Table F-5. Historical and 1996 effluent data summary for IRC Laboratories (IFF-603A).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	504	333	177	467	10/10	NA[g]
pH		7.51	7.79	7.49	8.23	10/10	5.5–9.0
Cyanide	µg/L	4.59	2.97	5.00 U[h]	7.22	10/1	1,200
Barium	µg/L	97.02	95.82	70.90	87.30	10/2	100,000[i]
Chromium	µg/L	8.41	5.69	7.50	9.40	10/2	2,770
Copper	µg/L	55.05	25.73	25.00 U	40.30	10/7	3,380
Lead	µg/L	6.90	14.82	3.00 U	55.20	10/2	620
Zinc	µg/L	54.10	23.71	12.80	56.10	10/7	2,610
Trichlorofluoromethane	µg/L	2.43	2.75	5.00 U	5.00	10/1	NA
Methylene Chloride	µg/L	30.38	2.55	1.00 J[j]	7.00	10/1	100
Gross Alpha	pCi/L	2.23 ± 1.34[k]	1.37 ± 0.20	–0.30 ± 1.52 U	2.61 ± 0.82	12/4	15[l]
Gross Beta	pCi/l	4.18 ± 1.86	3.59 ± 0.22	2.03 ± 2.02 U	6.10 ± 2.60	12/7	50[l]

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. City of Idaho Falls Sewer Code Limit, unless otherwise noted.
g. NA = not applicable.
h. U flag indicates that the result was below the detection limit.
i. RCRA TCLP Limit.
j. J flag indicates estimated value.
k. Uncertainties shown are the associated 2 sigma uncertainty.
l. Drinking water DCG.

Table F-6. Historical and 1996 effluent data summary for IRC Complex (IFF-603B).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	360	355	160	562	5/5	NA[g]
pH		7.62	7.74	7.50	7.93	5/5	5.5–9.0
Phenols	µg/L	12.37	6.30	5.00 U[h]	19.80	7/3	500
Copper	µg/L	42.40	34.95	31.10	38.80	2/2	3,380
Lead	µg/L	3.51	4.75	3.40	6.10	2/2	620
Zinc	µg/L	38.79	67.70	23.40	112.00	2/2	2,610
Trichlorofluoromethane	µg/L	2.50 U	2.00	1.00 J[i]	1.00 J	3/1	NA

a. Only parameters detected in 1996 are presented.

b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.

c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.

d. Maximum detectable concentration.

e. Number of samples collected/number of detectable results for 1996

f. City of Idaho Falls Sewer Code Limit.

g. NA = not applicable.

h. U flag indicates that the result was below the detection limit.

i. J flag indicates an estimated value.

Table F-7. Historical and 1996 effluent data summary for Willow Creek Building (IFF-616).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	825	575	283	841	15/15	NA[g]
pH		8.05	8.18	7.75	8.68	15/15	5.5–9.0
Cyanide	µg/L	9.49	4.51	5.00 U[h]	11.60	12/3	1,200
Phenols	µg/L	111	87.94	45.20	127.00	7/7	500
Total Oil and Grease	mg/L	6.40	24.70	14.00	35.40	2/2	100
Total Petroleum Hydrocarbons	mg/L	0.875	0.78	1.00	1.0	2/1	NA
Silver	µg/L	121	24.19	6.60 U	55.30	12/8	450
Barium	µg/L	169	92.99	57.50	58.40	12/2	100,000[i]
Chromium	µg/L	10.66	4.98	5.80 U	6.80	12/1	2770
Copper	µg/L	92.70	84.63	46.60	108.00	12/12	3,380
Lead	µg/L	2.39	8.92	3.00 U	7.30	12/5	620
Zinc	µg/L	123	87.53	45.70	149.00	12/12	2,610
1, 4,-Dichlorobenzene	µg/L	19.45	7.05	5.00 U	36.00	11/2	7,500[i]
Methylene chloride	µg/L	2.78 U	2.50	2.00 U	5.00	11/1	100

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. City of Idaho Falls Sewer Code Limit, unless otherwise specified.
g. NA = not applicable.
h. U flag indicates that the result was below the detection limit.
i. RCRA TCLP Limit.

Table F-8. Historical and 1996 effluent data summary for TAN-655.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Biological Oxygen Demand	mg/L	5.21	2.38	1.00 U[g]	4.00	8/6	NA[h]
Conductivity	µS	545	328	160	550	11/11	NA
pH		7.65	7.89	7.03	9.11	12/12	2.5–12
Chloride	mg/L	72.32	110.33	17.80	457.00	9/9	NA
Chemical Oxygen Demand	mg/L	10.49	5.40	5.00 U	14.10	4/1	NA
Fluoride	mg/L	0.318	0.217	0.190	0.230	9/9	NA
Nitrogen, as Ammonia	mg/L	—[i]	0.250	0.100 U	0.430	7/6	NA
Nitrogen, Nitrate+Nitrite	mg-N/L	6.59	4.17	3.80	4.51	3/3	NA
Nitrogen, as Nitrite	mg-N/L	—	0.103	0.020	0.200	6/6	NA
Nitrogen, as Nitrate	mg-N/L	3.83	4.05	2.00	4.90	6/6	NA
Nitrogen, Total Kjeldahl	mg/L	2.69	0.996	0.160	2.300	9/9	NA
Nitrogen, Total	mg/L	12.9	5.17	4.32	5.88	9/9	20[j]
Total Phosphorous	mg/L	1.28	1.276	0.360	6.30	9/9	NA
Sulfate	mg/L	40.59	75.66	33.00	339.00 J[k]	9/9	NA
TDS	mg/L	380	328	254	410	8/8	NA
TOC	mg/L	15.00	2.38	1.70	2.700	4/4	NA
TSS	mg/L	19.01	44.39	5.00 U	345.00	13/7	100[j]
Arsenic	µg/L	12.10	7.92	4.90	36.40 U	9/1	5,000
Barium	µg/L	115	102.28	98.50	200.00 U	9/2	100,000
Calcium	µg/L	66,960	58,050	51,600	60,800	4/4	NA
Chromium	µg/L	9.19	10.41	5.80 U	16.20	9/6	5000
Iron	µg/L	408	577	134	1,430	9/9	NA
Mercury	µg/L	0.970	0.117	0.100 U	0.400	9/1	200
Magnesium	µg/L	15,184	17,133	14,900	20,000	3/3	NA
Manganese	µg/L	36.70	13.59	5.90	40.00 U	8/3	NA
Sodium	µg/L	41,265	49,379	9,150	168,000	9/9	NA
Lead	µg/L	16.03	7.34	3.00 U	31.00 U	9/5	5,000
Selenium	µg/L	19.54	7.43	3.20	48.70 U	9/1	1,000
Zinc	µg/L	118	72.42	27.20	146.00	5/5	NA
Co-60	pCi/L	—	1.95 ± 0.00[l]	-2.62 ± 5.46 U	5.62 ± 4.68 J	12/1	5,000
Cs-137	pCi/L	4.79 ± 1.62	6.32 ± 1.84	-1.44 ± 6.58 U	15.90 ± 7.64	12/6	3,000
Gross Alpha	pCi/L	2.91 ± 1.33	2.01 ± 0.24	0.49 ± 1.65 U	4.50 ± 1.30	12/6	15[m]
Gross Beta	pCi/L	11.10 ± 1.39	14.71 ± 0.71	6.30 ± 2.70	33.40 ± 5.20	12/11	50[m]

Table F-8. (continued).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
H-3	pCi/L	—	195.18 ± 0.0	-26.10 ± 200.00 U	306.00 ± 156.00	12/3	20,000[m]
Sr-89	pCi/L	0.99 ± 1.10	0.34 ± 0.17	-1.18 ± 1.22 U	0.83 ± 0.48 U	12/2	20,000
Sr-90	pCi/L	3.07 ±0.67	2.06 ± 0.19	0.53 ± 0.27	6.51 ± 1.26	12/8	8.00[m]

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. RCRA TCLP Limit, unless otherwise specified. Radiological guideline limits are DCGs unless otherwise noted.
g. U flag indicates that the result was below the detection limit.
h. NA = not applicable.
i. Insufficient number of detectable values.
j. Wastewater Land Application Permit Limit.
k. J flag indicates an estimated value.
l. Uncertainties shown are the associated 2 sigma uncertainty.
m. Drinking water MCL.

Table F-9. Historical and 1996 effluent data summary for TRA-708.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	21,849	4,898	2,476	7,320	2/2	NA[g]
pH		8.24	9.05	8.63	9.46	2/2	2.5–12
Chloride	mg/L	190	69.73	9.60	185.00	3/3	NA
Chemical Oxygen Demand	mg/L	17.29	4.60	5.00 U[h]	8.80	3/1	NA
Fluoride	mg/L	8.02	0.597	0.120	1.50	3/3	NA
Nitrogen, Nitrate+Nitrite	mg-N/L	6.93	1.00	1.00	1.00	1/1	NA
Nitrogen, as Nitrate	mg-N/L	21.28	9.60	1.40	17.80	2/2	NA
Total Phosphorous	mg/L	0.182	0.143	0.050 U	0.310	3/2	NA
Sulfate	mg/L	17,968	2,860.4	81.20	5,220.0	3/3	NA
TDS	mg/L	21,602	9,977	8,330	11,200	3/3	NA
TSS	mg/L	487	247.23	73.70	420.00	3/3	NA
Arsenic	µg/L	53.72	27.93	10.00 U	100.00 U	3/1	5,000
Calcium	µg/L	438,188	350,667	300,000	386,000	3/3	NA
Chromium	µg/L	70.16	84.03	16.60	214.00	3/3	5,000
Iron	µg/L	5,518	2,143	1,200	2,650	3/3	NA
Mercury	µg/L	6.35	0.207	0.200 U	0.310	3/2	200
Potassium	µg/L	26,217	14,367	12,600	17,100	3/3	NA
Magnesium	µg/L	233,475	132,333	121,000	150,000	3/3	NA
Manganese	µg/L	28.81	29.93	15.40	39.40	3/3	NA
Sodium	µg/L	4,143,388	2,193,333	1,480,000	2,670,000	3/3	NA
Nickel	µg/L	35.20	41.37	40.00 U	84.10	3/1	NA
Zinc	µg/L	36.60	19.63	20.00 U	38.90	3/1	NA
Gross Alpha	pCi/L	45.00 ± 64.00[i]	13.00 ± 2.83	-1.34 ± 10.60	44.00 ± 36.00	6/3	15[j]
Gross Beta	pCi/L	61.00 ± 86.00	23.59 ± 6.62	0.82 ± 18.86	36.00 ± 17.70	6/2	50[j]
H-3	pCi/L	—	24.69 ± 0.00	-129.00 ± 198.60 U	480.00 ± 300.00	6/2	20,000[j]

a. Only parameters detected in 1996 are presented.

b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.

c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.

d. Maximum detectable concentration.

e. Number of samples collected/number of detectable results for 1996.

f. RCRA TCLP Limit, unless otherwise specified. Radiological guideline limits are DCGs unless otherwise noted.

g. NA = not applicable.

h. U flag indicates that the result was below the detection limit.

i. Uncertainties shown are the associated 2 sigma uncertainty.

j. Drinking water MCL.

Table F-10. Historical and 1996 effluent data summary for TRA-764.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Biological Oxygen Demand	mg/L	17.43	10.63	1.00 U[g]	32.00	4/3	NA[h]
Conductivity	µS	998	492	313	822	4/4	NA
pH		7.60	7.46	6.73	8.11	4/4	2.5–12
Chloride	mg/L	23.39	28.35	13.60	37.60J[i]	4/4	NA
Chemical Oxygen Demand	mg/L	8.93	4.70	5.00 U	11.30	4/1	NA
Fluoride	mg/L	0.317	0.318	0.140	0.420	4/4	NA
Nitrogen, Nitrate+Nitrite	mg-N/L	2.19	2.27	1.20	2.90	3/3	NA
Nitrogen, as Nitrate	mg-N/L	2.12	2.80	2.80	2.80	1/1	NA
Total Phosphorous	mg/L	1.10	1.378	0.110	1.900	4/4	NA
TDS	mg/L	517	698	249	850	4/4	NA
TOC	mg/L	5.36	1.088	0.500 U	1.800	4/3	NA
Arsenic	µg/L	17.29	11.05	10.00 U	16.00	4/1	5,000
Barium	µg/L	93.21	106	122	122	4/1	100,000
Calcium	µg/L	71,223	111,725	45,900	138,000	4/4	NA
Chromium	µg/L	12.12	7.35	8.60	10.80	4/2	5,000
Copper	µg/L	21.23	11.80	9.70	9.70	4/1	NA
Iron	µg/L	224	108	78.40 U	293.00	4/1	NA
Potassium	µg/L	7,168	8,268	5,000 U	11,900	4/3	NA
Magnesium	µg/L	26,532	41,175	16,900	52,300	4/4	NA
Manganese	µg/L	6.79	6.33	2.80	2.80	4/1	NA
Sodium	µg/L	13,547	21,213	7,850	26,700	4/4	NA
Zinc	µg/L	33.28	9.85	9.4	9.40	4/1	NA
Trichlorofluoromethane	µg/L	2.25	2.00	1.00 J	2.00 J	4/2	NA
Gross Alpha	pCi/L	1.66 ± 1.31	2.94 ± 0.16[j]	1.20 ± 1.86 U	13.00 ± 2.58	11/6	15[k]

Table F-10. (continued).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Gross Beta	pCi/L	8.17 ± 1.60	8.78 ± 0.65	1.90 ± 1.24	18.10 ± 3.06	11/10	50[k]
Sr-90	pCi/L	—	0.16 ± 0.00	-0.09 ± 0.51 U	0.51 ± 0.41 J	11/1	8.00[k]

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. RCRA TCLP Limit, unless otherwise specified. Radiological guideline limits are DCGs unless otherwise noted.
g. U flag indicates that the result was below the detection limit.
h. NA = not applicable.
i. J flag indicates estimated value.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. Drinking water MCL.

Appendix G

Storm Water Sampling Analyses Results

Table G-1. Historical and 1996 storm water data summary for ICPP Retention Basin (CPP-MP-1) composite samples.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	108.50	100	100	100	1/1	NA[g]
pH		7.27	7.65	7.65	7.65	1/1	6.5–8.5[h]
Biological Oxygen Demand	mg/L	5.42	2.00	2.00	2.00	1/1	NA
Chemical Oxygen Demand	mg/L	38.13	32.80	32.80	32.80	1/1	NA
Nitrogen, as Nitrate	mg-N/L	1.18	3.00	3.00	3.00	1/1	10
Total Phosphorus	mg/L	0.41	1.20	1.20	1.20	1/1	NA
TDS	mg/L	—[i]	189	189	189	1/1	500
Nitrogen, Total Kjeldahl	mg/L	1.83	1.80	1.80	1.80	1/1	NA
TSS	mg/L	340.67	221	221	221	1/1	NA
Barium	µg/L	118.67	354	354	354	1/1	2,000
Chromium	µg/L	14.98	36.90	36.90	36.90	1/1	100
Copper	µg/L	19.48	42.80	42.80	42.80	1/1	1,300
Nickel	µg/L	20.00	41.00	41.00	41.00	1/1	NA
Lead	µg/L	15.58	32.80	32.80	32.80	1/1	15
Zinc	µg/L	526.00	295	295	295	1/1	5,000
Gross Alpha	pCi/L	9.91 ± 9.76[j]	8.00 ± 3.13 J[k]	8.00 ± 1.40 J	8.00 ± 1.40 J	1/1	15

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1994 and 1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996.
f. Drinking Water MCLs and SMCLs unless otherwise specified
g. NA = not applicable.
h. NPDES permit pH limit for coal pile runoff.
i. Insufficient number of detectable values.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. J flag indicates estimated value.

Table G-2. Historical and 1996 storm water summary data for ICPP Retention Basin (CPP-MP-1) grab samples.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	130.50	65.00	60.00	70.00	2/2	NA[g]
pH		7.53	8.02	7.72	8.31	2/2	6.5–8.5[h]
Biological Oxygen Demand	mg/L	5.64	9.50	2.00	17.00	2/2	NA
Chemical Oxygen Demand	mg/L	40.81	40.00	32.00	48.00	2/2	NA
Nitrogen, as Ammonia	mg/L	0.090	0.080	0.100 U[i]	0.110	2/1	NA
Nitrogen, as Nitrate	mg-N/L	1.030	1.520	0.740	2.300	2/2	10
Total Phosphorus	mg/L	0.601	0.760	0.520	1.000	2/2	NA
TDS	mg/L	106.00	155.50	97.00	214.00	2/2	500
Nitrogen, Total Kjeldahl	mg/L	2.816	1.190	0.680	1.700	2/2	NA
TSS	mg/L	278.25	530	165	894	2/2	NA
Barium	µg/L	182.63	325	211	439	2/2	2,000
Chromium	µg/L	17.20	38.00	26.10	49.90	2/2	100
Copper	µg/L	22.81	32.15	25.00 U	51.80	2/1	1,300
Nickel	µg/L	20.00	37.80	40.00 U	55.60	2/1	NA
Lead	µg/L	22.91	26.55	14.40	38.70	2/2	15
Zinc	µg/L	537.60	434	418	450	2/2	5,000
Gross Alpha	pCi/L	7.04 ± 2.96[j]	7.01 ± 1.85	4.70 ± 1.30 J[k]	10.20 ± 1.80 J	2/2	15
Gross Beta	pCi/L	20.67 ± 4.85	20.40 ± 9.26	20.40 ± 3.50 J	20.40 ± 3.50 J	2/1	50

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1994 and 1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996.
f. Drinking water MCLs and SMCLs unless otherwise specified
g. NA = not applicable.
h. NPDES permit pH limit for coal pile runoff.
i. U flag indicates that the result was below the detection limit.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. J flag indicates estimated value.

Table G-3. Historical and 1996 storm water data for ICPP Coal Pile (CPP-MP-2).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	μS	88.75	65.33	50.00	80.00	3/3	NA[g]
pH		7.48	7.59	6.48	8.88	3/3	6.5–8.5 (6–9)[h]
Biological Oxygen Demand	mg/L	3.00	24.67	4.00	65.00	3/3	NA
Chemical Oxygen Demand	mg/L	63.60	192.33	31.00	349.00	3/3	NA
Nitrogen, as Ammonia	mg/L	0.075	0.143	0.120	0.180	3/3	NA
Nitrogen, as Nitrite	mg-N/L	—[i]	0.030	0.030	0.030	2/2	1
Nitrogen, as Nitrate	mg-N/L	—	0.670	0.670	0.670	1/1	10
Nitrogen, Total Kjeldahl	mg/L	1.500	1.097	0.590	1.400	3/3	NA
Total Phosphorus	mg/L	0.160	0.340	0.190	0.560	3/3	NA
TDS	mg/L	63.00	75.67	55.00	106.00	3/3	500
Total Oil & Grease	mg/L	4.75	3.80	5.00 U[j]	6.40	3/1	NA
Total Petroleum Hydrocarbons	mg/L	0.507	0.967	0.990 U	1.900	3/1	NA
TSS	mg/L	107.23	149.30	42.70	318.00	3/3	NA
Chromium	μg/L	5.00	9.03	10.00 U	17.10	3/1	100
Copper	μg/L	12.50	28.47	25.00 U	60.40	3/1	1300
Lead	μg/L	4.97	3.47	3.00 U	7.40	3/1	15
Zinc	μg/L	78.95	71.30	48.80	102.00	3/3	5000
Gross Alpha	pCi/L	5.00 ± 2.00[k]	2.18 ± 0.26	1.39 ± 0.83	3.71 ± 0.97 J[l]	3/3	15
Gross Beta	pCi/L	4.53 ± 0.97	7.62 ± 0.90	5.70 ± 1.20	13.00 ± 2.30 J	3/3	50

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996.
f. Drinking water MCLs and SMCLs unless otherwise specified
g. NA = not applicable.
h. NPDES permit pH limit for coal pile runoff.
i. Insufficient number of detectable values.
j. U flag indicates that the result was below the detection limit.
k. Uncertainties shown are the associated 2 sigma uncertainty.
l. J flag indicates an estimated value.

Table G-4. Historical and 1996 storm water data for RWMC Subsurface Disposal Area (RWMC-MP-2).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	200.75	110	100	120	2/2	NA[g]
pH		7.73	8.97	8.80	9.13	2/2	6.5–8.5
Biological Oxygen Demand (5-day)	mg/L	—[h]	6.50	1.00	12.00	2/2	NA
Chemical Oxygen Demand	mg/L	52.12	111.65	51.30	172.00	2/2	NA
Nitrogen, as Ammonia	mg/L	0.352	0.085	0.100 U[i]	0.120	2/1	NA
Nitrogen, Total Kjeldahl	mg/L	2.26	3.15	1.40	4.90	2/2	NA
Total Phosphorus	mg/L	—	2.540	0.280	4.800	2/2	NA
TDS	mg/L	203.00	425	160	690	2/2	500
TOC	mg/L	12.50	19.85	17.60	22.10	2/2	NA
TSS	mg/L	—	2,417.2	84.40	4,750.0	2/2	NA
Arsenic	µg/L	8.93	14.60	10.00 U	24.20	2/1	50
Barium	µg/L	329.50	980	200 U	1860	2/1	2,000
Cadmium	µg/L	3.12	4.10	5.00 U	5.70	2/1	5
Chromium	µg/L	28.85	60.00	10.00 U	115.00	2/1	100
Copper	µg/L	41.76	65.75	25.00 U	119.00	2/1	1,300
Mercury	µg/L	0.132	0.255	0.200 U	0.410	2/1	2
Magnesium	µg/L	20,003	24,695	6,990	42,400	2/2	NA
Magnesium, Soluble	µg/L	12,176	11,795	6,190	17,400	2/2	NA
Nickel	µg/L	35.84	79.50	40.00 U	139.00	2/1	NA
Lead	µg/L	17.25	44.75	3.00 U	88.00	2/1	15
Vanadium	µg/L	44.48	89.00	50.00 U	153.00	2/1	NA
Zinc	µg/L	208.56	390	121	659	2/2	5,000
Am-241	pCi/L	4.33 ± 0.28[j]	0.87 ± 0.16	0.32 ± 0.08	6.07 ± 0.74	2/2	30
Gross Alpha	pCi/L	—	10.36 ± 0.00	4.70 ± 1.80	33.30 ± 7.30	2/2	15
Gross Beta	pCi/L	—	17.29 ± 0.00	12.20 ± 3.80	30.40 ± 9.80	2/2	50
Pu-239/240	pCi/L	2.35 ± 0.05	0.18 ± 0.04	0.04 ± 0.02	4.22 ± 0.58	2/2	NA
Sr-90	pCi/L	2.49 ± 0.74	0.45 ± 0.66	0.45 ± 0.27	0.45 ± 0.27	2/1	8.00
Th-230	pCi/L	0.75 ± 0.07	0.38 ± 0.23	0.38 ± 0.12	0.38 ± 0.12	2/1	300[k]

Table G-4. (continued).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
U-234	pCi/L	1.07 ± 0.09	0.52 ± 0.37	0.52 ± 0.18	0.52 ± 0.18	2/1	500
U-235	pCi/L	—	0.16 ± 0.00	0.16 ± 0.09	0.16 ± 0.09	2/1	600
U-238	pCi/L	0.82 ± 0.08	0.29 ± 0.25	0.29 ± 0.12	0.29 ± 0.12	2/1	600

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1994–1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration in 1996.
e. Number of samples collected/number of detectable results for 1996.
f. Drinking water MCLs and SMCLs unless otherwise specified.
g. NA = not applicable.
h. Insufficient number of detectable values.
i. U flag indicates that the result was below the detection limit.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. Drinking water MCL.

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DOE

ACRONYMS

ANL–W	Argonne National Laboratory–West
ARA	Auxiliary Reactor Area
ATR	Advanced Test Reactor
BOD	biological oxygen demand
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulation
COD	chemical oxygen demand
CTF	Contained Test Facility
CY	calendar year
DCG	derived concentration guide
DOE	U.S. Department of Energy
DOE–ID	U.S. Department of Energy Idaho Operations Office
DWP	Drinking Water Program
EBR–I	Experimental Breeder Reactor No. I
EFS	Experimental Field Station
EPA	U.S. Environmental Protection Agency
ESP	Environmental Surveillance Program
ESRP	Eastern Snake River Plain
FY	fiscal year
GPRS	global positioning radiometric scanner
ICPP	Idaho Chemical Processing Plant
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Division of Environmental Quality
INEEL	Idaho National Engineering and Environmental Laboratory
IRC	INEEL Research Center
LMITCO	Lockheed Martin Idaho Technologies Company
LOFT	Loss-of-Fluid Test
M&O	management and operations
MAC	maximum allowable concentration
MCL	maximum contaminant level
MWSF	Mixed Waste Storage Facility
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRF	Naval Reactors Facility
OMRE	Organic Moderated Reactor Experiment

PBF	Power Burst Facility
PCB	polychlorinated biphenyls
PM_{10}	particulate matter $\leq 10\,\mu m$
ppb	parts per billion
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RESL	Radiological and Environmental Sciences Laboratory
RESP	Radiological Environmental Surveillance Program
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SDWA	Safe Drinking Water Act
SESP	Site Environmental Surveillance Program
SL-1	Stationary Low-Power Reactor No. 1
SMC	Specific Manufacturing Capability
SMCL	secondary maximum contaminant level
SRMP	Special Request Monitoring Program
SRPA	Snake River Plain Aquifer
STP	sewage treatment plant
SWEPP	Stored Waste Experimental Pilot Plant
TAN	Test Area North
TCE	trichloroethylene
TDS	total dissolved solids
TLD	thermoluminescent dosimetry
TRA	Test Reactor Area
TRU	transuranic
TSA	Transuranic Storage Area
TSF	Technical Support Facility
TSS	Total Suspended Solids
USGS	United States Geological Survey
VANB	Van Buren Boulevard
VOA	volatile organic analysis
VOC	volatile organic compound
WCB	Willow Creek Building
WERF	Waste Experimental Reduction Facility
WLAP	Wastewater Land Application Permit
WMF	waste management facilities
WRRTF	Water Reactor Research Test Facility

1996 LMITCO Environmental Monitoring Program Report for the Idaho National Engineering and Environmental Laboratory

1. INTRODUCTION

This report summarizes the monitoring results and activities of the Lockheed Martin Idaho Technologies Company (LMITCO) Environmental Monitoring Program at the Idaho National Engineering and Environmental Laboratory (INEEL) for calendar year (CY) 1996. The main purpose of the Environmental Monitoring Program is to monitor effluents and environmental media to assess the impact of INEEL operations on the environment and to protect public health.

1.1 History of the Monitoring Program

The INEEL is owned by the U.S. Department of Energy (DOE), and various management and operations (M&O) contractors have operated at the Site over the years; LMITCO is the current M&O contractor. The DOE established the INEEL as the National Reactor Testing Station in 1949 to conduct research and further the development of peaceful uses of atomic energy. The name changed in 1974 to the Idaho National Engineering Laboratory to include a broader scope of engineering support activities for DOE. In response to the increased role the laboratory currently plays in the environmental cleanup of the DOE complex, the current name was adopted in 1997.

Early monitoring activities focused on pathways along which radioactive contaminants from Site operations could be released and where exposure to the general public in southeast Idaho could occur.[1] The United States Geological Survey (USGS) has been involved in environmental surveillance at the INEEL from the very beginning by monitoring groundwater quality in the Snake River Plain Aquifer (SRPA). Because the INEEL was heavily involved in testing nuclear facilities, radionuclides were the major contaminants of concern. Facility operators conducted some sampling of liquid effluents for the purpose of developing waste inventory information. As the INEEL environmental monitoring program developed from 1950 to 1994, the M&O contractor conducted monitoring related to facility operations, and the DOE Radiological and Environmental Sciences Laboratory (RESL), or other government agencies such as the USGS conducted onsite and offsite environmental surveillance.

Facility-oriented monitoring was initiated during the early 1970s to evaluate facilities as sources of contamination to the environment. Ambient air surveillance at the Radioactive Waste Management Complex (RWMC) began in 1972, and monitoring of surface waters began in 1973.[1] These early activities were designed primarily to meet operational monitoring objectives rather than environmental surveillance objectives, and monitors were located in predominant release paths from disposal activities.

In 1984, an agreement between DOE and the U.S. Environmental Protection Agency (EPA) mandated the establishment of nonradiological environmental monitoring at DOE facilities to ensure compliance with applicable Federal, State, and local regulations, and to ensure the protection of human health and the environment. The INEEL M&O contractor instituted monitoring of nonradiological liquid effluent in 1986.

In 1988, in response to a U.S. Department of Energy Idaho Operations Office (DOE-ID) request, a centralized Drinking Water Program (DWP) was established. Prior to this, individual facilities were monitored separately. In September 1992, DOE submitted a Notice of Intent to the EPA to obtain coverage of the INEEL for the *Final National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Associated with Industrial Activity*[2] for storm water discharges. A storm water monitoring plan was implemented in 1993 in compliance with the conditions of the permit. The groundwater has been monitored since 1950, and in 1993, DOE formalized an INEEL Groundwater Monitoring Program.

Radiological monitoring of selected effluent streams was added to the Liquid Effluent Monitoring Program in 1992. During 1994, the INEEL obtained its first Wastewater Land Application Permit (WLAP) from the State of Idaho. Additional permit applications have been submitted to cover liquid waste disposal to infiltration ponds and other surface disposal sites. These permits require liquid effluent and groundwater monitoring at the ponds. Monitoring for compliance with permit conditions has been added to the Liquid Effluent Monitoring Program and the Groundwater Monitoring Program.

In 1994, the onsite portion of the INEEL Environmental Surveillance Program (ESP) was transferred from DOE to the INEEL M&O contractor. The offsite environmental surveillance program was transferred from DOE to the Environmental Science and Research Foundation.

1.2 Scope

The Environmental Monitoring Program is responsible for conducting environmental surveillance, compliance monitoring, and special request sampling at the INEEL to comply with DOE orders and Federal and state regulations and permits. Figure 1-1 illustrates the scope of the media sampled by the LMITCO Environmental Monitoring Program. Program responsibilities include programmatically supported environmental surveillance of ambient air, direct radiation, surface water, and biota at waste management facilities (WMF) and outside of facility fences. Compliance monitoring is conducted for drinking water, storm water, groundwater, and liquid effluents at all LMITCO facilities. Special request sampling in support of waste stream characterization is performed to ensure proper disposal of wastes and to support other programs, as needed.

Two facilities report to organizations outside the DOE-ID project office and have separate environmental monitoring programs. These facilities are Argonne National Laboratory-West (ANL-W), which reports to the DOE Chicago Operations Office, and the Naval Reactors Facility (NRF), which reports to the DOE Pittsburgh Naval Reactors Office. The LMITCO Environmental Monitoring Program is not responsible for monitoring within ANL-W and NRF facilities; however, the program cooperates with those facilities, and some program information is included in this report.

1.3 Program Organization

DOE Order 5400.1, "General Environmental Protection Program,"[3] divides environmental monitoring into two activities: environmental surveillance and effluent monitoring. Environmental surveillance is oriented to pathways in the environment along which contaminants could move or accumulate. Effluent monitoring is oriented towards release points at facilities and the wastes that facilities generate—liquid, solid, and gaseous. DOE further defines these two activities:

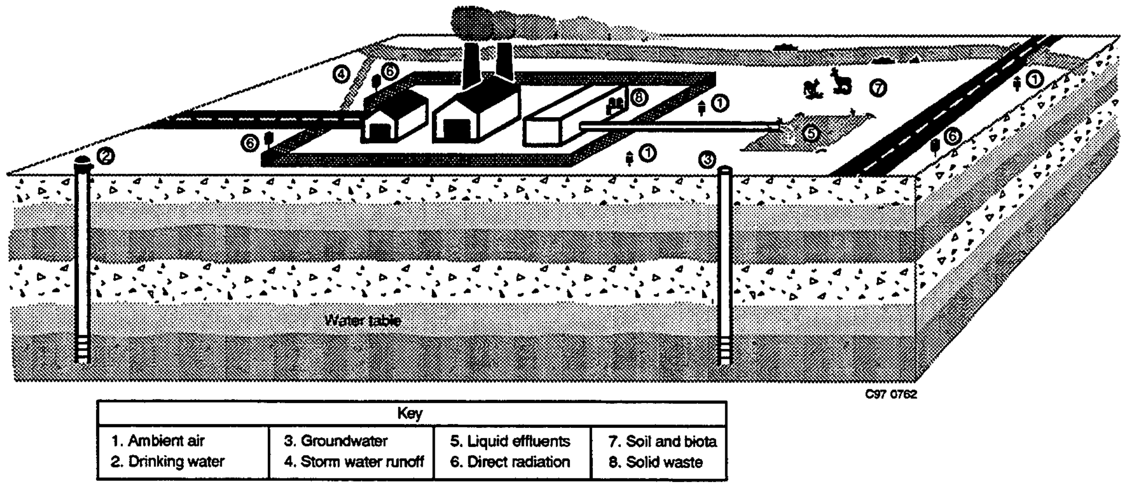


Figure 1-1. Environmental Monitoring media sampled (C970762).

Environmental surveillance involves the collection and analysis of samples or direct measurements of air, water, soil, foodstuff, biota, and other media from DOE sites and their environments for the purpose of determining compliance with applicable standards and permit requirements, assessing radiation exposures of members of the public and assessing the affects, if any, on the local environment.

Effluent monitoring involves the collection and analysis of samples or measurements of liquid and gaseous effluents for the purpose of characterizing and quantifying contaminants, assessing radiation exposures to members of the public, providing a means to control effluent at or near the point of discharge, and demonstrating compliance with applicable standards and permit requirements.

1.3.1 Environmental Surveillance

There are two environmental surveillance programs operated by the LMITCO Environmental Monitoring Program. The Radiological Environmental Surveillance Program (RESP) monitors soils, ambient air, direct radiation, biota, and surface water for impacts from facility operations. The Site Environmental Surveillance Program (SESP) monitors ambient air quality, soils, and direct radiation outside facility boundaries, within the borders of the INEEL.

1.3.2 Compliance Monitoring

Compliance monitoring activities include four separate programs: Drinking Water, Liquid Effluent Monitoring, Groundwater Monitoring, and Storm Water Monitoring Programs. These four compliance monitoring programs comprise the effluent monitoring activities for the INEEL.

The definition of a public water system is a system that provides piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily for at least 60 days out of the year. Since the water systems at the INEEL are classified as public water systems, the DWP monitors potable water supplied to INEEL facilities to ensure compliance with the Safe Drinking Water Act (SDWA).[4]

The Liquid Effluent Monitoring Program monitors process wastewaters and sanitary sewage discharged from INEEL facilities. At the INEEL, most of these liquid effluents are discharged to infiltration ponds that have been or will be permitted by the state of Idaho under the Wastewater Land Application permitting process. LMITCO has also obtained permits from the City of Idaho Falls to discharge from INEEL facilities in Idaho Falls to the City sewer system. Monitoring requirements are specified in the permits. The Liquid Effluent Monitoring Program also monitors for other parameters to ensure that discharges to infiltration ponds do not exceed hazardous waste limits or adversely impact the environment.

The Groundwater Monitoring Program monitors groundwater in perched water zones and in the SRPA. Some monitoring is required by WLAPs to demonstrate that wastewater disposal does not degrade groundwater quality. Other monitoring is conducted as a surveillance activity to look for trends in groundwater quality that could indicate releases to the groundwater from facilities.

The Storm Water Monitoring Program monitors runoff from industrial facilities at the INEEL. The program operates in compliance with the NPDES General Permit.[2]

Individual facilities are responsible for monitoring stacks and other emissions to the atmosphere. This information can be found in the *National Emission Standards for Hazardous Air Pollutants (NESHAP) Annual Report*[5] and the *Air Emissions Inventory Report.*[6]

1.3.3 Special Request Monitoring Program

The Special Request Monitoring Program (SRMP) provides on-call support to facilities and programs, including characterizing unknown materials and supporting waste disposal decisions.

1.4 Program Objectives

DOE Order 5400.1 is the primary DOE order governing environmental monitoring activities. Two other DOE orders are directly applicable to the program. DOE Order 5400.5, "Radiation Protection of the Public and the Environment,"[7] specifically addresses monitoring for radionuclides, and DOE Order 5820.2A, "Radioactive Waste Management,"[8] describes monitoring activities to be conducted at waste management facilities. The objectives in DOE Orders 5400.5 and 5820.2A are subsets of the overall objectives in DOE Order 5400.1. DOE orders provide the objectives of environmental monitoring, but do not provide the details on how objectives are to be met. Additional guidance is provided in the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance.*[9] This section also describes how the Environmental Monitoring Program meets the DOE order objectives.

1.4.1 Environmental Monitoring Objectives

Environmental monitoring is conducted to satisfy the following program objectives:

- Verify and support compliance with applicable Federal, State, and local environmental laws, regulations, and orders

- Establish baselines and characterize trends in the physical, chemical, and biological condition of effluent and environmental media
- Identify potential environmental problems and evaluate the need for remedial actions or mitigative measures
- Detect, characterize, and report unplanned releases
- Evaluate the effectiveness of effluent treatment and control and pollution abatement programs
- Determine compliance with commitments made in Environmental Impact Statements, Environmental Assessments, Safety Analysis Reports, or other official DOE documents.

1.4.2 Approach to Meeting Objectives

DOE orders provide objectives for environmental monitoring programs and some guidance on implementation. The general approach to meeting the DOE order objectives is to:

- Review proposed and implemented rules and regulations to determine requirements
- Develop a baseline for effluents and environmental media from historical monitoring data
- Compare monitoring data from effluents and environmental media to historical data to monitor trends and changes that may indicate loss of process control, unplanned releases, or loss of effectiveness of pollution abatement programs
- Obtain permits where regulations require permits for effluents
- Monitor according to effluent permit requirements in terms of parameters, frequency, and methods
- Develop voluntary release criteria or alert levels, where permit criteria are not provided, to define levels of compounds that can be released to the environment or be present in environmental media without creating environmental problems or incurring future remediation liability
- Compare current monitoring data to release criteria in permits and to other criteria that have been adopted by the program
- Identify concerns to facility operations and support operations managers to resolve issues.

2. QUALITY ASSURANCE/QUALITY CONTROL

The Quality Assurance (QA) Program ensures that the sampling methods produce representative samples of the media being monitored, confirms that laboratory analyses are reliable, and verifies that the quality of reported results is suitable to support decisions based on the monitoring data. Quality control (QC) samples are used to measure and document the uncertainty in analytical data.

2.1 Quality Assurance Program

A written QA Program is prepared for all of the Environmental Monitoring programs. Generating quality data begins with preparing written program plans to document responsibilities and requirements for collecting, analyzing, and processing samples. Program design criteria, decision criteria, and implementing procedures are documented in program plans and procedural manuals.

Qualifications for monitoring personnel are documented in the written plans. Sampling personnel are trained on the plans and in the field to ensure that field team members know and follow standard procedures for data collection. The written quality program includes processes by which the data and the program are monitored for acceptable performance. When deviations from acceptable performance are noted, corrective action is taken; appropriate corrective actions are included in the written program plans. Corrective actions include identifying the cause of the problem and the steps needed to prevent recurrence. Careful documentation is prepared for all samples collected by the program. Bound field log books are used to record activities during sample collection. Chain of custody forms are used to document the control of the samples from the time of collection until the laboratory has completed the analyses. Documentation of analytical results is reviewed and marked with flags to indicate the quality of data. Data qualifier flags are used to communicate the usability of the analytical data. The trail of documentation for monitoring samples is maintained in Environmental Monitoring Program files as records.

Written procedures are prepared, reviewed, and used in the data collection and analysis process. Sampling procedures are prepared following accepted methods published by EPA and DOE. For radionuclides, guidance presented in *The Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*[9] have been implemented, when applicable. Procedures are reviewed, and once approved, they are controlled to ensure that any revisions go through the same review and approval process as the original. During the laboratory procurement process, laboratory analytical procedures are reviewed, against the requirements of the EPA, State of Idaho, or DOE to ensure that analytical results will conform to regulatory requirements and standards of good practice.

Monitoring programs are developed to collect data from effluents and environmental media that will support decisions to meet objectives discussed in Section 1.4. Monitoring program design starts with the decisions to be made with the data, and then determines the location and frequency of sampling to obtain the data to support the decisions. Monitoring program design is also documented in internal written program plans and procedures.

Sampling supplies and laboratory services for analyses obtained from suppliers are procured only after vendor requirements have been carefully developed, and vendors are screened to ensure that supplied materials and services meet program requirements. Laboratories are audited by a team of experienced professionals and quality engineers to ensure that the laboratory has a QA program sufficient to provide analytical data suitable to support the program. Materials purchased by the program are inspected on receipt to ensure that procurement requirements have been met.

Analytical data obtained by the monitoring programs are validated upon receipt from the laboratory. Data validation ensures that method-specified QA steps were followed and that QA criteria were met. Data are marked with qualifier flags based on this validation. Data users can readily determine the usability of the data from the qualifier flags. Auditable records of analyses results or reports are maintained in accordance with the requirements of DOE 5700.6C.[10]

The monitoring programs are periodically assessed for performance by LMITCO management and by external organizations. Management self-assessments are performed by Environmental Monitoring staff to evaluate the programs for conformance to requirements. A self-assessment generally consists of an internal review of the sampling, shipping, and decontamination procedures used. An assessor accompanies the sampling team to the field and observes sample collection, preservation, shipping, and equipment decontamination. Any deviation from the technical procedure requirements are noted and corrected, and suggestions for process improvement are made and implemented. QC data are reviewed to determine if data meet acceptable levels of uncertainty upon which to base decisions.

Periodic external reviews are performed to determine if the program is acquiring data of suitable quality. QA audits are performed occasionally to determine if the program is following the documented program. There are also periodic technical reviews to assess the technical basis of the program. These reviews are much more intensive and review the design basis of the program, the adequacy of procedures, and other technical elements.

2.2 Quality Control Program

The QC Program consists of submitting samples to the laboratory to measure the amount of uncertainty in analytical data. Results of QC samples are reviewed as part of the program self-assessment to determine if the monitoring data are meeting program goals for uncertainty. The appropriateness of different types of QC samples to different media and the acceptable tolerance levels varies depending on the media and program. Specific QC samples, frequency, and tolerance levels are documented in program-specific plans.

Blank samples of the media to be analyzed are submitted to the laboratory to determine the potential for bias in analytical results. Examples of this are distilled water submitted for water samples, unexposed dosimeters submitted for direct radiation, and unused filters submitted for air samples. The blanks are used to determine if any sample contamination is picked up during field handling, shipping, sample preparation, or other sample handling process. Contamination can give a positive bias to the sample results.

Field replicate or duplicate samples are collected to determine accuracy of monitoring data. Duplicate samples are collected by co-locating samples or splitting sample media into two containers. Replicate samples are analyzed for the same set of elements or compounds. The relative percent difference is calculated for each element or compound and compared to tolerance criteria established in each program plan. Exceeding tolerance criteria can be an indication that an unacceptable level of uncertainty is introduced by sample collection, processing, or analysis.

Known standards are submitted blind to the laboratory to measure bias and accuracy of laboratory analysis. Standards are purchased from commercial suppliers, prepared in INEEL laboratories, or obtained from national laboratory comparison programs. LMITCO laboratories participate in the DOE Environmental Measurements Laboratory QA Program, the EPA Environmental Measurements Systems Laboratory QA Program, and several INEEL customer QA programs. Normal sample numbering, labeling, and containers are used for the known standards; so, there is no indication to the laboratory that the sample is a QC sample. The percent recovery is calculated for each parameter and compared to media-specific tolerance criteria given in program plans.

Whenever analyses for volatile organics are requested, a "trip blank" is included with the shipment. The trip blank consists of a sample of de-ionized water which is analyzed along with the effluent sample. The analyses of the trip blank provides information as to whether or not a volatile organic analysis (VOA) sample may have become contaminated during shipping and handling.

3. SITE OVERVIEW

The INEEL is located in southeastern Idaho, roughly equidistant from Salt Lake City, Utah (351 km, 211 mi); Butte, Montana (357 km, 214 mi); and Boise, Idaho (428 km; 257 mi). Fourteen Idaho counties are located in part or entirely within 80 km (50 mi) of the INEEL (Figure 3-1). The INEEL includes portions of five counties (Bingham, Bonneville, Butte, Clark, and Jefferson).

3.1 Demographics

The largest population centers near the INEEL are to the southeast and east along the Snake River and Interstate Highway 15. The largest communities in closest proximity to the INEEL boundaries include Idaho Falls (43,929 persons in 1990), which is about 35 km (22 mi) east of the nearest Site boundary; Blackfoot (9,646 persons in 1990), about 37 km (23 mi) southeast of the nearest Site boundary; Pocatello (46,080 persons in 1990), about 60 km (37 mi) south-southeast of the nearest Site boundary; and Arco (1,016 persons in 1990), about 11 km (7 mi) west of the nearest Site boundary. Atomic City (25 persons in 1990), which is within about 0.8 km (0.5 mi) of the southern boundary of the INEEL, is the closest town.

3.2 Regional Physical Setting

3.2.1 Physiography

The INEEL is located in the north-central part of the Eastern Snake River Plain (ESRP). The ESRP is the eastern segment of the Snake River Plain and extends from the Hagerman-Twin Falls area northeast toward the Yellowstone Plateau. The ESRP is bounded on the northwest and southeast by the north-to northwest-trending, fault-block mountains of the Basin and Range physiographic province. The southern extremities of the Lost River, Lemhi, and the Bitterroot Ranges extend to the western and northwestern borders of the INEEL. At the base of the mountain ranges, the average elevation is about 1,524 m (5,000 ft) above mean sea level. Individual mountains immediately adjacent to the plain rise to elevations of 3,300 m (10,830 ft) above mean sea level.

The surface of the ESRP is rolling-to-broken and is underlaid by basalt with a thin, discontinuous covering of surficial sediment. Hundreds of extinct volcanic craters and cones are scattered across the surface of the plain. Craters of the Moon National Monument, Big Southern Butte, Twin Buttes, and many small volcanic cones are aligned generally along a broad volcanic ridge trending northeastward from Craters of the Moon toward the Mud Lake basin. Between this ridge and the northern edge of the plain lies a lower area from which no exterior drainage exists. The INEEL occupies a substantial part of this closed topographic basin.

The INEEL measures approximately 63 km (39 mi) long in a north-south direction and 58 km (36 mi) wide at its widest point. The INEEL is approximately 2,307 km^2 (890 mi^2). The topography of the INEEL, like that of the entire Snake River Plain, is rolling-to-broken. The lowest area on the INEEL is the Big Lost River Sinks at an elevation of 1,455 m (4,774 ft) above mean sea level. The highest elevations occur at East Butte, 2,003 m (6,572 ft) above mean sea level, and Middle Butte, 1,948 m (6,391 ft) above mean sea level.

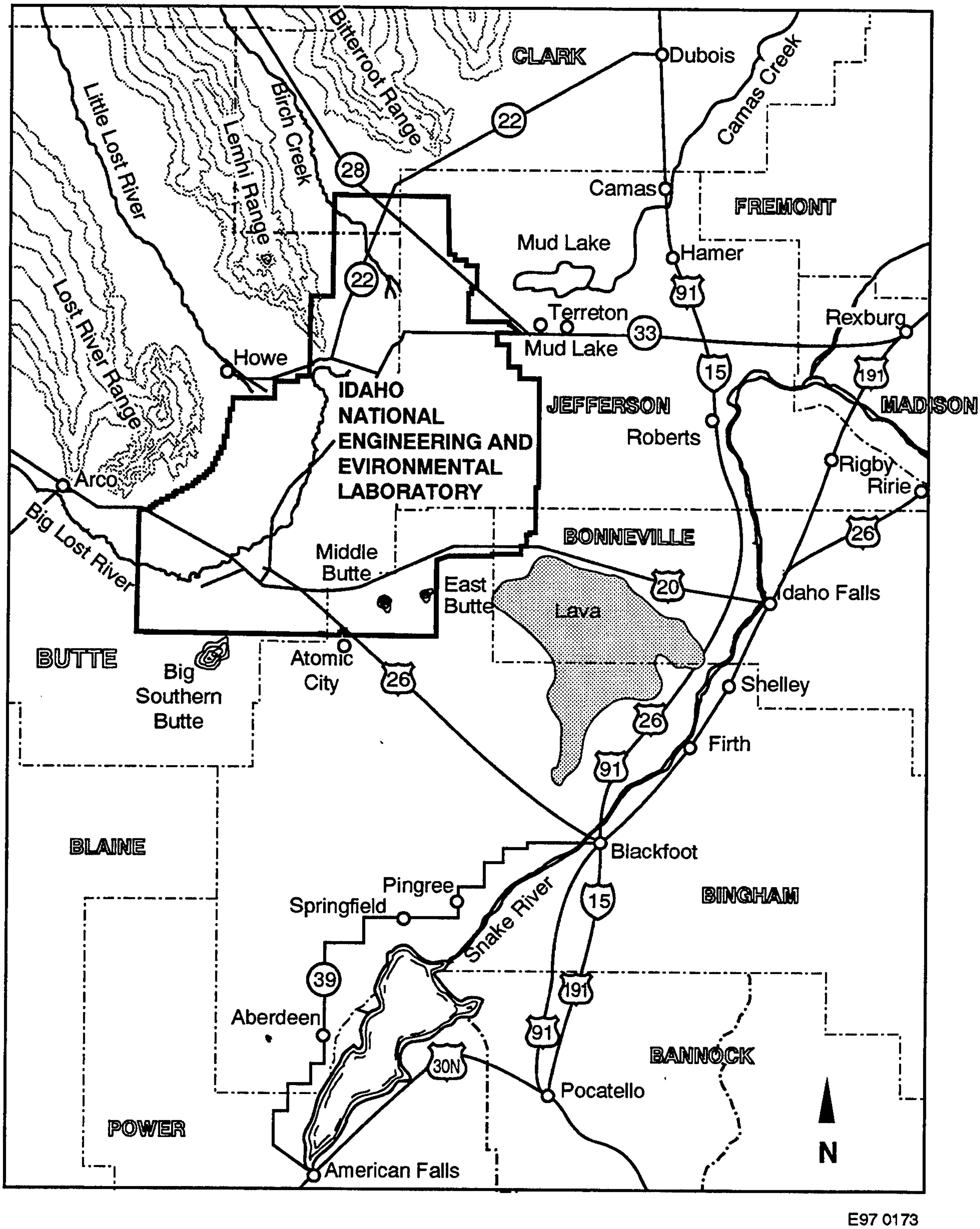


Figure 3-1. Map of INEEL vicinity showing counties and cities (E970173).

3.2.2 Climatology

Physiography is important to the climatology of the INEEL. The mountains lying west and north of the INEEL deflect moisture-laden air masses upward creating an arid to semi-arid climate on the downwind side of the mountains. The climate is characteristically warm and dry in the summer and cold in the winter. The relatively dry air and infrequent low clouds permit intense solar heating of the surface during the day and rapid cooling at night. The northeast-southwest orientation of the ESRP and the bordering mountain ranges tends to channel the west winds that prevail regionally so that a southwest wind predominates over much of the INEEL. The second most frequent wind direction is from the northeast.

Meteorological data have been collected at over 45 locations on and near the INEEL since 1949. Thirty stations are currently operating. The following climatological data came from a National Oceanic and Atmospheric Administration report by Clawson et al.[11]

Average annual precipitation amounts at the Central Facilities Area (CFA) and Test Area North (TAN) are 22.12 cm (8.71 in.) and 19.94 cm (7.85 in.), respectively. Thunderstorms cause a pronounced precipitation peak in May and June at both CFA and TAN, with an average of 3.1 cm (1.2 in.) at CFA and 3.3 cm (1.3 in.) at TAN for each of these months. Snowfall is a substantial contributor to total annual precipitation. Snowfall and snow depth records are available only for CFA. The annual average snowfall is 70.1 cm (27.6 in.), and the water content of melted snow probably contributes between one-quarter and one-third of average annual precipitation.

Surface air temperatures during 1996 at the INEEL were measured at an extreme low of −1°C (31°F) on February 3, and an extreme high of 37°C (99°F) on August 11. The 30-year normalized average daily air temperature at TAN ranges from −11°C (13°F) during mid-January to 21°C (70°F) during the latter half of July.

The average annual temperature at the Site exhibits a gradual seven-month increase beginning with the first week in January and continuing through the third week in July. The temperature then decreases over the course of five months until the minimum average temperature is again reached in January. A winter thaw has occurred on a number of years in late January. This thaw often has been followed by more cold weather until the spring thaw.

Wind speed and direction (always recorded as the direction from which the wind is blowing) have been continuously monitored at many stations on and surrounding the INEEL since 1950.[11] The orientation of the bordering mountain ranges and the general northeast trend of the ESRP exert a strong influence on wind direction. Eastern Idaho lies in a region of prevailing westerly winds. Channeling of these winds within the ESRP usually produces a west-southwest or southwest wind at most locations on the INEEL. The highest and lowest average wind speeds at CFA occur in April [15.0 km/hr (9.3 mph)] and December [8.2 km/hr (5.1 mph)], respectively.

Local topographic features at TAN result in a greater diversity of wind directions there than elsewhere on the INEEL. At the mouth of Birch Creek, the northwest to southeast orientation of the Birch Creek valley occasionally channels strong north-northwest winds into the TAN area. At TAN, average wind speeds are highest in April [15.3 km/hr (9.5 mph)] and lowest in December [7.4 km/hr (4.6 mph)]. Several wind directions are associated with the highest hourly wind speeds. Like the rest of the INEEL, TAN usually experiences the highest hourly wind speeds in association with west-southwest or southwesterly winds. However, strong winds also blow from the northwest and north-northwest.

3.3 Geology

The INEEL is located on the ESRP, a broad northeast trending structural depression that has been filled with silicic and basaltic volcanic rocks and interlayered sedimentary materials. Basalt vents of the ESRP form linear arrays of fissure flows, small shields, cones, pit craters, and open cracks. These features define volcanic rift zones where eruptive activity has been concentrated.[12] Individual basalt flows typically range from 3 to 75 m (10 to 250 ft) in thickness.[13,14] Sedimentary interbeds represent quiescent periods between volcanic episodes when the surface was covered by accumulations of windblown, alluvial, and lake bed sediments. The cumulative thickness of basalt lava flows and interflow sediments beneath the INEEL may vary from as little as 120 m (400 ft) to 760 m (2,500 ft) or more.[15]

3.4 Hydrology

3.4.1 Surface Water Hydrology

Three surface drainages terminate within the INEEL. The Big Lost River, Little Lost River, and Birch Creek drain mountain watersheds located to the north and west of the Site (Figure 3-1). For more than 100 years, flows from the Little Lost River and Birch Creek have been diverted for irrigation or have been lost to the subsurface because of high infiltration rates along the channel bed leading to the INEEL. More recently, Birch Creek has been diverted for hydropower purposes and terminates at a playa near the north end of the Site. The Little Lost River terminates at a playa just north of the central northwestern boundary of the INEEL. Surface water from the Birch Creek and Little Lost River watersheds has negligible impact on the INEEL except during infrequent high-runoff events caused by rapid snow melt and heavy precipitation.

The Big Lost River, the major surface water feature on the INEEL, drains more than 3,600 km^2 (1,400 mi^2) of mountainous area that includes parts of the Lost River and the Pioneer Ranges west of the INEEL. The river flows onto the INEEL near the southwestern corner, bends to the northeast, and flows northeastward to the Big Lost River playas.[16]

In addition to runoff from the Big Lost River, local precipitation and surface runoff occasionally affect the INEEL. INEEL facilities, such as the RWMC, experienced flooding in 1962, 1969, and 1982 caused by local basin runoff.[1] These events were caused by rapid snow melt combined with heavy rains and often compounded by frozen-soil conditions.

During the 1996 water year (October 1995–September 1996), the primary period of flow in the Big Lost River was March through June. Water flowed through the diversion near RWMC every month except August for a total volume of 4,070 ha-m (33,000 acre-ft). During peak flows in June, approximately 370 and 123 ha-m (3,000 and 1,000 acre-ft) of water flowed into Spreading Area A and Spreading Area B, respectively. Approximately 3,210 ha-m (26,000 acre-ft) flowed under the bridge on Lincoln Boulevard near Idaho Chemical Processing Plant (ICPP). Approximately 2,470 ha-m (20,000 acre-ft) of water flowed into the Big Lost River Sinks north of NRF. Water in Birch Creek flowed onto the INEEL and into the TAN borrow pit in April.

3.4.2 Groundwater Hydrology

The SRPA, a vast groundwater reservoir that may contain more than 1,200 km^3 (1 billion acre-ft) of water, lies under the ESRP.[17] The flow of groundwater in the aquifer is chiefly to the south-southwest at velocities that range from 1.5 to 6 m/day (5 to 20 ft/day).[18] Basaltic lava flows and interbedded sedimentary deposits are the main rock units that make up the aquifer. Water is contained in and moves through intercrystalline and intergranualar pores, fractures, cavities, interstitial voids, interflow zones, and lava tubes. Openings in the rock units and their degree of interconnection complicate the movement of groundwater in the aquifer.

Groundwater inflow to the aquifer at the INEEL consists mainly of underflow from the northeastern part of the plain and from drainages on the west and north.[18] Most of the groundwater is recharged in the uplands to the northeast, moves southwestward through the aquifer, and is discharged to springs along the Snake River near Hagerman. Lesser amounts of water are derived from local precipitation on the plain.[16] Part of the precipitation evaporates, but part infiltrates into the ground surface and percolates downward to the aquifer. At the INEEL, significant recharge is derived from the intermittent flows of the Big Lost River.

3.5 Facility Descriptions

There are nine primary facility areas at the INEEL (Figure 3-2) and a number of smaller facilities scattered around the Site. There are also administrative, scientific support, and non-nuclear research laboratories in Idaho Falls, Idaho. The LMITCO Environmental Monitoring Program conducts monitoring at eight of the nine Site facilities, at onsite INEEL areas outside facility boundaries, and at Idaho Falls facilities. The Environmental Monitoring Program does not monitor at the NRF because they have their own monitoring personnel. See Appendix A for specific facility maps and monitoring locations.

3.5.1 Argonne National Laboratory-West

The ANL-W conducts their own environmental surveillance and compliance monitoring, except for storm water monitoring, which is conducted as part of the Environmental Monitoring Program. ANL-W administratively controls an area of approximately 360 ha (890 acres) in the southeastern corner of the INEEL, while the facilities themselves cover less than 24 ha (60 acres). Research is typically focused on areas of national concern including those relating to energy, nuclear safety, spent nuclear fuel, proliferation, and decommissioning and dismantlement technologies. A number of major facilities at the present ANL-W site are used in research activities.

Radioactive liquid wastes are evaporated and solidified at ANL-W. Process wastewater is discharged to an infiltration pond, and sanitary sewage is discharged to a lined evaporation pond.

3.5.2 Auxiliary Reactor Area

The Auxiliary Reactor Area (ARA), formerly referred to as the Army Reactor Area, is located in the south-central portion of the INEEL. ARA was built to develop a compact power reactor for use as a power source at remote military bases. The ARA is made up of four facility areas: ARA-I, -II, -III, and -IV. In addition, the Stationary Low-Power Reactor No. 1 (SL-1) burial ground is located at ARA. The burial ground contains debris produced by a nuclear excursion and steam explosion, which took place at the SL-1 reactor during maintenance operations on January 3, 1961. ARA facilities occupy less than 16 ha (40 acres).

Activities associated with the ARA program occurred from 1957 through 1965. Use of the ARA facilities has been minimal since the Army reactor program was phased out in 1965, and essentially no activities have been undertaken there since 1988. The ARA facilities are currently being decontaminated and dismantled. The SL-1 burial ground was capped and fenced in 1996.

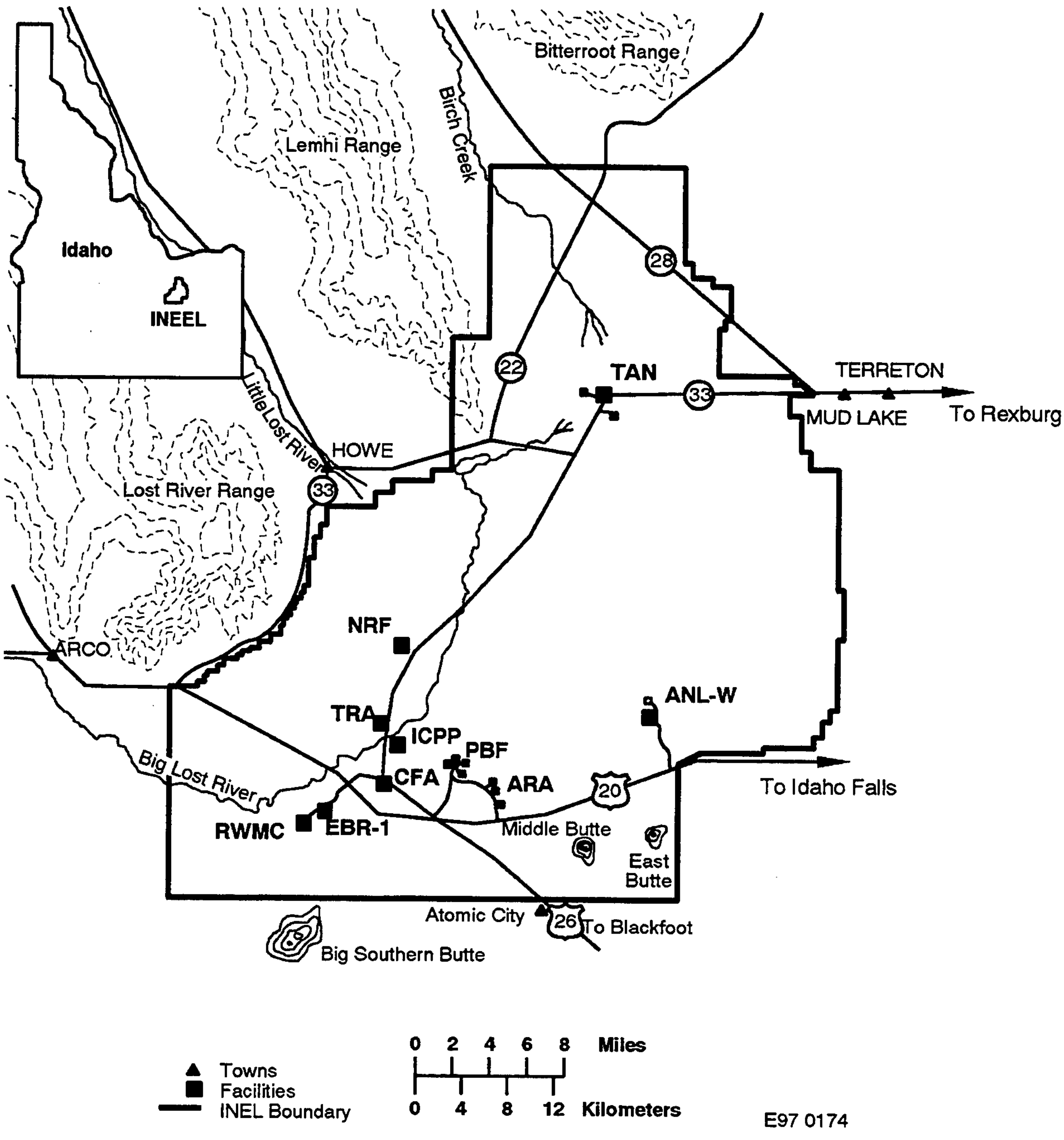


Figure 3-2. Map of the INEEL showing primary and secondary facilities (E970174).

3.5.3 Central Facilities Area

The CFA is located in the south-central part of the Site. The facilities provide four major types of functional space: craft, office, services, and laboratory, and many Site-wide services are located at CFA. These services include environmental monitoring, equipment calibration, security, fire protection, medical, communication systems, warehouses, cafeteria, vehicle and equipment pools, and transportation. Other services include providing clearance badges and visitor passes at the Main Gate and providing training for security and law enforcement agencies at the Gun Range.

The principle emission sources at CFA consist of solid waste landfills, fleet maintenance, and sanitary sewage. Process wastewaters from laboratories, print shop, medical facilities, and equipment repair shops are all routed to the sanitary sewage system. There are three inactive solid waste landfills north of CFA that were closed and capped in 1996 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). There are two active solid waste landfills north of CFA: one receives office and cafeteria waste; the other receives asbestos wastes. The CFA sewage treatment plant (STP) consists of three lined ponds where biological treatment of the wastewater takes place. The effluent is then spray irrigated onto the land surface.

3.5.4 Idaho Chemical Processing Plant

The ICPP is located on approximately 81 ha (200 acres) in the south-central part of the Site. ICPP houses one-of-a-kind reprocessing facilities for government-owned defense and research spent nuclear fuels. Since operations began in 1953, the facility has recovered more than $1 billion worth of uranium-235. The reprocessing mission was discontinued in 1992. Facilities at ICPP include spent fuel storage and reprocessing areas, high-level liquid waste storage tanks, a waste solidification facility and related waste storage bins, remote analytical laboratories, and a coal-fired steam generating plant.

Facility operations involve storage and handling radioactive and hazardous materials, including acids, bases, and petroleum products. Gaseous radionuclides and nitrous oxides are released to the atmosphere through the stack, and process wastewater and sanitary sewage wastes are discharged to percolation ponds and rapid infiltration trenches, respectively.

3.5.5 Naval Reactors Facility

The NRF is located in the central part of the Site and is operated by Westinghouse Electric Company through the DOE Naval Reactors Idaho Branch Office. Its primary function is examination of spent reactor fuel from Navy reactors. Section 9.g of DOE Order 5400.1 exempts the Naval Nuclear Propulsion Program at NRF from the provisions of the Order. The Naval Nuclear Propulsion Program separately maintains an environmental protection program for compliance with applicable environmental laws and regulations. Monitoring data and information specific to NRF are provided in a separate annual environmental report issued by NRF; however, some onsite environmental surveillance data from NRF are included in this report.

