2-PENTANONE	31	6.7 E-3	300. E-3
ACETONE	37	15. E-3	1.4 E0
BENZENE	4	390. E-6	1.2 E-3
BROMOBENZENE	2	230. E-6	3.1 E-3
BROMODICHLOROMETHANE	1	430. E-6	430. E-6
BROMOFORM	2	360. E-6	3.4 E-3
BROMOMETHANE	21	300. E-6	38. E-3
CARBON DISULFIDE	2	1.4 E-3	1.5 E-3
CHLOROBENZENE	1	450. E-6	450. E-6
CHLORODIBROMOMETHANE	1	560. E-6	560. E-6
CHLOROETHANE	2	7.9 E-3	9.2 E-3
CHLOROFORM	17	180. E-6	4.1 E-3
CHLOROMETHANE	16	440. E-6	42. E-3
CIS-1,2-DICHLOROETHENE	1	300. E-6	300. E-6
CIS/TRANS-1,2-DICHLOROETHENE	2	1. E-3	1.4 E-3
HEXACHLOROBUTADIENE	2	1.4 E-3	2.8 E-3
IODOMETHANE	6	930. E-6	8.3 E-3
METHYLENE CHLORIDE	30	1.1 E-3	15. E-3
N-BUTYLBENZENE	2	510. E-6	780. E-6
NAPHTHALENE	2	2.6 E-3	5.6 E-3
STYRENE	2	430. E-6	450. E-6
TOLUENE	6	250. E-6	1.1 E-3
TRANS-1,2-DICHLOROETHENE	2	1. E-3	1.4 E-3
TRANS-1,3-DICHLOROPROPENE	1	500. E-6	500. E-6
XYLENE (TOTAL)	1	870. E-6	870. E-6

Table 4-7
SVOC Detected in Weekly Samples of 2004 RLWTF Influent

SVOC (Methods 625A and 625B)	Weeks	Low (mg/L)	High (mg/L)
1,2-DICHLOROBENZENE	1	2.2 E-3	2.2 E-3
2,4-DINITROPHENOL	1	9.1 E-3	9.1 E-3
2-NITROPHENOL	6	2.6 E-3	12. E-3
4-NITROPHENOL	2	13. E-3	20. E-3
AZOBENZENE	6	2. E-3	20. E-3
BENZOIC ACID	16	6.2 E-3	85. E-3
BENZYL ALCOHOL	2	2.3 E-3	2.6 E-3
BIS(2-ETHYLHEXYL)PHTHALATE	41	2.7 E-3	91. E-3
BUTYLBENZYLPHTHALATE	1	2.6 E-3	2.6 E-3
DI-N-BUTYLPHTHALATE	1	2.5 E-3	2.5 E-3
DIETHYLPHTHALATE	3	3.2 E-3	8.4 E-3
N-NITROSO-DI-N-PROPYLAMINE	10	2.8 E-3	51. E-3
N-NITROSODIMETHYLAMINE	5	2.3 E-3	6. E-3
PHENOL	2	3.7 E-3	4.3 E-3
PYRIDINE	9	5.4 E-3	110. E-3

5. TA-50 Wastes

During the treatment of wastes, other (secondary) waste streams are generated. These secondary wastes can be grouped under two headings – secondary liquid waste streams, and solid wastes.

5.1 Secondary Liquid Wastes

Secondary liquid wastes include a wide variety of waste streams from each of the treatment operations. For example, clarifier and gravity filter operations result in a liquid, sludge-containing stream and backwash waters. Operations of the reverse osmosis unit creates a concentrate stream and wash solutions. Each of these secondary liquid waste streams are re-cycled and re-treated within the TA-50 RLWTF. For example, clarifier sludge is processed through the rotary vacuum filter in Room 116. Gravity filter backwash waters are returned to the headworks, and re-processed through the clarifier. RO concentrate is processed through the EDR and interim evaporator. The volume of these secondary liquid waste streams during 2004 is estimated to be about six million liters, more than 90% of which are generated via operation of the tubular ultrafilter and the reverse osmosis units. Appendix A provides additional information about the numbers and volumes of these liquid streams.

5.2 Solid Wastes

Influent to the TA-50 RLWTF contained 2,890 kilograms of solids. Treatment of this influent to achieve compliance with DOE, EPA, and NMED discharge standards resulted in the generation of nearly 44,000 kilograms of solid wastes. These solid wastes can be broadly grouped into three waste sources: operations wastes generated while conducting day-to-day activities, process sludges that result from chemical precipitation, and dried salts from evaporator bottoms.

In addition to solid wastes generated by treating RLW, solid wastes in the form of soils and asphalt were generated during the initial construction phase of the new pump house and influent storage tank building that is part of the Cerro Grande Rehabilitation Project. This non-routine waste generation totaled 104 cubic meters and 130,728 kilograms of radioactive low-level waste that was disposed at Area G, and 15 kilograms of contaminated lead sheets (mixed LLW) that will be shipped to a commercial vendor for treatment and disposal. (Sloan, 04/26/05)

Table 5-1 provides details of waste containers, volumes, and weights.

