Chapter 5 Highlights

Liquid effluents, drinking water, and surface water runoff were monitored in 2011 by the Idaho National Laboratory (INL) contractor and the Idaho Cleanup Project contractor for compliance with applicable regulatory standards established to protect human health and the environment.

Wastewater discharged to land surfaces and evaporation ponds at the INL Site is regulated by the state of Idaho groundwater quality and wastewater rules and requires a wastewater reuse permit. During 2011, permitted facilities were:

- Central Facilities Area (CFA) Sewage Treatment Plant
- Idaho Nuclear Technology and Engineering Center (INTEC) New Percolation Ponds
- Advanced Test Reactor (ATR) Complex Cold Waste Pond
- Material and Fuels Complex (MFC) Industrial Waste Ditch and Industrial Waste Pond.

These facilities were sampled for parameters required by their facility-specific permits. No permit limits were exceeded in 2011.

Additional liquid effluent and groundwater monitoring was performed in 2011 at ATR Complex, CFA, INTEC, and MFC to comply with environmental protection objectives of the Department of Energy (DOE). All parameters were below applicable health-based standards, with the exception of some groundwater samples from INTEC that had elevated aluminum, iron, and manganese results. It appears these were due to sediment in unfiltered samples.

Eleven drinking water systems were monitored in 2011 for parameters required by “Idaho Rules for Public Drinking Water Systems.” Water samples collected from drinking water systems were well below drinking water limits for all relevant regulatory parameters. Because workers are potentially impacted from radionuclides in the CFA distribution system, the dose from ingesting tritium to a CFA worker was calculated. The dose was 0.22 mrem for 2011. This is below the Environmental Protection Agency standard of 4 mrem/yr for public drinking water.

Surface water runoff from the Subsurface Disposal Area of the Radioactive Waste Management Complex was sampled in 2011 for radionuclides in compliance with DOE limits. Results were within historical measurements, with americium-241 and plutonium-239/240 about the same as the previous year’s results.
5. COMPLIANCE MONITORING FOR LIQUID EFFLUENTS, GROUNDWATER, DRINKING WATER, AND SURFACE WATER

This chapter presents analytical results of water samples collected by the Idaho National Laboratory (INL) contractor (Battelle Energy Alliance, LLC) and Idaho Cleanup Project (ICP) contractor (CH2M-WG Idaho, LLC) at the INL Site and the Research and Education Campus (Idaho Falls facilities). Included in this chapter are descriptions and results of liquid effluent and related groundwater monitoring, drinking water monitoring, and surface water runoff monitoring conducted for compliance with regulatory limits and permits.

To improve the readability of this chapter, data tables are only included that compare monitoring results to specified discharge limits, permit limits, or maximum contaminant levels. Data tables for other monitoring results are provided in Appendix C.

5.1 Summary of Monitoring Programs

The INL contractor and ICP contractor monitor drinking water, liquid effluent, surface water runoff, and groundwater that could be impacted by INL Site operations and activities. This monitoring is conducted to comply with applicable laws and regulations, Department of Energy (DOE) orders, and other requirements (e.g., wastewater reuse permit requirements).

Table 5-1 presents compliance monitoring performed at the INL Site. A comprehensive discussion and maps of environmental monitoring performed by various organizations within and around the INL Site may be found in the Idaho National Laboratory Environmental Monitoring Plan (DOE-ID 2010).

5.2 Liquid Effluent and Related Groundwater Compliance Monitoring

The INL contractor and ICP contractor monitor constituents of concern in liquid waste influent, effluent, and groundwater in the vicinity of and downgradient of the liquid releases. Wastewater is discharged to the ground surface at the following areas:

- Percolation ponds southwest of the Idaho Nuclear Technology and Engineering Center (INTEC), Materials and Fuels Complex (MFC) Industrial Waste Pond, and the Advanced Test Reactor (ATR) Complex Cold Waste Pond
- A sprinkler irrigation system at the Central Facilities Area (CFA) used during the summer months to apply industrial and treated sanitary wastewater.

Discharge of wastewater to the land surface is regulated by wastewater rules (Idaho Administrative Procedures Act [IDAPA] 58.01.16 and .17). A wastewater reuse permit normally requires monitoring of nonradioactive parameters in the influent waste, effluent waste, and groundwater, as applicable. However, some facilities may have specified radiological parameters monitored for surveillance purposes (not required by regulations). The liquid effluent and groundwater monitoring programs implement wastewater and groundwater quality rules at INL
Site facilities that have wastewater reuse permits. Table 5-2 lists the status of each wastewater reuse-permitted facility as of December 2011.

