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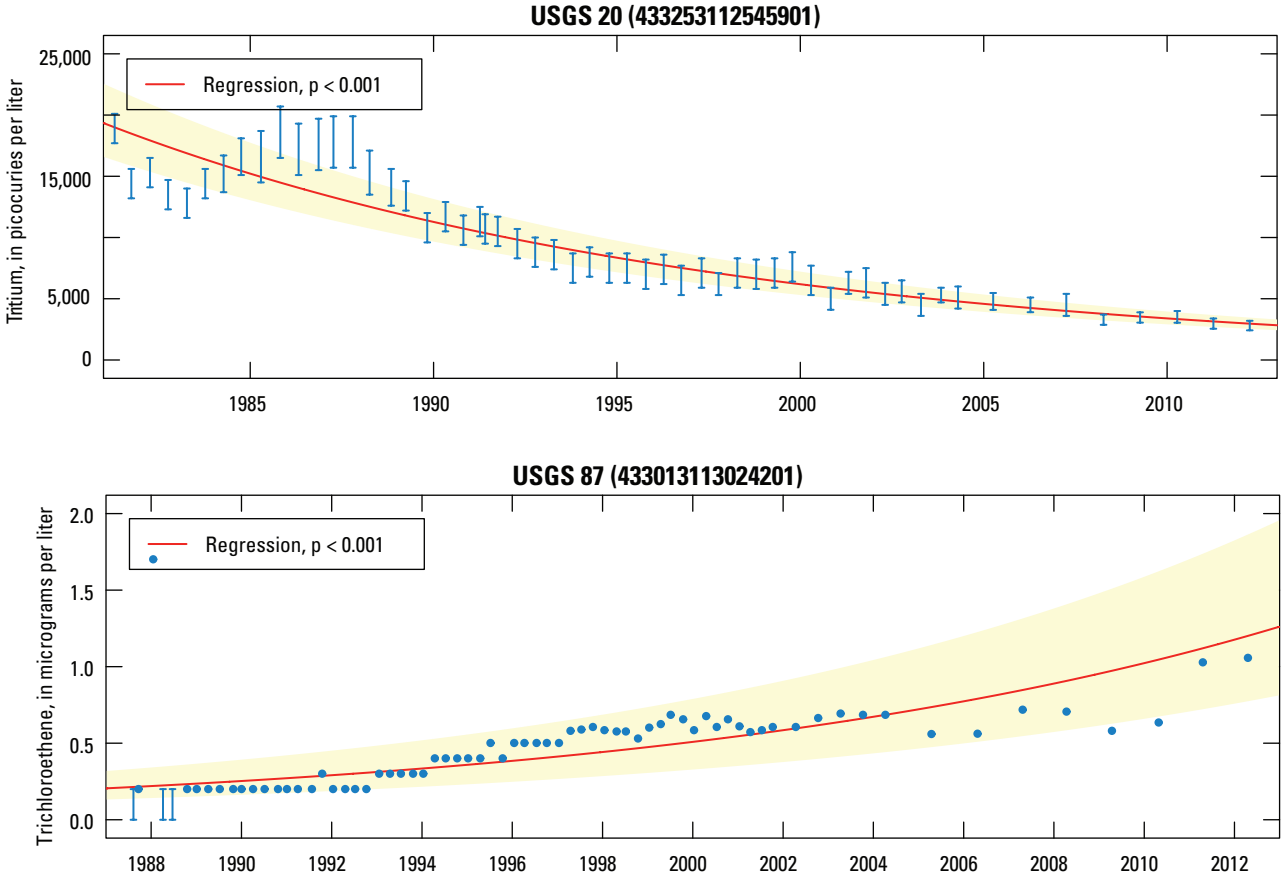
Water-Quality Characteristics and Trends for Selected Wells Possibly Influenced by Wastewater Disposal at the Idaho National Laboratory, Idaho, 1981–2012



Scientific Investigations Report 2015–5003

U.S. Department of the Interior
U.S. Geological Survey

Cover: Graphical presentations showing decreasing trending interval censored tritium data from well USGS 20 and increasing trending left censored trichloroethene data from well USGS 87.

Water-Quality Characteristics and Trends for Selected Wells Possibly Influenced by Wastewater Disposal at the Idaho National Laboratory, Idaho, 1981–2012

By Linda C. Davis, Roy C. Bartholomay, Jason C. Fisher, and Neil V. Maimer

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U.S. Department of the Interior
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Conversion Factors, Datums, and Abbreviations

Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
	Flow rate	
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
	Hydraulic conductivity	
foot per day (ft/d)	0.3048	meter per day (m/d)
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
	Transmissivity*	
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)

SI to Inch/Pound

Multiply	By	To obtain
	Volume	
liter (L)	33.82	ounce, fluid (fl. oz)
	Mass	
kilogram (kg)	2.205	pound avoirdupois (lb)
	Radioactivity	
picocurie per liter (pCi/L)	0.037	Becquerel per liter Bq/L

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times°C)+32.$$

*Transmissivity: The standard unit for transmissivity is cubic foot per day per square foot times foot of aquifer thickness [(ft^3/d)/ft^2]ft. In this report, the mathematically reduced form, foot squared per day (ft^2/d), is used for convenience.

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Conversion Factors, Datums, and Abbreviations—Continued

Datums

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

Altitude, as used in this report, refers to distance above the vertical datum.

Abbreviations

AFT	accelerated failure time
ATR Complex	Advanced Test Reactor Complex (formerly RTC, Reactor Technology Complex, and TRA, Test Reactor Area)
BLS	below land surface
CFA	Central Facilities Area
CFC	chlorofluorocarbon
CRAN	Comprehensive R Active Network
DOE	U.S. Department of Energy
ESRP	eastern Snake River Plain
E-value	estimated value
INEL	Idaho National Engineering Laboratory (1974–97)
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRL	interim reporting level
LRL	laboratory reporting level
LT-MDL	long-term method detection level
MCL	maximum contaminant level
MLE	maximum-likelihood estimation
NRF	Naval Reactors Facility
NWIS	National Water Information System
NWQL	National Water Quality Laboratory (USGS)
PBF	Power Burst Facility
RESL	Radiological and Environmental Sciences Laboratory (DOE)
QA	quality assurance
QC	quality control
RWMC	Radioactive Waste Management Complex
s	sample standard deviation
SDA	Subsurface Disposal Area
TAN	Test Area North
TOC	total organic carbon
USGS	U.S. Geological Survey
VOC	volatile organic compound

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Abstract

The U.S. Geological Survey, in cooperation with the U.S. Department of Energy, analyzed water-quality data collected from 64 aquifer wells and 35 perched groundwater wells at the Idaho National Laboratory (INL) from 1981 through 2012. The wells selected for the study were wells that possibly were affected by wastewater disposal at the INL. The data analyzed included tritium, strontium-90, major cations, anions, nutrients, trace elements, total organic carbon, and volatile organic compounds. The analyses were performed to examine water-quality trends that might influence future management decisions about the number of wells to sample at the INL and the type of constituents to monitor.

The data were processed using custom computer scripts developed in the R programming language. Summary statistics were calculated for the datasets. Water-quality trends were determined using a parametric survival regression model to fit the observed data, including left-censored, interval-censored, and uncensored data. The null hypothesis of the trend test was that no relation existed between time and concentration; the alternate hypothesis was that time and concentration were related through the regression equation. A significance level of 0.05 was selected to determine if the trend was statistically significant.

Trend test results for tritium and strontium-90 concentrations in aquifer wells indicated that nearly all wells had decreasing or no trends. Similarly, trends in perched groundwater wells were mostly decreasing or no trends; trends were increasing in two perched groundwater wells near the Advanced Test Reactor Complex. Decreasing trends generally are attributed to lack of recent wastewater disposal and radioactive decay.

Trend test results for chloride, sodium, sulfate, nitrite plus nitrate (as nitrogen), chromium, trace elements, and total organic carbon concentrations in aquifer wells indicated that most wells had either decreasing or no trends. The decreasing trends in these constituents are attributed to decrease in disposal of these constituents, as well as discontinued use of the old percolation ponds south of the Idaho Nuclear Technology and Engineering Center (INTEC) and redirection of wastewater to the new percolation ponds 2 miles southwest of the INTEC in 2002.

Chloride (along with sodium, sulfate, and some nitrate) concentrations in wells south of the INTEC may be influenced by episodic recharge from the Big Lost River. These constituent concentrations decrease during wetter periods when there is probably more recharge from the Big Lost River and increase during dry periods, when there is less recharge.

Some wells downgradient of the Central Facilities Area and near the southern boundary of the INL showed increasing trends in sodium concentration, whereas there was no trend in chloride. The increasing trend for sodium could be due to the long term influence of wastewater disposal from upgradient facilities and the lack of trend for chloride could be because chloride is more mobile than sodium and more dispersed in the aquifer system.

Volatile organic compound concentration trends were analyzed for nine aquifer wells. Trend test results indicated an increasing trend for carbon tetrachloride for the Radioactive Waste Management Complex Production Well for the period 1987–2012; however, trend analyses of data collected since 2005 show no statistically significant trend indicating that engineering practices designed to reduce movement of volatile organic compounds to the aquifer may be having a positive effect on the aquifer.

Introduction

The Idaho National Laboratory (INL), operated by the U.S. Department of Energy (DOE), encompasses about 890 mi^2 of the eastern Snake River Plain (ESRP) in southeastern Idaho (fig. 1). The INL was established in 1949 to develop atomic energy, nuclear safety research, defense programs, environmental research, and advanced energy concepts. Wastewater disposal sites at the Test Area North (TAN), the Naval Reactors Facility (NRF), the Advanced Test Reactor Complex (ATR Complex), and the Idaho Nuclear Technology and Engineering Center (INTEC) (fig. 1) have

contributed radioactive- and chemical-waste contaminants to the ESRP aquifer. These sites incorporated various wastewater disposal methods, including lined evaporation ponds, unlined percolation (infiltration) ponds and ditches, drain fields, and injection wells. Waste materials buried in shallow pits and trenches within the Subsurface Disposal Area (SDA) at the Radioactive Waste Management Complex (RWMC) also have contributed contaminants to groundwater.

Since 1949, the U.S. Geological Survey (USGS) has worked in cooperation with the DOE at the INL to define: (1) the quality and availability of water for human consumption, (2) the usability of the water for supporting construction and cooling of facilities and for diluting concentrated waste streams, (3) the location and movement of contaminants in the ESRP aquifer and perched groundwater zones, (4) the sources of recharge to the aquifer, (5) an early detection network for contaminants moving past the INL boundaries, and (6) the processes controlling the origin and distribution of contaminants and naturally occurring constituents in the aquifer (Ackerman and others, 2010).

Since its inception, this water-quality monitoring program at the INL has included a network that once numbered as many as 200 wells. The network of wells has been sampled over the years for tritium, strontium-90, iodine-129, cesium-137, plutonium-238, plutonium-239, -240 (undivided), americium-241, gross alpha- and gross beta-radioactivity, sodium, bromide, chloride, fluoride, sulfate, nitrate, chromium and other trace elements, volatile organic compounds (VOCs), and total organic carbon (TOC) (Bartholomay, 2013; Davis and others 2013). Most wells in this network were constructed as open boreholes, and many are open to the aquifer throughout their entire depth below the water table.

Purpose and Scope

This report presents an analysis of water-quality characteristics and trends for groundwater samples collected from selected wells that possibly are affected by wastewater disposal at and near the INL. Water-quality trends were examined to aid future management decisions regarding the number of wells to sample at the INL and the type of constituents to monitor. The criteria for selecting the sampling sites analyzed in this report were: (1) that at least 10 years of data were available for each site, and (2) that the sites represented water in a location that probably was affected by INL wastewater disposal.

Water samples collected from 64 aquifer wells and 35 perched groundwater wells were analyzed for selected constituents. The constituents include some combination of tritium, strontium-90, cesium-137, plutonium-238, plutonium-239, -240 (undivided), americium-241, gross alpha- and beta-particle radioactivity, calcium, magnesium, potassium, silica, sodium, bromide, chloride, fluoride, sulfate, nitrate (as N), orthophosphate (as P), chromium and other trace elements, and TOC. Constituent concentrations were plotted against time to evaluate the data; additional trend analyses were completed using the R programming language "Trends" package (Fisher and Davis, 2014; appendix A), which incorporates a parametric survival regression model that is fit to the observed data, including left-censored (values reported as less than a laboratory reporting level [LRL]), interval-censored (values with an associated uncertainty), and uncensored data. Summary statistics were also calculated for the datasets.

Geohydrologic Setting

The INL is located on the west-central part of the ESRP. The ESRP is a northeast-trending structural basin about 200 mi long and 50–70 mi wide (fig. 1). The basin has been filled with basaltic lava flows interbedded with terrestrial sediments. The basaltic rocks and sedimentary deposits combine to form the ESRP aquifer, which is the primary source of groundwater for the ESRP.

The ESRP aquifer is one of the most productive aquifers in the United States (U.S. Geological Survey, 1985, p. 193). Groundwater generally moves from northeast to southwest and discharges to springs along the Snake River downstream of Twin Falls, Idaho, about 100 mi southwest of the INL (fig. 1). Groundwater moves horizontally through basalt interflow zones and vertically through joints and interfingering edges of basalt flows. Infiltration of surface water, heavy pumpage, geohydrologic conditions, and seasonal fluxes of recharge and discharge locally affect the movement of groundwater (Garabedian, 1986). The ESRP aquifer is recharged primarily from infiltration of applied irrigation water, infiltration of streamflow, groundwater inflow from adjoining mountain drainage basins, and infiltration of precipitation (Ackerman and others, 2006).

At the INL, depth to water in wells completed in the ESRP aquifer ranges from about 200 ft below land surface in the northern part of the INL to more than 900 ft below land surface in the southeastern part of the INL. A significant proportion of the groundwater moves through the upper 200–800 ft of basaltic rock (Mann, 1986, p. 21). Ackerman (1991a, p. 30) and Bartholomay and others (1997, table 3) reported transmissivity values for basalt in the upper part of the aquifer ranging from 1.1 to 760,000 ft^2/d. The hydraulic gradient at the INL ranges from 2 to 10 ft/mi, with an average of 4 ft/mi (Davis and others, 2013, fig. 9). Horizontal flow velocities of 2 to 26 ft/d have been calculated based on the movement of various constituents in different areas of the aquifer at and near the INL (Robertson and others, 1974; Mann and Beasley, 1994; Cecil and others, 2000; Plummer and others, 2000; and Busenberg and others, 2001).

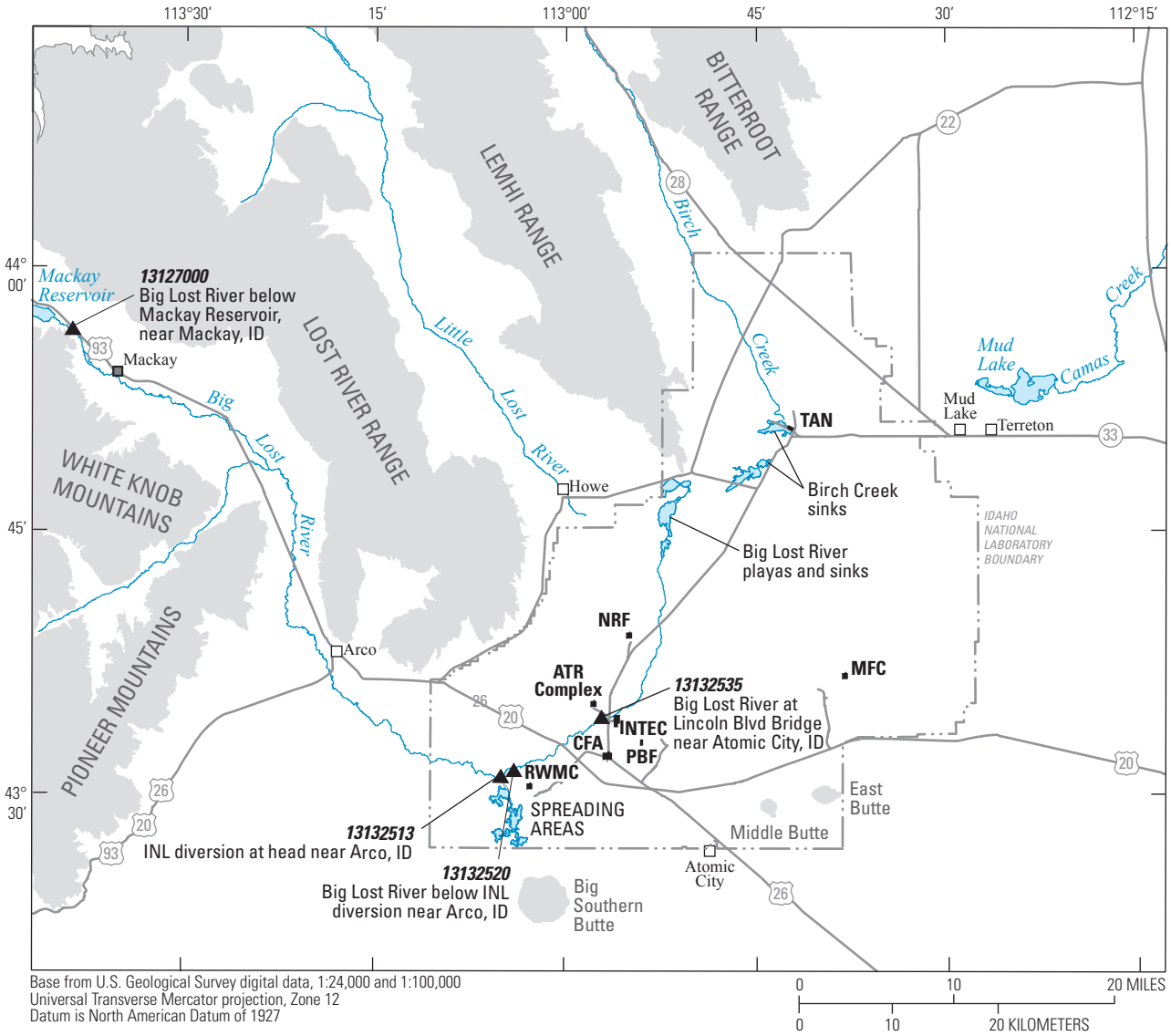


Figure 1. Locations of selected facilities at the Idaho National Laboratory, Idaho.

These flow rates equate to a travel time of about 50–700 years for water beneath the INL to travel to springs that discharge at the terminus of the ESRP groundwater- flow system near Twin Falls, Idaho. Localized tracer tests at the INL have shown that vertical- and horizontal-transport rates are as high as 60–150 ft/d (Nimmo and others, 2002; Duke and others, 2007).

Olmsted (1962), Robertson and others (1974), and Busenberg and others (2001) classified groundwater at the INL based on chemical types derived from dissolution of the rocks and minerals within the recharge source areas. Olmsted's type A water consisted of calcium and magnesium concentrations that constituted at least 85 percent of the cations and bicarbonate that constituted at least 70 percent of the anions. Type A water is present in the central and western part of the INL. Type A water is attributed to seepage loss from the Big Lost River and from groundwater underflow from the Big Lost River, Little Lost River, and Birch Creek drainage basins to the west and northwest of the INL (fig. 1) that contain alluvium derived from Paleozoic carbonate rocks from the surrounding mountains.

Olmsted's type B water, which is characterized by higher equivalent fractions of sodium, potassium, fluoride, and silica than type A water, underlies much of the eastern part of the INL and is often referred to as regional water. The groundwater originates from the area northeast of the INL that is composed of a much higher fraction of rhyolitic and andesitic volcanic rocks than mountains west and northwest of the INL that contribute to Type A water. Busenberg and others (2001) used age dating techniques of chlorofluorocarbons (CFCs), sulfur hexafluoride, and tritium/helium to further classify the regional water at the INL into two types based on the recharge type of the young fraction of groundwater. Water in the southeastern part of the INL represented a binary mixture of old (water greater than 40 to 55 years old that did not contain tritium or CFCs, respectively) regional groundwater underflow with young water derived from rapid, focused recharge, probably from precipitation infiltration. Water in the northeastern part of the INL is old, regional groundwater underflow that is mixed with local rapid, focused recharge; slow, diffuse areal recharge through the unsaturated zone; and agricultural return flow from the Mud Lake and Terreton areas (fig. 1).

Disposal of wastewater to infiltration ponds and infiltration of surface water at waste-burial sites at the INL has resulted in the formation of perched groundwater in basalts and in sedimentary interbeds that overlie the ESRP aquifer (Cecil and others, 1991). Perched groundwater has formed in a complex sequence of basalt flow and sedimentary interbeds beneath the ATR Complex, the INTEC, and the RWMC. Perched groundwater also has been detected beneath infiltration ponds and ditches at other facilities at the INL in the past, but is not discussed in this report.

Anderson and Lewis (1989) and Anderson (1991) correlated geophysical logs to describe the stratigraphic sequences in which perched groundwater has formed at the ATR Complex, INTEC, and the RWMC. Although the subsurface stratigraphy, geohydrologic characteristics, and waste disposal practices at each of these areas differs, the features controlling the formation of perched groundwater at these sites are similar (Cecil and others, 1991). Sedimentary interbeds in the subsurface may have smaller vertical hydraulic conductivities than overlying basalt flows, and alteration between basalt flows may contribute to reduced vertical hydraulic conductivity in the interflow rubble zones (Perkins and Winfield, 2007). Dense, unfractured basalt flows may have a decreased vertical hydraulic conductivity and inhibited downward flow, and sedimentary or chemical infilling of fractures in basalt may decrease vertical hydraulic conductivity by limiting the interconnectivity of fractures that reduce the water transmitting capability of the basalts (Cecil and others, 1991). Any combination of these factors may disrupt the downward vertical movement of water and contribute to the formation of perched groundwater zones.

At the ATR Complex, deep and shallow perched groundwater zones have formed as a result of disposal of wastewater to infiltration ponds (Tucker and Orr, 1998). South of the INTEC, perched groundwater zones formed previously because of wastewater disposal to the old percolation ponds, but the zones have dried up since the ponds were taken out of service in 2002. Perched groundwater also has been detected in other areas at the INTEC and may be attributed to leaking pipelines, leach fields, damaged casing in the upper part of the INTEC disposal well, other infiltration ponds, or landscape irrigation (Tucker and Orr, 1998). Perched groundwater also is present below the new percolation ponds that were put into service during 2002. Perched groundwater beneath the RWMC formed from infiltration of snowmelt and rain and recharge from the Big Lost River and INL spreading areas. This perched groundwater contains constituents leached from buried radioactive and organic-chemical wastes. Perched groundwater beneath wastewater infiltration ponds and buried waste is an integral part of the pathway for waste-constituent migration to the ESRP aquifer. The extent of perched groundwater is affected by the waste-disposal practices.

Previous Investigations

Hydrologic conditions and the distribution of selected wastewater constituents in groundwater and perched groundwater are discussed in a series of reports describing the INL. Table 1 summarizes selected previous investigations of the geology, hydrology, and characteristics of groundwater and perched water at and near the INL, specifies the periods covered by some of those investigations, and lists report citations. Full references for these citations are available in the section, "References Cited." Numerous previous investigations on the hydrology and geology at the INL have been done by INL contractors, state agencies, and the USGS. The USGS provides a list of references and hyperlinks to published reports from its previous INL studies at the USGS INL Project Office Web site at http://id.water.usgs.gov/projects/INL/index.html.

Table 1. Summary of selected previous investigations on geology, hydrology, and characteristics of groundwater and perched groundwater at and near the Idaho National Laboratory, Idaho, 1961–2013.

[**Abbreviations**: NRTS, National Reactor Testing Station; RWMC, Radioactive Waste Management Complex; INEL, Idaho National Engineering Laboratory; INEEL, Idaho National Engineering and Environmental Laboratory; INL, Idaho National Laboratory; ATR Complex, Advanced Test Reactor Complex (formerly the TRA, Test Reactor Area and the RTC, Reactor Technology Complex); INTEC, Idaho Nuclear Technology and Engineering Center (formerly the ICPP, Idaho Chemical Processing Plant); NA, not applicable]

Reference	Investigation period	Summary
	Groundwater	
Olmsted (1962)	NA	Chemical and physical character of groundwater at the NRTS, Idaho
Morris and others (1963, 1964, 1965)	NA	Hydrology of waste disposal at the NRTS, Idaho
Barraclough and others (1967a)	1965	Hydrology of the NRTS, Idaho
Barraclough and others (1967b)	1966	Hydrology of the NRTS, Idaho
Nace and others (1975)	NA	Generalized geologic framework of the NRTS, Idaho
Robertson and others (1974)	NA	Effects of waste disposal on the geochemistry of groundwater at the NRTS, Idaho
Barraclough and others (1976)	NA	Hydrology of the solid waste burial ground (now the RWMC)
Barracough and Jenson (1976)	1971–73	Hydrologic data for the Idaho INEL, Idaho
Barraclough and others (1981)	1974–78	Hydrologic conditions for the INEL, Idaho
Lewis and Jensen (1985)	1979–81	Hydrologic conditions for the INEL, Idaho
Pittman and others (1988) http://pubs.er.usgs.gov/publication/wri894008	1982–85	Hydrologic conditions for the INEL, Idaho
Orr and Cecil (1991) http://pubs.er.usgs.gov/publication/wri914047	1986–88	Hydrologic conditions and distribution of selected chemical constituents in water at the INEL, Idaho
Ackerman (1991a)	NA	Analyzed data from 183 aquifer tests conducted in 94 wells to estimate transmissivity of basalts and sedimentary interbeds containing groundwater beneath the INL
Bartholomay and others (1995)	1989–91	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in water, INEL, Idaho
Bartholomay and others (1997) http://pubs.er.usgs.gov/publication/wri974086	1992–95	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in water, INEL, Idaho
Bartholomay and others (2000) http://pubs.er.usgs.gov/publication/wri004192	1996–98	Hydrologic conditions and distribution of selected constituents in water, INEEL, Idaho
Davis (2006b) http://pubs.er.usgs.gov/publication/sir20065088	1999–2001	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in water, INL, Idaho
Ackerman and others (2006) http://pubs.er.usgs.gov/publication/sir20065122	NA	Conceptual model of groundwater flow in the eastern Snake River Plain aquifer, INL, with implications for contaminant transport
Davis (2008) http://pubs.er.usgs.gov/publication/sir20085089	2002–05	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in groundwater and perched groundwater, INL, Idaho
Davis (2010) http://pubs.er.usgs.gov/publication/sir20105197	2006–08	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in groundwater and perched groundwater, INL, Idaho.
Ackerman and others (2010)	NA	Steady-state and transient models of groundwater flow and advective transport in the eastern Snake River Plain aquifer at the INL.
Bartholomay and others (2012) http://pubs.er.usgs.gov/publication/sir20125169	1949–2009	Water-quality characteristics and trends for selected sites at and near the INL, Idaho
Fisher and others (2012)	NA	Comparison of 3-dimensional model estimates of groundwater source areas and velocities to independently derived estimates at INL
Davis and others (2013)	2009–11	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in groundwater and perched groundwater, INL, Idaho

Table 1. Summary of selected previous investigations on geology, hydrology, and characteristics of groundwater and perched groundwater at and near the Idaho National Laboratory, Idaho, 1961–2013.—Continued

[**Abbreviations**: NRTS, National Reactor Testing Station; RWMC, Radioactive Waste Management Complex; INEL, Idaho National Engineering Laboratory; INEEL, Idaho National Engineering and Environmental Laboratory; INL, Idaho National Laboratory; ATR Complex, Advanced Test Reactor Complex (formerly the TRA, Test Reactor Area and the RTC, Reactor Technology Complex); INTEC, Idaho Nuclear Technology and Engineering Center (formerly the ICPP, Idaho Chemical Processing Plant); na, not applicable]

Reference	Investigation period	Summary
	Perched groundwater	
Barraclough and others (1967a)	1965	Extent of perched groundwater and distribution of selected wastewater constituents in perched groundwater at the TRA
Barraclough and others (1967b)	1966	Extent of perched groundwater and distribution of selected wastewater constituents in perched groundwater at the TRA
Robertson and others (1974)	NA	Analysis of perched groundwater and conditions related to the disposal of wastewater to the subsurface at the INEL
Barraclough and Jensen (1976)	NA	Extent of perched groundwater and distribution of selected wastewater constituents in perched groundwater at the TRA
Robertson (1976)	NA	Numerical model simulating flow and transport of chemical and radionuclide constituents through perched water at the TRA
Barraclough and others (1981) http://pubs.er.usgs.gov/publication/wsp2191	1974–78	Hydrologic conditions for the INEL, Idaho
Lewis and Jensen (1985)	1979–81	Hydrologic conditions for the INEL, Idaho
Pittman and others (1988) http://pubs.er.usgs.gov/publication/wri894008	1982–85	Hydrologic conditions for the INEL, Idaho
Hull (1989)	NA	Conceptual model that described migration pathways for wastewater andconstituents from the radioactive-waste infiltration ponds at the TRA
Anderson and Lewis (1989) http://pubs.er.usgs.gov/publication/wri894065	NA	Correlation of drill cores and geophysical logs to describe a sequence of basalt flows and sedimentary interbeds in the unsaturated zones underlying the RWMC
Anderson (1991) http://pubs.er.usgs.gov/publication/wri914010	NA	Correlation of drill cores and geophysical logs to describe a sequence of basalt flows and sedimentary interbeds in the unsaturated zones underlying the TRA, and INTEC
Ackerman (1991b) http://pubs.er.usgs.gov/publication/wri914058	NA	Analyzed data from 43 aquifer tests conducted in 22 wells to estimate transmissivity of basalts and sedimentary interbeds containing perched groundwater beneath the TRA and INTEC
Cecil and others (1991) http://pubs.er.usgs.gov/publication/wri914166	1986–88	Mechanisms for formation of perched water at the TRA, ICPP, and RWMC, INEL, Idaho; distribution of chemical and radiochemical constituents in perched water at the TRA, ICPP and RWMC
Tucker and Orr (1998) http://pubs.er.usgs.gov/publication/wri984028	1989–91	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in perched groundwater, INEL, Idaho
Bartholomay (1998) http://pubs.er.usgs.gov/publication/wri984026	1992–95	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in perched groundwater, INEL, Idaho
Orr (1999) http://pubs.er.usgs.gov/publication/wri994277	NA	Transient numerical simulation to evaluate a conceptual model of flow through perched water beneathe wastewater infiltration ponds at the TRA
Bartholomay and Tucker (2000) http://pubs.er.usgs.gov/publication/wri004222	1996–98	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in perched groundwater, INEEL, Idaho
Davis (2006a) http://pubs.er.usgs.gov/publication/sir20065236	1999–2001	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in perched groundwater, INL, Idaho
Davis (2008) http://pubs.er.usgs.gov/publication/sir20085089	2002–05	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in groundwater and perched groundwater, INL, Idaho
Davis (2010) http://pubs.er.usgs.gov/publication/sir20105197	2006–08	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in groundwater and perched groundwater, INL, Idaho
Davis and others (2013)	2009–11	Hydrologic conditions and distribution of selected radiochemical and chemical constituents in groundwater and perched groundwater, INL, Idaho

Some qualitative information about trends of selected constituents for selected wells is given in the more recent hydrologic conditions reports listed in table 1, and trend data are given in Davis and others (2013) for wastewater constituents in water from several wells that are affected by wastewater disposal. Trends for most of the constituents plotted show decreasing concentrations because of the changes in the methods of disposal, dilution, and dispersion in the aquifer, and reductions of amounts of constituents being discharged. One exception is increasing trends in carbon tetrachloride concentration in two wells at the RWMC (Davis and others, 2013, fig. 29).

Knobel (2006) plotted water-quality data from 1990 through 2003 for 30 wells downgradient of the INTEC to visually compare historical water-quality data collected after purging three well volumes with water-quality data collected after purging one well volume. Qualitative and quantitative evaluations indicated that the water-quality data were comparable for the different purge volumes for the 30 wells studied.

Concentration trends for selected wells not affected by wastewater disposal at the INL are given for iron, zinc, and nitrate in U.S. Department of Energy (2010). That study indicated that the use of galvanized pipes in some of the wells probably is responsible for elevated zinc concentrations. Nitrate concentrations were plotted for wells USGS 2, 100, and 101, and the increasing trends were attributed to long-term agricultural practices northeast of the INL.