3.5.6 Power Burst Facility

The Power Burst Facility (PBF) is located in the south-central portion of the INEEL. It was initially constructed to test reactor transient behavior and to study safety of light-water-moderated enriched fuel systems. The PBF reactor has been in standby mode since 1975. In 1984 and 1985, four of the five reactors were removed, and the facilities were radiologically decommissioned and dismantled. The facilities are now used by Waste Management Operations for waste treatment and storage.

The Waste Experimental Reduction Facility (WERF) is used to incinerate low-level and mixed radioactive waste, and the Waste Reduction Operations Complex is used for storage and recovery of low-level and mixed radioactive waste. The Mixed Waste Storage Facility (MWSF) is used to store mixed radioactive and hazardous waste for which treatment technologies do not yet exist. There are no liquid process wastes generated by the facility. Sanitary wastes are discharged to drain fields, and gaseous effluents from the incineration of low-level radioactive waste are discharged through the WERF stack.

3.5.7 Radioactive Waste Management Complex

Various strategies for waste storage, processing, and disposal are studied at the RWMC, which was established in 1952 as a controlled area for disposal of solid radioactive wastes generated during INEEL operations. Since 1954, the facility has received defense wastes for storage.

RWMC is situated on 76 ha (187 acres) located 11 km (7 mi) southwest of CFA. It also supports research and development projects dedicated to shallow land burial technology and alternate ways of removing, reprocessing, and repackaging transuranic (TRU) wastes. The RWMC is subdivided into three primary zones:

- Administrative Area
- Subsurface Disposal Area (SDA)
- Transuranic Storage Area (TSA).

Office buildings and equipment maintenance facilities are located in the Administrative Area, which covers approximately 13 ha (33 acres).

The SDA is a fenced 39-ha (97-acre) facility dedicated to the permanent disposal of low-level beta, gamma, and nonretrievable TRU waste (buried prior to 1970) that is contaminated with mixed fission products and hazardous constituents. Major features at the SDA include the pits, trenches, and soil vaults in which waste was buried, and Pad A, which received low-level waste, primarily nitrate salts, from offsite generators. An area in the northeast corner of the SDA, Pit 9, is being remediated under CERCLA. Waste and contaminated soil will be excavated from the pit and treated to remove organic, transuranic, and heavy metal contamination.

The TSA is a 23-ha (57-acre) fenced facility dedicated to storing contact- and remote-handled solid TRU wastes. The wastes stored at TSA include TRU (e.g., plutonium) and intermediate-level waste. Major facilities at the TSA include the Type I and Type II storage buildings, TSA-1/TSA-Retrieval, TSA-2, and TSA-3. Within the TSA-2 and TSA-3 is the air-support structures and the Stored Waste Examination Pilot Plant (SWEPP).

There are no process liquid wastes or point source stack emissions generated at the RWMC. Sanitary sewage is discharged to a lined evaporation pond. Operations at the facility include transportation and burial of radioactively contaminated material that could result in releases to the atmosphere and direct exposure to ionizing radiation.

3.5.8 Test Area North

TAN is located approximately 43 km (27 mi) northeast of CFA. The TAN complex consists of several facilities for handling, storing, examining, and conducting research and development on spent nuclear fuel. The facilities include one of the world's largest hot shops, storage pools, and examination operations supporting research of the 1979 Three-Mile Island accident.

The major facilities at TAN include the following:

- Contained Test Facility (CTF)
- Technical Support Facility (TSF)
- Water Reactor Research Test Facility (WRRTF).

CTF is located on the west end of TAN. The mission of CTF was to perform reactor loss-of-coolant studies. After these studies were completed, the facility was decontaminated and used for decontamination and decommissioning of reactors used in the Aircraft Nuclear Propulsion Program.

Currently, part of the CTF and TSF area serves as an operational facility for the Specific Manufacturing Capability (SMC) project. SMC manufactures armor assemblies for the Army's Tank Unit. This project will likely continue into the first decade of the 21st century. TSF is located in the central part of TAN and serves as the main administration, assembly, and maintenance section for TAN. The Fire Department is also located there. Major programs at TSF include the Three-Mile Island Unit 2 Core Off-Site Examination, Process Experimental Pilot Plant, Spent Fuel Program, and the SMC.

WRRTF is located 2.6 km (1.6 mi) southeast of TSF and was originally constructed to conduct pool and table reactor experiments. Various reactor programs were conducted at WRRTF, including the Semiscale (TAN-646), Thermal Hydraulic Loss-of-Coolant Project (TAN-646), the Blowdown Facility (TAN-640), and Two-Phase Flow Loop (TAN-640) loss-of-coolant projects. The facility is currently used by the Applied Engineering and Development Laboratory to work on experimental projects.

Sewage and process wastewater from CTF is discharged to a lined evaporation pond. Process and sanitary sewage waste from TSF and WRRTF are discharged to percolation ponds.

3.5.9 Test Reactor Area

The Test Reactor Area (TRA) is located in the southwestern area of the INEEL, approximately 8 km (5 mi) northwest of CFA. The area was originally established in the early 1950s to conduct experiments associated with developing, testing, and analyzing materials used in nuclear and reactor applications The Advanced Test Reactor (ATR), located at TRA, produces a neutron flux that simulates long-duration radiation effects on materials and fuels.

Highly radioactive liquid wastes are put in containers and shipped to ICPP for evaporation and solidification. Low-level liquid radioactive wastes are discharged to a lined evaporation pond. Process wastewaters from ion exchange demineralizers and water softeners are discharged to a Chemical Waste Pond, and other process wastewaters are discharged to the Cold Waste Pond. Sanitary sewage is discharged to a lined evaporation pond.

3.5.10 Idaho Falls Facilities

There are 27 buildings operated by LMITCO in the City of Idaho Falls, 16 of which have Waste Acceptance Form Permits with the city. Only two of the permits require monitoring of liquid effluents: the permit for the Willow Creek Building (WCB) and the permit for the INEEL Research Center (IRC). The WCB houses mainly administrative functions, but also contains a print shop, a photography laboratory, and a medical facility. The IRC contains laboratories for research programs, including materials testing, fossil energy research, biotechnology, environmental monitoring, engineering research, advanced process research, and industrial research.

3.5.11 Secondary Facilities

A number of secondary facilities are located within the INEEL boundaries where the Environmental Monitoring Program conducts monitoring or maintains monitoring stations.

3.5.11.1 Experimental Breeder Reactor-I. Experimental Breeder Reactor No. I (EBR-I) consists of the Reactor Building and Annex (EBR-601), situated on approximately 4 ha (10 acres) of land located approximately 10 km (6 mi) southwest of CFA. EBR-I was constructed in 1949 and the early 1950s. EBR-I was the first reactor in the world to generate usable amounts of electricity. This historic accomplishment took place on December 20, 1951. Today, EBR-I is a Registered National Historical Landmark where several reactor cores were tested. Two prototype nuclear aircraft engines that were built at the INEEL in the 1950s are also displayed at EBR-I. EBR-I is open to the public from Memorial Day until Labor Day and for special tours after that. The EBR-I water system serves approximately 12,000 visitors per year.

3.5.11.2 Experimental Field Station. The Experimental Field Station (EFS) was previously known as the Experimental Dairy Farm. It was a small-scale dairy farm used to study the movement of radionuclides through the entire air-vegetation-cow-milk sequence of the human food chain. The site is approximately 10 km (6 mi) north of CFA along the channel of the Big Lost River. Research on methods to effectively provide barriers to water, small mammal, ant, and vegetation root intrusion through protective caps at waste disposal areas is currently conducted at the station. The Environmental Monitoring Program, along with several other programs, maintains a monitoring station at this location for onsite ambient air monitoring.

3.5.11.3 Security Training Facility. The Security Training Facility consists of two adjacent areas located approximately 4 km (2.5 mi) east of CFA. This facility was formerly known as the Experimental Organic Cooled Reactor and Organic Moderated Reactor Experiment (OMRE) areas. The Experimental Organic Cooled Reactor was constructed directly northwest of the OMRE in 1962. The project was canceled prior to completion, and the area has since been used for materials storage, security force practice, and explosives testing. The facility was decontaminated and dismantled in 1979. The OMRE was designed to develop power from an organic coolant reactor. It consisted of a reactor control building, reactor, heat exchangers, septic system, leach pond, and water tank. The building and underground reactor were disassembled; the radiologically contaminated material was disposed of at the RWMC, and the uncontaminated parts were sold as scrap. The leach pond was backfilled with soil, and the entire area was revegetated with a mixture of native grasses in 1981.

3.5.11.4 Van Buren Boulevard Monitoring Station. The Van Buren Boulevard (VANB) Monitoring Station is located 3.5 km (2.2 mi) west of CFA at the junction of Van Buren Boulevard and Highway 20/26. The Environmental Monitoring Program maintains an air monitoring station at this location consisting of nitrogen dioxide, sulfur dioxide, tritium, and low-volume air monitors. The State of Idaho INEEL Oversight Program and the Environmental Science and Research Foundation also maintain monitoring stations at this location.

4. ENVIRONMENTAL SURVEILLANCE PROGRAMS

The ESP conducts mostly radiological sampling of air, water, soil, biota, and direct radiation. The ESP consists of the Radiological Environmental Surveillance Program (RESP) and the Site Environmental Surveillance Program (SESP).

The RESP began in 1976 and is conducted in order to meet DOE Order 5820.2A, "Radioactive Waste Management."[8] This RESP provides routine surveillance data for selected LMITCO waste management facilities.

During the fall of 1993, the Radiological and Environmental Sciences Laboratory (RESL) was defederalized and divided into onsite and offsite surveillance. The onsite monitoring of air, soils, and direct radiation is currently known as SESP. The SESP, along with the offsite surveillance (conducted by the Environmental Science and Research Foundation), makes up the overall INEEL ESP that is required by DOE Orders 5400.1 and 5400.5. The SESP data are provided to the ESRF for incorporation into the *Annual Site Environmental Report.*[19] Only the highlights of the data and data not included in the ESRF report are included in this report.

The *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*[9] lists the criteria for establishing environmental surveillance programs. Both the RESP and SESP activities are structured in accordance with the regulatory guide to support the DOE-ID in maintaining an integrated INEEL ESP.

4.1 Radiological Environmental Surveillance Program

The RESP activities are structured to support DOE-ID to maintain an integrated INEEL environmental monitoring program. The particular requirements for radiological environmental surveillance at DOE waste management facilities are contained in DOE Orders 5400.1 and 5820.2A. As specified in DOE Order 5400.1, Chapter IV, Section 5, environmental surveillance programs and their components are "determined on a site-specific basis by the field organization." Consequently, the LMITCO Environmental Monitoring Program mission does not include all aspects of environmental surveillance, but only those components that have been assigned to LMITCO by DOE-ID. Responsibilities for each component of environmental monitoring are included in the *Idaho National Engineering Laboratory Environmental Monitoring Plan.*[20] In addition, the RESP complies with the recommendations in *The Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, when applicable.

4.1.1 Program Design Basis

The general basis for the current program design includes regulatory requirements and guidance for radiological environmental surveillance, historical commitments, and special requests from DOE-ID or LMITCO organizations.

The RESP provides surveillance data for selected INEEL waste management facilities: MWSF, OMRE area, RWMC (SDA and SWEPP), SL-1 surplus area, TAN, and WERF. The RESP activities include ambient air monitoring, biotic surveillance, direct radiation monitoring, surface radiation monitoring, surface water runoff sampling, and surface soil sampling. These programs are summarized in Table 4-1.

Table 4-1. Radiological Environmental Surveillance Program activities performed at waste management facilities.

Facility	Media	Description	Frequency of Analyses	Type of Analyses
RWMC				
SDA	Air			
	• PM_{10}	8 air monitor operated at 0.11 m^3/min (includes 1 control and 1 replicate)	Semi-monthly Semi-monthly Monthly Quarterly	Gross alpha Gross beta Gamma spectrometry Radiochemistry[a]
	• Suspended Particulate	1 air monitor operated at 0.14 m^3/min	Semi-monthly Semi-monthly Monthly Quarterly	Gross alpha Gross beta Gamma spectrometry Radiochemistry[a]
	Surface Water	One 4-L sample from SDA and control location	Quarterly, but depends on precipitation	Gross alpha Gross beta Gamma spectrometry Radiochemistry[a,b,c]
	Direct Radiation			
	• Surface gamma activity	GPRS detector system	Semi-annually	External radiation levels
	• Ionizing Radiation	4 TLD packets and 7 background communities (SESP/ESRF)	Semi-annually	External radiation levels
	Soil	5 surface locations in each of 5 major areas (plus 1 control area)	Triennially	Gamma spectrometry Radiochemistry[a]
	Vegetation	3 composites in each of 5 major areas (plus 1 control area)[d]	Annually, but species sampled varies each year as determined by availability	Gamma spectrometry Radiochemistry[a]
	Visual Inspection	Tour SDA and TSA	Monthly	Results reported for any required corrective action

Table 4-1. (continued).

Facility	Media	Description	Frequency of Analyses	Type of Analyses
SWEPP	Air			
	• PM_{10}	5 air monitors operated at 0.11 m^3/min (includes 1 control and 1 replicate)	Semi-monthly Semi-monthly Monthly Quarterly	Gross alpha Gross beta Gamma spectrometry Radiochemistry[a]
	• Suspended Particulate	2 air monitors operated at 0.14 m^3/min	Semi-monthly Semi-monthly Monthly Quarterly	Gross alpha Gross beta Gamma spectrometry Radiochemistry[a]
	Surface Water	One 4-L sample from TSA-1, TSA-2, TSA-3, TSA-4, and control locations	Quarterly, but depends on precipitation	Gross alpha Gross beta Gamma spectrometry Radiochemistry[a]
	Soil	9 locations sampled (plus 2 control areas)	Triennially	Gamma spectrometry Radiochemistry[a]
WERF	Air			
	• PM_{10}	3 air monitors operated at 0.11 m^3/min (includes 1 control)	Semi-monthly Semi-monthly Monthly	Gross alpha Gross beta Gamma spectrometry
	• Suspended Particulate	1 air monitor operated at 0.14 m^3/min	Semi-monthly Semi-monthly Monthly	Gross alpha Gross beta Gamma spectrometry
	• Ionizing radiation	11 TLD packets and 7 background communities (SESP/ESRF)	Semi-annually	External radiation levels
	Soil			
	• Surface Soils	15 surface locations	Triennially[d]	Gamma spectrometry[d]
	• Seepage Basins	3 locations	Annually	Gamma spectrometry
	Water	One 4-L from seepage basins	Quarterly, but depends on precipitation	Gamma spectrometry
	Vegetation	15 locations (includes 3 controls)	Triennially	Gamma spectrometry

Table 4-1. (continued).

Facility	Media	Description	Frequency of Analyses	Type of Analyses
MWSF	Air			
	• PM_{10}	1 air monitor operated at 0.11 m^3/min	Semi-monthly Semi-monthly Monthly	Gross alpha Gross beta Gamma spectrometry
TAN	Air			
	• Suspended Particulate	5 air monitors operated at 0.14 m^3/min	Semi-monthly Semi-monthly Monthly	Gross alpha Gross beta Gamma spectrometry
SL-1	Direct Radiation			
	• Surface gamma activity	Hand-held HHD-440	Semi-annually	External radiation levels
	Visual Inspection	Tour SL-1	Semi-annually	Results reported for any required corrective action
OMRE	Direct Radiation			
	• Surface gamma activity	GPRS detector system	Annually	External radiation levels
	Visual Inspection	Tour OMRE	Annually	Results reported for any required corrective action

a. Analysis for Am-241, Pu-238, Pu-239/240, U-235, U-238, and Sr-90.

b. Samples for radiochemical analyses usually taken during second quarter only.

c. Exact number of samples may vary, due to availability.

d. Sampling frequency may vary if air radioactivity levels increase.

The results reported by the surveillance activities of the program are primarily estimates of radioactivity concentrations in environmental media. These are typically based on two types of environmental data: (a) laboratory analysis of the amount of radioactivity in a sample and (b) a measurement of the volume or mass of environmental medium represented by the sample. Estimates of radioactivity concentrations are used by this program for two general purposes: (a) analysis of trends compared to past estimates and background levels and (b) comparison to appropriate alert levels.

The analytical results reported in the following sections are greater than two times the analytical uncertainty.

4.1.2 Ambient Air

Air is a critical pathway of contaminant migration through the environment at the INEEL. Fugitive dusts from the RWMC may contain small amounts of sorbed, man-made radionuclides in addition to naturally occurring radionuclides.[21] The general approach to monitoring an area source is to monitor the RWMC facility perimeter.

Ambient air was sampled for radioactive particulates during 1996 at the RWMC (SDA and SWEPP), TAN, WERF, and MWSF (Figures A-9, A-12, A-13 and A-16). In addition to general RESP objectives, the specific objectives of the ambient air sampling were as follows: (a) determine concentrations of airborne radionuclides in the vicinity of the waste management facilities, (b) report comparisons of measured concentrations to reference levels based on derived concentration guides (DCGs) for the public given in DOE Order 5400.5, (c) detect and report significant trends in measured concentrations of airborne radionuclides, (d) provide an indication of waste confinement integrity, and (e) provide data for pathways analyses on concentrations of airborne radionuclides.

Particulate material is collected on a membrane filter using two types of air monitors: suspended particulate air monitors and the PM_{10} air monitors. While, the RESP PM_{10} monitors are designed to only admit particles less than 10 microns in diameter, the suspended particulate air monitors admit larger particles. The PM_{10} monitors sample particulates considered to be the respirable fraction. The PM_{10} fraction is also the range of particle sizes that can be transported to the offsite locations by wind. Measuring the respirable fraction provides data that meet the general RESP objective for providing data that may be used for dose calculations.

Air filters are collected and analyzed semi-monthly for gross-alpha and gross-beta activity, and monthly composites of each location are analyzed quantitatively for gamma-emitting radionuclides. Filters from the RWMC are also composited quarterly by location and are analyzed for specific alpha- and beta-emitting radionuclides. The approach used for data analysis is presented in Appendix B.

Results of gross-beta analysis of the air filters are evaluated to determine if there are any significant increases in the sample radioactivity that may require more immediate or more in-depth analysis by gamma spectrometry or radiochemistry. Gross-beta analysis is thus used as a quick screening tool. Gross-beta results are evaluated semi-monthly by comparing these results with historical and background data to identify trends using a log concentration-versus-time plot. RESP compares each plot against control concentrations, detection limits, and alert levels. Alert levels are 25% of the most restrictive DCGs for the public. Comparisons are made between stations and control monitors using statistical analysis methods (Appendix B). The RESP also compares gross-beta activity to the DCGs for Sr-90, which is the most restrictive DCG for waste-related, beta-emitting radionuclides detected at the RWMC (Appendix C).

Replicate PM_{10} samples are collected at location 4.3 at the RWMC (Figure A-12) as part of the RESP QA/QC Program. Control sample locations 15 and 15.3 for the RWMC are at the EBR-I area, approximately 3 km (1.9 mi) east-northeast of the RWMC (Figure A-5). The WERF control sample, location 603.3, serves both MWSF and WERF, and is located next to the INEEL Main Gate Building 603 (Figure A-10).

4.1.2.1 Data Summary and Assessment. Ambient air results are evaluated to determine if radionuclide concentrations exceed alert levels and to detect significant increases that might indicate confinement failure.

Summarized 1995 and 1996 gross-alpha and gross-beta data are presented by facility in Figures 4-1 and 4-2 to provide an indication of short-term changes in levels. Corresponding summary statistics (e.g., means, medians, maximum, and minimum values) with all 1995 and 1996 data included are given in Tables 4-2 and 4-3. As with the 1995 analysis of gross-alpha values, very little variability was seen among facilities during 1996.

Quarterly averages of RWMC gross-beta activity (Cs-137 equivalent) since 1986 are shown in Figure 4-3. The rise in beta activity in the second quarter of 1986 is attributed to the fallout from the April 1986 Chernobyl reactor accident in the Soviet Union.

Figures 4-4 and 4-5 show the gross-beta concentration (Cs-137 equivalent) trends at the SDA and SWEPP, respectively, during each semi-monthly sampling period during 1996. The gross-beta data have historically followed a seasonal trend that usually increases during the latter part of the year; however, during 1996, the data departed from this trend. The data showed an increase during the third quarter due to the fires, and the delay in the increase at the end of the year could be attributed to meteorological conditions.

Man-made, gamma-emitting radionuclides were not detected at the MWSF during 1996. Specific alpha analyses were not performed because no known source of TRU radionuclides exists in this area. The quarterly average of gross-beta activity for the WERF is shown graphically in Figure 4-6. As with RWMC, the unusually high gross-beta results observed in 1986 are attributed to the Chernobyl accident.

Figures 4-7 and 4-8 show the maximum gross-beta concentrations and mean gross-beta activity at MWSF and WERF, respectively, for each semi-monthly period. Monthly mean concentrations were not statistically different from those reported from the control location.

Gross-alpha and gross-beta data from suspended particulate monitors located at the RWMC, WERF, and TAN are summarized in Tables 4-2 and 4-3. However, because samples were not analyzed for gross alpha and beta in previous years, no comparisons to TAN monitors are provided. The levels of gross alpha and beta are consistent with historical data seen in other areas at the INEEL.

Gamma-emitting radionuclides that could be present due to RWMC operations were not detected in the RESP air filters collected at the RWMC in 1996. (Radionuclides most likely to be found at the RWMC and detection limits are listed in Tables D-1 and D-2.) Also, no gamma-emitting radionuclides were detected in the air filters collected from WERF and TAN during 1996.

Composited filters from continuously operating air monitors are analyzed four times a year. Specific alpha- and beta-emitters are collected from each location in any year, and the results are frequently below the detection limit. Analyses of quarterly composited air filters indicate the effectiveness of waste confinement.

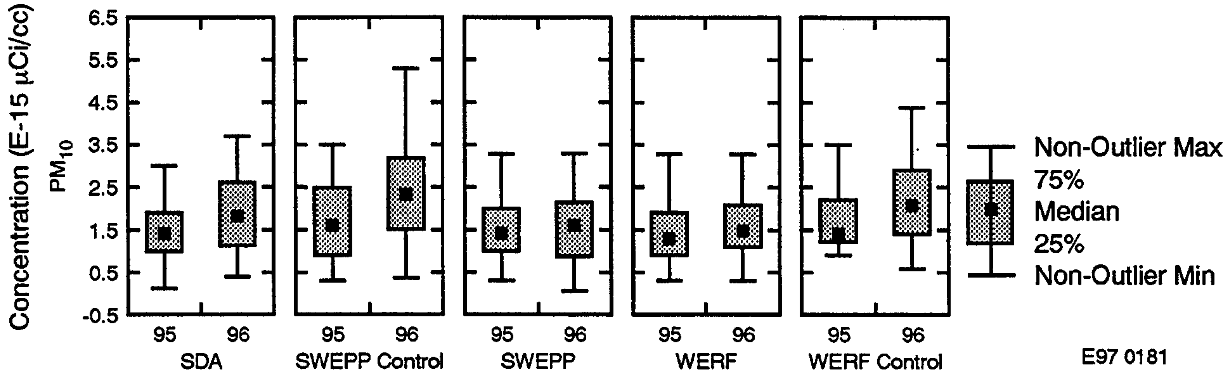


Figure 4-1. 1995 and 1996 box and whisker plots of the gross-alpha concentrations by facility (E970181).

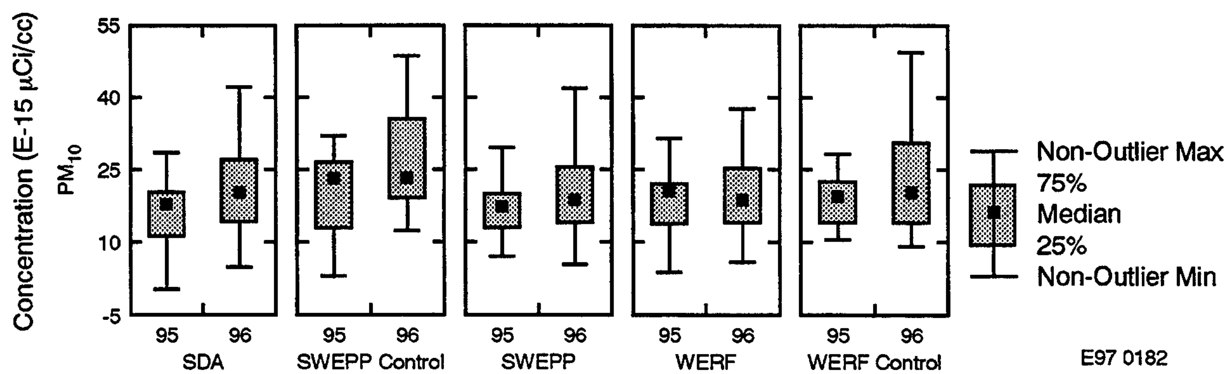


Figure 4-2. 1995 and 1996 box and whisker plots of the gross-beta concentrations by facility (E970182).

Table 4-2. Summary statistics for gross-alpha concentrations (E-15 μCi/cc).

Monitor Type	Facility	Year	N	Mean	Maximum
Suspended Particulate	SDA	95	22	1.53	3.0
		96	24	1.53	3.0
	SWEPP	95	42	1.35	3.2
		96	43	1.13	3.4
	SDA/SWEPP/ WERF Control	95	20	0.86	2.1
		96	23	1.34	2.6
	WERF	95	24	1.31	3.8
		96	23	1.20	4.0
	TAN	96	104	0.78	3.9
PM_{10}	SDA	95	135	1.47	3.6
		96	126	2.03	10.0
	SWEPP	95	92	1.50	4.0
		96	74	1.66	4.1
	SDA/SWEPP Control	95	22	1.74	3.5
		96	23	2.57	7.3
	WERF	95	72	1.52	5.0
		96	66	1.65	3.3
	WERF Control	95	23	1.80	4.5
		96	22	2.19	4.4

Table 4-3. Summary statistics for gross-beta concentrations (E-15 μCi/cc).

Monitor Type	Facility	Year	N	Mean	Maximum
Suspended Particulate	SDA	95	22	16.48	43.1
		96	24	16.45	30.8
	SWEPP	95	42	16.45	53.7
		96	43	12.45	28.1
	SDA/SWEPP/ WERF Control	95	22	12.46	44.1
		96	23	16.81	34.9
	WERF	95	24	17.77	43.9
		96	23	14.34	30.0
	TAN/SMC	96	110	8.00	35.0
PM_{10}	SDA	95	135	17.47	53.7
		96	126	22.04	69.0
	SWEPP	95	92	18.45	56.3
		96	74	20.42	47.1
	SDA/SWEPP Control	95	22	21.73	69.8
		96	23	27.61	73.0
	WERF	95	72	20.53	61.7
		96	66	20.14	45.0
	WERF Control	95	23	21.12	59.2
		96	22	25.10	74.4

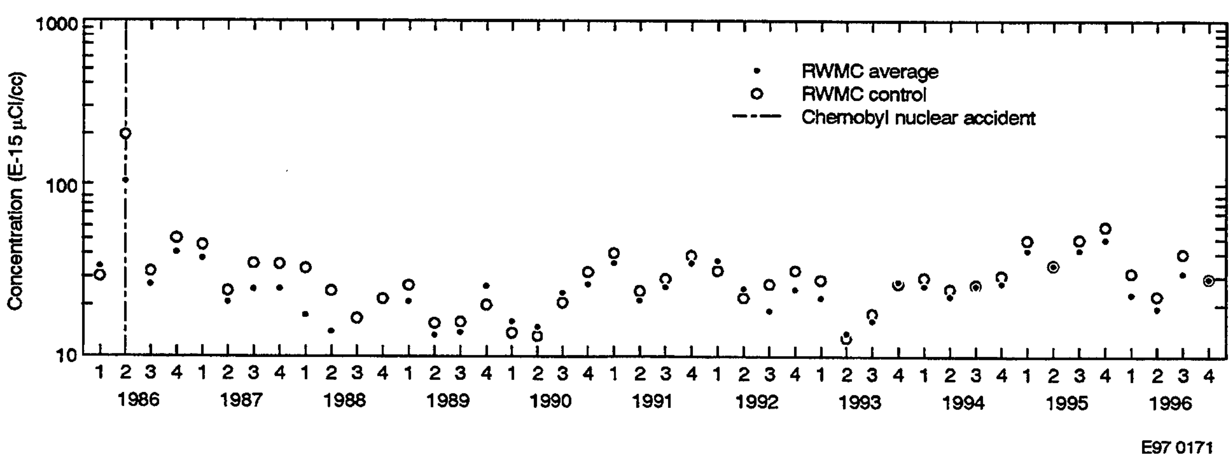


Figure 4-3. Quarterly averages of gross-beta air concentrations (Cs-137 equivalent) measured at RWMC since 1986 (E970171).

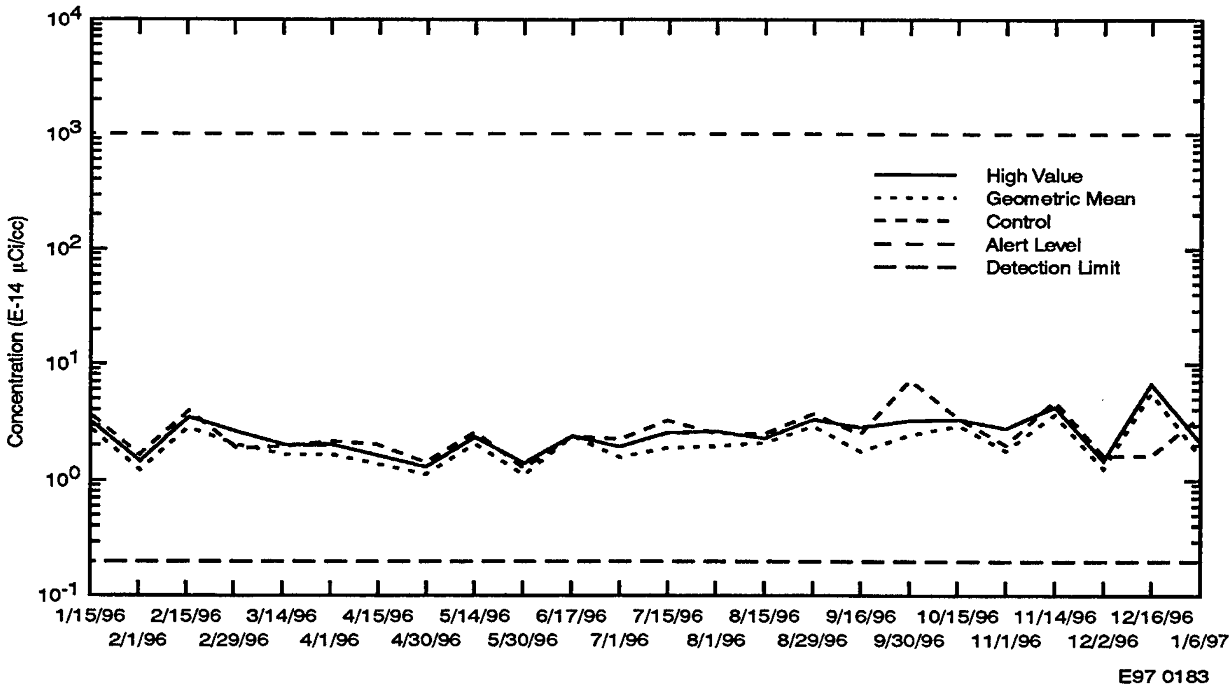


Figure 4-4. Gross-beta concentration (Cs-137 equivalent) trends for SDA air filters during each semi-monthly period of 1996 (E970183).

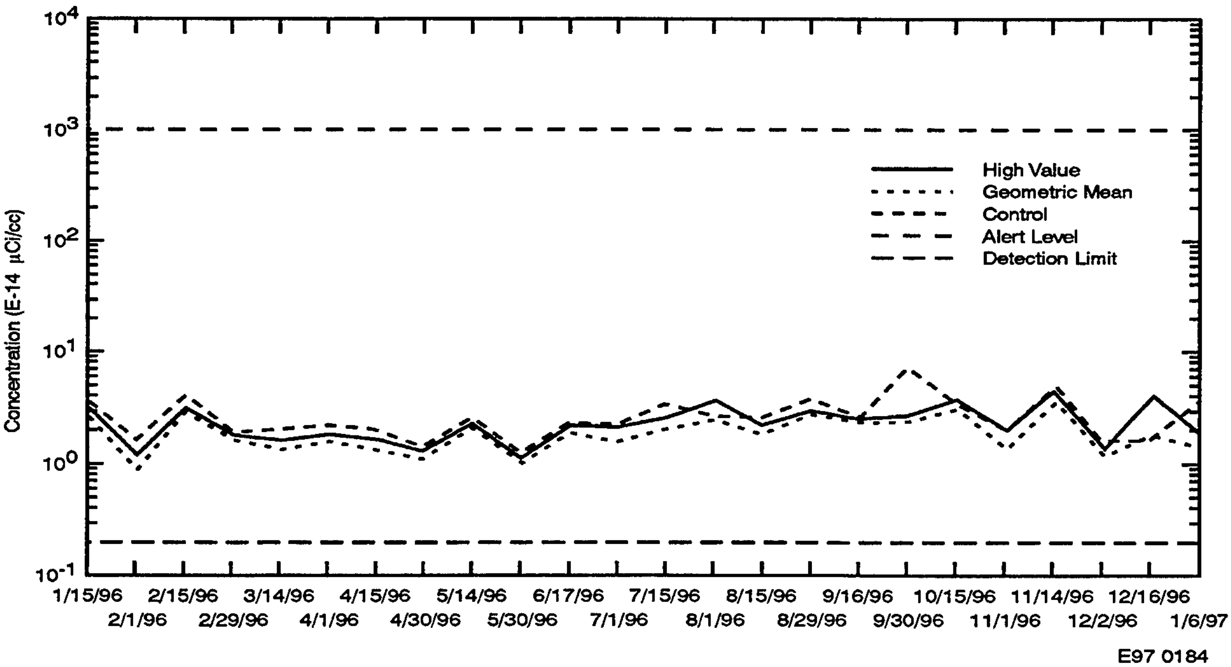


Figure 4-5. Gross-beta concentrations (Cs-137 equivalent) trends for SWEPP air filters during each semi-monthly period of 1996 (E970184).

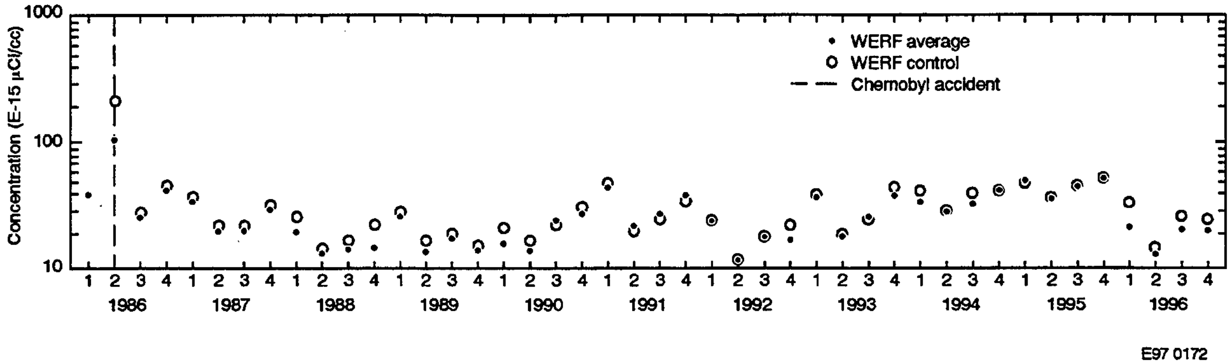


Figure 4-6. Quarterly average of gross-beta air concentrations (Cs-137 equivalent) measured at WERF since 1986 (E970172).

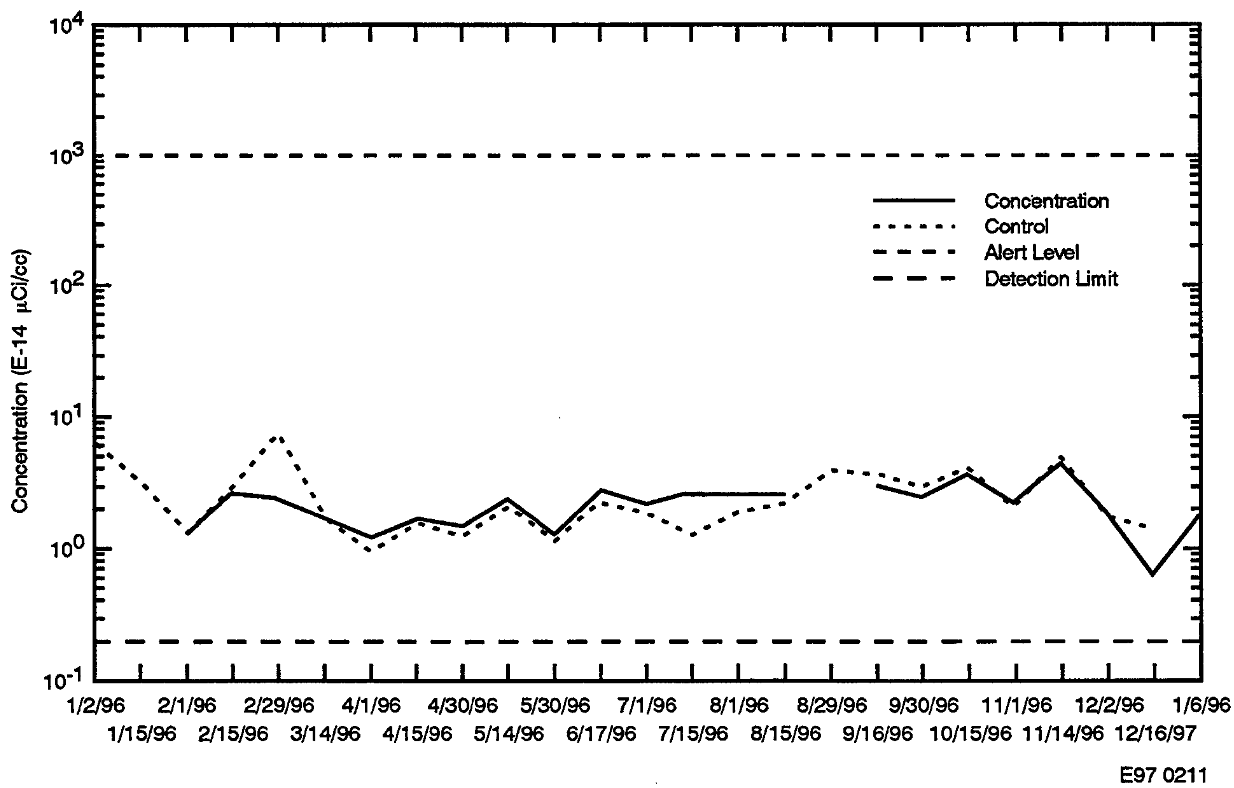


Figure 4-7. Maximum gross-beta concentrations (Cs-137 equivalent) for MWSF air filters during each semi-monthly period of 1996 (E970211).

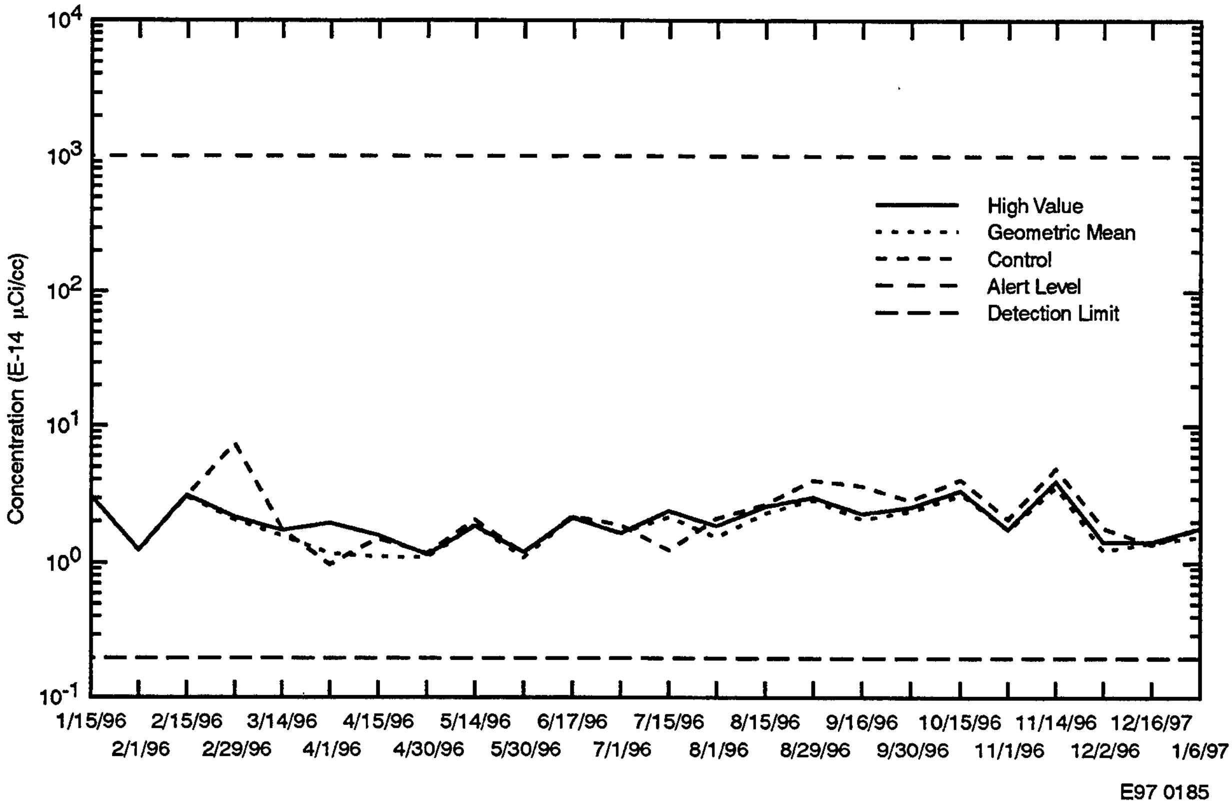


Figure 4-8. Maximum gross-beta concentrations (Cs-137 equivalent) for WERF air filters during each semi-monthly period of 1996 (E970185).

Table 4-4 contains the specific alpha-emitting radionuclides detected at the RWMC and TAN (SMC) during 1996. Since no known source of TRU radionuclides exists at the WERF, no specific-alpha analyses were performed; however, this will be re-evaluated during 1997 because of recent changes in the WERF incineration process. Am-241 and Pu-239/240 were the only two alpha- and beta-emitting radionuclides detected during 1996 at TAN and RWMC. The maximum concentration of Pu-239/240 was detected in composite air samples from TAN Location 103 (Figure A-9) during the second quarter. This concentration was 2.1 ± 0.4 E-18 µCi/cc and represents 0.01% of the DCG for airborne releases of Pu-239/240 to the public. During the third quarter of 1996, the maximum concentration of Am-241 was detected in a composite air sample collected from TAN Location 103. This concentration was 3.8 ± 1.3 E-18 µCi/cc and is 0.02% of the DCG. These concentrations are comparable to historical concentrations detected previously at the INEEL.

Sr-90 was detected in samples from all four quarters at the RWMC. However, due to detections in the blanks submitted with the routine composite air filters to the laboratory, the Sr-90 data are questionable. Sr-90 results and further discussion of this issue can be found in Section 4.1.8.

4.1.3 Biotic Surveillance

Biotic surveillance is conducted at the RWMC and WERF. Plant uptake of radionuclides at the RWMC has been documented by RESL.[22]

Table 4-4. Summary of specific alpha-emitting radionuclides.

Facility	Location	Radionuclide	Quarter	Concentration[a] (E-15 μCi/mL)	% of DCG[b]
SMC	105	Pu-239/240	First	0.006 ± 0.004	0.03
SMC	103	Pu-239/240	Second	0.021 ± 0.008	0.1
RWMC	2.0	Am-241	Third	0.0022 ± 0.002	0.01
SMC	104	Am-241		0.0024 ± 0.002	0.01
SMC	103	Am-241		0.0038 ± 0.0026	0.02
RWMC	2.0	Pu-239/240	Fourth	0.0058 ± 0.0034	0.03

a. Concentrations are those greater than 2 sigma.

b. In accordance with DOE Order 5400.5, the DCG for Am-241 and Pu-239/240 is 20 E-15 μCi/cc.

In addition to the general RESP objectives, the specific objectives of the routine biotic surveillance are to (a) determine if biota are transporting radionuclides from buried waste or contaminated soil, (b) identify biotic conditions that may compromise waste confinement at waste storage and disposal facilities, and (c) detect and report significant trends in the radionuclide concentrations in biotic samples.

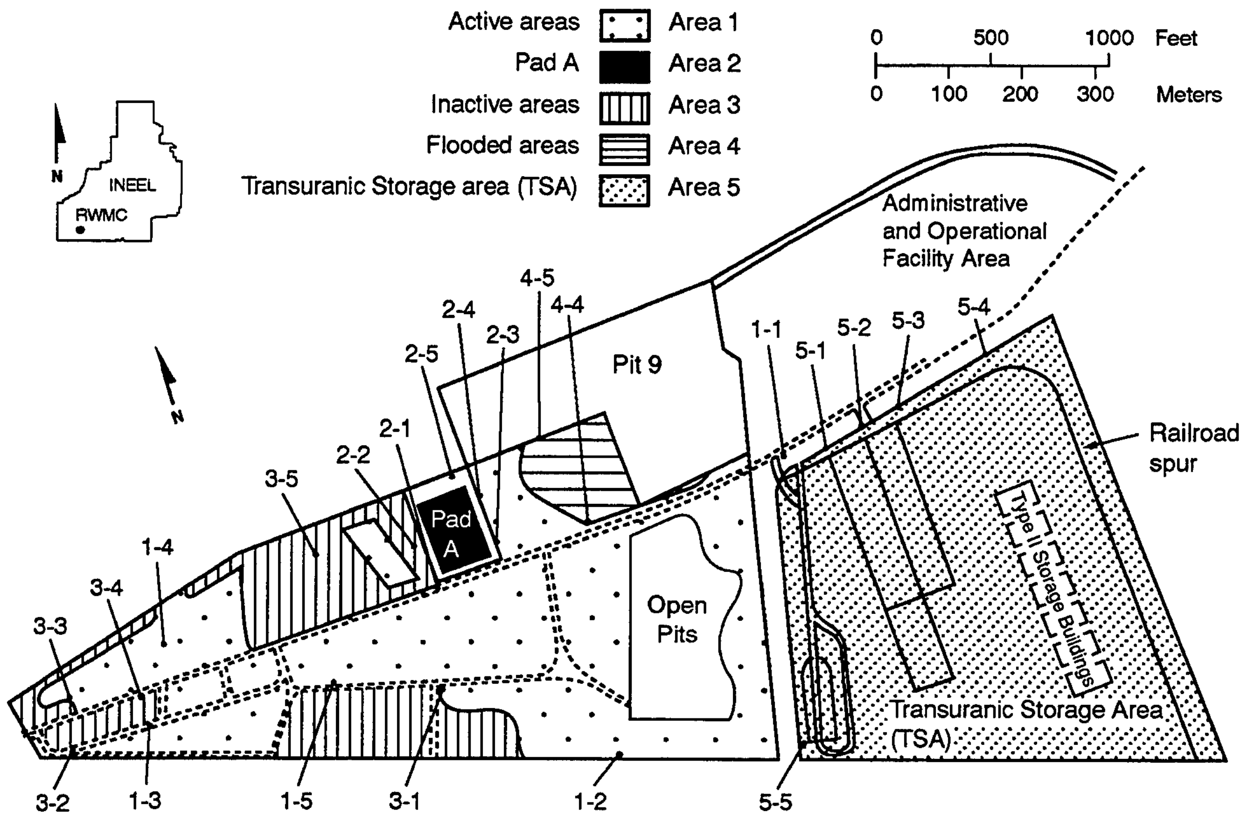
The sampling design involves sampling biota at five major areas designated for soil sampling (Figure 4-9). The method of collection and the species alternate each year. Crested wheatgrass is collected in odd-numbered years and is clipped at ground level within a 0.9 × 0.9-m (3 × 3-ft) frame. Russian thistle is collected in even-numbered years, and the entire plant is pulled up within a 0.9 × 0.9-m (3 × 3-ft) frame. Either rabbit brush or sagebrush is collected in odd-numbered years by clipping 20% of the branches from the designated plants. Thus, the same plant can be sampled biennially.

The samples are dried, milled, and weighed before they are submitted to the Radiation Measurements Laboratory for gamma spectrometry analyses. Based on gamma analyses, selected samples are submitted to the Radiological Environmental Measurements System for specific alpha and beta analyses.

Control samples were collected from the Tractor Flats area and the East Butte, located adjacent to U.S. Highway 20, which is approximately 5 miles east of the ANL-W entrance.

4.1.3.1 Data Summary and Assessment. Russian thistle was scheduled to be collected in 1996 from five major areas of the RWMC (Figure 4-9). However, due to operational activity and disturbance of the ground cover in and around RWMC, representative samples could not be obtained.

Vegetation collection at WERF began in 1984 and is performed every three years. Sagebrush samples were collected from all sampling locations at the WERF during 1996. Cs-137 was the only gamma-emitting radionuclide detected in 1996 and was found at WERF Location 7 (Figure A-16). The sample concentration was 2.1 ± 0.7 E-7 μCi/g and is within the range of concentrations that is attributable to fallout. This is comparable to historical concentrations for this area.



Location	General Reference
1-1	Discharge Channel
1-2	6th pole on South side
1-3	Trench 13 West monument
1-4	Middle of Pit 2
1-5	Southwest end of Pit 10, near road
2-1	South end of Pad A culvert
2-2	West side of Pad A
2-3	Southeast, mid-slope
2-4	Northeast, bottom of slope
2-5	North, bottom of slope
3-1	Trench 34 near LMITCO Well 76-4A
3-2	Between West Trench 4 & 6 monuments
3-3	Near LMITCO Well 93
3-4	Monitoring Station 25
3-5	Monitoring Station 19
4-4	Pit 8 Southeast Monument
4-5	Pit 8 Northwest Monument
5-1	TSA-1, culvert
5-2	TSA-2, culvert
5-3	TSA-3, culvert draining west side of Pad
5-4	Channel draining East side of Pad
5-5	West side of ILTSF

E97 0164

Figure 4-9. Five major areas of the RWMC used for vegetation and soil collection (E970164).

4.1.4 Direct Radiation

The specific objectives of the direct radiation monitoring activities are to (a) demonstrate compliance with the limit for direct penetrating radiation, (b) characterize direct radiation levels at specific points of interest at INEEL waste management facilities, and (c) detect and report significant trends in measured levels of penetrating radiation.

Thermoluminescent dosimetries (TLDs) are used to measure cumulative exposures to ambient ionizing radiation at the RWMC and WERF. The TLDs are used to detect changes in ambient exposures attributed to handling, processing, or disposing of radioactive waste. TLDs are sensitive to beta energies greater than 200 KeV and to gamma energies greater than 10 KeV. The TLD packets contain five lithium fluoride chips and are placed about 0.9 m (3 ft) above the ground at specified locations. The five chips provide replicate measurements at each location. The TLD packets are replaced in May and November of each year. The sampling periods for 1996 were from November 1995 to May 1996 and from May to November 1996.

4.1.4.1 Data Summary and Assessment. Background exposures result from direct radiation from natural terrestrial sources (rocks and soil), cosmic radiation, fallout from testing nuclear weapons, and local industrial processes. The background exposures used in this report are exposure averages measured by TLDs in 13 Snake River Plain distant communities located outside the INEEL boundary. Background exposures were measured at Aberdeen, Arco, Atomic City, Blackfoot, Craters of the Moon National Monument, Howe, Idaho Falls, Minidoka, Monteview, Mud Lake, Reno Ranch, Rexburg, and Roberts.

A statistical summary for the 1996 TLD 6-month exposures can be found in Table 4-5. The maximum concentration was measured on the SDA during the fall reporting period. Figure 4-10 shows the 31 TLD sampling locations and identification numbers on and around the RWMC, TSA, SWEPP, and SDA areas. WERF TLD locations are shown on Figure A-16.

Figures 4-11 through 4-13 show the six-month exposures measured by TLDs, which have changed significantly in the past year. Those areas that had low exposure levels or levels that were consistently near the background are not plotted. Average distant community background exposures are shown on each graph for comparison.

Table 4-5. Summary statistics for 1996 TLD 6-month exposures.

Facility	Season	N	Mean (mR)	Median (mR)	Minimum (mR)	Maximum (mR)
SDA	Spring	17	95.3	78	63	152
	Fall	19	103.8	89	72	232
TSA	Spring	11	76.0	78	57	145
	Fall	12	90.0	81	74	157
WERF	Spring	11	65.4	61	53	106
	Fall	11	83.7	75	63	153
Distant Communities	Spring	6	58.5	56.5	51	73
	Fall	7	67.9	68	64	71

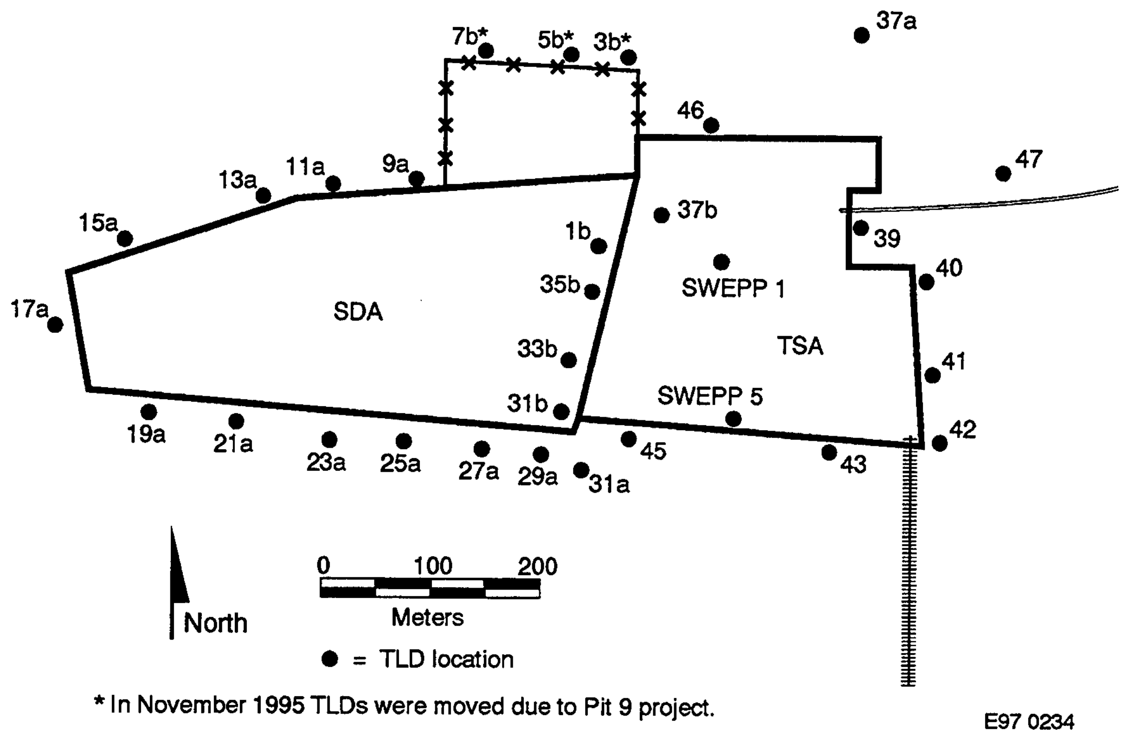


Figure 4-10. RWMC TLD locations (E970234).

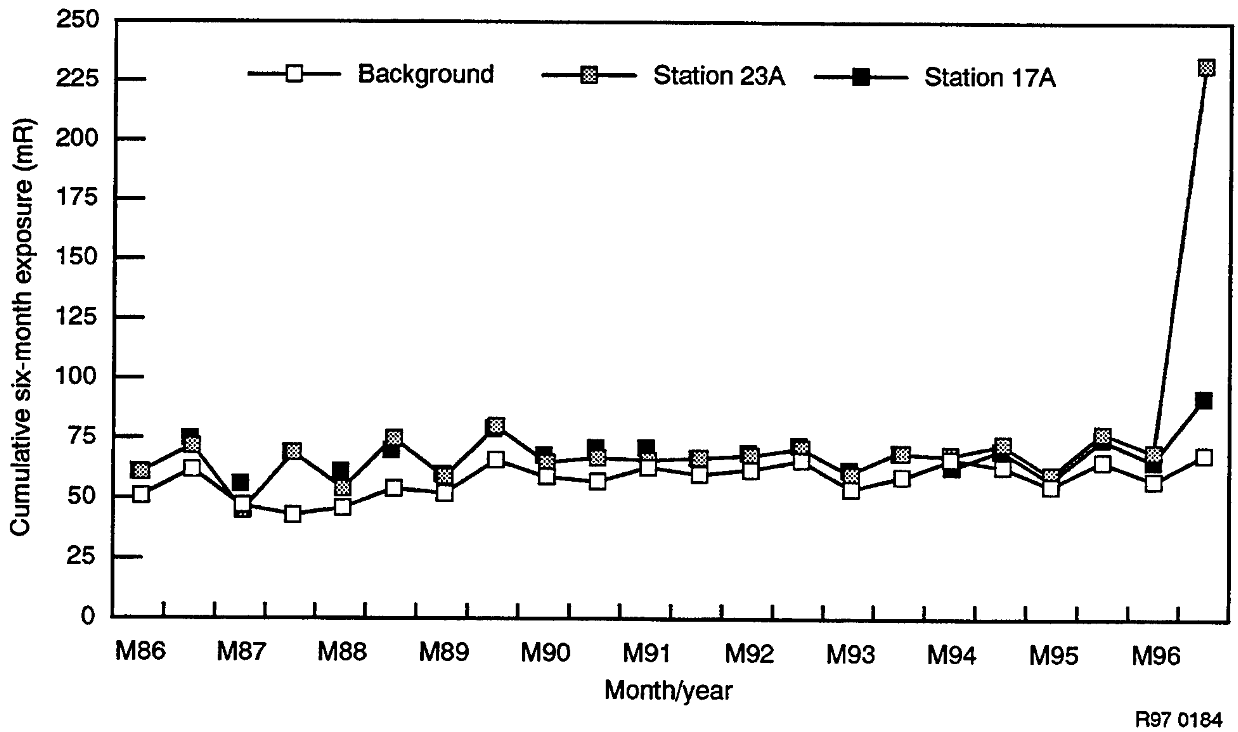


Figure 4-11. Six-month exposures measured by TLDs on the south and west borders of SDA (R970184).

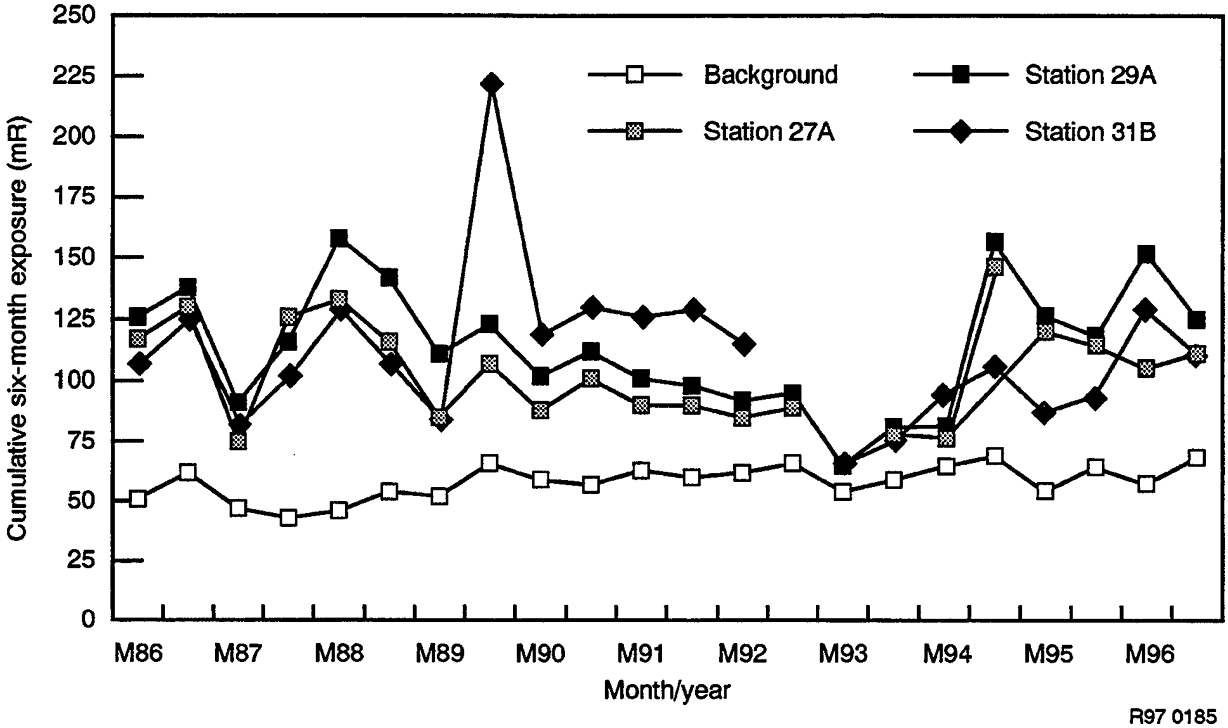


Figure 4-12. Six-month exposures measured by TLDs on the southeast border of (R970185).

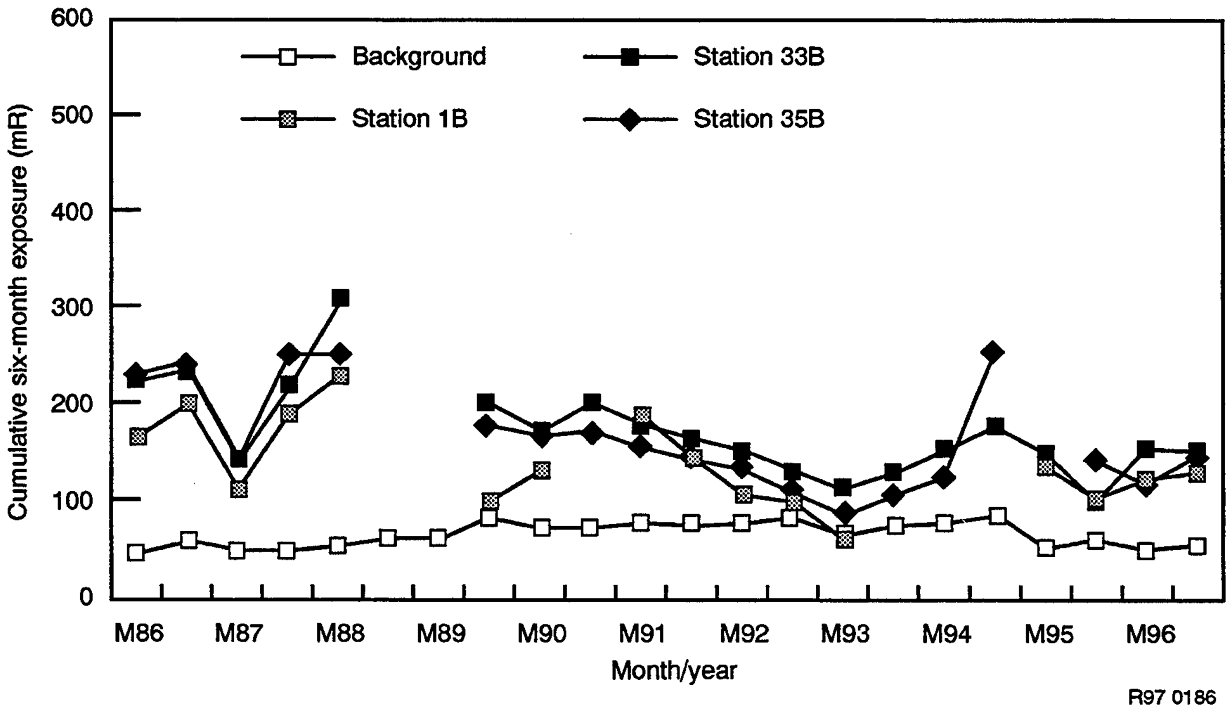


Figure 4-13. Six-month exposures measured by TLDs on the east border of SDA (R970186).

Long-term decreases can generally be attributed to the following: (a) changes in operational activities, (b) placement of additional soil over pits and trenches, and (c) radioactive decay of the radionuclides in waste already buried. Many exposures have decreased to near background exposures and tend to vary directly with background exposures.

Within each year exposures are generally lower from November through May than from May through November. Stations 1B, 31B, 33B, and 35B generally show the highest exposure levels measured by TLDs on the SDA. These stations measure exposures associated with the active disposal pit and operational activities in that area. In addition, measured exposures at many stations in the proximity of the active pit have slightly increased during the second reporting period.

Figure 4-11 shows the exposure levels for stations 17A and 23A on the west and south borders of the SDA. The maximum exposure level measured by TLDs for 1996 was at Station 23A. The TLD stations in the proximity of Station 23A showed exposures near background. After discussions with operations personnel, no known source was identified for the high exposures during the second period; however, acute exposure is suspected, and this location will be closely monitored.

Exposures measured at Stations 40, 41, and 42 (located along the east and northeast borders of the TSA) are shown in Figure 4-14. These exposures increased significantly due to waste being moved from the TSA-Retrieval Enclosure to building WMF-628. The exposures in this area are likely to continue to increase as the amount of waste in the Type II storage buildings increases.