The permits generally require that data from groundwater monitoring wells at the INL Site comply with the Idaho groundwater quality primary constituent standards and secondary...
constituent standards (IDAPA 58.01.11). The permits specify annual discharge volumes, application rates and effluent quality limits. Annual reports (ICP 2012a, 2012b; INL 2012a, 2012b, 2012c) were prepared and submitted to the Idaho Department of Environmental Quality (DEQ) as required for permitted facilities.

During 2011, the INL contractor and ICP contractor monitored, as required by the permits, the following facilities (Table 5-2):

- CFA Sewage Treatment Plant
- INTEC New Percolation Ponds
- ATR Complex Cold Waste Pond
- MFC Industrial Waste Ditch and Industrial Waste Ditch

<table>
<thead>
<tr>
<th>Facility</th>
<th>Permit Status at End of 2011</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Test Reactor Complex Cold Waste Pond</td>
<td>Permit issued</td>
<td>DEQ(^a) issued Permit #LA-000161-01 on February 26, 2008, modified on August 20, 2008, and expires on February 25, 2013.</td>
</tr>
<tr>
<td>Central Facilities Area Sewage Treatment Facility</td>
<td>Permit issued</td>
<td>DEQ issued Permit #LA-000141-03 on March 17, 2010. The permit will expire on March 16, 2015.</td>
</tr>
<tr>
<td>Materials and Fuels Complex Industrial Waste Pond and Industrial Waste Ditch</td>
<td>Permit issued</td>
<td>In 2010 DEQ issued permit LA-000160-01, effective May 1, 2010 to April 30, 2015.</td>
</tr>
</tbody>
</table>

\(^{a}\) DEQ = Idaho Department of Environmental Quality
The following subsections present results of wastewater and groundwater monitored to comply with facility-specific permits.

Additional effluent parameters are monitored to comply with environmental protection objectives of DOE Order 458.1 Administrative Change 2. Section 5.3 discusses the results of liquid effluent surveillance monitoring.

5.2.1 Research and Education Campus

Description – The City of Idaho Falls is authorized by the Clean Water Act, National Pollutant Discharge Elimination System to set pretreatment standards for nondomestic wastewater discharges to publicly owned treatment works. The INL contractor facilities in Idaho Falls are required to comply with the applicable regulations in Chapter 1, Section 8 of the Municipal Code of the City of Idaho Falls.

The Industrial Wastewater Acceptance Permits for the Research and Education Campus (Idaho Falls facilities) specify special conditions and compliance schedules, prohibited discharge standards, reporting requirements, monitoring requirements, and effluent concentration limits for specific parameters.

Wastewater Monitoring Results – In 2009 the City of Idaho Falls assumed responsibility for the semiannual monitoring conducted at the Research and Education Campus. The 2011 monitoring results complied with all applicable regulations established in the municipal code. Analytical results are available upon request from the City of Idaho Falls.

5.2.2 Central Facilities Area Sewage Treatment Facility

Description – The CFA Sewage Treatment Facility serves all major buildings at CFA. The treatment facility is southeast of CFA, approximately 671 m (2,200 ft) downgradient of the nearest drinking water well.

A 1,500-L/min (400-gal/min) pump applies wastewater from a 0.2-HA (0.5-acre) lined, polishing pond to approximately 30 HA (74 acres) of sagebrush steppe grassland through a computerized center pivot irrigation system.

Wastewater Monitoring Results for the Wastewater Reuse Permit – DEQ issued a permit for the CFA Sewage Treatment Plant on March 17, 2010. The permit requires effluent monitoring and soil sampling in the wastewater land application area (soil samples are only required in 2010 and 2013). Effluent samples were collected from the pump pit (prior to the pivot irrigation system) during land application in August. All samples were collected as 24-hour flow proportional composites, except pH and coliform samples, which were collected as grab samples. Table C-1 summarizes the results.

Wastewater was intermittently applied via the center pivot irrigation system in August 2011. On the days it operated, discharge to the pivot irrigation system averaged 506,235 L/day (133,733 gal/day).
A total of 1.22 MG of wastewater was applied to the land in 2011, which is equivalent to a loading rate of 0.61 acre-in./acre/yr. This is significantly less than the permit limit of 37 MG (18.5 acre-in./acre/yr). The nitrogen loading rate (0.28 lb/acre/yr) was significantly lower than the projected maximum loading rate of 32 lb/acre/yr. Nitrogen loading should not exceed the amount necessary for crop utilization plus 50 percent. However, wastewater is applied to grassland without nitrogen removal via crop harvest. To estimate nitrogen buildup in the soil under this condition, a nitrogen balance was prepared by Cascade Earth Science, Ltd., which estimated it would take 20 to 30 years to reach normal nitrogen agricultural levels in the soil (based on a loading rate of 32 lb/acre/yr) (CES 1993). The low nitrogen loading rate had a negligible effect on nitrogen accumulation.