Neher and others (1998) plotted water-quality data collected by the USGS from 1960 through 1995 for 66 wells near facilities at the INL and wells near the southern boundary of the INL to assist the scientific community in identifying issues that may require additional investigation and to provide a reference document for individuals interested in the water quality of the ESRP aquifer near the INL. Radionuclide data and inorganic chemicals that were commonly disposed at the INL and specific conductance measurements also were plotted by Neher and others (1998).

Bartholomay and others (2012) used statistical methods to determine trends for selected constituents for 67 wells and 7 surface-water sites sampled by the USGS at the INL that probably were not affected by wastewater disposal at the INL. They determined that chloride trends in wells influenced by recharge from the Big Lost River either decreased or had variable increases and decreases due to wet and dry cycles of precipitation and runoff. Wells influenced by regional recharge showed increasing trends for chloride, sodium, sulfate, and nitrate and the increases were attributed to agricultural or other anthropogenic influences upgradient of the INL. Some wells near the NRF and Power Burst Facility (PBF) showed increasing trends possibly due to wastewater disposal at those facilities.

Methods

Sample Collection and Analyses

Water samples analyzed for this study were collected from 64 ESRP aquifer wells (figs. 2 and 3) and 35 perched groundwater wells (fig. 4). Since 1989, water samples have been analyzed for chemical constituents at the USGS National Water Quality Laboratory (NWQL) in Lakewood, Colorado. Prior to 1989, water samples were analyzed by various laboratories for chloride, chromium, sodium, and nitrate (Wegner, 1989). Water samples have been analyzed for radiochemical constituents at the DOE Radiological and Environmental Sciences Laboratory (RESL) at the INL since samples were first collected. Many of the samples collected in the 1950s, 1960s, and 1970s were collected during or immediately after cable-drilling, and there was a high probability that some of the samples contained impurities introduced by the drilling (Robertson and others, 1974, appendix B). Some chemical and radiochemical analyses for special studies have been done at the NWQL and by contract laboratories throughout the history of the USGS monitoring program at the INL, but those data were not considered for statistical trend analysis in this study because of the variability of method detection levels and the analytical methods used. Until 2008, the RESL reported an uncertainty of 2s, where s is the sample standard deviation, for water samples analyzed for radionuclides, and data were entered into the USGS National Water Information System (NWIS) database with that uncertainty. In 2008, the RESL began reporting the uncertainty as 1s, and data are now entered into NWIS with the 1s uncertainty. Analytical uncertainties in this report are reported as 1s for consistency.

Methods used to sample and analyze for selected constituents generally follow the guidelines established by the USGS (Goerlitz and Brown, 1972; Stevens and others, 1975; Wood, 1976; Thatcher and others, 1977; Claassen, 1982; Wershaw and others, 1987; Fishman and Friedman, 1989; Faires, 1993; Fishman, 1993; and U.S. Geological Survey, variously dated). Water samples were collected according to a quality-assurance plan for water-quality activities conducted by personnel at the USGS INL Project Office. The plan was finalized in June 1989 and revised in March 1992, in 1996 (Mann, 1996), in 2003 (Bartholomay and others, 2003), in 2008 (Knobel and others, 2008), and in 2014 (Bartholomay and others, 2014). The plan is available for inspection at the USGS INL Project Office.

Field processing of water samples differed depending on the constituents for which analyses were requested and the time period in which they were collected.

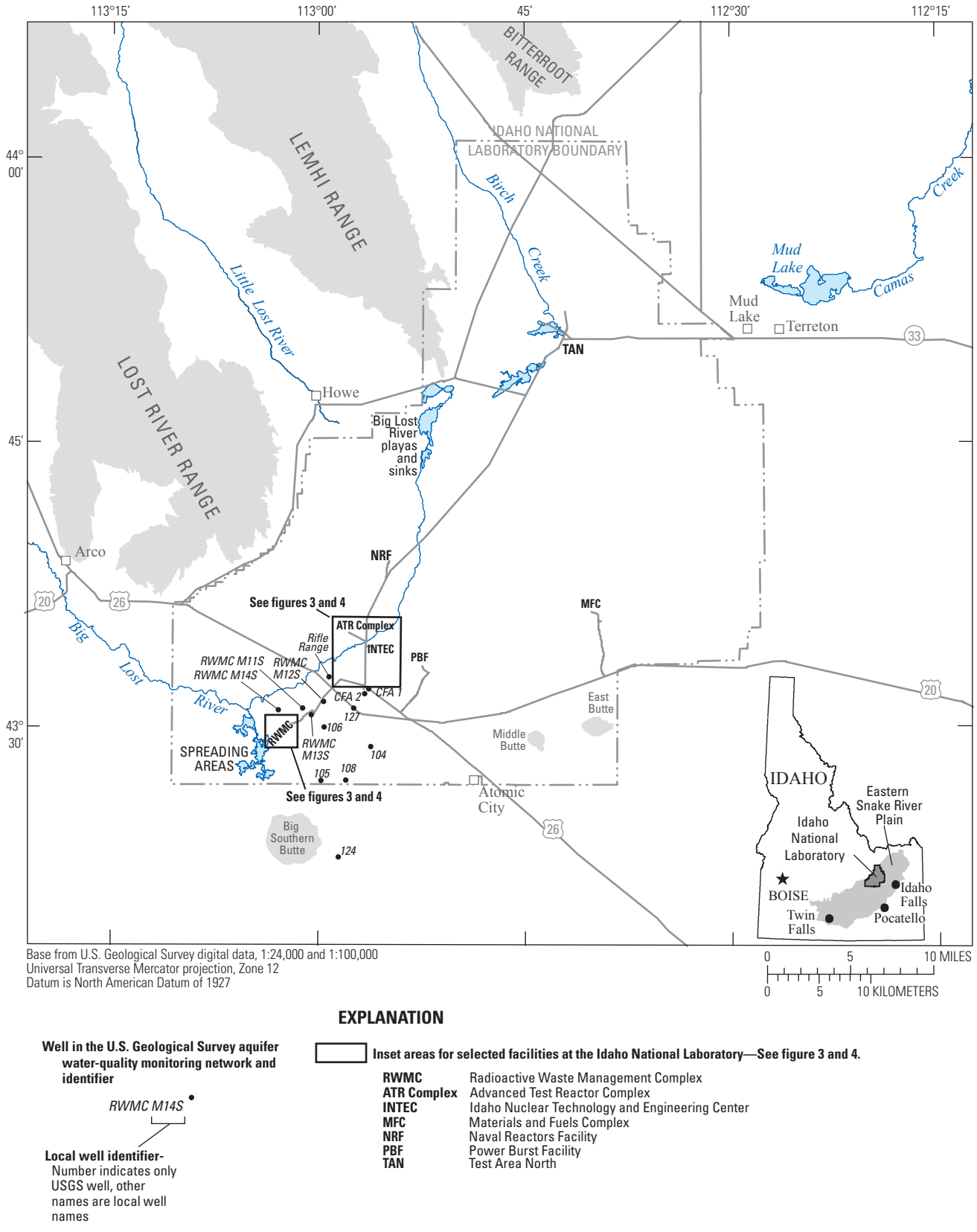
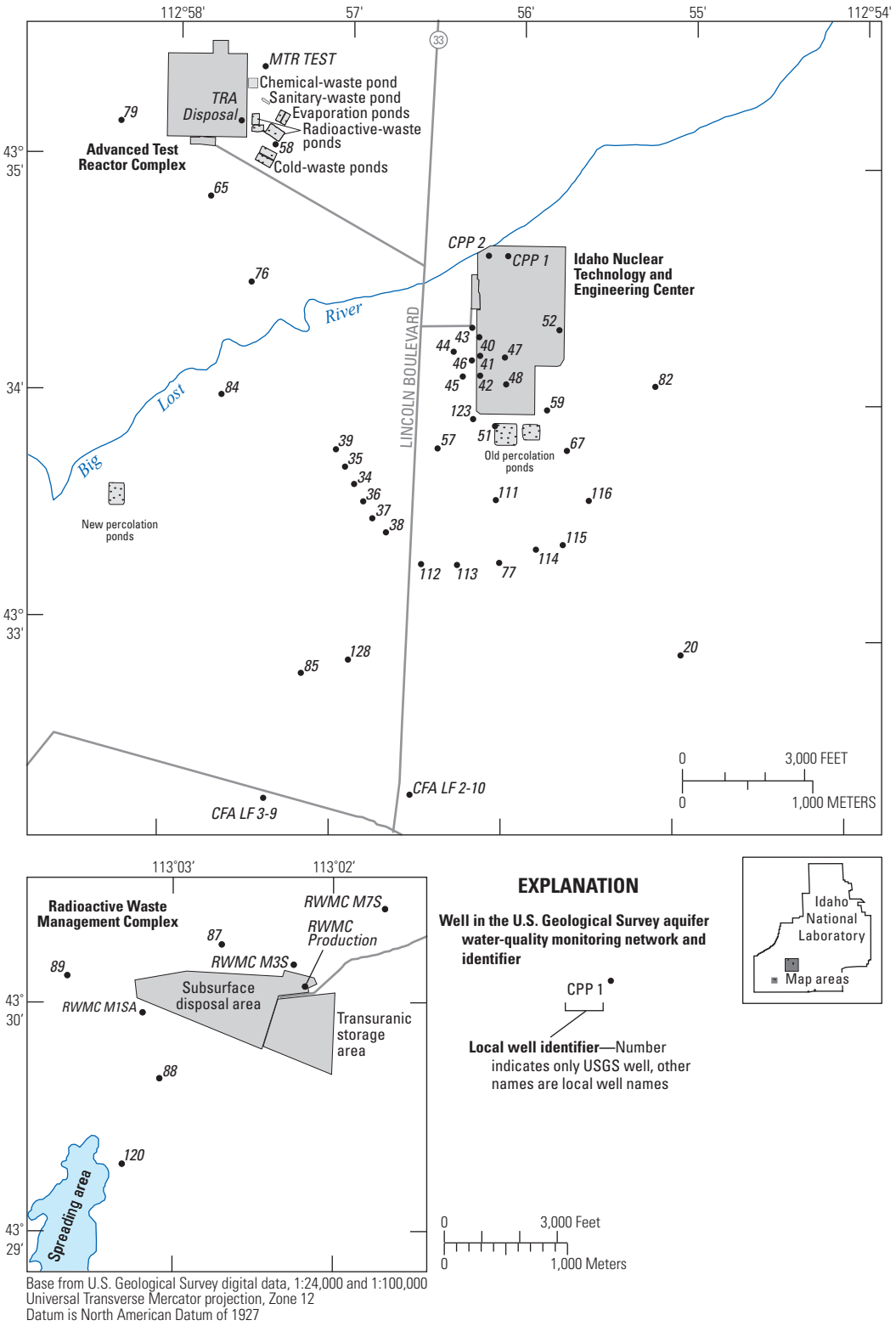


Figure 2. Locations of wells in the eastern Snake River Plain aquifer at and near the Idaho National Laboratory, Idaho.



Base from U.S. Geological Survey digital data, 1:24,000 and 1:100,000
Universal Transverse Mercator projection, Zone 12
Datum is North American Datum of 1927

Figure 3. Locations of wells in the eastern Snake River Plain aquifer at and near the Advanced Test Reactor Complex, the Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

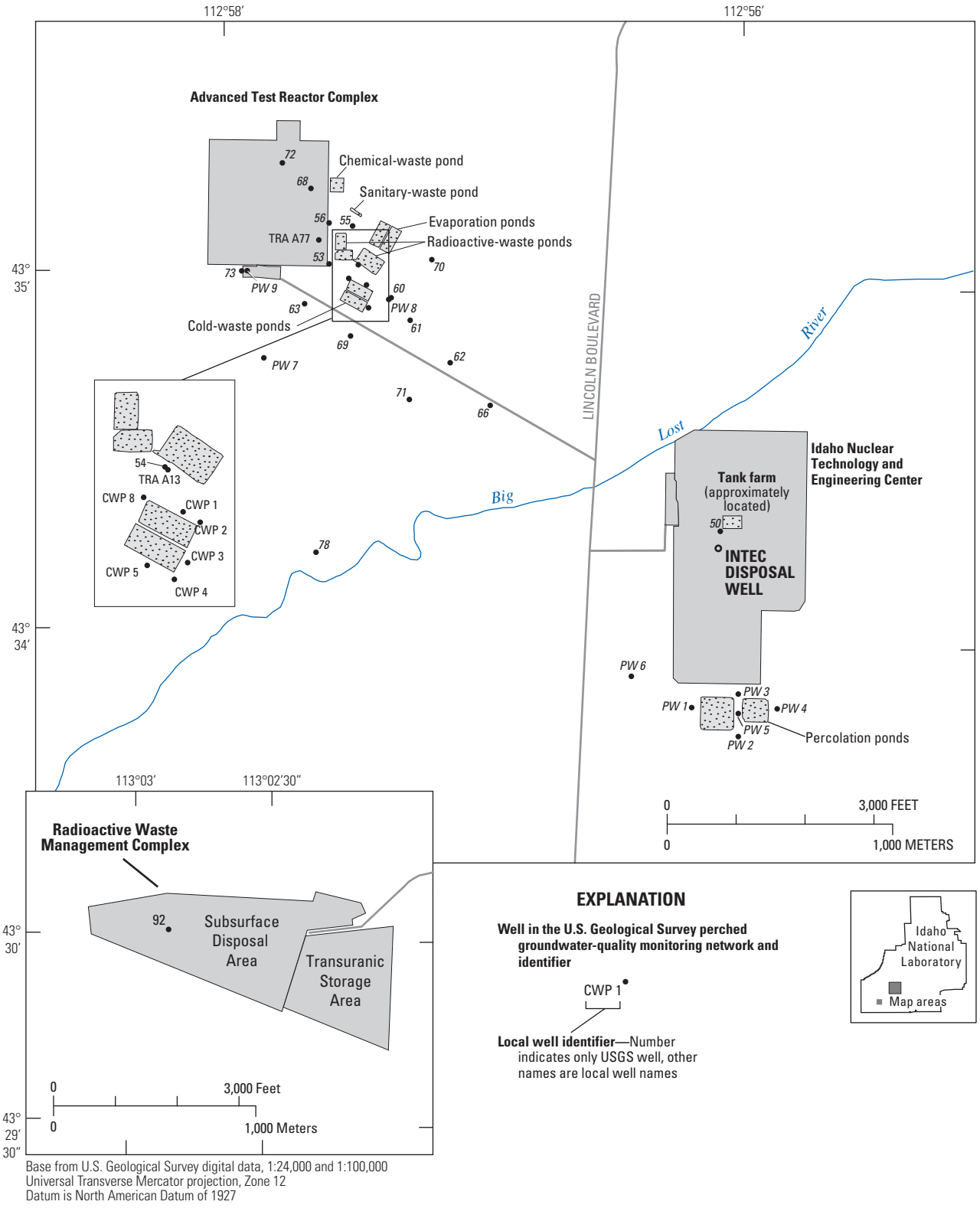


Figure 4. Locations of perched groundwater wells at and near the Advanced Test Reactor Complex, the Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

Water samples analyzed by the NWQL were placed in containers and preserved in accordance with laboratory requirements specified by Timme (1995) and Knobel and others (2008, appendix A). Containers and preservatives for samples collected since 1989 were supplied by the NWQL and were processed using a rigorous quality-control procedure (Pritt, 1989, p. 75) to minimize sample contamination. Water samples requiring filtration were filtered through disposable 0.45-µm plate filters or cartridge filters that were pre-rinsed depending on the sample protocol at the time of collection. Water samples analyzed by the RESL were placed in containers and preserved in accordance with laboratory requirements specified by Bodnar and Percival (1982), U.S. Department of Energy (1995), and Knobel and others (2008, appendix A).

Sample collection methods varied for several of the wells during the history of sampling. Permanent pumps were installed at various dates (table 2), with most installations occurring between 1985 and the early 1990s. Prior to installation of pumps, wells were sampled using a portable thief sampler. Some of the samples collected with thief samplers were collected at different depths in the aquifer during the same sampling period. When the depths at which thief samples were collected were known, the data from the depth similar to the depth setting of the current pump were used in the analyses. After pumps were installed, wells were purged for at least three well volumes prior to sample collection until October 2003, when procedures were changed to allow sample collection after one well volume was purged and readings were stable for water temperature, pH, and specific conductance. Studies by Bartholomay (1993) and Knobel (2006) indicated that different purge rates used at the INL did not affect the analytical results for the wells analyzed in the respective studies.

The methods used to preserve samples collected for nutrient analyses also changed over time. Until October 1994, samples collected for nutrients were analyzed at the NWQL and preserved with mercuric chloride and chilling. After October 1994, samples were preserved only by chilling. Bartholomay and Williams (1996) compared preservation methods, and their results indicated that data were comparable between the two methods.

Sample collection frequency varied for all sites used in this study. Since 2003, all sites have been sampled annually, but prior to that timeframe, wells were sampled annually, semi-annually, quarterly, or more frequently depending on the purpose of the sampling program. Some gaps in data occur when pumps were out for repair, samples were lost, or program changes did not call for sampling of the constituent in question.

Quality Assurance/Quality Control

Beginning in 1980, about 10 percent of water samples were collected for quality assurance (QA) purposes. Quality control (QC) water samples collected by the USGS INL Project Office generally include equipment blanks, splits, and replicates; however, other types of QC samples also have been collected throughout the history of the program. Comparative studies to determine agreement between analytical results for water-sample pairs by laboratories used by the INL Project Office QA program were summarized by Wegner (1989); Williams (1996, 1997); Rattray (2012); Davis and others, (2013); and Rattray (2014). Wegner (1989) also statistically compared analytical results among different laboratories used from 1980 to 1988. Analyses of water-sample pairs were in statistical agreement for more than 95 percent of the samples compared. Some outliers occurred; in cases where replicates were collected, data from the samples with the most reasonable result compared with the long-term trend were used in the trend analyses.

Guidelines for Interpretation of Analytical Results

Concentrations of radionuclides are reported with an estimated sample standard deviation, s, which is obtained by propagating sources of analytical uncertainty in measurements. McCurdy and others (2008) provided details on interpreting radiological data used by the USGS. The guidelines for interpreting analytical results are based on an extension of a method proposed by Currie (1984) and are given in Davis and others (2013). In this report, radionuclide concentrations of less than $3s$ are considered to be less than the "reporting level." The reporting level should not be confused with the analytical method detection limit, which is based on laboratory procedures.

Concentrations of inorganic and organic constituents are reported with reference to long term method detection levels (LT-MDL), LRL, and interim reporting levels (IRLs), or with reference to minimum reporting levels (MRLs). Childress and others (1999) provided details about the approach used by the USGS regarding detection and reporting levels. The USGS Office of Water Quality Technical Memorandum 2010.07 (U.S. Geological Survey, 2010) outlines changes to data reporting by the NWQL for inorganic and organic constituents. The primary change was that the reporting level for most inorganic constituents was set at the LT-MDL. The method detection limit is the minimum concentration of a substance that can be measured and reported with 99-percent confidence that the concentration is greater than zero. The LRL is the concentration at which the false negative error rate is minimized to be no more than 1 percent of the reported results. The MRL uses a censor-limit based reporting level below which no data are reported and is set at a concentration greater than the detection limit of the analyte. The LRL generally is equal to twice the yearly determined LT-MDL, which is a detection level derived by determining the standard deviation of a minimum of 24 MDL spike-sample measurements over an extended time. These reporting levels may be described as preliminary (IRL) for a developmental method if the levels have been based on a small number of analytical results.

Table 2. Site information for wells at and near the Idaho National Laboratory, Idaho.

[See figures 2 and 3 for well locations. **Local name:** Local well identifier used in this study. **Site identifier:** Unique numerical identifier used to access well data from the U.S. Geological Survey National Water Information System (http://waterdata.usgs.gov/nwis). **Pump installation date:** Date the first pump was installed in the well. **Abbreviations:** ft BLS, feet below land surface; NWQL, National Water Quality Laboratory; RESL, Radiological and Environmental Sciences Laboratory; NA, not applicable]

Sampling sites		Well depth (ft BLS)	Period of record		Pump installation date
Local name	Site identifier		NWQL chemical data	RESL radiochemical data	
Aquifer wells					
Idaho Nuclear Technology and Engineering Center					
CPP 1	433433112560201	586	1977–2012	1972–2012	12-07-1950
CPP 2	433432112560801	605	1981–2012	1972–2012	03-12-1951
RIFLE RANGE	433243112591101	620	1988–2012	1988–2012	06-29-1988
USGS 20	433253112545901	658	1968–2012	1966–2012	09-07-1990
USGS 34	433334112565501	700	1977–2012	1966–2012	08-14-1990
USGS 35	433339112565801	579	1977–2012	1972–2012	08-09-1990
USGS 36	433330112565201	567	1977–2012	1966–2012	08-14-1990
USGS 37	433326112564801	572	1971–2012	1966–2012	06-1993[1]
USGS 38	433322112564301	612	1977–2012	1966–2012	09-26-1990
USGS 39	433343112570001	493	1977–2012	1972–2012	08-09-1990
USGS 40	433411112561101	483	1977–2010	1972–2010	07-1980[1]
USGS 41	433409112561301	674	1977–2012	1972–2012	08-15-1990
USGS 42	433404112561301	678	1977–2012	1972–2012	08-15-1990
USGS 43	433415112561501	676	1977–2012	1972–2012	07-1980[1]
USGS 44	433409112562101	650	1977–2012	1967–2012	07-02-1990
USGS 45	433402112561801	651	1977–2012	1972–2012	07-26-1990
USGS 46	433407112561501	651	1977–2012	1972–2012	07-26-1990
USGS 47	433407112560301	652	1977–2012	1972–2012	10-1975[1]
USGS 48	433401112560301	750	1977–2012	1972–2012	08-08-1990
USGS 51	433350112560601	647	1960–2012	1972–2012	06-26-1987
USGS 52	433414112554201	602	1977–2012	1972–2012	06-24-1987
USGS 57	433344112562601	582	1971–2012	1972–2012	06-23-1987
USGS 59	433354112554701	657	1977–2012	1972–2012	06-24-1987
USGS 67	433344112554101	694	1977–2012	1972–2012	07-1980[1]
USGS 77	433315112560301	586	1968–2012	1966–2012	07-26-1990
USGS 82	433401112551001	693	1984–2012	1972–2012	06-25-1987
USGS 84	433356112574201	505	1984–2012	1972–2012	07-29-1992
USGS 85	433246112571201	614	1968–2012	1966–2012	08-23-1990
USGS 111	433331112560501	560	1986–2012	1985–2012	01-22-1985
USGS 112	433314112563001	563	1986–2012	1985–2012	01-26-1985
USGS 113	433314112561801	564	1986–2012	1985–2012	01-25-1985
USGS 114	433318112555001	560	1986–2012	1985–2012	01-24-1985
USGS 115	433320112554101	581	1986–2012	1985–2012	01-23-1985
USGS 116	433331112553201	572	1986–2012	1985–2012	01-30-1985
USGS 123	433352112561401	481	1991–2012	1991–2012	04-05-1994
USGS 128	433250112565601	615	2001–2012	2001–2012	08-19-2002
Advanced Test Reactor Complex					
MTR TEST	433520112572601	588	1984–2012	1972–2012	01-15-1986
TRA Disposal	433506112572301	1,267	1986–2012	1985–2012	02-04-1986
USGS 58	433500112572502	503	1977–2012	1962–2012	01-16-1986
USGS 65	433447112574501	498	1967–2012	1969–2012	10-05-1977
USGS 76	433425112573201	718	1981–2012	1972–2012	01-17-1986
USGS 79	433505112581901	702	1984–2012	1972–2012	08-23-1990

Table 2. Site information for wells at and near the Idaho National Laboratory, Idaho.—Continued

[See figures 2 and 3 for well locations. **Local name:** Local well identifier used in this study. **Site identifier:** Unique numerical identifier used to access well data from the U.S. Geological Survey National Water Information System (http://waterdata.usgs.gov/nwis). **Pump installation date:** Date the first pump was installed in the well. **Abbreviations:** ft BLS, feet below land surface; NWQL, National Water Quality Laboratory; RESL, Radiological and Environmental Sciences Laboratory; NA, not applicable]

Sampling sites		Well depth (ft BLS)	Period of record		Pump installation date
Local name	Site identifier		NWQL chemical data	RESL radiochemical data	
Aquifer wells—Continued					
Central Facilities Area					
CFA 1	433204112562001	639	1970–2012	1966–2012	07-1943[1]
CFA 2	433144112563501	681	1977–2012	1966–2012	01-18-1949
CFA LF 3-9	433216112571001	500	1993–2007	1993–2007	07-1994[1]
CFA LF 2-10	433216112563301	716	1993–2012	1993–2012	06-26-1991
USGS 127	433058112572201	596	2000–2012	2000–2012	09-12-2000
Radioactive Waste Management Complex					
RWMC M1SA	432956113030901	638	1993–2012	1993–2012	08-27-1992
RWMC M3S	433008113021801	633	1993–2012	1993–2012	09-04-1992
RWMC M7S	433023113014801	628	1993–2012	1993–2012	09-01-1992
RWMC M11S	433058113010401	624	2000–2012	2000–2012	1998[1]
RWMC M12S	433118112593401	572	2000–2012	2000–2012	1998[1]
RWMC M13S	433037113002701	643	2000–2012	2000–2012	1998[1]
RWMC M14S	433052113025001	635	2000–2012	2000–2012	1998[1]
RWMC Production	433002113021701	685	1981–2012	1977–2012	11-25-1974
USGS 87	433013113024201	673	1977–2012	1972–2012	10-1974[1]
USGS 88	432940113030201	662	1981–2011	1972–2011	10-1974[1]
USGS 89	433005113032801	637	1981–2012	1972–2012	07-1975[1]
USGS 120	432919113031501	705	1987–2012	1987–2012	11-12-1987
South of facilities					
USGS 104	432856112560801	700	1984–2012	1980–2012	01-27-1986
USGS 105	432703113001801	1,290	1981–2007	1980–2007	11-1983[1]
USGS 106	432959112593101	760	1981–2012	1980–2012	01-13-1981
USGS 108	432659112582601	1,192	1984–2008	1980–2008	11-1983[1]
USGS 124	432307112583101	800	1994–2012	1994–2012	04-1994[1]
Perched groundwater wells					
Idaho Nuclear Technology and Engineering Center					
PW 1	433349112560701	117	1989–2002	1987–2002	NA
PW 2	433344112555601	131	1989–2002	1987–2002	NA
PW 3	433351112555701	123	1989–2002	1987–2002	NA
PW 4	433348112554901	150	1989–2007	1987–2006	06-15-1992
PW 5	433348112555701	129	1989–2002	1987–2002	09-28-1993
PW 6	433353112562201	125	1989–2000	1987–2000	NA
USGS 50	433419112560201	405	1977–2008	1967–2008	12-1994[1]
Advanced Test Reactor Complex					
CWP 1	433459112572601	58	1989–2012	1982–2012	NA
CWP 2	433458112572401	50	1989–2001	1983–2001	NA
CWP 3	433455112572501	55	1989–2012	1982–2012	NA
CWP 4	433454112572601	61	1989–2010	1982–2010	NA
CWP 5	433455112572901	52	1989–2001	1982–2001	NA
CWP 8	433500112573001	64	1989–2012	1982–2012	NA
PW 7	433446112574602	237	1987–1994	NA	NA
PW 8	433456112572001	166	1989–2012	1987–2012	06-15-1992
PW 9	433500112575401	200	1987–2012	1987–2012	06-15-1992

Table 2. Site information for wells at and near the Idaho National Laboratory, Idaho.—Continued

[See figures 2 and 3 for well locations. **Local name:** Local well identifier used in this study. **Site identifier:** Unique numerical identifier used to access well data from the U.S. Geological Survey National Water Information System (http://waterdata.usgs.gov/nwis). **Pump installation date:** Date the first pump was installed in the well. **Abbreviations:** ft BLS, feet below land surface; NWQL, National Water Quality Laboratory; RESL, Radiological and Environmental Sciences Laboratory; NA, not applicable]

Sampling sites		Well depth (ft BLS)	Period of record		Pump installation date
Local name	Site identifier		NWQL chemical data	RESL radiochemical data	
Perched groundwater wells—Continued					
Advanced Test Reactor Complex—Continued					
TRA A13	433502112572802	59	1989–2001	1972–2001	NA
TRA A77	433507112573801	34	1989–1997	1972–1997	NA
USGS 53	433503112573401	71	1981–2012	1968–2012	08-08-1990
USGS 54	433503112572801	82	1981–2012	1962–2012	10-12-1993
USGS 55	433508112573001	81	1981–2012	1962–2012	09-23-1993
USGS 56	433509112573501	80	1981–2012	1962–2012	09-28-1993
USGS 60	433456112571901	117	1984–2011	1966–2011	06-15-1992
USGS 61	433453112571601	123	1986–2012	1966–2012	06-16-1992
USGS 62	433446112570701	165	1984–2012	1962–2012	06-17-1992
USGS 63	433455112574001	97	1986–2012	1962–2012	06-16-1992
USGS 66	433436112564801	475	1989–2012	1966–2012	NA
USGS 68	433516112573901	128	1962–2012	1972–2012	06-16-1992
USGS 69	433450112573001	115	1986–2012	1967–2012	06-16-1992
USGS 70	433504112571001	100	1981–2012	1962–2012	06-17-1992
USGS 71	433439112571501	171	1987–2012	1962–2012	06-17-1992
USGS 72	433519112574601	200	1989–2012	1974–2012	09-23-1993
USGS 73	433502112575401	127	1986–2012	1962–2012	2003[1]
USGS 78	433413112573501	204	1986–2012	1972–2012	NA
Radioactive Waste Management Complex					
USGS 92	433000113025301	214	1972–2012	1972–2012	NA

[1]Estimated date based on month or year of initial installation.

These levels also may vary from sample to sample for the same constituent and the same method, if matrix effects or other factors arise that interfere with the analysis. Concentrations measured between the LT-MDL and the LRL may be described as estimated values and are considered "qualitatively detected analytes" (Childress and others, 1999, p. 7). For most of the constituents in this report, concentrations generally are greater than the LT-MDLs, LRLs, or MRLs; however, some concentrations are reported as less than the LT-MDL or LRL and some concentrations are estimated.

Statistical Data Analysis Methods

Water-quality data collected for the monitoring program were analyzed using the summary statistics of mean, median, minimum, maximum, and standard deviation. The data were processed using custom computer scripts developed in the R programming language (R Development Core Team, 2014). All R functions written for this report are stored in an R-package called "Trends" (Fisher and Davis, 2014); function documentation and processing instructions for this package are given in appendix A. R-package installation instructions are located at https://github.com/jfisher-usgs/Trends/blob/master/README.md.

In addition to the base packages included with R, Trends depends on the "Survival" package (Therneau and Grambsch, 2000; Therneau, 2014), a contributed package available on the Comprehensive R Archive Network. The Trends package identifies statistical trends in water-quality data for multiple constituents and sample sites using a parametric survival regression model for left-censored data (values reported as less than a LRL), interval-censored data (data with an associated uncertainty), and uncensored data. This package also calculates summary statistics for multiple constituents and automates plotting of data and regression lines. A measured value is converted to censored data under the following conditions: (1) the measured value is less than the reporting level and is represented as left-censored data; or (2) there is a standard deviation and detection limit associated with the measured value; therefore, it is represented as interval-censored data. The upper and lower bounds of interval-censored data are calculated by adding and subtracting

three standard deviations to or from the measured value, respectively. Note that interval-censored data with a lower or upper bound less than the detection level is represented as left-censored data. For left-censored data, the upper bound is set to the detection level when its magnitude is less than the detection level. For datasets with estimated (E) concentrations, the E-value was treated the same as a concentration for an uncensored value.