5.2.1 Operations Wastes

Operations wastes result from both day-to-day water treatment activities and from facility and equipment repairs and modifications. A total of 13,916 kilograms of operations wastes (205 drum equivalents) were generated at the TA-50 RLWTF during 2004. Operations wastes

Table 5-1
Solid Wastes Shipped From the TA-50 RLWTF During 2004

	Chemical	LLW	MLLW	Totals
No. Items:				
Operations	10	123	0	133
Salts from Bear Creek	0	43	0	43
Sludge	0	66	0	66
Subtotals	10	232	0	242
CGR Pump House Preps.	5	8	1	14
Totals	15	240	1	256
Volume (m^3):				
Operations	0.013	41.0	0	41.0
Salts from Bear Creek	0	13.8	0	13.8
Sludge	0	13.7	0	13.7
Subtotals	0.013	68.6	0.000	68.6
CGR Pump House Preps.	0.238	104.0	0.034	104.3
Totals	0.251	172.6	0.034	172.9
Weight (Kg):				
Operations	16.5	13,916	0	13,933
Salts from Bear Creek	0	18,298	0	18,298
Sludge	0	11,760	0	11,760
Subtotals	16.5	43,975	0.0	43,992
CGR Pump House Preps.	78.5	130,635	15.2	130,728
Totals	95.0	174,610	15.2	174,720

consisted largely (80 of 133 items) of compactible trash generated in radiation control areas at the RLWTF. Compactible trash includes paper towels, discarded plastic sampling vials and bottles, protective gloves, and similar materials needed for day-to-day activities. Other operations waste included empty containers, used equipment components, and parts such as spent filter cartridges. Examples of waste from repairs and modifications include piping and worn pumps and motors.

5.2.2 Salts From Bear Creek

Bottoms from the interim evaporator are shipped to a subcontractor in Bear Creek, TN, where the bottoms are dried. The resultant dried salts are returned for disposal at Area G as LLW. During 2004, nine shipments containing 102,000 gallons of evaporator bottoms were made to Bear Creek, and 43 drums of dried salts weighing 18,300 kilograms were returned.

5.2.3 Process Sludge

Influent solids and process chemicals used to treat the influent are ultimately either discharged to Mortandad Canyon as dissolved solids in treated waters, or wind up as process sludge that is shipped to Area G for disposal (LLW) or storage (TRU). During 2004, 66 drums containing 11,760 kilograms of process sludge were shipped for disposal as LLW at Area G. No drums of solidified transuranic sludge were shipped. Table 5-2 provides some detail about the drums of LLW sludge.

Table 5-2
Vacuum Filter Sludge Shipped for Disposal During 2004

Month	No. of Drums	Total Volume (Liters)	Gross Weight (Kg)	U-234 (Curies)	U-235 (Curies)	Pu-238 (Curies)	Pu-239 (Curies)	Am-241 (Curies)
Mar-04	11	2,288	1,898	3.23E-04	1.70E-07	0	2.84E-03	1.29E-02
Apr-04	22	4,576	3,899	4.53E-04	2.78E-07	7.34E-03	5.27E-03	1.82E-02
Jun-04	33	6,864	5,801	5.15E-04	5.77E-07	2.68E-02	9.37E-03	2.63E-02
TOTAL	66	13,728	11,598	1.29E-03	1.03E-06	3.42E-02	1.75E-02	5.75E-02

6. TA-53 RLWTF Operations in 2004

The TA-53 RLWTF treats radioactive liquid waste from accelerator research at the Los Alamos Neutron Science Center. The treatment process includes wastewater storage to allow short-lived radioisotope decay and solar evaporation. Three flows are of importance.

- Water flows by gravity into lift stations adjacent to Experimental Area A and the Lujan center. The RLW is pumped from the lift stations through double-walled underground piping to one of three 30,000-gallon tanks inside Building 53-945. A total of 336,100 liters of RLW were transferred from the lift stations to the RLWTF during 2004.

- After aging in the RLWTF tanks, the RLW is pumped to the evaporator basins. During 2004, four pump-outs occurred: May 26, June 3, June 7, and October 4. The volume of RLW pumped to the basins totaled 330,700 liters.

- Tritiated waters are occasionally trucked directly to the TA-53 basins for evaporation. During 2004, 2050 liters were trucked to the basins from TA-16. These trucked wastewaters met the waste acceptance criteria for the TA-53 RLWTF.

The quantity of water sent to the basins during 2004 is far below the evaporative capacity (1.4 millions liters per year) of the basins at TA-53.

References

Much of the information presented in this Annual Report come from the RLWTF process control system, RS View, which automatically records temperatures, flow rates, flow totals, pressures, tank levels, and similar readings of process conditions. Another large segment of the information presented in graphs and tables in this Annual Report comes from analytical data results for process control samples. The below list of references points to data sources other than the process control system and process control analytical data that were used in compiling the Annual Report. They are cited within the text of the Annual Report.

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