The annual total chemical oxygen demand loading rate at the CFA Sewage Treatment Facility (7.98 lb/acre/yr) was less than state guidelines of 50 lb/acre/day (which is equivalent to 18,250 lb/acre/yr), and the annual total phosphorus loading rate (0.05 lb/acre/yr) was below the projected maximum loading rate of 4.5 lb/acre/yr. The amount of phosphorus applied was probably removed by sorption reactions in the soil and utilized by vegetation rather than lost to groundwater.

**Groundwater Monitoring Results for the Wastewater Reuse Permit** – The wastewater reuse permit does not require groundwater monitoring at the CFA Sewage Treatment Facility.

### 5.2.3 Advanced Test Reactor Complex Cold Waste Pond

**Description** – The Cold Waste Pond (CWP) is located approximately 137 m (450 ft) from the southeast corner of the ATR Complex compound and approximately 1.2 km (¾ of a mile) southwest of the Big Lost River channel (Figure 5-1). The existing CWP was excavated in 1982. It consists of two cells, each with dimensions of 55 × 131 m (180 × 430 ft) across the top of the berms, and a depth of 3 m (10 ft). Total surface area for the two cells at the top of the berms is approximately 1.44 hectares (3.55 acres). Maximum capacity is approximately 10.22 MG.

Wastewater discharged to the CWP consists primarily of noncontact cooling tower blowdown, once through cooling water for air conditioning units, coolant water from air compressors, secondary system drains, and other nonradioactive drains throughout the ATR Complex. Chemicals used in the cooling tower and other effluent streams discharged to the CWP include commercial biocides and corrosion inhibitors. DEQ issued a wastewater reuse permit for the pond in February 2008.

**Wastewater Monitoring Results for the Wastewater Reuse Permit** – The industrial wastewater reuse permit requires monthly sampling of the effluent to the Cold Waste Pond. The permit sets monthly concentration limits for total suspended solids (100 mg/L) and total nitrogen (20 mg/L), and the results (minimum, maximum, and median) of those permit-limited parameters are shown in Table 5-3. During 2011, neither total suspended solids nor total nitrogen exceeded the permit limit. The minimum, maximum, and median results of all parameters monitored are presented in Table C-2.
Figure 5-1. Permit Monitoring Locations for the ATR Complex Cold Waste Pond.
Concentrations of sulfate and total dissolved solids are higher during reactor operation because of evaporative concentration of the corrosion inhibitors and biocides added to the reactor cooling water.

**Groundwater Monitoring Results for the Wastewater Reuse Permit** – To measure potential impacts from the Cold Waste Pond, the permit requires groundwater monitoring in April and October at five wells (Figure 5-1; Table C-3).

Aluminum, iron, and manganese were elevated in some of the unfiltered samples because of suspended rock fragments or rust particles in the well water. The metals concentrations in the filtered samples were below the applicable standards.

5.2.4 *Idaho Nuclear Technology and Engineering Center New Percolation Ponds and the Sewage Treatment Plant*

**Description** – The INTEC New Percolation Ponds are comprised of two unlined ponds excavated into the surficial alluvium and surrounded by bermed alluvial material. Each pond is 93 m × 93 m (305 ft × 305 ft) at the top of the berm and is approximately 3 m (10 ft) deep. Each pond is designed to accommodate a continuous wastewater discharge rate of 3 MG per day.

The INTEC New Percolation Ponds receive discharge of only nonhazardous industrial and municipal wastewater. Industrial wastewater (i.e., service waste) from INTEC operations consists of steam condensates, noncontact cooling water, reverse osmosis/water softener/demineralizer regenerate, boiler blowdown wastewater, and storm water. Municipal wastewater (i.e., sanitary waste) is treated at the INTEC Sewage Treatment Plant prior to discharge to the New Percolation Ponds.

The Sewage Treatment Plant is located east of INTEC, outside the INTEC security fence, and treats and disposes of sanitary and other related wastes at INTEC. The Sewage Treatment Plant depends on natural biological and physical processes (digestion, oxidation, photosynthesis, respiration, aeration, and evaporation) to treat the sanitary waste in four lagoons. After treatment in the lagoons, the effluent is combined with the service waste and discharged to the INTEC New Percolation Ponds.
Wastewater Monitoring Results for the Wastewater Reuse Permit – Monthly samples were collected from:

- CPP-769 – influent to Sewage Treatment Plant
- CPP-773 – effluent from Sewage Treatment Plant prior to combining with service waste
- CPP-797 – combined effluent prior to discharge to the INTEC New Percolation Ponds.

