2. COMPLIANCE MONITORING PROGRAM

This section presents the results of the Compliance Monitoring Program at the INEEL. The Compliance Monitoring Program samples drinking water, liquid effluents, storm water, and groundwater to show compliance with federal, state, and local regulations and permits. Section 2.1 presents the Drinking Water Monitoring Program results, Section 2.2 presents the Liquid Effluent Monitoring Program results, Section 2.3 presents the Storm Water Monitoring Program results, and Section 2.4 presents the Groundwater Monitoring Program results.

2.1 Drinking Water Program

In 1988, a centralized drinking water program was established for most INEEL facilities. Argonne National Laboratory-West and the Naval Reactors Facility are the only two facilities that are not included in the INEEL Drinking Water Program. Argonne National Laboratory-West is managed by DOE-Chicago, and the Naval Reactors Facility is managed by the Department of Defense.

The Drinking Water Program was established to monitor production and drinking water wells, which are multiple-use wells for industrial use, fire safety, and drinking water. According to the "Idaho Regulations for Public Drinking Water Systems" (Idaho Administrative Procedures Act [IDAPA] 58.01.08),[20] INEEL drinking water systems are classified as either nontransient or transient, noncommunity water systems. The transient, noncommunity water systems are at the Experimental Breeder Reactor (EBR)-I, the Gun Range, and the Main Gate. The rest of the water systems at the INEEL are classified as nontransient, noncommunity water systems, which have more stringent requirements than transient, noncommunity water systems.

Because groundwater supplies the drinking water at the INEEL, information on groundwater quality was used to help develop the Drinking Water Program. The United States Geological Survey (USGS) and the management and operating contractor monitor and characterize groundwater quality at the INEEL. Three groundwater contaminants have impacted INEEL drinking water systems: tritium at Central Facilities Area (CFA), carbon tetrachloride at Radioactive Waste Management Complex (RWMC), and trichloroethylene at Test Area North/Technical Support Facility (TAN/TSF).

2.1.1 Program Design Basis

The Drinking Water Program monitors drinking water to ensure it is safe for consumption and to demonstrate that it meets federal and state regulations (that is, maximum contaminant levels [MCLs] are not exceeded). The Safe Drinking Water Act[2] establishes the overall requirements for the Drinking Water Program.

As required by the State of Idaho, the Drinking Water Program uses Environmental Protection Agency-approved (or equivalent) analytical methods to analyze drinking water in compliance with IDAPA 58.01.08[20] and 40 Code of Federal Regulations (CFR) 141–143.[21]

Currently, the Drinking Water Program monitors 10 water systems, which include 17 wells. Drinking water parameters are regulated by the State of Idaho under authority of the Safe Drinking Water Act. Parameters with primary maximum contaminant levels must be monitored at least once every compliance period, which is 3 years. Parameters with secondary maximum contaminant levels are monitored every 3 years based on a recommendation by the Environmental Protection Agency. The 3-year compliance periods for the Drinking Water Program are 1999–2001, 2002–2004, and so on. Many parameters require more frequent sampling during an initial period to establish a baseline, and subsequent monitoring frequency is determined from the baseline.

Because of known contaminants, the Drinking Water Program monitors more frequently than required. For example, the program monitors for bacteriological analyses more frequently because of historical problems with bacteriological contaminants. These detections were possibly caused by biofilm on older water lines and stagnant water, and resampling results were normally in compliance with the maximum contaminant level. Table 2-1 lists the 2000 Drinking Water Program monitoring locations, parameters, and frequencies.

Table 2-1. 2000 drinking water monitoring locations, parameters, and frequencies.

Facility	Sample Point	Parameters	Sample Frequency
CFA	Selected buildings	Bacteriological	2 quarterly[a] 3 monthly[b]
		Total trihalomethanes	1 quarterly[b]
	1603	Nitrate	1 annually[a]
	1603	Metals, inorganics, organics [c] and secondary drinking water standards	1, as required every 3 years
	Wells #1 and #2 and 1603	Gross alpha, beta, Sr-90, tritium, and radon[d]	1 sample each, quarterly
CTF	Selected buildings	Bacteriological	1 quarterly[a] 2 monthly[b]
		Total trihalomethanes	1 quarterly[b]
	614, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	614 and Wells #1 and #2	Gross alpha, beta, tritium, radon[d]	1 quarterly
	614	Metals, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years
EBR-I	Selected buildings	Bacteriological	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, radon,[d] and tritium	1 quarterly
	601	Metal, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years

Table 2-1. (continued).

Facility	Sample Point	Parameters	Sample Frequency
Gun Range	Selected buildings	Bacteriological	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, radon,[d] and tritium	1 quarterly
	608	Metals, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years
INTEC	Selected buildings	Bacteriological	2 quarterly[a] 3 monthly[b]
		Total trihalomethanes	1 quarterly[b]
	614, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	614 and Wells #1 and #5	Gross alpha, beta, radon,[d] tritium, and Sr-90	1 sample each, quarterly
	614	Metals, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years
Main Gate	Selected buildings	Bacteriological	1 quarterly[a] 1 monthly[b]
	603, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	603 and Well	Gross alpha, beta, radon,[d] and tritium	1 quarterly
		Metals, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years
PBF	Selected buildings	Bacteriological	1 quarterly[a] 2 monthly[b]
		Total trihalomethanes	1 quarterly[b]
	638, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	638 and Wells #1 and #2	Gross alpha, beta, radon,[d] and tritium	1 quarterly
	638	Metals, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years

Table 2-1. (continued).

Facility	Sample Point	Parameters	Sample Frequency
RWMC	Selected buildings	Bacteriological	1 quarterly[a] 3 monthly[b]
	604, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	604	Metals, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years
	603 Well and 604, point-of-entry to distribution system after treatment	Gross alpha, beta, radon,[d] and tritium	1 quarterly
TRA	Selected buildings	Bacteriological	1 quarterly[a] 3 monthly[b]
		Total trihalomethanes	1 quarterly[b]
	608, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	608 and Wells #1, #3, and #4	Gross alpha, beta, radon,[d] and tritium	1 quarterly
	608	Metals, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years
TSF	Selected buildings	Bacteriological	1 quarterly[a] 2 monthly[b]
		Total trihalomethanes	1 quarterly[b]
	610, point-of-entry to distribution system after treatment	Nitrate	1 annually[a]
	610 #1 and #2 Wells	Gross alpha, beta, radon,[d] and tritium	1 quarterly
	610	Metals, inorganics, organics,[c] and secondary drinking water standards	1, as required every 3 years

a. Compliance samples (required by regulations).

b. Surveillance samples (required by Program Plan).

c. Waivers for reduced monitoring of some organic parameters (e.g., dioxin) were obtained from the State of Idaho.

d. Radon sampled for special study in 2000.

2.1.2 Data Summary and Assessment by Facility

During 2000, 604 routine samples and 96 quality control samples were collected and analyzed from Central Facilities Area (CFA), Experimental Breeder Reactor-I (EBR-I), Gun Range, Idaho Nuclear Technology and Engineering Center (INTEC), Main Gate, Power Burst Facility (PBF), Radioactive Waste Management Complex (RWMC), Test Area North (TAN; Contained Test Facility [CTF] and Technical Support Facility [TSF]), and Test Reactor Area (TRA). In addition to the routine sampling, the Drinking Water Program also collects nonroutine samples. For example, a nonroutine sample is collected after a water main breaks and is repaired to determine if the water is acceptable for use before it is put back into service. The Drinking Water Program received 74 requests for nonroutine sampling.

Analytical results of interest in 2000 are presented in Table 2-2 and are discussed in the following subsections. EBR-I, Gun Range, INTEC, Main Gate, PBF, TAN/CTF, and TRA were well below drinking water limits for all regulatory parameters and are therefore not discussed.

Table 2-2. Monitored parameters of interest in 2000.

Parameter[a]	Location	Results (4-Quarter Average)	MCL
Trichloroethylene	TSF #1 Well	3.65 μg/L[b]	NA[c]
	TSF Distribution	0.97 μg/L[d]	5 μg/L
Tritium	CFA Distribution	11,126 pCi/L	20,000 pCi/L
	CFA #1 Well	11,673 pCi/L[e]	NA[c]
	CFA #2 Well	10,028 pCi/L	NA[c]
Carbon tetrachloride	RWMC Well	4.33 μg/L	NA[c]
	RWMC Distribution	2.33 μg/L	5 μg/L

a. These parameters are known contaminants that the Drinking Water Program is tracking. See specific sections for details.

b. Sampled only twice during the year for surveillance purposes (not required by regulations to be sampled). The compliance point is after the sparger system (air stripping process); the compliance result is 0.97 μg/L for the four-quarter average.

c. NA—Maximum contaminant level (MCL) is not applicable to the well concentration.

d. Result is based on a 3-quarter average. No volatile organic samples were collected during the third quarter of 2000 because no laboratory contract was in place.

e. Result is based on a 3-quarter average. No second quarter result was available for this location because of maintenance and repair.

2.1.2.1 Central Facilities Area. The CFA water system serves over 1,000 people daily. Since the early 1950s, wastewater containing tritium has been disposed to the Snake River Plain Aquifer at TRA and INTEC (Figure 1-1) through injection wells and infiltration ponds. These wastewaters migrated south-southwest and are the suspected source of tritium contamination in the CFA water supply wells. The practice of disposing of wastewater through injection wells and infiltration ponds was discontinued.

In 2000, water samples were collected quarterly from CFA #1 Well (at CFA-651), CFA #2 Well (at CFA-642), and CFA-1603 (point of entry to the distribution system) for compliance purposes. Since December 1991, the mean tritium concentration has been below the maximum contaminant level at all three locations. In general, tritium concentrations in groundwater have been decreasing due to changes in disposal rates, disposal techniques, recharge conditions, and radioactive decay.

2.1.2.2 Radioactive Waste Management Complex. Various solid and liquid radioactive and chemical wastes, including transuranic wastes, have been disposed at the RWMC. The RWMC contains pits, trenches, and vaults where radioactive and organic wastes were disposed belowgrade, as well as placed abovegrade and covered on a large pad. During an INEEL-wide characterization program conducted by USGS, carbon tetrachloride and other volatile organic compounds were detected in groundwater samples taken at the RWMC.[22] Review of waste disposal records indicated an estimated 334,600 L (88,400 gal) of organic chemical wastes (including carbon tetrachloride, trichloroethylene, tetrachloroethylene, toluene, benzene, 1,1,1-trichloroethane, and lubricating oil) were disposed at the RWMC before 1970. High vapor-phase concentrations (up to 2,700 parts per million vapor phase) of volatile organic compounds were measured in the unsaturated zone above the water table. Groundwater models predict that volatile organic compound concentrations will continue to increase in the groundwater at the RWMC.

The RWMC production well is located in WMF-603 and supplies all of the drinking water for over 150 people at the RWMC. The well was put into service in 1974. Water samples were collected at the wellhead and from the point of entry to the distribution system, which is the point of compliance, at WMF-604.

Since monitoring began at RWMC in 1988, there has been an upward trend in carbon tetrachloride concentrations (Figure 2-1). In October 1995, the carbon tetrachloride concentrations increased to 5.48 μg/L at the well. This was the first time the concentrations exceeded the maximum contaminant level of 5.0 μg/L. However, the maximum contaminant level for carbon tetrachloride is based on a four-quarter average and applies to the distribution system. The distribution system is the point from which water is first consumed at RWMC and is the compliance point. Table 2-3 presents the carbon tetrachloride concentrations at the RWMC drinking water well and distribution system for 2000. The mean concentration at the well for 2000 was 4.33 μg/L, and the maximum concentration was 4.8 μg/L. The mean concentration at the distribution system was 2.33 μg/L, and the maximum concentration was 2.9 μg/L.