Data were analyzed using the "RunAnalysis" function in the Trends package (appendix A), which uses the "survreg" function provided in the survival package. The survreg function uses methods to manage statistics for left-censored, interval-censored, and uncensored environmental data. The survreg function was used to fit a parametric survival regression model to the censored and uncensored data. The specific class of survival model is known as the accelerated failure time (AFT) model. A maximum-likelihood estimation (MLE) method is used to estimate parameters in the AFT model. The MLE is solved by maximizing the log-likelihood using the Newton-Raphson method, an iterative root-finding algorithm. The likelihood function is dependent on the distribution of the measured data. Data were assumed to follow a log-normal distribution because most of the variables have values spanning two or more orders of magnitude. If all observations are uncensored, the survival regression becomes identical to ordinary least squares regression. Summary statistics were not calculated for constituents when all concentrations were less than the reporting level.

The null hypothesis of the trend test was that the slope (the coefficient relating time and concentration) was zero; the alternate hypothesis was that the slope was not zero. A significance level of 0.05 was selected to determine if the slope was statistically significant. A two-sided *p*-value that was less than or equal to 0.05 indicated that there was a statistically significant slope, and the null hypothesis was rejected. The *p*-value is the linear trend over time for each dataset run. The sign of the slope indicated if there was an increasing or decreasing trend. If *p*-values were greater than 0.05, the slope was not statistically significant, and the null hypothesis was accepted. In some cases, the regression model could not determine if a trend was present because the AFT model failed to reach convergence after 100 iterations; no trend was assumed present when this occurred.

For selected datasets, water level, seasonal variability in sampling, and water level and seasonal variability were used as explanatory variables in the survival regression model. Results for *p*-values for comparison are given in table 3, and the description of the analyses is given in the Trends package in appendix A.

Table 3. Comparison of trend analyses for selected wells using additional explanatory variables, included as covariates to the trend model, Idaho National Laboratory, Idaho.

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Trend**: +, increasing; –, decreasing. *p* value is for linear trend over time. **Reg:** *p* values for temporal trend analyses done for this study. **WL:** *p* values for trend with residual water level as an additional explanatory variable. **Seasonal:** *p* values for trends with seasonality as an additional explanatory variable. **WL and seasonal:** *p* values for trend with both residual water levels and seasonality as additional explanatory variables]

Local name	Reg	Trend	WL	Trend	Seasonal	Trend	WL and seasonal	Trend
				Chloride				
USGS 35	0.000	–	0.000	–	0.000	–	0.000	–
USGS 39	0.128	none	0.481	none	0.076	none	0.674	none
USGS 114	0.000	+	0.000	+	0.000	+	0.000	+
USGS 87	0.000	+	0.000	+	0.000	+	0.000	+
PW 8	0.089	none	0.124	none	0.051	none	0.061	none
				Sulfate				
USGS 35	0.000	+	0.019	+	0.000	+	0.019	+
USGS 39	0.000	+	0.049	+	0.000	+	0.085	none
USGS 114	0.177	none	0.180	none	0.244	none	0.262	none
USGS 87	0.546	none	0.368	none	0.684	none	0.616	none
PW 8	0.049	–	0.009	–	0.003	–	0.001	–
				Sodium				
USGS 35	0.002	–	0.000	–	0.014	–	0.004	–
USGS 39	0.026	+	0.030	+	0.033	+	0.070	none
USGS 114	0.173	none	0.162	none	0.190	none	0.194	none
USGS 87	0.000	+	0.000	+	0.000	+	0.000	+
PW 8	0.420	none	0.619	none	0.461	none	0.696	none

Water-Quality Characteristics and Trends

Concentrations of constituents reported during this study represent water samples collected at different time intervals, starting in 1981 when known detection levels were used for radiochemical analyses, and continuing through 2012. Data used for selected plots of trend analyses (appendixes B–E) included all data identified as being reported by the NWQL or RESL that was in the NWIS database as of December 2013, except for some data that were identified as coming from special INL studies or data collected from different depths in the aquifer using a thief sampler. Wells were completed at various depths in the aquifer and with different well completions (for example, single and multiple screened intervals and open boreholes). Data included in NWIS but analyzed by different or unknown laboratories were not used. Data analyzed by the NWQL are routinely uploaded to the NWIS database; however, data from RESL were manually entered from paper copies until 2009. Trends were initially analyzed for entire datasets, but analyses of some wells seemed to indicate that pump installation created a change in the concentrations of some constituents (Bartholomay and others, 2012). Therefore, trends were determined for the period of record from some time after a pump was installed and all samples were analyzed by the NWQL (for non-radiochemical data). Some well pumps were installed for the entire period of record, but trends were analyzed only for data collected from between 1987 and 1989 (depending on the constituents) to 2012 for those wells because some of the earlier data appeared suspect or samples were analyzed by different laboratories with undocumented methods. Between 1987 and 1989, the USGS INL Project Office began using the NWQL for all organic and inorganic chemical analyses, and an established quality-assurance program was used to test sample variability and reproducibility. Trends for tritium and strontium-90 concentration data were analyzed for samples collected from 1981 to 2012 because samples collected prior to 1981 had unknown detection levels. The trends described in this report were based on statistical methods previously described in the statistical methods section of this report. For some datasets, the slope of the line or the visual appearance of the graphed data based on scale make it appear like there is a trend, when statistically, there is no trend.

Physical properties of water measured during sampling events included specific conductance, water temperature, and pH. Samples collected from wells included in this study were analyzed for some combination of the radiochemical and chemical constituents tritium, strontium-90, cesium-137, plutonium-238, plutonium-239, -240 (undivided), americium-241, gross alpha- and beta-particle radioactivity, sodium, chloride, fluoride, sulfate, nitrate (as N), orthophosphate (as P), chromium and other trace elements, TOC, and VOCs. Other constituents have been sampled at some of the wells, but data were not used because concentrations were either less than the reporting levels (in the case of some VOCs) or because data were insufficient to determine a statistically significant trend.

pH, Specific Conductance, and Temperature

Field measurements of pH, specific conductance, and water temperature were made in all 64 aquifer wells and 35 perched groundwater wells used for this study (figs. 2, 3, and 4). Summary statistics for the field measurements for 1989–2012 are given in table 4 (at back of report). Analyses for pH, specific conductance, and water temperature for the datasets are shown in appendix B.

Analyses of trends for pH indicate that many sites have statistically significant decreasing trends (table 4, appendix B). Of the 64 aquifer wells measured for pH, 43 of the wells showed a decreasing trend, 1 well showed an increasing trend, and 20 wells showed no trend. Of the 35 perched groundwater wells measured, 12 showed a decreasing pH trend, 3 showed an increasing trend, and 20 had no trend.

The pH is an indicator of hydrogen ion activity and is collected to understand the acid-base properties of water. Factors that may affect the precision of pH readings include careful attention to the electrode maintenance, buffer solutions, temperature corrections, instrument electronics, use of different meter brands, and collection methods. Because of variability in each of these factors throughout the history of sample collection, it is difficult to determine specifically whether the noted trends in pH are actually attributable to changing aquifer conditions or other factors.

Specific conductance is a measure of the electrical conductivity of water and is proportional to the quantities of dissolved chemical constituents in the water so trends in this measurement should be similar to the trends for chloride, sodium, and sulfate concentrations.

Trend analyses of specific conductance from 1989 to 2012 are shown in appendix B. The aerial distribution of trends in specific conductance for aquifer and perched groundwater wells sampled from 1989 to 2012 are shown in figures 5, 6, and 7. For the 64 aquifer wells (figs. 5 and 6, table 4) that were measured for specific conductance, 34 had a decreasing trend, 14 had an increasing trend, and 16 had no trend. Most of the wells that showed decreasing or no trend are near the INTEC. The decreasing trends may be a response to decreased wastewater disposal since 1989 or discontinued use of the percolation ponds south of the INTEC in 2002. Most aquifer wells that showed an increasing trend are south and southeast of the INTEC, or north of the RWMC. Increasing trends for these wells may be the result of longer groundwater travel times required for the wastewater plume to reach these wells.

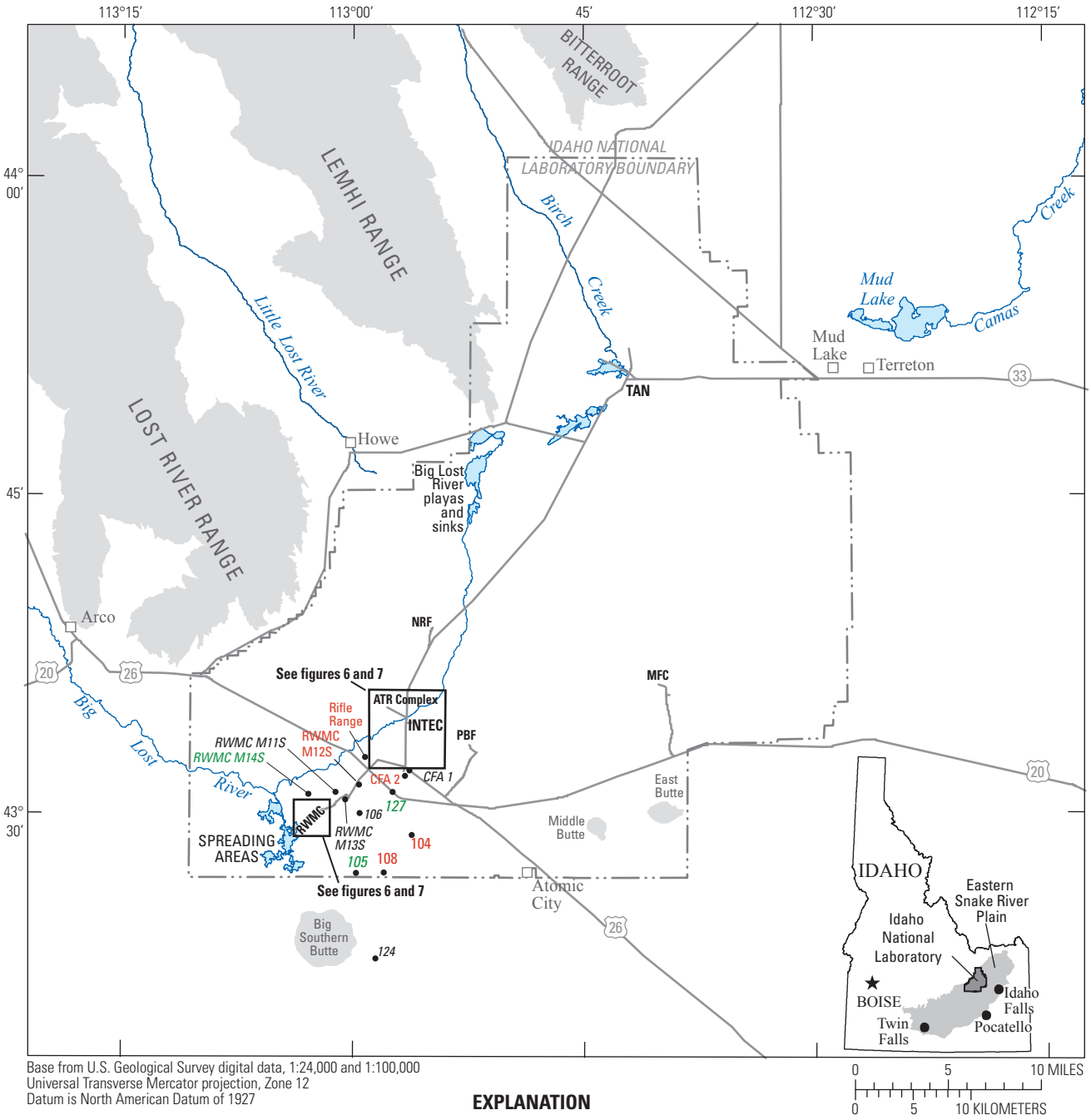
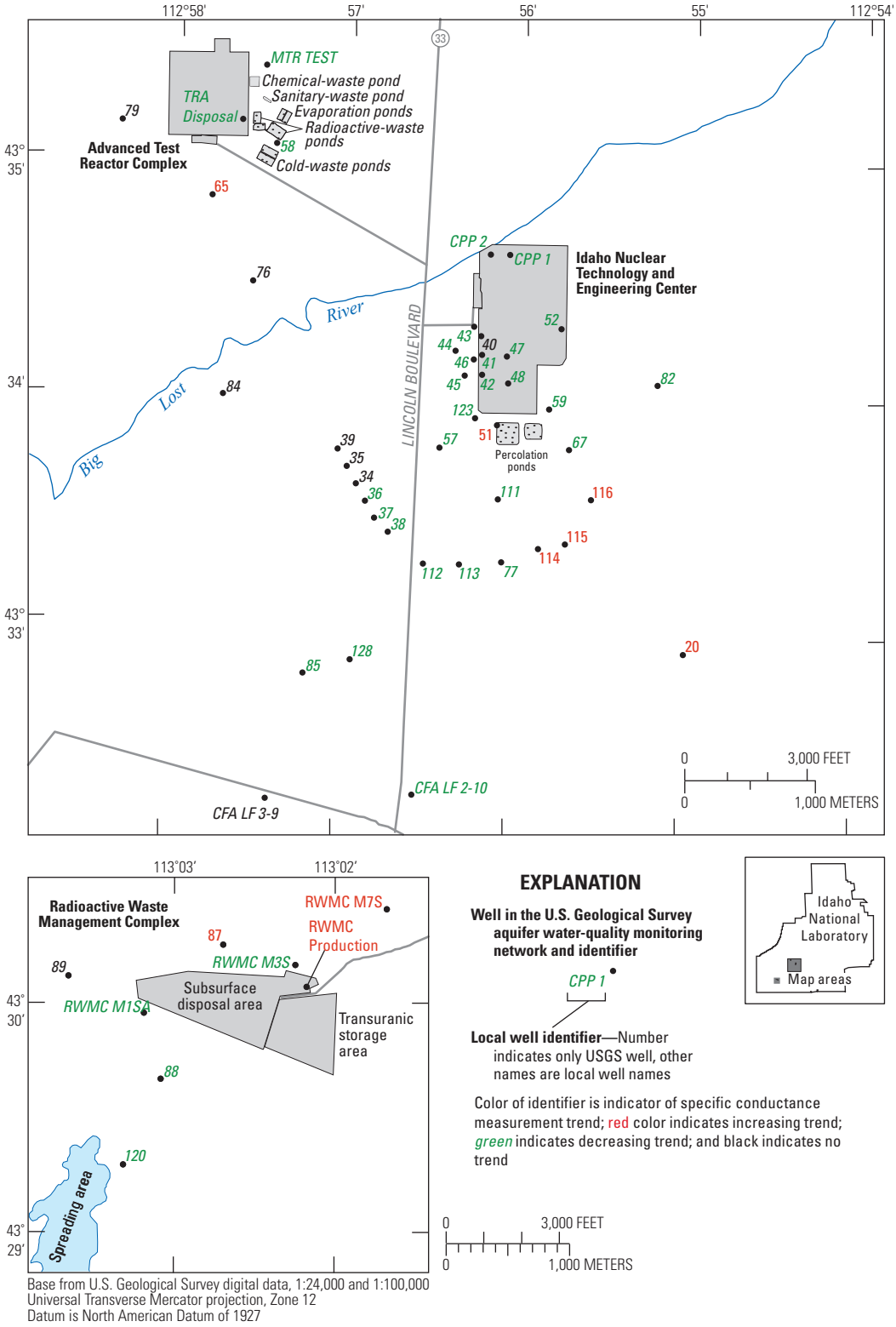


Figure 5. Areal distribution of specific conductance trends in water from selected aquifer wells at and near the Idaho National Laboratory, Idaho.



Base from U.S. Geological Survey digital data, 1:24,000 and 1:100,000
Universal Transverse Mercator projection, Zone 12
Datum is North American Datum of 1927

Figure 6. Areal distribution of specific conductance trends in water from selected aquifer wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

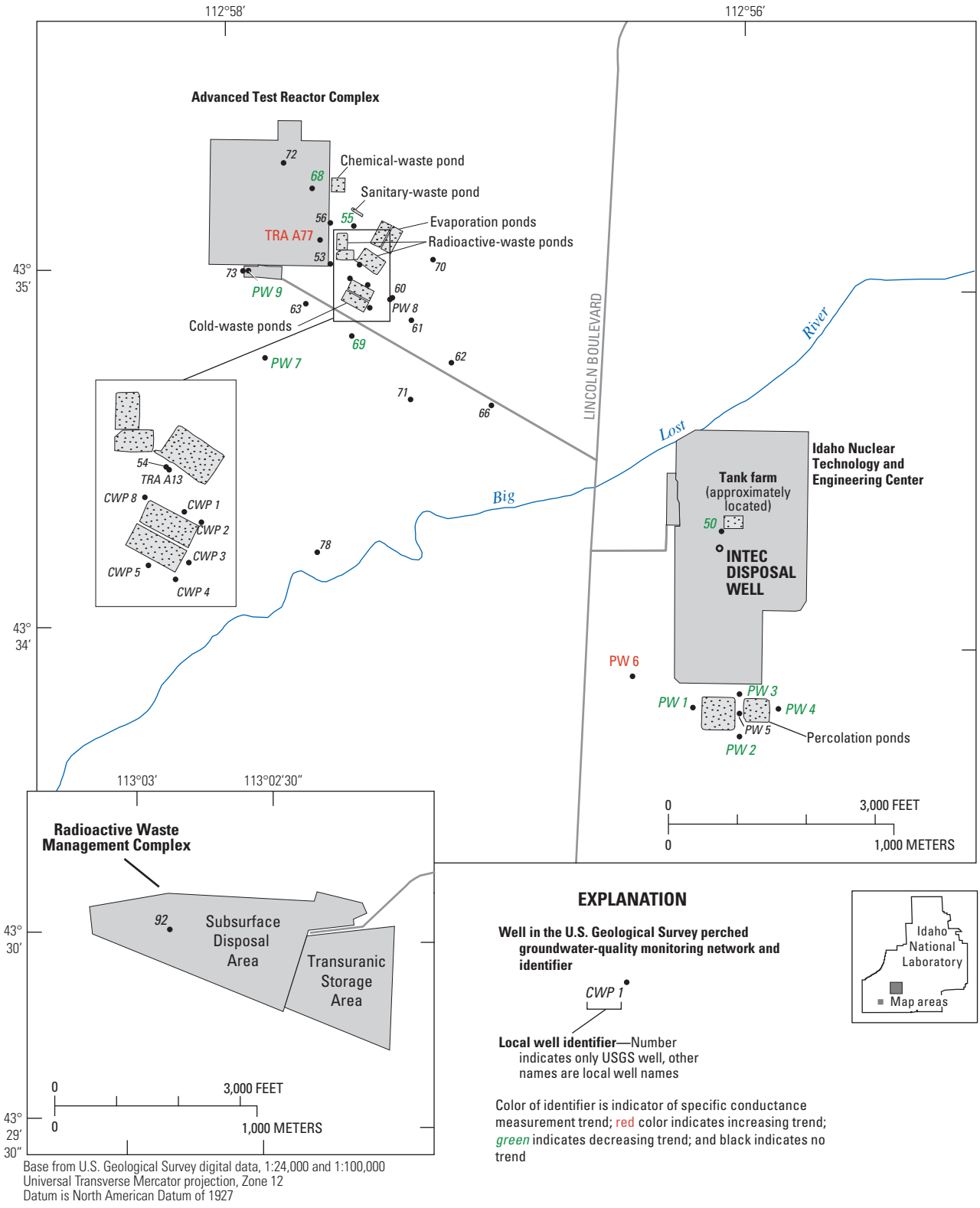


Figure 7. Areal distribution of specific conductance trends in water from selected perched groundwater wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, the Idaho National Laboratory, Idaho.

Most trends of specific conductance in perched groundwater wells near the INTEC and the ATR Complex were either decreasing or showed no trend (fig. 7, table 4). Only one well at each facility (TRA A77 at the ATR Complex, and PW 6 at the INTEC) had an increasing trend. At the INTEC, the decreasing trend could be attributed to decreased wastewater disposal or discontinued use of the percolation ponds. At the ATR complex, the decrease could be due to closure of the chemical-waste pond (fig. 7) in 1999.

For the 64 aquifer wells measured for statistically significant trends in water temperature, 32 showed a decreasing trend, 3 showed an increasing trend, and 29 showed no trend (figs. 8 and 9). Most wells around INTEC showed a decreasing trend, the cause of which is not certain, although changes could be related to the method of measurement and not to actual changes in the temperature of the aquifer for some of the wells. For example, temperature measurements made prior to 2003 were measured using a sample cup with a mercury thermometer, whereas recently, temperature was measured using a flow-through chamber with a digital thermometer. Of the 35 perched groundwater wells measured for temperature, 13 had a decreasing trend, 5 showed an increasing trend, and 17 showed no trend. All the perched groundwater wells that showed an increasing or decreasing trend were near the ATR Complex (fig. 10), but no pattern of trend is evident for a specific location.

Tritium

Tritium is a radioactive isotope of hydrogen that is formed in nature by interactions of cosmic rays with gases in the upper atmosphere (Orr and others, 1991). Tritium also is produced in thermonuclear detonations, and it has been discharged in wastewater at several facilities at the INL from the early 1950s to the present. Tritium has a half-life of 12.3 years (Walker and others, 1989, p. 20). Samples were routinely collected and analyzed for tritium from 63 aquifer wells and 33 perched groundwater wells.

Of the 63 aquifer wells that were analyzed for tritium trends, 45 showed decreasing trends, 1 showed an increasing trend, and 17 showed no trends (figs. 11 and 12) (table 5, at back of report). Of the 33 perched groundwater wells that were analyzed for trends, 22 showed a decreasing trend, and 11 showed no trend (fig. 13). The decreasing trends can be attributed to decreased disposal at facilities, and to the radioactive decay of tritium. A lack of trend is evident around the RWMC area (fig. 12). This may be an indication that leakage from buried waste is still contributing tritium to groundwater in this area and maintaining the concentration at a higher level than would be expected from radioactive decay. Some wells in RWMC area show no trend because concentrations in those wells always have been less than the reporting level.

Strontium-90

Strontium-90 is a fission product of nuclear weapons tests that is present in wastewater discharged at several facilities at the INL (Davis, 2010). Strontium-90 has a half-life of 29.1 years (Walker and others, 1989, p. 29). Water samples have been routinely collected and analyzed for strontium-90 from 52 aquifer wells and 32 perched groundwater wells.

Of the 52 aquifer wells analyzed for trends, 20 showed a decreasing strontium-90 trend and 32 showed no trend (figs. 14 and 15, table 5). Of the 32 perched groundwater wells that were analyzed for trends, 11 showed a decreasing trend, 2 showed an increasing trend, and 19 showed no trend (fig. 16, table 5). The decreasing trends are generally attributed to lack of recent disposal and to radioactive decay. Wells with no trend generally had concentrations less than the reporting level (tables 5 and 6, at back of report). The two perched groundwater wells that showed an increasing trend (TRA A77 and USGS 55) are near the radioactive-waste infiltration ponds at the ATR complex (fig. 16), and could be influenced by strontium-90 that was discharged to those ponds before they were replaced by lined evaporation ponds in 1993. The strontium-90 concentrations detected in these two perched groundwater wells also could be attributed to exchange reactions whereby strontium-90 sorbed to sediment is remobilized into solution in the unsaturated zone beneath the radioactive-waste infiltration ponds.

Cesium-137

The radionuclide cesium-137 is a product of nuclear weapons tests and is present in wastewater discharged at several facilities at the INL. Cesium-137 has a half-life of 30.17 years (Walker and others, 1989). The number of samples collected and the number of samples with concentrations greater than the reporting level are shown in table 6. Because concentrations for most samples were less than the reporting level (table 6), no trend analyses were done.

Plutonium

In 1974, the USGS began monitoring for plutonium-238 and plutonium-239, -240 (undivided) in water from selected wells near TAN, INTEC, and RWMC, because of waste disposal practices. The half-lives of plutonium-238, plutonium-239, and plutonium-240 are 87.7, 24,100, and 6,560 years, respectively (Walker and others, 1989, p. 46). The number of samples collected and the number of samples with concentrations greater than the reporting level are shown in table 6. Because plutonium-238 and plutonium-239, -240 (undivided) concentrations were less than the reporting levels for most samples, no trend analyses were done.

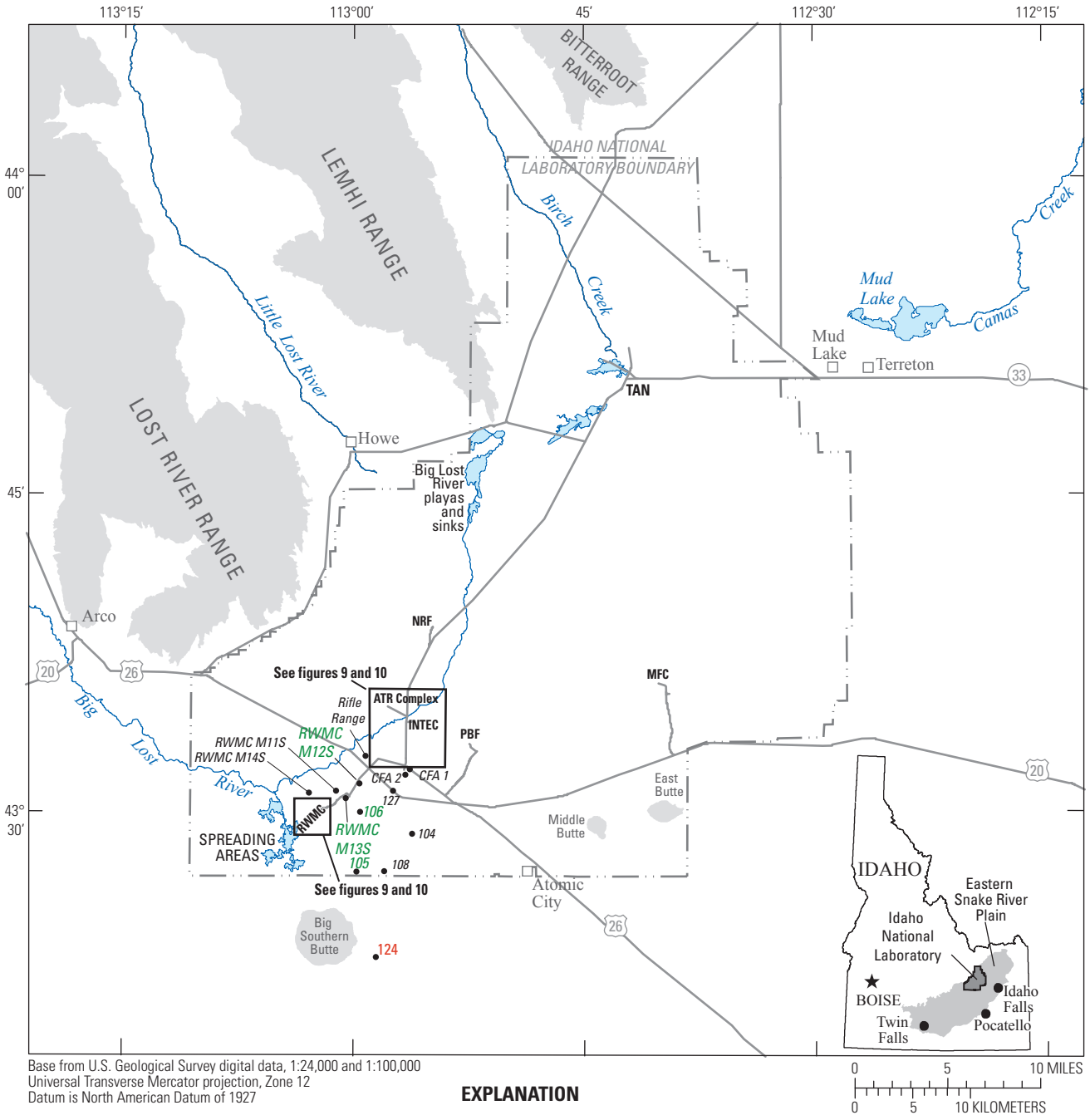


Figure 8. Areal distribution of temperature trends in water from selected aquifer wells at and near the Idaho National Laboratory, Idaho.