Figure A-16 shows the locations of the 11 TLD stations located around the WERF. Figures 4-15 through 4-19 show the six-month exposures measured by TLDs located in the WERF area.

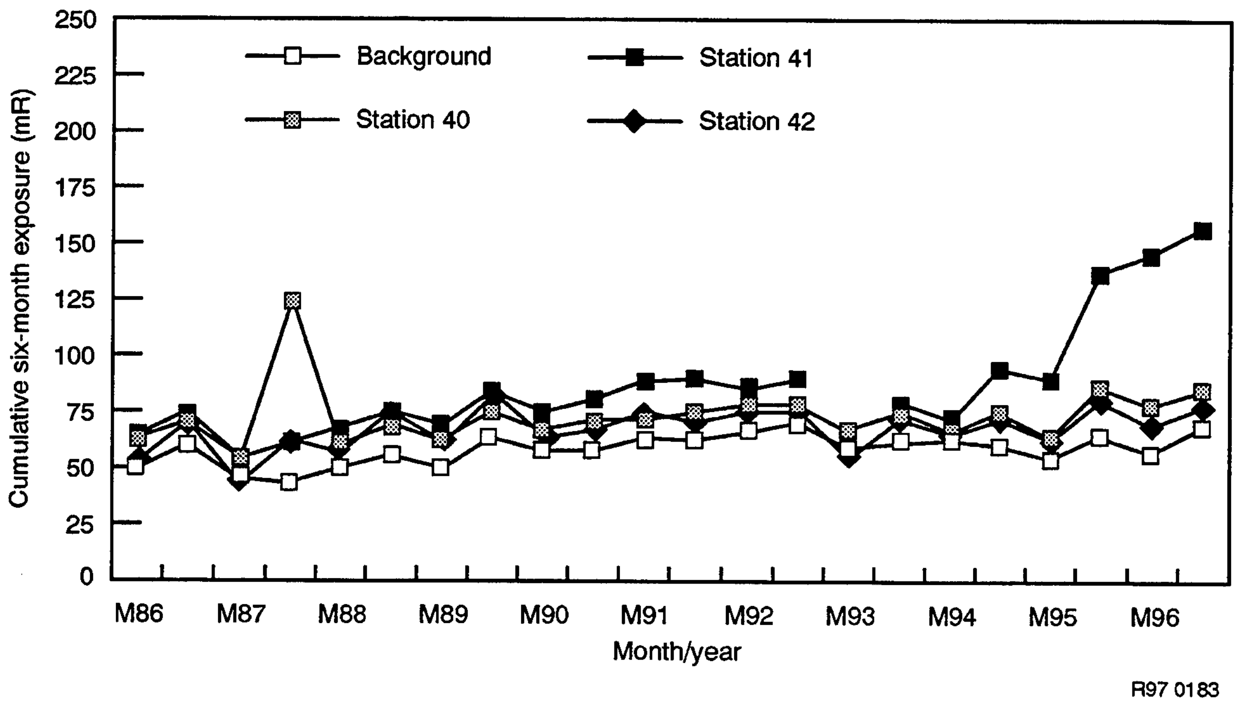


Figure 4-14. Six-month exposures measured by TLDs on the east and northeast borders of TSA (R970183).

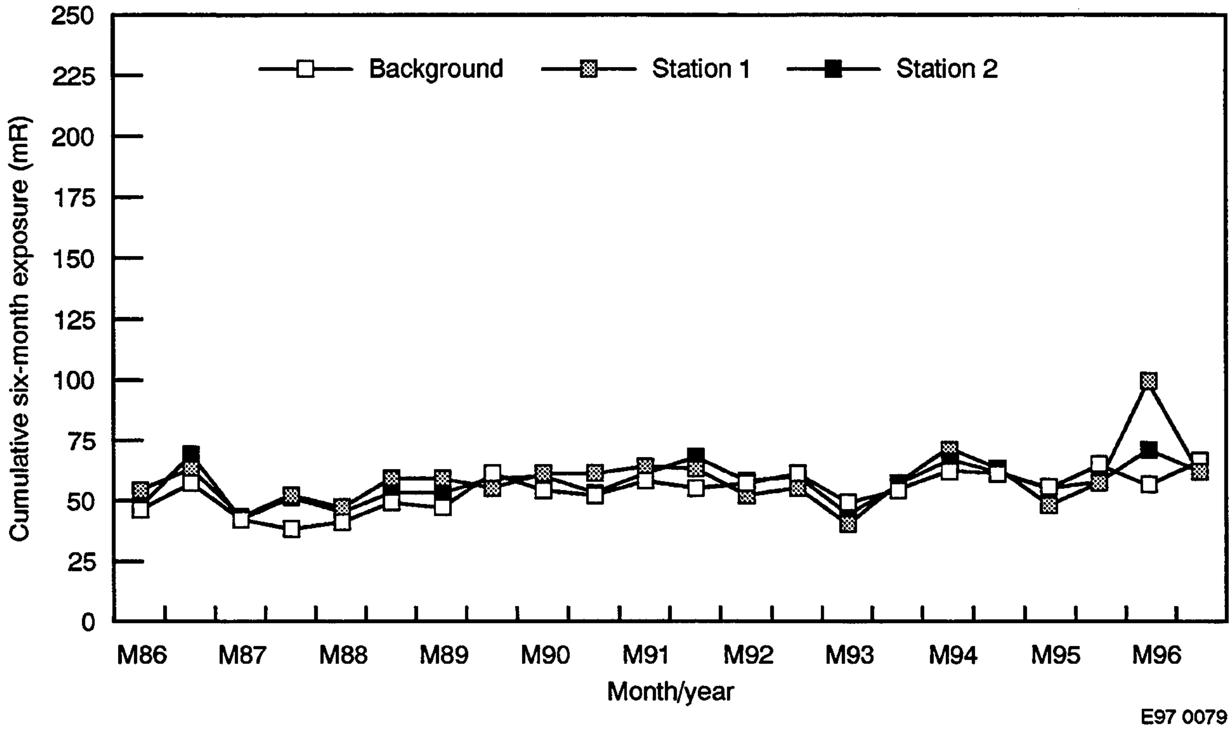


Figure 4-15. Six-month exposures measured by TLDs located 500 and 400 m northeast of WERF (E970079).

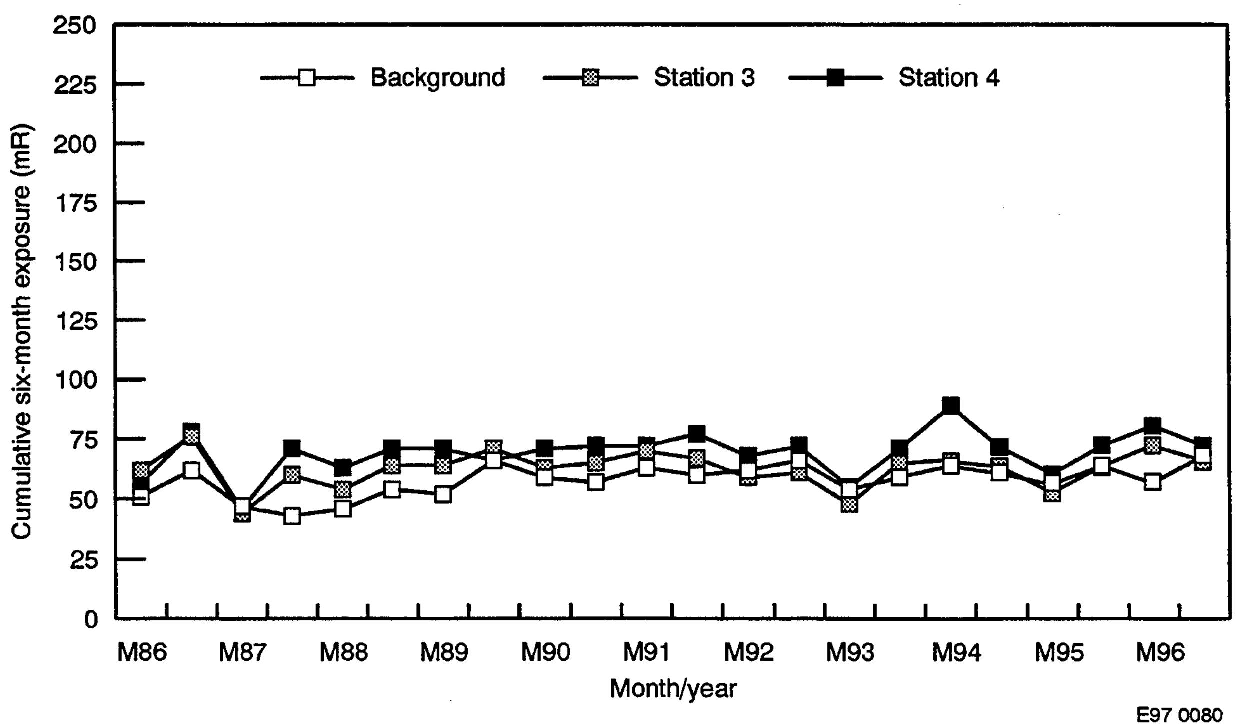


Figure 4-16. Six-month exposures measured by TLDs located 300 and 200 m northeast of WERF (E970080).

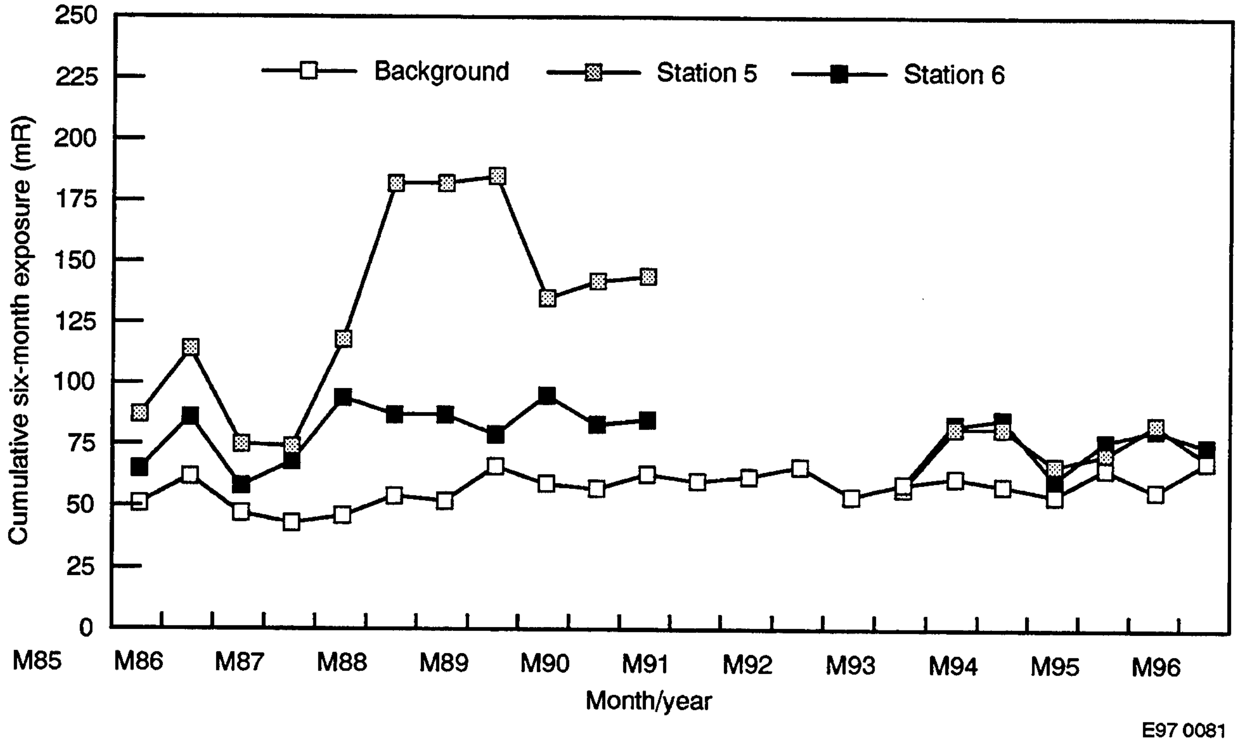


Figure 4-17. Six-month exposures measured by TLDs located northeast and southeast of the 50-m perimeter around WERF (E970081).

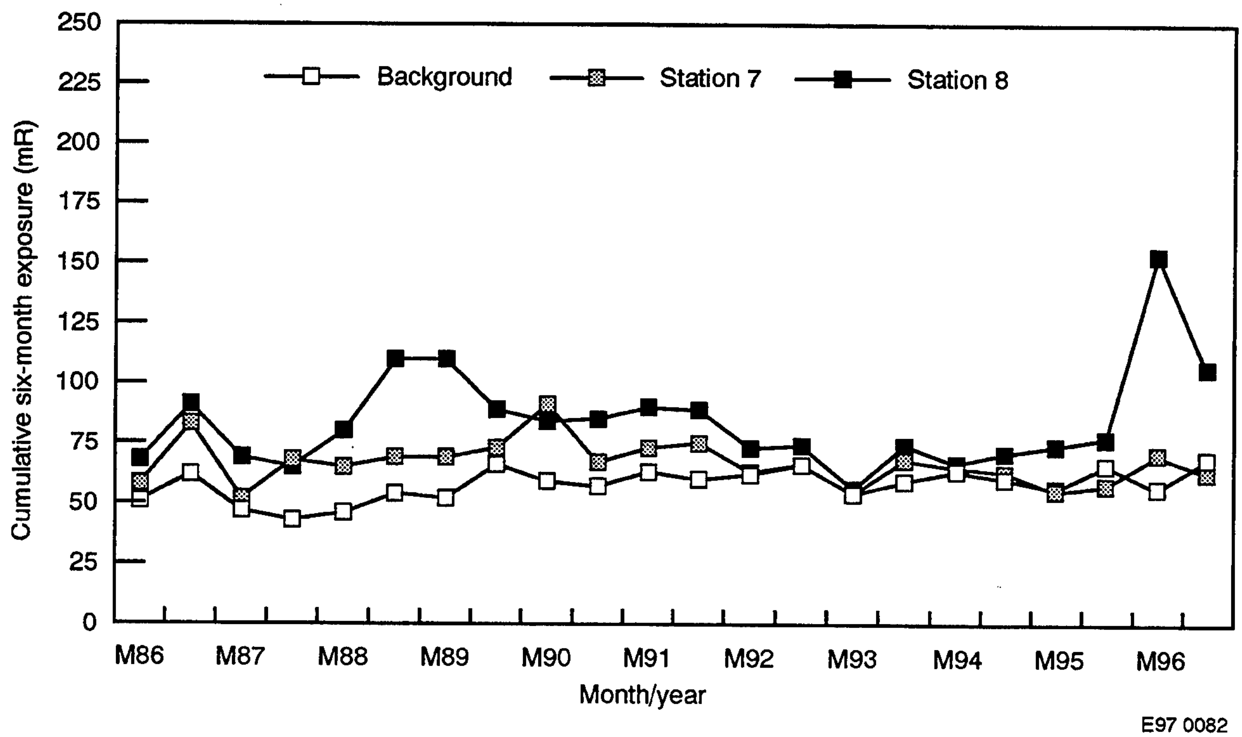


Figure 4-18. Six-month exposures measured by TLDs located southwest and northwest of the 50-m perimeter around WERF (E970082).

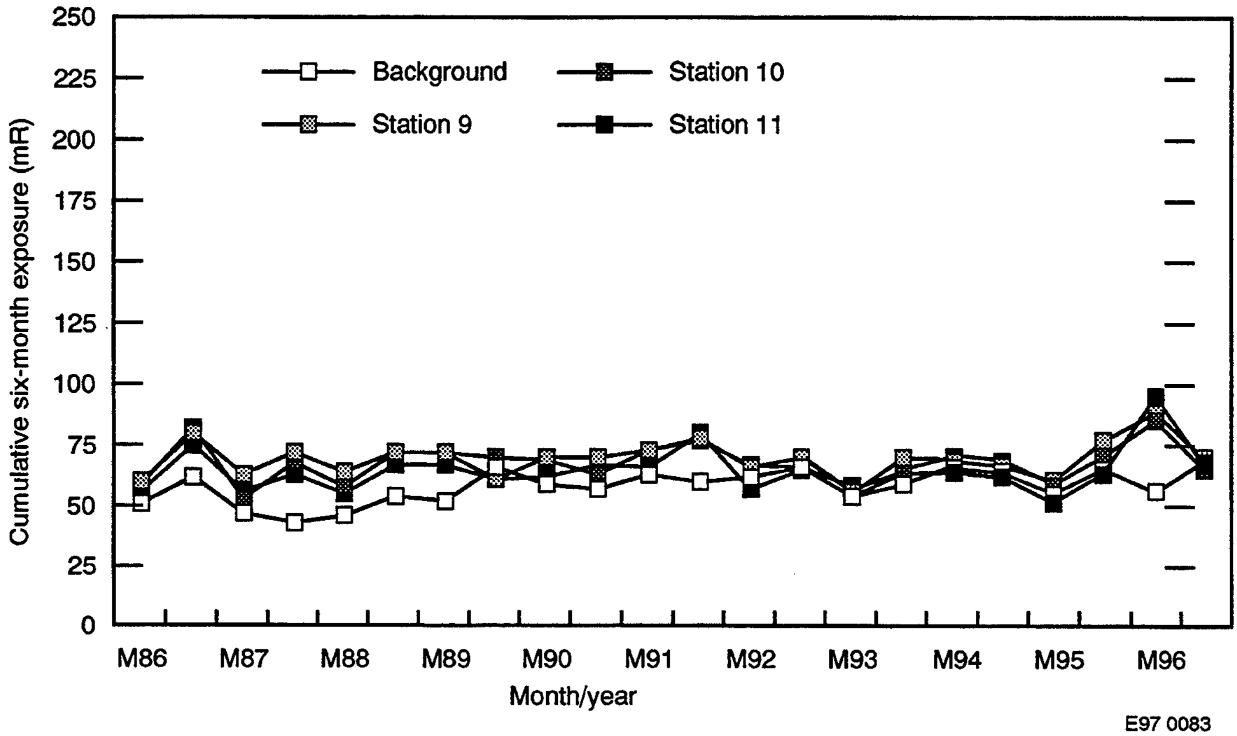


Figure 4-19. Six-month exposures measured by TLDs located northwest, southwest, and southeast of the perimeter around WERF (E970083).

Figures 4-15 and 4-16 show the exposures measured at Stations 1, 2, 3, and 4, which are located northeast of WERF along the predominant wind direction. Figures 4-17 and 4-18 show the exposures measured at Stations 5, 6, 7, and 8, which are located 50 m (55 yd) from WERF in the following directions, respectively: northeast, southeast, southwest, and northwest. An increase in exposure levels at all the WERF stations was seen in the first reporting period. Stations 5 and 8 are located near an area where waste is stored prior to processing. Variability in exposures is caused by the different amounts of waste stored in those areas. This accounts for the increase in exposures at all stations, especially 5 and 8, during 1996. Waste stored adjacent to Station 8 was removed during the second half of 1996. All stations, except Station 8, returned to near background levels during the second reporting period of 1996.

Figure 4-19 shows the exposures measured at Stations 9, 10, and 11, which are located 400 m (437 yd) from the WERF area in the following directions, respectively: northwest, southwest, and southeast. The exposures at each of these stations have remained fairly consistent over time and remain consistent with background exposures. These stations also showed a slight increase during the first reporting period; however, levels returned to at or near background during the second reporting period.

4.1.5 Surface Radiation

Annual radiation surveys have been conducted semi-annually since 1978. The surveys are useful in detecting soils that have become contaminated with gamma-emitting nuclides. Areas with high radiation fields are corrected by RWMC operational personnel, usually by adding soil cover.

The specific objectives of direct radiation monitoring are to (a) identify areas of surface contamination at the INEEL, (b) characterize direct radiation levels at specific points of interest at INEEL waste management facilities, and (c) detect and report significant trends in measured levels of direct radiation.

To conduct the surface gamma-radiation surveys, a vehicle-mounted, global positioning radiometric scanner (GPRS) using plastic scintillation detectors was mounted 0.9 m (3 ft) above the ground on the front of a four-wheel-drive vehicle (Figure 4-20). The vehicle was driven at approximately 5 km/h (3 mph) across each area.

4.1.5.1 Data Summary and Assessment. The maximum concentration of 0.20 mR/h at OMRE was lower than radiation levels found during previous area surveys, and no new areas with activity above background were identified (Figure 4-21). The measurements were close to background levels and comparable to historical values.

The radiation readings of the 1996 spring and fall surveys at the RWMC are shown in Figures 4-22 and 4-23. The maximum activity for the RWMC spring survey was 0.94 mR/h at 0.9 m (3 ft), which was along Soil Vault Row 7.

The maximum activity for the fall survey was 1.58 mR/h at 0.9 m (3 ft) and was at the same location as the maximum activity identified in the spring survey along the Soil Vault Row 7. As expected, activity levels increased during the fall survey due to a decrease in soil moisture.

Pad A cannot be surveyed using the GPRS vehicle due to facility driving restrictions. Therefore, no GPRS data for Pad A are plotted in either figure. Pad A was traversed with a hand-held HHD-440, which does not have global positioning capability. No area was noted above background levels at Pad A during either survey. During the fall survey, an area adjacent to Pad A was not surveyed due to mechanical error on the global positioning system relay network at Howe Peak. Weather conditions would not permit completion of the survey in this area.

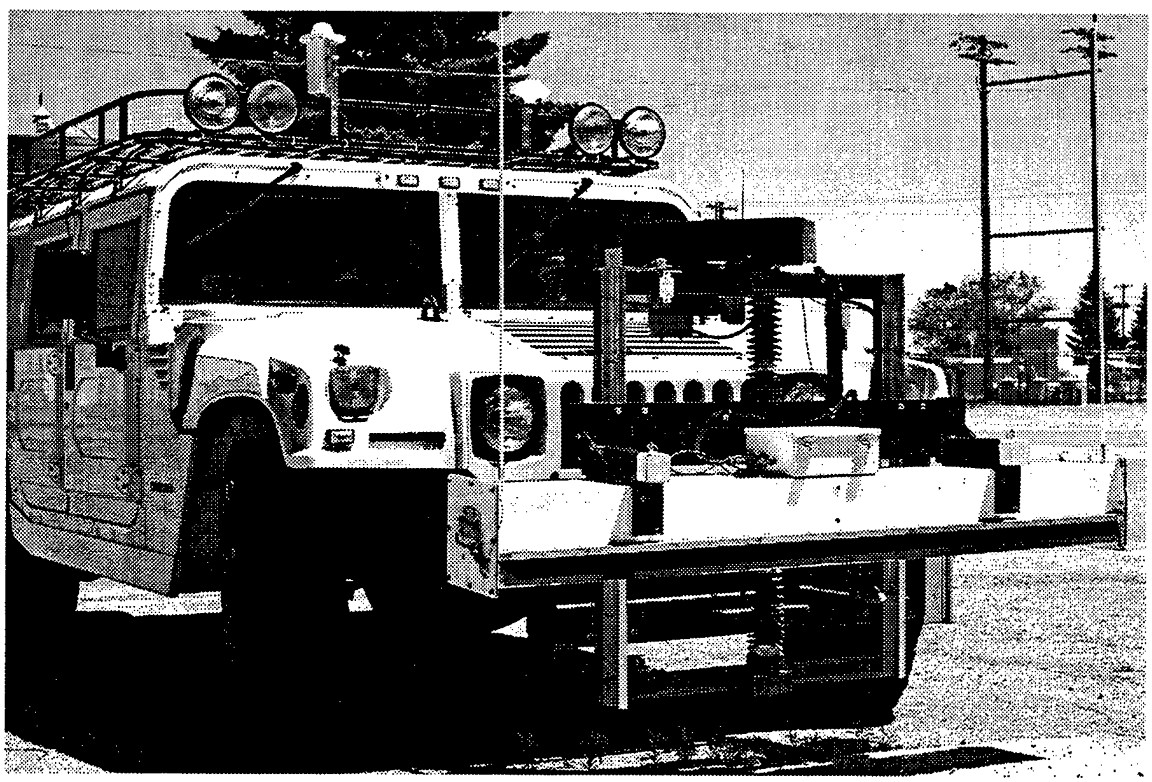


Figure 4-20. Global positioning radiometric scanner system (CD971365).

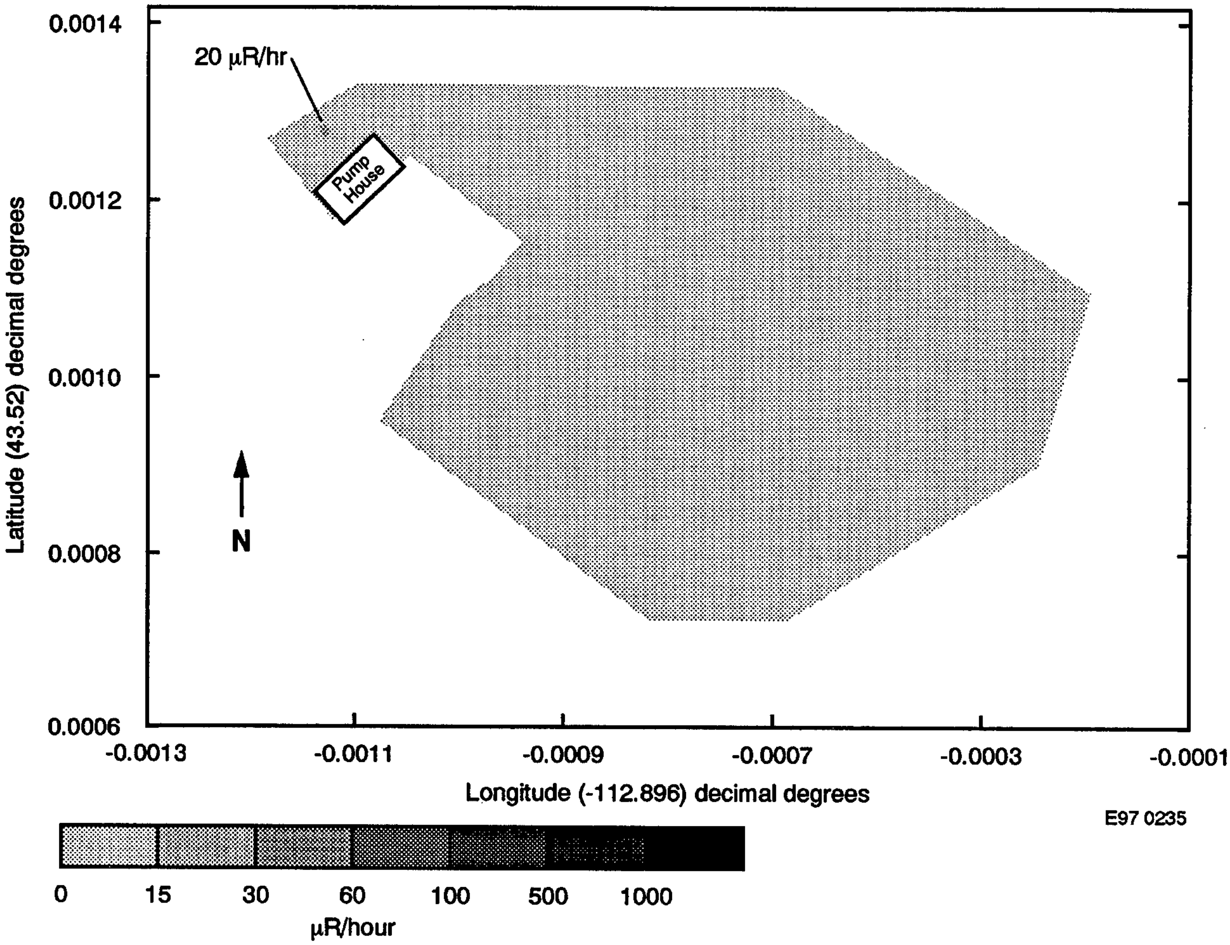


Figure 4-21. OMRE surface gamma radiation survey area (E970235).

No new areas were identified during either the spring or fall survey that had not already been identified in earlier surveys, and activities detected were comparable to historical references for the same locations.

The SL-1 area location is shown in Figure A-3. Due to remedial action of capping the area, no surveys were performed at SL-1 in 1996. A long-term engineering barrier was installed over the burial site to provide shielding from direct radiation, to inhibit contaminant migration, and to limit intrusion.

4.1.6 Surface Water Runoff

Surface water runoff is collected to determine if radionuclide concentrations exceed alert levels or if concentrations have increased significantly, which could indicate confinement failure.

The specific objectives of the surface water sampling activities are to (a) determine concentrations of radionuclides in any surface water leaving INEEL waste management facilities, (b) report comparisons of measured concentrations against reference levels based on DCGs for the public given in DOE Order 5400.5, and (c) detect and report significant trends in measured concentrations of radionuclides in surface waters leaving INEEL waste management facilities.

Radionuclides could be transported outside the boundaries of the RWMC via surface runoff. Surface runoff occurs at the SDA only during periods of rapid snow melt or heavy precipitation. At these times, water may be pumped out of the SDA into a drainage canal. Water also runs off the asphalt pads around

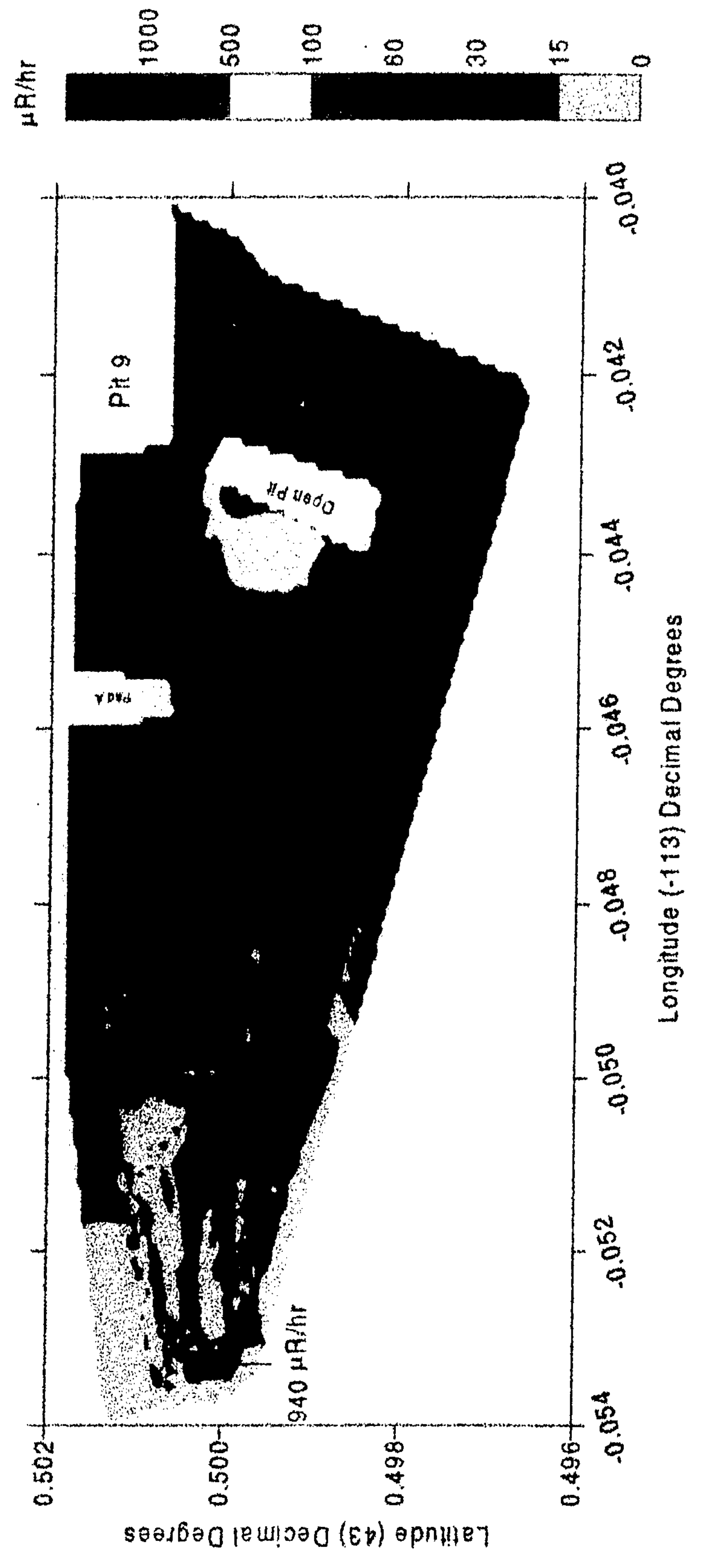


Figure 4-22. Results of 1996 spring RWMC surface radiation surveys.

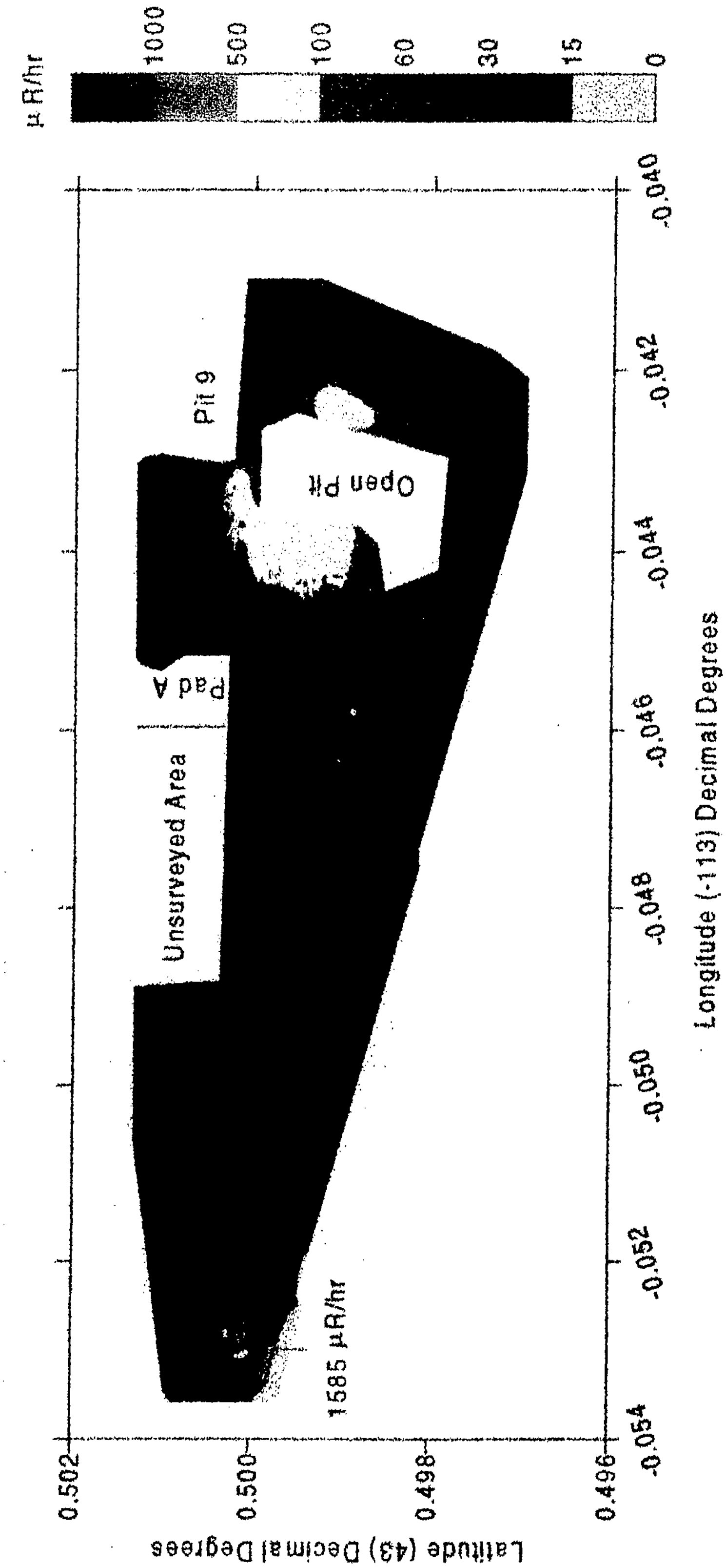


Figure 4-23. Results of 1996 fall RWMC surface radiation surveys.

TSA and into drainage culverts and the drainage canal, which direct the flow outside the RWMC. The canal carries outside runoff that has been diverted around the RWMC. Ponding of the runoff in a few low areas may increase subsurface saturation, enhancing subsurface migration.

At WERF, runoff water samples are collected from the seepage basins (Figure 4-24) to provide an indication of contamination releases from stored waste.

Two control locations, 2.0 km (1.24 mi) north of the RWMC, are sampled. The control location for TSA and WERF samples is located on the west side of the rest rooms at the Lost River Rest Area, and the control location for SDA is 1.5 km (0.93 mi) west on U.S. Highway 20 from the Van Buren Boulevard intersection and 10 m (33 ft) north on T-12 access road.

Each surface water sample is collected in a 4-L polyethylene container. Ashless filter paper and concentrated nitric acid is added, and the container is then sealed and dated. The Radiation Measurements Laboratory analyzes the samples for gamma spectrometry, which is performed on both liquid and particulate fractions. Detection limits for specific radionuclides, including those most likely to be found at the RWMC, are listed in Tables D-1, D-2, and D-3.

The DCGs are used only as a convenient means of relating concentrations in continuous effluents to exposure guidelines. In addition, other DOE facilities generally only compare results from permanent surface waters (i.e., lakes, rivers, and springs) with DCGs. Comparison of individual measurements to the DCGs gives the maximum dose a person could receive at the location where the sample was collected, given the following two assumptions:

- The concentration was at the DCG level continuously for the entire year.
- The person receiving the exposure was at that location for the entire year, continually drinking the water or inhaling the air.

4.1.6.1 Data Summary and Assessment. Surface water runoff samples were collected during all quarters of 1996 at the RWMC. Cs-137 was the only man-made, gamma-emitting radionuclide detected in samples collected from the SDA in the second quarter and at TSA-2 in the third and fourth quarters. The maximum concentration was 3.7 ± 0.9 E-8 μCi/mL in the second quarter sample collected from the SDA. Cs-137 is commonly detected in environmental samples collected at the RWMC and is usually at or near background levels. This concentration represents 1.2% of the DCG for water releases of Cs-137 to the public.

In the fall of 1994, RESP began collecting quarterly surface runoff samples at the WERF seepage basins (Figure 4-24). Samples were collected from the WERF seepage basins during all four quarters in 1996. No specific radiochemical analyses were performed on these samples since no source term exists at WERF for these nuclides. Cs-137 was detected in samples collected from all locations at WERF. The maximum concentration was 1.5 ± 0.4 E-9 μCi/mL. This sample was collected at the south basin and represents 0.05% of the DCG. These concentrations are comparable to historical values and other monitoring results from water samples collected at the INEEL during 1996.

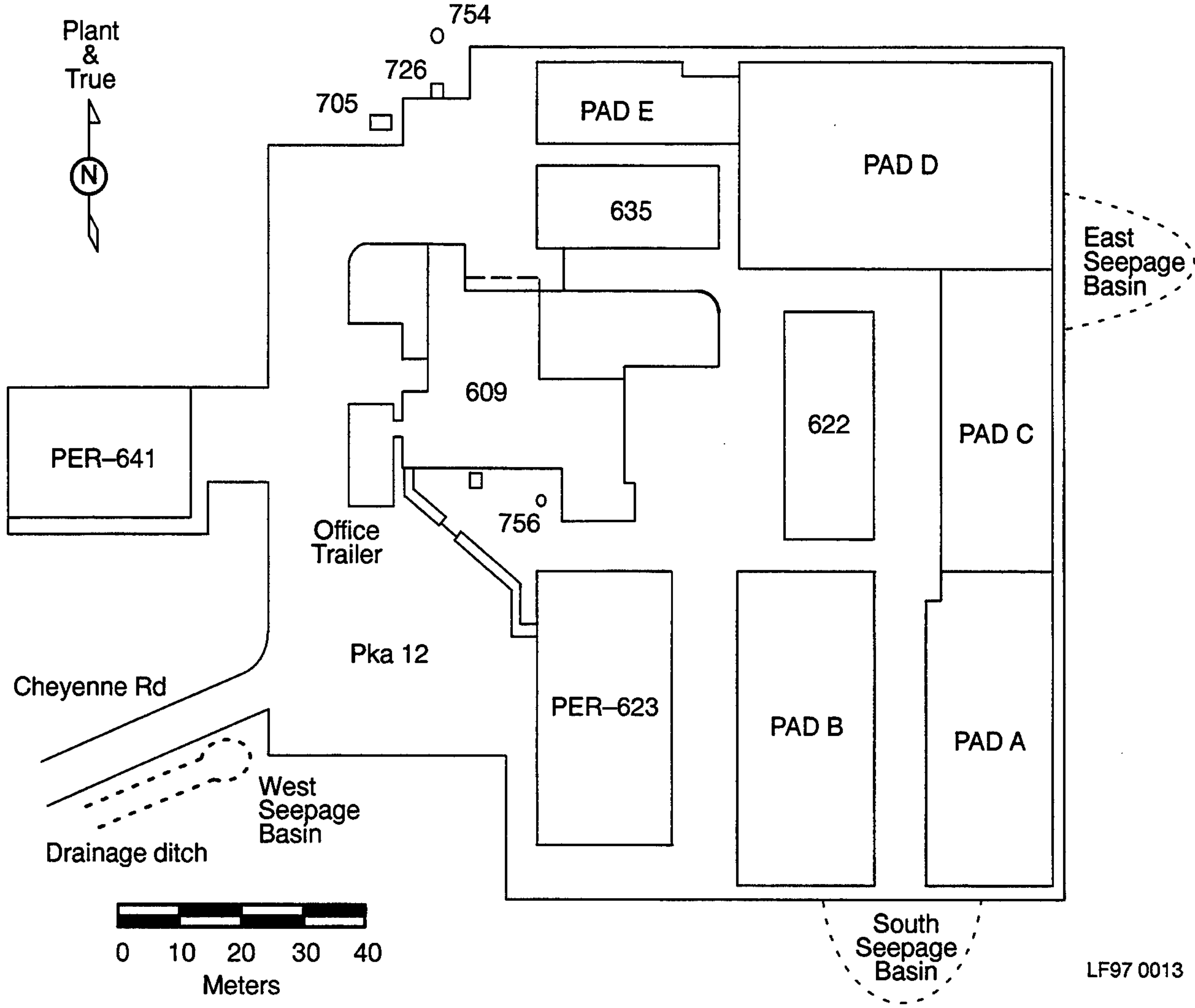


Figure 4-24. WERF surface water runoff and soil sampling locations (LF970013).

4.1.7 Surface Soils

RESP personnel sample surface soil to determine if radionuclide concentrations exceed alert levels or if an order of magnitude increase in concentrations exists, which might indicate confinement failure. These alert levels are not compliance requirements but are used as indicators of potential migration of radionuclides or loss of confinement integrity.

The specific objectives of the surface soil sampling activities are to determine concentrations of radionuclides in soils within the vicinity of INEEL waste management facilities and to detect and report significant trends in measured concentrations of radionuclides in soils. Surface soil sampling activities are conducted at RWMC, SWEPP, and WERF.

Benchmark concentrations serve as a basis for interim alert levels for radionuclides in soils.[7] Benchmark concentrations of radionuclides are defined as those concentrations which, if present in the soil, would contribute a maximum dose of 100 mrem/yr above background to individuals, assuming 50 years of continuous exposure in a homestead scenario.

Surface and near-surface soils at the RWMC have become contaminated as a result of the past flooding of open pits, waste handling, and intruding biota. Of particular concern is the presence of Pu-239/240 and Am-241 deposited in surface soils inside and outside of the northeast corner of the SDA during flooding events.[23] Wind, water, and biota could transport contaminated soil particulates outside of the RWMC boundaries.

At each sampling station, a soil sample is collected at each of the four corners of a 10 × 10-m (approximately 11 × 11-yd) square and at the center of the square. A stainless-steel sampling ring and scoop are used to collect a 12-cm (4.7-in.) diameter × 5-cm (2-in.) deep sample from these soils. The samples are combined to form a single composite sample. The composite samples are then dried, weighed, homogenized (ball-milled), screened through a number 35 sieve, and then analyzed by gamma spectrometry, and selected samples are submitted for radiochemistry. Specific radionuclides that are most likely to be detected and their detection limits are listed in Tables D-1 and D-2.

4.1.7.1 Data Summary and Assessment. During 1996, RESP collected soil samples from 11 WERF locations as shown in Figure A-16. Control samples for WERF are collected near the Main Gate, Building 603 (Figure A-10). Only one gamma-emitting radionuclide, Cs-137, was detected in the WERF soil samples. The maximum concentration collected at Location 9 was 6.8 ± 0.4 E-01 pCi/g. This concentration is consistent with previous samples collected at WERF and is within the range of concentrations that is attributable to historical fallout.

4.1.8 Quality Assurance/Quality Control

During 1996, an unusually high number of positive Sr-90 results reported in the RESP sampling media triggered an investigation of the analytical laboratory's sample preparation and data handling procedures. Additional samples of air, water, and soil were collected and analyzed with blind QA/QC and blank samples in an effort to identify the reason for high Sr-90 results during 1996. The laboratory determined the possible cause may have been the presence of some very short-lived natural radon daughters. This phenomenon was discovered while running laboratory and program blanks. As a result, the laboratory procedures have been modified to ensure credibility of Sr-90 data. Because this problem adds counts and cannot reduce them, only positive results are suspect and all negative results remain credible.

Spiked samples submitted, with the exception of the Sr-90 discussed above, demonstrated acceptable agreement ratios with spiked values for all other radionuclides. In most cases, all media showed unacceptable agreement ratios for Sr-90. Analytical results for laboratory blanks and blank samples submitted by the RESP contained several positive detections for Sr-90. For these reasons, Sr-90 data are considered questionable and have been reported separately in Table 4-6.

The radiochemical analyses of all samples, with the exception of the analysis for Sr-90, met the RESP objective for accuracy.

CY-1996 data are presented in the *Radiation Measurements Laboratory Quality Assurance and Quality Control Report for 1995/1996*[24] for both Environmental Measurements Laboratory and Environmental Monitoring System Laboratory results. With few exceptions, the laboratories met the performance objectives specified by the Environmental Measurements Laboratory and Environmental Monitoring System Laboratory. The Environmental Measurements Laboratory results are also available in the *INEEL Site Environmental Report for Calendar Year 1996.*[19]

Table 4-6. Summary of Sr-90 analyses[a] for air.

Facility	Location	Quarter	Concentration (E-15 μCi/mL)[b]	% DCG
RWMC	11.3	First	0.29 ± 0.06	0.003
RWMC	9.3		0.12 ± 0.04	0.001
RWMC	21.3		0.041 ± 0.032	0.0005
RWMC	20.3		0.025 ± 0.022	0.0003
SMC	26.3		0.022 ± 0.02	0.0002
SMC	103		0.07 ± 0.04	0.0008
RWMC	101		0.04 ± 0.04	0.0005
RWMC	15.0 (control)		0.037 ± 0.18	0.0004
RWMC	15.3 (control)		0.033 ± 0.022	0.0004
RWMC	11.3	Second	0.09 ± 0.04	0.001
RWMC	12.3 (blank)		0.15 ± 0.04	0.002
SMC	104		0.039 ± 0.038	0.0004
SMC	105		0.06 ± 0.04	0.0007
RWMC	19.3	Third	0.91 ± 0.52	0.01
RWMC	11.3		0.5 ± 0.4	0.006
RWMC	20.3		0.081 ± 0.04	0.0009
RWMC	20		0.039 ± 0.034	0.0004
RWMC	26		0.036 ± 0.028	0.0004
RWMC	6.3		0.026 ± 0.026	0.0003
RWMC	2		0.023 ± 0.022	0.0003
RWMC	2.3		0.0065 ± 0.004	0.00007
RWMC	12.3		0.028 ± 0.04	0.003
RWMC	15		0.19 ± 0.04	0.002
RWMC	15.3		0.069 ± 0.052	0.0008
RWMC	26.3	Fourth	0.045 ± 0.038	0.0005
RWMC	4.2		0.037 ± 0.038	0.0004
RWMC	20		1.8 ± .012	0.02
RWMC	12.3 (blank)		0.085 ± 0.056	0.0009

a. Caution should be exercised when using the Sr-90 data because the data are questionable.

b. Uncertainties are reported as 2 sigma.

4.2 Site Environmental Surveillance Program

The SESP complies with requirements for environmental surveillance contained in DOE Order 5400.1, Chapters II and IV,[3] and DOE 5400.5, Chapters II and III.[7] As specified in Section 5 of Chapter IV, environmental surveillance programs and their components are "determined on a site-specific basis by the field organizations." Consequently, the SESP mission does not include all aspects of environmental surveillance, but only those components that have been identified by the DOE-ID Environmental Programs as appropriate to the operations at the INEEL.

4.2.1 Program Design Basis

During normal operations at INEEL facilities, some radioactive and nonradioactive materials are released to the environment. These materials may be transported by various environmental processes from the site to nearby populations. Environmental transport through the atmosphere directly results in exposure of people offsite. Exposure may also occur indirectly from radionuclides deposited in soil or taken up by plants or animals. The SESP is responsible for conducting environmental surveillance onsite, and Table 4-7 summarizes the program activities.

The transport pathways are ranked in terms of relative importance according to four criteria: (a) mechanism of transport, which is considered to be either direct or indirect in terms of transporting contaminants to a human receptor, (b) amount of contaminant that could potentially be transported, (c) the rate at which the contaminant could be transported to the receptor point, and (d) the duration of the exposure to the contaminant by each transport pathway.[25]

The results of the ranking analysis, shown in Table 4-8, indicate that air is the most important transport pathway. It is considered more important than the groundwater pathway because air has the potential to transport a large amount of activity to the receptor in a relatively short time period. The biota pathway is ranked higher than the surface water pathway because there is seldom any surface water on the INEEL that could transport contaminants to offsite receptors. The biota and surface water pathways are both seasonal and intermittent, and neither are considered to be significant transport pathways to onsite or offsite receptors.

4.2.2 Ambient Air

The specific objectives of the ambient air monitoring activities are to (a) determine the concentration of airborne radionuclides in ambient air at the INEEL; (b) compare measured concentrations of radionuclides to reference levels based on applicable DCGs; (c) compare measured concentrations of nonradiological parameters to appropriate standards or regulatory limits; (d) conduct an ambient air monitoring program to determine concentrations of selected criteria pollutants as required by INEEL air permits; (e) detect and report significant trends in measured concentrations of airborne radionuclides; and (f) measure the ambient air concentrations of radionuclides in the event of a nonroutine or unmonitored release.

Ambient air results are evaluated to determine if radionuclide concentrations exceed alert levels and to detect significant increases that might indicate confinement failure. High-volume air monitors draw approximately 1,416 L/min (50 ft^3/min) through a 10-cm (4-in.) diameter polyester needled-felt filter. High-volume air monitors were used to collect filter samples each work day, counting the gross-gamma emissions and plotting a decay curve. Due to the *1994 Monitoring Activities Review*[26] recommendation,

Table 4-7. Summary of the Site Environmental Surveillance Program activities.

Sample Type	Analyses	Collection Frequency	Locations: Distant	Locations: INEEL (Onsite)
Air-Low Volume (Particulate)	Gross Alpha	Weekly	Blackfoot, Craters of the Moon, Idaho Falls, Rexburg	ANL-W, ARA, CFA, EBR-I, TAN, TRA, RWMC, ICPP, EFS, Van Buren, PBF, NRF
	Gross Beta	Weekly	Blackfoot, Craters of the Moon, Idaho Falls, Rexburg	ANL-W, ARA, CFA, EBR-I, TAN, TRA, RWMC, ICPP, EFS, Van Buren, PBF, NRF
	Gamma Spectrometry	Quarterly	Blackfoot, Craters of the Moon, Idaho Falls, Rexburg	ANL-W, ARA, CFA, EBR-I, TAN, TRA, RWMC, ICPP, EFS, Van Buren, PBF, NRF
	Transuranics[a]	Quarterly	Blackfoot, Craters of the Moon, Idaho Falls, Rexburg	ANL-W, ARA, CFA, EBR-I, TAN, TRA, RWMC, ICPP, EFS, Van Buren, PBF, NRF
	Particulate	Quarterly	Blackfoot, Craters of the Moon, Idaho Falls, Rexburg	ANL-W, ARA, CFA, EBR-I, TAN, TRA, RWMC, ICPP, EFS, Van Buren, PBF, NRF
Air-Low Volume (Cartridge)	I-131 (Gamma Screen)	Weekly	Blackfoot, Craters of the Moon, Idaho Falls, Rexburg	ANL-W, ARA, CFA, EBR-I, TAN, TRA, RWMC, ICPP, EFS, Van Buren, PBF, NRF
Air-High Volume[b]	Gross Gamma	Daily	NA[c]	EFS, CFA
	Gamma Spectrometry	Monthly	NA	EFS, CFA
Air-NO_x	NO_x	Continuously	NA	EFS, Van Buren
Air-SO_2	SO_2	Continuously	NA	Van Buren
Air-Moisture	Tritium	4 to 13 weeks	NA	EFS, Van Buren
Soil	Gamma Spectrometry	Annually	NA	Each major facility[d] once every seven years.
	Transuranics	Annually	NA	Each major facility once every seven years.
Direct Radiation	TLD[e]	Semiannually	Aberdeen, Arco, Atomic City, Blackfoot, Craters of the Moon, Howe, Idaho Falls, Minidoka, Monteview, Mud Lake, Reno Ranch, Rexburg, Roberts	ANL-W, ARA, CFA, EBR- I, TAN, TRA, RWMC, ICPP, EFS, Van Buren, PBF, NRF
	Surface Surveys	Annual	NA	Each perimeter of the major facilities every three years

a. Transuranics—Am-241, Pu-238, Pu-239/240; and Sr-90 is also included.

b. High-volume air was discontinued September 1, 1996, as per recommendations in the Monitoring Activities Review.

c. NA—not applicable.

d. Major facilities includes ANL-W, ARA, CFA, ICPP, NRF, PBF, RWMC, TAN, and TRA.

e. TLDs—Thermoluminescent dosimetry.

Table 4-8. Relative ranking of pathways at the INEEL.

Pathway	Mechanism	Amount	Rate	Duration	Rank[a] (Relative Importance)
Air	Direct	Large	Fast	Intermediate	1
Groundwater	Indirect	Large	Slow	Long	2
Biota	Indirect	Small	Slow	Short	3
Surface Water	Indirect	Small	Slow	Short	4

a. 1 = most important
4 = least important.

the high-volume air monitors were discontinued on September 1, 1996. Prior to the first of September, the slope of the lower portion of the decay curve was compared on the filters to the slope of a curve for Pb-212, a natural radionuclide, to determine if there were any measurable amounts of man-made, gamma-emitting radionuclides in the sample. The filters were composited for one month and then analyzed using gamma spectrometry.

A second method of air monitoring involves the weekly collection of filters from a network of low-volume air monitors. Each low-volume air monitor maintains an average air flow of about 57 L/min (2 ft^3/min) through a set of filters consisting of a 1.2 μm pore membrane filter followed by a charcoal cartridge. The filters are 99% efficient for airborne particulate radioactivity and airborne iodides. These filters are analyzed weekly for gross alpha and gross beta screening then composited quarterly by location. They are then analyzed using gamma spectrometry and specific alpha- and beta-emitting radionuclide analyses. In addition to the particulate filter, charcoal cartridges are collected and analyzed weekly by gamma spectrometry.

In the tritium monitors, air passes through a column of silica gel at a rate of approximately 18.4 L/hr (0.65 ft^3/hr). Water vapor in the air is absorbed by the gel in the column; columns are changed at least quarterly or when two-thirds of the indicator gel has changed color. Water extracted from the silica gel columns is analyzed by liquid scintillation.

Nonradiological constituents such as nitrogen oxides are monitored using an EPA-equivalent method at two locations on the INEEL to implement the *Ambient Nitrogen Dioxide Monitoring Plan for the INEEL*,[27] fulfilling one of the conditions specified in the "Permit to Construct, Idaho Chemical Processing Plant Nitrogen Oxide Sources."[28] Data are reported quarterly to the Site-wide Programs of DOE-ID, who forwards the reports to the State of Idaho.

Sulfur dioxide is monitored at a location that is downwind from the ICPP. These measurements are taken to confirm that the INEEL does not release significant sulfur dioxide concentrations with respect to national ambient air quality standards.

4.2.2.1 Data Summary and Assessment. The high-volume air monitor continuously sampled the air for particulate airborne radioactivity. All decay curves appeared normal, and no man-made, gamma-emitting radionuclides were identified.

The range of gross-alpha activity at the INEEL locations was 0.7 ± 12.0 E-16 to 6.0 ± 4.0 E-15 μCi/cc. The maximum concentration for each location is shown in Table 4-9. Gross-alpha concentrations for CY-1996 were, in general, typical of those measured previously. The mean gross-alpha concentrations are shown in Table 4-10. The mean quarterly concentration for most locations was highest in the third quarter. This is likely due to brush fires on and around the INEEL during this time. The fires produced additional ash and fine particulate, which may have contained naturally occurring radionuclides and fallout associated radionuclides.

Results of the gross-beta analysis of the air filters are evaluated to determine if there are any significant increases in the filter radioactivity that may require more immediate in-depth analyses by gamma spectrometry or radiochemistry. Therefore, gross-beta analysis is used as a screening tool. The results are also used to indicate any trends in environmental radioactivity. The range of gross-beta activity at the INEEL was 4.0 ± 2.0 E–15 to 6.5 ± 0.6 E–14 μCi/cc. Due to the meteorological conditions, high concentrations historically have been observed during January and February. Consistent with this historical trend, the January 3rd concentrations were the highest. The maximum concentration represented 0.72% of the DCG. The highest mean concentrations were detected in the third quarter (Table 4-11). This is consistent with the gross alpha quarterly mean data and is likely attributable to fires in and around the INEEL.

Besides Be-7, which is naturally occurring and appears in nearly all of the quarterly particulate filter composites analyzed, no other gamma-emitting radionuclides were detected.

TRA had the only positive detection of I-131 on a charcoal cartridge, and this sample was collected the week of February 21 through 28. This concentration was 4.3 ± 2.4 E-14 μCi/cc and was only 0.01% of the DCG. This detection was attributed to an out-of-state shipment of I-131, which was received at TRA for an experiment. Upon opening the shipment in a laboratory fume hood, it was found that one of the glass ampules containing I-131 was broken. Less than 1 μCi of I-131 was released. Two laboratory personnel received small doses from the incident, but these doses were well within the radiation protection standards.

Composite filters from continuously operating air monitors are analyzed four times a year, and results are frequently below the detection limit. In general, trend information cannot be developed over a one-year period, nor is it possible to obtain information regarding the specific time of release within a single quarter since they have been composited. Specific alpha- and beta-emitting results for CY-1996 are presented in Table 4-12. Pu-239/240 and Sr-90 were the only radionuclides detected. However, Sr-90 data are questionable due to the laboratory problem discussed in Section 4.1.8 and are further discussed in Section 4.2.5. The maximum concentration of Pu-239/240 was collected from the RWMC, and this concentration is most likely due to the resuspension of soil in the previously flooded area. The remaining three concentrations were either at or below the stated detection limit.

The suspended particulate dust burden is monitored using the same low-volume filters used to collect the radioactive particulate samples. There is no requirement to monitor the dust burden at the INEEL, but it is included in the program to provide comparison information to both SESP and DOE-ID.

Results for the 1996 annual mean of the quarterly total suspended particulate concentrations are shown in Table 4-13. Higher particulate concentrations were found at the distant and boundary locations than on the INEEL. The largest source of airborne particulates in the vicinity of the INEEL is considered to be resuspended dust from high winds and the local agricultural operations.

Table 4-9. Maximum gross-alpha concentrations for 1996 per location.

Location	Date	Maximum Concentration[a] (E-15 μCi/cc)
ANL-W	1/3	3.3 ± 1.8
ARA	8/14	4.8 ± 2.6
CFA	9/4	3.8 ± 2.0
EBR-I	7/10	6.0 ± 4.0
EFS	8/14	2.9 ± 2.0
EFS	11/13	2.9 ± 2.0
ICPP	3/27	2.4 ± 2.2
NRF	9/4	3.2 ± 1.8
PBF	9/4	5.8 ± 3.0
RWMC	8/28	2.4 ± 1.6
TAN	3/27	5.3 ± 2.4
TRA	11/13	2.8 ± 1.8
VANB	9/4	4.1 ± 2.4

a. Uncertainties shown are the associated 2 sigma uncertainty.

Table 4-10. Quarterly mean gross-alpha concentrations for 1996 per location.

Location	1st Quarter Concentration (E-15 μCi/cc)	2nd Quarter Concentration (E-15 μCi/cc)	3rd Quarter Concentration (E-15 μCi/cc)	4th Quarter Concentration (E-15 μCi/cc)	Annual Concentration (E-15 μCi/g)	% of DCG
ANL-W	1.06	1.00	1.20	0.700	1.03	5.0
ARA	0.0786	0.410	1.45	1.03	0.720	3.6
CFA	0.400	0.593	1.30	0.675	0.634	3.2
EBR-I	1.08	0.101	1.87	1.12	1.10	5.5
EFS	0.746	0.751	1.37	1.09	0.921	4.6
ICPP	0.785	0.957	1.15	1.04	0.999	5.0
NRF	0.631	0.751	1.63	1.08	0.916	4.6
PBF	0.493	0.478	1.07	1.30	0.782	3.9
RWMC	0.743	0.686	1.07	7.36	0.740	3.7
TAN	1.39	0.472	1.39	0.738	1.06	5.3
TRA	0.642	0.608	1.38	1.17	0.906	4.5
VANB	0.617	0.777	1.74	1.46	1.12	5.6
OFFSITE	0.903	1.06	1.54	1.09	1.08	5.4

Table 4-11. Quarterly mean gross-beta concentrations for 1996 per location.

Location	1st Quarter Concentration (E-15 μCi/cc)	2nd Quarter Concentration (E-15 μCi/cc)	3rd Quarter Concentration (E-15 μCi/cc)	4th Quarter Concentration (E-15 μCi/cc)	Annual Mean Concentration (E-15 μCi/cc)	% of DCG
ANL-W	19.8	16.6	24.2	20.0	20.2	0.2
ARA	21.1	14.9	25.4	23.8	21.3	0.2
CFA	23.2	18.5	25.9	21.1	22.2	0.2
CPP	21.9	17.9	23.6	26.6	22.5	0.3
EBR-I	22.4	19.1	29.0	26.8	24.3	0.3
EFS	24.1	18.0	28.2	25.9	24.1	0.3
NRF	21.8	18.6	28.6	24.4	23.4	0.3
PBF	25.2	17.8	27.5	24.4	23.7	0.3
RWMC	21.2	16.1	28.6	19.0	21.2	0.2
TAN	24.0	17.6	25.3	24.4	22.8	0.3
TRA	18.4	19.0	29.1	26.7	23.3	0.3
VANB	24.2	16.7	26.0	21.3	22.1	0.3
OFFSITE	20.7	22.6	22.6	21.3	21.8	0.2

Table 4-12. Specific alpha- and beta-emitting analyses results for 1996.

Location	Radionuclide	Quarter	Concentration[a] (E-15 μCi/cc)	% of DCG[b]
Blackfoot	Pu-239/240	First	0.0033 ± 0.0032	0.017
ANL-W	Pu-239/240	Second	0.0034 ± 0.0003	0.017
RWMC	Pu-239/240	Third	0.00548 ± 0.00374	0.030
TAN	Pu-239/240	Third	0.00268 ± 0.00252	0.009

a. Uncertainties are reported as 2 sigma.

b. The DCG value for Pu-239/240 (20 E-15) is defined in DOE Order 5400.5.

Table 4-13. 1996 annual mean for suspended particulate concentrations.

Location	Concentration ($\mu g/m^3$)
ANL-W	20.9
ARA	5.9
CFA	7.0
EBR-I	6.0
EFS	7.7
ICPP	7.2
NRF	7.2
PBF	7.5
RWMC	21.7
TAN	6.0
TRA	6.8
VANB	10.9
Blackfoot	16.0
Craters of the Moon	8.8
Idaho Falls	51.8
Rexburg	21.3

None of the atmospheric tritium samples collected at either EFS or VANB had a maximum concentration greater than or equal to two times the uncertainty (σ). All concentrations were also below the minimum detectable concentrations.

Ambient nitrogen dioxide measurements were obtained on a continuous basis at the stations located at the intersection of Van Buren Boulevard and U.S. Highway 20/26 and the EFS. The New Waste Calcining Facility at ICPP, the largest single source of nitrogen dioxide on the INEEL, did not operate during CY-1996. The mean nitrogen dioxide concentrations for 1996 at VANB and EFS were 3.2 $\mu g/m^3$ (1.6 ppb) and 8.1 $\mu g/m^3$ (4.3 ppb), respectively. These were significantly lower than the EPA national primary ambient air quality standard of 100 $\mu g/m^3$ (53 ppb). Data recovery for the year was about 97% at VANB and 79% at EFS.

A summary of the nitrogen dioxide ambient monitoring results from 1988 to 1996 at the INEEL are shown on Table 4-14. The highest annual mean concentrations were measured in 1993, and 1994 and can be correlated to the New Waste Calcining Facility operations or natural emissions. The annual mean concentrations for 1993 were 9.4 $\mu g/m^3$ (19.1 ppb) at EFS. This is the highest concentration of nitrogen dioxide observed at the EFS monitoring location since monitoring began in 1988.