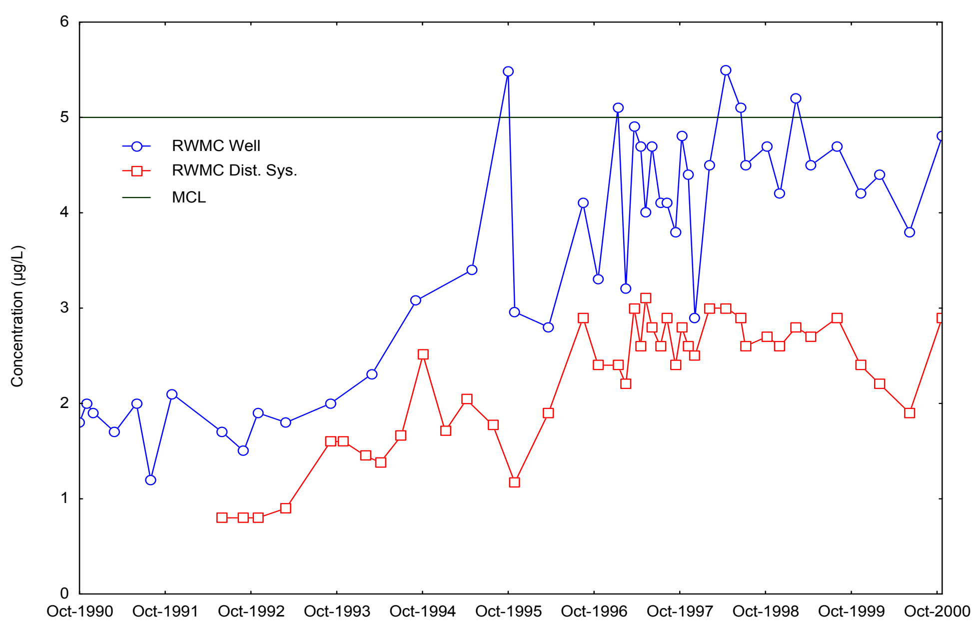


Figure 2-1. Carbon tetrachloride concentrations in Radioactive Waste Management Complex drinking water well and distribution system.

Table 2-3. Carbon tetrachloride concentrations in Radioactive Waste Management Complex drinking water well and distribution system (2000).

Location	Number of Samples [a]	Carbon Tetrachloride Concentration (μg/L) Minimum	Maximum	Mean	MCL
RWMC WMF-603 Well	3	3.8	4.8	4.33	NA[b]
RWMC WMF-604 Distribution	3	1.9	2.9	2.33	5.0

a. No samples were collected during the second quarter of 2000 because no laboratory was available to perform the analysis. The problem was resolved, and sampling resumed during the third quarter.

b. NA—Not applicable. MCL applies to the distribution system only.

2.1.2.3 Test Area North/Technical Support Facility. In 1987, trichloroethylene was detected at both TSF #1 and #2 Wells, which supply drinking water to approximately 100 employees at TSF daily. The inactive TSF injection well (TSF-05) is believed to be the principal source of trichloroethylene contamination at the TSF. Bottled water was provided until 1988 when a sparger system (air stripping process) was installed in the water storage tank to volatilize the trichloroethylene to levels below the maximum contaminant level.

During the third quarter of 1997, TSF #1 Well was taken off line, and TSF #2 Well was put on line as the main supply well because the trichloroethylene concentration of TSF #2 was below the maximum contaminant level of 5.0 μg/L. Therefore, by using TSF #2 Well, no treatment (sparger air stripping system) is required. TSF #1 Well is used as a backup to TSF #2 Well. If TSF #1 Well must be used, the sparger system must be activated to treat the water.

Table 2-4 presents the trichloroethylene concentrations at TSF #1 Well and the distribution system. Regulations do not require sampling of TSF #1 Well; however, samples were collected to monitor trichloroethylene concentrations. The distribution system is the compliance point. TSF #2 Well was not sampled during 2000 because it was not required by regulations. The mean concentration of trichloroethylene at the distribution system for 2000 was 0.97 μg/L, which is well below the MCL. Figure 2-2 illustrates the concentrations of trichloroethylene in both TSF wells and the distribution system from 1990 through 2000. Past distribution system sample exceedances are attributed to preventive maintenance activities interrupting operation of the sparger system. The decreasing concentration at TSF #1 Well is attributed to the plume shifting in response to reduced pumping at TSF #1 Well.

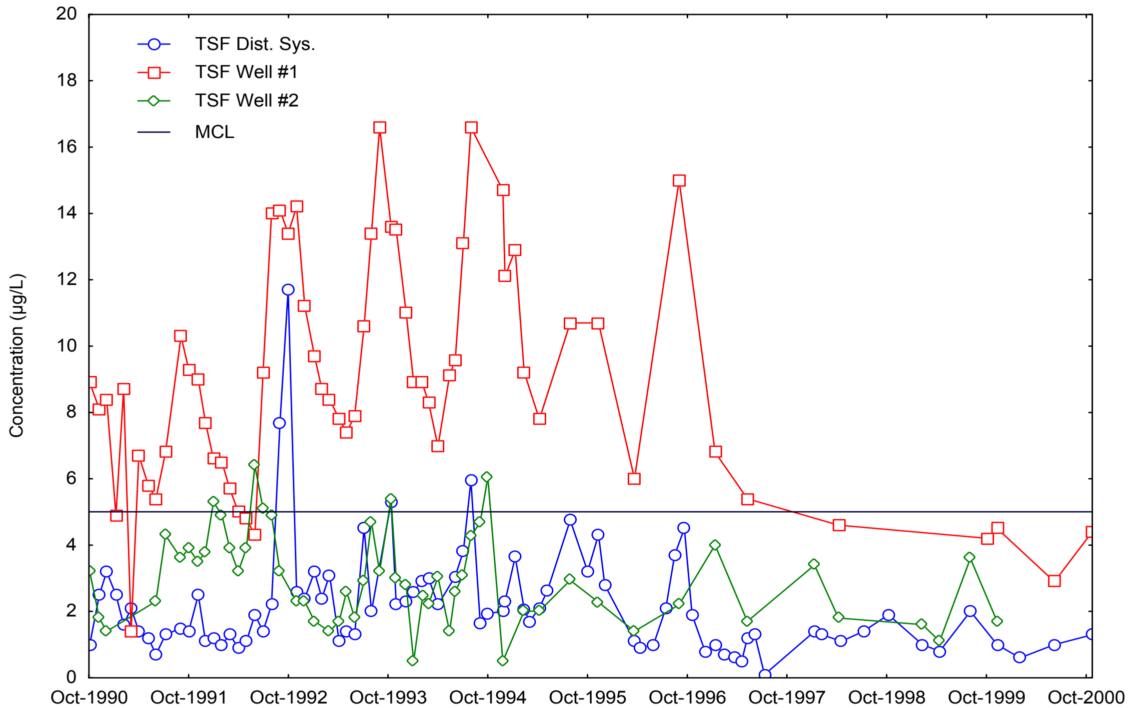
Table 2-4. Trichloroethylene concentrations at Technical Support Facility #1 Well and distribution system (2000).

Location	Number of Samples[a]	Trichloroethylene (μg/L) Minimum	Maximum	Mean	MCL
TSF #1 Well (612)[b]	2	2.9	4.4	3.65	NA[c]
TSF Distribution (610)	3	0.6	1.3	0.97	5.0

a. No samples were collected during the second quarter of 2000 because no laboratory was available to perform the analysis. The problem was resolved, and sampling resumed during the third quarter.

b. Regulations do not require sampling at this well.

c. NA— Not applicable. MCL applies to the distribution system only.



NOTE: During 2000, Well #2 was not sampled because it was not required by regulations.

Figure 2-2. Trichloroethylene concentrations in Technical Support Facility drinking water wells and distribution system.

2.1.3 Special Studies

The EPA has proposed new radon standards, which are expected to be effective in 2002. The EPA is considering one of two MCLs: 300 pCi/L in drinking water or 4,000 pCi/L for indoor air in conjunction with drinking water. The EPA recommended that radon be sampled before the new standards are effective. Therefore, The Drinking Water Program sampled for radon quarterly at all wells and distribution systems in Calendar Year 2000 in anticipation of the proposed radon standards, to establish baseline levels, and to assess the need for treatment equipment if 2000 radon levels exceed the proposed limit. Those wells or distribution systems that approached or exceeded the proposed maximum contaminant level of 300 pCi/L in drinking water are shown in Table 2-5.

Table 2-5. Radon results in 2000.

Location	Results (4-Quarter Average) (pCi/L)	Proposed MCL[a] (pCi/L)
CFA #1 Well	304	300/4,000
CFA #2 Well	348[b]	300/4,000
CFA Distribution	180	300/4,000
PBF #1 Well	228	300/4,000

a. Two proposed MCLs: 300 pCi/L is for drinking water, and 4,000 pCi/L is for indoor air in conjunction with drinking water.

b. Result is based on a 3-quarter average.

2.1.4 Quality Assurance/Quality Control

2.1.4.1 Data Accuracy, Precision, and Completeness. The Drinking Water Program is required to take compliance samples at a frequency and type specified in the regulations. Programmatic quality assurance/quality control goals have been established for accuracy, precision, and completeness.[23] Data accuracy is assessed by using field blind spike results. Precision is assessed by calculating the relative percent difference determined from duplicate samples. Completeness is assessed by comparing the number of samples required for compliance to the number of compliance samples collected.

The Drinking Water Program's accuracy goal is all blind spike percent recoveries must fall within their standards range. For the bacteriological analyses, the goal cannot be quantitatively assessed since a numerical result is not provided. All results (absent or present) from the bacteriological blind spikes agreed with the manufactures' specifications. One blind spike submitted with nitrate analyses performed during the year was within the performance acceptance limits set by the manufacturer. Sixteen blind spikes were submitted for radiological analysis: four each for gross alpha, gross beta, strontium-90, and tritium. Based on an in-house evaluation, all of the blind spikes fell within their expected range. However, the laboratory did not report results for one of the strontium-90 blind spikes due to a laboratory error.

The Drinking Water Program's precision goal states that the relative percent difference determined from duplicates must be 35% or less for 90% of all duplicates. During 2000, duplicate samples were taken and analyzed for one total trihalomethane pair and six radiological pairs of samples. The relative percent difference was not calculated for one pair of radiological samples because both results were less-than-detected. For the remaining six pairs of duplicate samples, all relative percent differences were less than 35%, except for one calculated from a pair of radiological samples. As a result, the precision goal of 90% of all duplicates having relative percent differences of less than 35% was not met. Corrective actions are specified in the *Drinking Water Program Plan* to address programmatic quality control problems and have been implemented by program personnel to address this issue.

The Drinking Water Program's completeness goal is to collect, analyze, and verify 100% of all compliance samples. This goal was met during 2000 for all analysis types except for organics. Second quarter organics samples could not be collected because no laboratory was available to perform the analysis. The problem was resolved, and sampling resumed during the third quarter.

In addition to goals for accuracy, precision, and completeness, the Drinking Water Program requires that 10% of the samples collected for each analysis type be quality assurance/quality control samples to include duplicates, field blanks, trip blanks, blind spikes, and splits. This goal was met in 2000 for all four analysis types (organic, inorganic, radiological, and bacteriological) required to be sampled during the year.

Additional quality assurance/quality control samples were taken during 2000 as trip blanks and splits. However, no performance criteria have been established for these types of samples. Performance criterion does exist for field blanks for the Drinking Water Program (i.e., they must be less than 10% of the maximum contaminant level). However, no field blanks were taken during 2000.

2.1.4.2 Data Validation and Sampling Issues. During 2000, none of the results were rejected as unusable during data validation. Two additional issues that possibly impacted the sample results were discovered.

One volatile organic compound sample taken in June was improperly preserved. The logbook indicated that the sample was collected from a nonchlorinated system; however, it was collected from a chlorinated system. Because the sample was not a compliance sample and the results were consistent with past historical results, the positive detections were "J" flagged, indicating that they were usable. Programmatic procedures addressing sampling and logbook documentation were reviewed to ensure that similar logbook errors did not impact future sampling results.