As required by the permit, all samples are collected as 24-hour flow proportional composites, except pH and total coliform, which are collected as grab samples. The permit specifies the parameters that must be monitored for each location, but the permit does not set limits for any of the parameters monitored at CPP-769 or CPP-773. The monitoring results (minimum, maximum, and average) for CPP-769 and CPP-773 are presented in Tables C-4 and C-5, respectively.

The permit sets monthly concentration limits for total suspended solids (100 mg/L) and total nitrogen (20 mg/L) at the combined effluent (CPP-797), and the results of those permit-limited parameters are shown in Table 5-4. During 2011, neither total suspended solids nor total nitrogen exceeded the permit limit in the combined effluent. The minimum, maximum, and average results of all parameters monitored at the combined effluent are presented in Table C-6.

The permit specifies maximum daily and yearly hydraulic loading rates for the INTEC New Percolation Ponds. Table 5-5 shows the maximum daily flow and the yearly total flow to the INTEC New Percolation Ponds. As the table shows, the maximum daily flow and the yearly total flow to the INTEC New Percolation Ponds were below the permit limits during 2011.

### Table 5-4. Total Nitrogen and Total Suspended Solids Effluent Monitoring Results at CPP-797 (2011).a

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Average</th>
<th>Permit Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nitrogen (mg/L)</td>
<td>1.61</td>
<td>6.94</td>
<td>3.24</td>
<td>20</td>
</tr>
<tr>
<td>Total suspended solids (mg/L)</td>
<td>2.0d</td>
<td>9.3</td>
<td>2.8</td>
<td>100</td>
</tr>
</tbody>
</table>

a. Duplicate samples were collected in May for nitrogen and June for total suspended solids. Duplicate results are included in the summaries.

b. Annual average is determined from the average of the monthly values. Half the reported detection limit was used in the yearly average calculation for those data reported as below the detection limit.

c. Total nitrogen is calculated as the sum of total Kjeldahl nitrogen and nitrate + nitrite, as nitrogen.

d. Sample result was less than the detection limit; value shown is half the detection limit.
Groundwater Monitoring Results for the Wastewater Reuse Permit – To measure potential impacts to groundwater from the INTEC New Percolation Ponds, the permit requires that groundwater samples be collected from six monitoring wells (Figure 5-2):

- One background aquifer well (ICPP-MON-A-167) upgradient of the INTEC New Percolation Ponds.
- One background perched water well (ICPP-MON-V-191) north of the INTEC New Percolation Ponds and just south of the Big Lost River.
- Two perched water wells (ICPP-MON-V-200 and ICPP-MON-V-212) adjacent to the INTEC New Percolation Ponds. Well ICPP-MON-V-200 is north of the INTEC New Percolation Ponds, and Well ICPP-MON-V-212 is between the two ponds.


The permit requires that groundwater samples be collected semiannually during April and October and lists which parameters must be analyzed. Contaminant concentrations in the compliance wells are limited by primary constituent standards and secondary constituent standards specified in IDAPA 58.01.11, “Ground Water Quality Rule.” All permit-required samples are collected as unfiltered samples.

Table C-7 shows the 2011 water table elevations and depth to water table, determined prior to purging and sampling, and the analytical results for all parameters specified by the permit for aquifer wells. Table C-8 presents similar information for the perched water wells. As the tables show, the majority of the permit-required parameters remained below their respective primary constituent standards or secondary constituent standards during the 2011 reporting year for all wells associated with the INTEC New Percolation Ponds. Additional information concerning groundwater concentrations for aluminum, iron, and manganese is provided in the following paragraphs.
Exceedances of aluminum, iron, and manganese in Well ICPP-MON-A-167 occurred in April and October 2011 (see Table C-7). Aquifer Well ICPP-MON-A-167 is an upgradient, noncompliance point and, therefore, these exceedances are not considered permit noncompliances. The logbook indicated that Well ICPP-MON-A-167 had only 1.83 ft of water and was described as very muddy in April 2011, and that it had only 1.45 ft of water and described as very dirty in October 2011. Because of the low volume of water in the well, both samples were collected using a bailer. Based on this information, the elevated total aluminum, iron, and manganese concentrations in the samples collected from Well ICPP-MON-A-167 are most likely the result of metals from the collected sediment within the well and are not representative of the groundwater upgradient of the New Percolation Ponds.

For the perched water wells, all groundwater results were below associated groundwater quality standards, except for exceedances of aluminum and iron, in Well ICPP-MON-V-212 in April and October 2011, and exceedances of aluminum, iron, and manganese in Well ICPP-MON-V-191 in July 2011 (see Table C-8). As required by the permit, DEQ was notified of the exceedances in Well ICPP-MON-V-212 (Hutchison 2011a, 2011b). The aluminum, iron, and manganese exceedances in Well ICPP-MON-V-191 are not permit noncompliances because this well is an upgradient noncompliance point and outside the zone of influence of the New Percolation Ponds.