Globally, emissions of nitrogen oxides from natural sources are almost 10 times greater than emissions from human-created sources. During the third quarter of 1994, the Butte City fire burned on the western border of the INEEL (Figure 4-25). The annual mean nitrogen dioxide concentrations were 15.4 $\mu g/m^3$ (8.2 ppb) at EFS and 4.9 $\mu g/m^3$ (2.6 ppb) at VANB. The maximum daily mean concentrations during the third quarter were 26.4 $\mu g/m^3$ (14.0 ppb) at EFS and 48.1 $\mu g/m^3$ (25.5 ppb) at VANB. These concentrations were measured on September 16, 1994, and September 23, respectively. The higher concentrations seen at the VANB station are attributed to the proximity of the fire and wind direction.

Table 4-14. Summary of nitrogen dioxide ambient monitoring results from 1988 through 1996.

VANB	Nitrogen Dioxide ($\mu g/m^3$)	Nitrogen Dioxide (ppb)	% of NAAQA	Calculated Maximum Site Boundary Concentration ($\mu g/m^3$)	Comments
1988	6.6	3.5	6.6	2	VANB operated 3/4 of 1988
1989	5.5	2.9	5.5	0.5	
1990	3.7	2.0	3.7	0.25	
1991	5.2	2.8	5.2	0.8	
1992	4.9	2.6	4.9	0.3	
1993	9.4	5.0	9.4	1.8	NWCF operated 2/3 of 1993
1994	4.9	2.6	4.9	0.4	NWCF did not operate
1995	3.8	2.0	3.8	0.14	Butte City Fire
1996	3.2	1.6	3.2	0.19	6 fires on and around the INEEL
EFS					
1988	0.6	0.3	0.6	2	EFS operated 1/4 of 1988
1989	3.6	1.9	3.6	0.5	
1990	8.7	4.6	8.7	0.25	
1991	7.2	3.8	7.2	0.8	
1992	12.5	6.6	12.5	0.3	
1993	36	19.1	36	1.8	NWCF operated 2/3 of 1993
1994	15.4	8.2	15.4	0.4	NWCF did not operate
1995	4.0	2.1	4.0	0.14	Butte City Fire
1996	8.1	4.3	8.1	0.19	6 fires on and around the INEEL

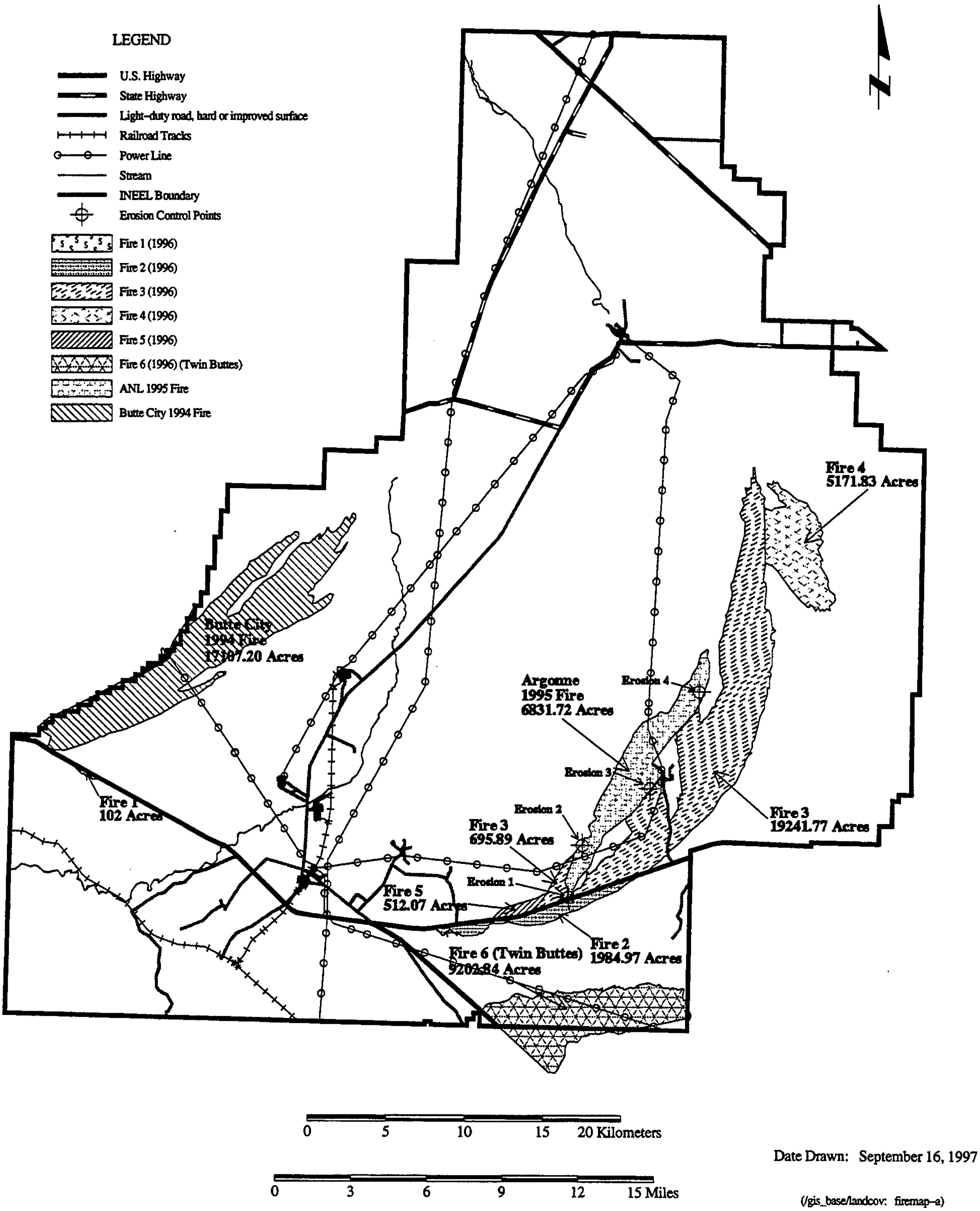


Figure 4-25. INEEL fire map.

A similar event occurred during 1996 when six fires burned on the INEEL in the third quarter. Figure 4-26 compares the quarterly mean concentration of nitrogen dioxide in 1996. The mean concentrations for 1996 were 8.1 $\mu g/m^3$ (4.3 ppb) at EFS and 3.2 $\mu g/m^3$ (1.6 ppb) at VANB. However, the maximum daily mean of nitrogen dioxide for the third quarter was 71.5 $\mu g/m^3$ (37.9 ppb) at EFS on August 3, which is approximately six times above the concentrations reported in the other quarters. The fires appear to have only a slight impact on the levels of nitrogen dioxide concentrations measured at VANB. The maximum daily mean concentration at the VANB station for the third quarter was 10.2 $\mu g/m^3$ (5.4 ppb).

The mean concentrations of nitrogen dioxide are calculated to be greater than at the nearest INEEL boundary in the direction of the prevailing winds (Table 4-14). However, even at the onsite locations, all means are well below the national primary ambient air quality standard of 100 $\mu g/m^3$.

Ambient sulfur dioxide was continuously monitored at VANB during 1996. The mean sulfur dioxide concentration was 4.02 $\mu g/m^3$ (1.51 ppb) or 5.0% of the annual primary air quality standard. The maximum daily concentration of 21 $\mu g/m^3$ (7.8 ppb) was 5.6% of the primary standard for a 24-hour period. The maximum recorded three hour average of 24 $\mu g/m^3$ (9.0 ppb) was 1.8% of the secondary standard. The analyzer operated satisfactorily for 97% of the year.

4.2.3 Direct Radiation

The specific objectives of direct radiation monitoring are to characterize direct radiation levels at the perimeter of INEEL facilities and to detect and report significant trends in measured levels of penetrating radiation.

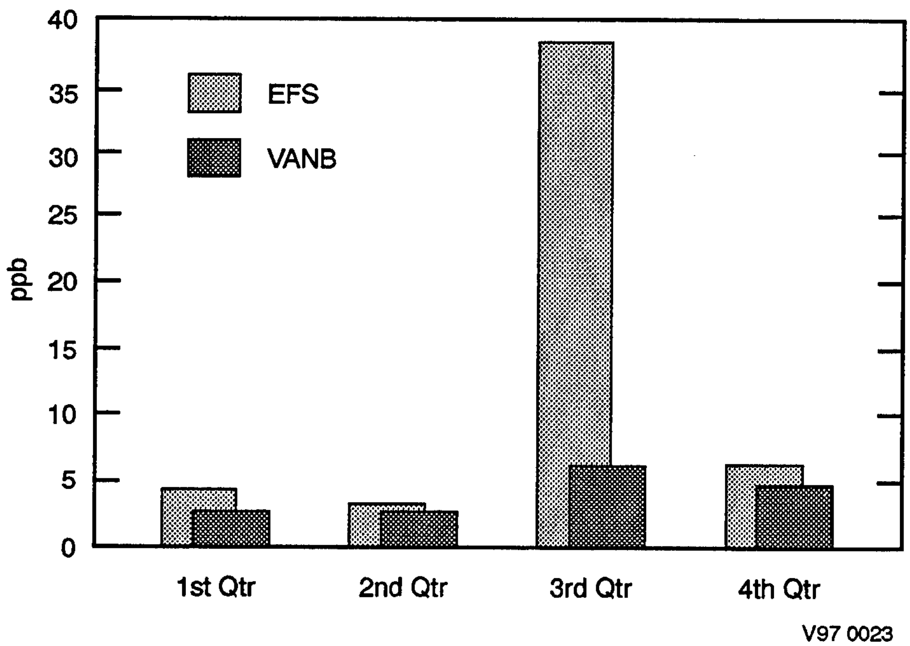


Figure 4-26. Quarterly mean concentration of nitrogen dioxide for 1996 (V970023).

The SESP maintains environmental TLD locations on the INEEL along major highways and around the perimeter fences of each major facility (Figure A-1). Results of TLD measurements (beta energies greater than 200 keV and gamma energies greater than 10 keV) are analyzed to detect trends and are directly compared to applicable standards and action levels. At each location, a dosimeter card containing five individual chips are placed 0.9-m (3-ft) above ground. The TLDs at each location are changed semi-annually. TLDs are placed at seven distant community locations, six boundary locations, and 135 locations at the various INEEL facilities.

To conduct the surface gamma-radiation surveys, a vehicle-mounted, GPRS using plastic scintillation detectors (Figure 4-20) was mounted 0.9 m (3 ft) above the ground on the front of a four-wheel-drive vehicle. The vehicle was driven at approximately 5 km/h (3 mph) across each area.

4.2.3.1 Data Summary and Assessment. The ANL-W #10 dosimeter was missing during the spring collections. During the fall collection, the following dosimeters were missing: ANL-W #10, ICPP #18, ICPP #25, ICPP #26, NRF #4, TAN/TSF #3, and Highway 26 #274.

Table 4-15 compares TLD data from the five locations with the highest measurements for 1994 through 1996. Most remaining exposures were close to background and are comparable to historical exposures.

At TRA, dosimeter #3 is adjacent to the former radioactive disposal pond that has been drained and covered with clean soil. It is also in close proximity to a radioactive material storage area. Other dosimeters (e.g., ICPP #20 and TRA #11) are also located in the vicinity of radioactive material storage areas. At ARA (dosimeter #3) and ICPP (dosimeter #9), slightly elevated exposures resulted from soil contamination.

Three high exposures were identified during the fall collection for which no known source was identified. These locations were the RWMC 17a, RWMC 23a, and Highway 20 mile marker 276. These locations will be monitored closely to see if a trend develops.

Triennial gamma radiation surveys around the perimeter of INEEL facilities, annual surveys in contaminated soil areas, and annual surveys of major INEEL roadways were conducted in 1996 to document gamma radiation levels using the GPRS system. No abnormalities were noted during any of the surveys, and levels were comparable to historical levels.

Table 4-15. Comparison of the highest average concentration of TLD data from 1994 through 1996.

	Exposure $\pm$ 2 σ (mR)		
Location	1994	1995	1996
ARA 3	241 $\pm$ 13	207 $\pm$ 13	198 $\pm$ 8
ICPP 9	202 $\pm$ 8	—[a]	283 $\pm$ 18
ICPP 20	217 $\pm$ 9	236 $\pm$ 9	251 $\pm$ 13
TRA 3	—[a]	295 $\pm$ 11	345 $\pm$ 16
TRA 11	148 $\pm$ 5	151 $\pm$ 4	194 $\pm$ 6

a. Dosimeters missing at collection time.

4.2.4 Soil Sampling

The specific objectives of the SESP soil sampling activities are to determine present concentrations of radioactivity in soil (natural and fallout), assess any buildup of radioactivity due to INEEL operations, and detect and report significant trends in measured concentrations of radionuclides in soil.

Soil samples are composited from five cores within a 1-m^2 (10.8-ft^2) area. Each core has a cylinder of 10-cm (4-in.) diameter and 5-cm (2-in.) deep. At each location, two samples are collected: one from 0 to 5 cm (0 to 2 in.) and a second from 5 to 10 cm (2 to 3.9 in.).

Following collection, the soils are dried at least 24 hours at approximately 120°C (250°F) and sieved using a number 35 mesh screen. All soil samples are analyzed for gamma-emitting radionuclides. Selected samples are then submitted for specific alpha- and beta-emitting nuclides.

4.2.4.1 Data Summary and Assessment. Fifty-three soil samples were collected from the ICPP soil sampling grid shown on Figure 4-27. Soil samples from the ICPP were selected statistically using both a bias and random criteria. Cs-137 was the only man-made, gamma-emitting radionuclide, and concentrations ranged from 1.11 $\pm$ 0.08 pCi/g to 29.1 $\pm$ 0.8 pCi/g. The maximum concentration of 29.1 $\pm$ 0.8 pCi/g was collected from a surface soil sample from a known soil contamination area located at A49. This range of concentrations is similar to historical concentrations from ICPP. These concentrations have been slowly decreasing over time. The specific alpha- and beta-emitting analytical results were also comparable to ranges detected historically.

4.2.5 Quality Assurance/Quality Control

As discussed in Section 4.1.8, the Radiological and Environmental Measurements Systems Laboratory noted a problem with Sr-90 analyses during 1996. During the second quarter Sr-90 analysis, the blank air filter showed a positive detection for Sr-90 (Table 4-16). This data must be used with caution. As stated earlier, the laboratory has identified this problem, and has implemented a corrective action plan to prevent recurrence.

All analyses, other than Sr-90, reported acceptable agreement rates. This includes EPA-Environmental Monitoring System Laboratory, DOE/Environmental Measurements Laboratory QA Program, and Program-submitted QA/QC samples. Therefore, all other SESP data met the data quality objectives for this program.

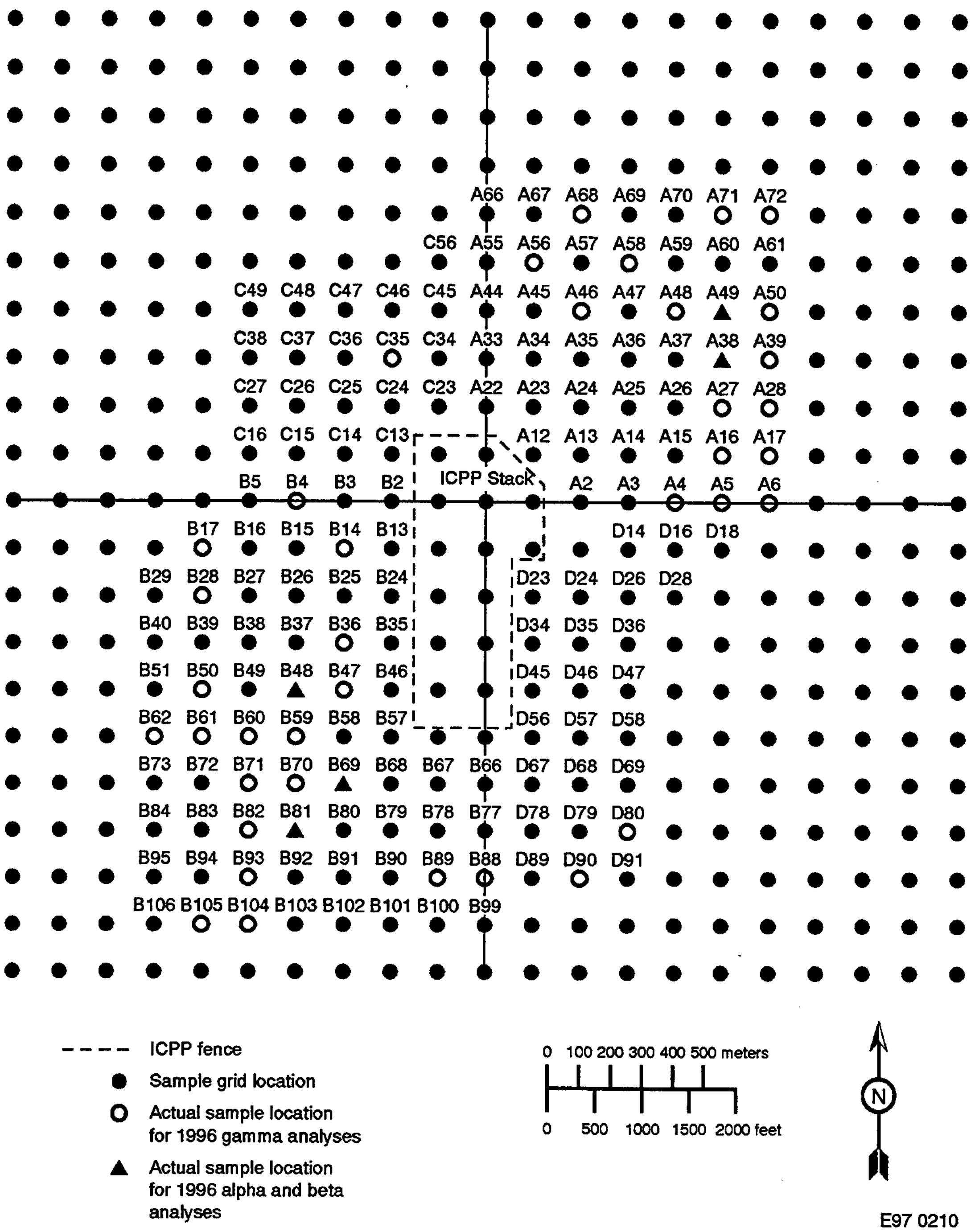


Figure 4-27. ICPP soil sampling locations grid map (E970210).

Table 4-16. Summary of Sr-90 analyses[a] for 1996.

Location	Quarter	Concentration (E-15 μCi/cc)[b]	% of DCG[c]
Blackfoot	First	0.16 ± 0.10	0.003
EBR-I	First	0.12 ± 0.08	0.001
NRF	First	0.06 ± 0.04	0.001
RWMC	First	0.07 ± 0.06	0.001
TRA	First	0.08 ± 0.06	0.001
VANB	First	0.14 ± 0.08	0.002
Blank	Second	0.24 ± 0.20	0.003
EFS	Second	0.24 ± 0.10	0.003

a. Caution should be exercised when using the Sr-90 data because data are questionable.

b. Uncertainties are reported as 2 sigma.

c. The DCG value for Sr-90 (9000 E-15) is defined in DOE Order 5400.5.

5. COMPLIANCE MONITORING PROGRAMS

The Compliance Monitoring Program consists of the following: Drinking Water, Effluent Monitoring, Storm Water Monitoring, and Groundwater Monitoring Programs.

In 1988, in response to a DOE-ID request, the M&O contractor at the INEEL established a centralized Drinking Water Program (DWP). With the consolidation of contractors, a Site-wide DWP was officially implemented January 1995. In addition to the monitoring, the DWP also coordinates the INEEL Cross-Connection Control Program.

The Nonradiological Liquid Effluent Monitoring Program was instituted at the INEEL in 1986, and radiological monitoring of selected effluent streams was added to the program in 1992. Effluent monitoring for compliance with various permits has been added over the years as permits are obtained.

In September 1992, DOE submitted a Notice of Intent to EPA to obtain coverage of the INEEL under the NPDES General Permit.[2] A Storm Water Monitoring Program in compliance with permit conditions was implemented in 1993. The Program has been modified over the years as data are evaluated and needs are identified.

In 1993, DOE-ID initiated the INEEL Groundwater Monitoring Program. The purpose of this program is to integrate, to the extent possible, all groundwater monitoring programs at the INEEL. The INEEL Groundwater Monitoring Program is documented in the *Idaho National Engineering Laboratory Groundwater Monitoring Plan*[29] and is coordinated through the INEEL Groundwater Committee.

5.1 Drinking Water Program

The DWP was established for monitoring production and drinking water wells, which are multiple-use wells for industrial, fire safety, and drinking water. Routine monitoring is conducted at all LMITCO-operated facilities. Under the Idaho Regulations for Public Drinking Water Systems [Idaho Administrative Procedures Act (IDAPA) 16.01.08.003.32],[30] LMITCO drinking water systems are classified as "nontransient or transient, noncommunity water systems." The transient, noncommunity water systems are at EBR-I, Gun Range, and Main Gate. The rest of the water systems at the INEEL are classified as nontransient, noncommunity water systems.

Because groundwater supplies the drinking water at INEEL, information on groundwater quality was used to help develop the DWP. The USGS and LMITCO monitor and characterize groundwater quality at the INEEL. The TAN area; the CFA, TRA, and ICPP area; and the RWMC area are areas of groundwater contamination that have been identified at the INEEL.

5.1.1 Program Design Basis

The DWP conducts monitoring to ensure drinking water is safe for consumption by demonstrating that the drinking water quality meets Federal and State regulations [maximum contaminant levels (MCLs) are not exceeded]. The SDWA establishes is the overall requirement for the DWP.

The DWP uses only EPA-approved analytical methods for drinking water analyses in compliance with IDAPA 16.01.08.100,10[30] and 40 CFR 141.28.[31] These EPA methods have specific practical quantitation levels and holding times that are listed in the 40 CFR 141-143.[31]

Laboratories used by the DWP performed analyses according to specified EPA methods, protocols, and procedures as listed in 40 CFR 141-143. In addition, the state of Idaho and EPA require laboratories to be certified by the state of Idaho to perform drinking water analyses or be certified by a state that has reciprocity with the state of Idaho. All laboratories used by the program were either state of Idaho-certified or were certified by a state that has reciprocity.

Currently, 19 wells and 10 distribution systems are monitored by the DWP on a routine basis at the INEEL.

Table 5-1 lists the drinking water parameters that were monitored in 1996 along with the frequency of sampling. Appendix E lists parameters regulated by the state of Idaho under authority of the SDWA. The state of Idaho regulations incorporate the Federal limits. Therefore, Appendix E gives the reference to the Federal regulations where the actual limiting concentrations are listed. Primary drinking water standards set MCLs for parameters that have been proven to cause cancer or other health problems at high concentrations. Parameters that have not been proven to cause adverse health effects, but can cause aesthetic problems in a water supply, are regulated by secondary maximum contaminant levels (SMCLs).

Appendix E also shows monitoring frequencies required by the regulations. Parameters with primary MCLs are required to be monitored at least once every compliance period, which is three years. Parameters with SMCLs are monitored every three years based on a recommendation by the EPA. The three-year compliance periods for the DWP are 1993–1995, 1996–1998, and so on. Many parameters require more frequent sampling during an initial time period to establish a baseline, and subsequent monitoring frequency depends on the baseline.

The DWP monitors more frequently than the minimum regulatory requirements at CFA, TSF, and RWMC because of known tritium, trichloroethylene (TCE), and carbon tetrachloride, respectively, in groundwater. Even though regulations only require quarterly monitoring for bacteriological analyses, the DWP collects some samples more frequently because of historical problems with bacteriological contaminants (Table 5-1). These detections were usually caused by deteriorating water lines and stagnant water, and resampling of these areas normally indicated compliance with the MCL.

5.1.2 Data Summary and Assessment by Facility

This section discusses and reports only the analytical results for each known contaminant that exceeded or approached MCLs. During 1996 a total of 804 routine samples were collected and analyzed for 1,388 parameters at CFA, EBR-I, Gun Range, ICPP, Main Gate, PBF, RWMC, TAN (CTF and TSF), and TRA. Table 5-2 lists analytical results that exceeded or approached the MCL in 1996. The only MCL that was exceeded in 1996 was coliform bacteria at CTF, PBF, TRA, and TSF.

5.1.2.1 Central Facilities Area. Routine monitoring for tritium in water from the Snake River Plain Aquifer (SRPA) began in 1961. In general, the tritium concentrations in groundwater have been decreasing due to changes in disposal rates, disposal techniques, recharge conditions, and radioactive decay. Water samples were collected quarterly from CFA #1 well, located in CFA-651; CFA #2 well, located in CFA-642; and from CFA-1603, the point of entry to the distribution system. The CFA water system serves over 1,000 people daily.

Since the early 1950s, wastewater containing tritium has been disposed to the SRPA at TRA and ICPP (Figure 3-2) through injection wells and infiltration ponds. These wastewaters migrated south-southwest and are the source of tritium contamination in the CFA water supply wells. In 1993, waste disposal practices were changed, and wastewater containing tritium is now discharged to lined ponds or evaporated.

Table 5-1. 1996 drinking water monitoring locations and schedule.

Facility	Sample Point[a]	Contaminant	Samples Collected
CFA	Selected Buildings	Microbiological	2 monthly[a] 4 monthly[b]
		Total Trihalomethanes	1 quarterly[a]
	1603	Nitrate	1 annually[a]
	1603, point-of-entry to distribution system after treatment and #1 Well	Organics (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[b]
	#1 Well	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
	#1 and #2 Well, and 1603	Gross Alpha, Beta, and Tritium	1 sample each, quarterly[b]
CPP	Selected Buildings	Microbiological	2 monthly[a] 2 monthly[b]
		Total Trihalomethanes	1 quarterly[b]
	614, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	614, #1 and #5 Wells	Organics (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[a]
		Gross Alpha, Beta, Tritium, and Sr-90	1 sample each, quarterly[b]
	#1 and #5 Wells	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
CTF	Selected Buildings	Microbiological	1 quarterly[a] 3 monthly[b]
	614, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
		Gross Alpha, Beta, and Tritium	1 quarterly[b]
	614, #1 and #2 Wells	Organics (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[a]
	#1 and #2 Wells	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
EBR-I	Selected Buildings	Microbiological	1 quarterly[a] 1 May, June, July, August, and September[b]
	601, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
		Gross Alpha, Beta, and Tritium	1 quarterly[b]
	601 and Well	Organics (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[a]
	Well	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
Gun Range	Selected Buildings	Microbiological	1 quarterly[a] 1 monthly[b]
		Total Trihalomethanes	1 quarterly[b]
	608, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
		Gross Alpha, Beta, and Tritium	1 quarterly[b]

Table 5-1. (continued).

Facility	Sample Point[a]	Contaminant	Samples Collected
Gun Range (continued)	608 and Well	Organics (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[a]
	Well	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
Main Gate	Selected Buildings	Microbiological	1 quarterly[a] 1 monthly[b]
	603, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
		Gross Alpha, Beta, and Tritium	1 quarterly[b]
	603 and Well	Organics (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[a]
	Well	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
PBF	Selected Buildings	Microbiological	1 quarterly[a] 3 monthly[b]
	638, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
		Gross Alpha, Beta, and Tritium	1 quarterly[b]
	638 and #2 Well	Organics (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[b]
	#2 Well	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
RWMC	Selected Buildings	Microbiological	1 quarterly[a] 3 monthly[b]
	604, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	638, point-of-entry to distribution system after treatment	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
	603 well, 604, point-of-entry to distribution system after treatment	Gross Alpha, Beta, and Tritium	1 quarterly[b]
		Organics as listed in Table 5 (40 CFR 141.12, .24, .40, and .61)[d]	1 as required (quarterly or annually)[a]
TRA	Selected Buildings	Microbiological	1 quarterly[a] 4 monthly[b]
		Total Trihalomethanes	1 quarterly[b]
	608, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
		Gross Alpha, Beta, and Tritium	1 quarterly[b]
	608, #1, #3, and #4 Wells	Organics (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[a]
	#1, #3, and #4 Wells	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years
TSF	Selected Buildings	Microbiological	1 quarterly[a] 3 monthly[b]
		Total Trihalomethanes	1 quarterly[b]
	610, point-of-entry to distribution system after treatment	Nitrate	1 annually[c]
		Gross Alpha, Beta, and Tritium	1 quarterly[b]

Table 5-1. (continued).

Facility	Sample Point[a]	Contaminant	Samples Collected
TSF (continued)	610, #1 and #2 Wells	Organics as listed in Table 5 (40 CFR 141.12, .24, .40, and .61)[c]	1 as required (quarterly or annually)[a]
	#1 and #2 Wells	Metals, Inorganics, and Secondary Drinking Water Standards	1 as required every 3 years

a. Compliance samples.

b. Pollution prevention practice samples.

c. Waivers for some organic parameters were obtained from the state of Idaho.

Table 5-2. Parameters that exceeded or approached the Environmental Protection Agency and state of Idaho MCLs for 1996.

Parameter	Location	Result	MCL
Total Coliform Bacteria	PBF	P[a] (Feb., May, Sept., Oct., Nov., and Dec.)[b]	P
	TAN/CTF	P (Jan. and Aug.)	P
	TAN/TSF	P (Aug.)	P
	TRA	P (Aug. and Oct.)	P
Trichloroethylene	TSF #1 Well	8.83 μg/L[c]	5.00 μg/L
Tritium	CFA	16,200 pCi/L[d]	20,000 pCi/L
Carbon Tetrachloride	RWMC	2.25 μg/L[d]	5.00 μg/L

a. P=Present

b. PBF personnel have been supplied with bottled water since July 1995, when total coliform bacteria was first identified.

c. This is a yearly average at the wellhead. The compliance point is after the sparger system (air stripping process); the compliance result is 1.84 μg/L for the yearly average.

d. These values did not exceed their respective MCLs, but are known contaminants that the DWP is tracking. See specific sections for details.

At CFA-1603, the mean concentration of tritium was 16,200 pCi/L; compared to the MCL of 20,000 pCi/L. These results were higher than the 1995 tritium results (14,000 pCi/L). The reason for this is that CFA #1 well was used 91% of the time, and the mean tritium concentration was 16,300 pCi/L. CFA #2 well mean tritium concentration was 13,625 pCi/L. For the 1996 dose calculation, the assumption was made that each employee's total water intake came from the CFA drinking water distribution system. This assumption overestimates the dose because workers typically consume only about half of their total intake during working hours and typically work only 240 days rather than 365 days per year. The estimated effective dose equivalent to a worker from consuming all drinking water at CFA during 1996 was 0.8 mrem. Since December 1991, the tritium concentration has been below the MCL at both wells and the distribution system. Figure 5-1 illustrates the variation of tritium concentrations over time. In

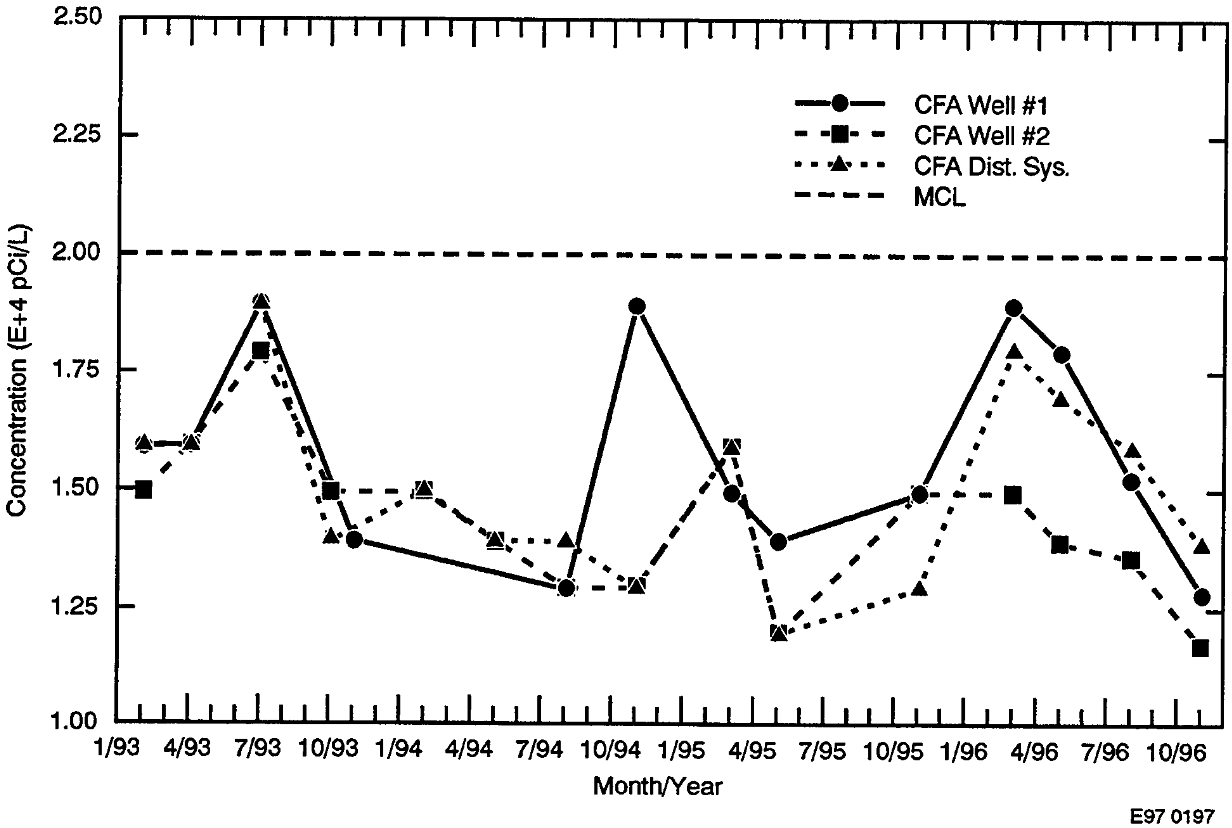


Figure 5-1. Tritium concentrations in CFA drinking water (E970197).

general, concentrations in both wells have been decreasing over time. The higher concentration of tritium in CFA #1 well appears to be related to different usage rates of the wells, proximity to the contamination source, and groundwater mobility.

5.1.2.2 Power Burst Facility. Water samples were collected from the PBF #1 well, located at PBF-602; PBF #2 well, located at PBF-614; and PBF distribution system, located at PBF-638, the point of compliance for drinking water sampling. PBF #1 and PBF #2 wells normally supply drinking water to all personnel at the PBF area. The PBF water system serves over 100 people on a daily basis.

The only parameter that exceeded an MCL for 1996 was coliform bacteria. The presence of coliform bacteria (absent for *Escherichia Coli*) is believed to be a result from a combination of old, deteriorating pipes, stagnant water from buildings and storage tanks where water usage is limited, and biofilm (bacteriological regrowth), which can cause positive coliform detections. Since July 1995, PBF personnel have been supplied with bottled water. Instead of super-chlorinating the system and risking the possible return of coliform bacteria, a continuous, mixed-oxidant disinfection system was installed. No other parameters were detected at concentrations exceeding the Federal and state MCLs, and 1996 data are consistent with historical data.

5.1.2.3 Radioactive Waste Management Complex. Various solid and liquid radioactive and chemical wastes, including TRU wastes, have been disposed at the RWMC. The RWMC contains pits, trenches, and vaults where radioactive and organic wastes were disposed below-grade, as well as placed above-grade and covered on a large pad. During a Site-wide characterization program, carbon tetrachloride and other volatile organic compounds (VOCs) were detected in groundwater at the RWMC.[32] Review of waste disposal records indicated an estimated 334,600 L (88,400 gal) of organic chemical wastes were disposed at the RWMC prior to 1970, including carbon tetrachloride, TCE, tetrachloroethylene, toluene, benzene, 1,1,1-trichloroethane, and lubricating oil. High vapor-phase concentrations (up to 2,700 ppmv) of VOCs have been measured in the unsaturated zone above the water table. Computer models predict that VOC concentrations will continue to increase in the groundwater at the RWMC.

The RWMC well is located in WMF-603, and it supplies all of the drinking water to the RWMC, which is approximately 100 people daily. The well was put into service in 1974. Water samples were collected from the RWMC well and from the point of entry to the distribution system, which is located at WMF-604.

Since 1989, concentrations of carbon tetrachloride have remained in a limited range with a mean value near 2.53 μg/L for the RWMC well and 1.49 μg/L for the RWMC distribution system. This is below the MCL of 5 μg/L. In October 1995, the levels of carbon tetrachloride increased to 5.48 μg/L at the well. This was the first time the levels in the well exceeded the MCL of 5 μg/L; however, the MCL was exceeded at the well and not at the compliance point. This value appears to be a real value because there has been an increase in carbon tetrachloride concentrations over time. Co-monitoring with USGS and increased monitoring are being conducted to track this upward trend. The mean concentration for 1996 was 3.70 μg/L for the well and 2.25 μg/L for the distribution system. Sampling was performed quarterly from the distribution system. Since monitoring began in 1988, there has been an upward trend in levels of carbon tetrachloride. These trends were analyzed, and methods of treatment are being considered. Figure 5-2 illustrates the concentration of carbon tetrachloride in both the well and distribution system from 1993 through 1996.

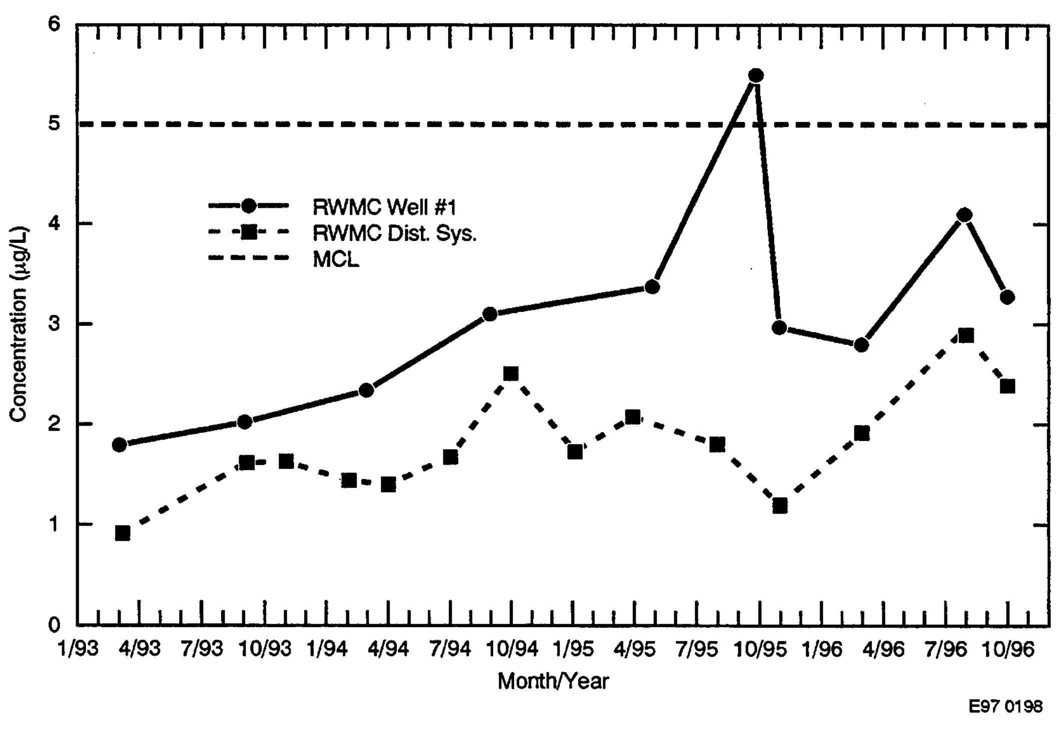


Figure 5-2. Carbon tetrachloride concentrations in the RWMC drinking water systems (E970198).

5.1.2.4 Test Area North. An injection well (TSF-05) at the TSF is believed to be the principle source of groundwater contamination at the TAN facilities. VOCs were first detected at TAN in 1987 during routine sampling of the water supply wells. The USGS followed up with a more comprehensive sampling program at TAN and detected high levels (up to 35,000 μg/L) of various VOCs in groundwater monitoring wells.[33] A number of investigations into the extent of groundwater contamination have been conducted under consent orders signed under CERCLA authority among DOE-ID, the state of Idaho, and the EPA Region 10. Groundwater contamination at TAN is currently being investigated under Operable Unit 1-07 of the Federal Facility Agreement and Consent Order (FFA/CO) for the Idaho National Engineering Laboratory.[34] A remedial investigation has been conducted to develop information necessary to assess the risk posed by the groundwater contamination and to select a remedial action, if necessary.[35] During 1996, water samples were collected from four wells and two distribution systems at CTF and TSF.

5.1.2.4.1 CTF Water System—CTF #1 and CTF #2 wells located at TAN-632 and TAN-639, respectively, supply all the drinking water to the CTF area. TAN-614 is the compliance monitoring point for the CTF water system. The CTF #1 and #2 wells were put into service in 1957 and 1958, respectively, and serve approximately 200 people daily. Except for coliform bacteria in the months of January and August, no MCLs were exceeded during 1996. The presence of coliform bacteria (absent for *Escherichia Coli*) is believed to be a result of a combination of old, deteriorating pipes, stagnant water from buildings and storage tanks where water usage is limited, and biofilm (bacteriological regrowth), which can all cause positive coliform detections. On October 14, 1996, a continuous chlorination system was installed. Since that time, no bacteria have been detected.

5.1.2.4.2 TSF Water System—In 1987, TCE was detected at both TSF #1 and #2 wells, which supply drinking water to approximately 100 employees at TSF daily. Bottled water was provided until a sparger system (air stripping process) was installed in 1988 in the water storage tank to volatilize the TCE below the MCL, providing drinking water safe for consumption (Figure 5-3). To date, the sparger system has been effective.

Concentrations of TCE averaged 8.83 μg/L in TSF #1 well, which exceeded the MCL of 5.00 μg/L. Although the MCL was exceeded at the wellhead, the compliance point is the point of entry (after the sparger system) to the distribution system (TSF-610) after treatment and did not exceed the MCL here. Average annual concentration for the distribution system was 1.84 μg/L in 1996. The TSF #2 well TCE concentration averaged 1.66 μg/L for 1996. Figure 5-4 illustrates the concentrations of TCE in both TSF wells and the distribution system from 1993 through 1996. The differences between the two wells are attributed to different usage rates of the wells, proximity to the contamination source, seasonal change, and groundwater mobility.

Water samples for coliform bacteria were collected monthly. Coliform bacteria have been detected in the past. Since this has been an ongoing problem for the last couple of years, TAN management decided to install a continuous chlorination system. The chlorination system was installed June 1996 and since that time, coliform bacteria have not been detected, except in August when the chlorination was out of service because the water system was under construction. No other MCL drinking water standards were exceeded.

5.1.2.5 Test Reactor Area. During 1996, samples were collected from the TRA #1 well, located at TRA-601; the TRA #3 well, located at TRA-650; the TRA #4 well, located at TRA-672; and the TRA distribution system, located at TRA-608. The three wells were put into service in 1950, 1957, and 1963, respectively, and are located upgradient from the contaminant plume at TRA. TRA-608 is the point of entry to the distribution system where compliance samples were collected and where the water from the

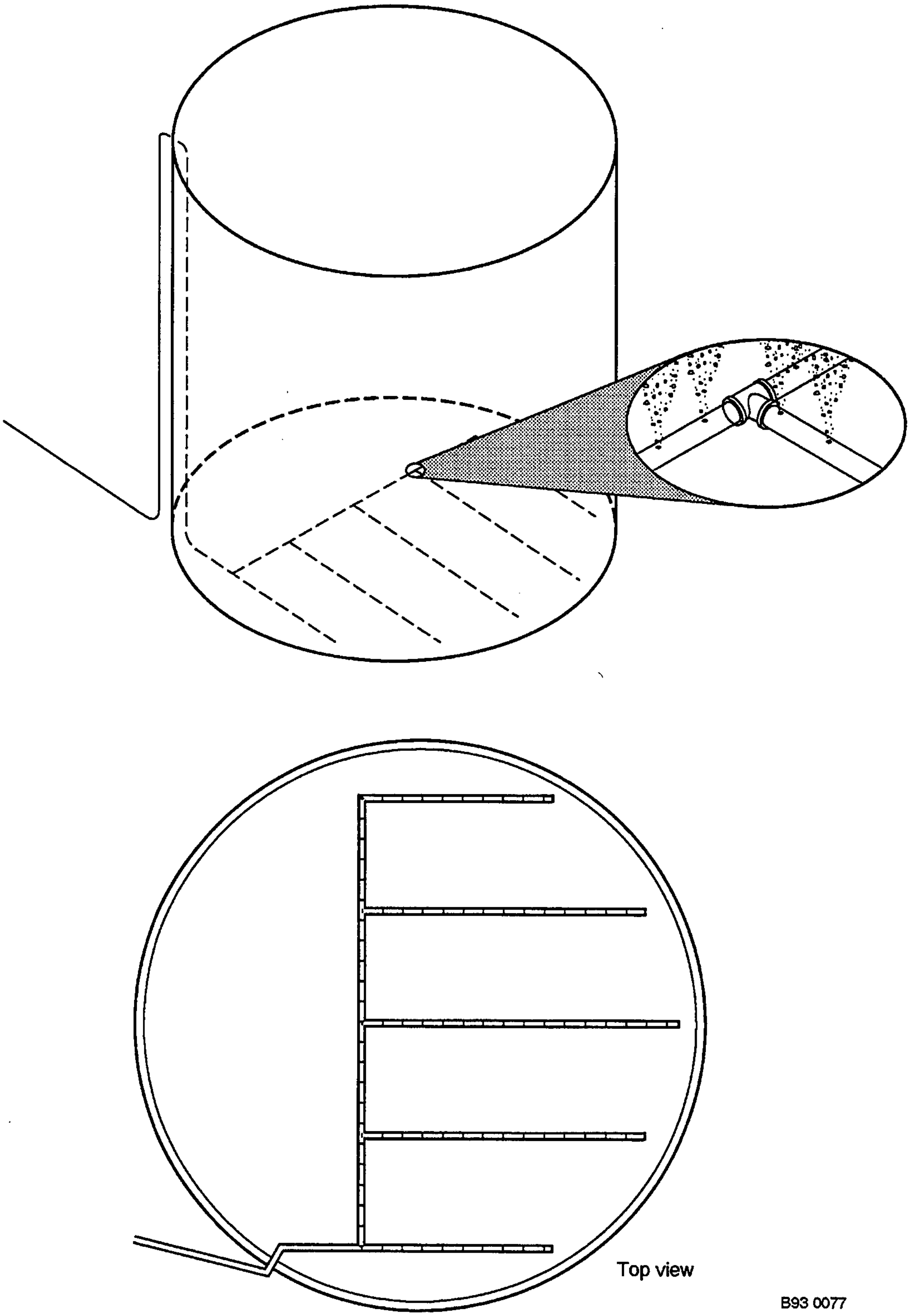


Figure 5-3. Sparger system installed in the water storage tank at TAN/TSF distribution system, TAN-610 (B930077).

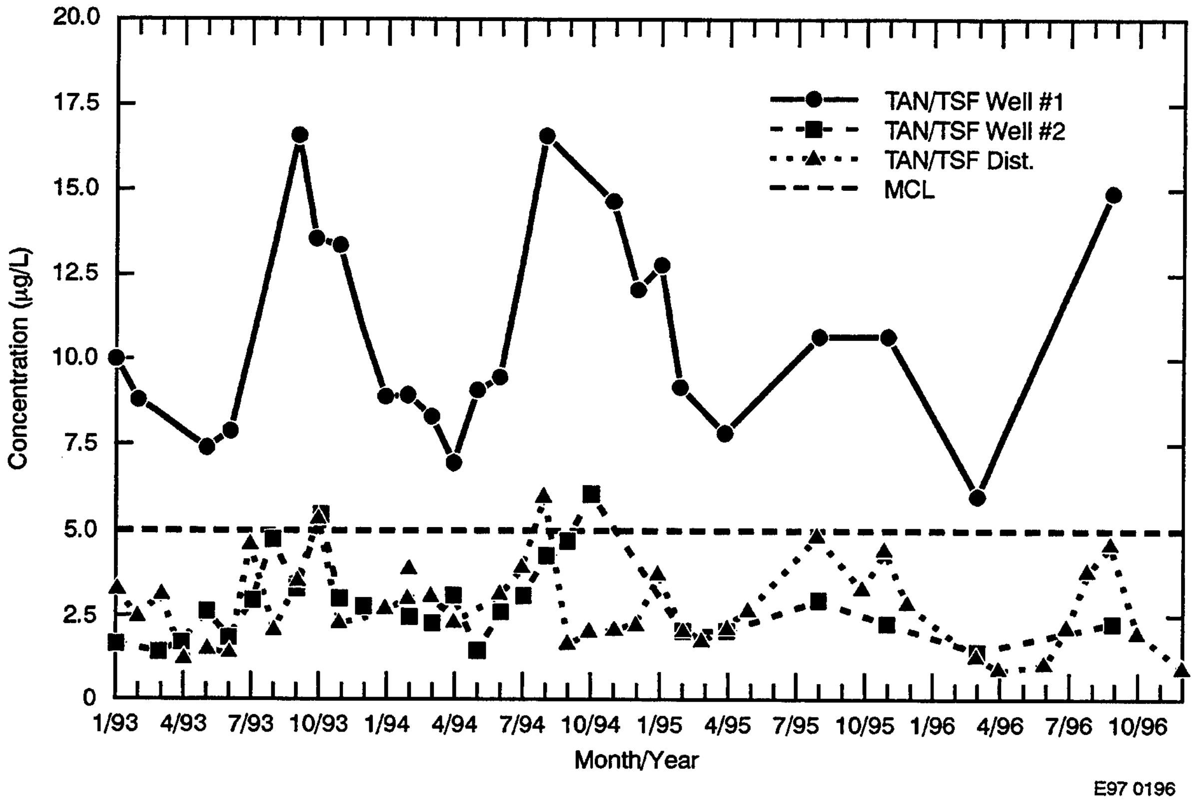


Figure 5-4. Trichloroethylene concentrations in TSF drinking water systems (E970196).

three wells was distributed throughout the TRA water system. The TRA water system supplies drinking water to approximately 500 personnel daily.

Coliform bacteria were detected in samples collected during the months of August and October. Only one sample was positive for coliform bacteria in October, and this is believed to be due to stagnant water in the line. Repeat samples were collected, and results were negative (no bacteria). The presence of the bacteria is believed to be a result of a combination of old deteriorating pipes, stagnant water from buildings where water usage is limited, and a biofilm (bacterial regrowth) problem, which can all cause a positive coliform detection. Since bacteria have been detected in the past, TRA management decided to install a mixed-oxidant disinfection system, and this was put online October 11, 1996. This mixed-oxidant system is a pilot program for the state of Idaho because it is the first one installed in the state. The mixed-oxidant system uses a salt solution that is run through an electrolysis system, which produces the oxidant (an ozone and chlorine solution) that disinfects the water. Since installation, there has been no bacteria detection. No other MCLs were exceeded at TRA.

5.1.3 Cross-Connection Control Program

In February 1988, the INEEL Cross-Connection Control Program was initiated to perform inspections of all facilities managed by the M&O contractor to locate cross-connections and identify potential problems. The main objective of the INEEL Cross-Connection Control Program is to ensure the work force is supplied safe water by protecting potable water from contamination from a non-potable source or from a reverse of normal flow in the distribution systems and plumbing within buildings. The Cross-Connection Control Program monitors the potable water plumbing and distribution systems for cross-connections with a non-potable source.

Water distribution systems at the INEEL consist of two types. Multiple use water systems (combination fire/industrial and potable water) utilize drinking water from a common water distribution system. These systems have the highest potential for cross-connections and the highest degree of oversight is applied in these areas of cross-connection control. Split systems typically are segregated from one another: fire/industrial water is either fed from a separate source or isolated from a common supply by means of a back-flow prevention device that is commensurate to the degree of hazard.

To meet guidelines set forth in OSHA Standard 1910.141 and 1926.51,[36] the INEEL Cross-Connection Control Program performs annual inspections of potable water plumbing and distribution systems, annual certified backflow assembly testing, and maintenance of backflow prevention devices and assemblies for properties owned or operated by the DOE-ID. System inspections, certified backflow device testing, and maintenance are performed in accordance with the *Uniform Plumbing Code*[37] and *Idaho Regulations for Public Drinking Water Systems*.[30]

5.1.4 Special Studies

In addition to the routine samples, the DWP had 17 special requests that required 214 analyses for 84 samples that were collected. The LMITCO-operated drinking water wells at the INEEL were last sampled in 1990 for the primary and secondary drinking water parameters. Drinking water regulations require most water systems at the INEEL to be sampled at the point of entry to the distribution system (after treatment) rather than at the well. However, the DWP sampled at the well to analyze for primary and secondary drinking water parameters during 1996 to compare source and distribution water data. Fifteen out of the 19 wells were monitored: CFA #1, CPP #1 and #5, CTF #1 and #2, EBR-I, Gun Range, Main Gate, PBF #2, RWMC well, TRA #1, #3, and #4, and TSF#1 and #2. Due to scheduled preventive maintenance activities, four wells could not be sampled (CFA #2, CPP #2 and #4, and PBF #1). All of the parameters were below the corresponding MCLs and SMCLs for the 15 wells that were sampled.

5.1.5 Quality Assurance/Quality Control

The DWP follows established procedures and analytical methodology before samples are collected. These include collecting field measurements such as pH, conductivity, and temperature using a portable water quality instrument. Before each sampling event, the water quality instruments are standardized according to manufacturer recommendations. This instrument measures the water quality parameters to ensure stable concentrations of the water source before collecting the samples. When the calculated purge time criteria are met, readings are recorded at the wellhead until the readings are consistently within $\pm$ 0.05 units for the pH and $\pm$ 10 mS/cm for conductivity before samples are collected. This ensures that the sample collected represents the water quality in the aquifer. In addition, distribution systems are purged for a minimum of two minutes or until readings consistently fall within $\pm$ 0.05 units for the pH and $\pm$ 10 mS/cm for conductivity.

Within each calendar year, 10% of the samples collected for each analysis type will be QA/QC samples, which includes duplicates, field blanks, and blind spikes.

Overall, the internal QC samples that were submitted for the DWP for CY-1996 were within the QC standards, and radiological QC samples were within the 2 sigma (σ) confidence level (95%). Organics (VOCs, etc.) were within the QC standards range and the $\pm$ 30% recovery limit, with the exception of the VOC data for May. These data were rejected, and a new laboratory was brought on line.

Some of the metals (lead, etc.) data for the special study sampling of wells were out of the QC acceptance range. These data were rejected, and resampling was conducted. The data from resampling were accepted.

5.2 Liquid Effluent Monitoring Program

The Liquid Effluent Monitoring Program provides environmental monitoring for nonradioactive and radioactive parameters in liquid waste effluents generated within selected facilities at the INEEL. The program is designed to ensure that liquid effluent samples provide representative data to demonstrate compliance with regulatory requirements.

5.2.1 Program Design Basis

INEEL Idaho Falls facilities are required to comply with the applicable regulations found in Chapter 1, Section 8, of the Municipal Code of the City of Idaho Falls.[38] The City of Idaho Falls is authorized by the Clean Water Act to set pretreatment standards for non-domestic discharges to the publicly–owned treatment works (40 CFR 403, "General Pretreatment Regulations for Existing and New sources of Pollution").[39] Industrial Waste Acceptance Forms are obtained for facilities that dispose process liquid effluent through the City of Idaho Falls sewer system. These requirements apply to all LMITCO and DOE-ID-operated facilities that discharge to the City sewer system. Permits include general requirements applicable to all facilities and specific monitoring requirements for the IRC and the WCB due to the nature of activities in these two facilities.

The state of Idaho regulates the discharge of liquid effluent under IDAPA 16.01.02, "Water Quality Standards and Wastewater Treatment Requirements."[40] Much of the wastewater discharges at the INEEL Site is to the ground surface through infiltration ponds or sprinkler irrigation systems. Discharge of wastewater to the land surface must be permitted under IDAPA 16.01.17, "Wastewater Land Application Permits."[41] LMITCO operates seven such facilities at the INEEL. Permit applications have been submitted to the Idaho Division of Environmental Quality (IDEQ) for three facilities: WRRTF process and sewage ponds, TRA Cold Waste Pond, and TRA Chemical Waste Pond. Four of the facilities have been issued WLAPs: CFA Sewage Treatment Plant (STP), ICPP Percolation Ponds, ICPP STP, and TAN/TSF STP. Each permit lists implementation, compliance, and monitoring requirements. The permits generally require compliance with the Idaho Groundwater Quality Standards in specified downgradient groundwater monitoring wells, annual discharge volume and application rates, and effluent quality limits.

The *1996 Annual Wastewater Land Application Site Performance Reports for the Idaho National Engineering Laboratory*[42] for permitted wastewater land application facilities were prepared and submitted to the IDEQ on January 31, 1997. The reports describe site conditions for the CFA STP, the ICPP STP, the ICPP Percolation Ponds, and the TAN/TSF STP as required by state of Idaho WLAPs. These reports contain permit-required monitoring data, status of special compliance conditions, and discussions of environmental impacts by the facilities.

The Industrial Wastewater Acceptance agreements with the City of Idaho Falls and WLAPs require use of analytical methods for the analysis of pollutants listed in Part 136 of 40 CFR, Subchapter N, "Effluent Guidelines and Standards."[43]

Parameters monitored in 1995 were reviewed in 1996 to accommodate new permits, regulations, orders, and codes and to reflect the changing processes at the INEEL. Sampling frequency and type are determined by considering the purpose for obtaining the data. Locations are chosen at points where the samples most closely represent the released effluent, when practical. Effluent discharges that fall under a permit are monitored as required.

Twenty-four hour composite samplers were used at all possible locations. Grab sampling was conducted at certain areas because of inaccessibility to the effluent stream or the nature of the discharge. Effluent streams that were sampled during 1996 and the parameters and frequency of monitoring for each stream are listed in Table 5-3.

Each facility area monitored (e.g., CFA, ICPP, Idaho Falls, RWMC, TAN, and TRA) was sampled monthly. The specific day was randomly selected. However, the specific locations sampled during any given month within each facility area varied. Location was determined by rotating through the complete list of available locations within one area or as required in applicable permits. This design resulted in each stream being monitored quarterly for nonradiological parameters and selected streams monitored monthly for radiological parameters. Monitoring for permit-required parameters was conducted according to the frequencies specified in permits for applicable streams.

During 1995, an approach was developed to evaluate effluent sampling locations, frequencies, and parameters based on risk.[44] Risk is defined as the statistical probability of exceeding a release limit (both regulatory limits and environmental risk-based limits). The program evaluated the historical data for all effluent streams using this approach and modified the sampling design during 1996. The modified design will be implemented in 1997.

5.2.2 Data Summary and Assessment by Facility

During 1996, a total of 27 effluent discharge points were routinely monitored for nonradiological parameters and 11 for radiological parameters at six areas: CFA, ICPP, Idaho Falls, RWMC, TAN, and TRA.

INEEL facilities use water in a variety of processes and operations; therefore, the final liquid effluents released to the environment are composed of discharges from a range of sources. In many cases, the impact of water usage by a given facility process on raw water quality is minimal, creating relatively clean wastewater effluents that are roughly comparable in quality to the raw water source. In other cases, however, wastewater effluents contain pollutants characteristic of particular processes.

Two major classes of liquid effluents from LMITCO facilities exist: those generated by numerous contributing sources within a facility, and those generated by a single source (i.e., a unique process or operation). For effluents generated by numerous contributing sources within a facility (i.e., nonspecific sources), operations have relatively little effect on water quality. Annual mean concentrations of individual pollutants usually lie in a relatively narrow range, well below regulated levels. General trends can often be attributed to a unique contributing source or operating history.

For a single-source effluent, a change associated with its source has a more direct impact on the observed character of the effluent than does a comparable change in a stream generated by nonspecific sources. A single-source effluent may be homogeneous or highly variable, depending on the nature of its source. Thus, interpreting data from a single-source effluent requires consideration of contributing sources. Unless the contributing sources are of similar nature, stream-to-stream comparisons with other single-source effluents are generally not useful.

To assess the data for trends or changes that might indicate loss of process control or unplanned release, statistical confidence limits are calculated based on past monitoring data. Limits are based on the variance estimate of the analyte concentrations around the mean concentration for the period 1986 through 1995. Because of the many measurements below the detection limit for radionuclides and volatile organic compounds, confidence limits are not calculated for those parameters. A Level 2 statistical control limit is set at the upper 99% confidence limit on individual measurements. If a measurement

Table 5-3. 1996 effluent monitoring locations, parameters, and frequencies.

Location	Parameters[a]	Frequency
CFA-LS1, STP Lift Station[b]	Priority pollutant metals[c] + Ba, Ca, Co, Fe, K, Mg, Mn, Na, and VOCs[d]	Quarterly
	WLAP and radiological parameters[f]	Monthly
CFA-STF, STP effluent pump pit[b]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, and VOCs	Quarterly
	WLAP[e] and radiological parameters	Monthly
CFA-603, Medical Services[b]	RCRA metals[g] and inorganics[g]	Quarterly
CFA-608, Safeguards and Security[b]	RCRA metals, inorganics, phenolics, and VOCs	Quarterly
CFA-612, Industrial Hygiene Laboratory[i]	Priority pollutant metals + Ba, Co, Fe, inorganics, and VOCs	Quarterly
CFA-625, Environmental Chemistry Laboratory[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, and VOCs	Quarterly
CFA-696, Big Shop[i]	RCRA metals, inorganics, and VOCs	Quarterly
CFA-688, Print Shop[b]	RCRA Metals + Ni, Cu, Zn, and inorganics	Quarterly
CFA-690, RESL[b]	Priority pollutant metals + Ba, Co, Fe, inorganics, and VOCs	Quarterly
CPP-769, influent to STP[b]	WLAP parameters	Monthly
CPP-773, STP effluent to Rapid Infiltration Trenches[b]	WLAP parameters	Monthly
TRA-708C, Acid Caustic Pumphouse[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, and radiological parameters	Quarterly
TRA-636, Retention Basin[i]	Priority pollutant metals + Ba, Mg, Ca, Na, K, Mn, Co, Fe, inorganics, VOCs, and radiological parameters	Quarterly
TRA-764, effluent to Cold Waste Pond[b]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, and VOCs	Quarterly
	Radiological parameters	Monthly
TRA-LS1, STP Lift Station[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, and VOCs	Quarterly
	Inorganics and radiological parameters	Monthly
TRA-STF, STP Pond 1[i]	Inorganics	Monthly
TAN-607, process wastewater[b]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, VOCs, and inorganics	Quarterly
TAN-623A, influent to STP[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, and VOCs	Quarterly
TAN-623B, effluent from STP[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, and VOCs	Quarterly
	Radiological parameters	Monthly

Table 5-3. (continued).

Location	Parameters[a]	Frequency
LOFT-01A, discharge from LOFT sump[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, VOCs, and radiological parameters	Quarterly
TAN-655, effluent to TSF pond[b]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, and VOCs,	Quarterly
	WLAP and radiological parameters	Monthly
WRRTF-1, Sewage Lagoon sump[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, and VOCs	Quarterly
WRRTF-2, process pond sump pit[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, and VOCs	Quarterly
IFF-603A, IRC west access port[b]	RCRA metals + Cu, Ni, Zn, CN, VOCs, and radiological parameters	Monthly
IFF-603B, IRC east access port[b]	RCRA metals + Cu, Ni, Zn, CN, phenolics, TOG, TPH, and VOCs	Semi-annually
IFF-616, WCB effluent[b]	RCRA metals + Cu, Ni, Zn, CN, and VOCs	Monthly
	RCRA metals + Cu, Ni, Zn, CN, phenolics, TOG, TPH, and VOCs	Semi-annually
RWMC, Sewage Lagoon[i]	Priority pollutant metals + Ba, Ca, Co, Fe, K, Mg, Mn, Na, inorganics, VOCs, and radiological parameters	Quarterly

a. All locations are sampled for field parameters including pH, specific conductance, and temperature.

b. These samples were collected as 24-hour composites.

c. Priority pollutant metals include antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, zinc.

d. EPA Method 624 Target List.

e. Wastewater Land Application Permit parameters are specified in the individual permits.

f. Radiological parameters include gross alpha, gross beta, tritium, Sr-89, Sr-90, and gamma spectrometry.

g. RCRA metals include arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

h. Inorganics include one or more of the following parameters: BOD, chemical oxygen demand (COD), TOC, TOG, TSS, F, NH_4-N, TKN, Cl, NO_3 +NO_2-N, TDS, SO_4, P, CN, MBAS, and sulfide.

i. These samples were collected as grab samples.

exceeds the Level 2 control limit, there is a less than 1% chance of this happening because of random fluctuations. Values that exceed the Level 2 control limit fall outside what is expected based on historical stream characteristics, but do not necessarily indicate possible adverse environmental consequences. Instances where monitoring data exceed the Level 2 control limit are reviewed to determine if a significant change has occurred in the effluent stream or to determine if there are possible adverse environmental consequences. In most cases, there is no concern identified. When the change is substantiated and environmental or regulatory issues are identified, appropriate follow-up action is taken. Table 5-4 summarizes the monitoring results that exceeded the Level 2 control limits in 1996.

Measurement results were compared to the regulatory limits. Regulatory limits include Resource Conservation and Recovery Act (RCRA) toxicity characteristic hazardous waste limits and limits set in applicable permits. Any detections above regulatory limits were addressed with facility representatives and regulatory agencies, and if required, actions were taken based upon these reviews. All results were below RCRA characteristic hazardous waste limits and City of Idaho Falls limits. With the exception of a single Total Suspended Solids (TSS) sample at TAN-655, which exceeded a WLAP limit, all results were within regulatory limits.

Because numeric regulatory limits for radionuclides have not been defined, radiological concentrations were compared to DCGs in DOE Order 5400.5 and to drinking water MCLs when available. These levels were used for comparison purposes only. All radiological results were below DCGs and with few exceptions, below MCLs.