During July, two samples were switched at the laboratory during tritium analysis. One sample was from a water system with a history of tritium, and the other sample was from a water system with no history of tritium. Because the initial results from the laboratory were not consistent with historical results, the laboratory was contacted, and the laboratory confirmed the two samples were mistakenly switched. The laboratory reanalyzed the samples, and the reanalyzed results were comparable to historical results for both water systems. Project personnel contacted the laboratory to prevent similar laboratory errors from occurring in the future.

No other sampling or validation issues were identified during the year.

2.2 Liquid Effluent Monitoring Program

The Liquid Effluent Monitoring Program monitors for nonradioactive and radioactive parameters in liquid waste effluents generated within selected facilities at the INEEL. This program ensures that liquid effluent samples provide representative data to demonstrate compliance with permits and regulations.

2.2.1 Program Design Basis

The 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 was added as permits were obtained.

INEEL Idaho Falls facilities are required to comply with the applicable regulations in Chapter 1, Section 8, of the Municipal Code of the City of Idaho Falls.[24] The City of Idaho Falls is authorized by the Clean Water Act to set pretreatment standards for nondomestic discharges to the publicly-owned treatment works.[25] Industrial Wastewater Acceptance Forms[7] are obtained for facilities that dispose process liquid effluent through the City of Idaho Falls sewer system. The forms contain requirements that apply to all management and operating contractor and Department of Energy Idaho Operations Office-operated facilities that discharge to the city sewer system. Forms include general requirements applicable to all facilities and specific monitoring requirements for the INEEL Research Center (IRC) and the Willow Creek Building (WCB) due to the nature of activities at these two facilities.

The State of Idaho regulation IDAPA 58.01.02, "Water Quality Standards and Wastewater Treatment Requirements,"[26] regulates liquid effluent discharges. Much of the wastewater discharged at the INEEL is to the ground surface through infiltration ponds or sprinkler irrigation systems. Discharge of wastewater to the land surface must be permitted under IDAPA 58.01.17, "Wastewater Land Application Permit Rules."[5] The management and operating contractor operates five facilities that require Wastewater Land Application Permits at the INEEL. The following four of the five facilities have been issued Wastewater Land Application Permits:

- CFA Sewage Treatment Plant (STP)
- INTEC Percolation Ponds
- INTEC STP

- TAN/TSF STP.

A Wastewater Land Application Permit application has been submitted to the Idaho Division of Environmental Quality for the TRA Cold Waste Pond. An application had also been submitted for Water Reactor Research Test Facility (WRRTF) process and sewage ponds. However, the WRRTF has since been shutdown, and the permit is no longer required.

The Wastewater Land Application Permits originally issued for the CFA STP, the INTEC Percolation Ponds, and the INTEC STP have expired. Permit extensions were received during Calendar Year 2000 for the CFA STP and the INTEC Percolation Ponds. A renewal application was submitted for the INTEC STP in March 2000, but notification to continue operation was not received before the end of the calendar year. Also during Calendar Year 2000, the Idaho Division of Environmental Quality approved plans and specifications to construct two new Percolation Ponds at INTEC to replace the current ponds. The new Percolation Ponds are expected to be completed by December 2003.

The Wastewater Land Application Permits generally require compliance with the Idaho groundwater quality standards[27] in specified downgradient groundwater monitoring wells. Annual discharge volume and application rates and effluent quality limits are specified in the permits.

The *2000 Annual Wastewater Land Application Permit Performance Reports for the Idaho National Engineering Laboratory*[28] for permitted wastewater land application facilities were submitted to the Idaho Division of Environmental Quality. As required by State of Idaho Wastewater Land Application Permits, the reports describe site conditions for the four permitted facilities. These reports contain:

- Permit-required monitoring data
- Status of special compliance conditions
- Discussions of environmental impacts by the facilities.

Parameters monitored by the Liquid Effluent Monitoring Program are reviewed periodically to comply with 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. Sampling locations are chosen where the samples most closely represent the released effluent when practical. Effluent discharges regulated by a permit are monitored as the permit requires.

The sampling design was based on an approach developed to evaluate effluent sampling locations, frequencies, and parameters based on risk.[29,30] Risk is defined as the statistical probability of exceeding a release limit (both regulatory limits and environmental risk-based limits). The sampling design differentiates between streams requiring characterization monitoring and those requiring surveillance monitoring. The objectives of characterization monitoring are to provide data from which risk can be quantified and to establish baseline conditions for measuring change. Streams requiring characterization monitoring did not have sufficient historical data to quantify risk. Sites requiring surveillance monitoring were determined from historical data to have a potential risk of exceeding a limit or potential impact to the environment.

Table 2-6 lists effluent streams that were sampled by Effluent Monitoring Program personnel during 2000 and the parameters and frequency of monitoring for each stream. The specific date during the period was randomly selected. Monitoring for permit-required parameters was conducted according to the frequencies specified in permits for applicable streams. INTEC Percolation Pond monitoring is performed by INTEC Operations; therefore, it is not included in Table 2-6.

Twenty-four-hour composite samplers were used at all accessible locations. Grab samples were collected at certain areas because of inaccessibility to the effluent stream or the nature of the discharge. The Industrial Wastewater Acceptance agreements with the City of Idaho Falls and the Wastewater Land Application Permits require that pollutants be analyzed using methods listed in 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants."[31]

2.2.2 Data Summary and Assessment by Facility

During 2000, 13 effluent discharge points were routinely monitored for nonradiological parameters and 5 for radiological parameters at the following five areas:

- CFA
- INTEC
- Idaho Falls
- TAN
- TRA.

Four hundred seventy effluent samples (defined as types of analyses performed) were collected.

To assess the data for trends or changes that might indicate loss of process control or unplanned release, current monitoring data are compared to statistical control limits. (Refer to Appendix B for the calculation of these limits). These statistical control limits are not regulatory limits, rather they are comparison limits used to monitor a given effluent for changes from expected levels. If a parameter concentration exceeds the upper statistical control limit, there is less than a 1% chance that the exceedance was due to random fluctuations. The effluent to the CFA Sewage Treatment Plant (Section 2.2.2.1), INTEC Sewage Treatment Plant (Section 2.2.2.2), and TAN/TSF effluent to the Disposal Pond (Section 2.2.2.4) were the only locations for which parameters repeatedly exceeded the upper statistical control limits. All other exceedances of the upper statistical control limits were infrequent occurrences and did not indicate a trend or identify a regulatory issue, and therefore, are not discussed.

Measurement results were compared to regulatory limits. Regulatory limits include Resource Conservation and Recovery Act toxicity characteristic hazardous waste limits and applicable permit limits. Any detections above regulatory limits were addressed with facility representatives and regulatory agencies, and if required, actions were taken based upon those reviews. All results were below Resource Conservation and Recovery Act toxicity characteristic hazardous waste limits and City of Idaho Falls limits. With the exception of three total nitrogen monthly results at the INTEC Sewage Treatment Plant, which exceeded the Wastewater Land Application Permit limit, all results were within regulatory limits.

Table 2-6. 2000 effluent monitoring locations, parameters, and frequencies.

Location	Discharge Description	Type of Monitoring	Parameters[a]	Frequency
CFA-LS1, Sewage Treatment Plant Lift Station	Untreated wastewater from all sanitary sewer drains throughout CFA	Wastewater Land Application Permit	Wastewater Land Application Permit parameters[b]	Monthly
CFA-STF, Sewage Treatment Plant effluent pump pit	Treated wastewater from the CFA Sewage Treatment Plant lagoons prior to land application	Wastewater Land Application Permit	Wastewater Land Application Permit parameters	Monthly (when pivot operating)
		Characterization	Cl, F, SO_4, total dissolved solids (TDS), metals,[c] and radiological parameters[d]	Quarterly (when pivot operating)
CFA-696,[e] Transportation Complex oil and water separator	Water from floor drains and vehicle maintenance areas in the Transportation Complex	Surveillance	Total oil and grease	Quarterly
CPP-769, influent to Sewage Treatment Plant	Untreated wastewater from sanitary sewer drain throughout INTEC	Wastewater Land Application Permit	Wastewater Land Application Permit parameters	Monthly
		Characterization	NNN, NH_3N, TKN, BOD, and alkalinity	Weekly nitrogen study upon request
CPP-771,[e] effluent from Cell No. 2	Treated wastewater from aeration lagoons	Characterization	NNN, NH_3 N, TKN, BOD, and alkalinity	Weekly nitrogen study upon request
CPP-773, Sewage Treatment Plant effluent to Rapid Infiltration Trenches	Treated wastewater from the INTEC lagoons prior to the infiltration trenches	Wastewater Land Application Permit	Wastewater Land Application Permit parameters	Monthly
		Characterization	Metals[c] and radiological parameters NNN, NH_3 N, TKN, BOD, and alkalinity	Quarterly Weekly nitrogen study upon request
TRA-608,[e,f] effluent from Reverse Osmosis Unit	Water treatment process at the TRA demineralizer facility	Characterization	Metals,[c] Cl, F, SO_4, TDS, and NNN	Quarterly
			Radiological parameters	Quarterly
TRA-764, effluent to Cold Waste Pond	Nonradioactive, nonsanitary drains throughout TRA	Surveillance	Metals,[c] Cl, F, SO_4, TDS, and radiological parameters	Quarterly

Table 2-6. (continued).

Location	Discharge Description	Type of Monitoring	Parameters[a]	Frequency
TAN-655, effluent to Sewage Treatment Plant pond	Combination of process water from TAN-607 and treated sewage	Wastewater Land Application Permit	Wastewater Land Application Permit parameters	Monthly
		Surveillance	Radiological parameters	Quarterly and upon request
			NNN, NH_3N, and TKN	Special study upon request
WRRTF-1,[e] Sewage Lagoon sump	Treated effluent from the sanitary system at WRRTF	Surveillance	Metals,[c] Cl, F, SO_4, TSS, TDS, BOD, NNN, TKN, and P	Annually
WRRTF-2,[e] process pond sump pit	Nonsanitary, nonradioactive sources at WRRTF	Surveillance	Metals,[c] Cl, F, SO_4, TSS, TDS, and NNN	Semiannually
IFF-603B, IRC east access port	Sewage and laboratory discharges from IRC and the Research Office Building	Industrial Wastewater Acceptance Form	Metals,[g] and CN	Semiannually
IFF-616, WCB effluent	Sanitary sewage and wastewater from WCB	Industrial Wastewater Acceptance Form	Metals,[g] and CN	Semiannually
Live Fire Range	Floor wash water from firing range	Surveillance	Total Pb	On request

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

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

c. Metals include the following target analyte list: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

d. Radiological parameters include gross alpha, gross beta, and gamma spectrometry.

e. These samples were grab samples. Other samples were 24-hour composites.

f. Sampling at TRA-608 was discontinued after the 3rd quarter 2000 sampling.

g. Required metals include arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc.

Additionally, annual average concentrations in discharges to land application facilities were compared to calculated risk-based release levels. Release levels were developed for disposal of wastewater to land application facilities (percolation ponds or sprinkler irrigation sites).[32,33] Release levels were developed to ensure that long-term use of the ponds for wastewater disposal would not result in accumulation of contaminants that potentially become an unacceptable risk to human health or result in degradation of groundwater quality in excess of Wastewater Land Application Permit limits. Gross alpha and gross beta concentrations were compared to the Derived Concentration Guide for the most restrictive alpha- and beta-emitting radionuclides (plutonium-239 and strontium-90, respectively). During 2000, the sulfate and total dissolved solids risk-based release levels were exceeded at the TRA cold waste pond and are discussed in Section 2.2.2.3. No other risk-based release levels were exceeded at any other facilities.

Historical and 2000 summary statistical data for effluent streams are in Environmental Monitoring Program files. In 2000, concentrations were below corresponding limits at the following facilities: CFA-LSI, CFA-696, TRA-608, WRRTF-1, WRRTF-2, IFF-603B, IFF-616 and are therefore not discussed. The following sections discuss only the effluent streams and parameters that exceeded the applicable limits in 2000. Effluent monitoring of the INTEC Percolation Ponds (CPP-797) is conducted by INTEC Operations. Therefore, results are not included in this report.