Perched water Well ICPP-MON-V-191 was dry during the April and October 2011 sampling events. The water level in this well is influenced by the presence or absence of flow in the Big Lost River. From June 25, 2011, until July 13, 2011, the Big Lost River flowed in the vicinity of the Vadose Zone Research Park. Groundwater Monitoring Program personnel identified an increase in the water level in Well ICPP-MON-V-191, and samples were collected on July 6, 2011. This was only the fourth time this well has been sampled since the New Percolation Ponds began operating in August 2002. The groundwater monitoring logbook from the July 2011 sampling event indicated that 9.01 ft of water was in Well ICPP-MON-V-191 at the time of sampling. The condition of the water in this well was described as clear when purging began, but became cloudier as the purge continued over the next 19 min. The water was described as very murky and dirty by the time the samples were collected. Monitoring personnel had to use two filters to obtain the filtered (dissolved) metal sample. Based on this information, the elevated aluminum, iron, and manganese concentrations in the samples collected from Well ICPP-MON-V-191 are most likely the result of metals from the collected sediment within the well.

In 2011, concentrations of aluminum, iron, and manganese in some of the filtered samples slightly exceeded the associated secondary constituent standards. However, concentrations in the filtered samples were significantly less than those in the unfiltered samples (see Tables C-7 and C-8), indicating that the elevated metals are not in solution in the groundwater, but are associated with the sediment in the unfiltered samples being dissolved during the analytical process (e.g., acidification). In the permit renewal application, the ICP contractor proposed to base compliance with the groundwater quality standards on filtered sample results (ICP 2009).

5.2.5 Materials and Fuels Complex Industrial Waste Ditch and Industrial Waste Pond

Description – The wastewater reuse permit issued by DEQ for the MFC Industrial Waste Ditch and Pond became effective May 1, 2010. The MFC Industrial Waste Pond was first excavated in 1959 and has a design capacity of 285 MG at a maximum water depth of 13 ft (Figure 5-3).

Industrial wastewater discharged to the pond via the Industrial Waste Pipeline consists primarily of noncontact cooling water, boiler blowdown, cooling tower overflow, air wash flows, and steam condensate.

Wastewater composed of mixed cooling tower blowdown, intermittent reverse osmosis effluent, and discharge to a laboratory flows from the MFC-768 Power Plant to Ditch C via the Industrial Waste Water Underground Pipe.
Figure 5-3. Wastewater and Groundwater Sampling Locations at the Materials and Fuels Complex.
Wastewater Monitoring Results for the Wastewater Reuse Permit – The industrial wastewater reuse permit requires monthly sampling of the effluent to the pond discharged to the Industrial Waste Pipeline. The permit requires quarterly samples of the discharge to Ditch C from the Industrial Waste Water Underground Pipe. The permit sets monthly concentration limits for total suspended solids (100 mg/L) and total nitrogen (20 mg/L), and the results of those permit-limited parameters are summarized in Tables 5-6 and 5-7. During 2011, neither total suspended solids nor total nitrogen exceeded the permit limit. The minimum, maximum, and median results of all parameters monitored for the permit are presented in Tables C-9 and C-10.

Groundwater Monitoring Results for the Wastewater Reuse Permit – To measure potential impacts from the Industrial Waste Pond, the permit requires groundwater monitoring in April/May and September/October at one upgradient and two downgradient wells (Figure 5-3).

### Table 5-6. Total Nitrogen and Total Suspended Solids Effluent Monitoring Results at MFC Industrial Waste Pipeline (2011).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
<th>Permit Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nitrogen(^a) (mg/L)</td>
<td>2.156</td>
<td>3.32</td>
<td>2.772</td>
<td>20</td>
</tr>
<tr>
<td>Total suspended solids (mg/L)</td>
<td>4 U(^b)</td>
<td>8</td>
<td>4 U</td>
<td>100</td>
</tr>
</tbody>
</table>

\(a\). Total nitrogen is calculated as the sum of total Kjeldahl nitrogen and nitrate + nitrite, as nitrogen.

\(b\). U flag indicates the result was below the detection limit.


<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
<th>Permit Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total nitrogen(^a) (mg/L)</td>
<td>4.533</td>
<td>5.747</td>
<td>4.633</td>
<td>20</td>
</tr>
<tr>
<td>Total suspended solids (mg/L)</td>
<td>4 U(^b)</td>
<td>4 U</td>
<td>4 U</td>
<td>100</td>
</tr>
</tbody>
</table>

\(a\). Total nitrogen is calculated as the sum of total Kjeldahl nitrogen and nitrate + nitrite, as nitrogen.