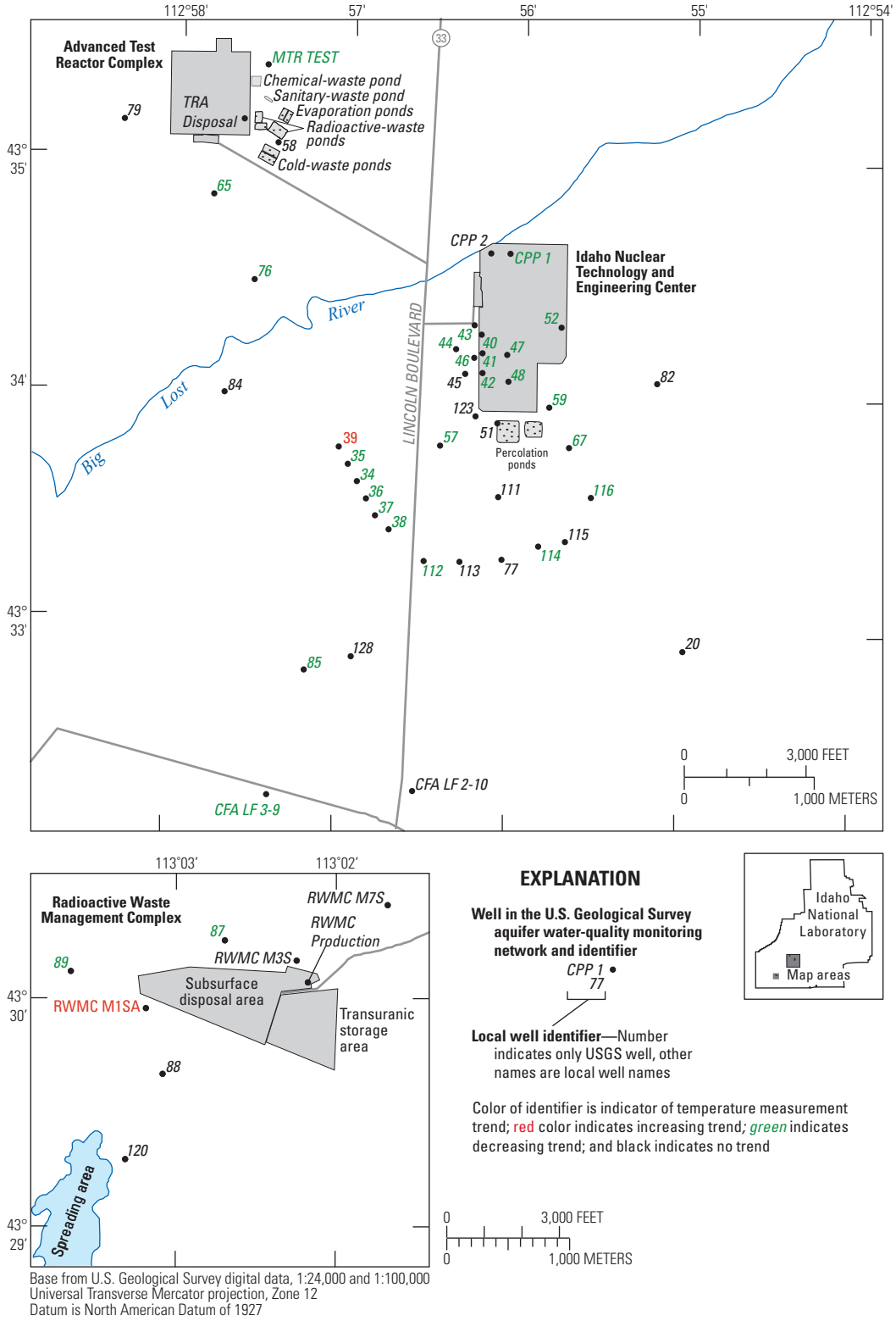


Figure 9. Areal distribution of temperature trends in water from selected aquifer wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

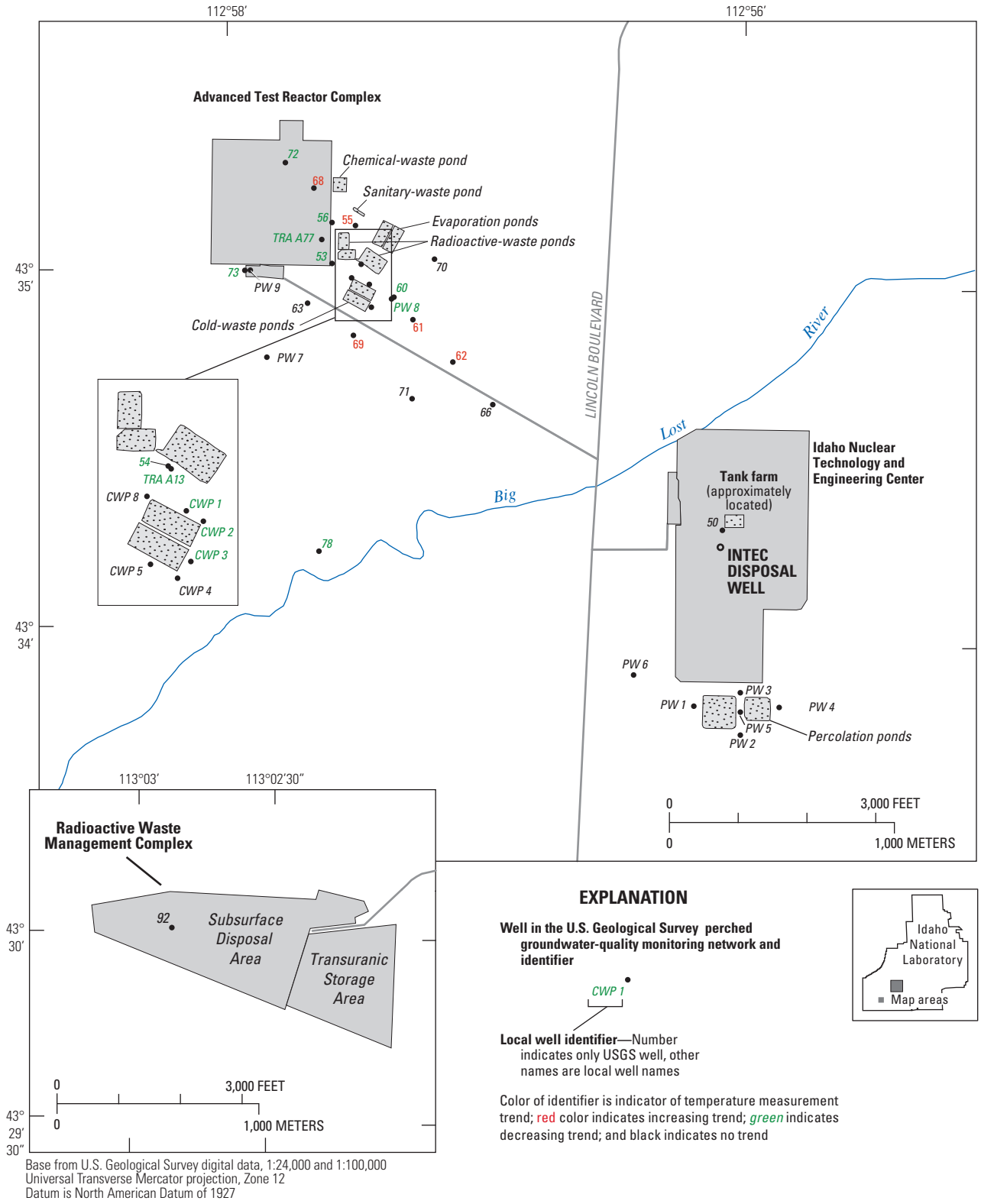


Figure 10. Areal distribution of temperature trends in water from selected perched groundwater wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

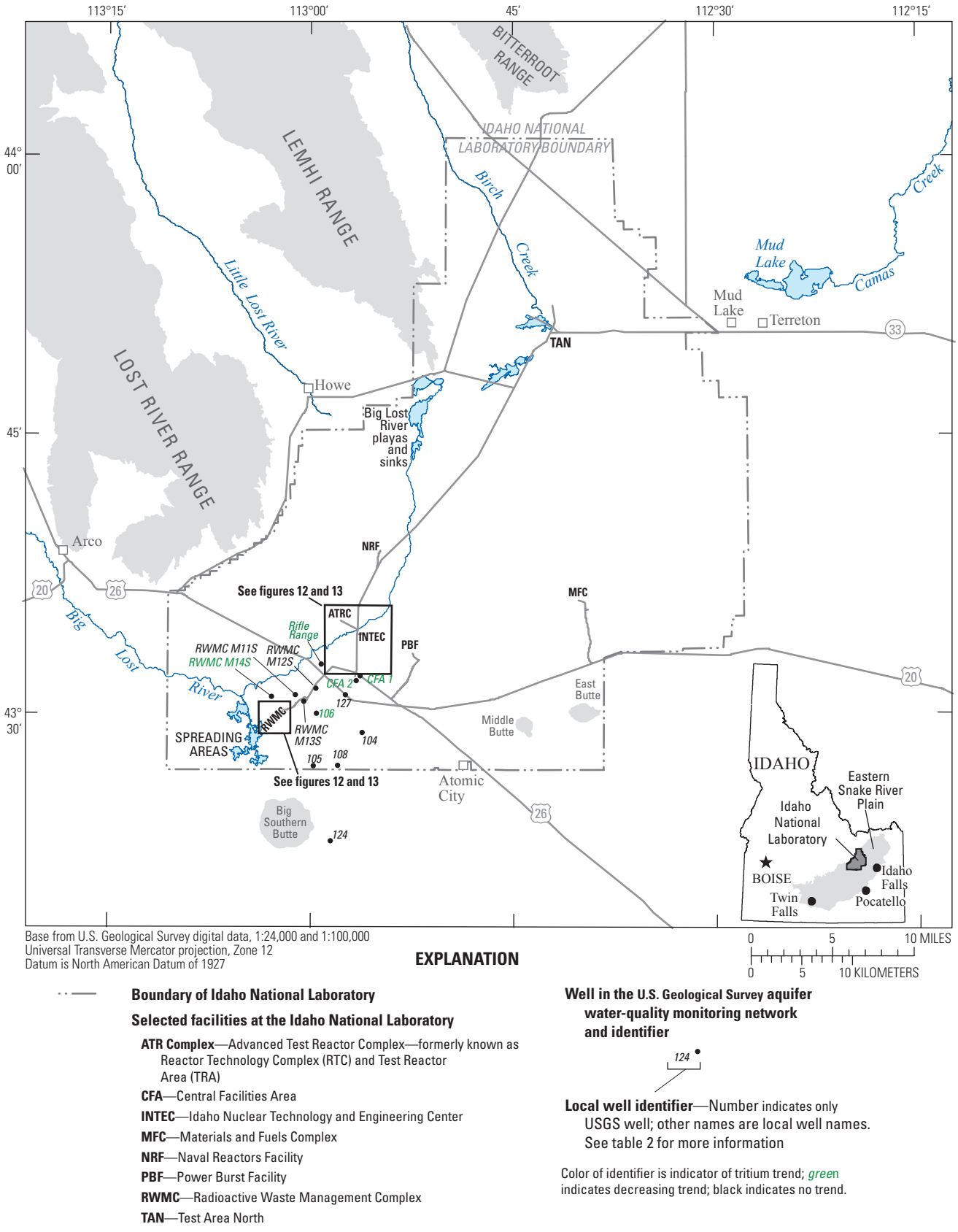


Figure 11. Areal distribution of tritium trends in water from selected aquifer wells at and near the Idaho National Laboratory, Idaho.

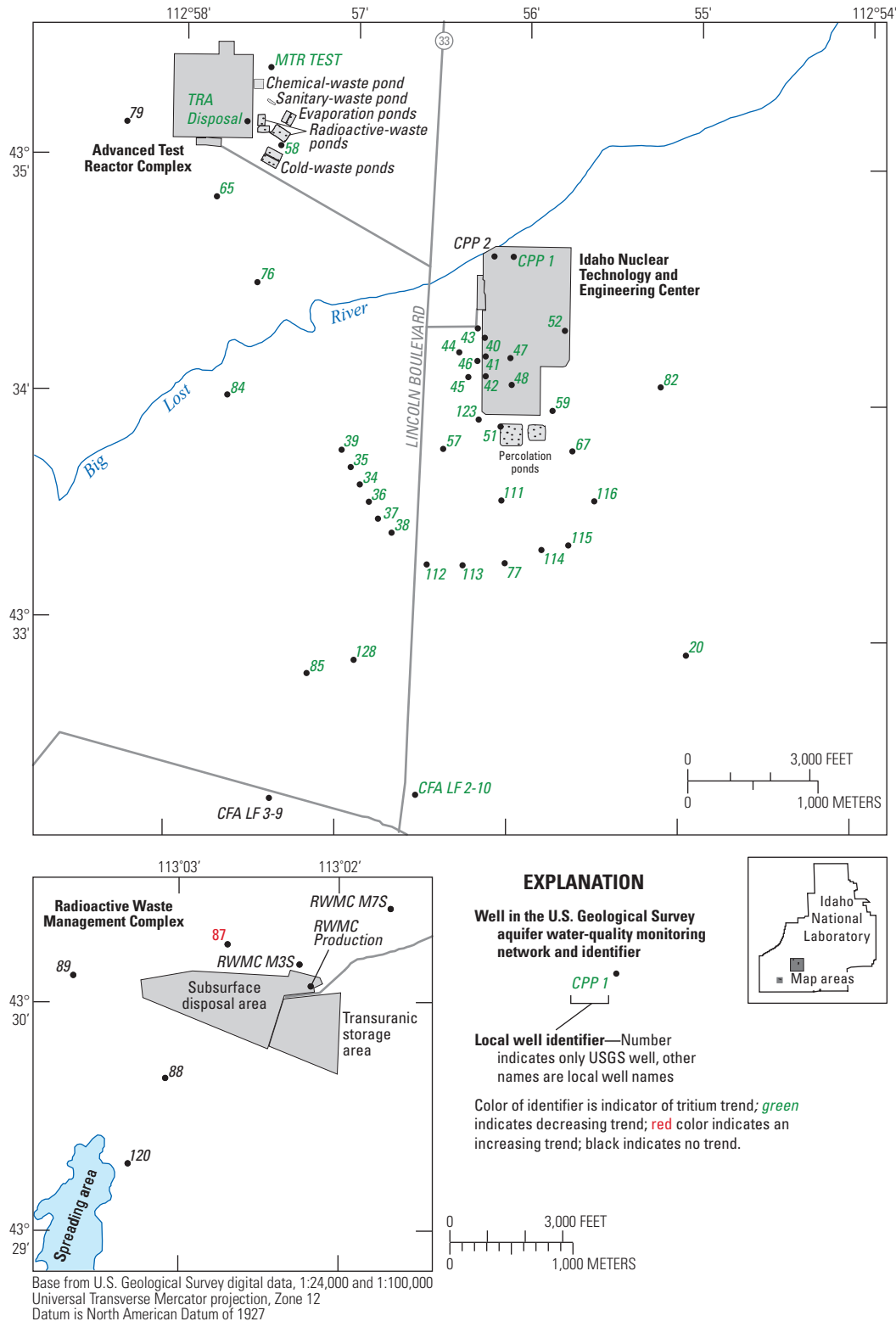


Figure 12. Areal distribution of tritium trends in water from selected aquifer wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

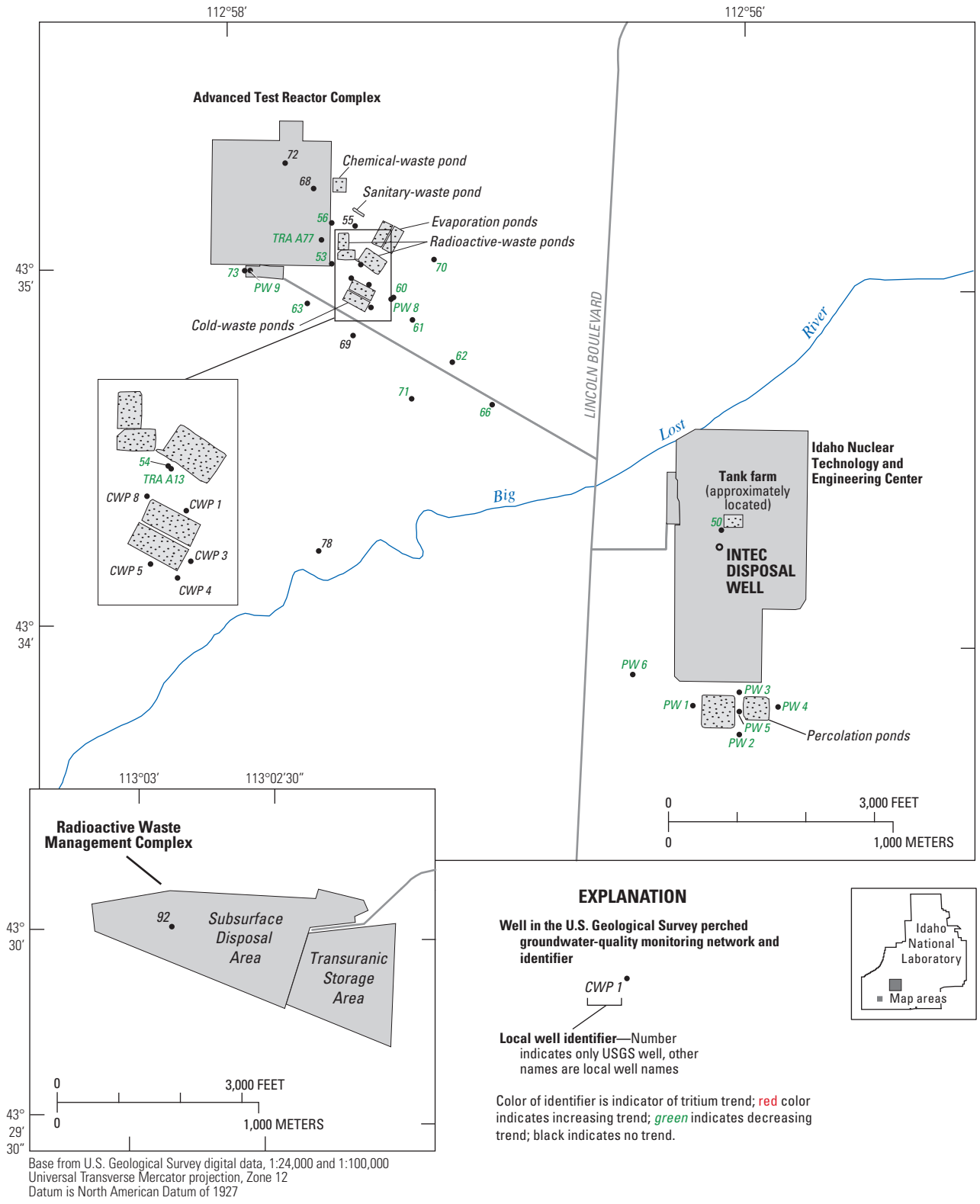


Figure 13. Areal distribution of tritium trends in water from selected perched groundwater wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

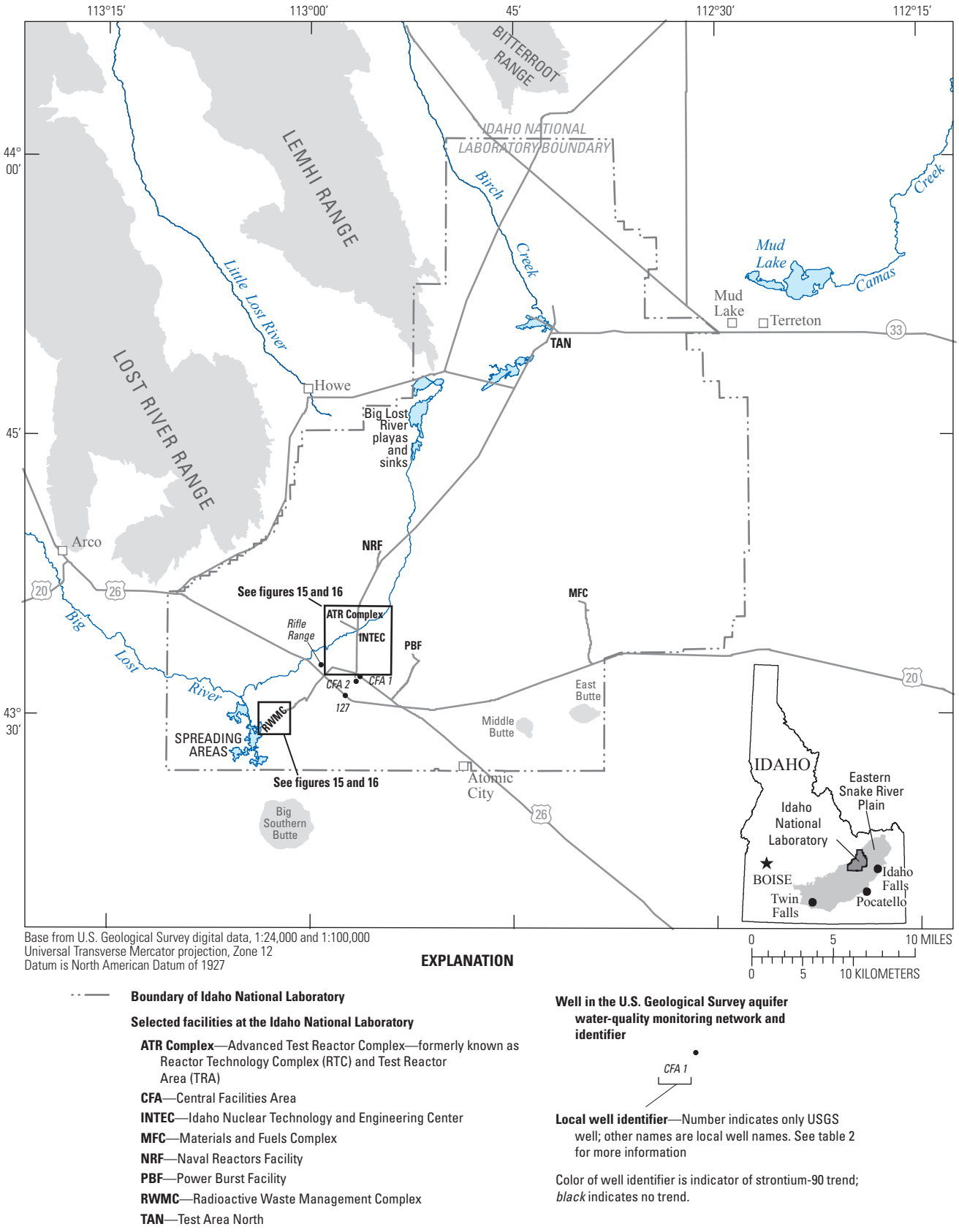


Figure 14. Areal distribution of strontium-90 trends in water from selected aquifer wells at and near the Idaho National Laboratory, Idaho.

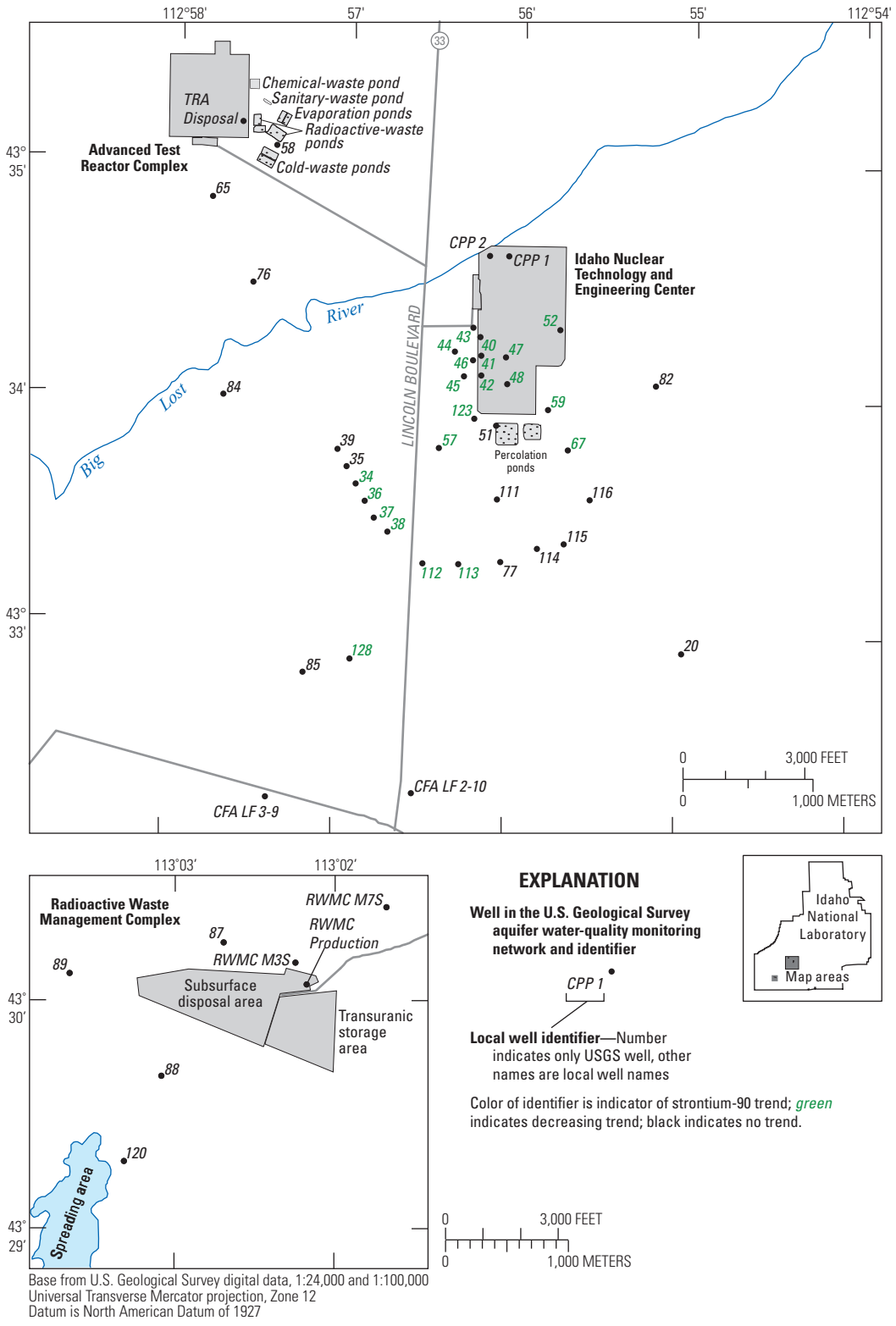


Figure 15. Areal distribution of strontium-90 trends in water from selected aquifer wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

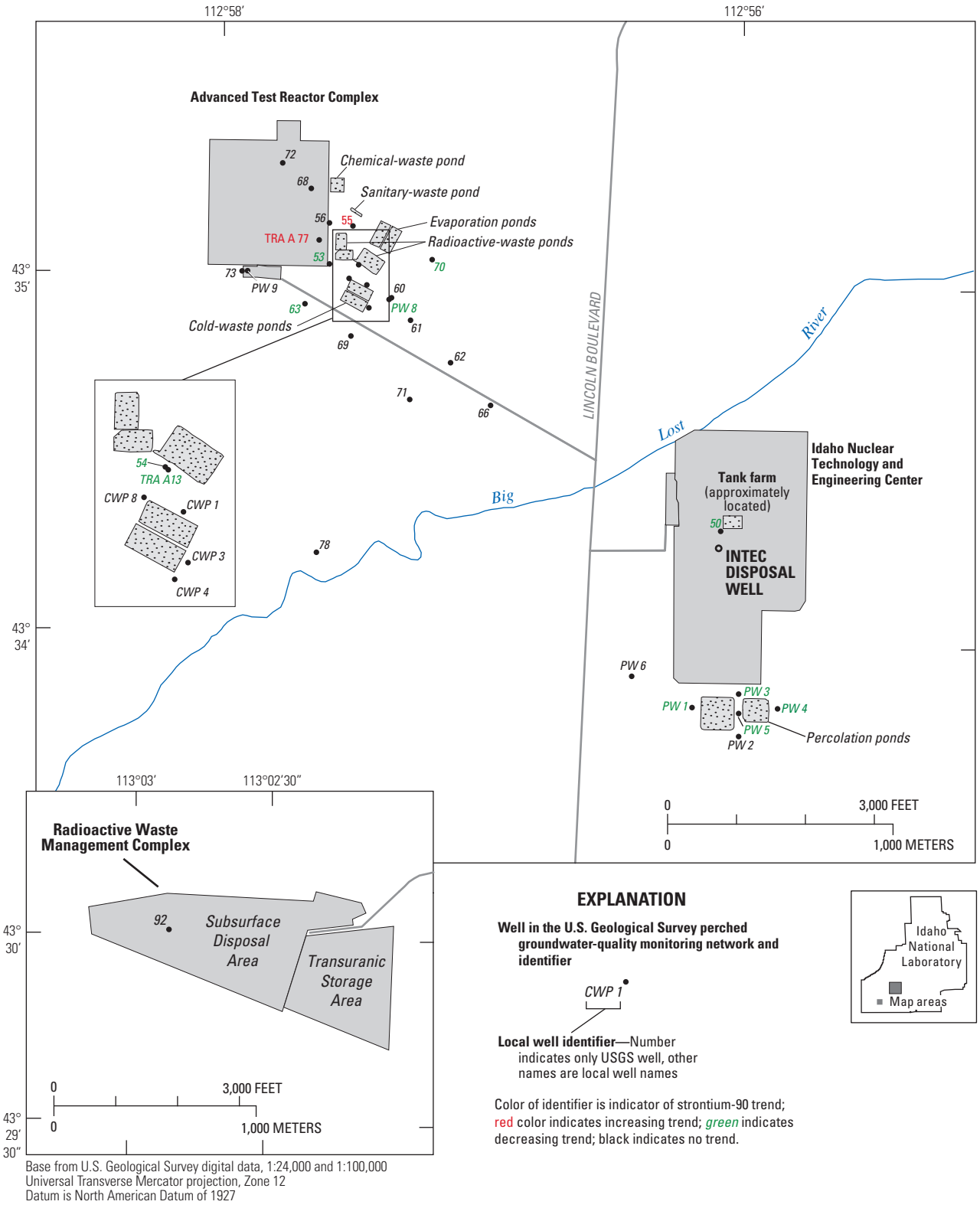


Figure 16. Areal distribution of strontium-90 trends in water from selected perched groundwater wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

Americium-241

Americium-241 is a decay product of plutonium-241. Plutonium isotopes have been detected in wastewater discharged to the ESRP aquifer at the INL and in waste buried at the RWMC. The half-life of americium-241 is 432.7 years (Walker and others, 1989, p. 46). Water from 16 aquifer wells and 1 perched groundwater well were routinely sampled and analyzed for plutonium isotopes. The number of samples collected and the number of samples with concentrations greater than the reporting level are shown in table 6. Because americium-241 concentrations were less than the reporting levels for most samples, no trend analyses were done.

Gross Alpha- and Beta-Particle Radioactivity

Gross alpha- and beta-particle radioactivity is a measure of the total radioactivity emitted as alpha and beta particles during the radioactive decay process. The radioactivity usually is reported as if it occurred as one radionuclide. Gross alpha and beta measurements are used to screen for radioactivity in the aquifer as a possible indicator of groundwater contamination, but measurable concentrations also can occur from the natural decay of radioactive material in aquifer material. In 2008, the RESL increased the sensitivity of the analyses; therefore, concentrations greater than the reporting level for natural background concentrations in the aquifer were sometimes measured, although those same concentrations may not have been reported in the past.

Water samples have been routinely collected and analyzed for gross alpha- and beta-particle activity from 16 aquifer wells and 2 perched groundwater wells used in this study. The number of samples collected and the number of samples with concentrations greater than the reporting level are shown in table 6. Because gross alpha- and beta-particle activity are less than the reporting levels for most of the samples, no statistical trend analyses were done. Concentrations for a few of the samples were equal to or greater than the reporting level. Some of the samples with results at reporting levels of 3s could be due to statistical fluctuations because the counting data are close to background concentrations. Other concentrations may represent background concentrations in the aquifer that have been detected because of increased sensitivity of the analyses, and some may be false positives (Davis, 2010, p. 28).

Chloride

Chloride has been discharged in wastewater at INL facilities since they were established. The background chloride concentration in water from the ESRP aquifer at the INL generally is about 15 mg/L (Robertson and others, 1974, p. 150). The secondary maximum contaminant level (MCL) for chloride in drinking water is 250 mg/L (U.S. Environmental Protection Agency, 2013). Samples were routinely collected and analyzed for chloride from 63 aquifer wells and 33 perched groundwater wells used in this study. One aquifer well, RWMC M1SA, was not sampled for chloride. Two of the perched groundwater wells (CWP 5 and PW 7) had insufficient data to determine trends. Summary statistics and trends for chloride are given in table 7 (at back of report).

Chloride analyses were done by various laboratories until 1989, and most analyses since 1989 have been done at the NWQL. The datasets include some outlier values, and if the value did not seem reasonable compared with the specific conductance of the well, the outlier value was not used in the trend analysis. Chloride trends in water from aquifer wells at the INL are shown in figures 17 and 18.

Of the 63 aquifer wells analyzed for statistically significant chloride concentration trends, 31 of these wells had a decreasing trend, 15 had an increasing trend, and 17 had no trend (table 7). Most wells near the INTEC and ATR Complex showed decreasing or no trends for chloride (fig. 18), probably the result of decreased disposal of wastewater and (or) discontinued use of the percolation ponds south of the INTEC and redirection of discharge to the new percolation ponds 2 mi southwest of the INTEC in 2002. Five aquifer wells south and southeast of the INTEC showed increasing chloride trends. Near the RWMC, most wells north of the facility showed increasing chloride trends (figs. 17 and 18). The statistically significant increasing trends in the wells southeast of INTEC are attributed to lower transmissivity for the part of the aquifer the wells sample. The lower transmissivity and subsequent slower movement of water may be an indication that wastewater from higher concentration disposal periods are still moving into the wells causing the concentrations to still be rising. The increasing concentrations of chloride in the RWMC area may be the result of chloride in wastes buried at RWMC moving into the aquifer, or from chloride in wastewater disposed at upgradient facilities finally reaching these wells.

Perched groundwater analyzed for statistically significant trends in chloride concentration showed that 11 perched groundwater wells had decreasing trends, 4 had increasing chloride concentration trends, and 18 had no trend (table 7). Most of the wells around the INTEC showed decreasing trends (fig. 19) and the trends are attributed to changes in disposal. Two of the wells (USGS 73 and PW 9) with increasing trends are in close proximity to each other and sample water from the same deep perched water zone, just south of the ATR Complex (fig. 19). Samples collected from the other two wells showed increasing trends (TRA A13 and A77) from a shallow perched zone. Chloride concentration trends generally were similar to the trend in specific conductance (appendixes B and D).

Chloride (along with sodium, sulfate, and some nitrate) concentrations in wells USGS 34–39 and USGS 112–113 may have been influenced by episodic recharge from the Big Lost River. Chloride, sodium, and sulfate concentrations seem to be inversely correlated with an increase in groundwater levels for wells USGS 35 and 39 (fig. 20).