2.2.2.1 Effluent from the CFA Sewage Treatment Plant. The CFA Sewage Treatment Plant treats water from sanitary sewage drains throughout CFA (Figure A-4). Wastewater is derived from restrooms, showers, and the cafeteria, a significant portion of which is comprised of noncontact cooling water from air conditioners and heating systems which dilutes the wastewater effluent.

The STP consists of:

- 1-acre partial-mix, aerated lagoon (Lagoon No. 1)
- 9-acre facultative lagoon (Lagoon No. 2)
- 0.5-acre polishing pond (Lagoon No. 3)
- Sprinkler pivot irrigation system, which applies wastewater on up to 73.5 acres of native desert rangeland.

A 400-gallon-per-minute pump applies wastewater from the lagoons to the land through a computerized center pivot system. The permit limits wastewater application to 25 acre-in./acre/year from March 15 through November 15 and limits leaching losses to 3 in./year.

During 2000, five effluent samples (including one duplicate sample) were taken from the pump pit (prior to the pivot) during the months of normal pivot operation. Effluent concentrations repeatedly exceeded the upper statistical control limits for the following parameters: conductivity (4 samples), total phosphorus (5 samples), and total Kjeldahl nitrogen (TKN) (5 samples). In addition, biochemical oxygen demand (BOD) results exceeded the associated upper statistical control limit and represented the highest BOD concentrations reported to date. These upper statistical control limit exceedances indicated concentrations that are significantly higher than what would be expected based on historical data. However, calculated loading rates for both total nitrogen (of which TKN is a main component) and total phosphorus remained much lower than projected in the initial permit application and do not indicate a negative impact to the application area. While removal efficiencies calculated for both total nitrogen and BOD were at lower-than-projected levels, treatment in the lagoons is still sufficient to produce a good quality effluent for land application. These parameters will continue to be monitored for continued increasing trends.

2.2.2.2 Idaho Nuclear Technology and Engineering Center Sewage Treatment Plant.

The INTEC Sewage Treatment Plant treats and disposes of sanitary and other related wastes at INTEC. It consists of:

- Two aerated lagoons
- Two quiescent, facultative stabilization lagoons
- Four rapid infiltration trenches
- Six weir boxes (control stations) that control the flow of the sewage through the lagoons and trenches.

Automatic, flow-proportional composite samplers are located at control stations CPP-769 (influent) and CPP-773 (effluent) (Figure A-8). The Wastewater Land Application Permit for the Sewage Treatment Plant sets the following limits for effluent prior to the infiltration trenches (CPP-773):

- Total suspended solids (TSS) of 100 mg/L averaged monthly
- Total nitrogen (nitrate + nitrite + TKN) of 20 mg/L averaged monthly
- Flow to rapid infiltration trenches of 30 million gallons annually.

December 2000 permit-required samples were not taken for either the influent or effluent. The effluent sample could not be taken due to construction activities in support of the scheduled shear gate replacement project. Failure to obtain the December influent sample is considered a permit noncompliance and required notification to the Idaho Division of Environmental Quality.[34] However, no environmental consequences were anticipated from the failure to collect the December influent sample.

For Calendar Year 2000, the INTEC Sewage Treatment Plant (CPP-773) effluent did not exceed the monthly average of 100 mg/L for TSS. The flow limit set forth in the permit was not exceeded during the 2000 permit year, which ran from November 1999 through October 2000. However, the total nitrogen limit of 20 mg/L was exceeded 3 months during Calendar Year 2000. The 2000 total nitrogen annual average concentration was 15.6 mg/L. Total nitrogen concentrations in the effluent exceeded the permit limit for the first time in December 1997. Although elevated nitrogen concentrations occur during warmer months, the highest total nitrogen concentrations typically occur during colder months, when biological activity of microorganisms decreases from the colder temperatures. Figure 2-3 shows influent and effluent total nitrogen concentrations from September 1995 through December 2000. Since the 1999 annual report was published, additional information was received from the analytical laboratory about the December 1999 influent result originally reported as 196 mg/L. As a result of this information and further validation of the associated data package, the result was rejected and is considered unusable. Figure 2-3 reflects this change.

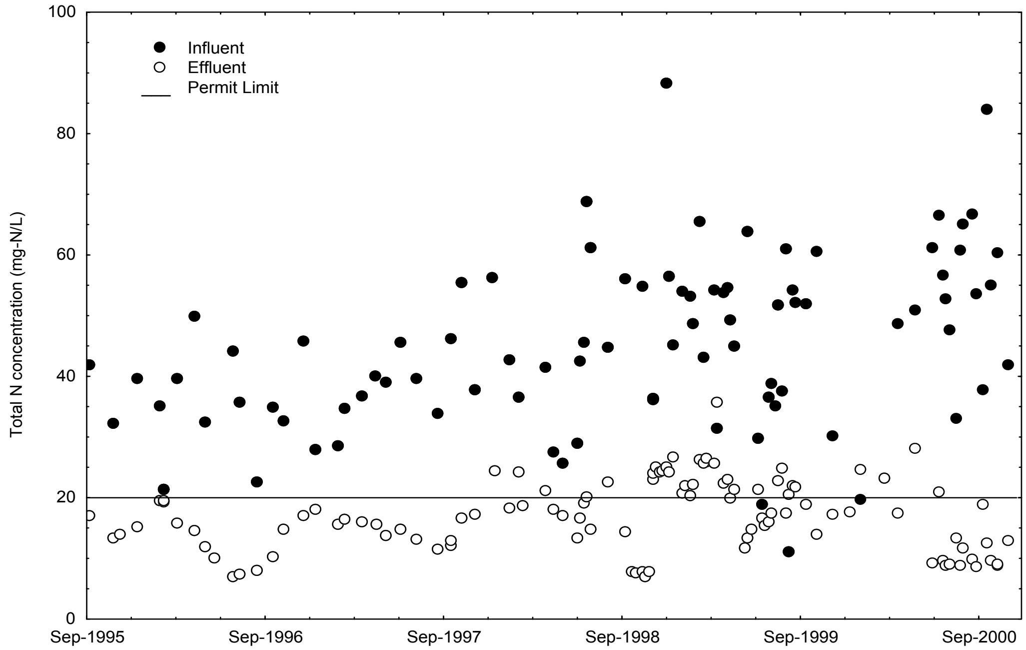


Figure 2-3. Total nitrogen concentrations at the Idaho Nuclear Technology and Engineering Center Sewage Treatment Plant from 1995 through 2000.

To better understand the removal of nitrogen during wastewater treatment, extra samples were taken as part of a nitrogen study. Additional monthly samples were collected for nitrogen (more than required by the permit) beginning in June 1998 and continued through most of 2000. The additional samples were collected from the influent (CPP-769), effluent from Cell No. 2 (CPP-771), and effluent (CPP-773) and analyzed for total Kjeldahl nitrogen (TKN), nitrate + nitrite as nitrogen (NNN), and ammonia (NH_3N).

From the sample results (Table 2-7), it was determined that as the wastewater enters the lagoon system, it is mainly composed of TKN (a form of nitrogen). The majority of the TKN is in the form of ammonia. The aerators in lagoon Cell Nos. 1 and 2 reduce the ammonia concentration from that found in the influent through the process of air stripping. Comparing the nitrogen concentrations from CPP-771 with the concentrations from the effluent shows little additional nitrogen removal is taking place in lagoon Cell Nos. 3 and 4. The majority of the total nitrogen in these two cells is still in the form of ammonia. During June 2000, aeration was increased to these two cells by operating both blowers simultaneously. Preliminary results from samples taken at control structure CPP-771 (effluent from Cell No. 2) indicate that operating both blowers may have increased ammonia removal. Blower operation was discontinued temporarily in November 2000 during the replacement of the shear gates. It is expected that the shear gate replacement will improve flow control. Additionally, two surface aerators will be installed, and testing will be performed during 2001 to determine their effectiveness in stripping additional ammonia from the wastewater.

Table 2-7. Idaho Nuclear Technology and Engineering Center Sewage Treatment Plant average[a] nitrogen concentrations.

		CPP-769			CPP-771			CPP-773		
Parameter	Units	1998	1999	2000	1998	1999	2000	1998	1999	2000
Ammonia as N	mg/L	36.14	33.99	42.92	14.86	19.38	12.44	14.98	14.57	11.63
Nitrate + nitrite as N	mg/L	0.14	0.11	0.06	0.97	1.75	3.07	0.75	1.80	1.41
Total Kjeldahl nitrogen	mg/L	44.57	46.27	47.23	16.46	22.05	15.59	16.67	17.99	14.24
Total nitrogen	mg/L	44.71	46.38	47.28	17.41	23.81	18.67	18.12	19.80	15.65

a. Calendar year averages are based on monthly averages of all data for a given month.

The 2000 annual effluent average decreased from the past several years. This decrease could be due to the increased aeration or other measures already implemented (such as bacterial reseeding in 1999).

Nineteen samples were taken during the year for both the influent and effluent, including the additional samples taken for the nitrogen study. Influent (CPP-769) concentrations repeatedly exceeded the upper statistical control limits for the following parameters: BOD (10 samples), ammonia (4 samples), TKN (4 samples), and TSS (10 samples). Effluent (CPP-773) concentrations exceeded the upper statistical control limit for TSS (14 samples). These concentrations were significantly higher than expected based on historical data, and all of these parameters showed increasing trends over time. However, TSS concentrations were well below the permit limit. Increases in TSS for both the influent and effluent do not appear to be related to the number of employees assigned to INTEC, as population levels have decreased since 1995. Levels of TSS, although elevated, remain below the permit limit of 100 mg/L, and both BOD and TSS are being treated efficiently by the lagoon system, based on the relatively high removal efficiencies.

Most of the maintenance and operational corrective actions have been completed. These corrective actions will be evaluated to determine the effectiveness in reducing nitrogen concentrations. During Calendar Year 2000, a waste stream evaluation was performed to attempt to locate unauthorized industrial wastewater sources that could be contributing to the nitrogen exceedances. The study did not identify any previously unidentified sources.[35] Additional operational and plant modifications could be required if planned corrective actions do not reduce the nitrogen to acceptable concentrations.

2.2.2.3 Effluent to the Cold Waste Pond (TRA-764). Effluent to the Cold Waste Pond (TRA-764) is from nonradioactive, cold waste drains within TRA (Figure A-15). 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 operations. The largest volume of wastewater received by the Cold Waste Pond is secondary cooling water from the Advanced Test 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.

In 2000, all comparison limits were met, except for sulfate and total dissolved solids. The 2000 annual average sulfate concentration barely exceeded the risk-based release level (280.1 mg/L vs. 280 mg/L).[30] The historical average (285.63 mg/L), based on all data through 1999, also exceeded the risk-based level. Both the 2000 average total dissolved solids concentration (715 mg/L) and the historical average (581 mg/L) exceeded the risk-based release level of 560 mg/L. Concentrations of total dissolved solids and sulfate in samples collected during reactor operation differ significantly from those collected during reactor outages. These differences are due to the discharge of approximately 80–120 gallons per minute of secondary cooling water containing four to five times the normal raw water hardness, as well as corrosion inhibitors and sulfuric acid. This discharge occurs when the reactor is operating and during the first day of the outage and results in concentrations two to three times that discharged during outages. The average concentrations slightly exceed the concentrations predicted to degrade groundwater quality above drinking water standards.

2.2.2.4 Effluent to the TAN/TSF Disposal Pond (TAN-655). The TSF sewage or sanitary wastewater consists primarily of spent water containing wastes from rest rooms, sinks, and showers. The wastewater goes to the TAN-623 Sewage Treatment Plant, and then to the TAN-655 lift station, which pumps to the Disposal Pond (Figure A-15).