Minimum, maximum, and mean concentrations for 1996 data were calculated. Historical and 1996 summary statistical data for permitted effluent streams and streams for which permit applications have been submitted are presented in Appendix F.

5.2.2.1 Central Facilities Area. The primary effluent discharge to the environment monitored at CFA was from the STP. The CFA STP receives wastewater from sanitary sewer drains throughout CFA. A new STP was put into operation and replaced the old system in February 1995. The STP consists of a 1-acre partial-mix, aerated lagoon, a 3.6 ha (9-acre) facultative lagoon, and a 0.2-ha (0.5-acre) polishing pond, and provides application on up to 30 ha (73.5 acres) of native desert range land through a sprinkler pivot irrigation system.

A state of Idaho WLAP was issued for this system in July 1994. The permit limits wastewater application to 63.5 ha-cm/ha/year (25 acre-in./acre/year) from March 15 through November 15 with leaching losses not to exceed 7.6 cm/yr (3 in./yr). Irrigation began in June 1996 and continued through September. Application of wastewater to a native range habitat is a unique practice, and this technology will be evaluated in the future to determine the benefits and feasibility.

The primary permit condition requires the wastewater to be applied in such a manner as to minimize wastewater leaching through the soil and to maximize plant uptake. This is achieved through managing the discharge rate and periods when the wastewater is applied. Leaching of wastewater was managed in accordance with permit requirements by using hydraulic loading measurements, water balance calculations, and soil sampling.

The permit specifies effluent monitoring locations, frequencies, and parameters. The two locations monitored for compliance with the permit include the influent to the STP collected at the Lift Station (CFA-LS1) and the final effluent to the pivot monitored at the pump pit (CFA-STF). No parameter concentration limits are specified in the permit.

Table 5-4. 1996 effluent data exceeding Level 2 control limits.

Stream	Parameter	Sample Date	Concentration (mg/L)	Level 2 Control Limit
CFA-603	Biological Oxygen Demand	01/03/96	41.0	19.3
	Biological Oxygen Demand	07/25/96	99.0	19.3
	pH	07/25/96	6.62	6.68-8.51
	TSS	01/03/96	50.2	42.4
	TSS	07/25/96	100	42.4
CFA-608	Nitrogen, as Ammonia	04/23/96	5.50	2.77
	Phenols	07/25/96	0.226	0.224
	Sulfide, Total	07/25/96	19.7	6.70
	TSS	07/25/96	1010	795.33
	Mercury	01/03/96	0.002	0.0008
CFA-625	Biological Oxygen Demand	06/19/96	36.0	13.7
	TOC	06/19/96	65.0	15.1
	Copper	06/19/96	0.125	0.121
	Iron	06/19/96	0.283	0.274
	Potassium	06/19/96	19.2	7.54
	Sodium	06/19/96	49.3	32.6
CFA-688	Cyanide	09/05/96	0.016	0.015
	TSS	03/19/96	1140.0	60.04
	TSS	06/19/96	550.0	60.04
	TSS	09/05/96	423.0	60.04
	TSS	12/10/96	687.0	60.04
	Barium	03/19/96	1.09	0.334
	Barium	06/19/96	0.351	0.334
	Barium	12/10/96	0.968	0.334
	Chromium	03/19/96	0.056	0.030
	Chromium	09/05/96	0.076	0.030
	Chromium	12/10/96	0.044	0.030
	Copper	03/19/96	0.171	0.084
	Copper	06/19/96	0.138	0.084
	Copper	09/05/96	0.179	0.084
	Copper	12/10/96	0.317	0.084
	Lead	03/19/96	0.055	0.036
	Lead	09/05/96	0.214	0.036
	Mercury	03/19/96	0.002	0.0005

Table 5-4. (continued).

Stream	Parameter	Sample Date	Concentration (mg/L)	Level 2 Control Limit
CFA-688 (continued)	Nickel	09/05/96	0.062	0.062
	Zinc	03/19/96	0.898	0.066
	Zinc	06/19/96	1.05	0.066
	Zinc	09/05/96	0.493	0.066
	Zinc	12/10/96	0.580	0.066
CFA-690	Chromium	12/10/96	0.038	0.025
	Iron	12/10/96	0.664	0.291
CFA-LS1	Biological Oxygen Demand	03/21/96	119.0	78.0
	pH	07/25/96	6.99	7.06–8.28
	pH	08/06/96	6.39	7.06–8.28
	TSS	03/21/96	2910.0	127.95
	TSS	07/25/96	206.0	127.95
IFF-603A	Lead	01/16/96	0.055	0.031
IFF-603B	Zinc	04/03/96	0.112	0.071
TAN-607	Total Phosphorus	11/20/96	2.0	0.93
TAN-623A	Surfactants	01/24/96	0.20	0.11
	Chromium	01/24/96	0.018	0.014
	Iron	04/11/96	3.33	0.865
	Iron	07/10/96	1.26	0.865
	Manganese	04/11/96	0.140	0.40
	Sodium	04/11/96	107.0	58.3
TAN-623B	Chloride	04/11/96	127.0	104
	Sodium	04/11/96	65.9	64.0
TAN-655	Chloride	12/12/96	457.0	185.30
	Sulfate	06/26/96	81.80	57.30
	Sulfate	12/12/96	339.0	57.30
	TSS	04/11/96	91.40	47.95
	TSS	07/10/96	345.0	47.95
	TSS	12/12/96	56.0	47.95
	Total Phosphorus	07/10/96	6.30	3.58
	Iron	07/10/96	1.43	1.22
	Sodium	12/12/96	168.0	104.4
WRRTF1	Arsenic	12/12/96	0.039	0.016

Table 5-4. (continued).

Stream	Parameter	Sample Date	Concentration (mg/L)	Level 2 Control Limit
WRRTF2	Biological Oxygen Demand	03/12/96	6.0	4.41
	Fluoride	03/12/96	1.50	0.41
	TOC	03/12/96	13.50	10.88
	TSS	03/12/96	24200.0	1769
	Arsenic	03/12/96	0.032	0.020
	Barium	03/12/96	1.83	0.584
	Cadmium	03/12/96	0.009	0.006
	Calcium	03/12/96	806.0	115.1
	Chromium	03/12/96	0.274	0.067
	Cobalt	03/12/96	0.223	0.050
	Copper	03/12/96	4.90	0.533
	Iron	03/12/96	247.0	70.5
	Lead	03/12/96	0.583	0.223
	Magnesium	03/12/96	141.0	68.0
	Manganese	03/12/96	2.55	0.850
	Nickel	03/12/96	0.318	0.087
	Potassium	03/12/96	14.5	11.5
TRA-708	Chromium	09/30/96	0.214	0.154
TRA-764	pH	11/12/96	6.73	6.97–8.66
TRA-LS1	pH	07/30/96	7.23	7.30–9.01
	Chemical Oxygen Demand	09/30/96	634.0	498.08
	Total Organic Carbon	09/30/96	114.0	110.70
	Zinc	03/12/96	6.08	0.737

The sanitary sewage drains throughout CFA effect the chemical characteristics of the overall CFA effluent. A number of unique discharge sources exist, including chemical laboratories, the craft shops, the cafeteria, the warehouse, vehicles services, and the dispensary:

- Access port southeast of building CFA-690, RESL—This effluent originates from the drain discharge from all laboratories in the RESL.
- Lift Station (CFA-LS1), influent to STP—This effluent receives untreated wastewater from all sanitary sewer drains throughout CFA.
- Pump pit to pivot (CFA-STF) final effluent from STP—This effluent is treated wastewater from the CFA STP lagoons prior to land application.

With the exception of TSS, yearly average concentrations for parameters measured in the influent to the CFA STP (CFA-LS1) were below levels typically classified as "weak" municipal wastewater [biological oxygen demand (BOD) < 110, TSS < 100, total N < 20 mg/L].[45] This is consistent with the significant portion of wastewater that is derived from noncontact cooling water from air conditioners and heating systems at CFA.

In addition to the STP monitoring, six locations upstream of the STP were monitored for nonradiological parameters, totaling nine CFA effluent monitoring locations (Table 5-3 and Figure A-4):

- Access port south of CFA-603, Medical Services—The x-ray photo processor of medical services contributes to this effluent.

- Access port upstream from the junction of the sanitary sewage system to CFA-608, oil and water separator—The oil and water separator collects waste products used in the helicopter maintenance area.

- Access port in parking lot east of CFA-612, Industrial Hygiene Laboratory—This effluent originates from discharges from the laboratory.

- Access port in parking lot on north side of CFA-625, Environmental Chemistry Laboratory—This effluent originates from analytical laboratory operations.

- Access port to CFA-696, Transportation Complex oil and water separator—The oil and water separator collects waste oil and water associated with the floor drains and vehicle maintenance areas in the new transportation complex.

- Access port to sanitary sewage from CFA-688—This effluent results from sanitary waste drains in CFA-688, including the Prototype Engineering Laboratory and High Bay.

Treatment in the CFA-STP lagoons was sufficient to produce good quality effluent for land application. This is indicated by the significant reduction in the average concentrations of Total N, BOD, chemical oxygen demand (COD), and TSS between influent (CFA-LS1) and effluent concentrations (CFA-STF).

Volatile organics detected in CFA effluents included trace amounts of 1,4-dichlorobenzene detected at several locations. 1,4-dichlorobenzene is an ingredient in toilet bowl deodorants, garbage deodorants, and moth flakes; therefore, it often occurs in sewage effluent. Toluene and xylene were detected at the Transportation Complex oil and water separator at concentrations of 0.015 and 0.025 mg/L, respectively. Toluene and xylene are components of fuels, and trace amounts of these compounds would be expected to be present in the oil and water separator discharge. Detections of these volatile organics at such low concentrations do not represent an environmental concern because they are well below regulatory limits and can be biologically treated in the STP.

Excursions beyond the Level 2 control limit were measured for several streams and parameters at CFA and are listed in Table 5-4. These excursions indicated a deviation from normal operating conditions, but were not above regulatory limits. Effluent from CFA-688 had the most excursions and consistently exceeded Level 2 control limits for TSS, copper, and zinc. Other heavy metals such as barium, chromium and lead at CFA-688 were detected above control limits indicating deviations from normal operating conditions. A possible source was identified from metal-working operations in the Prototype Engineering Laboratory and High Bay where brass and other metal filings may be discharging to drains. Management was informed and corrective actions are being evaluated.

Effluents monitored monthly for radiological parameters at CFA included the effluent from the new Lift Station (CFA-LS1) and final effluent (CFA-STF). Tritium concentrations in CFA effluents are the result of groundwater tritium contamination, which has affected the CFA water systems. Effluent tritium concentrations approximately equaled the tritium concentrations observed from the CFA drinking water wells. Other potential contributions of detectable levels of radionuclides included discharges from RESL and potentially contaminated sewer lines. Ce-141, Sr-90, and Cs-137 were detected at levels slightly above detection limits at CFA-LS1. All levels of radioactivity measured in CFA sewage effluent during 1996 were below the DCG and drinking water standards or below detectable levels.

5.2.2.2 Idaho Chemical Processing Plant. The primary discharges to the environment at ICPP include the effluent from the STP to rapid infiltration trenches (CPP-773) and effluent from the Service Waste System to the Percolation Ponds. WLAPs were issued for these systems in September 1995. The permits specify effluent monitoring locations, frequencies, and parameters. WLAP monitoring of the STP was conducted as part of the Liquid Effluent Monitoring Program beginning in October 1995. Prior to this date, STP monitoring was conducted by ICPP Operations. The ICPP generates 5.7 to 9.5 ML/day (1.5 to 2.5 MG/day) of process wastewater during normal operations. This service waste is discharged to Percolation Ponds 1 or 2 via the service waste system. The Percolation Ponds are used only to receive the discharge of nonhazardous wastewater. The service waste discharge to the Percolation Ponds was monitored by ICPP Operations during 1996, and data are not included in this report. Service waste sampling included the WLAP monitoring and monthly composite samples for radiological and nonradiological parameters. Effluent constituent concentrations were within normal ranges, and the annual flow volume was within permit limits. Required ICPP data are reported in the Annual Wastewater Land Application Site Performance Reports for the Idaho National Engineering and Environmental Laboratory,[42] and in the ICPP Environmental Monitoring Report.[46]

The STP at ICPP is used to treat and dispose of sanitary and other related wastes at the ICPP. It consists of two aerated lagoons, two quiescent, facultative stabilization lagoons, four rapid infiltration trenches, and six weir boxes (control stations) that move the sewage through the desired lagoons and trenches. From April 16 through April 23, 1996, treatment cell no. 2, one of the aeration lagoons, was bypassed so that a tear in the liner could be repaired. Although the location of the tear was above the water line, the water level had to be lowered to make the repair. The repair was successfully completed on April 23, 1996. In order to prevent potential tears in the liner due to wildlife entering the pond, it has been proposed to fence the pond area with chain-link fencing.

Automatic, flow-proportional composite samplers are located inside a heated structure at control stations CPP-769 and CPP-773 (Figure A-7). The CPP-769 sampler collects samples from the influent to the STP, and the sampler at CPP-773 collects effluent from the STP prior to the infiltration trenches. The WLAP for the STP sets the following limits for effluent prior to the infiltration trenches (CPP-773):

- TSS of 100 mg/L averaged monthly
- Total Nitrogen (NO_3-N + NO_2-N + TKN) of 20 mg/L averaged monthly (with interim limits of less than 40 mg/L averaged monthly and yearly average of less than 26 mg/L)
- Flow to rapid infiltration trenches of 30 million gallons annually.

For 1996, the STP effluent did not exceed the 20 mg/L total nitrogen limit, the 100 mg/L TSS, or the flow limit set forth in the permit. Monthly average concentrations ranged from 6.94 to 19.57 mg/L total nitrogen. The total nitrogen levels in effluent to the rapid infiltration trenches will continue to be evaluated since, in the past, a few of the total nitrogen levels exceeded the 30 day average limit (20 mg/L). As a result, efforts are underway to determine alternative treatment systems or methodologies that will ensure the total nitrogen levels remain below 20 mg/L.

Overall, treatment in the ICPP STP lagoons was sufficient to produce good quality effluent for land application to the rapid infiltration trenches. This is evidenced by the significant reduction in average concentrations of Total N, TSS, and BOD as determined from the differences between influent and effluent concentrations.

Level 2 statistical control limits were not calculated for these streams due to lack of available historical data. Radiological monitoring of the ICPP STP was conducted by ICPP Operations, and therefore, the data are not included in this report.

5.2.2.3 Idaho Falls Facilities. Sixteen Waste Acceptance Form Permits have been issued for 27 buildings operated by LMITCO. Administrative controls are in place at the IRC and WCB to ensure discharges from individual operations at these facilities are in compliance with the City discharge limits.

In 1996, Waste Acceptance Forms were modified to reflect the addition of three new buildings at the IRC complex and to cancel permits for two facilities that were no longer used or operated by LMITCO. In addition, approval was obtained for several non-routine releases to the City sewer system. All facilities were operated in accordance the City Sewer Ordinance, and no parameters exceeded discharge limits. An inspection by the City of Idaho Falls Pretreatment Coordinator revealed no deficiencies.

Industrial Wastewater Acceptance Forms for the IRC and the WCB specify semi-annual monitoring requirements to demonstrate compliance with City sewer limits. In addition, monthly self-monitoring was conducted as a pollution prevention practice and reported to the city. Table C-5 lists the 1996 concentration limits for discharges to the City of Idaho Falls sewer system.

Three major effluent streams in Idaho Falls were sampled in 1996 (see Figure A-8):

- Access port to laboratory and mechanical room effluent on west side of IRC [Idaho Falls Facility (IFF)-603A, monthly self-monitoring point]
- Access port to IRC Complex effluent on North Boulevard across from IRC driveway (IFF-603B, semi-annual City of Idaho Falls compliance point)
- Access port to WCB total building effluent on Science Center Drive (IFF-616C, monthly self-monitoring and semi-annual City of Idaho Falls compliance point).

No contaminants in IRC or WCB effluent discharges were detected above the City of Idaho Falls limits during 1996. Excursions beyond the Level 2 control limits are listed in Table 5-4; however, none of these excursions were at levels of concern because they were well below City Sewer Limits and were one-time occurrences.

5.2.2.3.1 INEEL Research Center Effluent—IRC effluent, which is monitored adjacent to the IRC building (IFF-603A), is generated by drain discharges from all laboratories and discharge from the mechanical room. The IRC Complex effluent monitored at North Boulevard (IFF-603B) includes these discharges, as well as sewage and related wastewater from the IRC and wastewater from the Research Office Building.

Methylene chloride and trichlorofluoromethane were the only volatile organic contaminants detected in IRC effluent during 1996. They were detected at IFF-603A at concentrations of 0.007 and 0.005 mg/L, respectively, during self-monitoring in February. Although methylene chloride was not detected in the laboratory method blank, its presence at such low concentrations was likely the result of contamination during sample handling or analysis. Trichlorofloromethane is not included in the Idaho Falls Sewer Code limits. It was banned for use as an aerosol propellant; however, it is still used as a refrigerant, a fire extinguishing medium, a foaming agent, and a solvent and degreaser.

Gross alpha and gross beta were detected at IFF-603A at levels well below drinking water standards. No man-made, gamma-emitting radionuclides were detected.

5.2.2.3.2 Willow Creek Building Effluent—WCB effluent is generated by the wastewater from WCB. Contributing sources include the discharge from the photography laboratory, print shop sinks and drains, and the x-ray photo processor in Medical.

Silver concentrations, which had been detected above the City Sewer Code limits in a 1995 sample, averaged 0.024 mg/L during 1996. The maximum silver concentration measured at IFF-616 in 1996 was 0.055 mg/L, which was well below the City Sewer limit of 0.45 mg/L.

Methylene chloride was detected at a concentration of 0.005 mg/L during self-monitoring in February. Although methylene chloride was not detected in the laboratory method blank, it was detected at an estimated concentration of 0.002 mg/L in the trip blank. This suggests possible methylene chloride contamination during sample handling or shipping.

1,4-dichlorobenzene was detected at concentrations of 0.036 and 0.019 mg/L in January and February, respectively. It is not included in the City Sewer Code limits and was detected at levels well below the RCRA Hazardous Waste limit of 7.5 mg/L. 1,4-dichlorobenzene is an ingredient in toilet bowl deodorants, garbage can deodorants, and moth flakes; therefore, it often occurs in sewage effluent. However, none of these sources could be identified at WCB. Toilet bowl deodorants were identified at the University Place indicating the possibility of commingling of the WCB and University Place effluents during these sampling events. Normally, the automatic sampler is inserted in the sewer line in a manner to obtain WCB effluents only.

5.2.2.4 Radioactive Waste Management Complex. Samples were routinely collected from the sewage lagoons at the RWMC (Figure A-12). The lagoons received sanitary sewage effluent from support facilities at the RWMC. The Liquid Effluent Monitoring Program began collecting wastewater samples at the RWMC sewage lagoons in April 1995 shortly after the lagoons were constructed.

All nonradiological analytes detected in water samples from the RWMC lagoons are typical of those that occur in sanitary sewage. No unusual compounds or elements were detected, and no volatile organics were detected. Level 2 control limits were not calculated for this stream due to lack of historical data.

The concentrations of all radiological analytes detected in water samples collected from the RWMC sewage lagoons were below drinking water standards and DCGs. Sr-89, U-234, -235, and -238, Cm-244, and Th-230 were detected at levels slightly above the detection limit.

5.2.2.5 Test Area North. The primary discharges to the environment monitored at TAN included the final effluent to the TAN/TSF Disposal Pond (TAN-655) and the effluent to the STP Sewage Lagoon and Process Pond (WRRTF-1 and WRRTF-2). Several other discharges monitored upstream from the primary discharges are included in the following list. These seven effluent monitoring locations were sampled:

- Access port access to TAN-607, process wastewater—This wastewater originates from nonsanitary, nonradioactive drains throughout TSF.

- Access to influent on the east side of TAN-623A, influent to STP—This effluent originates from untreated discharges from the TSF Sanitary System.

- Access to effluent on north side of TAN-623B, effluent from STP—This effluent originates from the final stage of the TSF Imhoff sewage treatment process.

- Final sump at TAN-655, effluent from sump to the TSF Disposal Pond—This effluent is a combination of untreated process water (TAN-607) and treated sewage (TAN-623B).

- Loss-of-Fluid Test (LOFT) sump monitor station in LOFT-725 (LOFT-IA) to SMC lagoons—This effluent originated from rain water and snow melt seepage into the LOFT basement and from back-siphonage from the SMC boiler pond via the sump discharge line.

- Sewage lagoon sump at WRRTF-1, effluent to sewage lagoon—This sewage lagoon receives treated effluent from the sanitary system at WRRTF.

- Pond pump pit at WRRTF-2, effluent to process pond—This effluent originates from nonsanitary, nonradioactive sources at WRRTF.

5.2.2.5.1 Effluent to the TAN/TSF Disposal Pond (TAN-655)—The TAN/TSF Disposal Pond is an unlined percolation pond. The pond receives wastewater discharges from a variety of contributing sources. The STP effluent (monitored at TAN-623A and TAN-623B) and process wastewater (monitored from the line at TAN-607) combine in the TAN-655 sump before being discharged to the pond. The TAN/TSF STP was constructed in 1956. The facility consists of a sewage collection lift station, Imhoff tank, sludge drying beds, trickle filter and settling tank, contact basin, and infiltration disposal pond. The TAN/TSF disposal pond was constructed in 1971; prior to that, treated wastewater was disposed via an injection well.

The TAN/TSF STP receives wastewater from sanitary sewage drains throughout the TSF area. Process water contributed to the pond includes boiler blowdown, such as that generated in the Service Building, which is expected to contribute inorganic salts concentrated from feedwater (calcium and magnesium salts, chlorides, and sulfates), corrosion products (metal oxides), and any chemical additives. Wastewater from the demineralizer system is expected to contribute mineral salts from makeup water and excess regenerant chemicals (sodium-hydroxide and sulfuric acid). Data from fiscal year (FY)-1987 to CY-1996 were generally consistent with these anticipated discharges.

A WLAP was issued for this system in May 1996. The permit specifies effluent monitoring requirements for the TAN-655 location. The WLAP set the following limits for effluent prior to discharge to the TSF Pond (TAN-655):

- TSS of 100 mg/L averaged monthly

- Total nitrogen (NO_3-N + NO_2-N +TKN) of 20 mg/L averaged monthly

- Flow volume of 34 million gallons annually.

With the exception of a single TSS excursion, the average monthly concentrations for total nitrogen, TSS, and annual flow volume were below permit limits. The TSS concentration in the July sample was 345 mg/L, which exceeded the permit limit of 100 mg/L. Iron, manganese, and phosphorous concentrations were also elevated in the July sample relative to other months. It was suspected that a flake from routine blowdown of air compressors and other equipment caused the high readings. IDEQ was notified, and sampling frequency for TSS was increased from October through December. No excessive TSS concentrations were observed for the remainder of the year.

Level 2 control limits were exceeded for several parameters at TAN-623A, TAN-623B, and TAN-655 during 1996 (Table 5-4). These excursions indicate a deviation from normal operating conditions, and with the exception of the high TSS sample, did not exceed regulatory limits.

On October 2, the drinking water system was super-chlorinated, which resulted in the STP receiving a slug-load of chlorine that caused sluffing of biomass from the trickling filter. BOD removal efficiency samples collected one week later indicated that treatment was not impacted.

Radiological monitoring was conducted monthly at the TAN-655 sump and STP effluent (TAN-623B). Although there were no processes generating radioactive liquid effluents at TSF, the STP and TSF Pond could have received low-levels of radionuclides from contaminated piping from past discharges to the wastewater system. Detectable levels of Cs-137, Sr-90, and Co-60 in effluents monitored during 1996 were less than 1% of their respective DCGs. Gross alpha and gross beta levels were below drinking water standards or less than detection limits.

5.2.2.5.2 Effluent to the WRRTF Sewage Lagoon and Process Pond (WRRTF-1 and WRRTF-2)—The WRRTF Sewage Lagoon receives effluent from sanitary drains from the WRRTF facility. Sewage passes through a septic tank and sand filter before being discharged to the pond. Due to limited personnel at WRRTF, this discharge was low-volume and intermittent. Data collected from FY-1992 to CY-1996 were comparable to data obtained from other STP effluents onsite.

The WRRTF Process Pond receives low-volume, intermittent discharges from secondary cooling water and boiler blowdown, and rarely receives demineralizer regenerant solutions. Data from FY-1987 to CY-1996 were generally consistent with these anticipated discharges. Several parameters were detected in effluent to the process pond (WRRTF-2) above the Level 2 control limits during March 1996 (Table 5-4). These excursions indicate a deviation from normal operating conditions, but were below regulatory limits. All sample results for the remainder of the year were within control limits.

5.2.2.5.3 Effluent from LOFT—Seepage of precipitation into the LOFT basement and back siphonage from the SMC boiler pond accumulate in the LOFT sump. Data from 1996 was consistent with these discharge sources. RCRA metals were generally non-detectable and concentrations of nonradiological parameters were similar to other process effluents onsite.

Gross alpha and beta levels were below drinking water standards, and U-235 was detected at 4% of the DCG. No other radionuclides were detected.

5.2.2.6 Test Reactor Area. At TRA, all wastewaters are handled as either nonradioactive (cold), low-level radioactive (warm), or highly radioactive (hot) waste. Cold waste is released to a percolation pond (Cold Waste Pond), and warm wastewater is discharged to a lined, evaporation pond (Warm Waste Pond). A tanker trailer contains the hot waste and is transported to ICPP for evaporation. Nonradioactive, sanitary waste is discharged to the STP, and nonradiological demineralizer waste is discharged to a percolation pond (Chemical Waste Pond).

The primary effluent discharges to the environment monitored at TRA during 1996 include: (a) effluent to the Cold Waste Pond (TRA-764), (b) effluent to the Chemical Waste Pond (TRA-708), (c) effluent to the STP Lagoons (TRA-LS1 and TRA-STF), and (d) effluent to the Warm Waste Evaporation Pond (TRA-636). A more detailed discussion of these effluents is provided below. These five effluent monitoring locations were sampled at TRA (Figure A-14):

- Lift station influent to STP Lagoons (TRA-LS1)—This effluent originates from the untreated discharges to the sanitary system.

- Transfer structure effluent from STP Lagoon No. 1 (TRA STF)—This effluent originates from sewage treated in lagoon No. 1.

- Sample tap at TRA-708 effluent to Chemical Waste Pond—The water treatment process at the TRA demineralizer facility produces this effluent.

- Retention basin at TRA-636, effluent to Warm Waste Evaporation Pond—Low-level radioactive waste drains generate this effluent.

- TRA-764, effluent to Cold Waste Pond—This effluent originates from nonradioactive, nonsanitary drains throughout TRA.

5.2.2.6.1 Effluent to the Cold Waste Pond (TRA-764)—Effluent to the Cold Waste Pond (TRA-764) is generated by the nonradioactive, cold waste drains within TRA. The cold drains are located throughout TRA, including laboratories and craft shops. Maintenance cleaning waste, floor, and yard drains are examples of intermittent TRA discharges that might alter water quality parameters during normal operation. The largest volume of wastewater received by the Cold Waste Pond is secondary cooling water from the ATR reactor when it is in operation. Chemicals used in cooling tower water are primarily commercial corrosion inhibitors and sulfuric acid to control pH. The cold waste effluents collect at the cold well sump and sampling station, and are pumped out to the Cold Waste Pond, which is located outside the TRA fence. A radiation monitor and alarm on the cooling tower system prevents accidental discharges of radiologically contaminated cooling water.

Trichlorofluoromethane was detected at estimated concentrations below the practical quantitation limit in the cold waste effluent during 1996. The presence of it at such low concentrations is not an environmental concern and is consistent with historical values.

Data collected from FY-1987 through CY-1996 indicated that the cold waste effluent is fairly homogenous, and met drinking water standards for most parameters monitored. With the exception of a slightly lower than normal pH reading in November, Cold Waste Pond discharges had no excursions beyond the Level 2 control limits during 1996.

Radiological monitoring results indicate that no gamma-emitting radionuclides were detected. Sr-90 was slightly above detectable levels in one sample. Levels of radioactivity for all parameters monitored were below DCGs and drinking water standards or below detection limits.

5.2.2.6.2 Effluent to the Chemical Waste Pond (TRA-708)—The TRA effluent to the Chemical Waste Pond is generated by water treatment processes at the TRA demineralizer facility. The ion-exchange process uses electrically-charged resin beads to attract and adsorb oppositely charged ions from the water until the resin exchange sites are filled with ions from the water. When the exchange capacity of the resin is saturated, the resin bed is regenerated by rinsing the resin with an appropriate chemical solution. Cation-exchange regeneration, which uses sulfuric acid as a regenerant, is carried out approximately every other day. Anion-exchange regeneration uses a sodium-hydroxide regenerant, and is performed approximately every third day. The waste streams are neutralized before being discharged to the Chemical Waste Pond. The neutralization took place in the brine pit (TRA-731A) until September 1995, when an above-ground tank (TRA-708C) was put into operation for neutralization. During 1996, the neutralized waste stream was sampled from the sampling point in TRA-708C. The field pH measurement range for CY-1996 was 8.63 to 9.46.

Ion-exchange regeneration waste streams typically contained mineral salts removed from the water, excess regenerant chemicals, and rinse waters from the regeneration process. Specific waste stream constituents anticipated in regeneration wastewater include calcium, sodium and magnesium salts, iron, copper, zinc, aluminum, manganese, potassium, chlorides, sulfates, mercury, and sodium-hydroxide. Constituents with elevated levels are discussed in the following paragraphs. All others were below concern levels.

Water quality data from FY-1987 to CY-1996 were consistent with the large quantities of dissolved salts in demineralizer effluents. The high historical mean conductivity (21,849 μS) and total dissolved solids (TDS) (21,602 mg/L) resulted from the elevated levels of dissolved salts and free ions introduced during the regeneration process. The high historical mean concentrations for sodium (4,143 mg/L) and sulfate (17,968 mg/L) resulted from the sodium-hydroxide and sulfuric acid used in the regeneration process. The high levels of TDS have potential to degrade groundwater and represent an environmental concern. Alternative processes are being evaluated.

Chromium was detected above the Level 2 control limits in one sample. This excursion indicates a deviation from normal operating conditions, but is not at a level of environmental concern because it was only 0.2 mg/L, which is well below the RCRA hazardous waste limit for chromium (5.0 mg/L).

Radiological monitoring was conducted monthly at TRA-708. No man-made, gamma-emitting radionuclides were detected. Gross alpha was detected at levels above the drinking water MCL during two sampling events. These levels [44.0 $\pm$ 36.0 and 33.0 $\pm$ 17.0 pCi/L (estimated)] were consistent with the historical average concentrations. All other radiological parameters were non-detectable or below drinking water standards.

5.2.2.6.3 Effluent from the Sewage Treatment Plant (TRA-LS1 and TRA-STF)—The TRA STP lagoons receive discharged wastewater from sanitary sewage drains throughout TRA. The old plant was replaced by two lined treatment lagoons in December 1995. Beginning in 1996, influent to the lagoons was sampled from the new Lift Station (TRA-LS1).

During 1996, it was determined that the liner in lagoon No. 2 was leaking. Beginning in September 1996, samples were collected from the transfer structure at lagoon No. 1. Sampling results were used to develop a WLAP application for a temporary irrigation system to be operated while the lagoon liner was being repaired.

Excursions beyond Level 2 control limits were detected at TRA-LS1 for pH, total organic carbon, zinc, and COD; however, these parameters have no regulatory criteria (with the exception of pH, which was well within the hazardous waste limits) and were one-time occurrences. 1,4-dichlorobenzene was detected in the influent at concentrations ranging from 0.016 to 0.058 mg/L, which were well below the RCRA hazardous waste limit of 7.5 mg/L. This compound is an ingredient in toilet bowl deodorants, garbage deodorants, and moth flakes; therefore, it often occurs in sewage effluent.

Results of radiological monitoring indicate that no man-made, gamma-emitting radionuclides were detected. All other radiological parameters monitored were non-detectable or below drinking water standards.

5.2.2.6.4 Effluent to the Warm Waste Evaporation Pond (TRA-636)—The TRA effluent to the Warm Waste Evaporation Pond is generated by low-level radioactive waste drains at TRA. These drains are located throughout TRA in laboratories and craft shops and within the reactor facilities. The effluent streams collect at the retention basin inlet (TRA-636) and are routed to the Warm Waste Evaporation Pond located outside the TRA fence. The Warm Waste Pond is double-lined with a leak detection system. No parameters were detected above the Level 2 control limits during 1996.

Radiological monitoring of the Warm Waste Pond effluent was performed routinely by TRA Operations; therefore, data are not included in this report, but are included in the Radioactive Waste Management Information System.

5.2.3 Special Studies

Sampling was conducted on a frequent basis at the WCB photography laboratory and medical silver recovery systems during 1996. Results were used by facility personnel to evaluate and track the efficiency of these systems. Results indicated that changes in system configuration and canister change-out frequency optimized silver recovery for discharges to the City of Idaho Falls sewer system.

5.2.4 Quality Assurance/Quality Control

Methylene chloride trip blank contamination was observed in 1996. Methylene chloride is a common laboratory contaminant and is often present in trip blanks and laboratory method blanks.

Field replicates, or duplicate samples (splits), are collected once per year per sampling location. The goal is to achieve less than or equal to 35% relative percent difference between any pair of duplicate samples. About 99% of the effluent VOA duplicates achieved this goal; approximately 87.4% of duplicates analyzed for metals achieved this goal; about 83% of duplicates analyzed for inorganics achieved this goal. It should be noted that the majority of effluent samples collected are either non-detected for the various analytes, or contain analytes at concentrations less than five times the method detection limits. When analyte concentrations are less than five times the method detection limit, quantification of the analyte becomes less certain, which has a negative effect on any statistical analyses that are performed on the data set.

Blind standards (QA/QC field blinds) are submitted approximately quarterly. Blind standard sample solutions are purchased from a supplier of laboratory QC standards. The samples are prepared in the Industrial Hygiene laboratory at CFA-612 using standard sample bottles. The standard labeling and sample numbering scheme is used so that there is no indication to the analytical laboratory that the samples are QC samples. First and second quarter blind standard results were within certified value ranges, except for BOD and TSS in the second quarter, which were biased low. Third and fourth quarter blind standard results exhibited low bias (60–70% of the known) for analyses of VOAs. Third quarter metals results were within performance acceptance limits, except for silver, which was biased low. All of the fourth quarter metals results were biased low, and total cyanide results for the third and fourth quarters were biased low.

Low bias in results of analyses performed on blind standard samples may indicate that the results of effluent samples collected in the same time period may also be biased low. For the 1996 effluent samples, the majority of the analytical results for BOD, TSS, VOAs, metals, and cyanide were several times lower than any specified limits and within historical ranges. For example, analytical results could have been several times higher than reported (with the exception of the TSS sample discussed in Section 5.2.2.5.1) and still be less than the discharge limits.

The Sample Management Office reviewed all blind standards data, but could find no specific problems. The raw data submitted showed no irregularities. The Sample Management Office has made some recommendations for possible improvements in the preparation of field blind standards. These recommendations are being implemented. More blind standard samples are being sent to the laboratory, and further evaluation is being conducted.

For effluent radiological analyses, inter-laboratory comparison samples (blind standards) are sent to participating laboratories (including Paragon Analytics) by the EPA-Las Vegas Performance Evaluation

Program, Department of Energy Mixed Analyte Performance Evaluation Program, and the Department of Energy Environmental Measurements Laboratory Quality Assessment Program. The INEEL Environmental Monitoring Drinking Water Program also sent blind standard samples to Paragon on a quarterly basis. The laboratory has demonstrated acceptable accuracy and precision for these analyses.

5.3 Storm Water Monitoring Program

The EPA NPDES rules for the point source discharges of storm water to waters of the U.S. require permits for discharges from industrial activities and construction sites. The permits require implementation of pollution prevention plans to reduce pollutants in storm water discharges. Additional requirements apply to water priority chemicals above a threshold quantity. Also, groundwater protection is required by a special condition included by the state of Idaho.

For regulatory purposes, surface water at the INEEL includes the Big Lost River, Little Lost River, Birch Creek, spreading areas, playas, and tributaries, which comprise the Big Lost River System (Figure 5-5). Groundwater could be influenced by storm water through deep injection wells located at CFA, PBF, and TAN.

On September 9, 1992, the EPA issued the *NPDES General Permit for Storm Water Discharges from Construction Sites*[47] with an effective date of October 1, 1992. To meet the requirements of the permit, DOE-ID prepared the *INEEL Storm Water Pollution Prevention Plan for Construction Activities.*[48] The plan provides for pollution prevention practices and inspections, but monitoring is not required.

On September 9, 1992, the EPA issued the *NPDES General Permit for Storm Water Discharges Associated with Industrial Activity*[2] with an effective date of October 1, 1992. To meet the requirements of the permit, DOE-ID prepared the *INEEL Storm Water Pollution Prevention Plan for Industrial Activities.*[49] The *Storm Water Pollution Prevention Plan for Industrial Activities* is applicable to all the facilities and includes pollution prevention teams, descriptions of potential sources of pollution, measures and controls, evaluation requirements, and monitoring requirements. Practices to minimize storm water pollution are evaluated annually, and the plan is revised accordingly.

5.3.1 Program Design Basis

The Storm Water Monitoring Program meets the NPDES General Permit[2] requirements by conducting required monitoring applicable to INEEL industrial facilities. In addition, the program monitors storm water runoff to deep injection wells because the state of Idaho stipulated a special condition in the NPDES General Permit concerning the protection of groundwater.

Storm water monitoring involves collecting and analyzing samples to determine the pollutants in storm water discharges. Storm water has the potential to transport pollutants to surface water or groundwater. Sources of pollutants include fallout from industrial air emissions, contaminated soil, pesticide and fertilizer application, vehicle and equipment wash and repair areas, parking lots, material handling areas, spills or leaks, illicit connections to the storm drain system, refueling operations, vehicular emissions, and material storage areas.

Parameters for all sites were based on specific facility operations. Sampling of snow melt and rain runoff began in 1993 at various facilities at the INEEL. Permit-required data are submitted to the EPA in the *Annual Discharge Monitoring Report.*[50] Additionally, all data are reported in the annual updates to the *Storm Water Pollution Prevention Plan for Industrial Activities.*

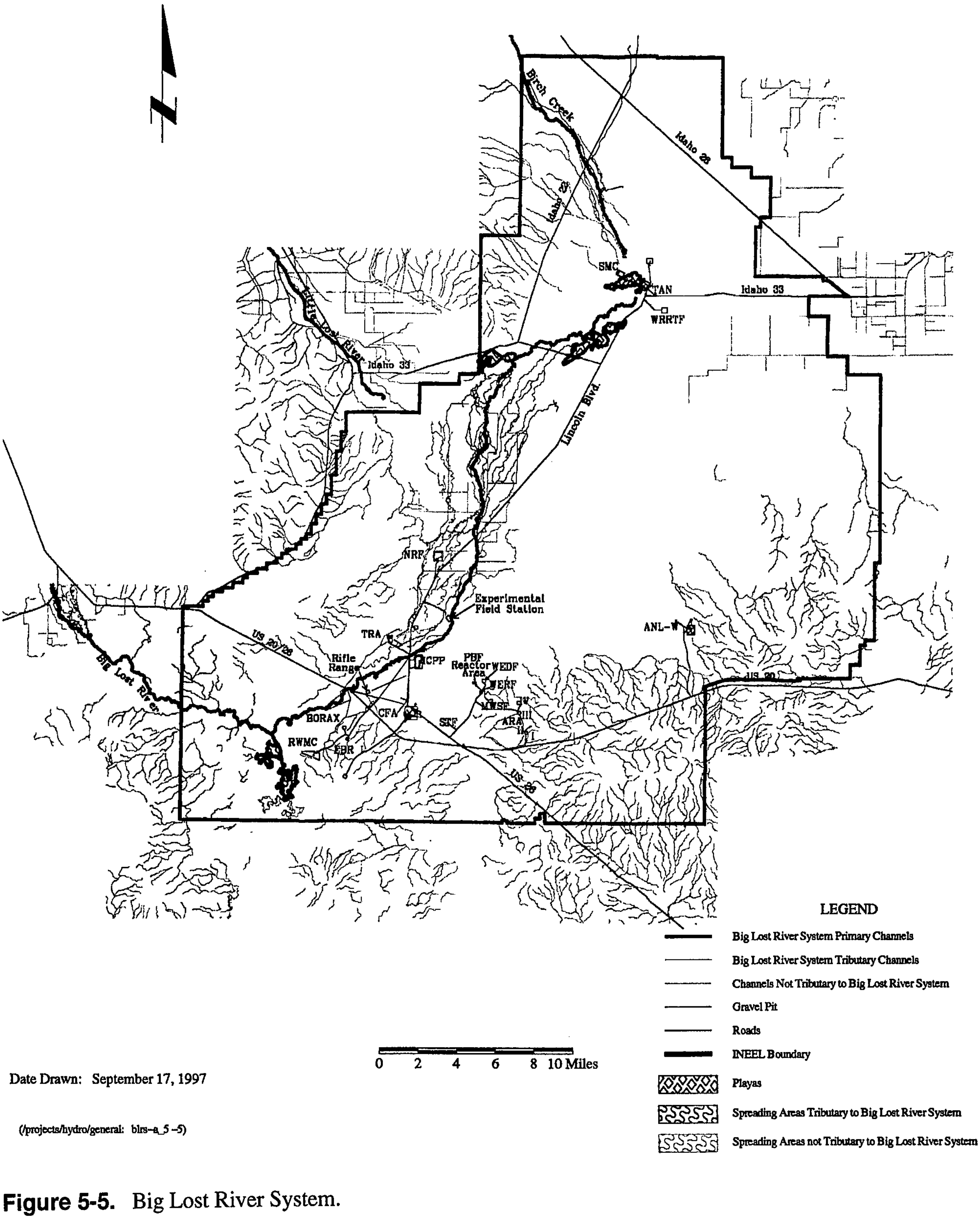


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Figure 5-5. Big Lost River System.

A total of 21 sites (Table 5-5) at nine INEEL areas (Appendix A) are designated as storm water monitoring locations based upon drainage patterns and proximity to potential sources of pollutants. Four facilities meet the conditions for semi-annual monitoring required by the NPDES General Permit when discharges occur to the Big Lost River System (CFA Landfill #3, ICPP Coal Pile, ICPP retention basin, and RWMC SDA). Seven locations at deep injection wells were monitored. Monitoring of storm water runoff not specifically required by the permit is also conducted to evaluate the effectiveness of storm water pollution prevention practices.

During 1996, the Storm Water Monitoring Program collected samples at the deep injection well basins, whether water was discharged down the injection well or not, to provide an indication if storm water could pose a threat to the aquifer. The USGS was responsible for collecting samples from water discharging down the deep injection wells for demonstration of compliance with the State of Idaho Injection Well Regulations[51] and permits.

Samples were collected from snow melt or storms that left at least 0.25 cm (0.1 in.) of precipitation preceded by at least 72 hours without precipitation to allow pollutants to build up and then be flushed from the drainage basin. Because sampling occurs in response to unique meteorological conditions, advance schedules cannot be developed. The NPDES General Permit requires two samples per year for the four locations that are subject to the permit requirements. An attempt was made to sample all locations three times a year: a snow melt event, a spring rain, and a fall rain. Samples were either grab samples or composite samples. Permit-required grab samples were collected within the first 30 minutes of discharge, if possible, or within the first hour if not. Permit-required composite samples were collected by collecting flow proportional aliquots every 15 to 20 minutes during the first three hours of discharge or when the storm ended, whichever was shortest. Basin grab samples were collected in the place of composites if the storm water was not discharged from the basin within 24 hours. Because of unique meteorological conditions, not all sites may be sampled every year.

The storm duration and amount were recorded for all precipitation events along with the duration between the storm event sampled and the end of the previous storm. The Permit requires these measurements, as well as total discharge volume, for storms resulting in a discharge to the Big Lost River System.

5.3.2 Data Summary and Assessment by Facility

During 1996, a total of 34 sampling events took place. A sampling event is defined as samples being obtained from one of the 21 monitoring locations for a single storm. Sixteen of the 21 sites were sampled for snow melt, and 11 of the 21 sites were sampled during at least one rainfall event. A total of 17 sites had at least one sample collected. Table 5-6 shows sampling dates and locations for the storm water events in 1996.

No flow was observed during 1996 at the following monitoring points; therefore, no samples were collected:

- CFA Landfill #3 Extension (CFA-MP-2)
- TRA North Perimeter (TRA-MP-1)
- TRA Northeast Corner (TRA-MP-2)
- TAN Drainage Disposal 2 (TSF-MP-2).

Additionally, no storm water flowed into any of the deep injection wells during 1996.

Table 5-5. 1996 storm water monitoring locations and frequencies.

Site ID	Site Description	Parameters[a]	Number of Sampling Events in 1996
ANL-MP-1	Confluence of ditches north of ANL-757	Metals[b], inorganics[c], and radiological parameters[d]	3
ANL-MP-2	Ditch northeast of building T-12 culvert	Inorganics and radiological parameters	3
CFA-MP-1	Culvert at Lansing Avenue and Antenna Farm Road	Inorganics and radiological parameters	3
CFA-MP-2[e]	CFA landfill #3 near entrance	Metals + total and dissolved Mg, organics + CN, NH_4-N, and radiological parameters	0
CFA-MP-3	CFA Disposal Well near junction of Lincoln and Wyoming	Metals + Sb, Tl, Mn, Fe, Be, Al, Na, inorganics + CN, surfactants, Cl, F, and radiological parameters + Ra-226/228, tritium, Sr-90, and drinking water organics[f]	1
CTF-MP-1	Ditch south of TAN-631	Metals, inorganics, and radiological parameters	2
CPP-MP-1[e]	East Perimeter Road at culvert to retention basin	Metals, inorganics + NO_3-N, NH_4-N, radiological parameters, and VOCs[g]	2
CPP-MP-2[e]	South side of coal pile at discharge to ditch	Metals, inorganics + NO_3-N, NH_4-N, radiological parameters, and VOCs	3
PBF-MP-1	Culvert under Navajo Road south of PBF-614	Metals, inorganics, and radiological parameters	1
PBF-MP-2	SPERT Disposal 1	Metals + Sb, Tl, Mn, Fe, Be, Al, Na, inorganics + CN, Cl, F, surfactants, radiological parameters + Ra-226/228, Sr-90, H-3, and drinking water organics	1
PBF-MP-3	SPERT Disposal 2	Metals + Sb, Tl, Mn, Fe, Be, Al, Na, inorganics + CN, Cl, F, surfactants, radiological parameters + Ra-226/228, Sr-90, H-3, and drinking water organics	1
PBF-MP-4	SPERT Disposal 3	Metals + Sb, Tl, Mn, Fe, Be, Al, Na, inorganics + CN, Cl, F, surfactants, radiological parameters + Ra-226/228, Sr-90, H-3, and drinking water organics	1
RWMC-MP-1	Culvert #16 under Adams Boulevard	Metals + total and dissolved Mg, inorganics + NH_4-N, and radiological parameters + H-3	3
RWMC-MP-2[e]	Outflow from the SDA at the sump by culvert C-12	Metals + Sb, Cr, Tl, V, inorganics + NH4-N, radiological parameters + H-3, Sr-90, Am-241, Pu-238/239, and VOCs	2
RWMC-MP-3	Culvert #23 northeast of WMF-635	Metals + total and dissolved Mg, inorganics + NH_4-N, and radiological parameters + H-3	3
SMC-MP-1	West-side of SMC on Taylor Creek Road	Metals, inorganics + NH_2-N, and radiological parameters	2

Table 5-5. (continued).

Site ID	Site Description	Parameters[a]	Number of Sampling Events in 1996
TRA-MP-1	Culvert C-11 north of TRA-602	Metals, inorganics, and radiological parameters	0
TRA-MP-2	Culvert C-10 north of TRA-601	Metals, inorganics, and radiological parameters	0
TSF-MP-1	TAN drainage disposal 1, corner of Lincoln and Nile	Metals + Sb, Tl, Mn, Fe, Be, Al, Na, inorganics + CN, Cl, F, surfactants, radiological parameters + H-3, Sr-90, Ra-226/228, and drinking water organics	2
TSF-MP-2	TAN drainage disposal 2, discharge to basin TAN-782	Metals + Sb, Tl, Mn, Fe, Be, Al, Na, inorganics + CN, Cl, F, surfactants, radiological parameters + H-3, Sr-90, Ra-226/228, and drinking water organics	0
TSF-MP-3	TAN drainage disposal 3, basin northwest of TSF	Metals + Sb, Tl, Mn, Fe, Be, Al, Na, inorganics + CN, Cl, F, surfactants, radiological parameters + H-3, Sr-90, Ra-226/228, and drinking water organics	1

a. All locations are sampled for field parameters including pH, electrical conductivity, and temperature.

b. Metals include As, Ba, Cd, Cr, Pb, Hg, Se,Ag,Cu, Ni, and Zn.

c. Inorganics include BOD, COD, TOC, TOG, TSS, TDS, TKN, SO_4, P, and TPH.

d. Radiological parameters include Gross Alpha, Gross Beta, and Gamma Spectroscopy.

e. These locations have specific permit monitoring requirements.

f. Drinking Water Organics include drinking water volatiles and synthetic organic compounds (40 CFR 141.61).

g. Volatile Organic Compounds EPA Method 624 Target List.

Table 5-6. 1996 storm water sampling events.

Location	Date	Event[a]	Precipitation (cm)	Discharge to Big Lost River System	Flow Rate (L/sec)
		Compliance Monitoring Points			
ICPP-MP-1	03/28/96	RR	1.12	No	0.23
	05/16/96	RR	1.88	No	7.08
ICPP-MP-2	02/08/96	SM	NA[b]	No	NF[c]
	03/28/96	RR	1.12	No	0.99
	09/16/96	RR	1.1	No	0.89
RWMC-MP-2	02/13/96	SM	NA	Yes	NF
	04/02/96	RR	1.75	No	NF
		Surveillance Monitoring Points			
ANL-MP-1	02/08/96	SM	NA	No	3.12
	05/16/96	RR	1.93	No	0.85
	09/16/96	RR	1.73	No	8.78
ANL-MP-2	02/08/96	SM	NA	No	3.12
	05/16/96	RR	1.93	No	1.98
	09/16/96	RR	1.73	No	0.37
CFA-MP-1	02/08/96	SM	NA	No	19.73
	05/16/96	RR	1.96	No	NF
	09/16/96	RR	1.27	No	0.62
CFA-MP-3	02/13/96	SM	NA	No	NF
CTF-MP-1	02/20/96	SM	NA	No	NF
	09/16/96	RR	0.84	No	1.13
PBF-MP-1	02/12/96	SM	NA	No	NF
PBF-MP-2	02/12/96	SM	NA	No	NF
PBF-MP-3	02/12/96	SM	NA	No	NF
PBF-MP-4	02/12/96	SM	NA	No	NF
RWMC-MP-1	02/08/96	SM	NA	No	NF
	03/28/96	RR	1.12	No	7.08
	09/16/96	RR	0.97	No	2.27
RWMC-MP-3	02/14/96	SM	NA	No	NF
	04/02/96	RR	1.75	No	3.40
	09/16/96	RR	0.97	No	1.42

Table 5-6. (continued).

Location	Date	Event[a]	Precipitation (cm)	Discharge to Big Lost River System	Flow Rate (L/sec)
Surveillance Monitoring Points (continued)					
SMC-MP-1	02/13/96	SM	NA	No	0.28
	09/16/96	RR	0.84	No	0.99
TSF-MP-1	09/17/96	RR	0.84	No	NF
	02/13/96	SM	NA	No	NF
TSF-MP-3	02/20/96	SM	NA	No	NF

a. SM = snow melt, RR = rain runoff.

b. NA = not applicable.

c. NF = no measurable flow at the time of sampling.

Storm water was discharged to the Big Lost River System from RWMC SDA (RWMC-MP-2) in February and was sampled in compliance with the NPDES Permit. The discharge was to the man-made channel that connects to the Big Lost River approximately 3 miles away, and therefore, the channel is considered part of the Big Lost River System. Water infiltrated within a short distance of the discharge point. All other samples were collected for surveillance purposes because they are not permit locations or did not discharge to the Big Lost River System.

Storm water monitoring results were compared to a number of criteria as a method of evaluating the quality of storm water discharges. The NPDES General Permit does not have numeric limitations for the required analytical parameters, with exception of the runoff from coal piles. The pH of runoff from the coal pile at ICPP must be within the range of 6 to 9. Only the pH in runoff from the coal pile is a regulatory limit, all other criteria were used for comparison purposes only. Nonradiological concentrations were compared to MCLs and SMCLs for drinking water. Radiological concentrations were compared to DCGs found in DOE Order 5400.5 and SDWA levels when available. Storm water data collected at injection wells were compared to drinking water standards to address the special permit condition to protect groundwater.

Volatile organic analytes were not detected in any of the samples, and therefore, are not discussed. Table 5-7 summarizes the analytical results that exceeded the guideline comparison level during 1996. No permit or regulatory limits were exceeded.

Minimum, maximum, and mean concentrations for 1996 sample events were calculated, and snow melt and rain runoff samples were averaged together to calculate the mean. Historical and 1996 summary data for permit-required monitoring locations are presented in Appendix G.

High metal concentrations in some samples are suspected to be a result of suspended sediments. Aluminum, iron, manganese, and other metals are typical rock- and soil-forming elements, and high concentrations could be expected in runoff waters. Some radiological parameters are also likely caused from high suspended solids. In the following sections, elevated concentrations of these parameters are compared to background soil concentrations using TSS levels, where data were available. INEEL background soil concentrations presented in Rood, Harris, and White[52] were used to make this assessment using the following equation:

$$C'_{sw} = \frac{C_{bk}}{10^6} \times TSS \qquad \text{Equation (1)}$$

where

C'_{sw} = the estimated concentration in runoff (mg/L) or (pCi/L)

C_{bk} = the concentration in background soil (mg/kg) or (pCi/kg)

TSS = total suspended solids concentration in runoff (mg/L).

Table 5-7 lists the estimated concentrations calculated from TSS and background soil concentration. In most cases, the predicted concentrations agree fairly well with the measured concentrations indicating that natural background concentrations in suspended sediment contributed most, if not all, of the sample concentration. Suspended solids are considered a pollutant when they significantly exceed natural concentrations and have a detrimental affect on water quality. TSS is a good indicator of pollutant removal efficiency and is used to evaluate storm water pollution prevention practices. Although background soil contributions do not indicate contamination from industrial activities at the INEEL, instances of high suspended solids may indicate that erosion control was not adequate at some facilities.

Table 5-7. Storm water/snow melt data comparisons.

Monitoring Point	Parameter	Sample Date	Measured Concentration (mg/L[a])	Estimated Concentration[b] (mg/L)	Guideline/ Limit[c] (mg/L[a])	TSS Concentration (mg/L[a])
ANL-MP-1	Lead	05/16/96	0.024	0.001	0.015	57.3
	Lead	09/16/96	0.031	0.0002	0.015	10.4
ANL-MP-2	TDS	02/08/96	673.0	—[d]	500	—
	Lead	05/16/96	0.037	0.010	0.015	562
	Lead	09/16/96	0.024	0.0008	0.015	44.7
CFA-MP-1	pH	09/16/96	8.68	—	6.5–8.5	—
	Lead	05/16/96	0.021	0.001	0.015	78.5
	Lead	02/08/96	0.022	0.001	0.015	58.0
CFA-MP-3	Gross Alpha	02/13/96	140 ± 38	139 to 209	15.0	8800
	Gross Beta	02/13/96	230 ± 50	223 to 334	50	8800
	Ra-226/228	02/13/96	22 ± 7.36[e]	2.63[f]	5	8800
	Antimony	02/13/96	0.06	0.042	0.006	8800
	Arsenic	02/13/96	0.054	0.051	0.05	8800
	Barium	02/13/96	3.2	2.64	2.0	8800
	Cadmium	02/13/96	0.013	0.019	0.005	8800
	Chromium	02/13/96	0.21	0.29	0.1	8800
	Lead	02/13/96	0.48	0.155	0.015	8800
	Manganese	02/13/96	3.7	4.35	0.05	8800
CTF-MP-1	pH	09/16/96	8.82	—	6.5–8.5	—
	TDS	02/20/96	833	—	500	—
	Lead	09/16/96	0.026	0.008	0.015	473
	Lead	02/20/96	0.028	0.002	0.015	91.7
ICPP-MP-1-C[g]	Lead	05/16/96	0.033	0.004	0.015	221
ICPP-MP-1-G[h]	Lead	05/16/96	0.039	0.016	0.015	894
ICPP-MP-2	pH	09/16/96	8.88	—	6.5–8.5 (6–9)[i]	—
	pH	02/08/96	6.48	—	6.5–8.5 (6–9)[i]	—
PBF-MP-2	Manganese	02/12/96	0.089	0.049	0.05	100
PBF-MP-3	Manganese	02/12/96	0.096	0.041	0.05	82
RWMC-MP-1	pH	09/16/96	9.36	—	6.5–8.5	—
	TDS	02/08/96	603	—	500	—

Table 5-7. (continued).

Monitoring Point	Parameter	Sample Date	Measured Concentration (mg/L[a])	Estimated Concentration[b] (mg/L)	Guideline/ Limit[c] (mg/L[a])	TSS Concentration (mg/L[a])
RWMC-MP-2	pH	04/02/96	9.13	—	6.5–8.5	—
	pH	02/13/96	8.80	—	6.5–8.5	—
	TDS	04/02/96	690	—	500	—
	Cadmium	04/02/96	0.006	0.010	0.005	4750
	Chromium	04/02/96	0.115	0.157	0.1	4750
	Lead	04/02/96	0.088	0.084	0.015	4750
	Gross Alpha	04/02/96	33.3 ± 7.3	75.1 to 113.1	15	4750
RWMC-MP-3	pH	09/16/96	8.66	—	6.5–8.5	—
SMC-MP-1	TDS	02/13/96	927	—	500	—
TSF-MP-1	Gross Alpha	02/13/96	32 ± 12	22.12 to 33.32	15	1400
	Gross Beta	02/13/96	61 ± 14	35.6 to 53.2	50	1400
	pH	09/17/96	8.95	—	6.5–8.5	—
	Iron	09/17/96	2.2	1.22	0.3	50
	Lead	02/13/96	0.054	0.025	0.015	1400
	Manganese	02/13/96	0.92	0.692	0.05	1400
TSF-MP-3	Manganese	02/20/96	0.120	0.07	0.05	150
	Thallium	02/20/96	0.21	0.00007	0.002	150

a. Radionuclide values are reported in pCi/L.

b. Calculated from equation 1, background soil concentrations from Rood, et al., and measured TSS sample concentrations. Gross alpha and beta background concentrations were obtained from D. A. Anderson, 1993.

c. Drinking water MCLs and SMCLs unless otherwise specified.

d. Insufficient number of detectable values.

e. The uncertainty shown for radium 226/228 is the root sum square of the uncertainties reported for each isotope separately. Activities for these isotopes were reported separately and added together for comparison to MCLs.

f. Ra-228 background soil concentration only was used in calculating estimated concentration for Ra-226/228.

g. Composite sample.

h. Grab sample.

i. NPDES permit pH limit for coal pile runoff.

Lead was the most frequently detected contaminant and exceeded the drinking water MCL at 8 of the 17 locations sampled in 1996. Figures 5-6 through 5-9 show lead concentrations for INEEL storm water runoff samples from 1993 through 1996. However, estimated lead concentrations were generally lower than actual measured concentrations, indicating that TSS may not have contributed all of the lead present in these samples. Lead is present Site-wide, suggesting a contribution unrelated to a specific facility, but from a source such as residue from tail pipe emissions.

From 1978 to 1983, the EPA conducted the Nationwide Urban Runoff Program, and the objective of the study was to characterize discharges from separate storm sewers that drained residential, commercial, and light industrial areas. The Nationwide Urban Runoff Program average lead concentration was used to determine how INEEL storm water compares nationally. Total average lead concentration from the Nationwide Urban Runoff Program study was 0.238 mg/L compared to the 1993 through 1996 average for INEEL of 0.022 mg/L. INEEL average lead concentrations in storm water runoff were less than 8% of the national average.

5.3.2.1 Argonne National Laboratory-West. ANL-W has two monitoring locations (Figure A-2). The samples showed no results above MCLs or DCGs, except for lead (Figure 5-6) and TDS (Table 5-7).

5.3.2.2 Central Facilities Area. CFA has three monitoring locations (Figure A-4). The samples from CFA-MP-1 showed no results above MCLs or DCGs, except for lead as depicted in Figure 5-6 and pH, which slightly exceeded the SMCL. The average lead concentration of the storm water from the culvert at CFA-MP-1 was 19.17 mg/L and ranged from 14.20 to 22.00 mg/L.

The snow melt sample collected from the CFA Disposal Well basin (CFA-MP-3) in February had concentrations greater than MCLs for antimony, arsenic, barium, cadmium, chromium, lead, and manganese. Radionuclide concentrations exceeded the MCLs for gross alpha, gross beta, and Ra-226/228. These concentrations represent an increase from 1995 levels, which were below MCLs.

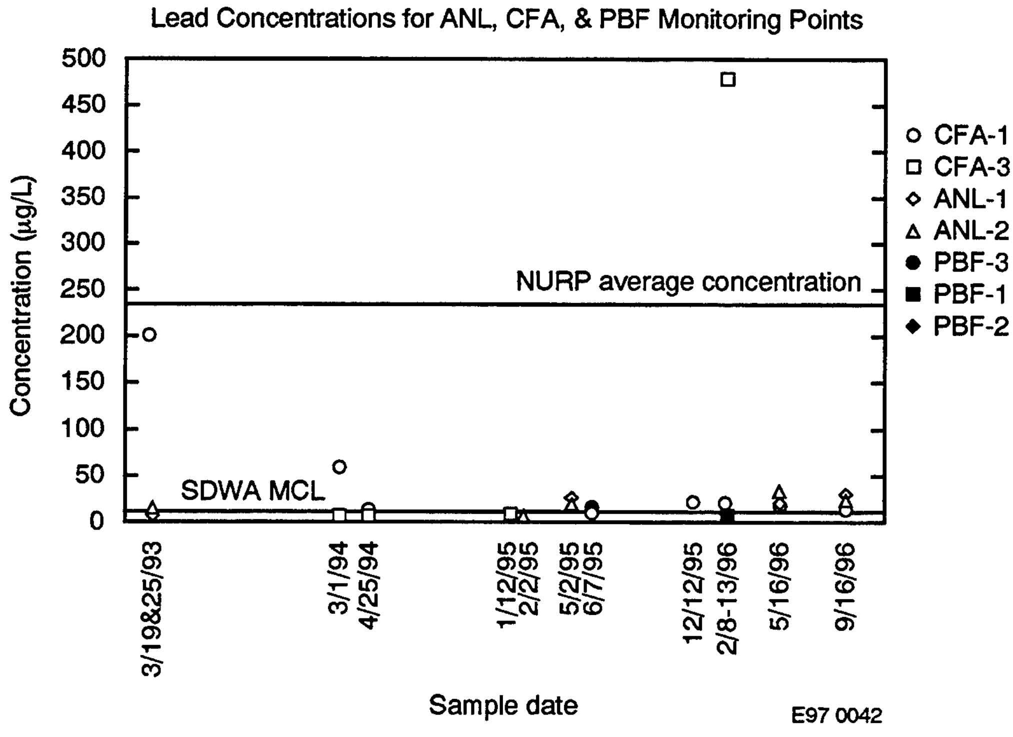


Figure 5-6. Lead concentrations for ANL-W, CFA, and PBF monitoring points (E970042).

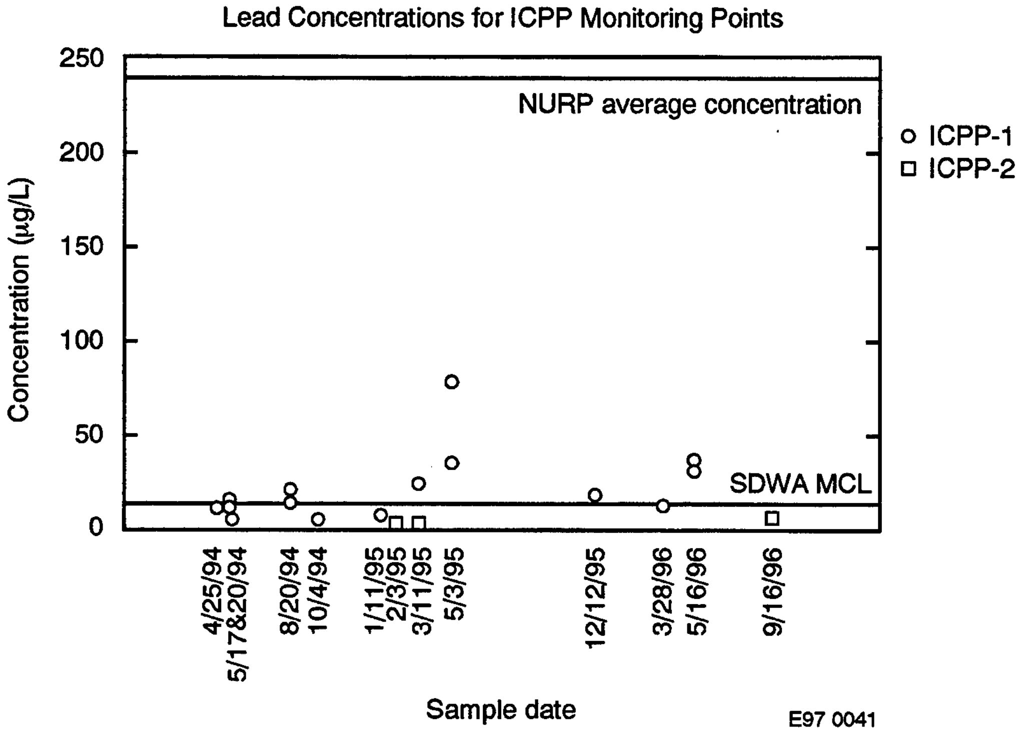


Figure 5-7. Lead concentrations for ICPP monitoring points (E970041).