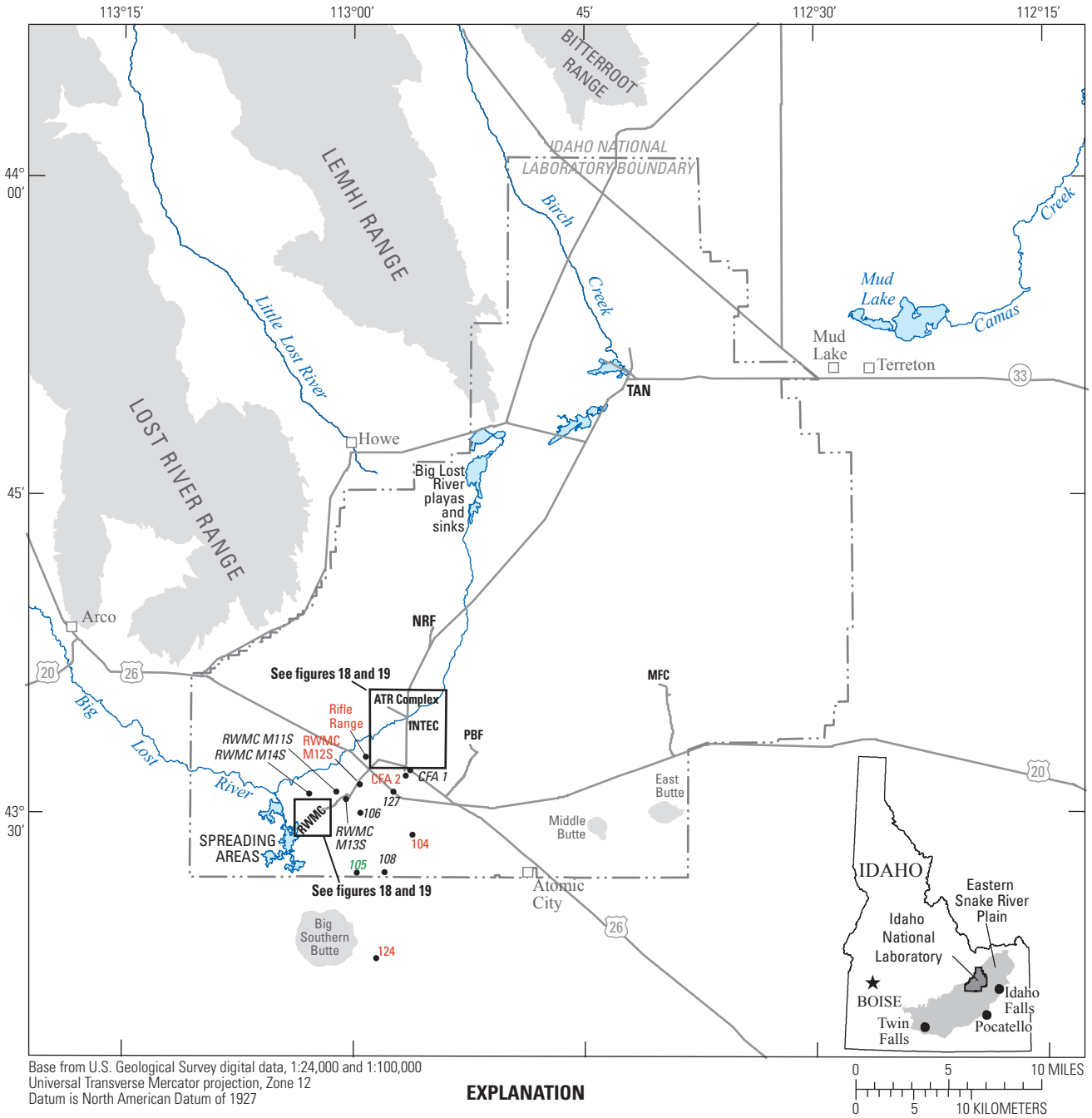
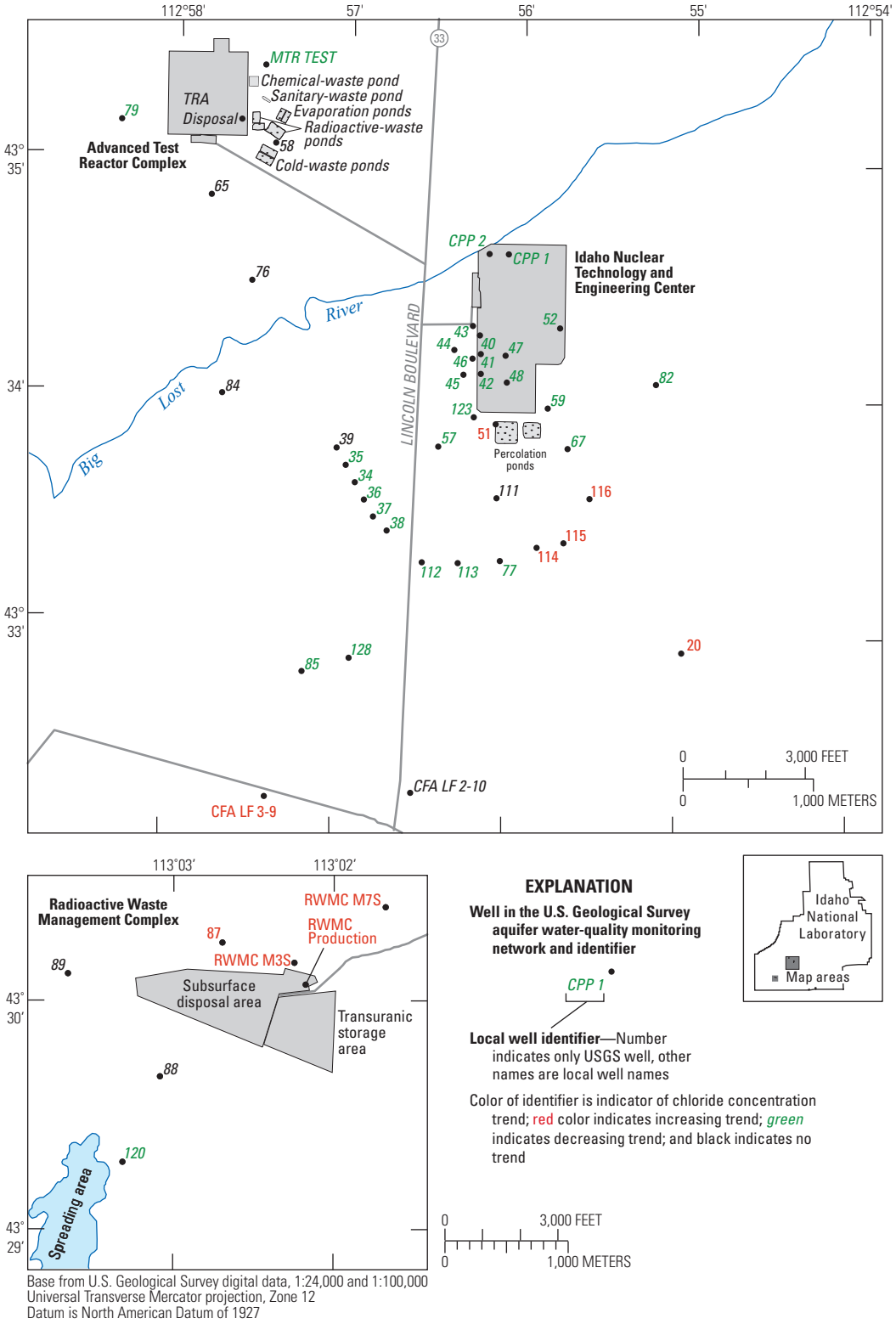


Figure 17. Areal distribution of chloride concentration trends in water from selected aquifer wells at and near the Idaho National Laboratory, Idaho.



Base from U.S. Geological Survey digital data, 1:24,000 and 1:100,000
Universal Transverse Mercator projection, Zone 12
Datum is North American Datum of 1927

Figure 18. Areal distribution of chloride concentration trends in water from selected aquifer wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

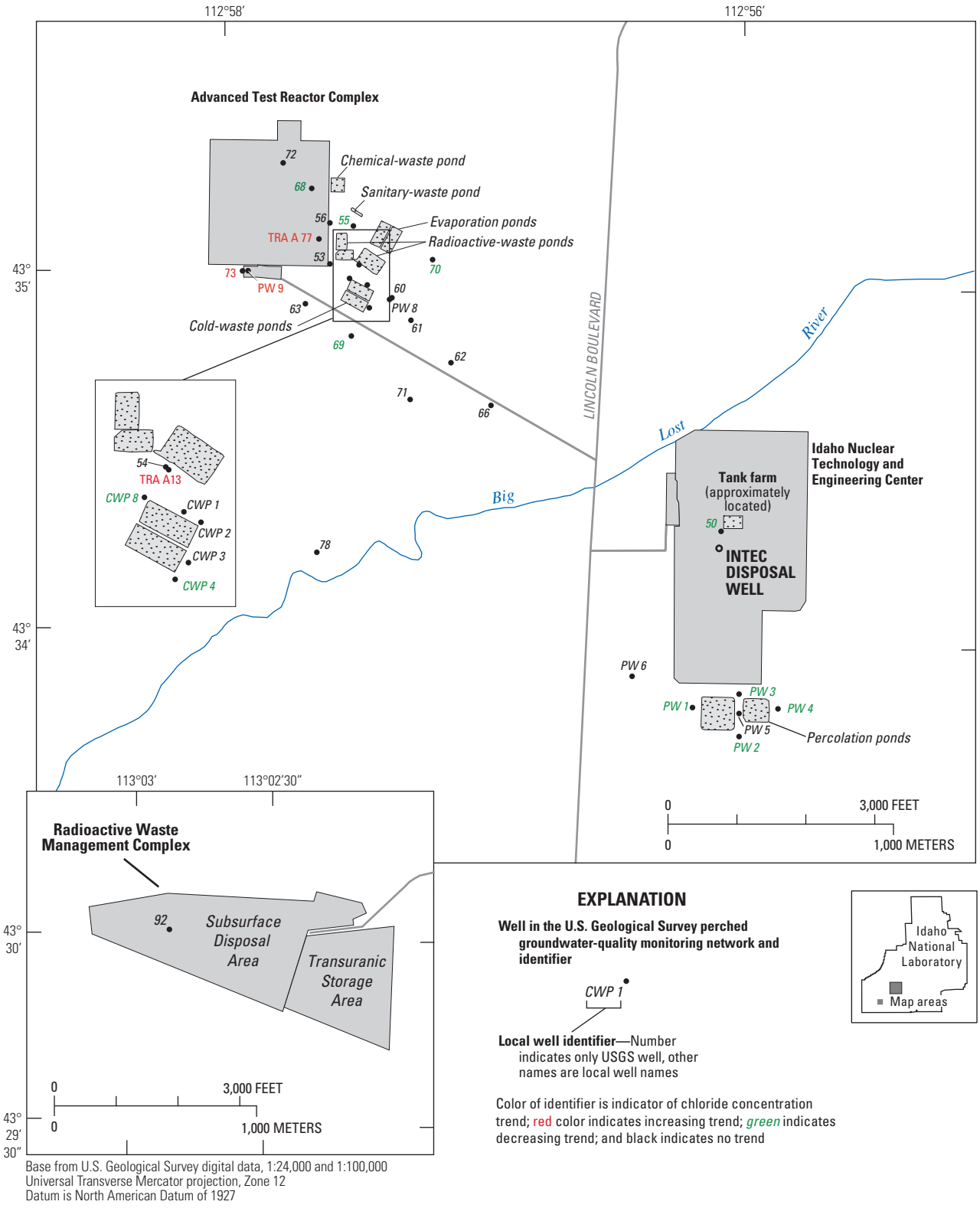


Figure 19. Areal distribution of chloride concentration trends in water from selected perched groundwater wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

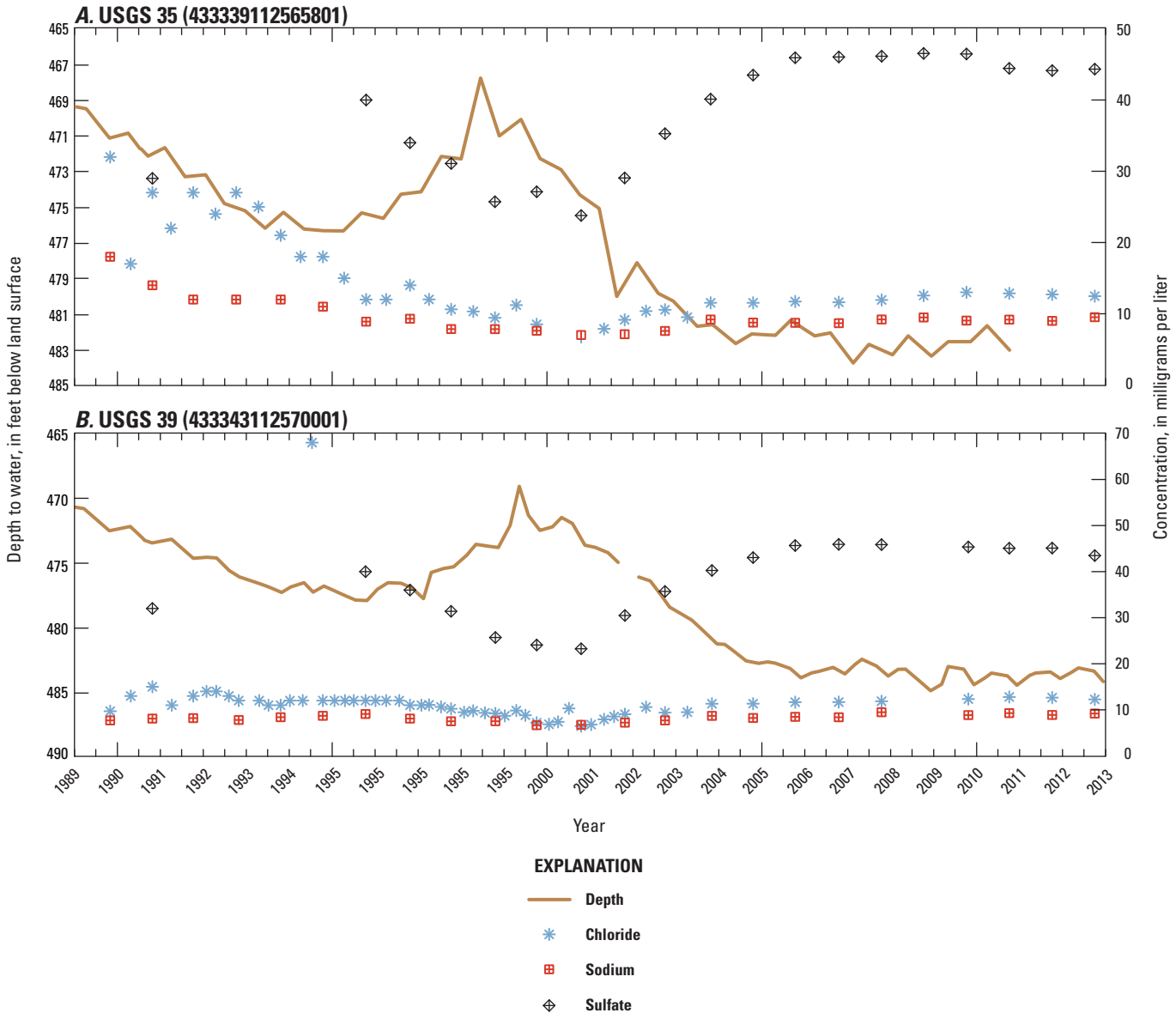


Figure 20. Fluctuations in chloride, sodium, and sulfate concentrations relative to water-level changes at wells (*A*) USGS 35 and (*B*) USGS 39 and (*C*) changes in streamflow from the Big Lost River, Idaho.

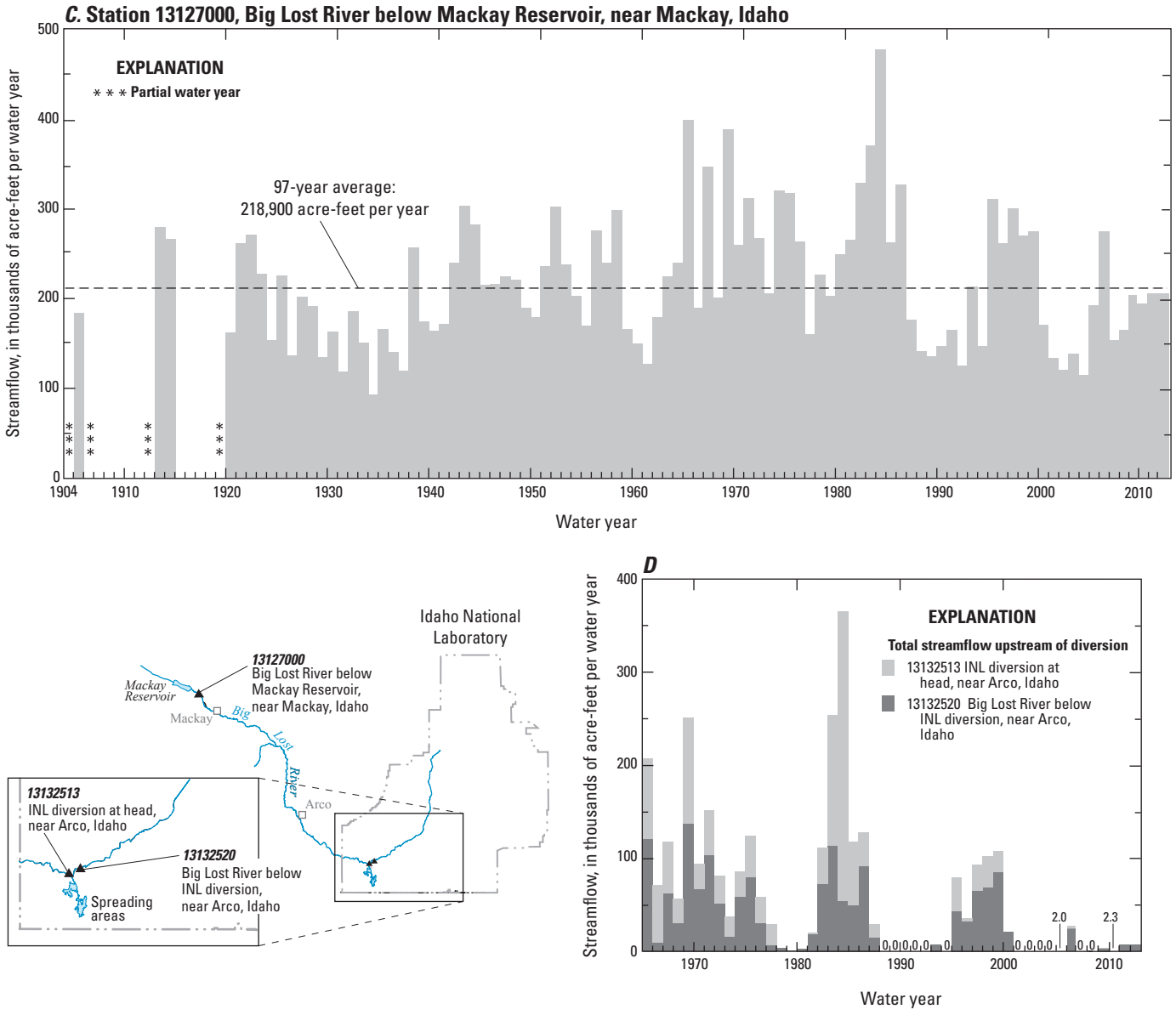


Figure 20.—Continued

Wells USGS 34, 36, 38, and USGS 112–113 show similar patterns with concentrations decreasing during wet periods when there is more recharge from the Big Lost River and thus increasing groundwater levels, and increasing during dry periods, when there is no recharge from the Big Lost River (fig. 20). Although groundwater levels visually appear to have some effect, when using water level as a covariant in the statistical model, no significant effect on trend occurs (table 3).

Sodium

Sodium has been discharged in wastewater at INL facilities since they were established. The background concentration of sodium in water from the ESRP aquifer near the INL generally is less than 10 mg/L (Robertson and others, 1974, p. 155). Samples were routinely collected and analyzed for sodium from 59 aquifer wells and 24 perched groundwater wells. Aquifer well CFA LF 3-9 was not analyzed for sodium, and wells RWMC M1SA, RWMC M3S, RWMC M7S, and USGS 128 had only one analysis each for sodium. Perched groundwater wells USGS 92, CWP 1, 2, 3, 5, and 8 were not analyzed for sodium, and wells CWP 4, PW 6, PW 7, TRA A 13, and TRA A 77 had insufficient data for trend analyses. Summary statistics and trends are given in table 7.

Sodium analyses were done by various laboratories until 1989 and most analyses since have been done at the NWQL. The datasets included some outlier values, and if the value did not seem reasonable compared with the specific conductance, the outlier value was not used in the trend analyses. Only analyses by the NWQL for 1989–2012 are included in the trend analyses. Sodium trends in water from aquifer wells and perched groundwater wells at the INL are shown in figures 21, 22, and 23.

Of the 59 aquifer wells analyzed for statistically significant sodium concentration trends, 22 wells showed a decreasing trend, 14 showed an increasing trend, and 23 showed no trend (figs. 21 and 22, table 7). Sodium hydrate was a predominant constituent in wastewater discharged to the chemical-waste infiltration pond at the ATR Complex (Davis, 2010). South and east of the ATR Complex, sodium showed increasing trends in a few wells (fig. 22). Sodium and chloride were two of the predominant chemical constituents in wastewater discharged at the INTEC (Pittman and others, 1988; Orr and Cecil, 1991; Bartholomay and others, 2000). South of the INTEC, trends in sodium generally were similar to trends in chloride, with the exception of well USGS 39, which had an increased sodium trend and no chloride trend. Some of the water from wells showing decreasing trends in chloride showed no trends in sodium at the INTEC (figs. 18 and 22). Sodium and chloride were predominant constituents discharged in wastewater at the Central Facilities Area (CFA) (Bartholomay and others, 2000). Some wells downgradient of the CFA and near the southern boundary of the INL showed increasing trends in sodium, whereas there was no trend in chloride (figs. 17 and 21). The increasing trend for sodium could be due to the long-term disposal of wastewater at upgradient facilities. The lack of trend for chloride could be because it is more mobile in groundwater (Hem, 1989, p. 118) than sodium and, thus, more dispersed in the aquifer system. The increasing sodium trend in the Rifle Range well is likely the result of the redirection of discharge from the INTEC to the new percolation ponds 2 mi southwest of the INTEC. Five perched groundwater wells analyzed for sodium trends had decreasing trends, 1 (USGS 71) had an increasing trend, and 18 had no trend (fig. 23, table 7).

Fluoride

Fluoride was discharged in wastewater to percolation ponds at the INTEC during 1971–98 (Bartholomay and others, 2000). Background concentrations of fluoride in the ESRP aquifer in the southwestern part of the INL range from about 0.1 to 0.3 mg/L (Robertson and others, 1974, p. 75). The MCL for fluoride in drinking water is 4 mg/L (U.S. Environmental Protection Agency, 2013). Samples were routinely collected and analyzed for fluoride from four wells used in this study. Summary statistics and trends calculated are given in table 7.

Fluoride concentration trends for four aquifer wells (CPP 1, USGS 34, 38, and 77) near the INTEC are shown in table 7. Other aquifer and perched groundwater wells were sampled sporadically for fluoride; however, data from those wells were not sufficient to determine statistically significant trends. For the four aquifer wells with sufficient data, two (USGS 38 and USGS 77) showed increasing trends and two (CPP 1 and USGS 34) showed no trend. All fluoride concentrations were within the background range of 0.1 to 0.3 mg/L, indicating that wastewater disposal has not had an appreciable effect on fluoride concentrations in the ESRP aquifer near the INTEC (Davis and others, 2013). The increasing trends probably are due to changes in the reporting standards by the NWQL and not the result of actual changes in the concentrations of fluoride in the aquifer.

Sulfate

Sulfate has been discharged in wastewater at the INL facilities since they were established. The background sulfate concentrations in water from the ESRP aquifer in the south-central part of the INL range from about 10 to 40 mg/L (Robertson and others, 1974, p. 72). The secondary MCL for sulfate in drinking water is 250 mg/L (U.S. Environmental Protection Agency, 2013). Sulfate was routinely analyzed for water samples from 48 aquifer wells and 22 perched groundwater wells used in this study.

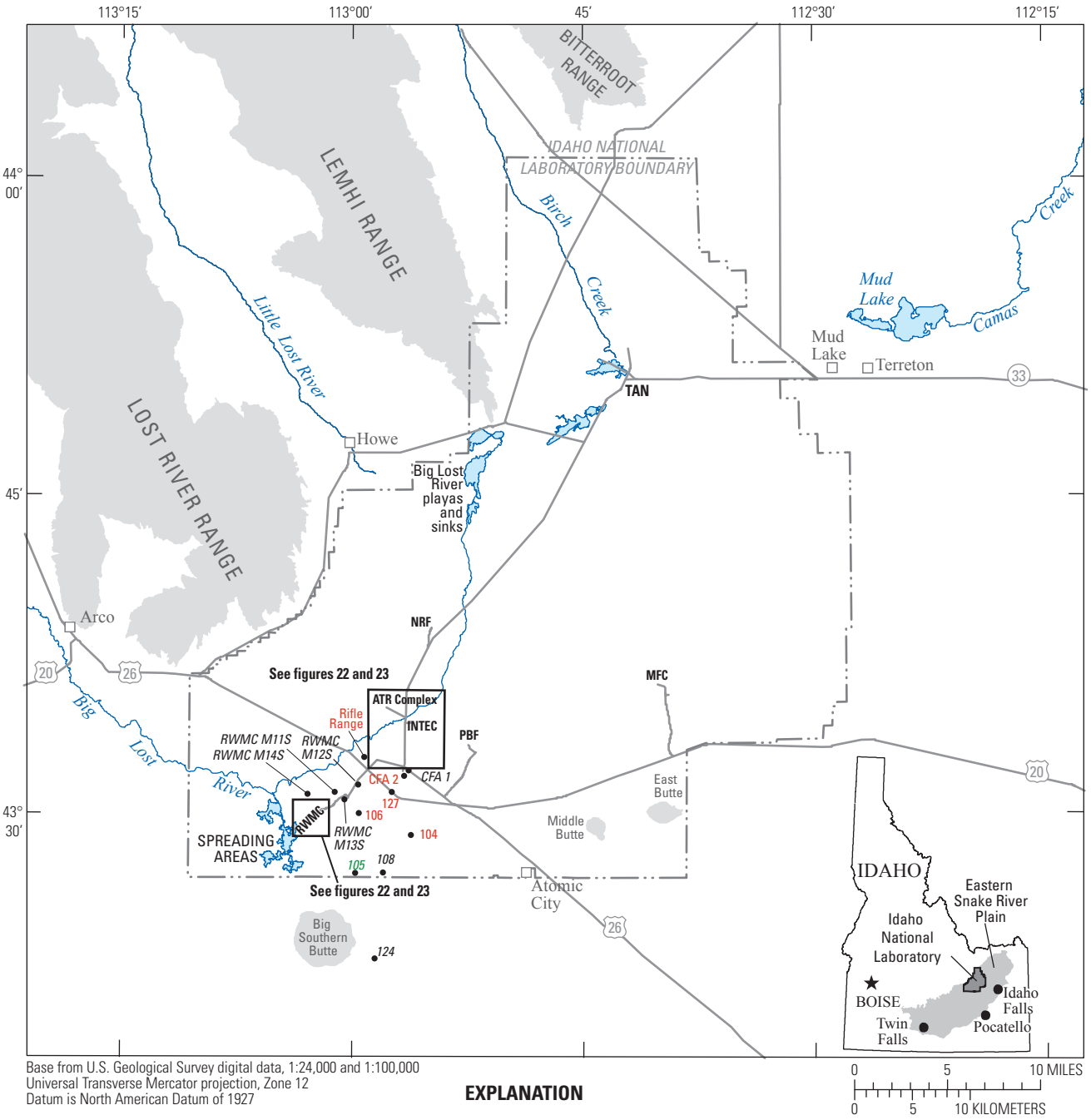


Figure 21. Areal distribution of sodium concentration trends in water from selected aquifer wells at and near the Idaho National Laboratory, Idaho.

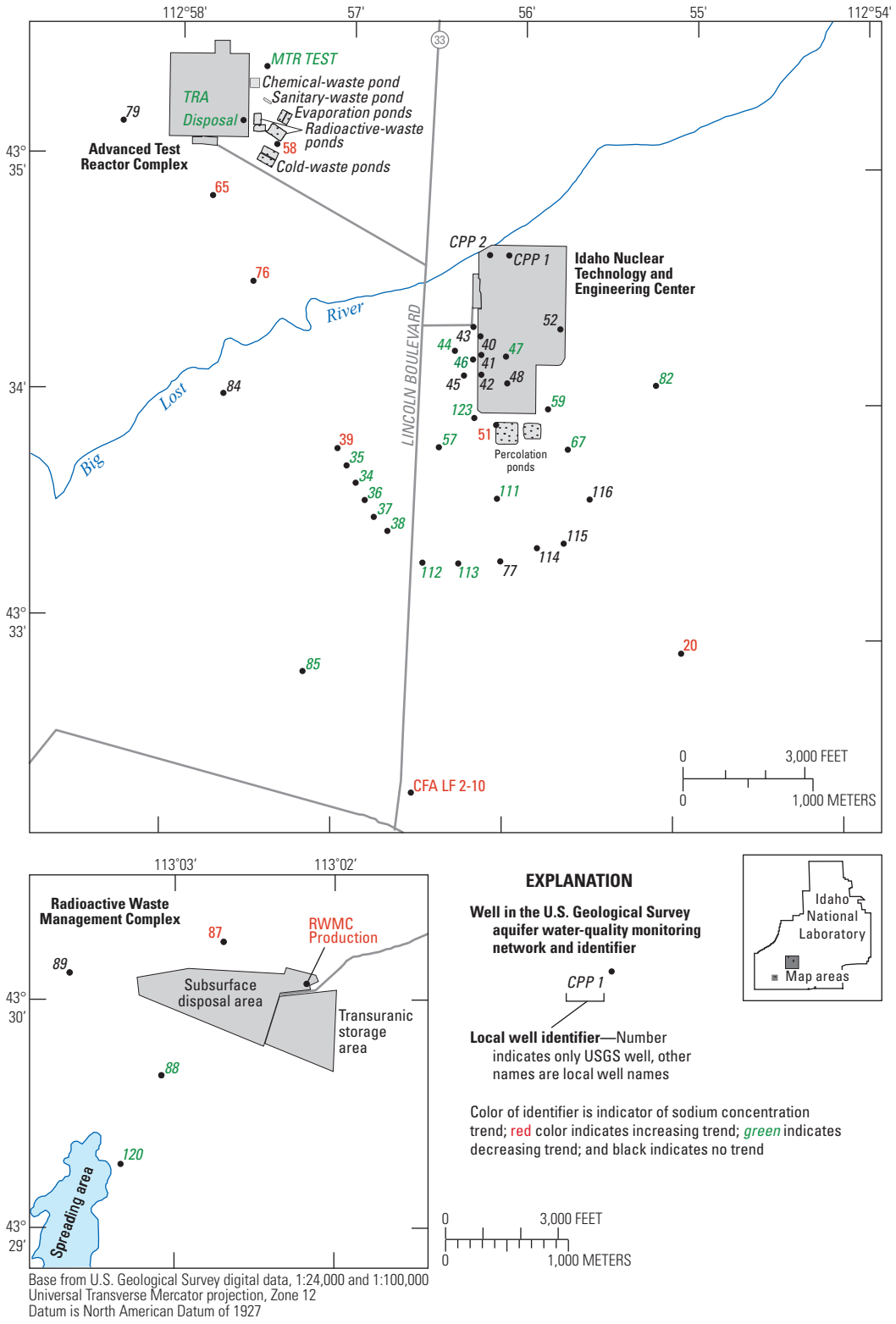


Figure 22. Areal distribution of sodium concentration trends in water from selected aquifer wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

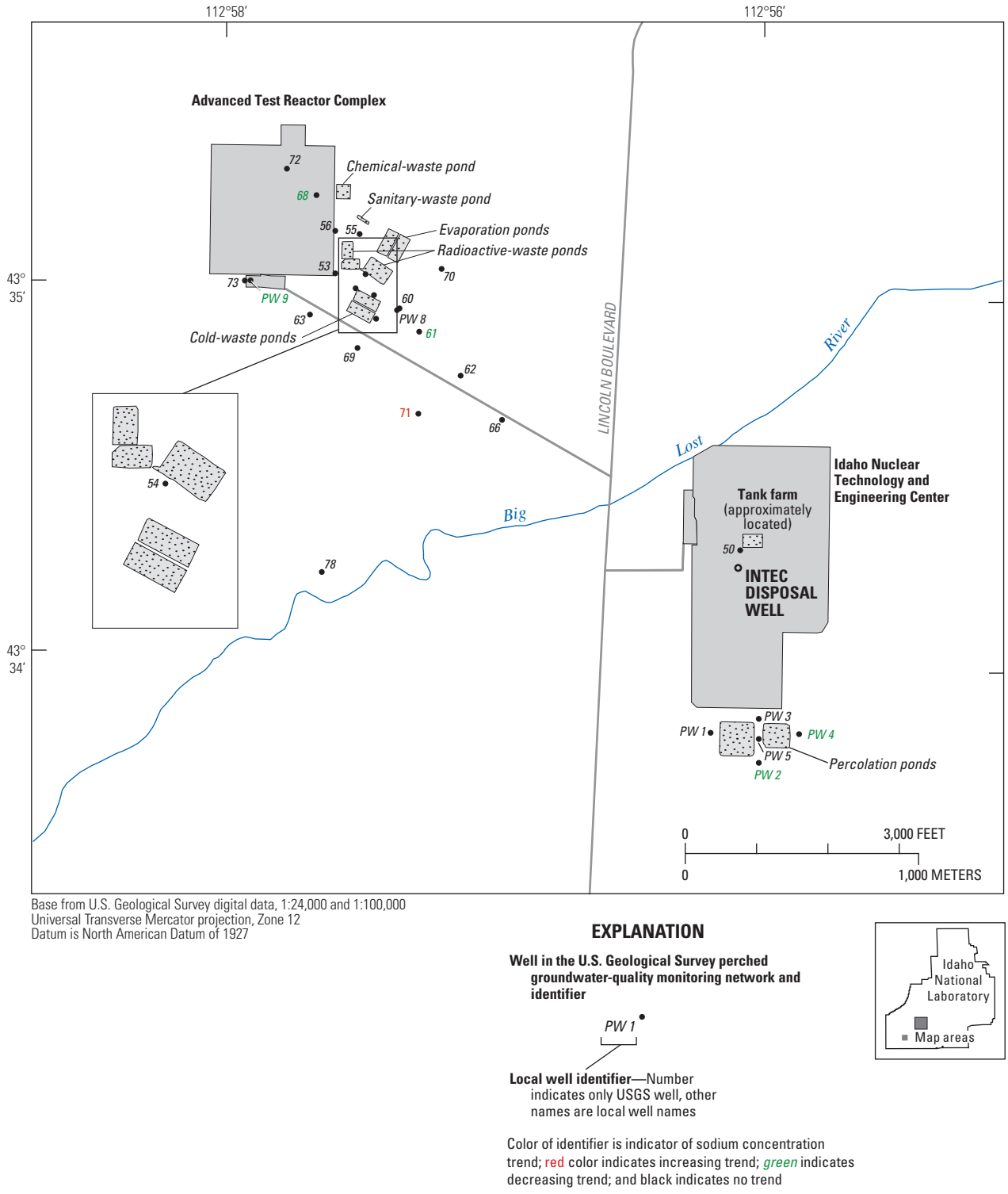


Figure 23. Areal distribution of sodium concentration trends in water from selected perched groundwater wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

Sulfate analyses were done by various laboratories until 1989, and most analyses since then have been done at the NWQL. The datasets include some outlier values, and if the value did not seem reasonable compared with the specific conductance of the well, the outlier value was not used in the trend analyses. Sulfate trends and summary statistics for water from sites at the INL from 1989 to 2012 are shown in figures 24–26, table 7, and appendix D.