The process water drain system collects wastewater from various TAN facilities. The process wastewater consists of effluent, such as steam condensate; water softener and demineralizer discharges; and cooling water, heating, ventilating, air conditioning, and air scrubber discharges. The process wastewater is transported directly to the TAN-655 lift station where it is mixed with treated sanitary wastewater before being pumped to the Disposal Pond.

The Wastewater Land Application Permit for the TAN/TSF Sewage Treatment Plant sets concentration limits for TSS and total nitrogen (measured at the effluent to the Disposal Pond) and requires that the effluent be sampled and analyzed monthly for several parameters.

Monthly TSS and total nitrogen concentrations were below the permit limits throughout the year. During Calendar Year 2000, 16 samples were taken at TAN-655, including duplicate samples and additional May samples. Effluent concentrations repeatedly exceeded the upper statistical control limits for the following parameters: BOD (13 samples), chloride (7 samples), ammonia (15 samples), TKN (10 samples), total phosphorus (7 samples), sulfate (4 samples), TDS (6 samples), and sodium (7 samples). These concentrations were significantly higher than expected based on historical data. In addition, all of these parameters, except sulfate, showed increasing trends over time when all permit data are considered. Increasing trends in ammonia and TKN could cause the Wastewater Land Application Permit limit of total nitrogen to be exceeded if concentrations continue to increase. However, both ammonia and TKN concentrations peaked in March and decreased during the remainder of the year. These parameters will continue to be monitored, and sampling will be increased, as required. Elevated sodium, chloride, and TDS concentrations are likely the result of effluents from demineralizer regeneration, boiler blowdown, and water softening. TDS concentrations appear to increase during the winter months, which could be attributed to reduced plant efficiency and possibly to boiler operations. A review of TAN utilities chemical use records identified an increase in salt use (for water softening) in 1999 and 2000. Salt usage is expected to decrease with the installation of a new water softener system. These parameters will continue to be monitored to determine the impact of the expected decrease in salt usage.

2.2.3 Special Studies

The CFA Sewage Treatment Plant was built in 1994 to treat wastewater in pretreatment lagoons followed by land application via a pivot irrigation system. The Wastewater Land Application Permit for the CFA Sewage Treatment Plant requires annual soil sampling inside the application area. These results are reported in the Annual Wastewater Land Application Permit Site Performance Reports.[28] Besides permit-required soil sampling, additional soil and soil pore-water sampling was initiated in 1997 as part of a special study. The primary objectives of this study are to evaluate the effects additional nitrogen and salt loading have on the overall soil profile in a native sagebrush steppe environment (one of three plant communities in the application area) and to determine the implications on the area's long-term ecological health. This study was designed to measure soil chemistry for the same constituents as those required for the Wastewater Land Application Permit (except phosphorous) inside the application area and compare them to similar measurements made immediately outside the application area in the same plant community. Lysimeters were also installed to extract soil pore-water at the same locations and depth intervals as the soil samples.

Sampling locations were chosen based on their proximity to the Environmental Science and Research Foundation's neutron probe access tubes. A cluster of three lysimeters (placed at 30-cm [12-in.], 60-cm [24-in.], and 90-cm [35-in.] depths) was placed adjacent to five neutron probes within the application area and five neutron probes in an adjacent control area during the summer of 1997. Soil pore-water sampling began at these locations in the spring of 1998 and continued in the spring of 1999. Soil pore-water sampling was not conducted in 2000, but soil samples were collected at the same depths in May 2000 and again in November 2000 in conjunction with the Wastewater Land Application Permit required sampling.

Soluble salts (as measured by electrical conductivity) were elevated inside the application area compared to the control area for the past 4 years in the surface interval (Figure 2-4). However, soil salinity levels are still in the range of those taken before wastewater application and are considered to have a negligible effect on plant growth. Sodium adsorption ratio levels were also elevated in the 0-12 in. interval of the application area when compared to the control area (Figure 2-5). Soils with high SARs can cause reduced infiltration Soils with electrical conductivity below 2 mmhos/cm and sodium adsorption ratio below 15 are generally classified as not having salinity or sodium problems.[36] As Figures 2-4 and 2-5 show, electrical conductivity and sodium adsorption ratio have been below those levels, indicating no salinity or sodium problems in the application area soils.

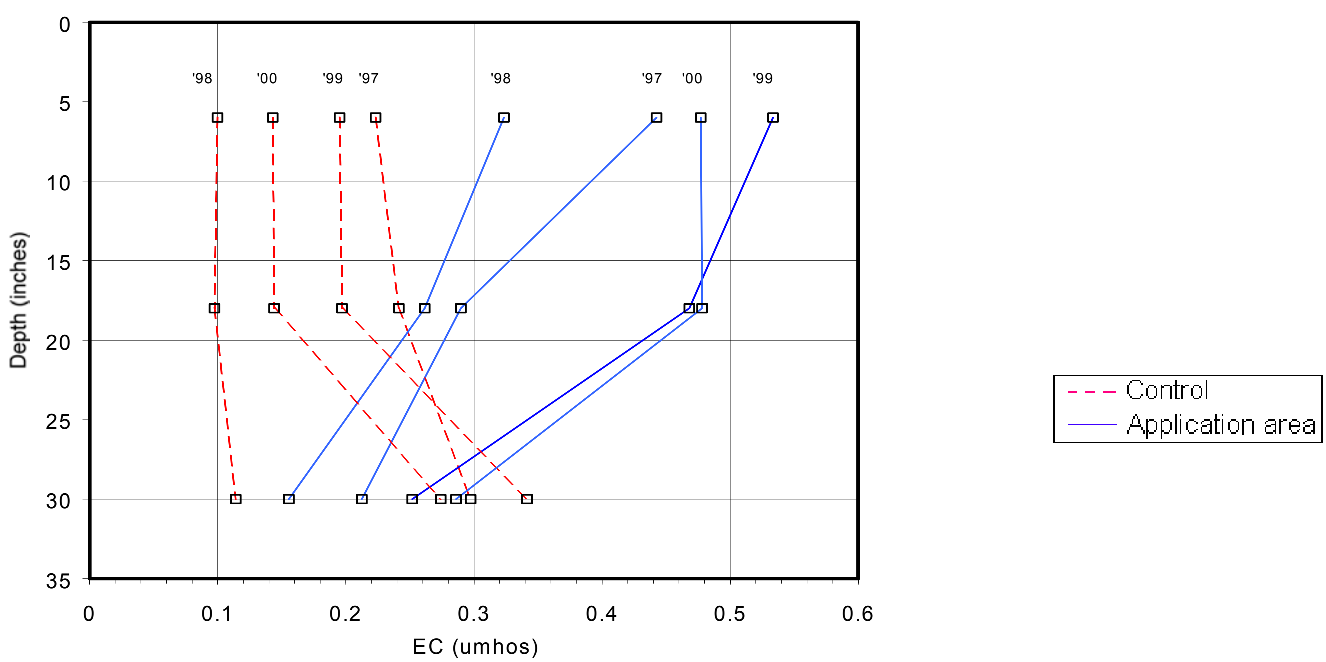


Figure 2-4. Electrical conductivity vs. soil depth (fall sampling).

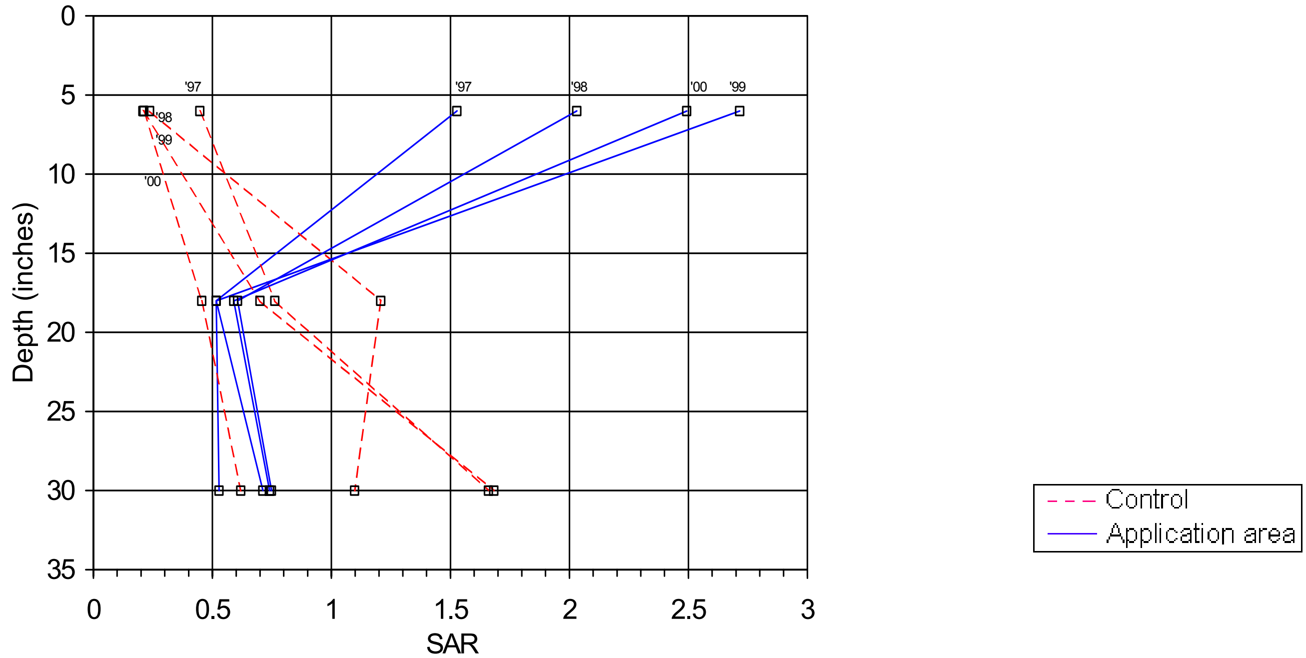


Figure 2-5. Sodium adsorption ratio vs. soil depth (fall sampling).

Ammonium, nitrate as nitrogen, and TKN concentrations in the soil have remained very low. It is possible that increased nutrients and water available to the plants as a result of wastewater application are actually stimulating plant growth, resulting in rapid utilization of plant-available nitrogen and ammonium.

Percent organic matter in the application area remains similar to that of the control area. Significant changes in the percentage of organic matter within the application area are not expected for several years until plant matter from several growing seasons is incorporated into the soil profile. Soil pH appears to be unaffected by wastewater application.

2.2.4 Quality Assurance/Quality Control

2.2.4.1 Data Accuracy, Precision, and Completeness. To assess the conformance of the analytical data for the Liquid Effluent Monitoring Program to programmatic quality assurance/quality control objectives, goals for accuracy, precision, and completeness have been established.[37] Accuracy is assessed by submitting field blind spike samples and is measured in terms of percent recovery. Precision is measured by calculating the relative percent difference between duplicate samples. Completeness is measured by comparing the number of samples required for compliance with the wastewater permits to the number of compliance samples collected.

Quarterly field blind spikes (or standards) are required to assess the analytical data accuracy. However in 2000, issues with past data and concerns with the number of laboratories used for analysis resulted in a total of twelve sets of blind standards being submitted. Blind standard sample solutions are purchased from a National Institute of Standards and Testing-certified supplier. The samples are prepared by the supplier of the standards using bottles supplied by the Liquid Effluent Monitoring Program. The supplier ships the prepared standards back to Liquid Effluent Monitoring Program personnel, who repackage, relabel, and ship them to the analytical laboratory with regular field samples. The standard labeling and sample numbering schemes are used so that there is no indication to the analytical laboratory that the samples are quality control samples.

Of the twelve blind standard sets submitted during the year, five reported at least one parameter that fell outside the performance acceptance limits recommended by the supplier of the standards. Of the 42 individual parameters and six metal suites submitted for analysis as blind standards, 13 parameters (including 3 individual metals parameters) were outside the performance acceptance limits. One of the three laboratories reported all results within the performance acceptance limits on the three blind standard sets submitted. Neither of the remaining two laboratories routinely missed the limits on any individual parameter.