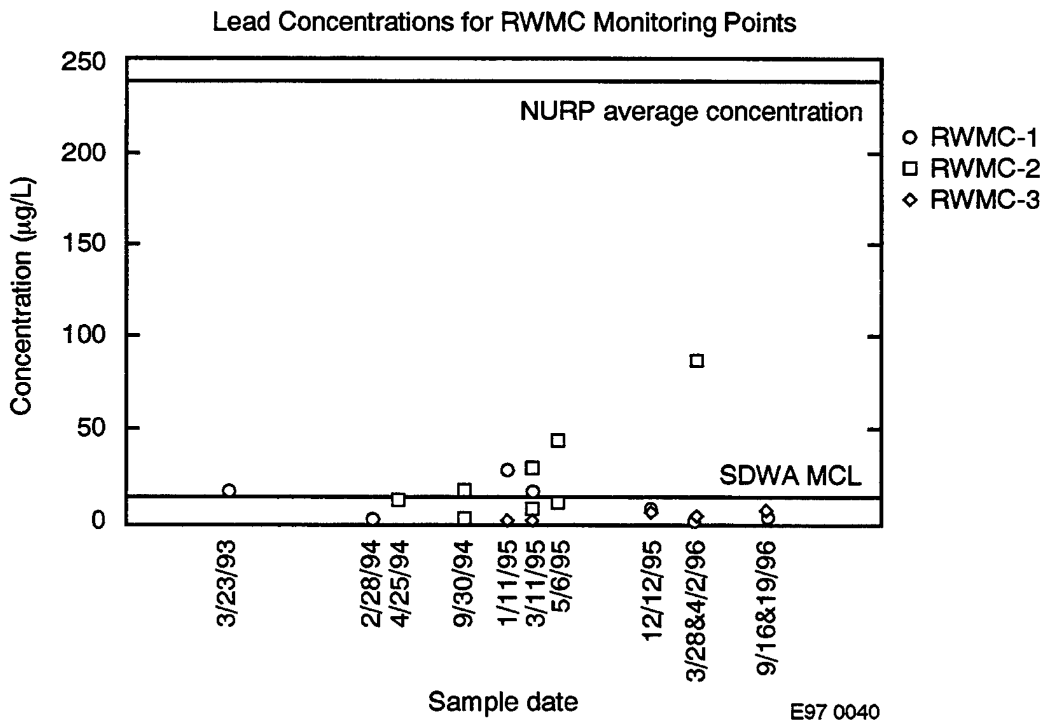


Figure 5-8. Lead concentrations for RWMC monitoring points (E970040).

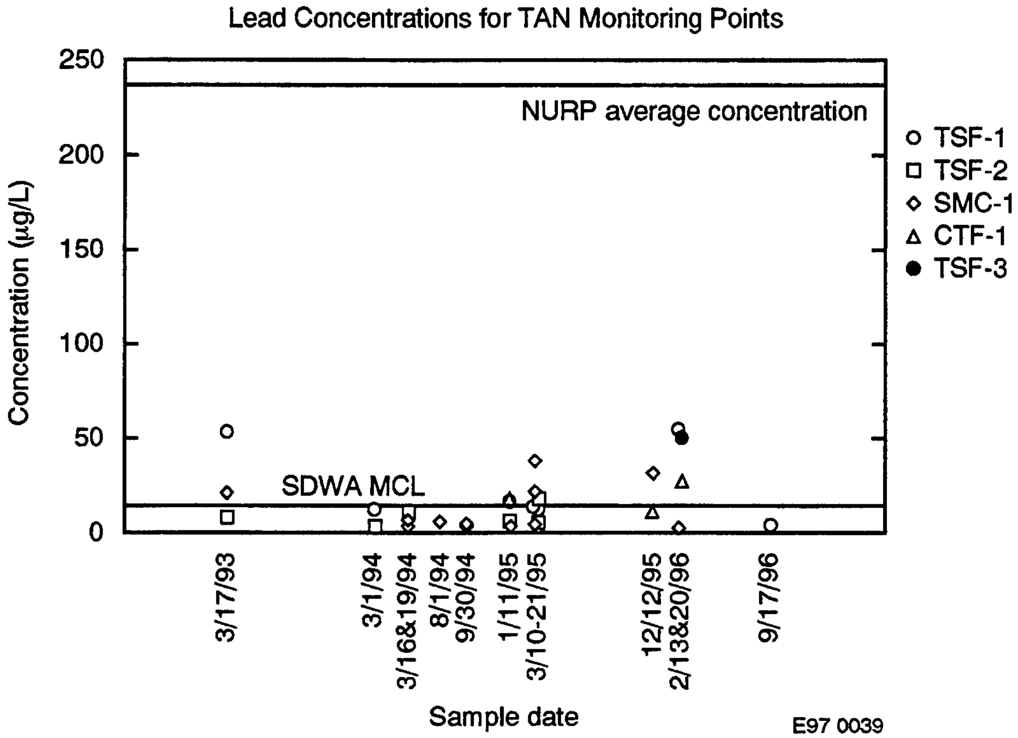


Figure 5-9. Lead concentrations for TAN monitoring points (E970039).

The elevated 1996 metal concentrations seem to be the result of natural background concentrations of suspended sediments in the sample. The radiological parameters could have been associated with suspended sediment also; however, the Ra-226 background soil level was not available for comparison. TSS concentrations for 1996 were significantly higher than 1995 levels possibly due to inadvertent disturbance of the basin bottom sediment during sampling in 1996 and a significant increase in erosion around culverts discharging to the basin. Stabilization of the soil around the culverts to decrease suspended solids loading to the basin is scheduled. Groundwater quality was not impacted from this runoff because no water flowed into the injection well.

5.3.2.3 Idaho Chemical Processing Plant. ICPP has two monitoring locations (Figure A-7); both of these locations are required by the NPDES General Permit. Two grab samples and one composite sample were collected from the culvert into the retention basin (ICPP-MP-1), and all parameters were reported below MCLs, except for lead at ICPP-MP-1 (Figure 5-7).

All analytes for the coal pile runoff (ICPP-MP-2) were below MCLs and DCGs and within permit conditions; pH ranged from 6.5 to 8.9, which was within the range of 6 to 9 as specified in the NPDES General Permit. Historical and summary data for both locations are presented in Appendix G.

5.3.2.4 Power Burst Facility. There are four monitoring locations at PBF (Figure A-16). Three of the locations (PBF-MP-2, -3, and -4) are at injection well basins. One snow melt grab sample was collected from each location during February 1996. The results were below the applicable MCLs and DCGs with the exception of manganese at the injection well locations. Groundwater quality was not impacted because no water flowed into any of the injection wells.

5.3.2.5 Radioactive Waste Management Complex. The RWMC has three monitoring locations (Figure A-12), and the RWMC SDA (RWMC-MP-2) is a permit-required location. Samples from

RWMC-MP-1 showed that all of the parameters were below MCLs and DCGs, with the exception of TDS and pH, which slightly exceeded the SMCLs in one sample.

Two grab samples were collected from RWMC SDA (RWMC-MP-2). One sample was collected from a snow melt event in February, which discharged to the man-made channel that is part of the Big Lost River System. Therefore, this sample is considered a permit compliance sample which requires that discharge volume be measured. The water was discharged without recording the flow, but it is estimated that less than 1,000,000 gallons were discharged. Since then, a process has been implemented to measure the volume during the discharge to the channel.

The snow melt sample slightly exceeded the SMCL pH range. A storm water sample exceeded the MCL for cadmium, chromium, and lead and the SMCL for TDS. The gross-alpha concentration of 33.3 pCi/L exceeded the MCL of 15 pCi/L. This sample also contained elevated TSS (4750 mg/L), which indicates background concentrations in suspended sediments contributed to elevated levels of metals and gross alpha (Table 5-7). Total and soluble magnesium concentrations in this sample were relatively high at 42.4 and 17.4 mg/L, respectively. RWMC applied magnesium chloride salts to roads for dust suppression prior to 1993. Residual salts are the suspected source of the elevated TDS and magnesium concentrations. Historical and 1996 summary data for the RWMC SDA (RWMC-MP-2) are presented in Appendix G.

Samples collected from RWMC-MP-3 had no results above MCLs and DCGs, with the exception of pH in one sample.

5.3.2.6 Test Area North. TAN has five monitoring locations (Figures A-9 and A-13). Parameters in samples collected from the SMC-MP-1 were below MCLs and DCGs, with the exception of one TDS sample. TAN Drainage Disposal 2 (TSF-MP-2) was not sampled due to lack of runoff in the basin.

Two samples were collected from CTF-MP-1, and lead, TDS, and pH were reported at concentrations exceeding drinking water standards. All other parameters were below MCLs and DCGs.

One sample was collected from TAN Drainage Disposal 3 (TSF-MP-3), and manganese and thallium were detected at concentrations above drinking water standards. Two samples were collected from TAN Drainage Disposal 1 (TSF-MP-1). A snow melt sample contained lead and manganese above the drinking water standards, and gross alpha and gross beta were also detected above the MCLs at concentrations of 32 and 61 pCi/L; these can be attributed to suspended solids (Table 5-7).

Aluminum, iron, and pH were reported at levels exceeding the SMCLs in the storm water sample from this location. In addition, trace levels of the pesticides, 2,4-D (0.0003 mg/L) and dicamba (0.0001 mg/L) were detected. The 2,4-D concentration was below the MCL of .070 mg/L and dicamba has no MCL. Currently the approved pesticides used at TAN do not contain these compounds, but in the past years, soil sterilants were applied that likely did contain 2,4,-D and dicamba. Field and laboratory notes on the sample indicate that this sample contained green matter, indicating that vegetation containing trace amounts of the residual pesticide may have entered the sample.

Although drinking water standards were exceeded for several constituents in each of the two injection well basins, groundwater quality was not impacted because no water flowed into either of the two injection wells during 1996.

5.3.3 Quality Assurance/Quality Control

The Storm Water Program uses the results of the effluent monitoring QC Program (Section 5.2.9). In addition, trip blanks are routinely submitted with storm water samples to be analyzed for volatile organic analysis. With the exception of methylene chloride, a common laboratory contaminant, no trip blank contamination was detected in 1996.

Storm water samples collected from the injection well catch basins were analyzed for VOA by EPA drinking water methods. The INEEL DWP submitted blind standard VOA samples to the same laboratory used by the Storm Water Program. The laboratory demonstrated acceptable accuracy and precision for these analyses (Section 5.1.5).

5.4 Groundwater Monitoring Program

Groundwater monitoring at the INEEL is divided into compliance monitoring and surveillance monitoring. Compliance monitoring includes all activities conducted specifically to meet Federal or state of Idaho regulations, with the exception of INEEL Federal Facilities Agreement and Consent Order-related activities. In 1996, compliance monitoring was conducted by LMITCO Environmental Monitoring Program to ensure that the INEEL WLAP facilities are in compliance with state of Idaho permits. Surveillance monitoring was conducted at the ICPP and RWMC to detect unplanned releases and identify potential environmental problems. The information and data provided in this section includes the compliance and surveillance groundwater monitoring data collected by LMITCO at ICPP and TAN and by the USGS at RWMC during 1996.

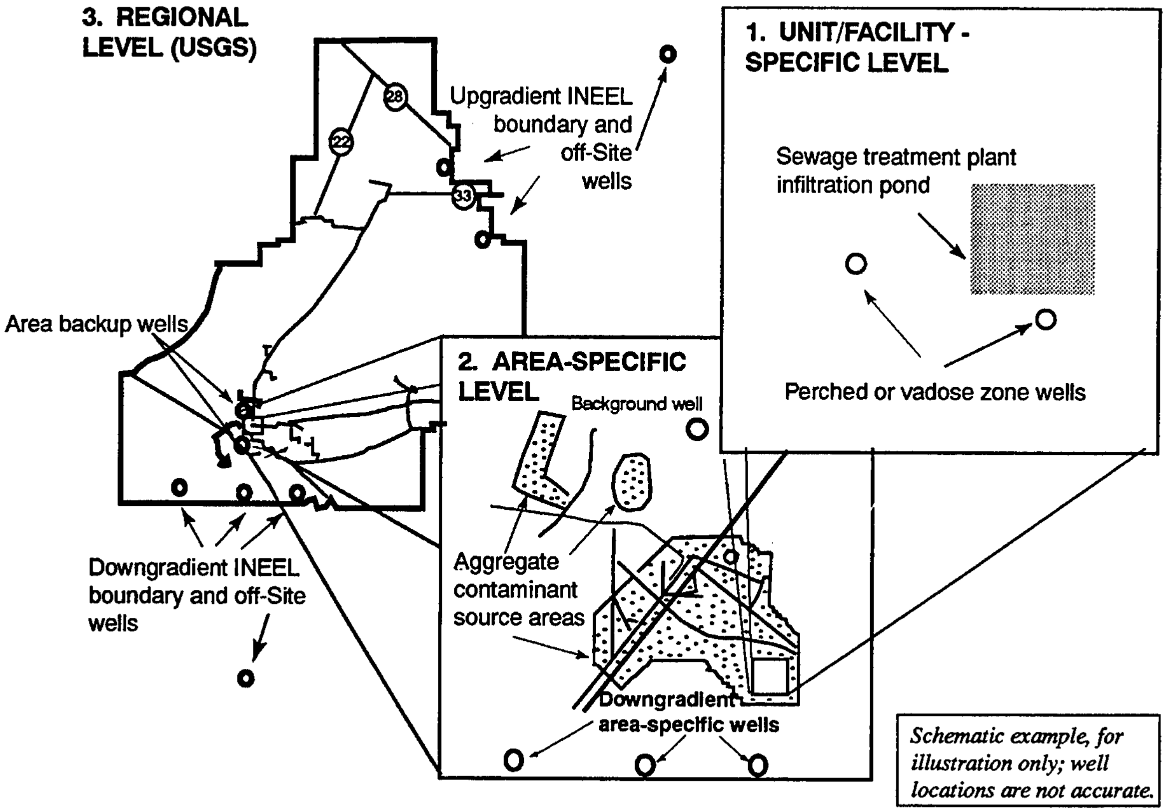
5.4.1 Program Design Basis

The INEEL Groundwater Monitoring Program was designed using a three-tiered approach (Figure 5-10). Regional monitoring (offsite wells and most onsite wells located outside of operational areas) is being conducted by the USGS. The USGS ongoing observational monitoring program continues to be implemented in accordance with its contractual agreements with DOE; however, selected monitoring points and analytes were added to provide additional information and to provide some independent verification of monitoring conducted by the compliance program. Area-specific monitoring networks were designed to determine the effects of INEEL operations on the SRPA. These networks include upgradient and downgradient monitoring that were designed to provide a 95% probability of detecting contaminants from those operational areas that have released or may release contaminants to the SRPA. Unit/facility-specific monitoring networks were designed to detect unplanned releases, identify potential environmental problems, and satisfy Federal or state regulations or permits.

The primary driver for the INEEL Groundwater Monitoring Program is DOE Order 5400.1. This Order requires each DOE facility or operation that has contaminated or potentially could contaminate groundwater resources to establish a groundwater monitoring program to determine and document the effects of operations on groundwater quality and quantity, and to demonstrate compliance with DOE requirements and applicable Federal, state, and local laws and regulations. For 1996, the only regulatory requirement for compliance groundwater monitoring was state of Idaho WLAPs at the ICPP and TAN, as required by IDAPA 01.17600.05.[41] Surveillance monitoring was conducted at a number of ICPP wells that were historically monitored for the purpose of RCRA treatment, storage, and disposal facility monitoring[53] and RCRA Closure monitoring.[54] These facilities were closed in accordance with RCRA requirements, and therefore, the regulatory requirement for conducting groundwater monitoring is no longer applicable. However, surveillance monitoring was conducted to maintain continuity between past RCRA sampling and sampling which will probably be required to support future closures of several other ICPP RCRA facilities (e.g., the ICPP Waste Calcining Facility). Surveillance monitoring is conducted at RWMC by USGS to provide an overall assessment of the impacts to the environment at this waste management facility.

Compliance groundwater monitoring was conducted by LMITCO at the ICPP and TAN. Surveillance groundwater monitoring was conducted by LMITCO at the ICPP and RWMC. The location, frequency, and requirements for each well being monitored by LMITCO Environmental Monitoring is listed in Table 5-8.

The USGS routinely samples groundwater from monitoring wells located in and adjacent to the RWMC. Immediately surrounding the RWMC are USGS Wells 87, 88, 89, 90, 117, 119, and 120, which penetrate the ESRP aquifer approximately 180 m (591 ft) beneath the surface. USGS Well 92, located in



Three-tier monitoring scheme example

1) If unit/facility-specific monitoring details are not otherwise specified by regulation, monitoring specific to an individual facility (in this example, an infiltration pond) will be established in the perched water or vadose zone as close as possible to the facility perimeter.

2) Monitoring in the SPRA will be the province of the well network specific to the operational area that includes the facility (or a number of facilities). The area-specific network provides monitoring coverage for all of the units and facilities within the outlined aggregate contaminant source area.

3) At the regional level, USGS SRPA wells between the operational-area well networks serve as backup to those networks. The USGS wells typically have long open intervals, offering the possibility of sampling aquifer horizons that may not be sampled by the restricted-interval wells of the area-specific well networks. USGS wells at Site boundaries and off-Site provide a coarse-scale view of the quality of water entering and leaving the Site.

V97 0022

Figure 5-10. Example of INEEL's Three-Tier Monitoring Scheme (V970022).

Table 5-8. 1996 LMITCO groundwater monitoring site schedule.

Well Number	Requirement	Constituents[a]	Schedule	Comments
		ICPP GROUNDWATER MONITORING		
PW-1, PW-2, PW-4, PW-5	5400.1 Surveillance Monitoring	1, 2, 8	October/ April	
ICPP-MON-A-022, ICPP-MON-A-023	5400.1 Surveillance Monitoring	3, 8, 9, 10	October	New Well Baseline Sampling
ICPP-MON-P-024	5400.1 Surveillance Monitoring/IDAPA 01.17600.05	3, 6, 8, 9, 10	October/ April	New Well Baseline Sampling/ WLAP STP Perched Water Monitoring
USGS-36, USGS-39	5400.1 Surveillance Monitoring	1, 2, 8	October/ April	
USGS-48	5400.1 Surveillance Monitoring/ IDAPA 01.17600.05	1, 2, 7, 8	October/ April	
USGS-52	IDAPA 01.17600.05	6, 8	October/ April	
USGS-57, USGS-67, USGS-82, USGS-111	5400.1 Surveillance Monitoring	1, 2, 8	October/ April	
USGS-112	5400.1 Surveillance Monitoring/ IDAPA 01.17600.05	1, 2, 7, 8	October/ April	
USGS-113	IDAPA 01.17600.05	7, 8	October/ April	
USGS-114, USGS-116	5400.1 Surveillance Monitoring	1, 2, 8	October/ April	
USGS-121	5400.1 Surveillance Monitoring/ IDAPA 01.17600.05	1, 2, 6, 7, 8	October/ April	

Table 5-8. (continued).

Well Number	Requirement	Constituents[a]	Schedule	Comments
TAN GROUNDWATER MONITORING 1996				
TANT-MON-A-001, TAN-10A, TAN-13A	IDAPA 01.17600.05	8, 11	October/ January/ April/July	Compliance sampling was initiated in October 1996.
TANT-MON-A-002	IDAPA 01.17600.05	8, 11	October/ January/ April/July	Compliance sampling was initiated in October 1996.

a. Constituents

Annually—40 265 Parameters establishing groundwater quality: chloride, iron, manganese, phenols, sodium, sulfate [Comment: These parameters are to be used as a basis for comparison in the event a groundwater quality assessment is required under 265.93(d).]

Semi-annually—40 265 Parameters used as indicators of groundwater contamination: pH, specific conductance, TOC, total organic halogen.

Baseline RCRA Sampling—40 265 appendix III—EPA interim primary drinking water standards (maximum levels given in mg/L): arsenic (0.05 mg/L), barium (1.0 mg/L), cadmium (0.01 mg/L), chromium (0.05 mg/L), fluoride (1.4-2.4 mg/L), lead (0.05 mg/L), mercury (0.002 mg/L), nitrate (as N) (10 mg/L), selenium (0.01 mg/L), silver (0.05 mg/L), endrin (0.0002 mg/L), lindane (0.004 mg/L), methoxychlor (0.1 mg/L), toxaphene (0.005 mg/L), 2,4-d (0.1 mg/L), 2,4,5-tp silver (0.01 mg/L), radium (5 pci/L), gross alpha (15 pci/L), gross beta (4 millirem/yr), coliform bacteria (1/100 mL).

Semi-annually—WLAP: MACs

Semi-annually—WLAP: Secondary Quality Standards less radiological parameters

Semi-annually—WLAP: Total Kjeldahl Nitrogen, ammonium-nitrogen (NH_4-N), nitrate-nitrogen (NO_3-N), nitrate-nitrogen (NO_2-N), BOD, fecal coliform, total coliform, total phosphorous, TDS, chlorides.

Semi-annually—WLAP: Total Kjeldahl Nitrogen, nitrate-nitrogen (NO_3-N), nitrite-nitrogen (NO_2-N), TDS, chlorides, sodium, arsenic, cadmium, chromium, mercury, selenium, silver, fluorides, iron, magnesium, copper, aluminum, pH.

All Sampling Events—Water level elevation, pH, specific conductance, temperature, turbidity.

All 5400.1 Sampling Events—DOE 5400.1 General Indicator Parameters—field pH, specific conductance, sodium, calcium, magnesium, potassium, iron, chloride, sulfate, carbonate, bicarbonate, nitrate, arsenic, alkalinity, TDS, turbidity, temperature, water level, TOC, total organic halogen, gross alpha, gross beta, tritium.

DOE 5400.1 ICPP-specific parameter list—barium, cadmium, chromium, fluoride, lead, mercury, selenium, silver, zirconium, coliform bacteria, endrin, lindane, methoxychlor, toxaphene, 2,4 D, 2,4,5-TP silvex, antimony-125, cobalt-60, cesium-137, iodine-129, Sr-90, tritium.

Quarterly—WLAP: ammonia (as N), arsenic, barium, BOD, chloride, chromium, coliform (fecal/total), fluoride, iron, lead, manganese, mercury, nitrate, nitrite, selenium, sodium, sulfate, TDS (filtered/unfiltered), Total Kjeldahl Nitrogen, Total Phosphorous, zinc.

the west central portion of the SDA, is used for collecting perched groundwater samples and monitoring the depth to perched water. In 1973, the well was sealed with expanding concrete at a dense basaltic zone about 65 m (213 ft) below the surface, so that perched water could accumulate. Due to the removal of water during sampling, the water level varies between 63.3 and 64.0 m (207.7 and 210.0 ft) below the surface.

Each quarter, the USGS measures specific conductance, pH, temperature, and chloride, as well as tritium and Sr-90. During 1996, samples from Wells 87, 88, 89, 90, 117, 119, 120, and the RWMC Production Well were analyzed for gamma-emitting radionuclides (i.e., Co-60 and Cs-137), and TRU radionuclides (Pu-238, Pu-239/240, and Am-241). The RWMC Production Well is sampled monthly for purgeable organic compounds, while all other wells are sampled quarterly.

All LMITCO compliance groundwater monitoring samples were collected from wells using dedicated pumps. Each well is purged a minimum of three well volumes. Additional purging is conducted, as necessary, until the chemistry of the discharge stabilizes as indicated by a pH change of less than 0.1 and specific conductance change of less than 10 $\mu S/cm^2$. Field parameters collected from each well include pH, specific conductivity, turbidity, temperature, and water levels. All sampling conducted by the USGS follows their standard practices and procedures.

The specific sample analyses conducted were dependant on: (a) regulatory requirements, (b) historical analytical results, and (c) the constituents outlined in the *INEL Groundwater Monitoring Plan.*[NO TAG] WLAP samples were analyzed for the constituents and parameters required under the applicable WLAP permit and other selected groundwater general and facility-specific water quality parameters outlined in the *INEL Groundwater Monitoring Plan* (Table 5-8). ICPP surveillance groundwater monitoring samples were analyzed for the constituents and parameters listed in 40 CFR 265, Subpart F, and selected water quality parameters outlined in the *INEL Groundwater Monitoring Plan* (Table 5-8). All analyses were conducted using established sampling protocols and EPA analytical methods.[43,55]

5.4.2 Data Summary and Assessment by Facility

Groundwater monitoring was conducted by LMITCO Environmental Monitoring at four facilities; the ICPP Percolation Ponds, the ICPP STP, and the TAN/TSF STP. Surveillance monitoring was conduced by the USGS at the RWMC. A summary of parameters that exceeded regulatory limits and significant trends is provided below. A more detailed discussion of the analytical results for WLAP wells is provided in the *1996 Annual Wastewater Land Application Site Performance Reports for the Idaho National Engineering Laboratory.*

5.4.2.1 ICPP Compliance Sampling groundwater monitoring was conducted at the ICPP Percolation Ponds and STP. Sampling at these facilities was conducted to meet the groundwater monitoring requirements of the ICPP WLAPs. The WLAPs require that contaminant concentrations at the designated compliance point wells do not exceed state of Idaho's groundwater quality standards maximum allowable concentrations (MACs) or drinking water SMCLs, unless a permit variance is granted by IDEQ. Permit variances have been granted for TDS and for chloride at the ICPP percolation ponds compliance point wells. Results from ICPP Percolation Pond monitoring show that groundwater concentrations in compliance point wells remained within the permit limits. For the ICPP STP, none of the monitored constituents exceeded permit limits at the compliance point well. A discussion of the compliance monitoring results is provided in Sections 5.4.2.1.1 and 5.4.2.1.2 for the ICPP Percolation Ponds and the ICPP STP, respectively.

Surveillance groundwater sampling was conducted in ICPP aquifer wells, which had historically been part of the percolation pond RCRA sampling program, and three newly installed wells. Although the wells monitored for surveillance purposes are not regulated by any specific regulatory threshold, the analytical results were evaluated against SDWA primary and secondary MCLs and RCRA toxic characteristic thresholds for comparison purposes. In cases where numerical thresholds are established under both the SDWA and RCRA, the lower of the two thresholds was used in the evaluations. A discussion of the surveillance monitoring results is provided in Section 5.4.2.2.

5.4.2.1.1 ICPP Percolation Ponds—Groundwater samples were collected during the second and fourth quarters from USGS-112, USGS-113, USGS-121, and USGS-48 (Figure A-7) as required by the ICPP Percolation Ponds permit. USGS-112 and USGS-113 are designated as compliance points. USGS-121 is the facility upgradient background well, and USGS-48 is the upgradient background well for the percolation ponds.

No permit limits or permit variance limits were exceeded at the ICPP percolation pond in 1996. Permit variance limits of 800 mg/L for TDS and 350 mg/L for chloride were negotiated with the state.

Although there is a certain amount of fluctuation in the groundwater data, an evaluation of the historical data indicated that the concentrations of chloride and TDS are in general reaching steady state in the groundwater.[56] However, it is unclear whether the apparent increases in some wells during November (e.g., chloride, sodium, and TDS concentrations in USGS-112 and USGS-113) are significant. Further evaluations will be made when additional data are obtained.

The primary source of chloride, sodium, and TDS in the ICPP Percolation Ponds is the ICPP water treatment processes. LMITCO conducted several studies in the past to determine options for reducing water use and the quantity of salt used or discharged to the ICPP Percolation Ponds. In addition, the LMITCO Environmental Restoration Program is presently evaluating several waste treatment and disposal options to reduce or eliminate discharges to the ponds.

5.4.2.1.2 ICPP Sewage Treatment Plant—Groundwater samples were collected in April and November from USGS-052 (the downgradient compliance point), USGS-121 (the upgradient, background well), and ICPP-MON-P-024 (completed in a shallow perched water zone, immediately adjacent to the STP) (see Figure A-7). Since USGS-052 is the compliance point, contaminant concentrations must not exceed the MACs or the SMCLs at this well.

In both USGS-052 and ICPP-MON-P-024, TDS, chloride, NO_3-N + NO_2-N, and NO_3-N levels were elevated compared to the levels in USGS-121. However, at USGS-052, there no MACs were exceeded.

The primary purpose for monitoring ICPP-MON-P-024 is to evaluate the extent of natural attenuation or treatment provided by the soil column and to monitor for unplanned releases; therefore, monitoring at ICPP-MON-P-024 is not required to meet the WLAP limits. NO_3-N concentrations in April (15.13 mg/L) and November (11.01 mg/L) exceeded the MAC limit of 10 mg/L. Although not regulated by the WLAP, NO_3-N + NO_2-N concentrations (15.6 mg/L and 13.6 mg/L, respectively) exceeded the SDWA MCL of 10 mg/L, further indicating higher-than-desired concentrations of nitrogen compounds in the perched water. During the 1996 monitoring period, the concentration of total nitrogen ranged from a high of 19.57 mg/L to a low of 6.94 mg/L in effluent discharged to the rapid infiltration trenches, with an average of 13.8 mg/L. A comparison of the levels of nitrogen in the effluent and groundwater indicated that nitrogen removal was not occurring in the soil column above the perched water table. TDS levels in April (512 mg/L) and in November (510 mg/L) exceeded the MAC for TDS (500 mg/L). These concentrations were similar to the concentrations found in the STP effluent, which ranged from 353 to 531 mg/L during this period. Total coliform was present in both April (1270 col/100 mL) and November (59.1 col/100 mL). Fecal coliform was detected only in November (1.0 col/100 mL).

Since the ICPP STP has only been monitored for a short duration (approximately 1-1/2 years), it is difficult to make predictions whether the observed concentrations are a long-term trend or a short-term deviation from the norm. However, based on the perched water data, it appears that the present two week discharge rotation between the rapid infiltration trenches may not allow optimal denitrification by the soil column. Therefore, the rotation times will be shortened in the future, and the results will be evaluated to optimize waste treatment. Although the process does not appear to be optimal, data from USGS-052 indicate that the contaminant concentrations are significantly reduced by the time the discharge reached the compliance point.

5.4.2.2 ICPP Surveillance Sampling. Surveillance sampling was conducted at ICPP wells. Thirteen of these wells had historically been part of the ICPP RCRA/DOE Order 5400.1 sampling program. These wells included Percolation Pond perched water wells PW-1, PW-2, PW-4, PW-5, and aquifer wells USGS-036, USGS-039, USGS-057, USGS-067, USGS-082, USGS-111, USGS-114, USGS-116, and USGS-121 (see Figure A-7).

Samples were collected at three wells that were installed near the ICPP STP in the fall of 1995 for the purpose of determining baseline water quality for the wells. ICPP-MON-A-021 is an upgradient aquifer monitoring well; ICPP-MON-A-022 is a downgradient aquifer monitoring well, and ICPP-MON-P-024 is a perched water monitoring well (see Figure A-7). ICPP-MON-P-024 was monitored as part of both the ICPP STP WLAP permit monitoring program and for surveillance purposes. Surveillance monitoring at these wells was conducted to meet internal DOE requirements rather than a specific regulatory requirement; therefore, the evaluations made against RCRA and SDWA thresholds are for comparison purposes only. No RCRA limits were exceeded. A summary of the those constituents that exceeded the applicable thresholds is provided in Table 5-9.

The constituents detected above threshold levels in the ICPP Percolation Pond perched water wells during 1996 include aluminum, chloride, and Sr-90. Aluminum concentrations detected in PW-2 were higher than the SMCL range of 0.05 to 0.2 mg/L during both sampling events (0.209 mg/L and 0.237 mg/L). The cause for the elevated levels of aluminum is unclear, and the highest concentration observed in the Percolation Pond effluent during 1995 and 1996 was 0.037 mg/L. This will be evaluated as additional data are collected.

Chloride concentrations were near or exceeded the SMCL (250 mg/L) in all four wells. Chloride concentrations in PW-1 (247 mg/L) increased from below the SMCL in April to 258 mg/L in December, and exceeded the MCL in PW-2 (271 and 287 mg/L), PW-4 (294 and 282 mg/L), and PW-5 (257 and 259 mg/L) during both sampling events. These concentrations are consistent with historical concentrations observed in groundwater near the ponds and with the concentrations observed in the effluent which ranged from 204 to 349 mg/L during this period. The primary source of chloride discharged to the Percolation Ponds is the ICPP water treatment processes. As discussed above, LMITCO conducted several studies in the past to determine options for reducing water use and is evaluating several water treatment options or replacing the ponds.

Sr-90 concentrations in PW-2 exceeded the MCL of 8 pCi/L in April (8.3 $\pm$ 3.4 pCi/L), but dropped below the MCL (4.78 $\pm$ 9.12 pCi/L) in November. The Sr-90 concentrations are most likely residual from historical discharges of radionuclides to the Percolation Ponds. This assumption is based on the fact that most radionuclide discharges to the Percolation Ponds were discontinued when the ICPP Liquid Effluent Treatment and Disposal facility went on line in 1993. Since that time, radionuclide concentrations in effluents have met drinking water standards.

Table 5-9. 1996 exceeded parameters for the ICPP surveillance wells.

Location	Exceeded Parameter	2nd Quarter Concentrations (mg/L)	4th Quarter Concentrations (mg/L)	Surveillance Threshold[a] (mg/L)
PW-1[b]	Chloride	—[c]	258	250
PW-2[b]	Aluminum	0.209	0.237	0.05–0.2
	Chloride	287	271	250
	Iron	0.876	1.190	0.3
	Sr-90	8.3 ± 3.4 pCi/L[d]	—	8.0 pCi/L
PW-4[b]	Chloride	294	282	250
	Iron	1.616	2.250	0.3
PW-5[b]	Chloride	257	259	250
USGS-036[e]	Sr-90	10.4 ± 4.0 pCi/L	9.68 ± 1.78 pCi/L	8.0 pCi/L
USGS-039[e]	Fluoride	40.6	—	4.0
USGS-057[e]	Sr-90	27.8 ± 10.2 pCi/L	25.9 ± 4.70 pCi/L	8.0 pCi/L
USGS-067[e]	Sr-90	13.2 ± 5.0 pCi/L	17.4 ± 3.18 pCi/L	8.0 pCi/L
	Tritium	21,700 ± 5,600 pCi/L	22,000 ± 2,820 pCi/L	20,000 pCi/L
ICPP-MON-A-021[f]	Total Coliform	20 col/100 mL	—	<1 col/100 mL
ICPP-MON-A-022[g]	Iron	0.353	0.487	0.3
USGS-052[f]	Sr-90	11 ± 4.2 pCi/L	10.3 ± 1.91 pCi/L	8.0 pCi/L

a. Surveillance thresholds are comparison values based on MCLs and SMCLs.

b. ICPP Percolation Pond perched water surveillance well.

c. No exceedances for any parameter.

d. Radionuclide uncertainties are at 2 sigma.

e. ICPP Percolation Pond Aquifer surveillance well.

f. ICPP upgradient background well.

g. ICPP Sewage Treatment Plant surveillance well.

The constituents detected above their threshold in the ICPP aquifer monitoring wells include fluoride, Sr-90, and tritium. Fluoride concentrations in USGS-039 (40.6 mg/L) exceeded the MCL of 4 mg/L in April. Fluoride results were not available for the November sampling period. The source of this constituent is unknown at this time. This concentration is more than two orders of magnitude greater than the maximum concentration of fluoride observed in the effluent during this period (0.29 mg/L). Fluoride concentrations will be evaluated further as additional data are collected.

The MCL for strontium-90 (8 pCi/L) was exceeded in four wells. Concentrations in USGS-036 decreased from 10.4 ± 4 pCi/L in April to 9.68 ± 1.78 pCi/L in November; concentrations decreased in USGS-057 from 27.8 ± 10.2 pCi/L in May to 25.9 ± 4.70 pCi/L in November; concentrations increased in USGS-067 from 13.2 ± 5.0 pCi/L in April to 17.4 ±3.18 pCi/L in November; and concentrations increased in USGS-112 from 22.5 ± 8.4 pCi/L to 27.1 ± 4.96 pCi/L. The Sr-90 concentrations are consistent with historical USGS data.

The MCL for tritium (20,000 pCi/L) was exceeded in USGS-114 during both sampling events (21,700 ± 5,600 pCi/L and 22,000 ± 2,820 pCi/L). These levels are consistent with historical discharge and groundwater data and are remnants of past discharge practices.

Surveillance monitoring at the ICPP STP was conducted at wells ICPP-MON-A-021 and ICPP-MON-A-022. The results of sampling at ICPP-MON-P-024 and USGS-52 are discussed in the ICPP STP compliance monitoring section above. The constituents detected above a threshold during surveillance monitoring at the ICPP STP include total coliform, iron, and Sr-90.

The concentrations of iron (0.353 mg/L and 0.487 mg/L) in ICPP-MON-A-022 exceeded the SMCL of 0.3 mg/L during both sampling events. The source of iron in this sample is not known, but will be evaluated further as additional data are collected.

Total coliform in one sample from ICPP-MON-A-021 (20 colonies/100 mL) exceeded the MCL of < 1 colony per 100 mL. This is consistent with the results in ICPP-MON-P-24; however, this well is completed in the aquifer upgradient from the STP and is far enough away that it would not be expected to be influenced by discharges from the STP. These results are probably due to cross-contamination during sampling. If coliform are detected in this well during future sampling, the samples will be speciated in order to determine the source of contamination.

Sr-90 concentrations in USGS-052 were above the MCL of 8 pCi/L during both sampling events (11 ± 4.2 and 10.3 ± 1.91 pCi/L). These concentrations are consistent with historical values.

5.4.2.3 RWMC Surveillance Monitoring. Since operations began at the INEEL in the 1950s, wastewater disposal at the INEEL has increased the specific conductance of groundwater in the vicinity of INEEL facilities. The background specific conductance of water from the ESRP at the INEEL generally ranged from 178–860 μS/cm.[57] This range was compared to the specific conductance measurements of water samples collected from wells at the RWMC in 1996 (Table 5-10). These specific conductance measurements are comparable to those made in previous years.

Table 5-10. Results of chemical analyses of subsurface water at the RWMC in 1996.

Well	Month Sampled	Specific Conductance μS/cm	Concentration (mg/L) Cl$^-$	Na$^+$
87	January	356	13	—[a]
	April	351	14	10
	July	358	14	—
	October	358	14	10
88	January	581	86	—
	April	580	82	—
	July	584	81	—
	October	583	87	44
89	January	381	36	—
	April	382	38	—
	July	385	38	—
	October	385	37	20
90	January	373	15	—
	April	365	16	—
	July	383	19	—
	October	378	17	8.6
117	January	272	13	—
	April	277	13	—
	July	277	14	—
	October	279	13	9.9
119	January	280	8.4	—
	April	274	9.8	—
	July	285	9.2	—
	October	286	9.5	10
120	January	470	23	—
	April	426	18	25
	July	444	22	—
	October	414	18	21

Table 5-10. (continued).

Well	Month Sampled	Specific Conductance μS/cm	Concentration (mg/L)	
			Cl^-	Na^+
RWMC Production Well	January	385	17	—
	February	385	—	—
	March	367	—	—
	April	382	18	—
	May	382	—	—
	June	388	—	—
	July	386	17	—
	August	383	—	—
	September	—	—	—
	October	376	15	8.7
	November	382	—	—
	December	—	—	—
Natural background[b] (of aquifer)	—	300–325	8–15	10

a. No sample taken.

b. J. R. Pittman et al., *Hydrologic Conditions at the Idaho National Engineering Laboratory*, Idaho, 1982–1985 update, 89-4008, 1988.

Water from some of the RWMC monitoring wells contained sodium concentrations that exceeded the background level of 10 mg/L (shown in Table 5-10). Sodium concentrations have fluctuated in water from these wells. One possible cause for these fluctuations is the method used to construct the wells. During construction, the wells were pressure-grouted to prevent water from cascading from perched zones down to the SRPA. The grout mixture could contribute to higher sodium concentrations.

The chloride concentration (Table 5-10) was also above background levels (8 to 15 mg/L), but well below the SMCL for drinking water, which is 250 mg/L. The elevated chloride concentrations may be attributed to the same cause as the high sodium concentrations. Both the chloride and sodium concentrations are comparable to concentrations from previous years at these well locations.

Tritium was detected in Well 87, Well 90, and in the RWMC Production Well (Table 5-11). The maximum concentration of tritium was 1.5 E-6 μCi/mL in the RWMC Production Well and Well 90 with a standard deviation of 0.4 E-6 μCi/mL. This concentration is well below the DCG for the public (less than 0.1% of the DCG, as shown in Table D-1). Tritium concentrations in these wells are plotted in Figure 5-11. The source of the tritium is attributed to past disposal of wastewater from operations at the ICPP and TRA.[57] Other radionuclides were not detected in the wells in any quarter.

Table 5-11. Results of tritium analyses from RWMC subsurface water.

Well	Month Sampled	Radionuclide[a]	Concentration[b] (E-6 μCi/mL)	Percentage of DCG[c]
87	January	H-3	1.4 ± 0.8	0.07
	April	H-3	1.1 ± 0.8	0.06
	July	H-3	1.2 ± 0.8	0.06
	October	—	—	—
88[d]	January	—	—	—
	April	—	—	—
	July	—	—	—
	October	—	—	—
89[d]	January	—	—	—
	April	—	—	—
	July	—	—	—
	October	—	—	—
90	January	H-3	1.5 ± 0.8	0.08
	April	H-3	1.4 ± 0.8	0.07
	July	H-3	1.5 ± 0.8	0.08
	October	H-3	—	—
117[d]	January	—	—	—
	April	—	—	—
	July	—	—	—
	October	—	—	—
119[d]	January	—	—	—
	April	—	—	—
	July	—	—	—
	October	—	—	—
120[d]	January	—	—	—
	April	—	—	—
	July	—	—	—
	October	—	—	—
RWMC Production Well	January	H-3	1 .5 ± 0.8	0.08
	April	H-3	1.4 ± 0.8	0.07
	July	—	—	—
	October	—	—	—

a. No radionuclides detected other than tritium. (See Tables B-1 and B-2 for limits of detection for other radionuclides.)

b. Uncertainties are reported as 2 sigma.

c. Derived Concentration Guide values for the public are based on the dose conversion factors provided in DOE Order 5400.5, "Radiation Protection of the Public and the Environment," February 8, 1990.

d. All radionuclides were below 3 times the analytical uncertainty.

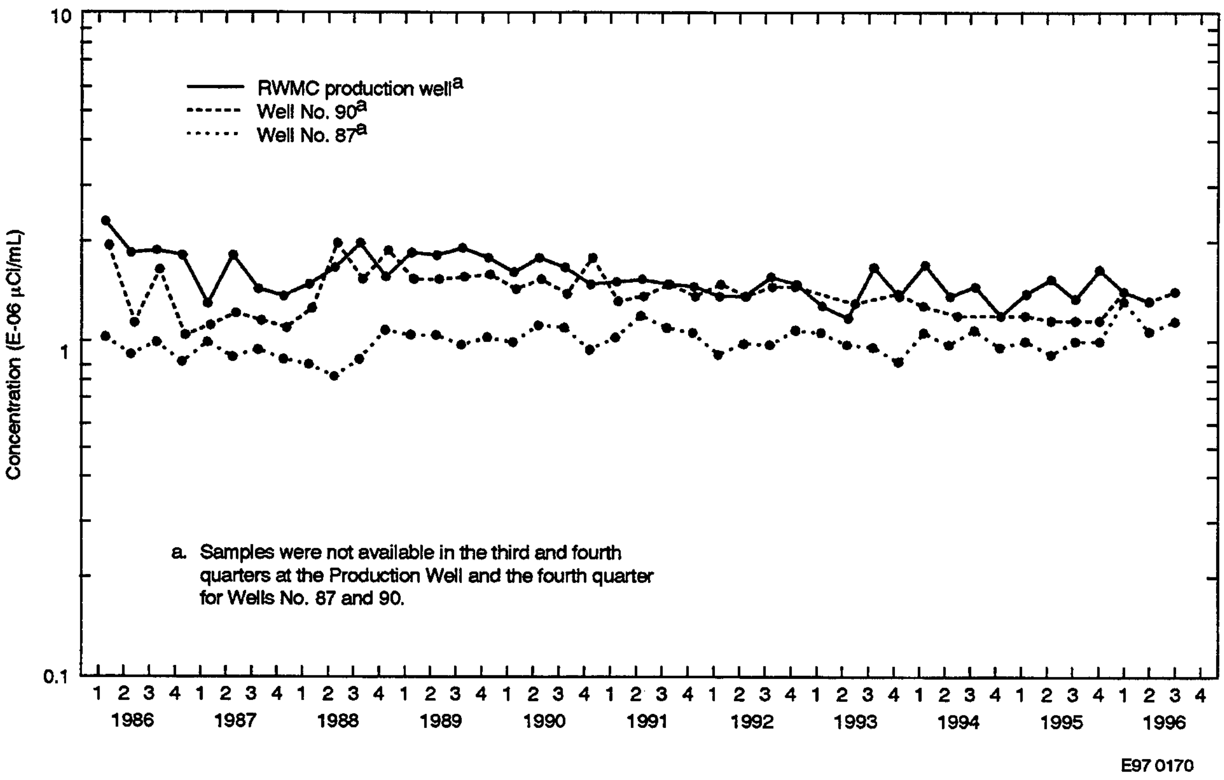


Figure 5-11. Tritium concentrations in RWMC wells (E970170).

Approximately 330,000 L (87,179 gallons) of organic waste were disposed prior to 1970 at the RWMC.[58] These buried wastes included about 92,000 L (24,304 gallons) of carbon tetrachloride, 148,000 L (39,098 gallons) of lubricating oil, and about 95,000 L (25,097 gallons) of other organic compounds, including trichloroethane, trichloroethylene, perchloroethylene, toluene, and benzene.

Table 5-12 shows the 1996 concentrations of VOCs at USGS monitoring wells. The 1996 results are comparable to previous data, with the exception of carbon tetrachloride in Wells 87, 88, and 90. No MCLs for VOCs or radiological constituents were exceeded for the annual average during 1996. Although no MCLs were exceeded, carbon tetrachloride concentration levels have gradually increased in these three wells over the past three years (Figure 5-12). However, MCLs for carbon tetrachloride were exceeded two times at the RWMC production well.

5.4.2.4 TAN/TSF Compliance Monitoring. Groundwater samples were collected from TAN-10A, TAN-13A, TANT-MON-A-001, and TANT-MON-A-002 (see Figure A-13) as required by the TAN/TSF WLAP. TANT-MON-A-001 is the background aquifer monitoring well. TAN-10A, TAN-13A, and TANT-MON-A-002 are the designated compliance points for the TAN/TSF STP permit. Sampling was conducted in late August and early September at TAN-10A and TAN-13A and from all four wells in November. Wells TANT-MON-A-001 and TANT-MON-A-002 were installed in September; therefore, only one–quarter of sampling was conducted at these wells.

Of the parameters analyzed for in wells TANT-MON-A-001 and TANT-MON-A-002, no constituents were detected above the permit limits in November. Concentrations exceeding the MAC in TAN-10A and TAN-13A are summarized in Table 5-13.

Table 5-12. Concentrations ($\mu g/L$) of selected volatile organic compounds in groundwater.

Well Identifier	Date Sampled	Carbon Tetra–chloride	Chloro-form	1,1,1–Trichloro–ethane	Trichloro–ethylene	Tetrachlo–roethylene	Dichloro–difluoro–methane	Toluene	1,1–Dichloro–ethane	1,1–Dichloro–ethylene
87	1/96	1.8	<0.2	<0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2
	4/96	1.9	<0.2	<0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2
	7/96	1.9	<0.2	0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2
	10/96	2.3	<0.2	0.2	0.5	<0.2	<0.2	<0.2	<0.2	<0.2
88[a]	1/96	2.1	0.5	0.2	0.9	<0.2	<0.2	<0.2	<0.2	<0.2
	4/96	2.0	0.5	0.2	0.7	<0.2	<0.2	<0.2	<0.2	<0.2
	7/96	2.0	0.5	0.2	0.8	<0.2	<0.2	<0.2	<0.2	<0.2
	10/96	2.1	0.5	0.2	0.8	<0.2	<0.2	<0.2	<0.2	<0.2
89	1/96	—[b]	—	—	—	—	—	—	—	—
	4/96	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	7/96	—	—	—	—	—	—	—	—	—
	10/96	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
90	1/96	2.4	0.2	0.3	1.0	<0.2	<0.2	<0.2	<0.2	<0.2
	4/96	2.6	0.3	0.4	1.0	<0.2	<0.2	<0.2	<0.2	<0.2
	7/96	2.8	0.4	0.4	1.3	<0.2	<0.2	<0.2	<0.2	<0.2
	10/96	2.6	0.3	0.4	1.2	<0.2	<0.2	<0.2	<0.2	<0.2
117	1/96	—	—	—	—	—	—	—	—	—
	4/96	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	7/96	—	—	—	—	—	—	—	—	—
	10/96	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
119	1/96	—	—	—	—	—	—	—	—	—
	4/96	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	7/96	—	—	—	—	—	—	—	—	—
	10/96	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Table 5-12. (continued).

Well Identifier	Date Sampled	Carbon Tetra–chloride	Chloro-form	1,1,1–Trichloro–ethane	Trichloro–ethylene	Tetrachlo–roethylene	Dichloro–difluoro–methane	Toluene	1,1–Dichloro–ethane	1,1–Dichloro–ethylene
120	1/96	1.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	4/96	0.9	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	7/96	1.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	10/96	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
RWMC Production Well	1/96	4.4	0.7	0.6	2.3	<0.2	<0.2	<0.2	<0.2	<0.2
	2/96	4.7	0.7	0.7	2.5	<0.2	<0.2	<0.2	<0.2	<0.2
	3/96	4.8	0.8	0.7	2.6	0.2	<0.2	<0.2	<0.2	<0.2
	4/96	4.6	0.8	0.6	2.3	0.2	<0.2	<0.2	<0.2	<0.2
	5/96	4.6	0.7	0.6	2.3	0.2	<0.2	<0.2	<0.2	<0.2
	6/96	4.8	0.7	0.6	2.4	0.2	<0.2	<0.2	<0.2	<0.2
	7/96	4.6	0.7	0.6	2.3	0.2	<0.2	<0.2	<0.2	<0.2
	8/96	4.7	0.7	0.6	2.1	<0.2	<0.2	<0.2	<0.2	<0.2
	9/96	5.0	0.8	0.6	2.2	0.2	<0.2	<0.2	<0.2	<0.2
	10/96	3.4	0.4	0.5	1.5	<0.2	<0.2	<0.2	<0.2	<0.2
	11/96	4.6	0.7	0.6	2.1	0.2	<0.2	<0.2	<0.2	<0.2
	12/96	5.1	0.8	0.7	2.5	0.2	<0.2	<0.2	<0.2	<0.2

a. Tests specific to pumps and instrumentation were conducted on Well 88 during February 1992. The results of these tests are reported in a USGS report titled *Purgeable Organic Compounds in the Ground Water at the Idaho National Engineering Laboratory*, 1990–1992.[19]

b. No samples were collected.

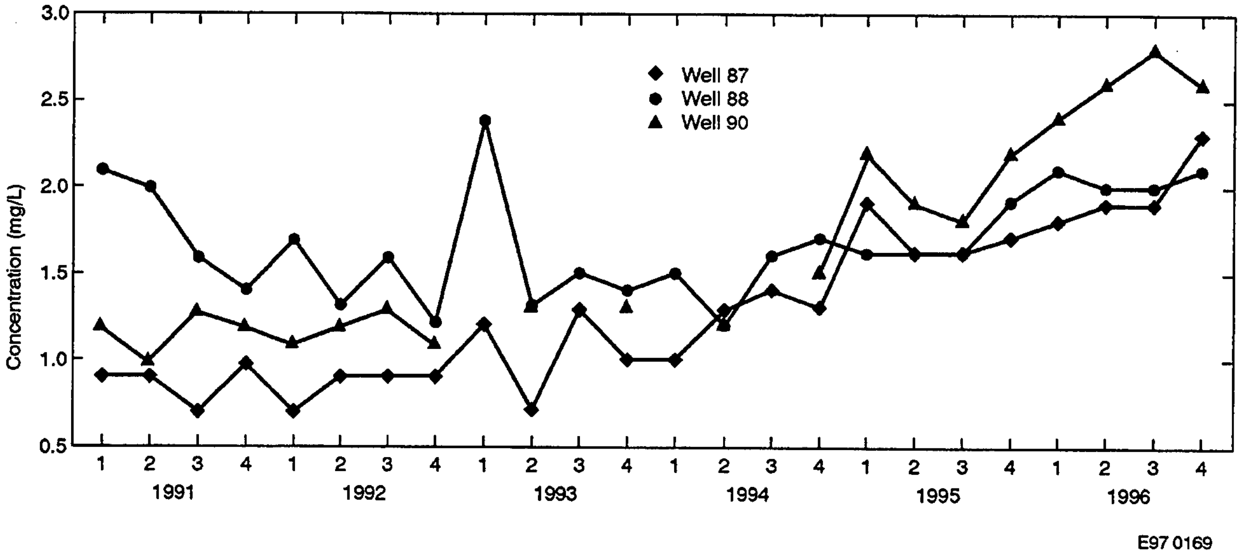


Figure 5-12. Carbon tetrachloride concentrations in Wells 87, 88, and 90 (E970169).

Table 5-13. 1996 exceeded parameters for the TAN WLAP wells.

Location	Exceeded Parameter	3rd Quarter Concentrations (mg/L)	4th Quarter Concentrations (mg/L)	WLAP Limits[a] (mg/L)
TANT-MON-A-001[b]	—[c]	—	—	—
TAN-10A[d]	Total Coliform	—	300 col/100 mL	2 col/100 mL
	Iron	2.74	0.75	0.3
	Manganese	0.053	—	0.05
	Sodium	31.6	34.5	20[e]
TAN-13A[d]	Total Coliform	30 col/100 mL	20 col/100 mL	2 col/100 mL
	Iron	—	1.24	0.3
TANT-MON-A-002[d]	—	—	—	—

a. WLAP limits are based on MACs and SMCLs.

b. Designated by the TAN Sewage Treatment Facility WLAP as the TAN upgradient background well.

c. No exceedances for any parameter.

d. Designated as a "compliance point" by the TAN Sewage Treatment Facility WLAP.

e. The limit for sodium represents an "optimum value" rather than a WLAP limit.

The constituents detected above their threshold in TAN-10A included sodium, iron, manganese, and total coliform. Sodium concentrations (31.6 and 34.5 mg/L) exceeded the MAC of 20 mg/L during both sampling events; however, the level listed for sodium in the groundwater quality standards is an optimum value and is not a permit compliance limit. Manganese (0.053 mg/L) exceeded the MAC of 0.05 mg/L during the August sampling event, but dropped below the MAC in November (0.0119 mg/L). The concentration of iron exceeded the SMCL of 0.3 mg/L during both sampling events; however, the concentration declined significantly (from 2.74 to 0.75 mg/L) during this period. Total coliform was absent in August, but exceeded the MAC (2 col/100 mL) significantly in November (300 colonies/100 mL).

The constituents detected above MACs in TAN-13A include iron and total coliform. Iron was observed below the MAC of 0.3 mg/L in August (0.211 mg/L) but the concentration increased to 1.2 mg/L in November. Total coliform exceeded the MAC (2 col/100 mL) during both sampling events. In August, 30 colonies per 100 mL were observed, but the concentration decreased to 20 colonies per 100 mL in November.

Iron, manganese, and sodium concentrations at TAN have historically been detected at levels exceeding the MAC and were reported in the permit application. However, since there were a number of parameters that exceeded their applicable MACs during the August and November sampling events, additional sampling was conducted at TAN-10A and TAN-13A and in January 1997. Results of the January 1997 sampling event were consistent with those from November 1996, confirming that manganese concentrations were below the MAC and that iron and sodium levels remain elevated. The possibility that the elevated levels of iron may be due to well construction is being evaluated. The results were inconclusive concerning the concentrations of total coliform. It is suspected that the observed concentrations are due to cross-contamination during sampling. Coliform samples are now being speciated in order to determine the contaminant source. Additional perched water and aquifer wells will be monitored in 1997 to better quantify the concentrations and pinpoint the sources of these contaminants.

5.4.3 Special Studies

Two groundwater studies were initiated in 1996. First, an informal evaluation has been initiated by Environmental Monitoring to determine if there are significant differences in analytical results between filtered and non-filtered groundwater samples. Because of the uncertainty associated with the effects of either filtering or not filtering samples and differences in regulatory requirements (some requiring filtering, some not allowing filtering samples), it is a fairly common practice within the groundwater industry to collect both types of samples. At the INEEL, there is a potential for pumping turbid water from the wells, especially in perched water wells. Therefore, filtered and unfiltered samples were collected and analyzed for most groundwater samples collected in 1996. Although for most parameters, there appears to be relatively insignificant differences between filtered and unfiltered analyses, for a few parameters it appears that there may be significant differences (e.g., iron). Filtered and unfiltered samples are being collected again in 1997. Once sufficient data are collected, they will be statistically analyzed. If, based on the statistical evaluation, it is determined that the differences are statistically insignificant, the Environmental Monitoring Groundwater Program will discontinue routinely collecting paired filtered and unfiltered samples and only collect unfiltered samples.

Second, a two-part evaluation of all available historical groundwater data at the INEEL was initiated in 1996. The purpose of this study is to evaluate historical contaminant patterns and trends in groundwater. The first phase of the study was an evaluation to determine where chemical and radiological contaminants have been detected at or near established regulatory thresholds. This evaluation has been completed and is presently in review. Following this review, the information will be compared with information from ongoing Environmental Monitoring and Environmental Restoration Programs to ensure that all significant sources of contamination are being properly addressed. The second phase of this study will be to evaluate and document contaminant trends at wells that have significant levels of contamination. This information will be used to evaluate whether there are new or previously undetected sources of groundwater contamination and if trends are increasing or decreasing at faster rates than expected. Since this evaluation will include data from almost all monitoring wells onsite, it allow the INEEL to detect previously unrecognized contaminant problems, provide new insights into the locations of contaminant sources and plumes, and allow INEEL groundwater monitoring and characterization programs to focus their monitoring efforts on the areas and contaminants of greatest concern.

6. SPECIAL REQUEST MONITORING PROGRAM

The SRMP provides on-call support to facilities and programs to provide characterization of unknown materials and to support waste disposal decisions. Abbreviated sampling and analysis plans are prepared to obtain representative samples to meet project-specific waste acceptance criteria for disposal.

6.1 Program Design

In accordance with the Code of Federal Regulations, waste must be characterized or adequate historical knowledge must be documented to make waste disposal determinations. The vast majority of SRMP projects are to provide characterization of waste for disposal in accordance with the RCRA. Typical governing regulations or guidance documents include the Toxic Substances Control Act, Land Disposal Restrictions, Universal Treatment Standards, and the INEEL Reusable Property, Recyclable Materials, and Waste Acceptance Criteria.

The SRMP tracks the project from the initial request through preparing the sampling plan, coordinating plan reviews, obtaining laboratory services, scheduling sampling activities, and tracking the resulting data. Upon receipt of the data, and validation if requested, the SRMP summarizes the data and issues a closure report to the project requester. All files are maintained in the SRMP database for future reference. Each abbreviated sampling and analysis plan is prepared by an experienced sampler and goes through extensive reviews including peer, project requester, radiological, industrial hygiene, environmental, and transportation, as applicable.

The SRMP provides representative data that meets regulatory and waste acceptance criteria for disposal. Program methods are typically SW-846; frequency varies from project to project. Media types may include solids (soils), concentrated liquids, wastewater, nonwastewater, and miscellaneous debris. Sampling locations in the SRMP are generally Site-wide but also include offsite areas. Results are reported separately for each sampling event.

6.2 Activities Summary

One-hundred forty six sampling requests for the SRMP were received in 1996 (Table 6-1). The following is a list of facilities and the number of requests the SRMP responded to during 1996:

- CFA—25
- ICPP—28
- PBF—7
- RWMC—9
- TAN—31
- TRA—38
- Other (Idaho Falls, Greece, ARA, etc)—8.

Table 6-1. Special request environmental monitoring projects for 1996.

Project Number	Description
EMS-001-96	TAN Solvent Extraction System Room Sludge Characterization
EMS-002-96	TAN Used Oil Characterization
EMS-003-96	Environmental Management Sampling of CFA 640 Drywell
EMS-004-96	TCLP Metals Analysis of Waste Management Office Crane Pieces (Emergency Request)
EMS-005-96	TRA Lead Based Paint Component
EMS-006-96	TRA Used Oil
EMS-007-96	CFA-686/688/689 Roof Sampling
EMS-008-96	WERF Temporary Accumulation Area Paint Chips
EMS-009-96	CFA-640 Hydraulic Ram Sampling
EMS-010-96	TRA Cold Waste Pond (Previously EMS-068-95)
EMS-011-96	Drill Cuttings of Lead Based Painted Walls (Emergency Request)
EMS-012-96	Boiler Sump Sludge
EMS-013-96	STR-780 Radiological Soil and Gravel Drums
EMS-014-96	STR-780 Antifreeze in Kitty Litter
EMS-015-96	MON-PW-024 Perched Well Monitoring
EMS-016-96	Electrical Cable Tar (Emergency Request)
EMS-017-96	Sample Drum of Radioactively Contaminated Oil for Polychlorinated Biphenyls (PCBs) at Engineering Test Reactor
EMS-018-96	April RCRA Groundwater ICPP
EMS-019-96	CFA-621 Equipment Sampling for PCBs
EMS-020-96	Borax V Demineralizer Column and Lead Sampling
EMS-021-96	TRA-653 Machine Shop Process Work
EMS-022-96	Envirocare Characterization for CPP Waste Disposal
EMS-023-96	CPP Steam Condensation
EMS-024-96	Baseline Sampling of Carbon Drums
EMS-025-96	TRA-731 Demineralizer Area
EMS-026-96	CFA-688/689 Roof Sampling for PCBs
EMS-027-96	Oil and Oil Residue at WERF
EMS-028-96	Plywood and Drum Sampling at RWMC
EMS-029-96	Sample Cargo Bins For Incinerable Waste at WERF
EMS-030-96	Sampling for Compactible Storage at WERF
EMS-031-96	RCRA Closure of Hazardous Waste Storage Facility
EMS-032-96	Characterize TAN Groundwater Treatment Facility Waste Streams for Disposal at WERF

Table 6-4. (continued).

Project Number	Description
EMS-033-96	Envirocare Characterization for TRA Soil and Sludge
EMS-034-96	Characterization of Wastewater Treatment Plant and Crude Oil Tanks—Athens, Greece
EMS-035-96	Sampling of 14 Drums of Liquid at TAN-603 Boiler Room
EMS-036-96	Pooching, Acidic Leaking Drums at RWMC/SWEPP
EMS-037-96	PCB Oil Sampling-2 Pumps Advanced Test Reactor Laydown Area
EMS-038-96	CFA-614 Compressor Fluids for Disposal
EMS-039-96	Mercury Characterization of Soil
EMS-040-96	Respirator Cartridges for CFA Landfill Disposal
EMS-041-96	Unknown "Spill-X" Absorbent at TAN-607
EMS-042-96	Submit TAN Sample #01195011R4 for Reanalysis
EMS-043-96	ATR Cooling Tower Sediment TRA-657 Temporary Accumulation Area
EMS-044-96	IFF-606 Backflow Preventer Deposit Sampling
EMS-045-96	TAN-624 Resin Beads And Crud
EMS-046-96	CFA TAA Liquid Characterization
EMS-047-96	Engineering Test Reactor Transformer Yard-PCB Testing
EMS-048-96	Characterization of CFA-657 Septic Tank
EMS-049-96	TRA Water Tanks Sandblasting Grit
EMS-050-96	TRA-TAA Sulfuric Acid
EMS-051-96	CFA-1711 Kitty Litter (Emergency Sampling)
EMS-052-96	RWMC-612 Temporary Accumulation Area High Efficiency Particulate Air Filter
EMS-053-96	CFA-608 Oil Separator, Septic Tank, Aviation Hanger
EMS-054-96	CF-633 Lead Bricks
EMS-055-96	TAN Waste Stream Characterization
EMS-056-96	TAN PPE for Lead
EMS-057-96	TRA-731 Tank Area (Previously EMS-025-96)
EMS-058-96	RCRA Closure Sampling at Waste Engineering Development Facility
EMS-059-96	CFA STP WLAP Soil Monitoring
EMS-060-96	TAN WLAP Groundwater Monitoring
EMS-061-96	Water Levels And Samples at TRA Retention Basin
EMS-062-96	ATR Emergency High Rad Resin
EMS-063-96	CPP-698 Used Oil Characterization
EMS-064-96	Emergency Sampling of IRC Water System

Table 6-4. (continued).