\(b\). U flag indicates the result was below the detection limit.
The analytical results are summarized in Table C-11. Analyte concentrations in the downgradient wells were essentially indistinguishable from background levels in the upgradient well.

5.3 Liquid Effluent Surveillance Monitoring

The following sections discuss results of additional liquid effluent monitoring performed at each facility. As stated in Section 5.2, additional constituents of concern specified in the Idaho groundwater quality standards also are monitored. This additional monitoring is performed to comply with environmental protection objectives of DOE Orders 450.1A and 458.1.

5.3.1 Advanced Test Reactor Complex

The effluent to the Cold Waste Pond receives a combination of process water from various ATR Complex facilities. Table C-12 lists wastewater surveillance monitoring results for those parameters with at least one detected result. Radionuclides detected in groundwater samples are summarized in Table C-13. The tritium concentrations are below the Idaho groundwater primary constituent standard for tritium (20,000 pCi/L), which is the same as the Environmental Protection Agency health-based maximum contaminant level (MCL) for tritium in drinking water.

5.3.2 Central Facilities Area

The effluent from the CFA Sewage Treatment Facility is monitored according to the wastewater reuse permit. Table C-14 lists surveillance monitoring results for 2011 at the CFA Sewage Treatment Facility and shows parameters with at least one detected result during the year. The reported concentrations were consistent with historical data.

5.3.3 Idaho Nuclear Technology and Engineering Center

Table C-15 summarizes the additional monitoring conducted during 2011 at the INTEC Sewage Treatment Plant and INTEC New Percolation Ponds and shows the analytical results for parameters that were detected in at least one sample during the year. During 2011, most of the additional parameters were within their expected historical concentration levels, except for conductivity at CPP-769, and CPP-773, which were above their historical averages.

In addition, groundwater samples for radiological parameters were collected from five wells (aquifer Wells ICPP-MON-A-164B, ICPP-MON-A-165, and ICPP-MON-A-166, and perched water Wells ICPP-MON-V-200 and ICPP-MON-V-212) near the INTEC New Percolation Ponds in April and October 2011. These samples were collected to satisfy the surveillance objectives of DOE Order 450.1A. Table C-15 shows the results. The gross alpha activity was below the 15-pCi/L action level, and the gross beta activity was below the 40-pCi/L action level in all five monitoring wells.

5.3.4 Materials and Fuels Complex

The Secondary Sanitary Lagoon and Industrial Waste Pond are sampled quarterly for gross alpha, gross beta, gamma spectroscopy, and tritium. Annual samples are collected for selected isotopes of americium, cerium, iron, strontium, plutonium, and uranium (Figure 5-3). In addition, the Secondary Sanitary Lagoon is sampled annually for selected metals, nutrients, and other
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parameters. Tables C-16 and C-17 summarize the results for analytes detected in at least one sample.

5.4 Drinking Water Monitoring

The INL and ICP contractors monitor drinking water to ensure it is safe for consumption and to demonstrate that it meets federal and state regulations. Drinking water parameters are regulated by the state of Idaho under authority of the Safe Drinking Water Act. Parameters with primary MCLs must be monitored at least once every 3 years. Parameters with secondary MCLs are monitored every 3 years based on a recommendation by the Environmental Protection Agency. Many parameters require more frequent sampling during an initial period to establish a baseline, and subsequent monitoring frequency is determined from the baseline results.

Currently, the INL Site has 11 drinking water systems. The INL contractor and ICP contractor monitor these systems to ensure a safe working environment. The INL contractor monitors nine of these drinking water systems, and the ICP contractor monitors two. According to the “Idaho Rules for Public Drinking Water Systems” (IDAPA 58.01.08), INL Site drinking water systems are classified as either nontransient or transient, noncommunity water systems. The five INL contractor transient, noncommunity water systems are at the Experimental Breeder Reactor I, Gun Range (Live Fire Test Range), Critical Infrastructure Test Range Complex (CITRC), Test Area North/Technical Support Facility (TAN/TSF), and the Main Gate. The four remaining INL contractor water systems are classified as nontransient, noncommunity water systems. These systems are located at CFA, MFC, ATR Complex, and TAN/Contained Test Facility (CTF). The two ICP contractor nontransient, noncommunity water systems are INTEC and the Radioactive Waste Management Complex (RWMC).