Failure of the blind spike results for any parameter could impact the results reported for the associated monitoring samples. The concern is that the actual results could be biased in the same direction as the blind spike results and could result in an exceedance of a permit limit. In all but one case, either no permit limit existed or the blind spike result was higher than the performance acceptance limit (which could result in the actual concentration being less than that reported). For one of the fourth-quarter submittals, the blind spike result for TKN was below the associated performance acceptance limit and could have resulted in the actual TKN concentration being higher than what was reported (6.64 mg/L). The Wastewater Land Application Permit for the effluent to the TAN Disposal Pond sets a concentration limit for total nitrogen, of which TKN is a component, at 20 mg/L as measured at TAN-655. The December total nitrogen (8.04 mg/L) based on the reported TKN result was well below the permit limit and could more than double and still be within the permit limit. To estimate the impact of the low bias in the TKN blind spike sample, the reported blind spike result (1.02 mg/L) was compared to the certified value for the TKN standard (1.48 mg/L) and was approximately 69% of the certified value. If it is assumed that the reported concentration of TKN in the associated TAN-655 sample were also low by the same percent, then the value could be closer to 11.2 mg/L and the resulting total nitrogen could then be closer to 12.6 mg/L, still well within the permit limit.

Collection of duplicate samples is required approximately once per year per sampling location to assess data precision. The precision goal is to achieve less than or equal to 35% relative percent difference between any pair of duplicate samples. For metals, all of the duplicate pairs had relative percent differences less than 35%. For inorganics, 89% of the duplicate pairs had relative percent differences less than 35%. Of the five pairs that exceeded the 35% relative percent difference, one had concentrations that were below detection limits. No duplicate pairs of radiological samples were taken. In many instances, the effluent samples collected were either nondetected for various analytes or contained analytes at concentrations less than five times the method detection limit. When analyte concentration is less than five times the method detection limit, quantification of the analyte becomes less certain.

The goal for completeness is to collect 100% of all required compliance samples. However, during 2000 this goal was not met. December 2000 permit-required samples were not taken for either the influent (CPP-769) or effluent (CPP-773) to the INTEC STP. The effluent sample could not be taken due to scheduled construction activities, and the influent sample was not taken because of a miscommunication. Failure to obtain the December influent sample was considered a noncompliance and required Idaho Department of Environmental Quality notification. No environmental consequences were anticipated from the failure to collect the December influent sample, and steps were taken to correct impacts to future sample collection.

2.2.4.2 Data Validation and Sampling Issues. During 2000, nine results (eight BOD and one TSS) were rejected as unusable during data validation because the laboratory exceeded the holding time. Five of these nine results were compliance-required samples from four different compliance points.

In addition, all eight results from one sampling event were rejected as unusable because the sample was not representative of the monitored effluent. The compositor at that location malfunctioned and collected too little sample volume and collected a large amount of sediment. This sample event was not a required compliance sample.

No other sampling or validation issues were identified during the year.

2.3 Storm Water Monitoring Program

The Environmental Protection Agency National Pollutant Discharge Elimination System rules for the point source discharges of storm water to waters of the U.S. require permits for discharges from industrial activities.[8] For regulatory purposes, waters of the U.S. at the INEEL include:

- Big Lost River
- Little Lost River
- Birch Creek
- Spreading areas
- Playas
- Tributaries.

Together the above comprise the Big Lost River System (Figure 2-6).

A Storm Water Monitoring Program was implemented in 1993 when storm water permits initially applied to the INEEL. The program was modified as permits changed, data were evaluated, and needs were identified. In 1997, monitoring of storm water that enters deep injection wells was transferred from the United States Geological Survey to the management and operating contractor. On September 30, 1998, the Environmental Protection Agency issued the "Final Modification of the National Pollutant Discharge Elimination System Storm Water Multi-Sector General Permit for Industrial Activities."[8] The INEEL implemented the analytical monitoring requirements of the permit starting January 1, 1999, and ending September 30, 1999. Visual monitoring was implemented starting October 1, 1998, and continues to be performed quarterly. The permit requires analytical monitoring in year 4 of the permit (1999) and from the coal pile when there is a discharge to the Big Lost River System. But storm water did not discharge to the Big Lost River System; therefore, during 2000, all storm water monitoring were visual examinations only. The *INEEL Storm Water Pollution Prevention Plan for Industrial Activities*[38] was revised to meet the requirements of the Storm Water Industrial Permit. The *INEEL Storm Water Pollution Prevention Plan for Industrial Activities* applies to certain industrial facilities and includes:

- Pollution prevention teams
- Descriptions of potential sources of pollution

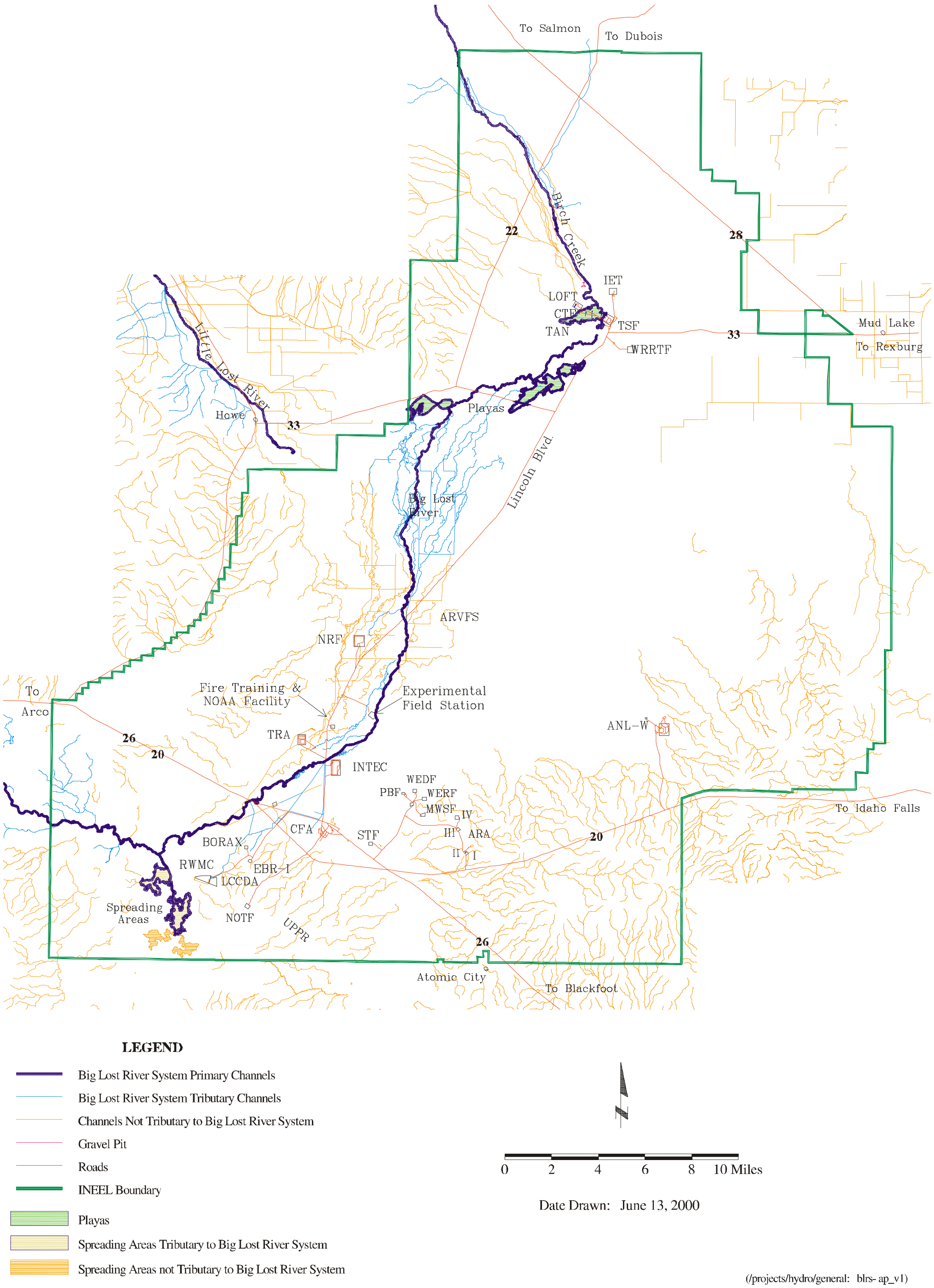


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Figure 2-6. Big Lost River System.

- Measures and controls
- Evaluation requirements
- Monitoring requirements and data.

Practices to minimize storm water pollution are evaluated annually, and the *Storm Water Pollution Prevention Plan for Industrial Activities* is revised accordingly.

2.3.1 Program Design Basis

The Storm Water Monitoring Program meets the Storm Water Industrial Permit[8] requirements by conducting permit-required monitoring. In addition, the program monitors storm water to deep injection wells to comply with State of Idaho Injection Well Permits.[6] Storm Water Industrial Permit-required data are submitted to the Environmental Protection Agency in a Discharge Monitoring Report.[39] Additionally, Storm Water Industrial Permit visual data are included, and analytical data are summarized in the annual revisions of the *INEEL Storm Water Pollution Prevention Plan for Industrial Activities*. Data for storm water discharged to deep injection wells are reported to the Idaho Department of Water Resources.

For 2000, a total of 34 sites (Table 2-8) at five INEEL areas (Appendix A) were designated as storm water monitoring locations based upon drainage patterns and proximity to potential sources of pollutants. Twenty-seven locations met the conditions for quarterly visual monitoring required by the Storm Water Industrial Permit when discharges occur to the Big Lost River System. The Storm Water Industrial Permit requires visual examinations of storm water for obvious indications of storm water pollution. In addition, visual examinations were conducted for surveillance purposes at some locations whether or not storm water discharged to the Big Lost River System. At permit-specified locations, storm water is collected for laboratory analysis when storm water discharged to the Big Lost River System during year 4 of the permit only (1999) and annually from discharges from the coal pile to the Big Lost River System.

The Storm Water Industrial Permit requires that samples be collected and visually examined from rain storms that accumulated at least 0.25 cm (0.1 in.) of precipitation preceded by at least 72 hours without measurable precipitation (0.1 in) to allow pollutants to build up and then be flushed from the drainage basin. Because of unique meteorological conditions, not all sites may have storm water discharge from storms that meet the permit requirements every quarter. Therefore, additional samples may be collected from snow melt or from storms that do not meet permit requirements.

The storm duration, amount, and duration between the storm event sampled and the end of the previous storm are recorded for all precipitation events. In addition, if a storm results in a discharge to the Big Lost River System and analytical samples are required at that location, total discharge volume is estimated as required by the Storm Water Industrial Permit.

Seven deep injection wells are monitored when storm water discharges to those wells as required by the "Injection Well Permits."[6] Injection well sample data are compared to primary drinking water maximum contaminant levels from 40 CFR 141.[21] No analytical samples were required for 2000 because there was no discharge down any permitted injection well.

Table 2-8. 2000 storm water monitoring locations and frequencies.