Project Number	Description
EMS-065-96	ATR Resins TRA 605 Warm Waste Treatment Facility
EMS-066-96	Certified and Segregated Building Solids
EMS-067-96	TAN System Demineralizer (Formerly EMS-083-95)
EMS-068-96	Demineralizer System at TRA (Formerly EMS-099-95)
EMS-069-96	TAN-603 Used Oil
EMS-070-96	PBF Low-level Radioactive Waste Characterization
EMS-071-96	TAN Tanks 701 and 733 Paint Chips
EMS-072-96	TRA TAA Bulk Diesel Tank Leak
EMS-073-96	Contaminated Oil TRA Temporary Accumulation Area
EMS-074-96	Petroleum Contaminated Soil for Landfill Disposal
EMS-075-96	TAN Radioactive Parts Security Storage Area Rainwater
EMS-076-96	Army Reentry Vehicle Facility Site Bunker French Drain
EMS-077-96	ARA Septic System
EMS-078-96	TRA-603 Hydraulic Fluid
EMS-079-96	TAN Well Drill Cuttings and GW
EMS-080-96	TSA-Firewater at RWMC
EMS-081-96	TRA-614 Varnish Bath
EMS-082-96	ICPP-Exhaust Stack Residue
EMS-083-96	ICPP-659 Vent Air Scrubber Solution
EMS-084-96	ARA III Septic Sludge Boxes (Emergency Request)
EMS-085-96	WMF-602 HEPA Filter Sampling
EMS-086-96	Oil Collected During Maintenance at TRA and Acidic Liquid
EMS-087-96	TRA Drummed Liquid Sludge
EMS-088-96	Two Equipment Filters at TRA
EMS-089-96	Environmental Restoration CFA STP Characterization
EMS-090-96	TAN Groundwater Treatment Facility Injection Well Groundwater
EMS-091-96	ICPP, TAA #12 Solidified Soil
EMS-092-96	ICPP Nitric Acid
EMS-093-96	ARA Box Sampling—Same Boxes as EMS-084-96
EMS-094-96	Revision of EMS-078-95—ICPP Demineralizer
EMS-095-96	EMS-057-96 Reopened—TRA-731 Tanks
EMS-096-96	Characterization of INEEL Well Site Soils
EMS-097-96	Valve Pit #1 Liquid at TAN
EMS-098-96	Two Diesel #5 Tanks at TAN
EMS-099-96	Construction Sump at CFA

Table 6-4. (continued).

Project Number	Description
EMS-100-96	Characterization—High Efficiency Particulate Air Filters, Rain Water, Parts Cleaner, etc.
EMS-101-96	Solid Debris at ICPP 631
EMS-102-96	CF-655 Decontamination and Dismantlement Sampling
EMS-103-96	ICPP Miscellaneous Waste Characterization
EMS-104-96	Cleanup Waste of Air Support Building-II Floors
EMS-105-96	PPE from Cleanup at RWMC
EMS-106-96	CPP-603 Basin Water Treatment
EMS-107-96	TRA STR 780 Spill—Transmission Fluid
EMS-108-96	Storm Water Assessment TAN-687 Fire Station
EMS-109-96	Decontamination and Dismantlement Tank Bottoms—TAN-702 and 724 #5 Fuel Oil
EMS-110-96	PBF-732 Hazardous Waste Storage Facility Liquid for Transfer to CPP Process Equipment Waste
EMS-111-96	ICPP Wells Sampling for October
EMS-112-96	TAN/TSF Wells
EMS-113-96	SMC Liquid Characterization
EMS-114-96	ICPP Northeast Corner Oily Soil
EMS-115-96	ICPP Environmentally Controlled Area Soils
EMS-116-96	CPP-606 Southwest Corner Sensor Solution
EMS-117-96	WRRTF TAN-646 Demineralizer
EMS-118-96	TRA-731 B, C, D & E Tanks—Insulation Characterization
EMS-119-96	LOFT Hot Waste Sump Drums
EMS-120-96	Spill of Diesel to be Land Farmed at CFA
EMS-121-96	ICPP Contaminated Soil in TAA
EMS-122-96	Used Sand Blast Grit at TAN
EMS-123-96	Materials Test Reactor Stack Oil/Water (TRA)
EMS-124-96	Heat Transfer Reactor Experiment II
EMS-125-96	TAN-603 Drums
EMS-126-96	CFA-697 Used Oil
EMS-127-96	TAN Warm Shop TAA—Rain Water
EMS-128-96	CPP-1647 Sodium Hydroxide Products
EMS-129-96	Acid Spill onto TRA-708C Soils
EMS-130-96	Temporary Accumulation Area #11 CPP-602 Unknown Liquid
EMS-131-96	708C TRA Soil Spill (Emergency Request)

Table 6-4. (continued).

Project Number	Description
EMS-132-96	CPP-1647 Sulfuric Acid
EMS-133-96	CPP-637 Temporary Accumulation Area #2 Acidic Waste
EMS-134-96	TAN-607 Solidified Process Water
EMS-135-96	Advanced Test Reactor Lab 124 Liquid Waste
EMS-136-96	Flash Arresters TRA-780 TAA
EMS-137-96	Liquid Legacy Waste at ICPP
EMS-138-96	TAN Process Experimental Pilot Plant Incinerator Ash
EMS-139-96	ICPP-626 Septic Tank ST-SFE-101
EMS-140-96	Scientech TRA Tanks
EMS-141-96	TRA Used Oil
EMS-142-96	Belt Grinder Sludge ICPP-637
EMS-143-96	Underground Storage Tank-766 TAN Sampling
EMS-144-96	CPP-659 Sump
EMS-145-96	CPP-633 Condensate/Snowmelt to Vessel WC-119
EMS-146-96	CPP-603 Paint Chips

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Appendix A

Facility Maps with Monitoring Locations

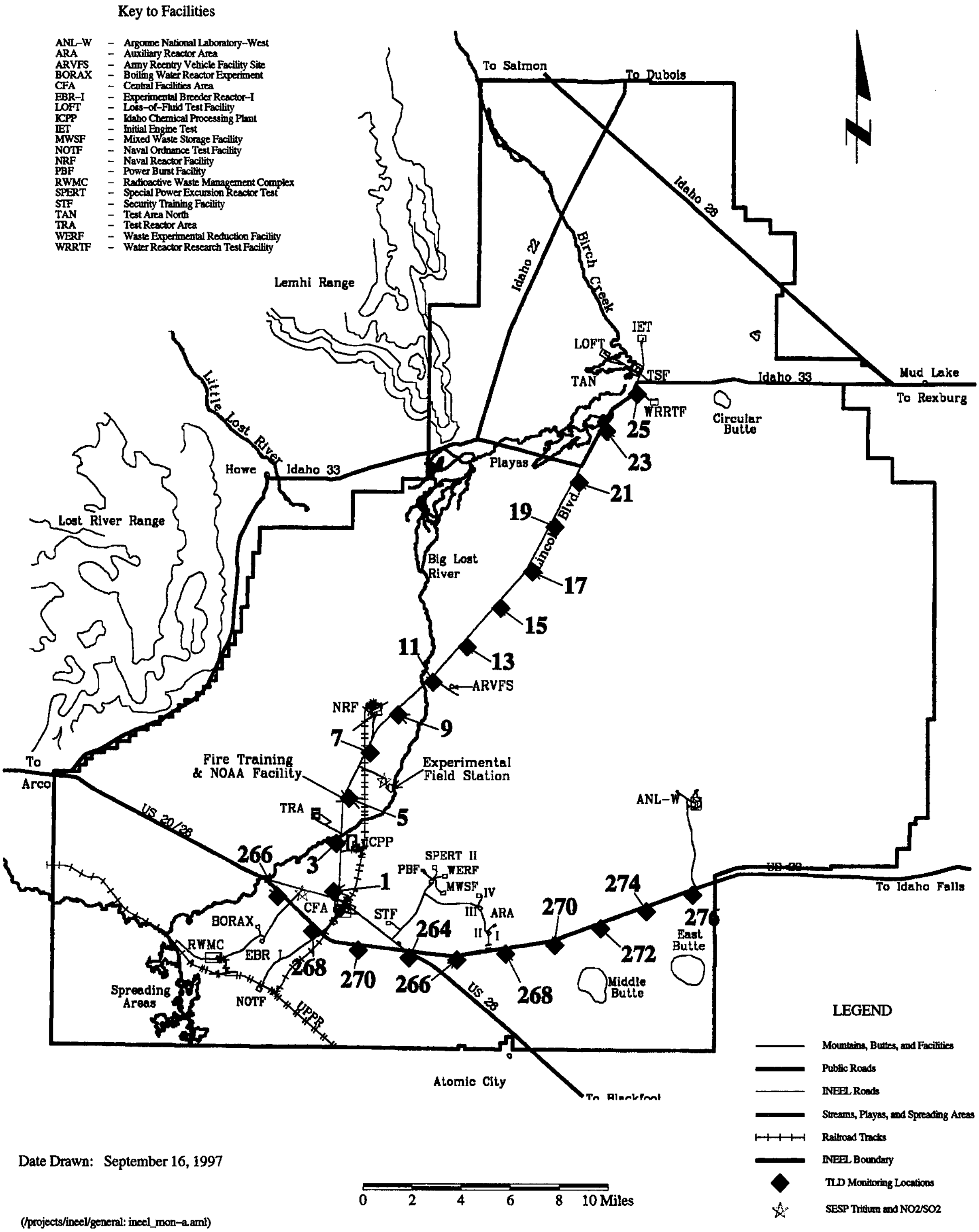

Figure A-1. Idaho National Engineering and Environmental Laboratory (INEEL) monitoring locations.

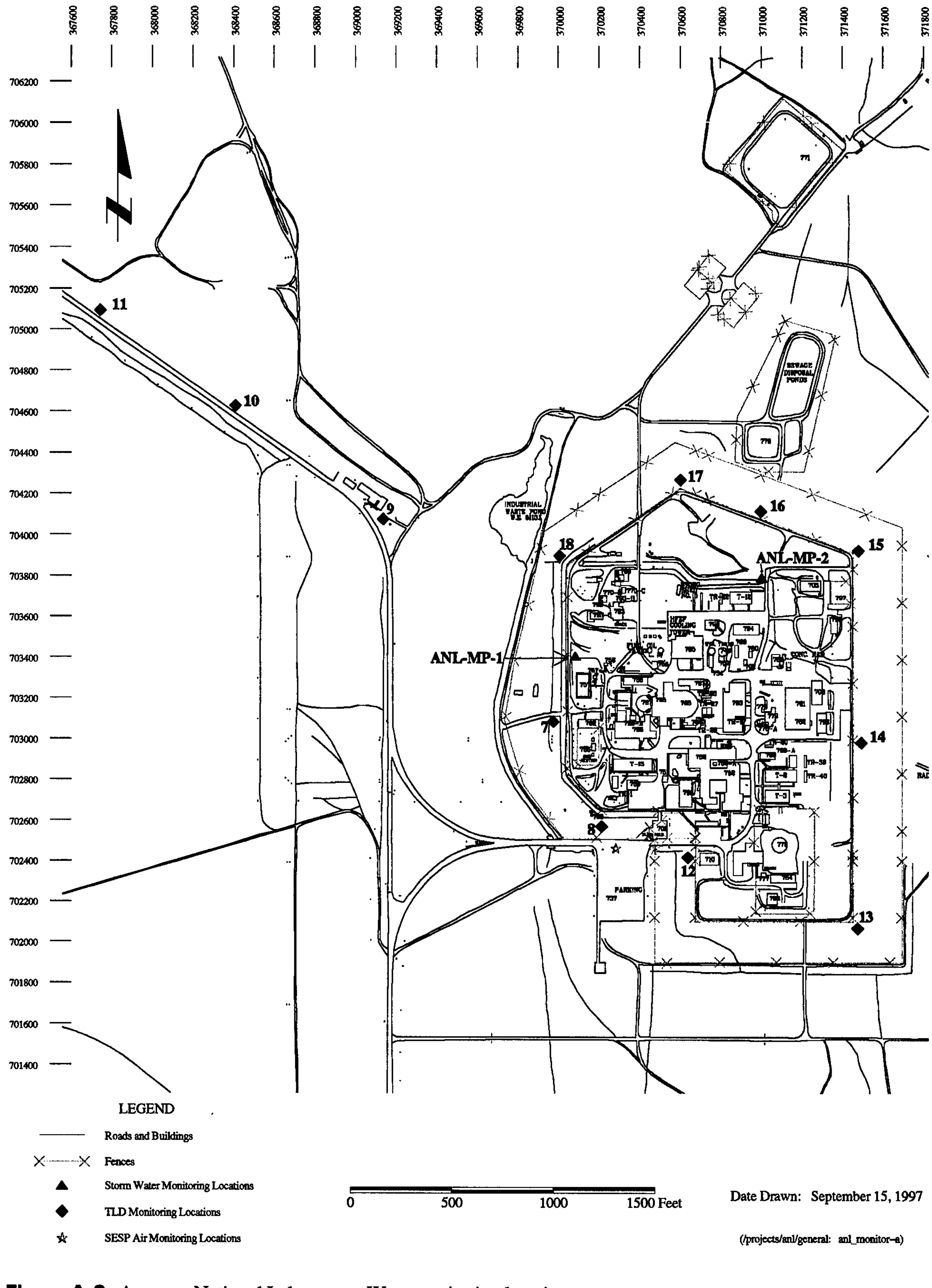

Figure A-2. Argonne National Laboratory–West monitoring locations.

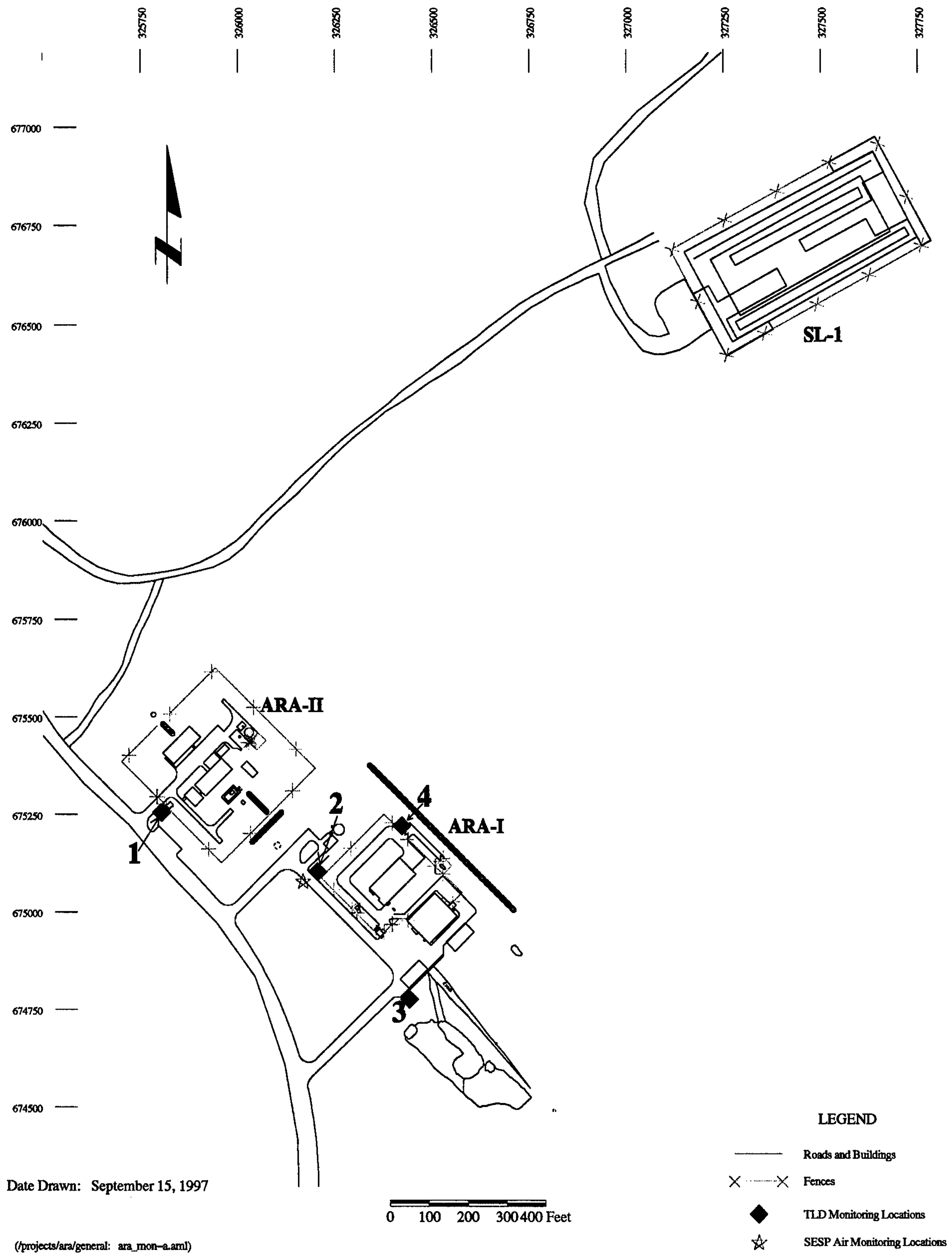

Figure A-3. Auxiliary Reactor Area monitoring locations.

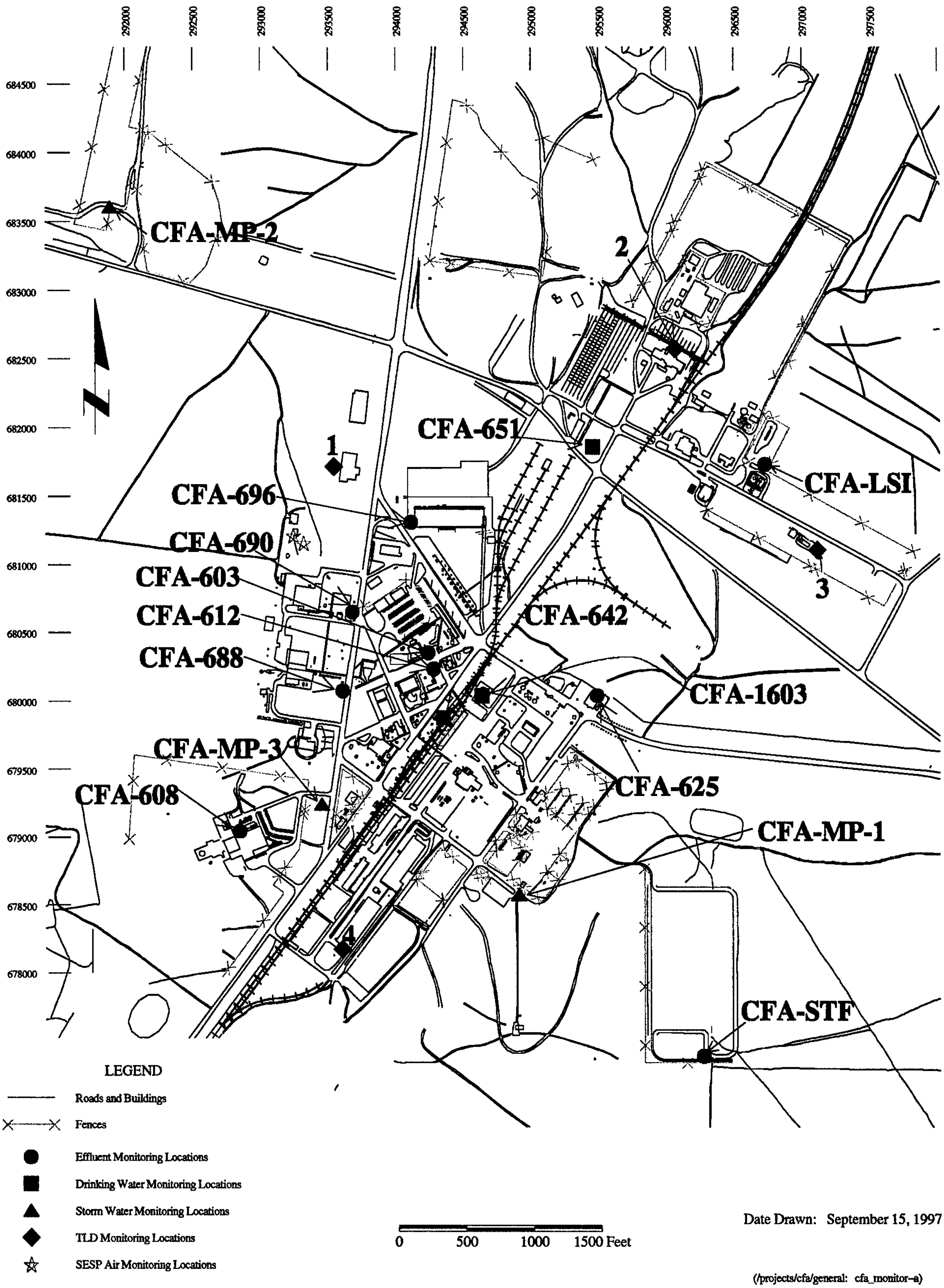

Figure A-4. Central Facilities Area monitoring locations.

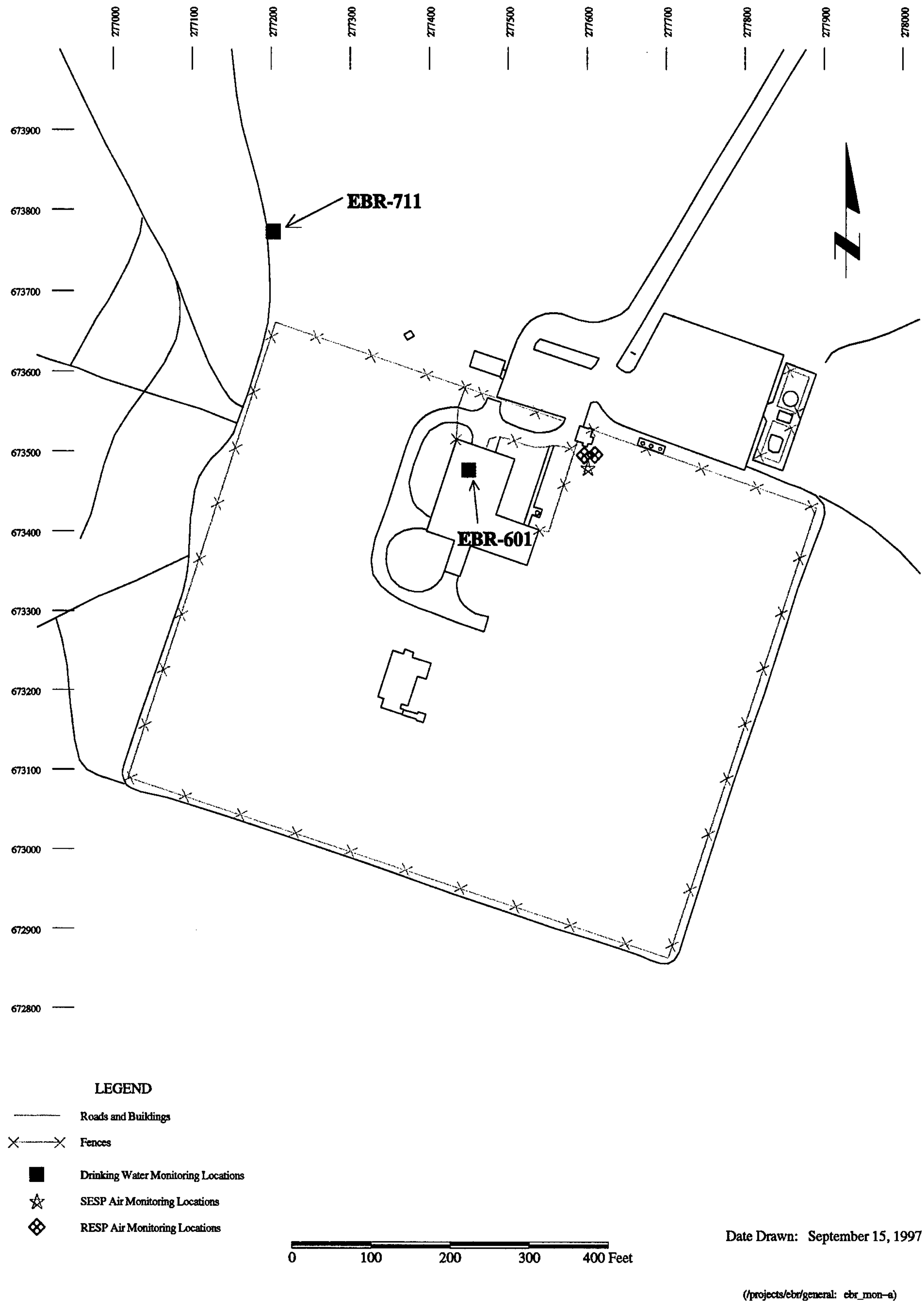

Figure A-5. Experimental Breeder Reactor–I monitoring locations.

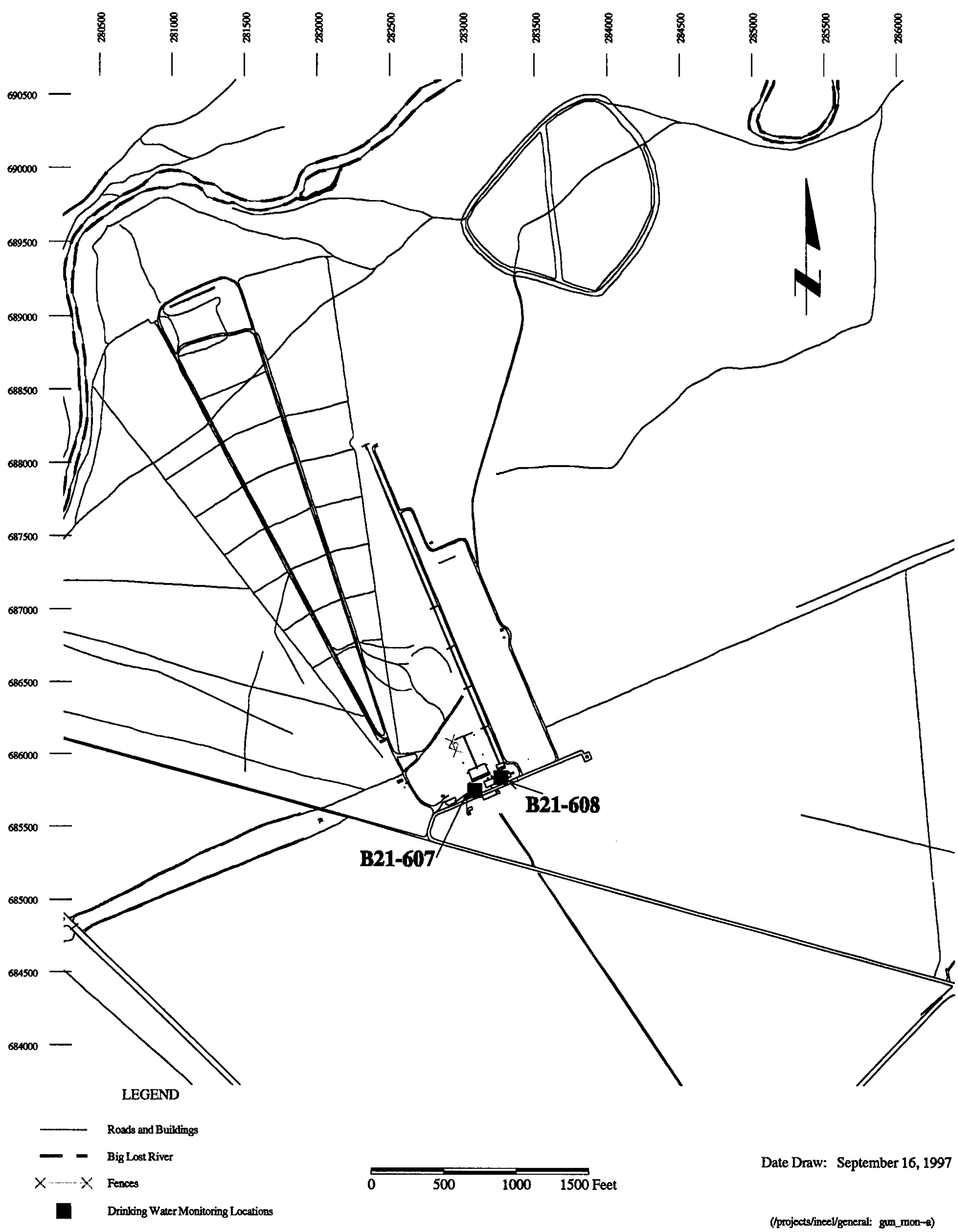

Figure A-6. Gun Range monitoring locations.

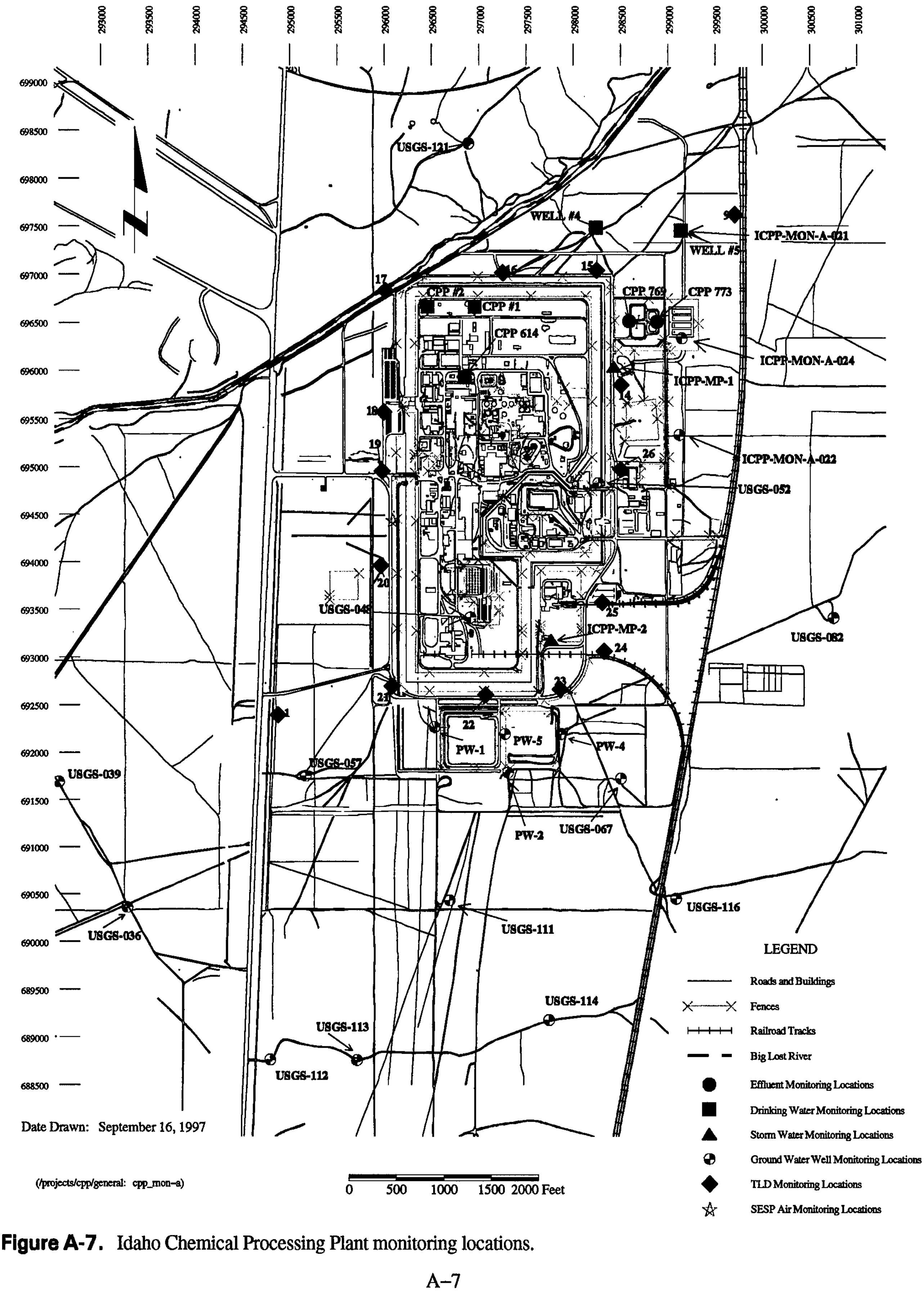

Figure A-7. Idaho Chemical Processing Plant monitoring locations.

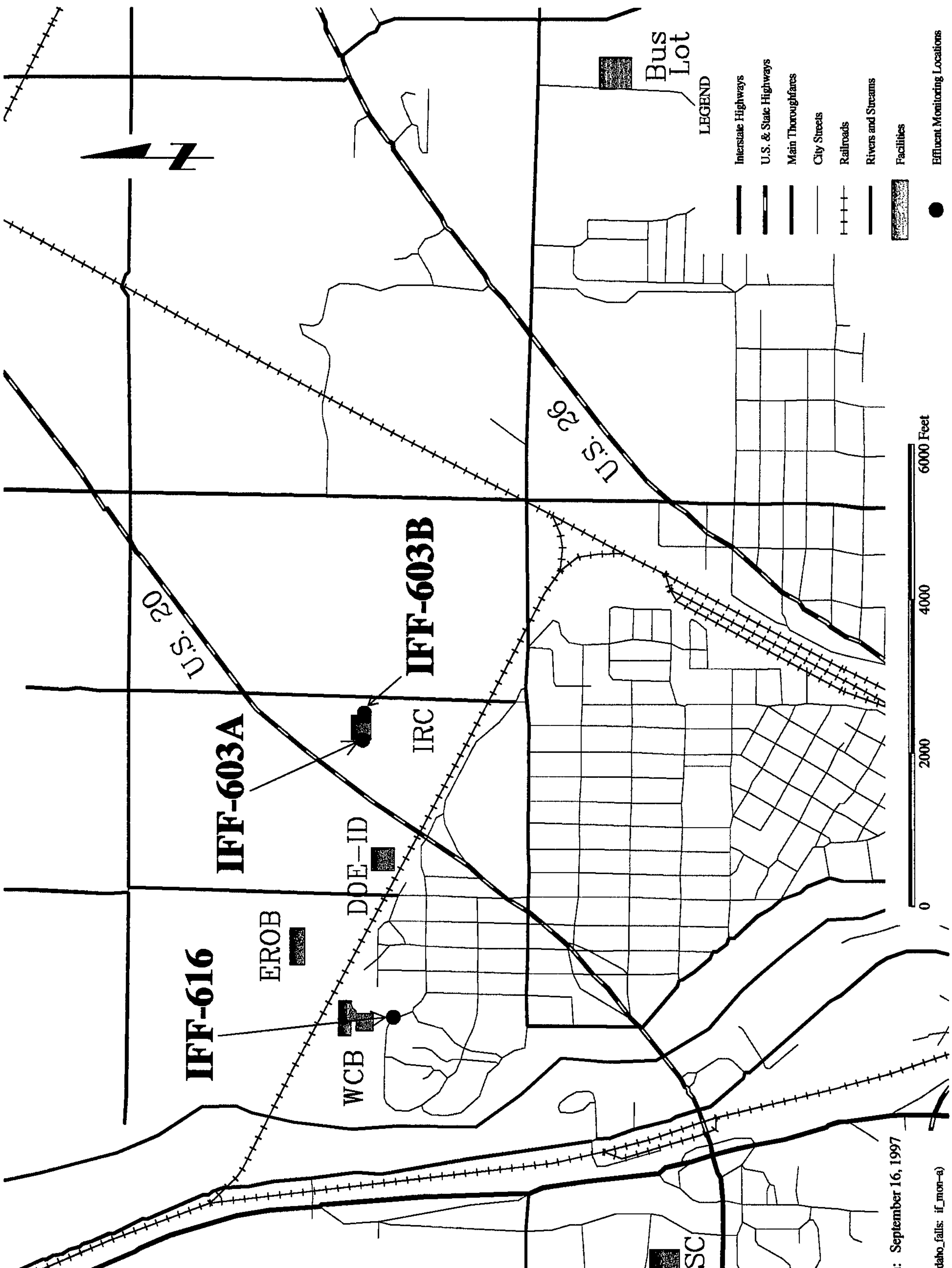

Figure A-8. Idaho Falls monitoring locations.

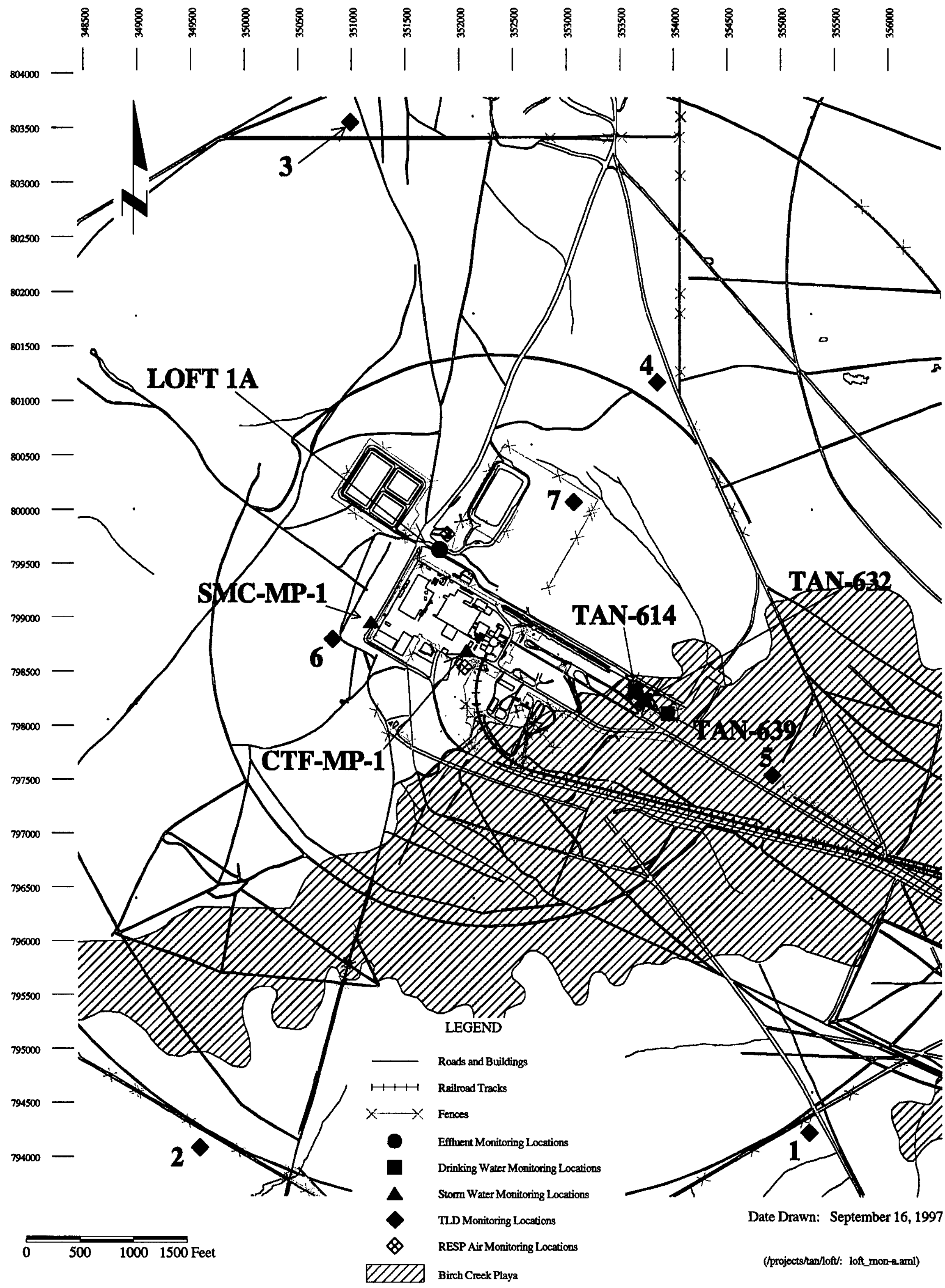

Figure A-9. Loss-of-Fluid Test Facility monitoring locations.

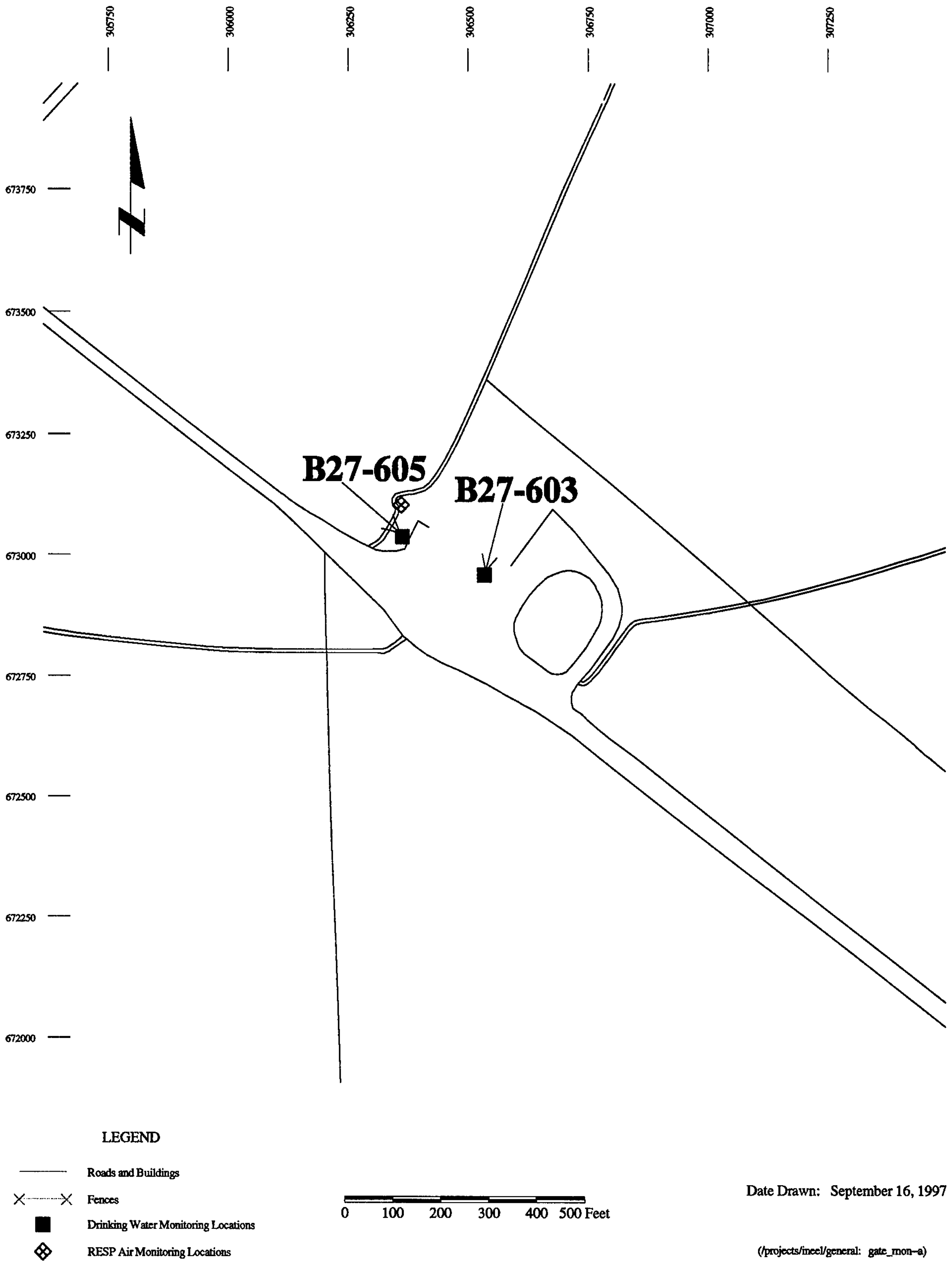

Figure A-10. Main Gate monitoring locations.

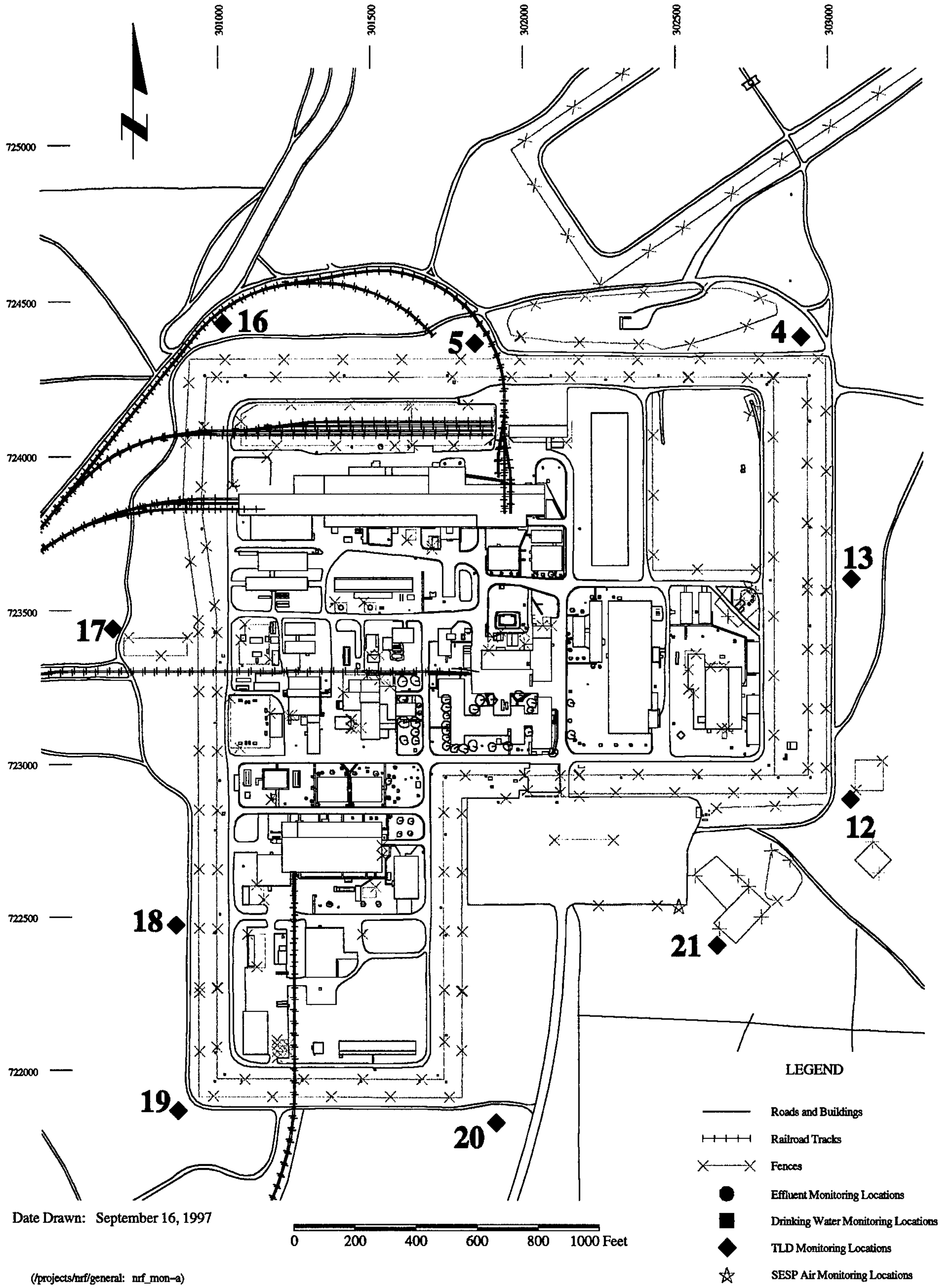

Figure A-11. Naval Reactor Facility monitoring locations.

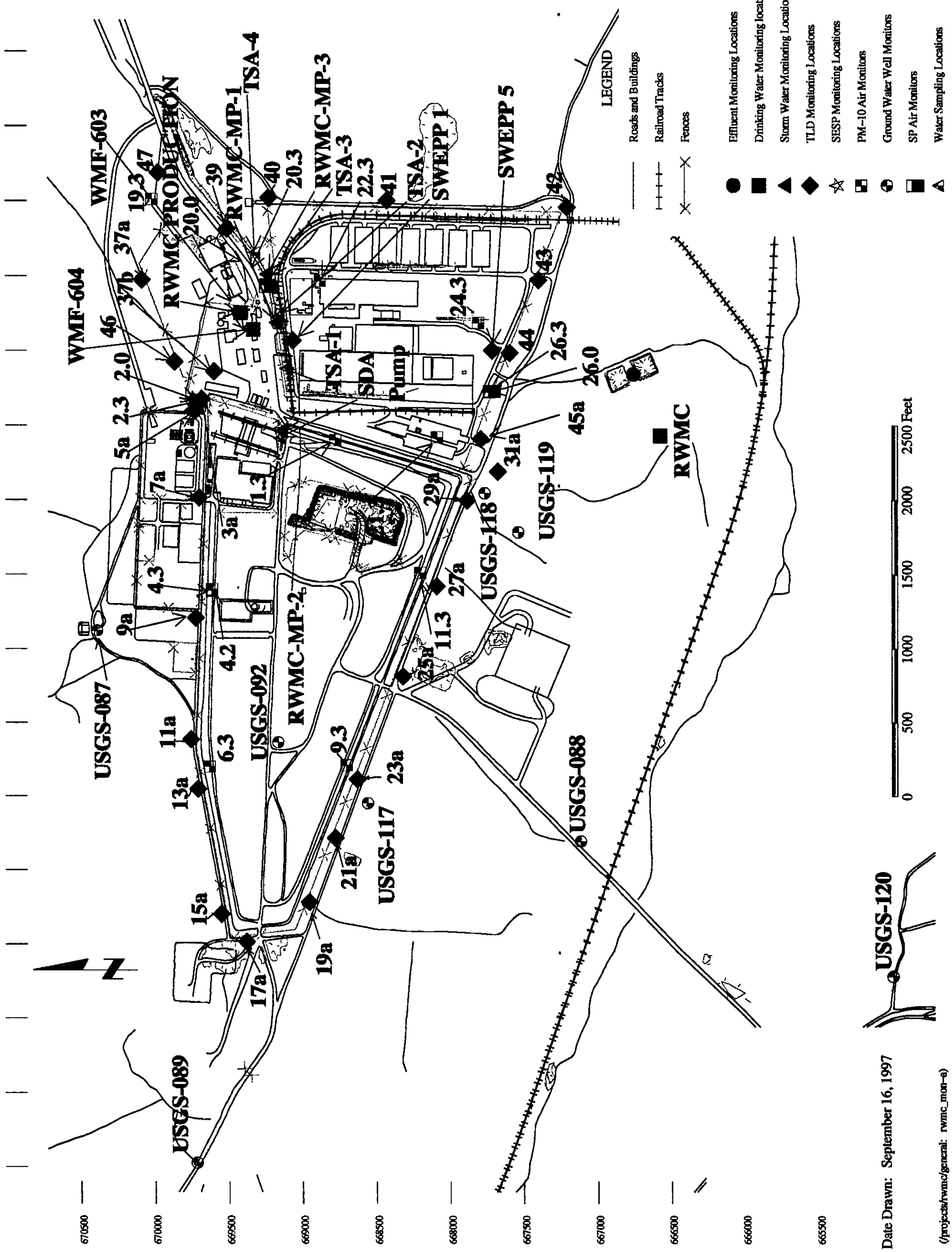

Figure A-12. Radioactive Waste Management Complex monitoring locations.

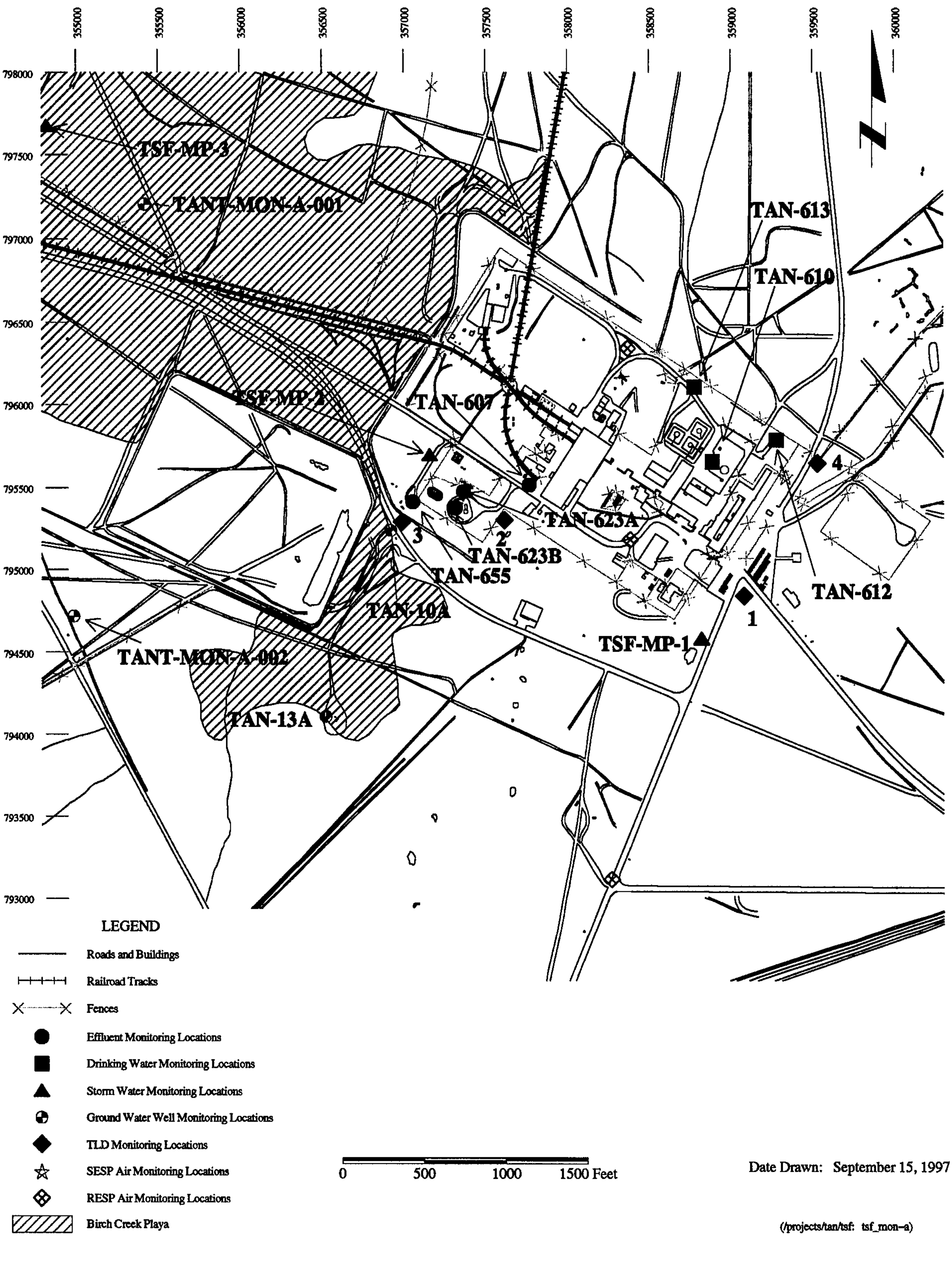

Figure A-13. Technical Support Facility monitoring locations.

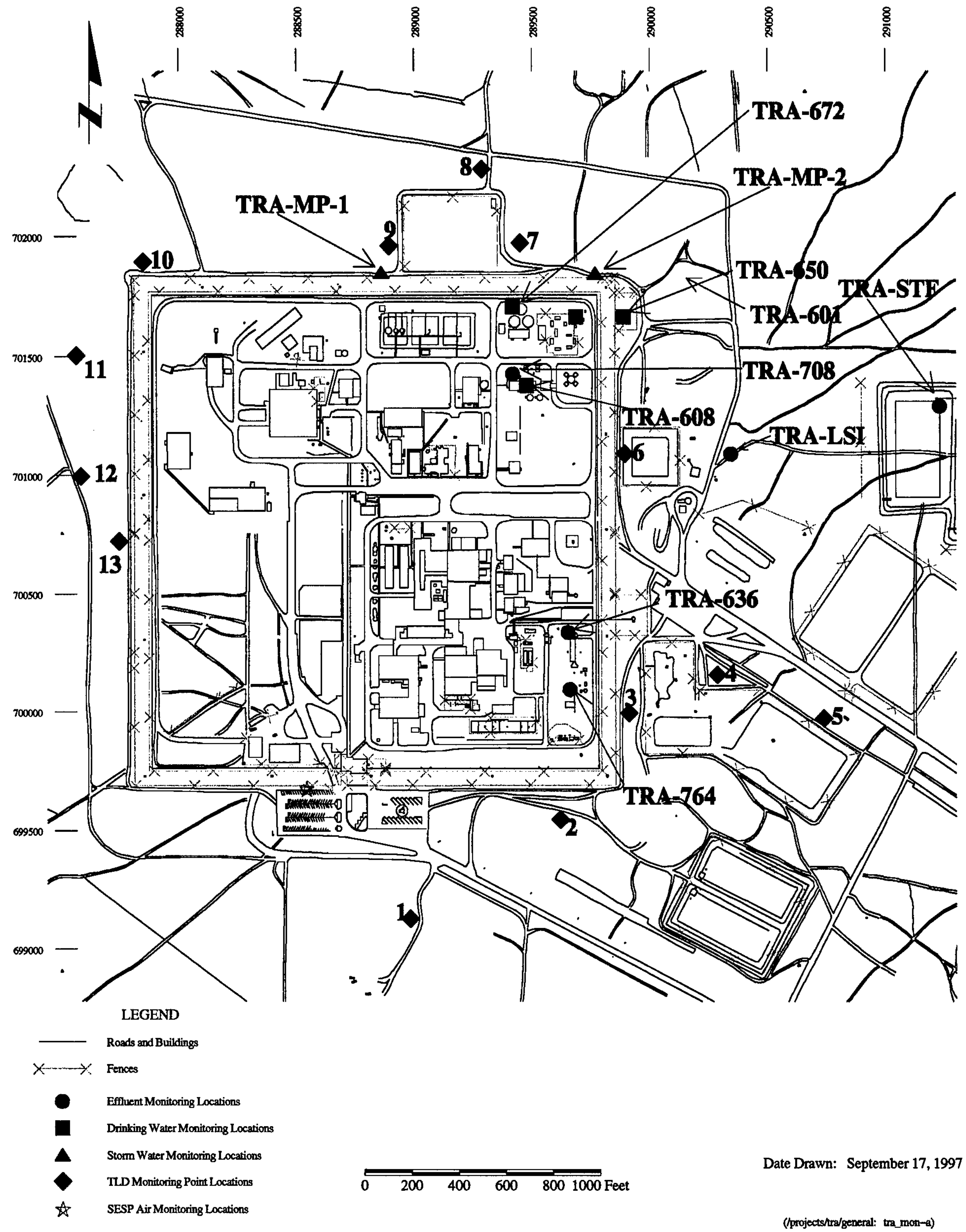

Figure A-14. Test Reactor Area monitoring locations.

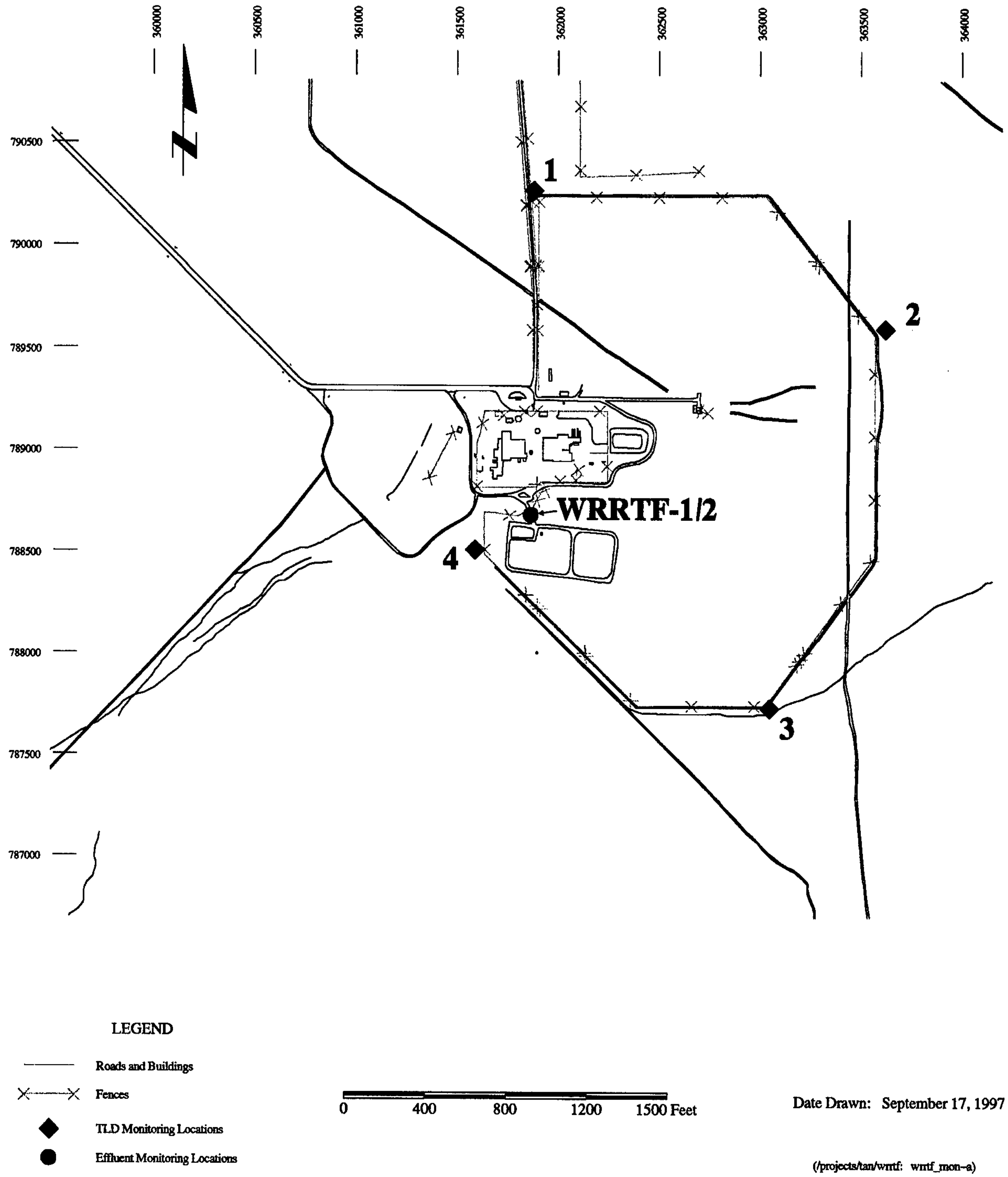

Figure A-15. Water Reactor Research Test Facility monitoring locations.

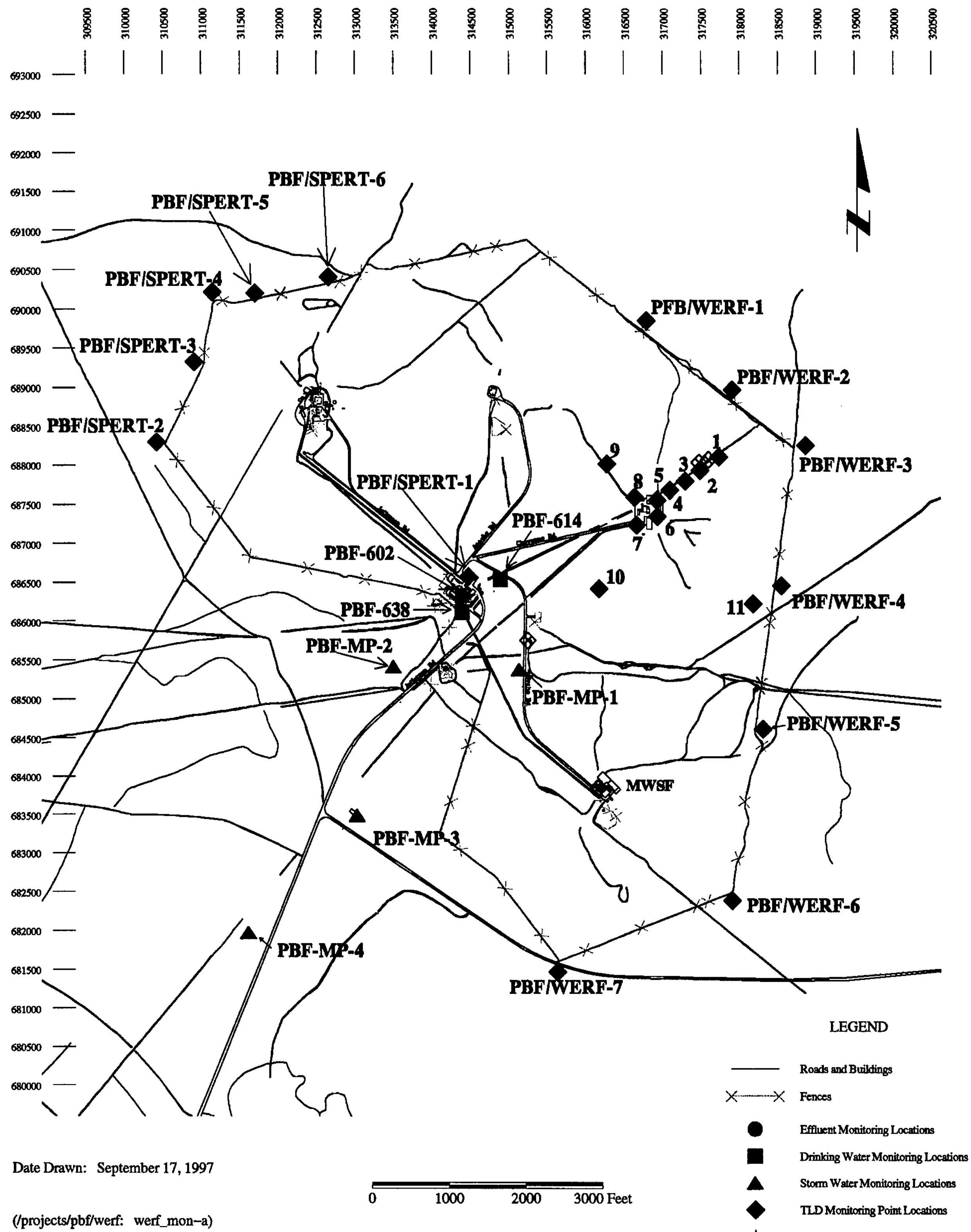

Figure A-16. Waste Experimental Reduction Facility monitoring locations.