As required by the state of Idaho, the INL contractor and the ICP contractor Drinking Water Programs use Environmental Protection Agency-approved (or equivalent) analytical methods to analyze drinking water in compliance with current editions of IDAPA 58.01.08 and 40 Code of Federal Regulations Parts 141 – 143. State regulations also require that analytical laboratories be certified by the state or by another state whose certification is recognized by Idaho. DEQ oversees the certification program and maintains a list of approved laboratories.

Because of historic or problematic contaminants in the drinking water systems, the INL contractor and the ICP contractor monitor certain parameters more frequently than required by regulation. For example, bacterial analyses are conducted monthly rather than quarterly at all nine INL contractor drinking water systems and at one ICP contractor drinking water system during months of operation. No compliance samples were positive (present) for bacteria in 2011. Because of known groundwater plumes near two INL contractor drinking water wells and one ICP contractor drinking water well, additional sampling is conducted for tritium at CFA, for trichloroethylene at TAN/TSF, and for carbon tetrachloride at RWMC.

5.4.1 INL Site Drinking Water Monitoring Results

During 2011, the INL contractor collected 293 routine samples and 16 quality control samples from the nine INL Site drinking water systems. In addition to routine samples, the INL contractor
also collected 23 nonroutine samples after a water main was repaired, a building put into service, or maintenance repairs. Drinking water systems at Experimental Breeder Reactor I, CITRC, Gun Range, MFC, ATR Complex, and TAN/CTF were well below drinking water limits for all regulatory parameters; therefore, they are not discussed further in this report. In addition, all water systems were sampled for nitrates. All water systems results were less than the reporting limit of 1.0 mg/L, except for CFA and MFC. Their results were 2.49 mg/L and 1.90 mg/L, respectively, which is less than the MCL of 10.00 mg/L.

Also, lead and copper sampling was conducted at ATR-Complex, CFA, MFC, and TAN/CTF water systems as is required once every 3 years. All results were less than the MCL of 15 ppb for lead and 1300 ppb for copper.

5.4.2 Central Facilities Area

The CFA water system serves approximately 600 people daily. Since the early 1950s, wastewater containing tritium was disposed of to the Eastern Snake River Plain Aquifer through injection wells and infiltration ponds at INTEC and the ATR Complex. This wastewater migrated south-southwest and is the suspected source of tritium contamination in the CFA water supply wells. Disposing of wastewater through injection wells was discontinued in the mid-1980s. In general, tritium concentrations in groundwater have been decreasing (Figure 5-4) because of changes in disposal techniques, diffusion, dispersion, recharge conditions, and radioactive decay.

Prior to 2007, compliance samples for the CFA water distribution system were collected semiannually from Well CFA #1 at CFA-651 and Well CFA #2 at CFA-642, and quarterly from the distribution manifold at CFA-1603. Because the results were consistently below the MCL for tritium, the INL contractor decreased the tritium sampling frequency to semiannually at CFA-1603 [manifold]) and annually at the wells.

**CFA Worker Dose** – Because of the potential impacts to workers at CFA from an upgradient plume of radionuclides in the Eastern Snake River Plain Aquifer, the potential effective dose equivalent from radioactivity in water was calculated. The 2011 calculation was based on the mean tritium concentration for the CFA distribution system in 2011. For the 2011 dose calculation, it was assumed that each worker’s total daily water intake would come from the CFA drinking water distribution system. This assumption overestimates the actual dose because workers typically consume only about half their total intake during working hours and typically work only 240 days rather than 365 days per year. The estimated annual effective dose equivalent to a worker from consuming all their drinking water at CFA during 2011 was 0.22 mrem (2.2 μSv), below the Environmental Protection Agency standard of 4 mrem/yr for public drinking water systems.

5.4.3 Idaho Nuclear Technology and Engineering Center

Drinking water for INTEC is supplied by two wells, CPP-04 and ICPP-POT-A-012, located north of the facility. A disinfectant residual (chlorine) is maintained throughout the distribution system. Samples were collected from the point of entry to the distribution system (CPP-614) and from various buildings throughout the distribution system. During 2011, the following drinking water samples were collected at INTEC:
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• 43 routine (compliance) samples
• 13 quality control samples (eight field duplicates, two trip blanks, and three performance evaluation samples)
• 52 nonroutine samples (52 bacterial construction/special samples).

All parameters monitored at INTEC were below their respective drinking water limits in 2011.

5.4.4 Radioactive Waste Management Complex

The RWMC production well is located in Building WMF-603 and is the source of drinking water for RWMC and the Advanced Mixed Waste Treatment Project. A disinfectant residual (chlorine) is maintained throughout the distribution system. Samples were collected from the source (WMF-603), from the point of entry to the distribution system (WMF-604), and from various buildings throughout the distribution system.
During 2011, the following drinking water samples were collected at RWMC:

- 27 routine (compliance) samples
- 17 quality control samples (eight field duplicates, four trip blanks, and five performance evaluation samples)
- 44 nonroutine samples (37 bacterial construction/special samples; and seven samples for 524.2 volatile organics).