Site ID	Site Description	Parameters[a]	Number of Sampling Events	
			Analytical[b]	Visual[c]
CFA-MP-2	CFA Landfill #3 east side	Total suspended solids, iron, visual	0	0[f]
CFA-MP-3[d]	CFA Disposal Well near junction of Lincoln and Wyoming	Drinking water metals, organics, inorganics, coliform, and radiological parameters	0	0
CPP-MP-1	East Perimeter Road at culvert to retention basin	CN, chemical oxygen demand, ammonia-N, total recoverable metals,[e] total suspended solids, NNN, visual	0	4
CPP-MP-2	South side of coal pile at discharge to ditch	pH, total suspended solids, visual	0	4
CPP-MP-3	INTEC Ash Pit	Total suspended solids, iron, visual	0	3
PBF-MP-2[d]	SPERT Disposal 1	Drinking water metals, drinking water organics, inorganics, coliform, radiological parameters	0	0
PBF-MP-3[d]	SPERT Disposal 2	Drinking water metals, drinking water organics, inorganics, coliform, radiological parameters	0	0
PBF-MP-4[d]	SPERT Disposal 3	Drinking water metals, drinking water organics, inorganics, coliform, radiological parameters	0	0
WMC-MP-2	Outflow from the SDA at the sump by Culvert C-12	Total suspended solids, iron, NNN, zinc, visual	0	0[f]
WMC-MP-1	East culvert off Ops. Area	CN, chemical oxygen demand, ammonia, total suspended solids, metals,[e] dissolved magnesium, NNN, visual	0	6
WMC-MP-4	West culvert off Ops. Area	CN, chemical oxygen demand, ammonia, metals, total suspended solids, dissolved magnesium, NNN, visual	0	7
WMC-MP-C13	North side of road in culvert just prior to entering SDA	Visual inspection only	0	0[f]
WMC-MP-C26	Culvert C-26 north of TSA	Visual inspection only	0	1
WMC-MP-C15	Culvert C-15 north of TSA	Visual inspection only	0	1
WMC-MP-C23	Culvert C-23 north of TSA	Visual inspection only	0	0[g]
WMC-MP-C18	Culvert C-18 north of TSA	Visual inspection only	0	1
WMC-MP-C17	Culvert C-17 north of TSA	Visual inspection only	0	1
WMC-MP-C33	Culvert C-33 north of TSA	Visual inspection only	0	1
WMC-MP-C40	Culvert C-40 south of WMF-636	Visual inspection only	0	1
WMC-MP-C41	Culvert C-41 southwest of WMF-636	Visual inspection only	0	3

Table 2-8. (continued).

Site ID	Site Description	Parameters[a]	Number of Sampling Events Analytical[b]	Number of Sampling Events Visual[c]
WMC-MP-C25	Culvert C-25 northwest corner of TSA	Visual inspection only	0	4
SMC-MP-1	West side of Specific Manufacturing Capability (SMC) on Taylor Creek Road	Visual inspection only	0	4
SMC-MP-2	North side of SMC	Visual inspection only	0	4
CTF-MP-1	South of SMC 631 off of Snake Ave.	Visual inspection only	0	3
TSF-MP-1[d]	TAN Drainage Disposal 1, corner of Lincoln and Nile	Drinking water metals, drinking water organics, inorganics, coliform, radiological parameters	0	0
TSF-MP-2[d]	TAN Drainage Disposal 2, discharge to basin TAN-782	Drinking water metals, drinking water organics, inorganics, coliform, radiological parameters	0	0
TSF-MP-3[d]	TAN Drainage Disposal 3, basin northwest of TSF	Drinking water metals, drinking water organics, inorganics, coliform, radiological parameters	0	0
TAN-MP-1	T-28 N. Borrow Source inflow	NNN, total suspended solids, visual	0	2
TAN-MP-2	T-28 N. Borrow Source outflow	NNN, total suspended solids, visual	0	2
TGP-MP-11	T-28 S. Borrow Source	NNN, total suspended solids, visual	0	0[f]
RGP-MP-11	T-12 Borrow Source	NNN, total suspended solids, visual	0	0[f]
BGP-MP-11	Adams Blvd. Borrow Source	NNN, total suspended solids, visual	0	0[f]
LGP-MP-11	Lincoln Blvd. Borrow Source	NNN, total suspended solids, visual	0	0[f]
TRP-MP-11	Monroe Blvd. Borrow Source	NNN, total suspended solids, visual	0	0[f]

a. All locations are sampled for field parameters including pH, electrical conductivity, and temperature, except those requiring visual inspections only.

b. As specified by the permit, no analytical samples were required for 2000.

c. Visual examination includes a description of color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other indicators of storm water pollution.

d. Injection well permit monitoring.

e. Metals are: silver, arsenic, cadmium, iron, mercury, manganese, lead, selenium.

f. No discharge available; therefore, no visual examination performed.

g. Visual examination inadvertently missed.

2.3.2 Data Summary and Assessment

No analytical monitoring was performed during 2000. Only the coal pile required analytical monitoring, but no storm water discharged from the coal pile to the Big Lost River System. Therefore, an analytical sample was not collected. Fifty-two storm water visual examinations were performed at 18 locations. Twenty-six of the 52 storm water visual examinations were performed on water discharged to the Big Lost River System from the RWMC monitoring points in compliance with the Storm Water Industrial Permit. During 2000, no rainfall, snow melt, or discharge down injection wells was observed at 16 monitoring points, including all seven injection wells, and nine storm water monitoring locations; therefore, no visual examinations were performed or analytical samples taken (injection wells only) at those locations.

Visual examinations of storm water samples indicate that a small amount of suspended solids is usually present and is normal due to high winds blowing dust onto facilities; therefore, no corrective actions are required.

An unusual odor at location WMC-MP-4 was noted during visual examinations on July 20 and October 10, 2000; however, it was determined that recent paving activity in the area caused the odor. No other obvious indicators of storm water pollution were observed.

2.3.3 Quality Assurance/Quality Control

The completeness goal is to collect 100% of all compliance samples. However, during 2000 this goal was not met. Location WMC-MP-C23 was inadvertently overlooked during visual examinations performed on October 10, 2000, and a subsequent storm did not occur during the quarter. However, water quality was not degraded during the October storm because there were no exposed pollutants in the drainage area to Culvert #23, and if there were a discharge to the drainage channel, the storm water would have remained in the drainage channel, evaporated, and infiltrated. Therefore, the storm water did not commingle with water in the Big Lost River, which is more than 4 miles from the RWMC facility.

No analytical samples were collected in 2000; therefore, no quality control samples were submitted. Visual examination reports were checked for accuracy against logbook entries prior to submittal to the industrial storm water coordinator.

2.4 Groundwater Monitoring Program

Groundwater Monitoring Program personnel collect all routine groundwater samples required by the Wastewater Land Application Permits, Remedial Investigation/Feasibility Studies, and Records of Decision for INEEL facilities managed by the management and operating contractor. This section summarizes the results from the 2000 groundwater monitoring activities conducted to demonstrate compliance with INEEL Wastewater Land Application Permits. Results from the groundwater monitoring activities supporting Remedial Investigation/Feasibility Studies and Records of Decision are summarized in reports prepared and published by the respective Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Waste Area Groups.

2.4.1 Program Design Basis

The sampling locations, frequency, and analyses to be performed for all Wastewater Land Application Permit groundwater monitoring activities were negotiated with the State of Idaho during the approval stages of the respective Wastewater Land Application Permit. Monitoring wells were selected based on the hydrogeology of the area to best determine the impact to the subsurface and the Snake River

Plain Aquifer by liquid effluent discharges to the percolation ponds. Sampling frequency was established based on the amount of historical data available for the specific monitoring wells, and analytical parameters were chosen to match the contaminants commonly found in the liquid effluent of the respective ponds. Contaminant concentrations in the monitoring wells are compared to the primary constituent standards and the secondary constituent standards, specified in IDAPA 58.01.11, "Ground Water Quality Rule."[27] These standards replace the previous maximum allowable concentrations and secondary maximum contaminant levels specified in the groundwater quality standards.[26] An exception to the primary constituent standards and the secondary constituent standards is made in the INTEC Percolation Pond Wastewater Land Application Permit, where specific limits are established for total dissolved solids and chloride levels. Table 2-9 lists the monitoring wells sampled during 2000, the sampling frequency, and the analyses performed.

2.4.2 Data Summary and Assessment by Facility

The following sections discuss parameters of interest in groundwater at the INTEC Percolation Ponds, the INTEC Sewage Treatment Plant, and the TAN/TSF Sewage Treatment Plant.

2.4.2.1 Idaho Nuclear Technology and Engineering Center Percolation Ponds Monitoring Wells. During the 2000 reporting period, groundwater samples were collected at the INTEC Percolation Pond Wastewater Land Application Permit monitoring wells in April and October (see Figure A-8 for well locations). The 2000 analytical results were very similar to those of the previous years: no permit levels were exceeded in the compliance wells; the chloride, total dissolved solids, and sodium concentrations remained elevated downgradient of the Percolation Ponds; and concentrations were nondetectable for most of the remaining analytical parameters. Chloride, sodium, and total dissolved solids concentrations continue to be elevated in USGS-112 and USGS-113 compared to the upgradient well (USGS-048) for the Percolation Ponds. These elevated concentrations are the result of the continued water softening and treatment processes at INTEC, which introduce total dissolved solids, chloride, and sodium into the Service Waste System and eventually to the Percolation Ponds. Groundwater concentrations for total dissolved solids, chloride, and sodium in USGS-112 and USGS-113 are generally expected to follow the decreasing trends exhibited by the Percolation Ponds' effluent (measured at CPP-797), with the exception of lower concentrations due to mixing in the aquifer, and a time lag and dampening effect from the 137-m (450-ft) vadose zone. Significant decreasing trends in concentrations of these parameters were not evident in the groundwater. The trends in the compliance wells will continue to be evaluated as more data become available. Figures 2-7 and 2-8 show the chloride and total dissolved solids concentrations for the Percolation Ponds' effluent, USGS-112, and USGS-113.

Iron concentrations increased but were below the secondary constituent standard limits in all of the monitoring wells. As in previous years, USGS-112 exhibited the highest iron concentrations of the four monitoring wells. However, the iron concentrations in USGS-112 are not believed to be the result of Percolation Ponds operation because concentrations increased in wells both upgradient and downgradient of the Percolation Ponds over the past few years. In addition, the iron concentrations in the Percolation Ponds' effluent are well below those in USGS-112. Based on a 1999 study[40] of wells of similar ages at TAN, corrosion of the riser pipes is suspected to cause the increased iron concentrations.

Table 2-9. 2000 Groundwater Monitoring Program sampling locations for INEEL Wastewater Land Application Permit facilities.

Permit	Monitoring Well	Well Description	Sampling Frequency	Analysis Parameters
INTEC Percolation Ponds Wastewater Land Application Permit	USGS-121	Facility background aquifer well upgradient of INTEC	Semiannually in April and October	Total Kjeldahl nitrogen, chloride, total dissolved solids, sodium, nitrate-nitrogen, nitrite-nitrogen, arsenic, cadmium, chromium, mercury, selenium, silver, fluoride, iron, manganese, copper, aluminum, pH
	USGS-048	Surveillance aquifer well upgradient of Percolation Ponds		
	USGS-112	Point of compliance aquifer well		
	USGS-113	Point of compliance aquifer well		
INTEC Sewage Treatment Plant Wastewater Land Application Permit	USGS-121	Facility background aquifer well upgradient of INTEC	Semiannually in April and October	Total Kjeldahl nitrogen, ammonium-nitrogen, nitrate-nitrogen, nitrite-nitrogen, biochemical oxygen demand, fecal coliform, total coliform, total phosphorous, chloride, total dissolved solids
	ICPP-MON-PW-024	Surveillance perched water well adjacent to infiltration trenches		
	USGS-052	Point of compliance aquifer well		
TAN/TSF Sewage Treatment Plant Wastewater Land Application Permit	TANT-MON-A-001	Facility background aquifer well upgradient of TAN	Semiannually in April and October	Total Kjeldahl nitrogen, ammonium-nitrogen, nitrate-nitrogen, nitrite-nitrogen, biochemical oxygen demand, fecal coliform, total coliform, total phosphorous, chloride, total dissolved solids, arsenic, barium, chromium, fluoride, lead, iron, manganese, mercury, selenium, sodium, sulfate, zinc
	TANT-MON-A-002	Point of compliance aquifer well		
	TAN-10A	Point of compliance aquifer well		
	TAN-13A	Point of compliance aquifer well		