Appendix B

Statistical Analysis Methods

Appendix B

Statistical Analysis Methods

General

This appendix summarizes the statistical methods used to analyze the Radiological Environmental Surveillance Program (RESP) airborne particulate and penetrating radiation data presented in the text of this report. Specifically, these methods are used for determining long-term trends and for determining differences between groupings (i.e., by monitor type, by facility, or by season) of data are addressed. These methods are detailed in Blackwood.[1]

Data Pretreatment and Validation

Prior to using data for comparative purposes, data are prescreened to ensure no gross data errors occur, such as transcription errors, missing values, out of range data points, and data points that do not meet other specific criteria. Initial screening includes eliminating data from instruments that do not meet the minimum required operating characteristics as specified in the data quality objectives.

Once the basic checks for errors and operating criteria are complete, the data are screened for outliers. Graphical techniques (e.g., probability plots, stem and leaf plots, box plots, and other exploratory data analysis techniques) are the primary tools used for detecting potential data outliers. In cases where outliers are traceable to a specific error, a corrected value may be used to replace the outlier. If no correction is possible, then the point is deleted from the data set; however, outliers with unattributable causes are rarely eliminated from the data set. Such outliers may be truly accurate data measurements indicative of unusual but important phenomena. In these cases, two sets of analyses are performed with the outliers, one with and one without, which provides results that can be compared.

Trend Analysis

To visually evaluate long-term trends, cumulative data are presented graphically. For RESP gross-alpha and gross-beta air data, concentration data for specific locations are plotted over the year of interest.

For TLD data, cumulative six-month exposure data from specific locations, with background (or distant community) data, are plotted over time. All historical data are smoothed and plotted on a linear scale to give an indication of the trend over time.

Comparisons Between Groupings

Penetrating Radiation Data from TLDs

Differences in yearly TLD data, either seasonally or by facility location, are analyzed using the nonparametric Kruskal-Wallis test for differences in medians. Nonparametric analyses are performed since the data are not expected to follow a normal distribution. Changes among groups are considered to be statistically significant if the p-value, associated with the null hypothesis, is less than 0.05. The null hypothesis is that the different samples in the groupings were from the same distribution or from distributions with the same median.

The statistical significance of changes seen in median exposure values from the previous year to the current year is determined by facility. Facility groupings consist of background (or distant community) data, as well as individual RESP locations. Since TLDs are changed out every six months, the significance of the differences in median seasonal exposure values (either spring or fall) is also of interest.

Box and whisker plots are used to graphically display the differences in median values between groups (either by facility or season). For each grouping, the median value is shown on the box and whisker plots, along with a box indicating the 25th to 75th percentile range. The whiskers on the plots indicate the (non-outlier) minimum and maximum values within each grouping. For the box and whisker plots, outliers are defined as those data values greater than 1.5 times the range of the box.

Airborne (Gross-Alpha and Gross-Beta) Data

Differences in year-to-year median concentrations for facility groupings of airborne data are also analyzed using the Kruskal-Wallis test for differences in medians. Data from the current year are grouped by facility for each contaminant and monitor type (i.e., gross-alpha or gross-beta and PM_{10} or SP monitor). Differences in groupings are also graphically displayed using the box and whisker plots discussed above.

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Appendix C

Environmental Standards

Appendix C

Environmental Standards

RADIOLOGICAL SURVEILLANCE AT WASTE MANAGEMENT FACILITIES

Radionuclide concentrations in air and groundwater samples collected at MWSF, RWMC, and WERF are compared with Derived Concentration Guide (DCG) values for air and water.[1] The DCG values listed are provided as reference values for conducting radiological protection programs at operational DOE facilities and sites.

Table C-1 lists applicable DCGs. The DCGs represent the concentrations of radioactivity in air inhaled or water ingested continuously during a year that resulted in a 100-mrem, 50-year committed effective dose equivalent (EDE). The DCGs are used as a point of reference only. Comparing individual measurements to the DCGs gives the maximum dose a person could receive at the location where the sample was collected, given the following two assumptions: (1) the concentration was at the DCG level continuously for the entire year, and (2) the person receiving the exposure was at that location for the entire year, continually drinking the water or inhaling the air. In practice, DCGs are rarely, if ever, exceeded for even a short period of time during the year. In addition, the radionuclide concentration at any area accessible to the public will be even less due to the dispersion from the facility boundary (where the sample was collected) to the site boundary (the closest location where the public has unrestricted access).[2]

Table C-2 lists environmental concentration guidelines for the radionuclides in soil that are most likely to be found in environmental samples collected at the RWMC. The concentration guides in Table C-2 are based on a homestead scenario. This scenario considers the radiation dose to the homesteader from inhalation and ingestion of radionuclides, as well as external radiation. Since the hypothetical homesteader is assumed to live on a uniformly contaminated area that is large enough for subsistence farming, this scenario results in very conservative concentration guides. The homestead scenario overestimates the actual doses that would be received by off-homestead individuals from radionuclides in soil at the RWMC.

WATER

The environmental regulations that apply to the Drinking Water Program are as follows: the Federal Safe Drinking Water Act,[3] Code of Federal Regulations (40 CFR Parts 141–143);[4,5,6] the Idaho Regulations for Public Drinking Water Systems, IDAPA 16.01.08000–.08999;[7] DOE Order 5400.5;[8] and *Environmental Compliance Planning Manual.*[9]

In addition to the eighteen regulated VOCs (see Table C-3), unregulated organic compounds are monitored and reported.

Table C-1. Derived Concentration Guides.

Radionuclide	DCGs for the public[a,b] DCG for Air (μCi/mL)	DCG for Water (μCi/mL)
H-3	1 E-7	2 E-3
Sc-46	6 E-10	2 E-5
Cr-51	5 E-8	1 E-3
Mn-54	2 E-9	5 E-5
Co-58	2 E-9	4 E-5
Fe-59	8 E-10	2 E-5
Co-60	8 E-11	5 E-6
Zn-65	6 E-10	9 E-6
Sr-90	9 E-12	1 E-6
Nb-95	3 E-9	6 E-5
Zr-95	6 E-10	4 E-5
Ru-103	2 E-9	5 E-5
Ru-106	3 E-11	6 E-6
Ag-110m	2 E-10	1 E-5
Sb-125	1 E-9	5 E-5
I-129	7 E-11	5 E-7
I-131	4 E-10	3 E-6
Cs-134	2 E-10	2 E-6
Cs-137	4 E-10	3 E-6
Ce-141	1 E-9	5 E-5
Ce-144	3 E-11	7 E-6
Eu-152	5 E-11	2 E-5
Eu-154	5 E-11	2 E-5
Ra-226	1 E-12	1 E-7
Pu-238	3 E-14	4 E-8
Pu-239[c]	2 E-14	3 E-8
Am-241	2 E-14	3 E-8
U-235	1 E-13	6 E-7
U-238	1 E-13	6 E-7
Gross Alpha[c]	2 E-14	
Gross Beta[c]	9 E-12	

a. This table contains the air and water DCGs based on concentrations that could be continuously inhaled or ingested, respectively, and do not exceed an effective dose equivalent of 100 mR/yr.

b. DCGs apply to radionuclide concentrations in excess of those occurring naturally or due to fallout.

c. The DCGs of Pu-239 and Sr-90 are the most restrictive for alpha- and beta-emitting nuclides, respectively, and are appropriate to use for gross alpha and gross beta DCGs.

Table C-2. Environmental Concentration Guidelines for common radionuclides found in environmental soil samples collected at the RWMC.

Radionuclide	Environmental Concentration Guides for Soil[a] (μCi/g)
Mn-54	4 E-6
Co-58	4 E-6
Co-60	1 E-6
Ru-106	2 E-5
Sb-125	8 E-6
Cs-134	2 E-6
Cs-137	6 E-6
Ce-144	6 E-5
Eu-152	3 E-6
Am-241	4 E-5
Sr-90	6 E-6
U-232	2 E-6
U-233	2 E-4
U-234	2 E-4
U-235	2 E-5
U-238	1 E-4
Pu-238	8 E-5
Pu-239,-240	8 E-5

a. See Reference 2. Concentrations correspond to a 50-yr dose commitment of 100 mrem/yr to a homesteader beginning in the first year after release of facility. This concentration assumes uniform contamination of an area adequate for subsistence farming.

Table C-3. Standards for volatile organic compounds.

REGULATED VOCs

Parameter	Maximum Contaminant Level (mg/L)
Benzene	0.005
Vinyl Chloride	0.002
Carbon Tetrachloride	0.005
1,2-Dichloroethane	0.005
Trichloroethylene	0.005
1,1-Dichloroethylene	0.007
1,2,4-Trichlorobenzene	0.07
1,1,1-Trichloroethane	0.200
1,1,2-Trichloroethane	0.005
para-Dichlorobenzene	0.075
cis-1,2-Dichloroethylene	0.07
1,2-Dichlorpropane	0.005
Dichloromethane	0.005
Ethylbenzene	0.7
Monochlorobenzene	0.1
O-Dichlorobenzene	0.6
Styrene	0.1
Tetrachloroethylene	0.005
Toluene	1.0
Trans-1,2-Dichloroethylene	0.1
Xylenes (total)	10.0

UNREGULATED VOCs WITH NO MCL

Chloroform	O-Chlorotoluene
Chlorobenzene	P-Chlorotoluene
Bromodichloromethane	Bromobenzene
Chlorodibromomethane	1,3-Dichloropropene
Bromoform	1,2,4-Trimethylbenzene
M-Dichlorobenzene	1,2,4-Trichlorobenzene
1,1-Dichloropropane	1,1-Dichloroethane
1,1,1,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane
Chloroethane	1,3-Dichloropropane
2,2-Dichloropropane	Chloromethane
Bromomethane	Isopropylbenzene
1,2,3-Trichlorobenzene	Tert-Butylbenzene
N-Butylbenzene	SEC-Butylbenzene
N-Propylbenzene	Fluorotrichloromethane
Naphthalene	Dichlorodifluoromethane
Hexachlorobutadiene	Bromochloromethane
1,3,5-Trimethylbenzene	1,2,3-Trichloropropane
P-I propyltoluene	

The INEEL is a nuclear facility, which implies that radiological contamination of the drinking water is possible. Because of the possibility of radiological contaminants, Lockheed Martin Idaho Technologies Company monitors for gross alpha, gross beta, and tritium (see Table C-4), as recommended in IDAPA 16.01.08100,06.

The City of Idaho Falls has developed an Industrial Pretreatment Program in accordance with 40 CFR 403 and the Clean Water Act. Industrial Wastewater Acceptance Forms issued by the City, authorize discharges to the City of Idaho Falls sewer system in compliance with Chapter 1, Section 8, of the City of Idaho Falls Sewer Ordinance. Table C-5 lists the 1996 concentration limits for discharges to the City of Idaho Falls sewer.

Table C-4. Applicable radiological drinking water standards.

Parameter	Maximum Contaminant Level (pCi/L)
Gross Alpha	15
Gross Beta	50
Tritium	20,000

Table C-5. City of Idaho Falls Sewer Code effluent concentration limits for 1996.

Parameter	Sewer Limit (mg/L)
pH	5.5–9.0
Arsenic	0.07
Cadmium	0.69
Chromium, total	2.77
Copper	3.38
Cyanide	1.20
Lead	0.62
Mercury	0.25
Methylene chloride	0.1
Phenol	0.5
Nickel	3.98
Silver	0.45
Tetrachloroethylene	0.099
Total heavy metals	5.0
Oil and Grease (petroleum or mineral oil products)	100
Oil and Grease (animal and vegetable based)	250
Trichloroethylene	0.099
Zinc	2.61
Stoddard Solvent	0.099

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Appendix D

Detection Limits

Appendix D

Detection Limits

RADIOCHEMICAL ANALYSIS DETECTION LIMITS

Tables D-1, D-2 and D-3 list approximate detection limits of present methods used to analyze the samples discussed in this report. These limits are based on sample sizes and forms as described in this report. Actual detection limits may vary depending upon background, yield, counting time, and sample volume.

The detection limits given in Table D-1 in terms of activity per unit weight or volume are derived from the total activities in microcuries (μCi) that must be present in the sample aliquot. The detection limits are calculated under the following conditions: a counting time of 1,000 minutes, a counting efficiency of about 25%, a chemical yield of about 80%, clean detector and reagent blanks that give not more than about 5 counts in 1,000 minutes in any given energy interval, and the calculation performed according to the definition of detection limits given by L. A. Currie:

$$\textit{detection limit} = \frac{2.71 + 4.66\ B^{1/2}}{t \times E \times Y \times 2.22E+6}\ \mu Ci$$

where

B = the total background and blank correction

t = the counting time in minutes

E = the counting efficiency as a fraction

Y = the chemical yield as a fraction

2.22E+6 = the dpm/μCi.

These absolute detection limits, in terms of total microcuries per sample, are approximately 3 E-6 for Sr-90 and approximately 3 E-8 for all alpha-emitting nuclides. To determine the detection limits as activity concentration, as given in Table D-1, the absolute detection limits must be divided by the sample size taken for analysis. On samples, the activity found is divided by the actual sample size analyzed or reported in terms of total activity per sample.

Table D-1. RESP samples for radiochemical analysis.

Media	Sample description	Method of treatment	Detection limits (µCi/g or mL)	
Air	Sampled approximately at 4 cfm for 2 weeks on Versapor 1,200 filters, 6 filters per quarter for a total of ~1.7 E+10 cc of air.	Dry ash, dissolve and analyze the total sample of 6 filters.	Sr-90 Pu-238 Pu-239 Am-241	3.5 E-17 2 E-18 2 E-18 2 E-18
Water	4-L collapsible polyethylene container containing 25 mL of conc. HNO_3 and 2 Whatman ashless filter tablets for 4,000 mL water.	Separate and dissolve paper pulp, reconstitute sample, and boil down to 100 mL. Analyze 1/2 sample or 2–L equivalent.	Sr-90 Pu-238 Pu-239 Am-241	3 E-10 2 E-11 2 E-11 2 E-11
Soil	At least 25 g in appropriate container. Larger quantities are permissible if convenient.	Analyze 10-g sample.	Sr-90 Pu-238 Pu-239 Am-241	6 E-8 3 E-9 3 E-9 3 E-9
Vegetation	16-oz squat jar filled to rim below threads (avg wt 150 g).	Dry ash and dissolve the total sample completely. Analyze the equivalent of 50 g of original sample.	Sr-90 Pu-238 Pu-239 Am-241	1.2 E-8 6 E-10 6 E-10 6 E-10
Animal Tissue	16-oz squat jar containing 10 dried deer mice, or 1 dried ground squirrel (avg wts: mice, 170 g; squirrel, 100 g).	Dry ash, dissolve, and analyze the equivalent of 50 g of the original sample.	Sr-90 Pu-238 Pu-239 Am-241	1.2 E-8 6 E-10 6 E-10 6 E-10

Table D-2. RESP air, water, and soil samples for gamma spectrometry.

	Air Filters		Water Filtrate		Water Insoluble		Soils	
Radionuclides	10^{-9} pCi/mL	Total pCi	10^{-2} pCi/mL	Total pCi	10^{-4} pCi/mL	Total pCi	pCi/g	Total pCi
Sc-46	1	6	0.2	8	5	2	0.19	120
Cr-51	5	3	1.1	44	20	8	0.5	300
Mn-54	0.5	3	0.5	20	3	1.2	0.1	60
Co-58	0.5	3	0.09	3.6	4	1.6	0.1	60
Fe-59	0.9	5.4	1.5	60	7	2.8	0.11	60
Co-60	0.8	4.8	0.8	32	6	2.4	0.2	120
Zn-65	1	6	0.5	20	15	6	0.2	120
Nb-94	0.5	3	0.15	6	4	1.6	0.1	60
Nb-95	0.5	3	0.11	4.4	80	32	0.1	60
Zr-95	0.8	4.8	0.3	8	7	2.8	0.11	60
Ru-103	0.7	4.2	0.16	6.4	4	1.6	0.1	60
Ru-106	5	30	0.12	4.8	40	1.6	0.5	300
Ag-110m	0.5	3	0.15	6	5	20	0.1	60
Sb-124	0.5	3	0.13	5.2	5	2	0.1	60
Sb-125	1.5	9	0.3	12	15	6	0.2	120
Cs-134	0.6	3.6	0.09	3.6	4	1.6	0.1	60
Cs-137	0.8	4.8	0.3	12	20	8	0.1	60
Ce-141	0.9	5.4	0.3	12	6	2.4	0.1	60
Ce-144	5	30	1.0	40	20	8	0.4	240
Eu-152	2	12	0.5	20	15	6	0.2	120
Eu-154	2	12	0.3	12	15	6	0.3	180
Eu-155	2	12	0.8	32	10	4	0.3	180
Hf-181	0.6	3.6	0.12	4.8	6	2.4	0.1	60
Ta-182	2	12	0.5	20	20	8	0.4	240
Hg-203	0.5	3	0.15	6	2	0.8	0.1	60
Am-241	4	24	1.5	60	40	16	1.2	700
Gross Beta	9.5							
Gross Alpha	3.3							

Table D-3. RESP biotic samples for gamma spectrometry.

Radionuclide	Small Mammals		Vegetation	
	pCi/g	Total pCi	pCi/g	Total pCi
Sc-46	0.2	12	0.07	12
Cr-51	1.4	84	0.4	67
Mn-54	0.18	11	0.05	8.4
Co-58	0.3	18	0.05	8.4
Fe-59	0.6	36	0.08	14
Co-60	1	60	0.1	17
Zn-65	0.7	42	0.13	22
Nb-94	0.2	12	0.05	8.4
Nb-95	0.2	12	0.04	6.7
Zr-95	0.3	18	0.07	12
Ru-103	0.2	120	0.04	6.7
Ru-106	2	12	0.5	84
Ag-110m	0.2	12	0.05	8.4
Sb-124	0.2	12	0.04	6.7
Sb-125	0.7	42	0.11	18
Cs-134	0.3	18	0.04	6.7
Cs-137	1.3	78	0.13	22
Ce-141	0.2	12	0.05	8.4
Ce-144	1.1	66	0.16	27
Eu-152	0.6	36	0.1	17
Eu-154	0.7	42	0.15	25
Eu-155	0.6	36	0.1	17
Hf-181	0.2	12	0.04	6.7
Ta-182	1.1	66	0.3	50
Hg-203	0.16	96	0.05	8.4
Am-241	2	120	0.3	50

GAMMA SPECTROMETRIC ANALYSIS DETECTION LIMITS

Tables D-2 and D-3 give absolute detection limits in the right-hand column for each sample type. The absolute detection limits are the total activities that should be present in the sample aliquot taken for analysis. These activities should be detected under the counting conditions described and calculated according to the definition of L. A. Currie. This definition is as follows:

$$\textit{detection limit} = \frac{2.71 + 4.66\ B^{1/2}}{t \times E \times P \times 2.22}$$

where

B = the total correction in counts (Compton, background, blanks, etc., for the same counting time)

t = the counting time in minutes

E = the counting efficiency as a fraction

P = the gamma-ray emission probability for the particular gamma ray being measured

2.22 = the dpm/pCi.

The figures in the left-hand column of each sample type give the same detection limits expressed in terms of pCi/unit weight or volume for the average sample sizes expected to be analyzed. Because the absolute detection limits must remain constant for a given counting time and efficiency, the detection limits in terms of concentrations become higher or lower as the sample size actually used in the analysis becomes smaller or larger. Table D-4 presents descriptions of environmental monitoring samples for gamma spectrometry analysis and counting conditions for stated detection limits.

Table D-4. Description of RESP samples for gamma spectrometry analysis.

Media	Sample Description	Counting Conditions
Air	Sampled at approximately 4 cfm for 2 weeks on 4-in. Versapor 1200 membrane filters for a total of 3×10^9 cc per filter.	Monthly composite samples of two 4-in. filters containing a total of about 6×10^9 cc of air are held flat over the detector and counted for 12 to 16 hours depending on the detector system used.
Water	4-L collapsible polyethylene container containing 25 mL of conc. HNO_3 and two Whatman ashless filter paper tablets for 4000 mL of water.	The sample is shaken vigorously to dislodge all material from the sides and bottom of the container and filter. The filtrate is transferred to a 4-L Marinelli beaker and counted for 16 hours. The filter and paper pulp are also counted for 16 hours in contact with detector. Sample size, 4000 mL.
Soil	16-oz squat jar filled to the bead below the threads after settling.	The sample is counted in the squat jar for 2 hours with the jar being rotated as close to the detector as possible. Sample size approximately 700 g.
Vegetation	16-oz squat jar filled to the bead below the threads after settling.	The dry sample is counted in the squat jar for 16 hours with the jar being rotated as close to the detector as possible. Sample size about 150 g, average.

Appendix E

Drinking Water Parameters

Table E-1. Primary and secondary drinking water standards.

Type of Contaminant	Contaminant	Maximum Contaminant Level	Required Compliance Frequency	EPA Approved Methods
Microbiological 40 CFR Parts 141.14, 141.21, and 141.63	Total Coliform	If less than 40 samples per month are collected, you can have no more than 1 positive for total coliform	25 to 1,000 people – 1 sample per quarter 1,001 to 2,500 people – 2 samples per month	Multiple–Tube Fermentation (MTF), Membrane Filter (MF) Technique, Presence–Absence (P–A) Coliform Test, and Minimal Medium ONPG–MUG (MMO–MUG) Test also known as the Autoanalysis Colilert Test.
Inorganic 40 CFR Parts 141.11, 141.23, and 141.62	Asbestos	7 million fibers per liter (>10µm)	every 3 years	EPA–600/4–83–043, Sept. 1993
	Fluoride	4 mg/L	every 3 years	340.1, .2, .3
	Cadmium	0.005 mg/L	every 3 years	200.7A, 213.2
	Chromium	0.1 mg/L	every 3 years	200.7, 218.2
	Mercury	0.002 mg/L	every 3 years	245.1, .2
	Selenium	0.05 mg/L	every 3 years	270.2, .3
	Arsenic	0.05 mg/L	every 3 years	200.7A, 206.2, .3, .4
	Barium	2 mg/L	every 3 years	200.7, 208.1, .2
	Lead	0.015 mg/L (TT)[a]	every 3 years	200.7, .8, .9, 239.1, .2
	Nitrate	10 mg/L (as Nitrogen)	Annually	300.0, 353.1, .2, .3
	Nitrite	1 mg/L (as Nitrogen)	Annually	300.0, 353.1, .2, .3
	Total Nitrite/Nitrate	10 mg/L (as Nitrogen)	Annually	300.0, 353.1, .2, .3
Inorganic 40 CFR Parts 141.80 – .91	Lead	0.015 mg/L[b]	Semi–annual 1st year, once a year for 2 years, action levels not exceeded; reduce to once every 3 years.	200.7, .8, .9, 239.1, .2
	Copper	1.3 mg/L[b]		200.7, .8, .9, 220.1, .2

Table E-1 (continued).

Type of Contaminant	Contaminant	Maximum Contaminant Level	Required Compliance Frequency	EPA Approved Methods
Organic (a), (b)	(a) Chlorinated hydrocarbons:			
40 CFR Part 141.12	Endrin	0.0002 mg/L	4 quarters of monitoring	505,508,525.1
	Lindane	0.0002 mg/L	4 quarters of monitoring	505,508,525.1
	Methoxychlor	0.04 mg/L	4 quarters of monitoring	505,508,525.1
	Toxaphene	0.003 mg/L	4 quarters of monitoring	505,508,525.1
	(b) Chlorophenoxys:			
	2,4–D	0.07 mg/L	4 quarters of monitoring	515.1
	2,4,5–TP Silvex	0.05 mg/L	4 quarters of monitoring	515.1
Disinfection By–Products (c) 40 CFR Parts 141.12 and 141.30	(c) Total Trihalomethanes [the sum of the concentrations of bromodichloromethane, dibromachloromethane, tribromomethane (bromoform), and trichloromethane (chloroform)]	0.10 mg/L	N/A; monitor as a Best Management Practice	501.1, .2
Volatile Organic Compounds	Vinyl chloride	0.002 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
40 CFR 141.12, 141.24, and 141.61	Benzene	0.005 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	Carbon tetrachloride	0.005 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	1,2–Dichloroethane	0.005 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	Trichloroethylene	0.005 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	para–Dichlorobenzene	0.075 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	1,1–Dichloroethylene	0.007 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	1,1,1–Trichloroethane	0.2 mg/L	Annually	502.1, .2, 503.1, 524.1, .2

Table E-1 (continued).

Type of Contaminant	Contaminant	Maximum Contaminant Level	Required Compliance Frequency	EPA Approved Methods
Volatile Organic Compounds 40 CFR 141.12, 141.24, and 141.61 (continued)	cis–1,2–Dichloroethylene	0.07 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	1,2–Dichloropropane	0.005 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	Ethylbenzene	0.7 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	Monochlorobenzene	0.1 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	o–Dichlorobenzene	0.6 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	Styrene	0.1 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	Tetrachloroethylene	0.005 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	Toluene	1 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	trans–1,2–Dichloroethylene	0.1 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
	Xylenes(total)	10 mg/L	Annually	502.1, .2, 503.1, 524.1, .2
Pesticides and other Synthetic Organic Compounds 40 CFR Parts 141.12, 141.24, 141.40, and 141.61	Alachlor	0.002 mg/L	4 consecutive quarters of sampling	505, 507, 525.1
	Atrazine	0.003 mg/L	4 consecutive quarters of sampling	505, 507, 525.1
	Carbofuran	0.04 mg/L	4 consecutive quarters of sampling	531.1
	Chlordane	0.002 mg/L	4 consecutive quarters of sampling	505, 508, 525.1
	Dibromochloropropane	0.0002 mg/L	4 consecutive quarters of sampling	504
	Ethylene dibromide	0.00005 mg/L	4 consecutive quarters of sampling	504
	Heptachlor	0.0004 mg/L	4 consecutive quarters of sampling	505, 508, 525.1
	Heptochlor epoxide	0.0002 mg/L	4 consecutive quarters of sampling	505, 508, 525.1

Table E-1 (continued).

Type of Contaminant	Contaminant	Maximum Contaminant Level	Required Compliance Frequency	EPA Approved Methods
Pesticides and other Synthetic Organic Compounds 40 CFR Parts 141.12, 141.24, 141.40, and 141.61 (continued)	Polychlorinated biphenyls (PCBs)	0.0005 mg/L	4 consecutive quarters of sampling	505, 508, 508A
	Pentachlorophenol	0.001 mg/L	4 consecutive quarters of sampling	515.1, 525.1
	Aldricarb	0.003 mg/L	4 consecutive quarters of sampling	531.1
	Aldicarb sulfone	0.002 mg/L	4 consecutive quarters of sampling	531.1
	Aldicarb sulfoxide	0.004 mg/L	4 consecutive quarters of sampling	531.1
Radionuclides	Radium 228[c]		Required to be sampled	304, 305, 904
40 CFR Parts 141.15, 141.16, 141.25, 141.26 and DOE Order 5400.5, Section II–5, D.	Radium 226		once every 4 years.	304, 305, 903.1
	Radium 226/228	5 pCi/L		302, 900
	Gross alpha particle activity (including radium–226, but excluding radon and uranium): Beta particle/photon radioactivity	15 pCi/L Shall not produce annual dose equivalent to the total body or internal organ greater than 4 millirem/year		306, 906
	Tritium	20,000 pCi/L		303, 905
	Strontium–90	8 pCi/L		202.1, .2, 306A, 304, 200.7, .8, .9
Secondary Drinking Water Standards	Chloride	250 mg/L	Recommended to be	Potentiometric
40 CFR Parts 143.3 and 143.4	Color	15 color units	Monitored once every	Platinum Cobalt
	Corrosivity	Non–corrosive	3 years.	Langlier Index

Table E-1 (continued).

Type of Contaminant	Contaminant	Maximum Contaminant Level	Required Compliance Frequency	EPA Approved Methods
Secondary Drinking Water Standards	Fluoride	2.0 mg/L		340.1, .2. .3
40 CFR Parts 143.3 and 143.4 (continued)	Foaming agents	0.5 mg/L		Methylene Blue
	Iron	0.3 mg/L		200.7
	Manganese	0.05 mg/L		200.7
	Odor	3 threshold odor number		Consistent Series
	pH	6.5–8.5		150.1, .2
	Silver	0.1 mg/L		340, 272.1, .2, 200.7, .8, .9
	Sulfate	250 mg/L		Colorimetric
	Total dissolved solids (TDS)	500 mg/L		Total Residue
	Zinc	5 mg/L		200.7
Special monitoring for organics, inorganics,	Antimony	0.006 mg/L	One sample every 3 years	204.2, 200.8, .9
sodium, and corrosivity	Beryllium	0.004 mg/L	One sample every 3 years	200.7, .8, .9, 210.2
40 CFR Parts 141.40, 141.41, and 141.42	Nickel	0.1 mg/L	One sample every 3 years	200.7, .8, .9, 249.1, .2
	Thallium	0.002 mg/L	One sample every 3 years	200.8, .9, 279.2
	Cyanide	0.2 mg/L	One sample every 3 years	335.1, .2, .3
	Sulfate	500 mg/L	One sample every 3 years	Colorimetric
	Dichloromethane	0.005 mg/L	Annual if samples before 1/93	502.1, .2, 524.1, .2
	1,2,4–Trichlorobenzene	0.07 mg/L	Annual if samples before 1/93	502.2, 503.1, 524.2
	1,1,2–Trichloroethane	0.005 mg/L	Annual if samples before 1/93	502.1, .02, 524.1, .2, 524.1, .2
	Dalapon	0.2 mg/L	Quarterly for 1 year	515.1
	Dinoseb	0.007 mg/L	Quarterly for 1 year	515.1
	Diquat	0.02 mg/L	Quarterly for 1 year	549
	Endothall	0.1 mg/L	Quarterly for 1 year	548
	Glyphosate	0.7 mg/L	Quarterly for 1 year	547
	Oxamyl (Vydate)	0.2 mg/L	Quarterly for 1 year	531.1
	Picloram	0.5 mg/L	Quarterly for 1 year	515.1
	Simazine	0.004 mg/L	Quarterly for 1 year	505, 507, 525.1
	Benzo(a)pyrene (PAH)	0.0002 mg/L	Quarterly for 1 year	550.0, .1, 525
	Di(2–ethylhexyl) (adipate)	0.4 mg/L	Quarterly for 1 year	506, 525.1

Table E-1 (continued).

Type of Contaminant	Contaminant	Maximum Contaminant Level	Required Compliance Frequency	EPA Approved Methods
Special monitoring for organics, inorganics, sodium, and corrosivity (continued) 40 CFR Parts 141.40, 141.41, and 141.42	Di(2–ethylhexyl) (phthalate)	0.006 mg/L	Quarterly for 1 year	506, 525.1
	Hexachlorobenzene	0.001 mg/L	Quarterly for 1 year	505, 508, 525.1
	Hexachlorocyclo–pentadiene	0.05 mg/L	Quarterly for 1 year	505, 508, 525.1
	2,3,7,8–TCDD (Dioxin)	0.00000003 mg/L	Quarterly for 1 year	1613, 513
	Aldrin	No MCL	Quarterly for 1 year	505, 508, 525
	Butachlor	No MCL	Quarterly for 1 year	507, 525
	Carbaryl	No MCL	Quarterly for 1 year	531.1
	Dicamba	No MCL	Quarterly for 1 year	515.1
	Dieldrin	No MCL	Quarterly for 1 year	505, 508, 525
	3–Hydroxycarbofuran	No MCL	Quarterly for 1 year	531.1
	Methomyl	No MCL	Quarterly for 1 year	531.1
	Metolachlor	No MCL	Quarterly for 1 year	507, 525
	Metribuzin	No MCL	Quarterly for 1 year	507, 508, 525
	Propachlor	No MCL	Quarterly for 1 year	507, 525

a. TT = Treatment technique.

b. Sample collected at consumers tap. If 90th percentile is exceeded treatment is required.

c. If Radium 226 exceeds 3 pCi/L, then Radium 228 needs to be analyzed.

Appendix F

Effluent Sampling Analyses Results

Table F-1. Historical and 1996 effluent data summary for CFA Sewage Treatment Plant Influent (CFA-LS1).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Biological Oxygen Demand	mg/L	24.47	30.25	5.00	119.00	12/12	NA[g]
Conductivity	µS	754	442	250	940.00	12/12	NA
pH		7.34	7.44	6.39	7.85	12/12	2.5–12
Chloride	mg/L	169	120.95	99.8	140.00	4/4	NA
Chemical Oxygen Demand	mg/L	105	120.62	25.30	400.00	12/12	NA
Fluoride	mg/L	0.208	0.203	0.180	0.230	4/4	NA
Surfactants	mg/L	0.146	0.258	0.100	0.680	4/4	NA
Nitrogen, Nitrate+Nitrite	mg–N/L	1.02	0.910	0.020 U[h]	1.600	5/4	NA
Nitrogen, as Nitrite	mg-N/L	0.050	0.251	0.010 U	0.610	7/5	NA
Nitrogen, as Nitrate	mg-N/L	0.160	0.591	0.020 U	1.100	7/6	NA
Nitrogen, Total Kjeldahl	mg/L	13.03	13.98	6.60	22.10	12/12	NA
Total Phosphorous	mg/L	1.89	1.800	0.700	3.500	4/4	NA
Sulfate	mg/L	42.40	32.03	30.00	35.70	4/4	NA
Sulfide, Total	mg/L	0.143	0.245	0.100 U	0.780	4/2	NA
TDS	mg/L	522	436	384	482	4/4	NA
TOC	mg/L	25.62	11.53	3.70	18.00	4/4	NA
Total Oil & Grease	mg/L	26.92	4.33	4.40	7.90	4/2	NA
TSS	mg/L	117	293.76	8.20	2,910.0	12/11	NA
Barium	µg/L	97.32	96.68	86.70	86.70	4/1	100,000
Calcium	µg/L	62,969	64,375	63,400	65,700	4/4	NA
Chromium	µg/L	13.14	9.80	10.00 U	17.80	4/2	5000
Copper	µg/L	26.12	20.20	24.60	31.20	4/2	NA
Iron	µg/L	611	384	119.0	712	4/3	NA
Potassium	µg/L	8,166	7,313	5,000 U	11,500	4/3	NA
Magnesium	µg/L	20,769	18,700	18,000	19,400	4/4	NA
Manganese	µg/L	15.83	14.60	10.90	10.90	4/1	NA
Sodium	µg/L	73,075	57,025	48,400	70,000	4/4	NA
Lead	µg/L	5.22	8.00	3.00 U	13.50	4/1	5,000
Zinc	µg/L	78.82	73.90	22.90	181.00	4/4	NA
1,4,-Dichlorobenzene	µg/L	9.38	4.88	3.00	8.00	4/3	7,500
Ce-141	pCi/L	—[i]	3.28 ± 0.00 J[j,k]	3.28 ± 1.251 J	3.28 ± 2.51 J	12/1	50,000
Cs-137	pCi/L	—	0.57 ± 0.00	-2.33 ± 4.42	6.22 ± 5.20	12/1	3,000
Gross Alpha	pCi/L	2.10 ± 2.19	3.57 ± 0.22	0.69 ± 1.53 U	14.30 ± 2.46	12/9	15[l]
Gross Beta	pCi/L	8.69 ± 1.58	13.20 ± 0.81	9.40 ± 5.70	25.70 ± 3.50	12/10	50[l]

Table F-1. (continued).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
H-3	pCi/L	13,217.69 ± 1,122.86	16,546.54 ± 566.21	125,00.00 ± 1,624.00	18,400.00 ± 2,360.00	12/12	20,000[l]
Sr-89	pCi/L	—	0.15 ± 0.00	-0.31 ± 0.54 U	2.49 ± 1.40 J[l]	12/1	20,000
Sr-90	pCi/L	—	0.10 ± 0.00	-0.37 ± 0.53 U	0.86 ± 0.64	12/1	8.00[l]

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in these averages.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the average.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996.
f. RCRA TCLP Limit, unless otherwise specified. Radiological guideline limits are DCGs unless otherwise noted.
g. NA = not applicable.
h. U flag indicates that the result was below the detection limit.
i. Insufficient number of detectable values.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. Drinking water MCL.
l. J flag indicates an estimated value.

Table F-2. Historical and 1996 effluent data summary for CFA Sewage Treatment Plant Effluent (CFA-STF).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Biological Oxygen Demand	mg/L	3.40	2.75	1.00	5.00	4/4	NA[g]
Conductivity	µS	645	685	410	893	4/4	NA
pH		8.33	9.02	8.34	9.78	4/4	2.5–12
Chloride	mg/L	144	295	295	295	1/1	NA
Chemical Oxygen Demand	mg/L	19.87	37.53	25.30	52.80	4/4	NA
Fluoride	mg/L	0.215	0.290	0.290	0.290	1/1	NA
Nitrogen, Nitrate+Nitrite	mg-N/L	0.267	0.060	0.020 U[h]	0.110	2/1	NA
Nitrogen, as Nitrite	mg-N/L	—[i]	0.100	0.010 U	0.190	2/1	NA
Nitrogen, as Nitrate	mg-N/L	—	0.320	0.080	0.560	2/2	NA
Nitrogen, Total Kjeldahl	mg/L	1.12	3.40	1.10	9.30	4/4	NA
Total Phosphorous	mg/L	0.235	0.413	0.070	1.100	4/4	NA
Sulfate	mg/L	38.70	47.00	47.00	47.00	1/1	NA
TDS	mg/L	404	685	685	685	1/1	NA
TOC	mg/L	7.30	11.20	11.20	11.20	1/1	NA
TSS	mg/L	5.92	15.90	5.00	27.10	4/4	NA
Calcium	µg/L	44,650	69,500	69,500	69,500	1/1	NA
Iron	µg/L	184	168	168.00	168	1/1	NA
Potassium	µg/L	4,195	6,680	6,680	6,680	1/1	NA
Magnesium	µg/L	18,750	17,100	17,100	17,100	1/1	NA
Sodium	µg/L	51,150	139,000	139,000	139,000	1/1	NA
Gross Alpha	pCi/L	3.10 ± 4.00	0.32 ± 0.11[j]	-1.50 ± 3.82 U	8.00 ± 3.30	5/2	15[l]
Gross Beta	pCi/L	5.53 ± 1.63	3.36 ± 0.45	1.10 ± 0.39	10.00 ± 5.54 J[k]	5/5	50[l]
H-3	pCi/L	104,44.78 ± 1,153.94	11,941.46 ± 944.36	116,00.00 ± 1,500.00	12,400.00 ± 1,620.00	5/4	20,000[l]

a. Only parameters detected in 1996 are presented.
b. Historical average were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the average.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996.
f. RCRA TCLP Limit, unless otherwise specified. Radiological guideline limits are DCGs unless otherwise noted.
g. NA= not applicable.
h. U flag indicates that the result was below the detection limit.
i. Insufficient number of detectable values.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. J flag indicates an estimated value.
l. Drinking water MCL.

Table F-3. Historical and 1996 effluent data summary for ICPP Sewage Treatment Plant Influent (CPP-769).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Biological Oxygen Demand	mg/L	62.33	86.08	8.00	193.00 J[g]	12/12	NA[h]
Conductivity	μS	792	604	234	1,120	11/11	NA
pH		8.68	7.90	6.90	9.30	12/12	2.5–12
Nitrogen, as Ammonia	mg/L	—[i]	24.00	17.90	31.40	4/4	NA
Nitrogen, as Nitrite	mg-N/L	0.010	0.073	0.010 U[j]	0.240	12/11	NA
Nitrogen, as Nitrate	mg-N/L	0.107	0.118	0.020 U	0.540	12/10	NA
Nitrogen, Total Kjeldahl	mg/L	37.00	34.99	20.70	49.80	12/12	NA
Total Phosphorous	mg/L	7.67	4.39	2.00	9.10	12/12	NA
TSS	mg/L	61.90	46.63	21.30	123.00	12/12	NA

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the average.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. RCRA TCLP Limit, unless otherwise specified.
g. J flag indicates an exceeded value.
h. NA = not applicable.
i. Insufficient number of detectable values.
j. U flag indicates that the result was below the detection limit.

Table F-4. Historical and 1996 effluent data summary for ICPP Sewage Treatment Plant Effluent (CPP-773).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Biological Oxygen Demand	mg/L	16.00	11.83	1.00 U[g]	77.00	12/10	NA[h]
Conductivity	µS	707	648	204	1,010	12/12	NA
pH		9.03	7.98	6.98	9.10	12/12	2.5–12
Chloride	mg/L	81.15	117.83	66.50	229.00	12/12	NA
Nitrogen, as Ammonia	mg/L	—[i]	3.80	1.10	10.00	4/4	NA
Nitrogen, as Nitrite	mg-N/L	0.047	0.175	0.020	0.350	13/13	NA
Nitrogen, as Nitrate	mg-N/L	9.33	4.648	0.770	8.600	13/13	NA
Nitrogen, Total Kjeldahl	mg/L	4.87	8.55	2.60	18.70	13/13	NA
Nitrogen, Total	mg/L	—	13.37	6.94	19.57	13/13	20[j]
Total Phosphorous	mg/L	2.33	3.39	2.40	4.60	12/12	NA
TDS	mg/L	418	442	353	531.0	12/12	NA
TSS	mg/L	9.33	6.59	5.00 U	22.40	12/6	100[j]

a. Only parameters detected in 1996 are presented.
b. Historical average were calculated from data collected from 1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the average.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. RCRA TCLP Limit, unless otherwise specified.
g. U flag indicates that the result was below the detection limit.
h. NA = not applicable.
i. Insufficient number of detectable values.
j. Wastewater Land Application Permit Limit.

Table F-5. Historical and 1996 effluent data summary for IRC Laboratories (IFF-603A).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	504	333	177	467	10/10	NA[g]
pH		7.51	7.79	7.49	8.23	10/10	5.5–9.0
Cyanide	µg/L	4.59	2.97	5.00 U[h]	7.22	10/1	1,200
Barium	µg/L	97.02	95.82	70.90	87.30	10/2	100,000[i]
Chromium	µg/L	8.41	5.69	7.50	9.40	10/2	2,770
Copper	µg/L	55.05	25.73	25.00 U	40.30	10/7	3,380
Lead	µg/L	6.90	14.82	3.00 U	55.20	10/2	620
Zinc	µg/L	54.10	23.71	12.80	56.10	10/7	2,610
Trichlorofluoromethane	µg/L	2.43	2.75	5.00 U	5.00	10/1	NA
Methylene Chloride	µg/L	30.38	2.55	1.00 J[j]	7.00	10/1	100
Gross Alpha	pCi/L	2.23 ± 1.34[k]	1.37 ± 0.20	–0.30 ± 1.52 U	2.61 ± 0.82	12/4	15[l]
Gross Beta	pCi/l	4.18 ± 1.86	3.59 ± 0.22	2.03 ± 2.02 U	6.10 ± 2.60	12/7	50[l]

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. City of Idaho Falls Sewer Code Limit, unless otherwise noted.
g. NA = not applicable.
h. U flag indicates that the result was below the detection limit.
i. RCRA TCLP Limit.
j. J flag indicates estimated value.
k. Uncertainties shown are the associated 2 sigma uncertainty.
l. Drinking water DCG.

Table F-6. Historical and 1996 effluent data summary for IRC Complex (IFF-603B).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	360	355	160	562	5/5	NA[g]
pH		7.62	7.74	7.50	7.93	5/5	5.5–9.0
Phenols	µg/L	12.37	6.30	5.00 U[h]	19.80	7/3	500
Copper	µg/L	42.40	34.95	31.10	38.80	2/2	3,380
Lead	µg/L	3.51	4.75	3.40	6.10	2/2	620
Zinc	µg/L	38.79	67.70	23.40	112.00	2/2	2,610
Trichlorofluoromethane	µg/L	2.50 U	2.00	1.00 J[i]	1.00 J	3/1	NA

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. City of Idaho Falls Sewer Code Limit.
g. NA = not applicable.
h. U flag indicates that the result was below the detection limit.
i. J flag indicates an estimated value.

Table F-7. Historical and 1996 effluent data summary for Willow Creek Building (IFF-616).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	825	575	283	841	15/15	NA[g]
pH		8.05	8.18	7.75	8.68	15/15	5.5–9.0
Cyanide	µg/L	9.49	4.51	5.00 U[h]	11.60	12/3	1,200
Phenols	µg/L	111	87.94	45.20	127.00	7/7	500
Total Oil and Grease	mg/L	6.40	24.70	14.00	35.40	2/2	100
Total Petroleum Hydrocarbons	mg/L	0.875	0.78	1.00	1.0	2/1	NA
Silver	µg/L	121	24.19	6.60 U	55.30	12/8	450
Barium	µg/L	169	92.99	57.50	58.40	12/2	100,000[i]
Chromium	µg/L	10.66	4.98	5.80 U	6.80	12/1	2770
Copper	µg/L	92.70	84.63	46.60	108.00	12/12	3,380
Lead	µg/L	2.39	8.92	3.00 U	7.30	12/5	620
Zinc	µg/L	123	87.53	45.70	149.00	12/12	2,610
1, 4,-Dichlorobenzene	µg/L	19.45	7.05	5.00 U	36.00	11/2	7,500[i]
Methylene chloride	µg/L	2.78 U	2.50	2.00 U	5.00	11/1	100

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. City of Idaho Falls Sewer Code Limit, unless otherwise specified.
g. NA = not applicable.
h. U flag indicates that the result was below the detection limit.
i. RCRA TCLP Limit.

Table F-8. Historical and 1996 effluent data summary for TAN-655.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Biological Oxygen Demand	mg/L	5.21	2.38	1.00 U[g]	4.00	8/6	NA[h]
Conductivity	µS	545	328	160	550	11/11	NA
pH		7.65	7.89	7.03	9.11	12/12	2.5–12
Chloride	mg/L	72.32	110.33	17.80	457.00	9/9	NA
Chemical Oxygen Demand	mg/L	10.49	5.40	5.00 U	14.10	4/1	NA
Fluoride	mg/L	0.318	0.217	0.190	0.230	9/9	NA
Nitrogen, as Ammonia	mg/L	—[i]	0.250	0.100 U	0.430	7/6	NA
Nitrogen, Nitrate+Nitrite	mg-N/L	6.59	4.17	3.80	4.51	3/3	NA
Nitrogen, as Nitrite	mg-N/L	—	0.103	0.020	0.200	6/6	NA
Nitrogen, as Nitrate	mg-N/L	3.83	4.05	2.00	4.90	6/6	NA
Nitrogen, Total Kjeldahl	mg/L	2.69	0.996	0.160	2.300	9/9	NA
Nitrogen, Total	mg/L	12.9	5.17	4.32	5.88	9/9	20[j]
Total Phosphorous	mg/L	1.28	1.276	0.360	6.30	9/9	NA
Sulfate	mg/L	40.59	75.66	33.00	339.00 J[k]	9/9	NA
TDS	mg/L	380	328	254	410	8/8	NA
TOC	mg/L	15.00	2.38	1.70	2.700	4/4	NA
TSS	mg/L	19.01	44.39	5.00 U	345.00	13/7	100[j]
Arsenic	µg/L	12.10	7.92	4.90	36.40 U	9/1	5,000
Barium	µg/L	115	102.28	98.50	200.00 U	9/2	100,000
Calcium	µg/L	66,960	58,050	51,600	60,800	4/4	NA
Chromium	µg/L	9.19	10.41	5.80 U	16.20	9/6	5000
Iron	µg/L	408	577	134	1,430	9/9	NA
Mercury	µg/L	0.970	0.117	0.100 U	0.400	9/1	200
Magnesium	µg/L	15,184	17,133	14,900	20,000	3/3	NA
Manganese	µg/L	36.70	13.59	5.90	40.00 U	8/3	NA
Sodium	µg/L	41,265	49,379	9,150	168,000	9/9	NA
Lead	µg/L	16.03	7.34	3.00 U	31.00 U	9/5	5,000
Selenium	µg/L	19.54	7.43	3.20	48.70 U	9/1	1,000
Zinc	µg/L	118	72.42	27.20	146.00	5/5	NA
Co-60	pCi/L	—	1.95 ± 0.00[l]	-2.62 ± 5.46 U	5.62 ± 4.68 J	12/1	5,000
Cs-137	pCi/L	4.79 ± 1.62	6.32 ± 1.84	-1.44 ± 6.58 U	15.90 ± 7.64	12/6	3,000
Gross Alpha	pCi/L	2.91 ± 1.33	2.01 ± 0.24	0.49 ± 1.65 U	4.50 ± 1.30	12/6	15[m]
Gross Beta	pCi/L	11.10 ± 1.39	14.71 ± 0.71	6.30 ± 2.70	33.40 ± 5.20	12/11	50[m]

Table F-8. (continued).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
H-3	pCi/L	—	195.18 ± 0.0	-26.10 ± 200.00 U	306.00 ± 156.00	12/3	20,000[m]
Sr-89	pCi/L	0.99 ± 1.10	0.34 ± 0.17	-1.18 ± 1.22 U	0.83 ± 0.48 U	12/2	20,000
Sr-90	pCi/L	3.07 ±0.67	2.06 ± 0.19	0.53 ± 0.27	6.51 ± 1.26	12/8	8.00[m]

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996
f. RCRA TCLP Limit, unless otherwise specified. Radiological guideline limits are DCGs unless otherwise noted.
g. U flag indicates that the result was below the detection limit.
h. NA = not applicable.
i. Insufficient number of detectable values.
j. Wastewater Land Application Permit Limit.
k. J flag indicates an estimated value.
l. Uncertainties shown are the associated 2 sigma uncertainty.
m. Drinking water MCL.

Table F-9. Historical and 1996 effluent data summary for TRA-708.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	21,849	4,898	2,476	7,320	2/2	NA[g]
pH		8.24	9.05	8.63	9.46	2/2	2.5–12
Chloride	mg/L	190	69.73	9.60	185.00	3/3	NA
Chemical Oxygen Demand	mg/L	17.29	4.60	5.00 U[h]	8.80	3/1	NA
Fluoride	mg/L	8.02	0.597	0.120	1.50	3/3	NA
Nitrogen, Nitrate+Nitrite	mg-N/L	6.93	1.00	1.00	1.00	1/1	NA
Nitrogen, as Nitrate	mg-N/L	21.28	9.60	1.40	17.80	2/2	NA
Total Phosphorous	mg/L	0.182	0.143	0.050 U	0.310	3/2	NA
Sulfate	mg/L	17,968	2,860.4	81.20	5,220.0	3/3	NA
TDS	mg/L	21,602	9,977	8,330	11,200	3/3	NA
TSS	mg/L	487	247.23	73.70	420.00	3/3	NA
Arsenic	µg/L	53.72	27.93	10.00 U	100.00 U	3/1	5,000
Calcium	µg/L	438,188	350,667	300,000	386,000	3/3	NA
Chromium	µg/L	70.16	84.03	16.60	214.00	3/3	5,000
Iron	µg/L	5,518	2,143	1,200	2,650	3/3	NA
Mercury	µg/L	6.35	0.207	0.200 U	0.310	3/2	200
Potassium	µg/L	26,217	14,367	12,600	17,100	3/3	NA
Magnesium	µg/L	233,475	132,333	121,000	150,000	3/3	NA
Manganese	µg/L	28.81	29.93	15.40	39.40	3/3	NA
Sodium	µg/L	4,143,388	2,193,333	1,480,000	2,670,000	3/3	NA
Nickel	µg/L	35.20	41.37	40.00 U	84.10	3/1	NA
Zinc	µg/L	36.60	19.63	20.00 U	38.90	3/1	NA
Gross Alpha	pCi/L	45.00 ± 64.00[i]	13.00 ± 2.83	-1.34 ± 10.60	44.00 ± 36.00	6/3	15[j]
Gross Beta	pCi/L	61.00 ± 86.00	23.59 ± 6.62	0.82 ± 18.86	36.00 ± 17.70	6/2	50[j]
H-3	pCi/L	—	24.69 ± 0.00	-129.00 ± 198.60 U	480.00 ± 300.00	6/2	20,000[j]

a. Only parameters detected in 1996 are presented.

b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.

c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.

d. Maximum detectable concentration.

e. Number of samples collected/number of detectable results for 1996.

f. RCRA TCLP Limit, unless otherwise specified. Radiological guideline limits are DCGs unless otherwise noted.

g. NA = not applicable.

h. U flag indicates that the result was below the detection limit.

i. Uncertainties shown are the associated 2 sigma uncertainty.

j. Drinking water MCL.

Table F-10. Historical and 1996 effluent data summary for TRA-764.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Biological Oxygen Demand	mg/L	17.43	10.63	1.00 U[g]	32.00	4/3	NA[h]
Conductivity	µS	998	492	313	822	4/4	NA
pH		7.60	7.46	6.73	8.11	4/4	2.5–12
Chloride	mg/L	23.39	28.35	13.60	37.60J[i]	4/4	NA
Chemical Oxygen Demand	mg/L	8.93	4.70	5.00 U	11.30	4/1	NA
Fluoride	mg/L	0.317	0.318	0.140	0.420	4/4	NA
Nitrogen, Nitrate+Nitrite	mg-N/L	2.19	2.27	1.20	2.90	3/3	NA
Nitrogen, as Nitrate	mg-N/L	2.12	2.80	2.80	2.80	1/1	NA
Total Phosphorous	mg/L	1.10	1.378	0.110	1.900	4/4	NA
TDS	mg/L	517	698	249	850	4/4	NA
TOC	mg/L	5.36	1.088	0.500 U	1.800	4/3	NA
Arsenic	µg/L	17.29	11.05	10.00 U	16.00	4/1	5,000
Barium	µg/L	93.21	106	122	122	4/1	100,000
Calcium	µg/L	71,223	111,725	45,900	138,000	4/4	NA
Chromium	µg/L	12.12	7.35	8.60	10.80	4/2	5,000
Copper	µg/L	21.23	11.80	9.70	9.70	4/1	NA
Iron	µg/L	224	108	78.40 U	293.00	4/1	NA
Potassium	µg/L	7,168	8,268	5,000 U	11,900	4/3	NA
Magnesium	µg/L	26,532	41,175	16,900	52,300	4/4	NA
Manganese	µg/L	6.79	6.33	2.80	2.80	4/1	NA
Sodium	µg/L	13,547	21,213	7,850	26,700	4/4	NA
Zinc	µg/L	33.28	9.85	9.4	9.40	4/1	NA
Trichlorofluoromethane	µg/L	2.25	2.00	1.00 J	2.00 J	4/2	NA
Gross Alpha	pCi/L	1.66 ± 1.31	2.94 ± 0.16[j]	1.20 ± 1.86 U	13.00 ± 2.58	11/6	15[k]

Table F-10. (continued).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Gross Beta	pCi/L	8.17 ± 1.60	8.78 ± 0.65	1.90 ± 1.24	18.10 ± 3.06	11/10	50[k]
Sr-90	pCi/L	—	0.16 ± 0.00	-0.09 ± 0.51 U	0.51 ± 0.41 J	11/1	8.00[k]

a. Only parameters detected in 1996 are presented.

b. Historical averages were calculated from data collected from 1986–1995. Non-detectable values from samples prior to 1991 were not included in the averages.

c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.

d. Maximum detectable concentration.

e. Number of samples collected/number of detectable results for 1996

f. RCRA TCLP Limit, unless otherwise specified. Radiological guideline limits are DCGs unless otherwise noted.

g. U flag indicates that the result was below the detection limit.

h. NA = not applicable.

i. J flag indicates estimated value.

j. Uncertainties shown are the associated 2 sigma uncertainty.

k. Drinking water MCL.

Appendix G

Storm Water Sampling Analyses Results

Table G-1. Historical and 1996 storm water data summary for ICPP Retention Basin (CPP-MP-1) composite samples.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	108.50	100	100	100	1/1	NA[g]
pH		7.27	7.65	7.65	7.65	1/1	6.5–8.5[h]
Biological Oxygen Demand	mg/L	5.42	2.00	2.00	2.00	1/1	NA
Chemical Oxygen Demand	mg/L	38.13	32.80	32.80	32.80	1/1	NA
Nitrogen, as Nitrate	mg-N/L	1.18	3.00	3.00	3.00	1/1	10
Total Phosphorus	mg/L	0.41	1.20	1.20	1.20	1/1	NA
TDS	mg/L	—[i]	189	189	189	1/1	500
Nitrogen, Total Kjeldahl	mg/L	1.83	1.80	1.80	1.80	1/1	NA
TSS	mg/L	340.67	221	221	221	1/1	NA
Barium	µg/L	118.67	354	354	354	1/1	2,000
Chromium	µg/L	14.98	36.90	36.90	36.90	1/1	100
Copper	µg/L	19.48	42.80	42.80	42.80	1/1	1,300
Nickel	µg/L	20.00	41.00	41.00	41.00	1/1	NA
Lead	µg/L	15.58	32.80	32.80	32.80	1/1	15
Zinc	µg/L	526.00	295	295	295	1/1	5,000
Gross Alpha	pCi/L	9.91 ± 9.76[j]	8.00 ± 3.13 J[k]	8.00 ± 1.40 J	8.00 ± 1.40 J	1/1	15

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1994 and 1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996.
f. Drinking Water MCLs and SMCLs unless otherwise specified
g. NA = not applicable.
h. NPDES permit pH limit for coal pile runoff.
i. Insufficient number of detectable values.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. J flag indicates estimated value.

Table G-2. Historical and 1996 storm water summary data for ICPP Retention Basin (CPP-MP-1) grab samples.

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	130.50	65.00	60.00	70.00	2/2	NA[g]
pH		7.53	8.02	7.72	8.31	2/2	6.5–8.5[h]
Biological Oxygen Demand	mg/L	5.64	9.50	2.00	17.00	2/2	NA
Chemical Oxygen Demand	mg/L	40.81	40.00	32.00	48.00	2/2	NA
Nitrogen, as Ammonia	mg/L	0.090	0.080	0.100 U[i]	0.110	2/1	NA
Nitrogen, as Nitrate	mg-N/L	1.030	1.520	0.740	2.300	2/2	10
Total Phosphorus	mg/L	0.601	0.760	0.520	1.000	2/2	NA
TDS	mg/L	106.00	155.50	97.00	214.00	2/2	500
Nitrogen, Total Kjeldahl	mg/L	2.816	1.190	0.680	1.700	2/2	NA
TSS	mg/L	278.25	530	165	894	2/2	NA
Barium	µg/L	182.63	325	211	439	2/2	2,000
Chromium	µg/L	17.20	38.00	26.10	49.90	2/2	100
Copper	µg/L	22.81	32.15	25.00 U	51.80	2/1	1,300
Nickel	µg/L	20.00	37.80	40.00 U	55.60	2/1	NA
Lead	µg/L	22.91	26.55	14.40	38.70	2/2	15
Zinc	µg/L	537.60	434	418	450	2/2	5,000
Gross Alpha	pCi/L	7.04 ± 2.96[j]	7.01 ± 1.85	4.70 ± 1.30 J[k]	10.20 ± 1.80 J	2/2	15
Gross Beta	pCi/L	20.67 ± 4.85	20.40 ± 9.26	20.40 ± 3.50 J	20.40 ± 3.50 J	2/1	50

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1994 and 1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996.
f. Drinking water MCLs and SMCLs unless otherwise specified
g. NA = not applicable.
h. NPDES permit pH limit for coal pile runoff.
i. U flag indicates that the result was below the detection limit.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. J flag indicates estimated value.

Table G-3. Historical and 1996 storm water data for ICPP Coal Pile (CPP-MP-2).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	88.75	65.33	50.00	80.00	3/3	NA[g]
pH		7.48	7.59	6.48	8.88	3/3	6.5–8.5 (6–9)[h]
Biological Oxygen Demand	mg/L	3.00	24.67	4.00	65.00	3/3	NA
Chemical Oxygen Demand	mg/L	63.60	192.33	31.00	349.00	3/3	NA
Nitrogen, as Ammonia	mg/L	0.075	0.143	0.120	0.180	3/3	NA
Nitrogen, as Nitrite	mg-N/L	—[i]	0.030	0.030	0.030	2/2	1
Nitrogen, as Nitrate	mg-N/L	—	0.670	0.670	0.670	1/1	10
Nitrogen, Total Kjeldahl	mg/L	1.500	1.097	0.590	1.400	3/3	NA
Total Phosphorus	mg/L	0.160	0.340	0.190	0.560	3/3	NA
TDS	mg/L	63.00	75.67	55.00	106.00	3/3	500
Total Oil & Grease	mg/L	4.75	3.80	5.00 U[j]	6.40	3/1	NA
Total Petroleum Hydrocarbons	mg/L	0.507	0.967	0.990 U	1.900	3/1	NA
TSS	mg/L	107.23	149.30	42.70	318.00	3/3	NA
Chromium	µg/L	5.00	9.03	10.00 U	17.10	3/1	100
Copper	µg/L	12.50	28.47	25.00 U	60.40	3/1	1300
Lead	µg/L	4.97	3.47	3.00 U	7.40	3/1	15
Zinc	µg/L	78.95	71.30	48.80	102.00	3/3	5000
Gross Alpha	pCi/L	5.00 ± 2.00[k]	2.18 ± 0.26	1.39 ± 0.83	3.71 ± 0.97 J[l]	3/3	15
Gross Beta	pCi/L	4.53 ± 0.97	7.62 ± 0.90	5.70 ± 1.20	13.00 ± 2.30 J	3/3	50

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration.
e. Number of samples collected/number of detectable results for 1996.
f. Drinking water MCLs and SMCLs unless otherwise specified
g. NA = not applicable.
h. NPDES permit pH limit for coal pile runoff.
i. Insufficient number of detectable values.
j. U flag indicates that the result was below the detection limit.
k. Uncertainties shown are the associated 2 sigma uncertainty.
l. J flag indicates an estimated value.

Table G-4. Historical and 1996 storm water data for RWMC Subsurface Disposal Area (RWMC-MP-2).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
Conductivity	µS	200.75	110	100	120	2/2	NA[g]
pH		7.73	8.97	8.80	9.13	2/2	6.5–8.5
Biological Oxygen Demand (5-day)	mg/L	—[h]	6.50	1.00	12.00	2/2	NA
Chemical Oxygen Demand	mg/L	52.12	111.65	51.30	172.00	2/2	NA
Nitrogen, as Ammonia	mg/L	0.352	0.085	0.100 U[i]	0.120	2/1	NA
Nitrogen, Total Kjeldahl	mg/L	2.26	3.15	1.40	4.90	2/2	NA
Total Phosphorus	mg/L	—	2.540	0.280	4.800	2/2	NA
TDS	mg/L	203.00	425	160	690	2/2	500
TOC	mg/L	12.50	19.85	17.60	22.10	2/2	NA
TSS	mg/L	—	2,417.2	84.40	4,750.0	2/2	NA
Arsenic	µg/L	8.93	14.60	10.00 U	24.20	2/1	50
Barium	µg/L	329.50	980	200 U	1860	2/1	2,000
Cadmium	µg/L	3.12	4.10	5.00 U	5.70	2/1	5
Chromium	µg/L	28.85	60.00	10.00 U	115.00	2/1	100
Copper	µg/L	41.76	65.75	25.00 U	119.00	2/1	1,300
Mercury	µg/L	0.132	0.255	0.200 U	0.410	2/1	2
Magnesium	µg/L	20,003	24,695	6,990	42,400	2/2	NA
Magnesium, Soluble	µg/L	12,176	11,795	6,190	17,400	2/2	NA
Nickel	µg/L	35.84	79.50	40.00 U	139.00	2/1	NA
Lead	µg/L	17.25	44.75	3.00 U	88.00	2/1	15
Vanadium	µg/L	44.48	89.00	50.00 U	153.00	2/1	NA
Zinc	µg/L	208.56	390	121	659	2/2	5,000
Am-241	pCi/L	4.33 ± 0.28[j]	0.87 ± 0.16	0.32 ± 0.08	6.07 ± 0.74	2/2	30
Gross Alpha	pCi/L	—	10.36 ± 0.00	4.70 ± 1.80	33.30 ± 7.30	2/2	15
Gross Beta	pCi/L	—	17.29 ± 0.00	12.20 ± 3.80	30.40 ± 9.80	2/2	50
Pu-239/240	pCi/L	2.35 ± 0.05	0.18 ± 0.04	0.04 ± 0.02	4.22 ± 0.58	2/2	NA
Sr-90	pCi/L	2.49 ± 0.74	0.45 ± 0.66	0.45 ± 0.27	0.45 ± 0.27	2/1	8.00
Th-230	pCi/L	0.75 ± 0.07	0.38 ± 0.23	0.38 ± 0.12	0.38 ± 0.12	2/1	300[k]

Table G-4. (continued).

Parameter[a]	Units	Historical Average[b,c]	1996 Average[c]	1996 Minimum	1996 Maximum[d]	Number of Samples[e]	Guideline[f]
	pCi/L	1.07 ± 0.09	0.52 ± 0.37	0.52 ± 0.18	0.52 ± 0.18	2/1	500
U-234							
U-235	pCi/L	—	0.16 ± 0.00	0.16 ± 0.09	0.16 ± 0.09	2/1	600
U-238	pCi/L	0.82 ± 0.08	0.29 ± 0.25	0.29 ± 0.12	0.29 ± 0.12	2/1	600

a. Only parameters detected in 1996 are presented.
b. Historical averages were calculated from data collected from 1994–1995.
c. For nonradiological parameters with analyte concentrations less than the detection limit, half the detection limit was used in calculating the averages.
d. Maximum detectable concentration in 1996.
e. Number of samples collected/number of detectable results for 1996.
f. Drinking water MCLs and SMCLs unless otherwise specified.
g. NA = not applicable.
h. Insufficient number of detectable values.
i. U flag indicates that the result was below the detection limit.
j. Uncertainties shown are the associated 2 sigma uncertainty.
k. Drinking water MCL.

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