Forty-eight aquifer wells were analyzed for statistically significant sulfate concentration trends; 24 had decreasing trends, 13 had increasing trends, and 11 had no trend. Most aquifer wells that had increasing trends were located downgradient of the INTEC or ATR Complex, in the general direction of regional groundwater flow toward the southwest. The increasing trend in these wells may be attributable to disposal of sulfate-enriched wastewater at the ATR Complex cold and chemical waste ponds. As with chloride and sodium, some wells appear to be affected by episodic recharge from the Big Lost River, which dilutes sulfate concentrations in the groundwater (fig. 20). Closer to the facilities, sulfate trends either decreased or there was no trend (figs. 24 and 25, table 7). Most perched groundwater wells near the INTEC and ATR Complex showed decreasing or no trends, with the exception of well PW 4, east of the percolation ponds at the INTEC, which showed an increasing trend (fig. 26).

Nitrite Plus Nitrate (as N)

Wastewater containing nitrate was injected into the ESRP aquifer through the INTEC disposal well from 1952 to February 1984, and was discharged to the INTEC percolation ponds after February 1984 (Orr and Cecil, 1991). Because nitrite analyses indicate that almost all nitrite plus nitrate concentrations are nitrate (as N), concentrations will be referred to as nitrate in this report. Background concentrations of nitrate in groundwater not affected by wastewater disposal from INL facilities generally are less than 1 mg/L (Robertson and others, 1974, p. 73). The MCL for nitrate in drinking water is 10 mg/L (U.S. Environmental Protection Agency, 2013). Nitrate was routinely analyzed for water samples from 59 aquifer wells and 1 perched groundwater well. Nitrate trends and summary statistics for water from wells at the INL for 1989–2012 are shown in figures 27–28, table 7, and appendix D.

Fifty-nine aquifer wells were analyzed for trends in nitrate concentrations. Of those, 28 showed a decreasing trend, 8 showed an increasing trend, and 23 showed no trend (figs. 27 and 28). As was shown for chloride, sodium, and sulfate for wells near the Big Lost River, the nitrate concentrations decreased during periods when water levels were higher, probably due to recharge and dilution from Big Lost River seepage, and increased when recharge from Big Lost seepage was less (Bartholomay and others, 2012) (appendix D). Most of the wells around INTEC showed decreasing or no trend, which probably is due to discontinued use of the disposal well in 1984 and the percolation ponds in 2002. The increasing concentration in USGS 67 (fig. 28) is puzzling and may indicate another source of contamination rather than the percolation ponds. Only one perched groundwater well (USGS 50) was analyzed for a trend in nitrate. Results for this well indicated a decreasing trend (table 7) which probably was due to discontinued use of the INTEC disposal well in 1984.

Orthophosphate (as P)

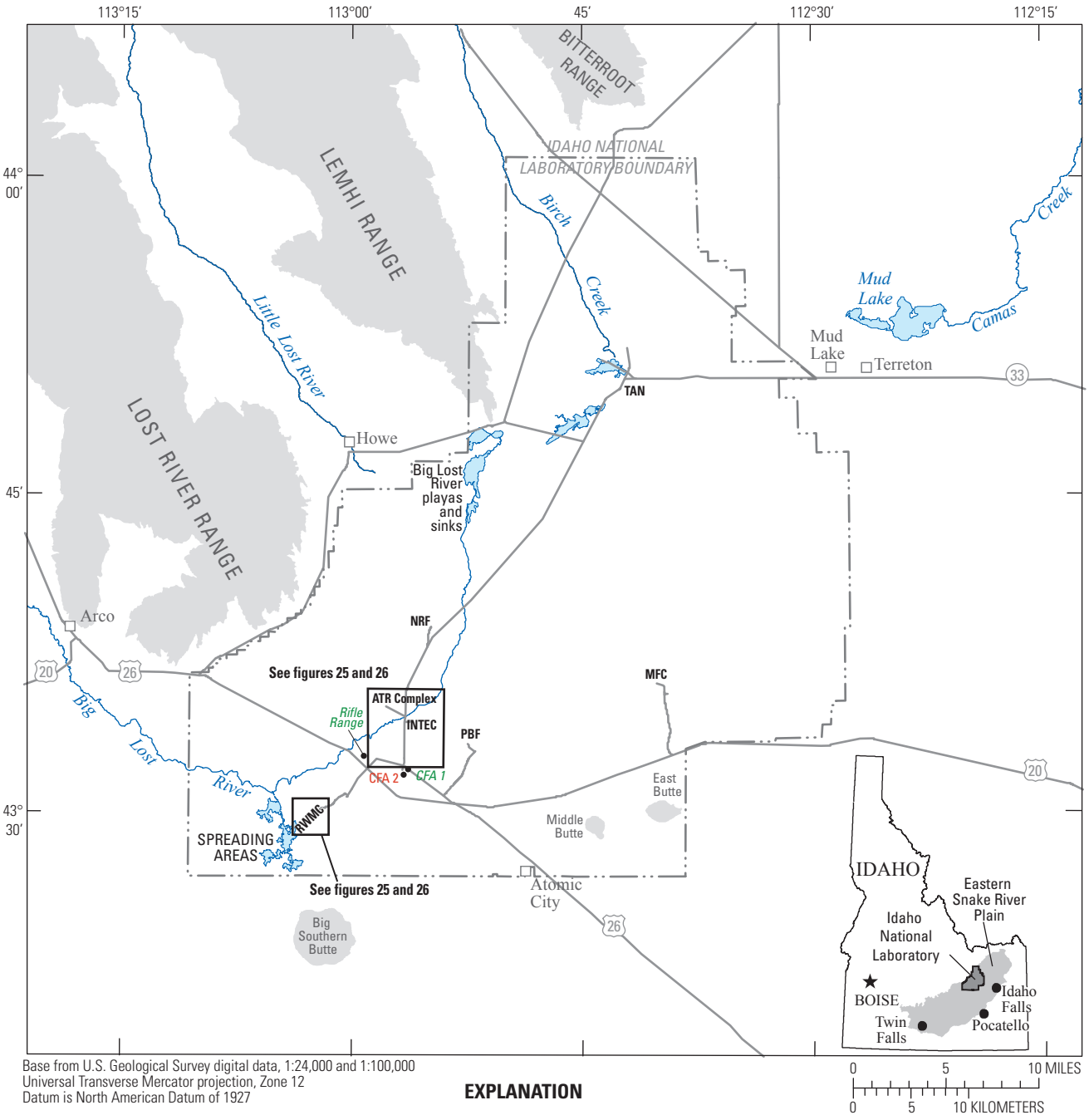
Orthophosphate (as P) has not been a major constituent discharged in wastewater at the INL; only about 9 kg was discharged in liquid effluent at the INL from 1971 to 1998 (French and others, 1999). Water samples from 59 aquifer wells and 1 perched groundwater well were routinely analyzed for orthophosphate (as P). Summary statistics and trends for orthophosphate (as P) are given in table 7.

Orthophosphate (as P) concentrations were near or less than the reporting levels for most of the samples in most of the wells. Of the 59 aquifer wells analyzed for statistically significant orthophosphate concentration trends, 26 had increasing trends and 33 had no trend. The increasing trends could be due to anthropogenic influence from activities upgradient of the INL or could be due to changes in data reporting by the NWQL rather than actual changes in concentrations in the aquifer. Prior to 2003, results were rounded to the nearest tenth and since 2003, results are rounded to the nearest hundredth of a milligram per liter. The only perched aquifer well analyzed for an orthophosphate trend at the INTEC was USGS 50; results indicated no trend (table 7).

Trace Elements

A suite of trace elements including aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, lead, manganese, molybdenum, nickel, silver, uranium, and zinc were routinely collected from two wells (USGS 65 and USGS 84). Water samples were analyzed for chromium from 25 aquifer wells and 21 perched groundwater wells. Samples for selenium analysis were collected from wells USGS 65 and USGS 84 downgradient of the ATR Complex. Selenium was considered a constituent of concern in the 1993 INL groundwater-monitoring plan at that facility (Sehlke and Bickford, 1993). Neither well had sufficient data for statistical analysis of beryllium and silver.

Results of trend tests for trace element concentrations are shown in appendix D. Summary statistics and trend test results are given in table 7. Well USGS 65 showed a decreasing trend for barium, cadmium, cobalt, lead, and zinc, increasing trends for arsenic, molybdenum, and uranium, and no trend for aluminum, antimony, copper, manganese, nickel, and selenium. Well USGS 84 showed decreasing trends for cadmium, cobalt, copper, lead, nickel, and zinc, an increasing trend for arsenic, and no trend for aluminum, antimony, barium, manganese, molybdenum, selenium and uranium.



EXPLANATION

Boundary of Idaho National Laboratory

Selected facilities at the Idaho National Laboratory

- **ATR Complex**—Advanced Test Reactor Complex—formerly known as Reactor Technology Complex (RTC) and Test Reactor Area (TRA)
- **CFA**—Central Facilities Area
- **INTEC**—Idaho Nuclear Technology and Engineering Center
- **MFC**—Materials and Fuels Complex
- **NRF**—Naval Reactors Facility
- **PBF**—Power Burst Facility
- **RWMC**—Radioactive Waste Management Complex
- **TAN**—Test Area North

Well in the U.S. Geological Survey aquifer water-quality monitoring network and identifier

CFA 1

Local well identifier—Number indicates only USGS well; other names are local well names. See table 2 for more information

Color of identifier is indicator of sulfate concentration trend; red color indicates increasing trend; and *green* indicates decreasing trend

Figure 24. Areal distribution of sulfate concentration trends in water from selected wells at and near the Idaho National Laboratory, Idaho.

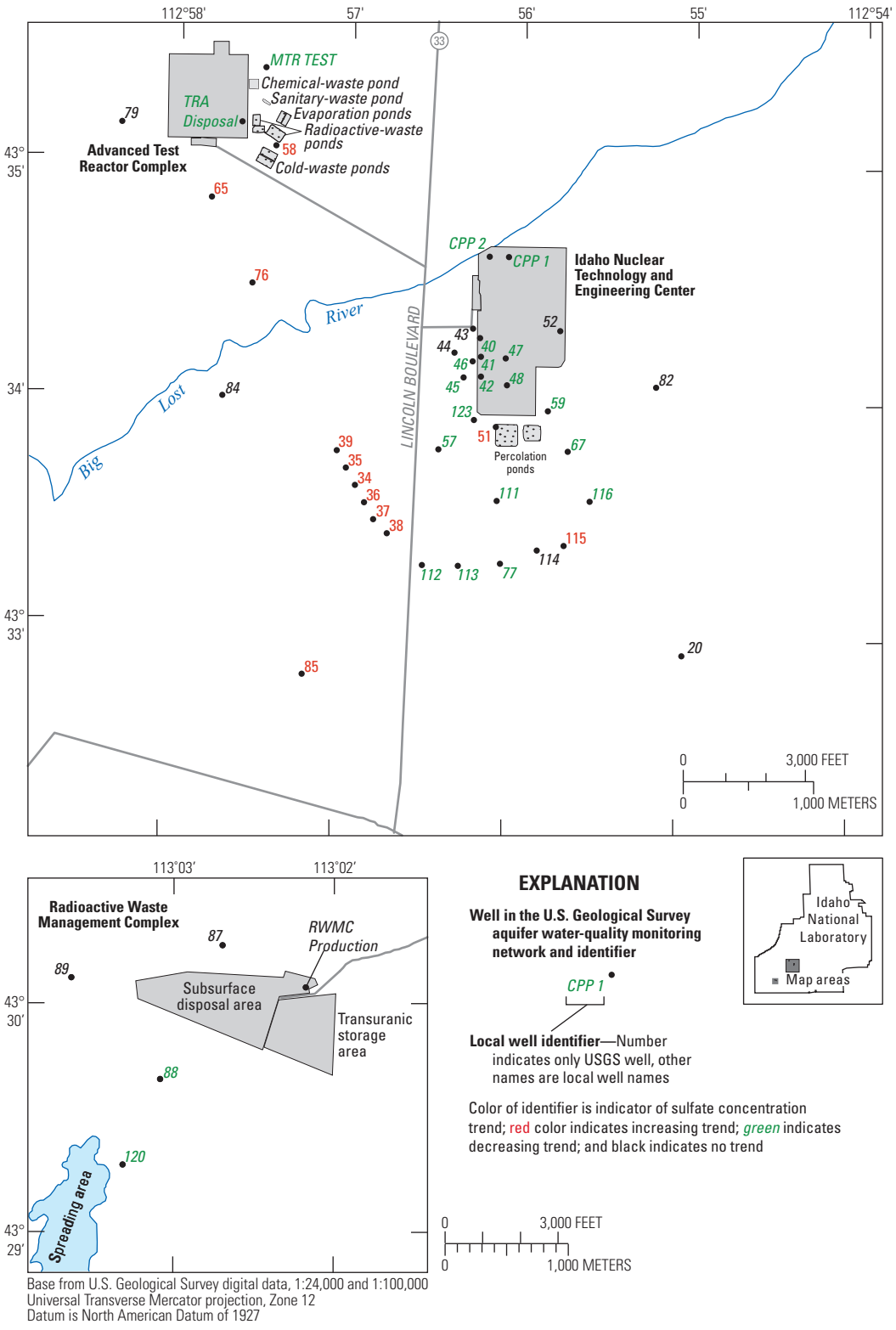


Figure 25. Areal distribution of sulfate concentration trends in water from selected aquifer wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

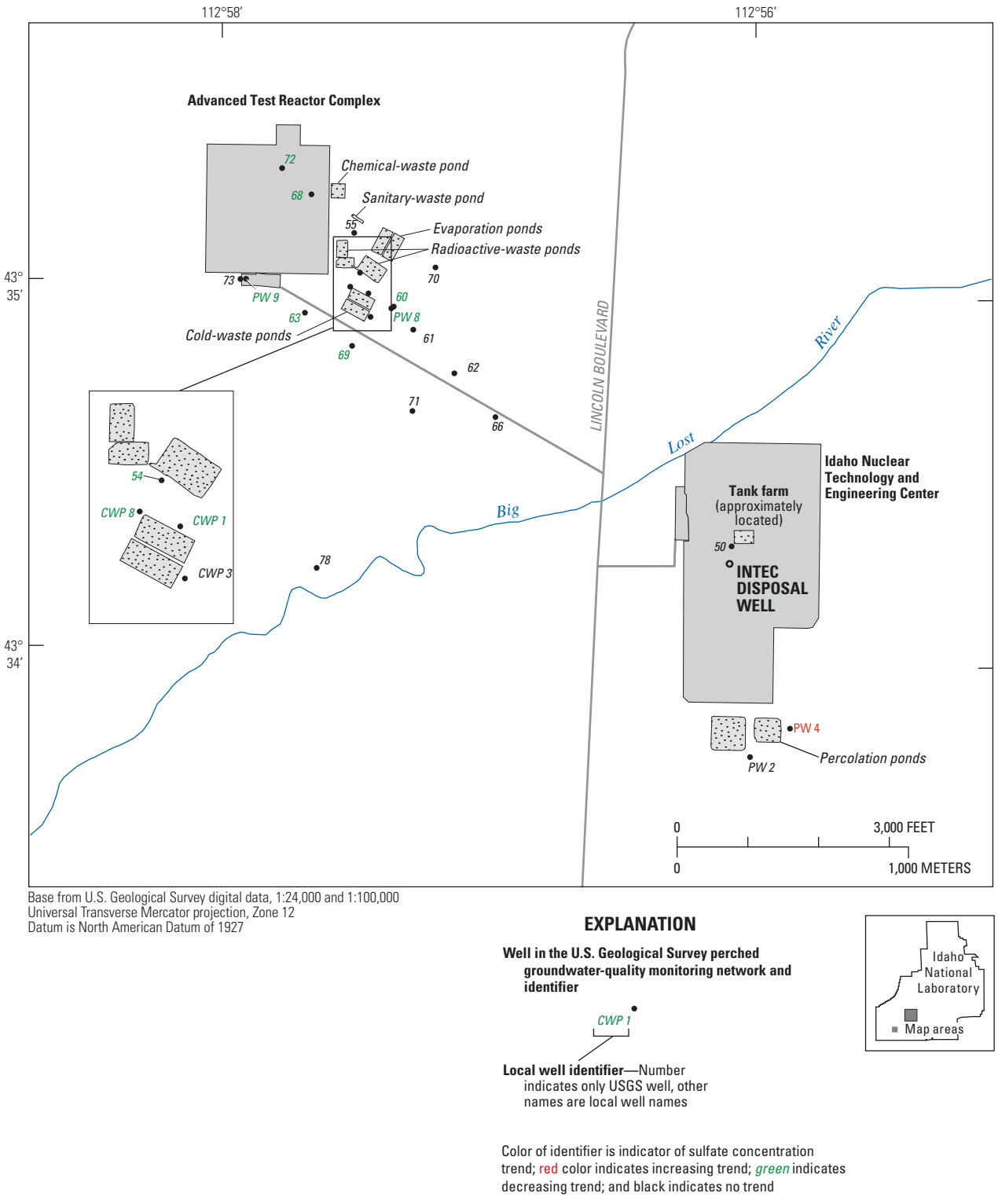


Figure 26. Areal distribution of sulfate concentration trends in water from selected perched groundwater wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

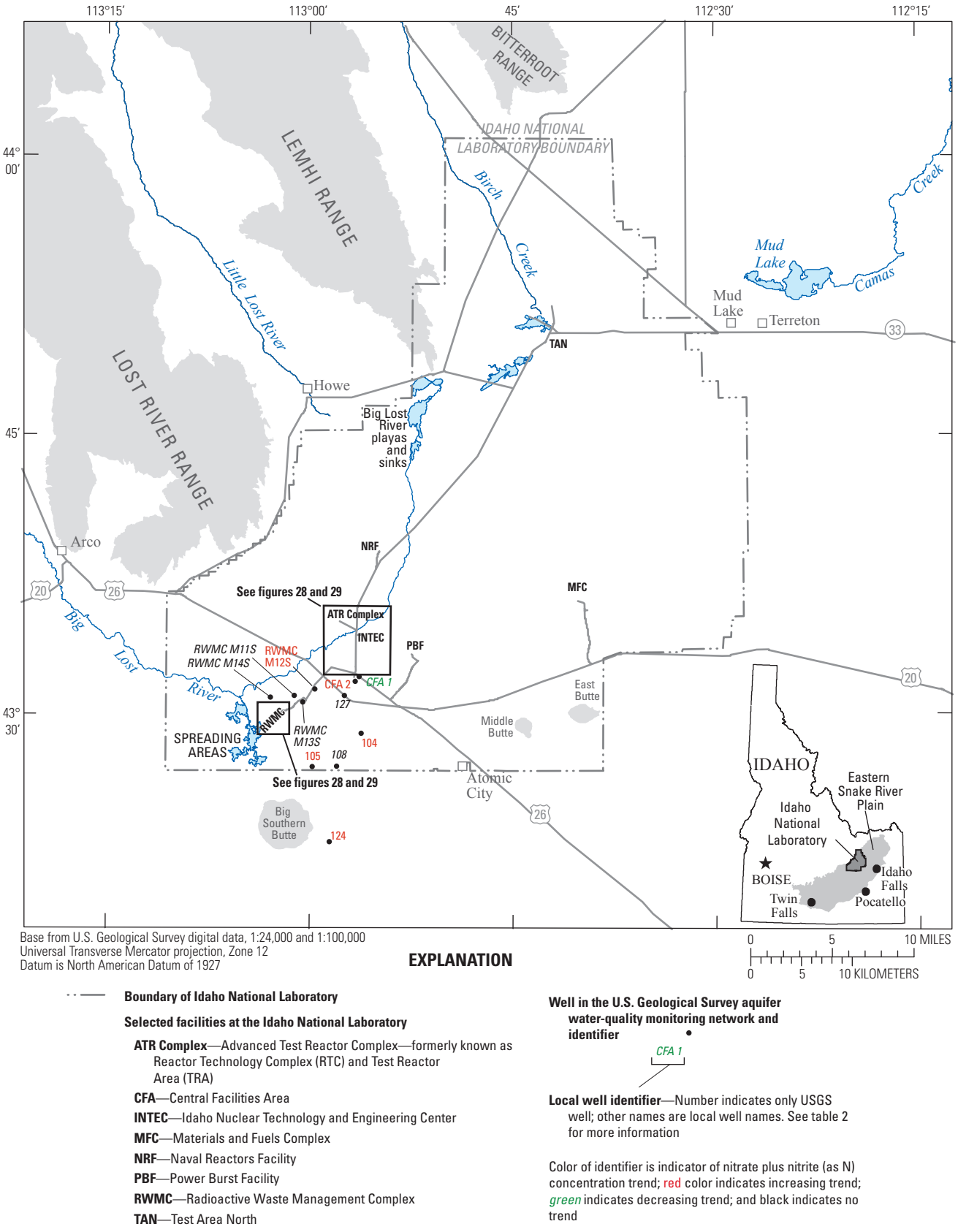


Figure 27. Areal distribution of nitrite plus nitrate (as N) concentration trends in water from selected wells at and near the Idaho National Laboratory, Idaho.

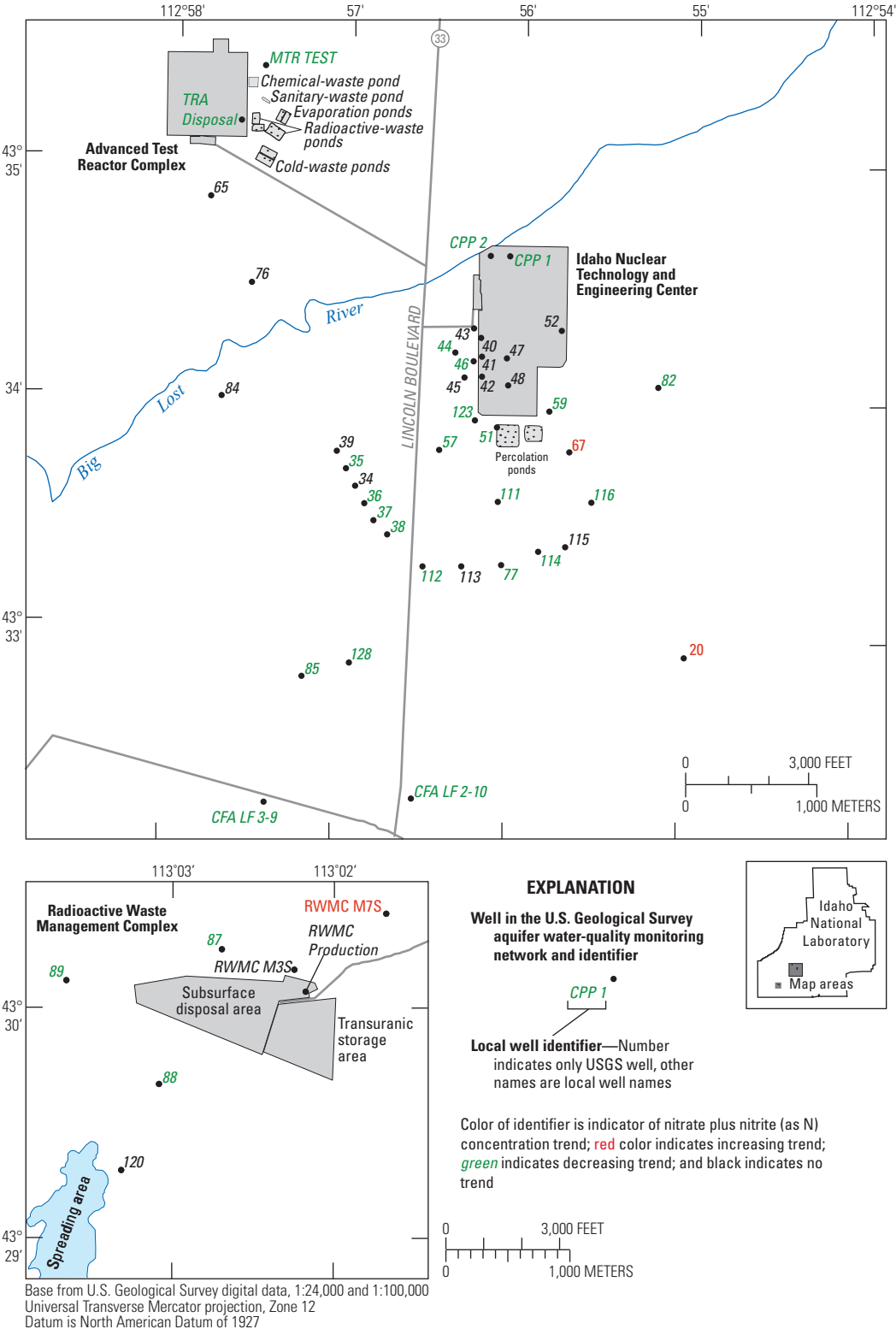


Figure 28. Areal distribution of nitrite plus nitrate (as N) concentration trends in water from selected aquifer wells at the Advanced Test Reactor Complex, Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex, Idaho National Laboratory, Idaho.

Chromium

Disposal of chromium in wastewater has occurred at the ATR Complex, INTEC, and the Power Burst Facility (PBF) (Davis, 2010, p. 37). Background concentrations of chromium in water from the ESRP aquifer at the INL range from 2 to 3 µg/L (Orr and others, 1991, p. 41). The MCL for chromium in drinking water is 100 µg/L (U.S. Environmental Protection Agency, 2013). Water samples were routinely collected and analyzed for chromium from 25 aquifer wells and 21 perched groundwater wells. Summary statistics and trend test results for chromium concentrations are shown in table 7 and appendix D.

Of the 25 aquifer wells analyzed for statistically significant chromium concentration trends, 8 showed decreasing trends, 3 showed increasing trends, and 14 showed no trend. The three wells that showed increasing trends (CPP 1, USGS 34, and USGS 38) are located at or just downgradient of the INTEC. One well downgradient of the ATR Complex (USGS 65) showed a decreasing trend. Most of the other wells showing decreasing trends (Rifle Range Well, CFA LF- 2-10, RWMC M12S, RWMC M14S, USGS 77, USGS 87, and USGS 127) are near the CFA and the RWMC.

Of the 21 perched groundwater wells analyzed for chromium, 13 showed a decreasing trend, 1 well (USGS 68, at the ATR Complex) showed an increasing trend, and 7 showed no trend. All of the perched groundwater wells showing decreasing trends (CWP 3, PW 8-9, USGS 54-55, USGS 60-63, USGS 70-71, USGS 73, and USGS 78) are south or southeast of the ATR Complex. Decreasing trends in chromium concentrations in this area probably are due to discontinued disposal at the ATR complex.

Total Organic Carbon

Total organic carbon (TOC) is used as a general indicator of groundwater contamination and as a screen for other organic compounds in the aquifer. As part of the INL groundwater-monitoring program adopted in 1994, the USGS began collecting and analyzing water from several wells at the INL for TOC. Water samples were routinely analyzed for TOC from 15 aquifer wells but no water samples from perched groundwater wells were analyzed. Summary statistics and trend test results for TOC concentrations are shown in table 7 and appendix D. Four wells near the RWMC (RWMC M11S, RWMC M12S, RWMC M13S, and RWMC M14S) showed decreasing trends for TOC; no wells showed increasing trends, and 11 wells had no trend.

Volatile Organic Compounds

Volatile organic compounds (VOCs) are present in water from the ESRP aquifer because of historical waste-disposal practices at the INL. The VOCs were used for degreasing, decontamination, and other activities at INL facilities (Mann and Knobel, 1987, p. 1). An estimated 88,400 gal of organic waste was buried before 1970 in the SDA at the RWMC (Mann and Knobel, 1987, p. 1). These buried organic wastes included about 24,400 gal of carbon tetrachloride; 39,000 gal of lubricating oil; and about 25,000 gal of other organic compounds, including trichloroethane, trichloroethylene, perchloroethylene, toluene, and benzene. VOC concentrations for nine aquifer wells were analyzed for trends. At other aquifer wells, data were not sufficient to evaluate concentration trends, or the concentrations were all less than the reporting level. Concentration trends in aquifer wells with VOC data are given in table 8 (at back of report) and appendix E.

Historically, concentrations of VOCs in water samples from several wells at and near the RWMC exceeded the reporting levels (Bartholomay and others, 2000). However, concentrations for all VOCs except carbon tetrachloride were less than the MCL for drinking water (U.S. Environmental Protection Agency, 2013). Trend test results for carbon tetrachloride concentrations in water from the RWMC Production Well (appendix E) indicate a statistically significant increase in concentrations has occurred since 1987 (table 8 and appendix E). Concentrations have routinely exceeded the MCL for carbon tetrachloride in drinking water (5 µg/L) since 1998.