Historically, carbon tetrachloride had been detected in samples collected at the WMF-603 Production Well (Figure 5-5). In July 2007, a packed tower air stripping treatment system was placed into operation to treat the water. During 2011, carbon tetrachloride was not detected (<0.5 μg/L) in any of the samples collected at the WMF-604 point of entry to the distribution system.

All other RWMC-monitored parameters were below their respective drinking water limits in 2011.
5.4.5 Test Area North/Technical Support Facility

Well TSF #2 supplies drinking water to less than 25 employees at TSF. The facility is served by a chlorination system. TSF #2 is sampled for surveillance purposes only (not required by regulations), and the distribution system is the point of compliance (required by regulations).

In the past, trichloroethylene contamination has been a concern at TSF. The principal source of this contamination was an inactive injection well (TSF-05). Although regulations do not require sampling Well TSF #2, samples are collected to monitor trichloroethylene concentrations due to the historical contamination. Since mid-2006, concentrations appear to be declining, but this will have to be confirmed with the collection of additional data.

Figure 5-6 illustrates the trichloroethylene concentrations in both Well TSF #2 and the distribution system from 2001 through 2011. Table 5-8 summarizes the trichloroethylene concentrations at TSF #2 and the distribution system. The mean concentration at the distribution system for 2011 was less than the reporting limit of 0.5 μg/L.

Figure 5-6. Trichloroethylene Concentrations in Technical Support Facility Drinking Water Well and Distribution System (2001 – 2011).
5.5 Waste Management Surveillance Surface Water Sampling

In compliance with DOE Order 435.1, the ICP contractor collects surface water runoff samples at the RWMC Subsurface Disposal Area (SDA) from the location shown in Figure 5-7. Near the end of 2009, a lift station was installed, and the sampling point is now at the lift station. Surface water is collected to determine if radionuclide concentrations exceed administrative control levels or if concentrations have increased significantly compared to historical data. A field blank is also collected for comparison. Because of changes in the area and the change to the lift station as the sampling point, samples were collected monthly the first quarter during 2011 and then quarterly during the remaining 2011 to more closely monitor these changes.

Radionuclides could be transported outside the RWMC boundaries via surface water runoff. Surface water runs off the SDA only during periods of rapid snowmelt or heavy precipitation. At these times, water may be pumped out of the SDA retention basin into a drainage canal, which directs the flow outside RWMC. The canal also carries runoff from outside RWMC that has been diverted around the SDA.

Samples collected were sent to ALS Laboratory Group, Fort Collins, Colorado, for analysis. Table 5-9 summarizes the specific alpha and beta results of human-made radionuclides. No human-made gamma-emitting radionuclides were detected. The americium-241 and plutonium-239/240 concentrations are approximately the same as those detected in 2010 and are well below the applicable DOE derived concentration standards and MCLs. There were no positive detections of plutonium-238 during 2011. The ICP contractor will closely monitor quarterly during 2012, when water is available, and evaluate the results to identify any abnormal trends or the need to change sampling frequency.

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of samples</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>MCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAN/TSF #2 (612)*</td>
<td>1</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>NA</td>
</tr>
<tr>
<td>TAN/TSF Distribution (610)</td>
<td>2</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>5.0</td>
</tr>
</tbody>
</table>

a. Since regulations do not require sampling at this well and there was no detection at TAN-610, TAN #2 well was not sampled in 2009.

b. MCL = Maximum contaminant level (see Table A-3).

c. NA = Not applicable. Maximum contaminant level applies to the distribution system only.

Table 5-9. Trichloroethylene Concentrations at Test Area North/Technical Support Facility Well #2 and Distribution System (2011).
Figure 5-7. Surface Water Sampling Location at RWMC Subsurface Disposal Area.

Table 5-9. Radionuclides Detected in Surface Water Runoff at the RWMC Subsurface Disposal Area (2011).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Concentration^a (pCi/L)</th>
<th>% Derived Concentration Standard^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Americium-241</td>
<td>2.25 ± 0.18</td>
<td>1.32</td>
</tr>
<tr>
<td>Plutonium-239/240</td>
<td>1.73 ± 0.26</td>
<td>1.24</td>
</tr>
<tr>
<td>Strontium-90</td>
<td>1.08 ± 0.15</td>
<td>0.01</td>
</tr>
</tbody>
</table>

^a. Result ± 1s. Results shown are ≥ 3s.
^b. See Table A-2.
REFERENCES


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