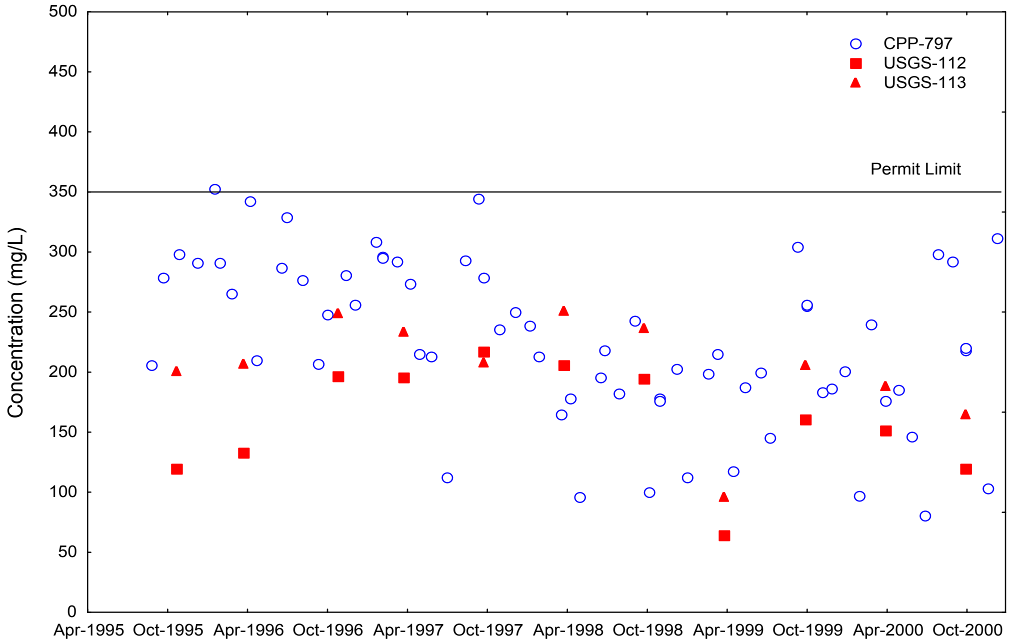

Figure 2-7. Chloride concentrations from Idaho Nuclear Technology and Engineering Center Percolation Ponds wells and effluent (CPP-797).

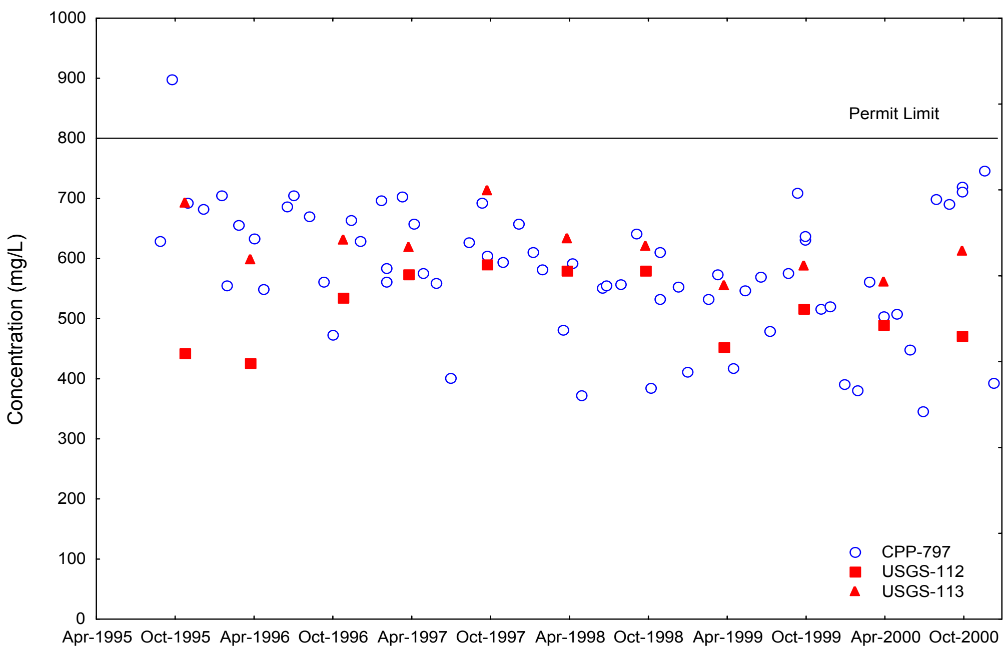

Figure 2-8. Total dissolved solids concentrations from Idaho Nuclear Technology and Engineering Center Percolation Ponds wells and effluent (CPP-797).

2.4.2.2 Idaho Nuclear Technology and Engineering Center Sewage Treatment Plant Monitoring Wells. Groundwater samples were collected at the three monitoring wells specified by the INTEC Sewage Treatment Plant Wastewater Land Application Permit in April and October (see Figure A-8 for well locations). All groundwater samples collected from USGS-052 (representing the point of compliance) met permit limits during 2000. Similar to previous years, chloride, total dissolved solids, and nitrate concentrations were only slightly elevated in USGS-052 compared to the facility upgradient well, and concentrations were largely nondetectable for the remaining analytical parameters.

Results for ICPP-MON-PW-024, a perched water well completed approximately 21 m (70 ft) below the surface of the infiltration trenches, were largely unchanged from 1999. Unlike USGS-052, ICPP-MON-PW-024 is used as an indicator of soil treatment efficiency rather than as a point of compliance. Total dissolved solids and chloride in the perched water approximate that of the effluent, while total coliform concentrations are less than the effluent. Total nitrogen (the sum of total Kjeldahl nitrogen, nitrate as nitrogen, and nitrite as nitrogen) is also present in the perched water at reduced concentrations. This reduction (Figure 2-9) may be partly due to the increased trench rotation frequency that was implemented in March 1997. This increased trench rotation frequency will continue, and contaminant trends in the perched water and aquifer will be observed and tracked.

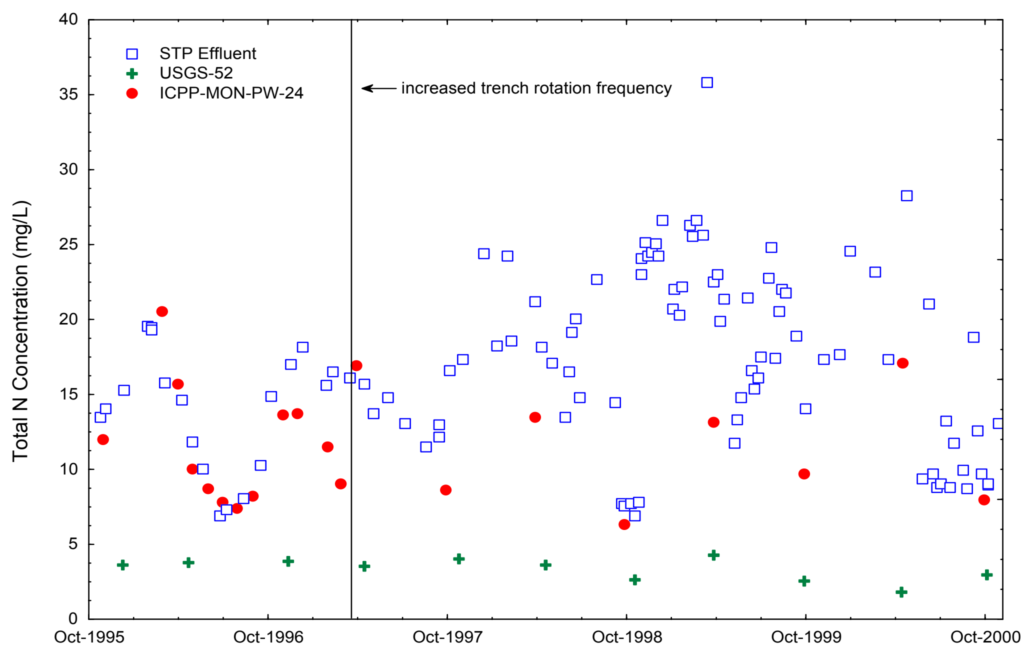

Figure 2-9. Total nitrogen concentrations in Sewage Treatment Plant effluent, ICPP-MON-PW-024, and USGS-052.

2.4.2.3 Test Area North/Technical Support Facility Sewage Treatment Plant Monitoring Wells.

Groundwater samples were collected at the TAN Sewage Treatment Plant Wastewater Land Application Permit monitoring wells in April and October (see Figure A-15 for well locations). Total coliform was absent in the 2000 sampling except for the presence of *citrobacter* reported in upgradient well TANT-MON-A-001 for April 2000 (40 col/100 mL). This coliform bacteria is a relatively free-living bacteria found in natural water bodies and soils. This, coupled with its detection in a well upgradient of the Disposal Pond, indicates that the Disposal Pond is unrelated to the detection of coliform in the groundwater.

Total dissolved solids concentrations exceeded the permit limit (500 mg/L) in TAN-10A in October. Iron concentrations exceeded the permit limit (0.3 mg/L) in TAN-13A in April and October, in TANT-MON-A-002 in April, and in TAN-10A in October. Zinc and lead concentrations also exceeded the permit limit in TAN-13A in October. The elevated iron concentrations are believed to be the result of galvanic corrosion of the riser pipes. Zinc concentrations also increased in all four wells during the same period. Galvanic corrosion problems were confirmed during a corrosion evaluation[40] performed late in 1999 on several TAN monitoring wells of similar construction and age. Plans to mitigate the galvanic corrosion are underway.

Of the three monitoring wells used as points of compliance for the TAN Sewage Treatment Plant Wastewater Land Application Permit, TAN-10A had the highest contaminant concentrations compared to the upgradient background monitoring well. It is difficult to establish a strong relationship between the water quality in TAN-10A and the Disposal Pond. First, injectate from a former injection well (located close to TAN-10A and used for disposal of numerous waste streams) is still present in the groundwater and continues to substantially impact groundwater quality. Second, groundwater remediation now underway near the former injection well significantly influences local hydraulic gradients and contaminant concentrations.

2.4.3 Quality Assurance/Quality Control

The groundwater sampling activities associated with Wastewater Land Application Permit compliance sampling follow established procedures and analytical methodologies.

During 2000, 234 groundwater samples, which yielded 482 parameter results, were collected from the INTEC and TAN Wastewater Land Application Permit monitoring wells. In addition, 69 quality control samples were collected. One hundred percent of the samples required for permit compliance were collected (meeting project data completeness goals), and only two parameter results (less than 1% of the total) were rejected as unusable during data validation due to laboratory errors.

Quality assurance/quality control practices used by the Environmental Monitoring Program assess and enhance the reliability and validity of field and laboratory measurements conducted to support Environmental Monitoring Programs. Therefore, field quality control samples were collected or prepared during the sampling activity in addition to regular groundwater samples. All analyses were performed by certified laboratories. Because TAN and INTEC are regarded as separate sites, quality control samples (duplicate samples, field blanks, and equipment blanks) were prepared for each site. One duplicate groundwater sample was collected for every 20 samples collected or, at a minimum, 5% of the total number of samples collected. Duplicates were collected using the same sampling techniques and preservation requirements as regular groundwater samples. Field blanks were collected at the same frequency as the duplicate samples, and were prepared by pouring deionized water into the prepared bottles at the sampling site. Equipment blanks (rinsates) were collected from the sample port manifold after decontamination and before subsequent use, also using deionized water.

Duplicate samples are collected to assess the potential for any bias introduced by analytical laboratories. Duplicates have precision goals within 35%, as determined by the relative percent difference measured between the paired samples. For all duplicate analyses, 54 out of 57 total pairs (95%) had relative percent differences less than 35%. This high percentage of acceptable duplicate results indicates little problem with laboratory contamination and good overall precision. Of the three pairs that exceeded the 35% relative percent difference, all concentrations were below detection limits or less than five times the method detection limit. Quantification of the analyte becomes less certain at these levels.

Field blanks and equipment blanks are collected to assess the potential introduction of contaminants during sampling and decontamination activities. For most chemical constituents, results above two times the method detection limit are identified as suspected contamination. Results from the field blanks and rinsates did not indicate field contamination or improper decontamination procedures.

Results from the duplicate, field blank, and rinsate samples indicate that field sampling procedures, decontamination procedures, and laboratory procedures have been used effectively to produce high quality data.