Davis and others (2013) indicated that more recent data collected since 2005 may be showing indications that concentrations are leveling off in the RWMC Production well. To further test this statement, a trend analyses was run on the dataset from 2005 through 2012 (fig. 29). The trend test on that dataset had a p-value of 0.054, and still shows a positive increase, but the trend is not considered significant using the criteria for this report. The lack of a more recent significant increasing trend may indicate that engineering practices designed to reduce VOC concentration movement to the aquifer are having a positive effect. The RWMC Production well also had increasing trends for trichloroethene, trichloromethane, tetrachloroethene, 1,1,1-trichloroethane, and tribromomethane (table 7, appendix E). During 2009–11, water from well USGS 87, just north of the RWMC (fig. 3), had detectable concentrations of carbon tetrachloride, and exceeded the MCL for the first time in 2011 (Davis and others, 2013). Concentrations of carbon tetrachloride from this well have had an increasing trend since 1987 (table 8, appendix E). Well USGS 87 also had increasing concentration trends for trichloroethene, trichloromethane, dichlorodifluoromethane, but not a significant trend for 1,1,1-trichloroethane and tetrachloroethene. Well USGS 120, south of the RWMC (fig. 3), had increasing concentration trends of carbon tetrachloride and trichloromethane and no significant trends for tetrachloroethene, 1,1,1-trichloroethane, and trichloroethene (table 8, appendix E). Well USGS 88 had decreasing concentration trends for carbon tetrachloride, trichloroethene, and 1,1,1-trichloroethane, and no significant trend for trichloromethane (table 8, appendix E).

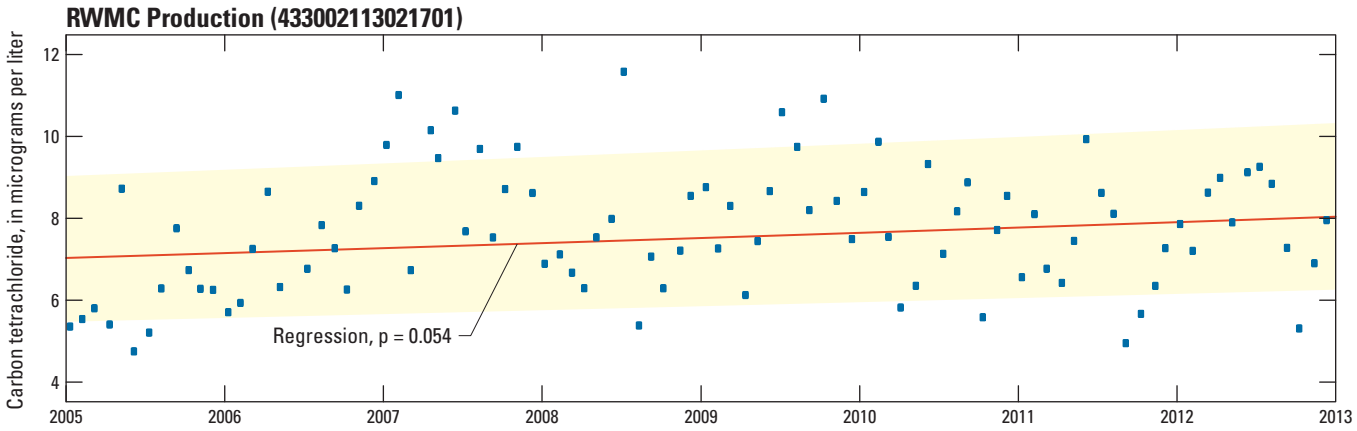


Figure 29. Carbon tetrachloride trend from Radioactive Waste Management Complex Production well, Idaho National Laboratory, Idaho, 2005–12.

Wells near the INTEC and ATR Complex (USGS 34, USGS 38, USGS 65, and USGS 77) had decreasing trends for 1,1,1-trichloroethane. Well USGS 77 also had a decreasing trend for 1,1,-dichloroethene. Wells USGS 34, USGS 38, and USGS 65 had no significant trend for dichlorodifluoromethane, and wells USGS 77 and 84 had decreasing trends for dichlorodifluoromethane. All other VOCs in all of the wells not mentioned had concentrations less than their respective reporting levels.

Factors Influencing Water-Quality Trends at Each Well

Chloride, chromium, nitrate, sodium, and sulfate are the primary non-radioactive constituents that have been discharged in wastewater at INL facilities. Additionally, elevated concentrations of these constituents in water samples also can come from other anthropogenic sources. Tritium and strontium-90 are the primary radioactive constituents that have been discharged in wastewater at INL facilities. Because of this, these are the primary constituents discussed for each well.

Aquifer Wells near Idaho Nuclear Technology and Engineering Center

CPP-1.—Trend test results for this well indicate that chloride, nitrate, sulfate, and tritium concentrations show decreasing trends, chromium shows an increasing trend, and fluoride, sodium, and strontium-90 show no trend (tables 5 and 7). The decreasing trends are attributed to discontinued disposal of these constituents at the INTEC along with continued dilution and dispersion in the aquifer system, and to radioactive decay for tritium.

CPP-2.—Chloride, nitrate, and sulfate concentrations show decreasing trends and sodium, strontium-90, and tritium show no trend (tables 5 and 7). The decreasing trends are attributed to discontinued disposal of these constituents at the INTEC along with continued dilution and dispersion in the aquifer system.

Rifle Range well.—Sodium and chloride concentrations show an increasing trend, and chromium, sulfate, and tritium show a decreasing trend, and strontium-90 shows no trend (tables 5 and 7). The increases in sodium and chloride are related to waste disposal into the new INTEC percolation ponds upgradient of this well beginning in 2002. The decreasing trends are attributed to discontinued disposal of these constituents, continued dilution and dispersion in the aquifer system, and to radioactive decay for tritium.

USGS 20.—Chloride, sodium, and nitrate concentrations all show increasing trends, tritium shows a decreasing trend, and sulfate and strontium-90 show no trend (tables 5 and 7). The decreasing trend for tritium can probably be attributed to lack of recent wastewater disposal and to radioactive decay. The increasing trends of the other constituents are probably due to a mass of water from periods of higher wastewater disposal reaching this well and increasing the overall concentration in the aquifer over time.

USGS 34.—Chloride, sodium, 1,1,1,-trichloroethane, tritium, and strontium-90 concentrations all show decreasing trends, sulfate and chromium show increasing trends, and nitrate and fluoride show no trend (tables 5 and 7). The decreasing trends for sodium, chloride, 1,1,1,-trichloroethane, tritium, and strontium-90 probably can be attributed to lack of recent wastewater disposal, and to radioactive decay in the case of tritium and strontium-90. Sulfate and chromium increases could be the result of wastewater discharged at the ATR Complex finally reaching this well and causing concentrations to increase. Several of the constituents

(especially sulfate) (appendix D) show fluctuating concentrations with rising and declining water levels, so dilution or lack of dilution from recharge also be may contributing to the concentration changes.

USGS 35.—Chloride, nitrate, sodium, and tritium concentrations show decreasing trends, sulfate shows an increasing trend, and strontium-90 shows no trend (tables 5 and 7). The decreasing trends for chloride, nitrate, and sodium and tritium can probably be attributed to lack of recent wastewater disposal and to radioactive decay in the case of tritium. Sulfate increases could be the result of wastewater discharged at the ATR Complex finally reaching this well and causing concentrations to increase. Several of the constituents (especially sulfate) (appendix D, fig. 20) show fluctuating concentrations with rising and declining water levels, so dilution or lack of dilution from recharge may also be contributing to the concentration changes.

USGS 36.—Chloride, nitrate, sodium, tritium, and strontium-90 concentrations all show decreasing trends, and sulfate shows an increasing trend (tables 5 and 7). The decreasing trends for sodium, chloride, nitrate, tritium, and strontium-90 probably can be attributed to lack of recent wastewater disposal and to radioactive decay in the case of tritium and strontium-90. Sulfate increases could be the result of wastewater discharged at the ATR Complex finally reaching this well and causing concentrations to increase.

USGS 37.—Chloride, sodium, nitrate, tritium, and strontium-90 concentrations all show decreasing trends, and sulfate shows an increasing trend (tables 5 and 7). The decreasing trends for sodium, chloride, tritium, and strontium-90 probably can be attributed to lack of recent wastewater disposal and to radioactive decay in the case of tritium and strontium-90. Sulfate increases could be the result of wastewater discharged at the ATR Complex finally reaching this well and causing concentrations to increase.

USGS 38.—Chloride, nitrate, sodium, 1,1,1,-trichloroethane, tritium, and strontium-90 concentrations all show decreasing trends, and chromium, fluoride, and sulfate show an increasing trend (tables 5, 7, and 8). The decreasing trends for sodium, chloride, 1,1,1,-trichloroethane, tritium, and strontium-90 probably can be attributed to lack of recent wastewater disposal and to radioactive decay in the case of tritium and strontium-90. Chromium and sulfate increases could be the result of wastewater discharged at the ATR Complex finally reaching this well and causing concentrations to increase.

USGS 39.—Tritium concentrations show a decreasing trend, sulfate and sodium show increasing trends, and chloride, nitrate and strontium-90 show no trend (tables 5 and 7, appendixes C and D). This well is near the Big Lost River and concentrations of all the constituents seem to fluctuate opposite to increases and decreases with water levels in the aquifer (fig. 20). For example, all the concentrations were the lowest when the water level was at its highest around 2000.

USGS 40.—Chloride, sulfate, tritium, and strontium-90 concentrations all show decreasing trends, and nitrate and sodium show no trend (tables 5 and 7). The decreasing trends for chloride, sulfate, tritium, and strontium-90 probably can be attributed to lack of recent wastewater disposal and to radioactive decay in the case of tritium and strontium-90.

USGS 41.—Chloride, sulfate, tritium, and strontium-90 concentrations all show decreasing trends, and nitrate and sodium show no trend (tables 5 and 7). The decreasing trends for chloride, sulfate, tritium, and strontium-90 probably can be attributed to lack of recent wastewater disposal and to radioactive decay in the case of tritium and strontium-90.

USGS 42.—Chloride, sulfate, tritium, and strontium-90 concentrations show decreasing trends, and nitrate and sodium show no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 43.—Chloride, tritium, and strontium-90 concentrations show decreasing trends, and nitrate, sulfate, and sodium show no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 44.—Chloride, nitrate, sodium, tritium, and strontium-90 concentrations show decreasing trends and sulfate shows no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 45.—Chloride, sulfate, tritium, and strontium-90 concentrations show decreasing trends, and nitrate and sodium show no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 46.—Chloride, nitrate, sodium, sulfate, tritium, and strontium-90 concentrations show decreasing trends (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 47.—Chloride, sodium, sulfate, tritium, and strontium-90 concentrations show decreasing trends, and nitrate shows no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 48.—Chloride, sulfate, tritium, and strontium-90 concentrations show decreasing trends, and nitrate and sodium show no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 51.—Nitrate and tritium concentrations show decreasing trends, chloride, sodium, and sulfate show increasing trends, and strontium-90 shows no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium. The increasing trends for the other constituents may be due to remnant movement of these constituents from the old percolation ponds until 2002 when the new percolation ponds were put into service; as appendix D shows, concentrations do start to decrease slightly after 2002.

USGS 52.—Chloride, tritium, and strontium-90 concentrations show decreasing trends, and nitrate, sulfate, and sodium show no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 57.—Chloride, nitrate, sodium, sulfate, tritium, and strontium-90 concentrations show decreasing trends (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 59.—Chloride, nitrate, sodium, sulfate, tritium, and strontium-90 concentrations all show decreasing trends (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 67.—Chloride, sodium, sulfate, tritium, and strontium-90 concentrations show decreasing trends and nitrate shows an increasing trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90. Nitrate concentrations have fluctuated through the period of record (appendix D) and the increase may indicate another possible source of contamination other than the infiltration ponds.

USGS 77.—Chloride, chromium, sulfate, nitrate, and tritium concentrations show decreasing trends, fluoride shows an increasing trend, and sodium and strontium-90 show no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium.

USGS 82.—Chloride, nitrate, sodium, and tritium concentrations show decreasing trends, and sulfate and strontium-90 show no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium.

USGS 84.—Tritium concentrations show a decreasing trend, and chloride, nitrate, sodium, sulfate, and strontium-90 show no trend. This well is near the Big Lost River, and concentrations of all the constituents seem to fluctuate opposite to increases and decreases of water levels in the aquifer (appendixes C and D). For example, all concentrations (except for the trace elements) were the lowest when the water level was at its highest about 1998–2000. The large decrease in zinc in the mid-2000s (appendix D) is probably due to the change of a galvanized sample pipe to stainless steel.

USGS 85.—Tritium, chloride, nitrate, and sodium concentrations show decreasing trends, and sulfate shows an increasing trend and strontium-90 shows no trend (tables 5 and 7). The decreasing trends are attributed to discontinued wastewater disposal at the INTEC and to radioactive decay for tritium. The increasing trend for sulfate could be due to water from the ATR Complex finally reaching this well.

USGS 111.—Nitrate, sodium, sulfate, and tritium concentrations show decreasing trends, and chloride and strontium-90 show no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium.

USGS 112.—Chloride, nitrate, sodium, sulfate, tritium, and strontium-90 concentrations all show decreasing trends (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium and strontium-90.

USGS 113.—Chloride, sulfate, sodium, tritium, and strontium-90 concentrations show decreasing trends and nitrate shows no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium.

USGS 114.—Nitrate and tritium concentrations show decreasing trends, chloride shows an increasing trend, and sodium, sulfate, and strontium-90 show no trend (tables 5 and 7). The decreasing trends for nitrate and tritium probably can be attributed to lack of recent wastewater disposal near this well and to radioactive decay for tritium. The increase in chloride is probably due to the variable wastewater disposal in the past and slower groundwater movement to this well than to other wells in this area.

USGS 115.—Tritium concentrations show a decreasing trend, chloride and sulfate show increasing trends, and nitrate, sodium, and strontium-90 show no trend (tables 5 and 7). The decreasing trends for tritium probably can be attributed to lack of recent wastewater disposal near this well and to radioactive decay. The increase in chloride and sulfate is probably due to variable wastewater disposal in the past and slower groundwater movement to this well than to other wells in this area.

USGS 116.—Nitrate, sulfate, and tritium concentrations show decreasing trends, chloride shows an increasing trend, and sodium and strontium-90 show no trend (tables 5 and 7). The decreasing trends probably can be attributed to lack of recent wastewater disposal near this well and to radioactive decay for tritium. The increase in chloride is probably due to the more variable wastewater disposal of this constituent compared to the others in the past and slower groundwater movement to this well than to other wells in this area.

USGS 123.—Chloride, nitrate, sulfate, sodium, tritium, and strontium-90 concentrations all show decreasing trends (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well, deepening of the well, and to radioactive decay for tritium and strontium-90. The large drop in concentrations in 2005 (appendix C and D) are due the deepening of this well in 2004 (Forbes and others, 2007), which resulted in sampling a larger zone of the upper part of the aquifer, thereby diluting future samples.

USGS 128.—Chloride, nitrate, and tritium concentrations show decreasing trends, and strontium-90 shows no trend (tables 5 and 7). The decreasing trends probably can be attributed to dilution and dispersion and the lack of recent wastewater disposal near this well and to radioactive decay for tritium.

Aquifer Wells near Advanced Test Reactor Complex

MTR TEST.—Chloride, nitrate, sodium, sulfate, and tritium concentrations all show decreasing trends (tables 5 and 7). The decreasing trends are attributed to discontinued disposal of these constituents at the ATR Complex, along with clean-up of ponds the constituents were disposed of in the past. Although concentrations of tritium and sodium generally are decreasing, they show increases from 1990 to 1994 before decreasing (appendixes C and D); the increases were probably due to disposal in the radioactive-waste ponds reaching the aquifer before the ponds were taken out of service in the case of tritium and due to variable disposal in the chemical waste pond in the case of sodium.

TRA Disposal.—Tritium, nitrate, sodium, and sulfate concentrations show decreasing trends and chloride and strontium-90 show no trend (tables 5 and 7). The decreasing trends are attributed to discontinued disposal of these constituents at the ATR Complex along with continued dilution and dispersion in the aquifer system, and because of radioactive decay for tritium.

USGS 58.—Tritium concentrations show a decreasing trend, sodium and sulfate show increasing trends, and chloride, chromium, and strontium-90 show no trend (tables 5 and 7). The decreasing trends for tritium probably can be attributed to lack of recent wastewater disposal near this well and to radioactive decay. The increasing sodium and sulfate concentrations are probably due to wastewater disposal in the chemical and cold waste ponds at the ATR Complex.

USGS 65.—Chromium and tritium concentrations show decreasing trends, sodium and sulfate show increasing trends, and chloride, nitrate, and strontium-90 show no trend (tables 5 and 7). The decreasing trends for chromium and tritium probably can be attributed to lack of recent wastewater disposal and to radioactive decay in the case of tritium. The increasing sodium and sulfate concentrations are probably due to wastewater disposal in the chemical and cold waste ponds at the ATR Complex. The large decrease in zinc in the mid-2000s (table 7) is probably due to the change of a galvanized sample pipe to stainless steel.

USGS 76.—Tritium concentrations show a decreasing trend, sodium and sulfate show increasing trends, and chloride, chromium, nitrate, and strontium-90 show no trend (tables 5 and 7). The decreasing trend for tritium probably can be attributed to lack of recent wastewater disposal near this well and to radioactive decay. The increasing sodium and sulfate concentrations are probably due to wastewater disposal in the chemical and cold waste ponds at the ATR Complex.

USGS 79.—Chloride concentrations show a decreasing trend, and sodium, sulfate, and tritium show no trend (tables 5 and 7). The decreasing trend for chloride probably can be attributed to Big Lost River seepage in this part of the aquifer diluting the amount of chloride.

Aquifer Wells near Central Facilities Area

CFA-1.—Tritium, nitrate, and sulfate concentrations show decreasing trends and chloride, sodium, and strontium-90 show no trend (tables 5 and 7). The decreasing trends are attributed to discontinued disposal of these constituents at the INTEC along with continued dilution and dispersion in the aquifer system and also because of radioactive decay for tritium.

CFA-2.—Chloride, sodium, sulfate, and nitrate concentrations all show increasing trends, tritium shows a decreasing trend, and strontium-90 shows no trend (tables 5 and 7). The decreasing trend for tritium probably can be attributed to lack of recent wastewater disposal and to radioactive decay. The increasing trends of the other constituents are probably due to a mass of water from periods of high wastewater disposal reaching this well and increasing the overall concentration in the aquifer over time. Busenberg and others (2001) indicated that this well contains about three-quarters young water , whereas CFA 1 consists of only about half young water, so this well may be more influenced by past wastewater disposal. This well is in the southern part of the CFA, and the increasing nitrate trend could be attributed to leakage from disposal at the former CFA mercury pond (U.S. Department Energy, 2011).

CFA LF 2-10.—Tritium, nitrate, and chromium concentrations show decreasing trends, sodium shows an increasing trend, and chloride and strontium-90 show no trend (tables 5 and 7). The decreasing trends are attributed to discontinued disposal of these constituents at the INTEC along with continued dilution and dispersion in the aquifer system and because of radioactive decay for tritium. The increasing sodium trend may be due to a mass of water from a previous higher disposal period reaching this well and increasing the overall concentration in the aquifer; this trend may be an indication that sodium is moving more slowly in the aquifer than some of the other constituents.

CFA LF 3-9.—Nitrate concentrations show a decreasing trend, chloride shows an increasing trend, and tritium and strontium-90 show no trend (tables 5 and 7). The decreasing trend for nitrate is attributed to discontinued disposal at the INTEC along with continued dilution and dispersion in the aquifer system. The increasing trend for chloride is attributed to variable chloride disposal finally reaching this well and three of the four values collected since 2002 decreased from previous samples (appendix D).

USGS 127.—Sodium concentrations show an increasing trend, chromium shows a decreasing trend, and chloride, nitrate, tritium, and strontium-90 show no trend (tables 5 and 7). The increasing trend of sodium probably is due to a mass of water from periods of higher wastewater disposal reaching this well and increasing the overall concentration in the aquifer over time. Although regional flow paths indicate that wastewater should move through this area, the water chemistry in this well is indicative of natural aquifer background, except for chromium.

Aquifer Wells near Radioactive Waste Management Complex

RWMC M3S.—Chloride concentrations show an increasing trend and nitrate, tritium, and strontium-90 show no trend (tables 5 and 7). The increasing chloride trend may be due to a mass of water from periods of higher wastewater disposal reaching this well and increasing the overall concentration in the aquifer over time, or may be due to slow seepage from buried waste at RWMC.

RWMC M7S.—Chloride and nitrate concentrations show an increasing trend and tritium and strontium-90 show no trend (tables 5 and 7). The increasing chloride and nitrate trends may be due to a mass of water from periods of higher wastewater disposal reaching this well and increasing the overall concentrations in the aquifer over time, or may be due to slow seepage from buried waste at RWMC.

RWMC M11S.—Trend test results for constituents in water from this well indicate no trends for any of the major constituents for which trend analyses were completed (tables 5 and 7).

RWMC M12S.—Chloride and nitrate concentrations show increasing trends, chromium has a decreasing trend, and tritium and sodium show no trend (tables 5 and 7).The increasing chloride and nitrate trends may be due to a mass of water from periods of higher wastewater disposal reaching this well and increasing the overall concentrations in the aquifer over time.

RWMC M13S.—Trend test results for constituents in water from this well indicate no trends for any of the major constituents for which trend analyses were completed (tables 5 and 7). Although regional flow paths indicate that wastewater from the INTEC/ATR Complex disposal should move through this area, the water chemistry in this well seems to be indicative of natural aquifer background concentrations except for chromium.

RWMC M14S.—Chromium and tritium concentrations show decreasing trends and no trend for chloride, nitrate, and sodium (tables 5 and 7). The decreasing concentrations are probably due to dilution and dispersion in the aquifer and also due to radioactive decay for tritium.

RWMC Production.—Chloride and sodium concentrations along with the VOCs 1,1,1-trichloroethane, tetrachloroethene, carbon tetrachloride, trichloroethene, trichloromethane, and tribromomethane (tables 7 and 8, appendixes D and E) show increasing trends. Nitrate, sulfate, tritium, and strontium-90 show no trend. The increasing constituent trends are likely due to the movement of wastes buried at the RWMC moving to the aquifer.

USGS 87.—Chromium and nitrate concentrations show a decreasing trend; chloride, sodium, trichloromethane, trichloroethene, carbon tetrachloride, dichlorodifluoromethane, and tritium show increasing trends; and sulfate and strontium-90 show no trend (tables 5, 7, and 8). Both sodium and chloride show large increases in 2005 (appendix D). This well is along the flow path downgradient of the new INTEC percolation ponds installed in 2002, so the changes in these concentrations are attributed to disposal in the new ponds. The increases in the VOCs are attributed to continued leakage from buried waste at RWMC.

USGS 88.—Concentrations of 1,1,1-trichloroethane, carbon tetrachloride, nitrate, sodium, sulfate, and trichloroethene show decreasing trends, and chloride, tritium, and strontium-90 show no trend (tables 5, 7, and 8). The decreasing concentrations of the constituents may be an indication that clean-up at RWMC is having a positive influence on the aquifer where this well is located.

USGS 89.—Nitrate concentrations show a decreasing trend, and chloride, sodium, sulfate, tritium, and strontium-90 show no trend (tables 5 and 7). The decreasing concentrations of nitrate may be an indication that clean-up at RWMC is having a positive influence on the aquifer where this well is located.

USGS 120.—Chloride, sodium, sulfate, and tetrachloroethene concentrations show decreasing trends, carbon tetrachloride and trichloromethane show an increasing trend, and nitrate, tritium, and strontium-90 show no trend (tables 5, 7, and 8). Sodium, sulfate, and several VOCs show large increases in the late 1990s and early 2000s and, conversely, nitrate shows a decrease in the same period (appendixes C and E). This well is near the INL spreading areas (fig. 1) and was influenced by spreading area water from 1996 to 1999 (Bartholomay and others, 2000; Nimmo and others, 2002). The nitrate decrease corresponds with an increase of dilution from spreading area water, but the other constituent increases do not. The increase of the VOCs may suggest a large movement of contaminants from the unsaturated zone below the RWMC during this period and spreading area recharge may have been a factor that influenced the increase in the movement of the buried waste.

Aquifer Wells South of Facilities

USGS 104.—Chloride, sodium, and nitrate concentrations show increasing trends, and tritium shows no trend (tables 5 and 7). The increasing trends may represent the overall increase due to a mass of water from higher wastewater disposal periods reaching this well and increasing the overall concentration in the aquifer over time.

USGS 105.—Sodium and chloride concentrations show decreasing trends, nitrate shows an increasing trend, and tritium shows no trend (tables 5 and 7). The decreasing sodium and chloride may be an indicator that the sodium and chloride concentrations are originating from a different source than INTEC disposal and may have different travel times than other wells near the southern border. The presence of chromium concentrations above background concentrations may suggest some water originates from the ATR Complex area.

USGS 106.—Tritium concentrations show a decreasing trend, sodium shows an increasing trend, and chloride shows no trend (tables 5 and 7). The increasing trend for sodium may be due to a mass of water from periods of higher wastewater disposal reaching this well and increasing the overall concentration in the aquifer over time. The decreasing tritium concentration is probably due to radioactive decay.

USGS 108.—Chloride, nitrate, sodium, and tritium concentrations show no trend (tables 5 and 7). Concentrations of the inorganic constituents generally are at levels considered as background for the ESRP and water from this well probably represents well-mixed aquifer water with little influence from wastewater disposal.

USGS 124.—Chloride and nitrate concentrations show increasing trends, and sodium and tritium show no trend (tables 5 and 7). The increasing trends may be due to a mass of water from periods of higher wastewater disposal reaching this well and increasing the overall concentration in the aquifer over time.

Perched Groundwater Wells near Idaho Nuclear Technology and Engineering Center

PW 1.—Chloride, tritium, and strontium-90 concentrations show decreasing trends and sodium shows no trend (tables 5 and 7). This well gets all of its water from leakage from the old percolation ponds at the INTEC that were taken out of service in 2002 and the trends are attributed to variable wastewater disposal.

PW 2.—Chloride, sodium, and tritium concentrations show decreasing trends, and sulfate and strontium-90 show no trend (tables 5 and 7). This well gets all of its water from leakage from the old percolation ponds at the INTEC that were taken out of service in 2002 and the trends are attributed to variable wastewater disposal.

PW 3.—Chloride, tritium, and strontium-90 concentrations show a decreasing trend and sodium shows no trend (tables 5 and 7). This well gets all of its water from leakage from the old percolation ponds at the INTEC that were taken out of service in 2002 and the trends are attributed to variable wastewater disposal.

PW 4.—Chloride, sodium, strontium-90 and tritium concentrations show decreasing trends, and sulfate shows an increasing trend (tables 5 and 7). This well gets most of its water from leakage from the old percolation ponds at the INTEC that were taken out of service in 2002 and the trends are attributed to variable wastewater disposal.

PW 5.—Tritium and strontium-90 concentrations show decreasing trends, and chloride and sodium show no trend (tables 5 and 7). This well gets all of its water from leakage from the old percolation ponds at the INTEC that were taken out of service in 2002 and the trends are attributed to variable wastewater disposal.

PW 6.—Tritium concentrations show a decreasing trend and chloride and strontium-90 show no trend (tables 5 and 7). This well gets all of its water from leakage from the old percolation ponds at the INTEC that were taken out of service in 2002 and the trends are attributed to variable wastewater disposal.

USGS 50.—Chloride, nitrate, tritium, and strontium-90 concentrations show decreasing trends, and sodium and sulfate show no trend (tables 5 and 7). This well gets most of its water from leakage from cracks in the old INTEC disposal well and leaky pipes around INTEC and the trends can be attributed to variable wastewater disposal and radioactive decay. The well was abandoned in 2009.

Perched Groundwater Wells near Advanced Test Reactor Complex

CWP 1.—Sulfate concentrations show a decreasing trend and chloride, chromium, tritium, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from

leakage from the cold waste ponds at the ATR Complex and the trend and lack of trends is due to variable discharge of the constituents in the wastewater.

CWP 2.—Chloride concentrations show no trend (table 7). This well gets most of its water from leakage from the cold waste ponds at the ATR Complex and the lack of trend is due to variable discharge in the wastewater.

CWP 3.—Chromium concentrations show a decreasing trend and chloride, sulfate, tritium, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the cold waste ponds at the ATR Complex and the trends are due to variable discharge of the constituents in the wastewater.

CWP 4.—Chloride concentrations show a decreasing trend and tritium and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the cold waste ponds at the ATR Complex and the decreasing trend is attributed to variable wastewater disposal.

CWP 5.—Tritium concentrations show no trend (table 5).

CWP 8.—Chloride and sulfate concentrations show decreasing trends and chromium, tritium, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the cold waste ponds at the ATR Complex and the trends are attributed to variable wastewater disposal.

PW 8.—Chromium, sulfate, tritium, and strontium-90 concentrations show decreasing trends, and chloride and sodium show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends are attributed to variable wastewater disposal and to radioactive decay for tritium and strontium-90.

PW 9.—Chromium, sodium, sulfate, and tritium concentrations show decreasing trends, chloride shows an increasing trend, and strontium-90 shows no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends are attributed to variable wastewater disposal and to radioactive decay for tritium.

TRA A 13.—Tritium and strontium-90 concentrations show decreasing trends, and chloride shows an increasing trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993. The trends can be attributed to variable discharge and radioactive decay. Sampling was discontinued in 2008 and the well was later abandoned.

TRA A 77.—Tritium concentrations show a decreasing trend, chloride and strontium-90 show increasing trends (table 5 and 7). This well gets most of its water from leakage from a retention basin prior to flow to the old radioactive-waste infiltration ponds that were discontinued in 1993. The trends can be attributed to variable wastewater disposal and radioactive decay and a different affinity for strontium-90 to absorb to sediments and then possibly get reintroduced later to the water column through cation exchange. Sampling was discontinued in 2008 and the well was later abandoned.

USGS 53.—Tritium and strontium-90 concentrations show decreasing trends, and chloride, chromium, and sodium show no trend (tables 5 and 7). This well previously was used as a disposal well and gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal, discontinuation of disposal to the radioactive waste ponds, and radioactive decay for tritium and strontium-90.

USGS 54.—Chromium, sulfate, tritium, and strontium-90 concentrations show decreasing trends, and chloride and sodium show no trend (tables 5 and 7). This well historically got most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal, discontinuation of disposal to the radioactive waste ponds, and radioactive decay for tritium and strontium-90.

USGS 55.—Chloride and chromium concentrations show decreasing trends, strontium-90 shows an increasing trend, and sodium, sulfate, and tritium show no trend (tables 5 and 7). This well historically got most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal. Strontium-90 shows an increasing trend through 2006 and then concentrations decrease (appendix C). The increase could be due to sodium discharge into the chemical waste pond exchanging with strontium-90 making it mobile; the subsequent decrease after 2006 could be due to the closing of the chemical waste ponds in 1999. Although sodium does not show a statistically significant trend, sodium concentrations in this well do somewhat show an inverse relationship with strontium-90 concentrations (appendixes C and D).

USGS 56.—Tritium concentrations show a decreasing trend, and chloride, chromium, sodium, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal, discontinuation of disposal to the radioactive waste ponds, and radioactive decay for tritium.

USGS 60.—Chromium, sulfate, and tritium concentrations show decreasing trends, and chloride, sodium, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the old

radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal.

USGS 61.—Chromium, sodium, and tritium concentrations show decreasing trends, and chloride, sulfate, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex and the trends (or lack of trends) are attributed to variable wastewater disposal and to radioactive decay for tritium.

USGS 62.—Chromium and tritium concentrations show decreasing trends, and chloride, chromium, sulfate, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal and to radioactive decay for tritium.

USGS 63.—Chromium, sulfate, tritium, and strontium-90 concentrations show a decreasing trend, and chloride and sodium show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal and to radioactive decay for tritium and strontium-90.

USGS 66.—Tritium concentrations show a decreasing trend, and chromium, sodium, sulfate, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal and to radioactive decay for tritium.

USGS 68.—Chloride, sodium, and sulfate concentrations show decreasing trends, chromium shows an increasing trend, and tritium and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the chemical waste infiltration ponds that were discontinued in 1999 and the cold waste-ponds at the ATR Complex. The trends are attributed to variable wastewater disposal.

USGS 69.—Chloride and sulfate concentrations show decreasing trends, and chromium, sodium, tritium, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal.

USGS 70.—Chloride, chromium, tritium, and strontium-90 concentrations show decreasing trends, and sulfate and sodium show no trend (tables 5 and 7). This well historically got most of its water from leakage from the old radioactive waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends (or lack of trends) are attributed to variable wastewater disposal, discontinuation of disposal to the radioactive waste infiltration ponds, and to radioactive decay for tritium and strontium-90.

USGS 71.—Chromium and tritium concentrations show decreasing trends; sodium shows an increasing trend; and chloride, sulfate, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex and the trends (or lack of trends) are attributed to variable wastewater disposal and to radioactive decay for tritium.

USGS 72.—Sulfate concentrations show a decreasing trend, and chloride, chromium, sodium, tritium, and strontium-90 show no trend (tables 5 and 7). This well probably gets most of its water from leakage from landscape irrigation water and from other unknown sources around the ATR Complex and possibly some minimal influence by wastewater ponds around the ATR Complex. The decreasing sulfate may be an indication that the water was influenced by the chemical waste pond and the decreases are probably due to the discontinued use of the pond in 1999.

USGS 73.—Chromium and tritium concentrations show decreasing trends, chloride shows an increasing trend, and sodium, sulfate, and strontium-90 show no trend (tables 5 and 7). This well gets most of its water from leakage from the old radioactive-waste infiltration ponds that were discontinued in 1993 and from leakage from the cold waste ponds near the ATR Complex. The trends are attributed to variable wastewater disposal and to radioactive decay for tritium.

USGS 78.—Chromium concentrations show a decreasing trend, and chloride, sulfate, sodium, tritium and strontium-90 show no trend (tables 5 and 7). This well probably gets all of its water from recharge from the Big Lost River (Orr, 1999), and the increasing chromium may be due to variable reporting levels as only four concentrations exceeded the reporting level (appendix D).

Perched Groundwater Well at Radioactive Waste Management Complex

USGS 92.—Chloride, tritium, and strontium-90 concentrations show no trend (tables 5 and 7).

Summary and Conclusions

The U.S. Geological Survey (USGS), in cooperation with the U.S. Department of Energy, has maintained a water-quality monitoring network at the Idaho National Laboratory (INL) since 1949 to define the quality of water for human and industrial use and to better understand the location and movement of contaminants in the eastern Snake River Plain aquifer underlying the INL. Trends in constituent concentrations for 64 regional aquifer wells and 35 perched groundwater wells were analyzed from 1981 through 2012. Constituents analyzed included some combination of tritium, strontium-90, cesium-137, plutonium-238, plutonium-239, -240 (undivided), americium-241, gross alpha- and beta-particle radioactivity, calcium, magnesium, potassium, silica, sodium, bromide, chloride, fluoride, sulfate, nitrate (as N), orthophosphate (as P), chromium and other trace elements, and total organic carbon. The wells selected for analysis in this report likely were affected by wastewater disposal practices at the INL. Concentration trends were determined to assist with future management decisions concerning which wells to sample and which constituent types to monitor.

Water-quality trends were determined from groundwater data collected after the date of pump installations to eliminate variability associated with sample-collection methods. Concentration trends also were from data sets from the same laboratory, either the USGS National Water Quality Laboratory or the Department of Energy Radiological and Environmental Sciences Laboratory. Data not used for the trend analyses included data from special INL studies, data collected prior to 1981 when laboratory methods were unknown and quality assurance data were not routinely collected, and data collected from different depths in the aquifer using a thief sampler. Outlier data that did not correlate with field-specific conductance measurements and replicate values were not used.

The data were processed using custom computer scripts developed in the R programming language. All R functions written for this report are stored in an R-package called "Trends." In addition to the base packages included with R, Trends depends on the "Survival" package. The Trends package identifies statistical trends in water-quality data for multiple constituents and sample sites using a parametric survival regression model for left-censored data (values reported as less than a laboratory reporting level [LRL]), interval-censored data (data with an associated uncertainty), and uncensored data. This "Trends" package also calculates summary statistics of mean, median, minimum, maximum, and standard deviation for multiple constituents, and automates plotting the data and regression lines.

A significance level of 0.05 was selected to determine if the result of the test was statistically significant. A two-sided *p*-value that was less than or equal to 0.05 indicated that there was a statistically significant correlation, or trend, in the data. The sign of the percent change per year indicated whether there was an increasing or decreasing trend if a significant correlation existed. If *p*-values were greater than 0.05, there was no statistically significant correlation, or trend, between time and concentration.

Data for field measurements of pH, specific conductance, and water temperature were analyzed for trends. Of the 64 aquifer wells measured for pH, 43 of the wells had a decreasing pH trend, and 20 wells had no trend. Only one well showed an increasing trend in pH. Of the 35 perched groundwater wells measured, 12 had a decreasing pH trend, 3 had an increasing pH trend, and 20 had no trend. It was difficult to assess whether or not the trends for pH were due to actual changes in the aquifer or perched groundwater, or because of variability in the sample collection methods or meter types.

Sixty-four aquifer wells were analyzed for a trend in specific conductance; 34 had a decreasing trend, 16 had no trend, and 14 had an increasing trend. Most of the wells that showed decreasing or no trend are located near the Idaho Nuclear Technology and Engineering Center (INTEC), and the decreasing trends may be a response to decreased wastewater disposal since 1989 or discontinued use of the old percolation ponds south of the INTEC in 2002. Most aquifer wells that showed an increasing trend are located south and southeast of the INTEC, or north of the RWMC. Most of the specific conductance data in perched groundwater wells near the INTEC and the Advanced Test Reactor Complex (ATR Complex) showed either a decreasing trend or no trend.

Sixty-four aquifer wells were evaluated for temperature trends; 32 showed a decreasing trend, 29 showed no trend, and 3 showed an increasing trend. Of the 35 perched groundwater wells analyzed for temperature trends, 13 showed a decreasing trend, 17 showed no trend, and 5 showed an increasing trend. All the perched groundwater wells with an increasing trend in temperature are near the ATR Complex.

Of the 63 aquifer wells that were analyzed for tritium concentration trends, 45 showed decreasing trends, 1 showed an increasing trend, and 18 showed no trends. Of the 33 perched groundwater wells that were analyzed for tritium trends, 22 showed a decreasing trend and 11 showed no trend. The decreasing trends can be attributed to decreased disposal at facilities and to the radioactive decay of tritium.

Fifty-two aquifer wells were analyzed for strontium-90 concentration trends; 20 showed a decreasing strontium-90 trend and 32 showed no trend. Of the 32 perched groundwater wells that were analyzed for strontium-90 trends, 11 showed a decreasing trend, 19 showed no trend, and 2 showed an increasing trend. The two wells that showed an increasing trend (TRA A 77 and USGS 55) are near the radioactive-waste infiltration ponds at the ATR Complex, and could be influenced by strontium-90 that was discharged to the radioactive-waste infiltration ponds before they were replaced by lined evaporation ponds in 1993.

Water from 63 wells was analyzed for chloride concentration trends. Thirty-one of these wells had decreasing trends, 17 had no trend, and 15 had an increasing trend. Most wells near the INTEC and ATR Complex showed decreasing or no trends for chloride, probably the result of decreased disposal of wastewater and (or) discontinued use of the old percolation ponds south of the INTEC and redirection of discharge to the new percolation ponds 2 miles southwest of the INTEC in 2002. Chloride concentrations in some wells south of the INTEC were influenced by episodic recharge from the Big Lost River; chloride concentrations decreased during wetter periods when there is probably more recharge from the Big Lost River, and increased during dry periods, when there is less recharge.

Perched groundwater analyzed for chloride concentration trends showed that 10 perched groundwater wells had decreasing trends, 18 had no trend, and 4 had increasing chloride concentration trends.

Sodium hydrate was a predominant constituent in wastewater discharged to the chemical-waste infiltration pond at the ATR Complex, and sodium and chloride were predominant chemical constituents in wastewater discharged at the INTEC and the Central Facilities Area (CFA). Of the 59 aquifer wells analyzed for sodium concentration trends, 22 wells showed a decreasing trend, 23 showed no trend, and 14 showed an increasing trend. The increasing trend for sodium in some wells could be due to the long term influence of wastewater disposal from upgradient facilities and the lack of trend for chloride could be because it is more mobile than sodium and more dispersed in the aquifer system. Five perched groundwater wells analyzed for sodium trends had decreasing trends, 18 had no trend, and 1 well had an increasing trend.

Forty-eight aquifer wells were analyzed for sulfate concentration trends; 24 had decreasing trends, 11 had no trend, and 13 had increasing trends. Most aquifer wells that had increasing trends were located downgradient of the INTEC or ATR Complex, in the general direction of regional groundwater flow to the southwest. Closer to the facilities, sulfate trends either decreased or there was no trend. Most perched groundwater wells near the INTEC and ATR Complex showed decreasing or no trends.

Fifty-nine aquifer wells were analyzed for trends in nitrate concentrations; 28 showed a decreasing trend, 23 showed no trend, and 8 showed an increasing trend. As was shown for chloride, sodium, and sulfate for wells near the Big Lost River, the nitrate concentrations fluctuated in response to recharge from the Big Lost River. Only one well completed in perched groundwater at the INTEC was analyzed for a nitrate trend; it had a decreasing trend.

Trace element concentrations from two wells were analyzed for trends. Well USGS 65 showed no trend for aluminum, antimony, copper, manganese, nickel, and selenium. Barium, cadmium, cobalt, lead, and zinc had decreasing trends, and arsenic, molybdenum, and uranium had increasing trends. Well USGS 84 showed no trend for aluminum, antimony, barium, manganese, molybdenum, selenium and uranium. Cadmium, cobalt, copper, lead, nickel, and zinc showed decreasing trends, and arsenic showed an increasing trend.

Twenty-five aquifer wells were analyzed for chromium concentration trends; 14 showed no trend, 8 showed decreasing trends, and 3 showed increasing trends. The three wells that showed increasing trends are located at or just downgradient of the INTEC. One well downgradient of the ATR Complex showed a decreasing trend. Most of the other wells showing decreasing trends are located near the CFA and the Radioactive Waste Management Complex (RWMC). Of the 21 perched groundwater wells analyzed for chromium trends, 7 showed no trend, 13 showed a decreasing trend, and 1 showed an increasing trend. All the perched groundwater wells that had decreasing trends are south or southeast of the ATR Complex and the decreasing trends are probably due to discontinued disposal.

Volatile organic compound (VOC) concentration trends were analyzed for nine aquifer wells for this study. Historically, concentrations of VOCs in water samples from several wells at and near the RWMC exceeded the reporting levels. Concentrations for all VOCs except carbon tetrachloride were less than the maximum contaminant level (MCL) for drinking water. A plot of carbon tetrachloride concentrations in water from the RWMC Production Well indicates that concentration trends in this well have increased since 1987; however, trend analyses of data collected since 2005 show no statistically significant trend indicating that engineering practices designed to reduce movement of volatile organic compounds to the aquifer may be having a positive effect on the aquifer. The RWMC Production well also had increasing trends for trichloroethene, trichloromethane, tetrachloroethene, 1,1,1-trichloroethane, and tribromomethane.

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Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells											
Idaho Nuclear Technology and Engineering Center											
CPP 1	433433112560201	pH	46	7.44	8.08	7.96	7.92	0.125	-0.151	0.000	–
		Specific conductance	46	350	465	405	405	18.2	-0.387	0.000	–
		Temperature	46	11.6	13.0	12.0	12.1	0.333	-0.158	0.010	–
CPP 2	433432112560801	pH	39	7.42	8.14	7.95	7.89	0.168	-0.192	0.000	–
		Specific conductance	39	365	426	405	400	18.0	-0.449	0.000	–
		Temperature	39	11.5	13.7	12.0	12.2	0.501	0.101	0.279	none
RIFLE RANGE	433243112591101	pH	13	7.31	7.99	7.85	7.77	0.194	0.091	0.643	none
		Specific conductance	13	418	488	450	451	26.0	1.20	0.007	+
		Temperature	13	12.1	13.6	12.4	12.5	0.395	0.065	0.787	none
USGS 20	433253112545901	pH	40	7.48	8.06	7.95	7.92	0.127	-0.059	0.143	none
		Specific conductance	40	280	394	362	360	21.3	0.617	0.000	+
		Temperature	40	11.1	14.0	12.6	12.6	0.603	-0.059	0.614	none
USGS 34	433334112565501	pH	38	7.69	8.12	7.98	7.93	0.110	-0.074	0.034	–
		Specific conductance	38	380	455	424	424	20.4	0.035	0.773	none
		Temperature	38	11.0	13.0	12.0	12.0	0.466	-0.273	0.005	–
USGS 35	433339112565801	pH	38	7.59	8.10	7.98	7.94	0.119	-0.167	0.000	–
		Specific conductance	38	372	490	440	430	23.7	-0.109	0.427	none
		Temperature	38	11.0	13.5	11.6	11.8	0.523	-0.242	0.022	–
USGS 36	433330112565201	pH	56	7.64	8.09	7.91	7.89	0.100	-0.097	0.001	–
		Specific conductance	56	418	601	491	503	61.0	-1.31	0.000	–
		Temperature	56	11.5	14.0	12.5	12.6	0.531	-0.541	0.000	–
USGS 37	433326112564801	pH	40	7.46	8.05	7.90	7.88	0.111	-0.088	0.009	–
		Specific conductance	40	345	828	618	622	142	-1.82	0.000	–
		Temperature	40	11.0	14.0	13.0	13.1	0.681	-0.609	0.000	–
USGS 38	433322112564301	pH	37	7.64	8.78	7.84	7.90	0.239	-0.181	0.016	–
		Specific conductance	37	417	979	732	698	200	-3.21	0.000	–
		Temperature	37	10.3	15.0	13.5	13.4	0.958	-0.730	0.000	–
USGS 39	433343112570001	pH	57	7.38	8.13	7.98	7.93	0.158	-0.174	0.000	–
		Specific conductance	57	361	453	420	416	23.4	0.066	0.626	none
		Temperature	57	10.6	13.8	11.6	11.7	0.616	0.311	0.009	+

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 40	433411112561101	pH	56	7.46	8.06	7.94	7.92	0.119	-0.043	0.265	none
		Specific conductance	56	418	593	471	476	38.2	-0.603	0.002	–
		Temperature	56	11.8	14.5	13.1	13.2	0.552	-0.512	0.000	–
USGS 41	433409112561301	pH	38	7.57	8.07	7.95	7.91	0.116	-0.114	0.002	–
		Specific conductance	38	409	521	446	451	26.6	-0.594	0.000	–
		Temperature	38	11.3	13.5	12.3	12.2	0.378	-0.222	0.003	–
USGS 42	433404112561301	pH	38	7.30	8.08	7.95	7.91	0.148	-0.109	0.023	–
		Specific conductance	38	384	498	443	445	27.4	-0.600	0.000	–
		Temperature	38	11.6	13.5	12.2	12.3	0.355	-0.237	0.001	–
USGS 43	433415112561501	pH	37	7.60	8.30	8.05	8.02	0.170	-0.191	0.000	–
		Specific conductance	37	445	590	483	483	28.2	-0.698	0.000	–
		Temperature	37	11.8	15.0	12.9	13.0	0.597	-0.418	0.000	–
USGS 44	433409112562101	pH	46	7.44	8.10	7.94	7.89	0.147	-0.115	0.008	–
		Specific conductance	46	369	446	420	413	22.1	-0.743	0.000	–
		Temperature	46	11.0	14.5	11.7	11.9	0.691	-0.356	0.006	–
USGS 45	433402112561801	pH	39	7.51	8.12	7.96	7.89	0.154	-0.182	0.000	–
		Specific conductance	39	384	455	427	422	18.5	-0.549	0.000	–
		Temperature	39	11.0	13.1	12.0	12.2	0.458	-0.039	0.664	none
USGS 46	433407112561501	pH	38	7.36	8.03	7.97	7.89	0.157	-0.133	0.008	–
		Specific conductance	38	381	515	437	437	27.9	-0.774	0.000	–
		Temperature	38	11.7	13.5	12.1	12.3	0.450	-0.260	0.004	–
USGS 47	433407112560301	pH	44	7.33	8.01	7.91	7.85	0.143	-0.180	0.000	–
		Specific conductance	44	410	572	478	481	37.1	-0.446	0.010	–
		Temperature	44	11.2	15.0	13.8	13.7	0.767	-0.613	0.000	–
USGS 48	433401112560301	pH	39	7.42	8.66	7.88	7.88	0.191	-0.129	0.031	–
		Specific conductance	39	395	525	460	461	25.6	-0.437	0.002	–
		Temperature	39	11.8	14.2	13.1	13.1	0.457	-0.262	0.003	–
USGS 51	433350112560601	pH	38	7.57	8.83	8.15	8.06	0.308	-0.472	0.000	–
		Specific conductance	38	460	960	725	687	137	2.60	0.000	+
		Temperature	38	12.5	14.1	13.3	13.3	0.398	-0.120	0.103	none

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 52	433414112554201	pH	39	7.46	8.66	7.91	7.90	0.185	-0.207	0.000	–
		Specific conductance	39	416	489	455	452	18.8	-0.320	0.002	–
		Temperature	39	12.3	14.0	13.0	13.0	0.359	-0.217	0.001	–
USGS 57	433344112562601	pH	57	7.44	8.80	7.89	7.85	0.177	0.024	0.632	none
		Specific conductance	57	407	1,020	805	769	178	-2.46	0.000	–
		Temperature	57	10.8	15.5	13.3	13.4	0.749	-0.702	0.000	–
USGS 59	433354112554701	pH	37	7.68	8.43	7.99	8.03	0.181	-0.236	0.000	–
		Specific conductance	37	389	1,040	519	567	172	-1.73	0.005	–
		Temperature	37	12.9	15.4	14.1	14.2	0.616	-0.243	0.027	–
USGS 67	433344112554101	pH	32	7.44	8.47	7.87	7.86	0.170	-0.199	0.000	–
		Specific conductance	32	519	909	704	717	135	-1.09	0.018	–
		Temperature	32	11.5	14.5	13.3	13.4	0.630	-0.476	0.000	–
USGS 77	433315112560301	pH	38	7.34	8.07	7.88	7.82	0.159	-0.146	0.004	–
		Specific conductance	38	550	847	730	721	78.4	-0.431	0.111	none
		Temperature	38	11.0	15.5	12.1	12.2	0.690	-0.204	0.112	none
USGS 82	433401112551001	pH	55	7.09	8.16	8.04	7.99	0.177	-0.176	0.001	–
		Specific conductance	55	321	406	343	342	12.0	-0.190	0.018	–
		Temperature	55	11.2	15.0	12.1	12.2	0.553	-0.173	0.090	none
USGS 84	433356112574201	pH	36	7.61	8.41	8.00	7.97	0.173	-0.231	0.000	–
		Specific conductance	36	376	460	429	420	25.3	-0.164	0.295	none
		Temperature	36	10.0	13.1	12.4	12.3	0.608	0.253	0.060	none
USGS 85	433246112571201	pH	40	7.33	8.06	7.95	7.91	0.142	-0.141	0.002	–
		Specific conductance	40	422	605	497	496	49.9	-1.23	0.000	–
		Temperature	40	10.5	13.5	12.4	12.4	0.485	-0.245	0.012	–
USGS 111	433331112560501	pH	40	7.78	8.64	8.04	8.05	0.153	0.031	0.492	none
		Specific conductance	40	553	817	615	645	78.5	-0.864	0.000	–
		Temperature	40	11.0	15.0	13.1	13.2	0.714	-0.124	0.336	none
USGS 112	433314112563001	pH	61	7.39	8.17	7.88	7.85	0.137	-0.092	0.016	–
		Specific conductance	61	435	1,015	783	778	172	-2.98	0.000	–
		Temperature	61	11.8	15.5	13.3	13.4	0.599	-0.522	0.000	–

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 113	433314112561801	pH	59	7.55	8.08	7.90	7.87	0.110	-0.045	0.156	none
		Specific conductance	59	480	1,129	978	931	176	-2.76	0.000	–
		Temperature	59	12.1	14.6	13.0	13.0	0.385	-0.091	0.169	none
USGS 114	433318112555001	pH	59	7.40	8.04	7.88	7.83	0.140	-0.178	0.000	–
		Specific conductance	59	545	638	570	578	21.4	0.225	0.005	+
		Temperature	59	12.2	14.8	13.2	13.3	0.606	-0.244	0.014	–
USGS 115	433320112554101	pH	59	7.34	8.21	7.94	7.89	0.158	-0.165	0.000	–
		Specific conductance	59	369	494	403	408	23.6	0.265	0.032	+
		Temperature	59	12.3	14.0	13.0	13.0	0.325	0.030	0.584	none
USGS 116	433331112553201	pH	58	7.32	8.22	8.02	7.98	0.151	0.008	0.851	none
		Specific conductance	58	515	725	608	607	52.9	0.591	0.002	+
		Temperature	58	11.3	14.0	12.5	12.5	0.461	-0.246	0.004	–
USGS 123	433352112561401	pH	33	7.61	9.14	7.89	7.92	0.255	0.197	0.020	+
		Specific conductance	33	351	832	699	629	172	-4.01	0.000	–
		Temperature	33	10.8	15.0	14.0	13.9	0.734	-0.137	0.382	none
USGS 128	433250112565601	pH	11	7.55	8.02	7.74	7.77	0.165	-0.315	0.089	none
		Specific conductance	11	436	531	440	450	27.6	-1.16	0.020	–
		Temperature	11	10.9	12.7	12.1	12.0	0.571	0.158	0.712	none
Advanced Test Reactor Complex											
MTR TEST	433520112572601	pH	38	7.57	8.10	7.93	7.91	0.123	-0.114	0.005	–
		Specific conductance	38	395	711	525	521	98.8	-2.36	0.000	–
		Temperature	38	12.2	14.0	13.0	13.1	0.387	-0.237	0.002	–
TRA Disposal	433506112572301	pH	41	7.47	8.11	7.90	7.86	0.148	-0.111	0.009	–
		Specific conductance	41	418	495	460	456	21.0	-0.582	0.000	–
		Temperature	41	12.7	17.0	13.4	13.6	0.949	-0.243	0.093	none
USGS 58	433500112572502	pH	35	7.42	8.23	7.95	7.91	0.173	-0.185	0.002	–
		Specific conductance	35	416	460	443	442	9.29	-0.118	0.038	–
		Temperature	35	12.3	13.5	12.7	12.8	0.282	-0.032	0.582	none
USGS 65	433447112574501	pH	61	7.52	8.27	7.98	7.94	0.134	-0.123	0.001	–
		Specific conductance	61	572	643	609	612	14.5	0.118	0.025	+
		Temperature	61	11.2	14.0	13.2	13.3	0.479	-0.340	0.000	–

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Advanced Test Reactor Complex—Continued											
USGS 76	433425112573201	pH	42	7.62	8.21	8.00	7.97	0.117	-0.121	0.000	–
		Specific conductance	42	422	470	445	444	9.26	-0.082	0.096	none
		Temperature	42	12.1	13.6	12.5	12.6	0.348	-0.222	0.001	–
USGS 79	433505112581901	pH	38	7.59	8.14	7.94	7.91	0.135	-0.095	0.030	–
		Specific conductance	38	350	422	393	391	15.0	-0.122	0.219	none
		Temperature	38	12.0	13.0	12.5	12.4	0.256	-0.015	0.781	none
Central Facilities Area											
CFA 1	433204112562001	pH	60	7.55	7.98	7.81	7.79	0.103	-0.120	0.000	–
		Specific conductance	60	560	733	662	651	46.5	0.076	0.635	none
		Temperature	60	9.50	13.0	12.0	12.0	0.437	0.054	0.527	none
CFA 2	433144112563501	pH	55	7.35	8.07	7.82	7.76	0.150	-0.222	0.000	–
		Specific conductance	55	580	864	701	699	86.3	1.81	0.000	+
		Temperature	55	10.5	12.5	12.0	12.0	0.364	0.060	0.383	none
CFA LF 3-9	433216112571001	pH	12	7.50	7.89	7.73	7.73	0.123	-0.055	0.585	none
		Specific conductance	12	657	819	723	724	46.2	0.351	0.374	none
		Temperature	12	11.2	13.4	12.5	12.4	0.655	-0.754	0.025	–
CFA LF 2-10	433216112563301	pH	31	7.50	8.10	7.97	7.92	0.156	-0.139	0.035	–
		Specific conductance	31	452	504	488	483	17.1	-0.433	0.000	–
		Temperature	31	12.3	13.5	12.6	12.6	0.231	0.085	0.155	none
USGS 127	433058112572201	pH	18	7.49	8.23	8.08	7.99	0.220	-0.099	0.571	none
		Specific conductance	18	287	307	303	301	5.70	-0.296	0.013	–
		Temperature	18	11.4	14.2	11.7	11.8	0.620	0.014	0.962	none
Radioactive Waste Management Complex											
RWMC M1SA	432956113030901	pH	8	8.32	8.72	8.39	8.43	0.129	-0.023	0.789	none
		Specific conductance	8	277	288	283	283	3.77	-0.028	0.708	none
		Temperature	8	12.0	13.3	12.6	12.7	0.396	0.352	0.048	+
RWMC M3S	433008113021801	pH	21	7.56	9.18	8.08	8.01	0.335	0.092	0.514	none
		Specific conductance	21	348	376	369	368	6.61	0.048	0.454	none
		Temperature	21	12.3	13.8	13.0	12.9	0.427	-0.167	0.148	none
RWMC M7S	433023113014801	pH	23	7.45	9.07	8.10	8.03	0.320	-0.107	0.399	none
		Specific conductance	23	328	365	356	354	8.11	0.223	0.003	+
		Temperature	23	12.4	14.0	13.3	13.4	0.430	-0.022	0.831	none

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Radioactive Waste Management Complex—Continued											
RWMC M11S	433058113010401	pH	15	7.47	8.30	7.87	7.93	0.245	-0.208	0.274	none
		Specific conductance	15	266	345	299	306	21.7	-0.629	0.142	none
		Temperature	15	14.1	17.4	16.5	16.3	0.792	0.097	0.754	none
RWMC M12S	433118112593401	pH	14	7.53	8.06	7.93	7.88	0.165	-0.038	0.782	none
		Specific conductance	14	363	383	373	373	5.48	0.223	0.020	+
		Temperature	14	11.8	13.1	12.2	12.3	0.392	-0.404	0.049	–
RWMC M13S	433037113002701	pH	15	7.51	8.33	8.12	8.05	0.236	-0.020	0.913	none
		Specific conductance	15	253	267	261	261	3.26	-0.121	0.117	none
		Temperature	15	13.9	16.2	14.7	14.9	0.784	-0.887	0.005	–
RWMC M14S	433052113025001	pH	15	7.62	8.08	7.90	7.89	0.126	-0.015	0.880	none
		Specific conductance	15	370	389	379	379	6.06	-0.305	0.002	–
		Temperature	15	12.5	13.4	13.1	13.1	0.252	-0.071	0.551	none
RWMC Production	433002113021701	pH	277	6.79	8.32	7.96	7.91	0.220	-0.200	0.000	–
		Specific conductance	277	348	411	389	387	14.3	0.499	0.000	+
		Temperature	277	12.0	15.1	12.9	12.9	0.378	-0.048	0.056	none
USGS 87	433013113024201	pH	63	7.63	8.23	8.08	8.04	0.098	0.015	0.572	none
		Specific conductance	63	335	385	358	357	8.79	0.192	0.000	+
		Temperature	63	11.7	15.8	14.0	13.9	0.703	-0.386	0.001	–
USGS 88	432940113030201	pH	63	7.23	8.60	8.30	8.22	0.237	-0.298	0.000	–
		Specific conductance	63	549	605	580	581	9.81	-0.080	0.035	–
		Temperature	63	9.80	14.7	13.7	13.7	0.824	-0.052	0.727	none
USGS 89	433005113032801	pH	63	7.95	8.95	8.32	8.32	0.178	0.015	0.745	none
		Specific conductance	63	359	392	380	379	7.81	-0.008	0.863	none
		Temperature	63	11.0	15.0	13.0	13.1	0.732	-0.269	0.028	–
USGS 120	432919113031501	pH	64	7.77	8.35	8.18	8.14	0.126	-0.115	0.001	–
		Specific conductance	64	372	511	449	449	31.0	-0.586	0.000	–
		Temperature	64	10.9	13.0	11.6	11.7	0.484	0.099	0.255	none
South of facilities											
USGS 104	432856112560801	pH	59	7.54	8.52	8.03	7.98	0.159	-0.178	0.000	–
		Specific conductance	59	305	333	327	325	7.27	0.123	0.018	+
		Temperature	59	11.6	13.6	12.0	12.1	0.347	-0.081	0.211	none

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
South of facilities—Continued											
USGS 105	432703113001801	pH	33	7.61	8.23	8.02	8.01	0.137	-0.153	0.009	–
		Specific conductance	33	363	390	380	379	5.41	-0.184	0.000	–
		Temperature	33	13.2	14.5	13.7	13.7	0.294	-0.185	0.011	–
USGS 106	432959112593101	pH	42	7.49	8.09	7.95	7.89	0.154	-0.207	0.000	–
		Specific conductance	42	382	410	399	397	7.33	0.029	0.495	none
		Temperature	42	13.4	14.5	13.8	13.9	0.289	-0.138	0.004	–
USGS 108	432659112582601	pH	35	7.36	8.20	8.02	7.98	0.152	-0.152	0.014	–
		Specific conductance	35	345	362	355	354	4.92	0.156	0.000	+
		Temperature	35	12.5	13.5	13.0	13.0	0.225	-0.048	0.385	none
USGS 124	432307112583101	pH	30	7.66	8.08	7.93	7.91	0.112	-0.051	0.299	none
		Specific conductance	30	356	374	368	367	5.01	-0.029	0.543	none
		Temperature	30	13.0	14.2	13.5	13.5	0.233	0.139	0.020	+
Perched groundwater wells											
Idaho Nuclear Technology and Engineering Center											
PW 1	433349112560701	pH	44	7.60	9.34	8.03	8.10	0.339	0.252	0.153	none
		Specific conductance	44	814	1,545	1,197	1,139	178	-3.28	0.000	–
		Temperature	44	9.60	18.0	14.9	14.8	2.14	-1.23	0.052	none
PW 2	433344112555601	pH	34	7.64	8.37	7.97	8.02	0.201	0.301	0.005	+
		Specific conductance	34	860	1,340	1,180	1,166	120	-1.62	0.000	–
		Temperature	34	12.5	19.5	14.5	14.8	1.64	-0.775	0.070	none
PW 3	433351112555701	pH	31	7.72	8.38	8.01	8.00	0.163	0.134	0.157	none
		Specific conductance	31	857	1,452	1,240	1,210	149	-1.24	0.029	–
		Temperature	31	11.2	19.5	15.6	15.7	1.79	0.147	0.787	none
PW 4	433348112554901	pH	51	6.78	8.55	7.97	7.90	0.335	-0.331	0.017	–
		Specific conductance	52	627	1,447	1,218	1,169	209	-2.64	0.000	–
		Temperature	52	9.10	17.0	14.0	13.8	1.82	-0.446	0.274	none
PW 5	433348112555701	pH	30	7.20	8.27	7.93	7.95	0.209	0.281	0.035	+
		Specific conductance	30	737	1,473	1,195	1,198	176	-1.23	0.107	none
		Temperature	30	9.80	19.0	16.4	15.6	2.21	1.26	0.084	none
PW 6	433353112562201	pH	30	7.94	10.5	9.50	9.23	0.689	0.233	0.586	none
		Specific conductance	30	560	950	771	777	105	1.77	0.013	+
		Temperature	30	9.00	14.1	11.3	11.4	1.38	-0.292	0.660	none

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 50	433419112560201	pH	40	7.63	8.50	7.96	7.97	0.177	0.115	0.092	none
		Specific conductance	40	655	1,130	856	887	118	-1.68	0.000	–
		Temperature	40	14.2	20.3	17.6	17.4	1.40	-0.134	0.596	none
Advanced Test Reactor Complex											
CWP 1	433459112572601	pH	26	7.44	8.20	7.97	7.94	0.162	0.008	0.885	none
		Specific conductance	26	372	1,110	561	715	289	0.163	0.887	none
		Temperature	26	12.9	22.0	17.7	17.7	2.88	-1.11	0.005	–
CWP 2	433458112572401	pH	11	7.63	8.63	8.27	8.20	0.326	-0.113	0.712	none
		Specific conductance	11	223	725	455	440	147	-2.15	0.405	none
		Temperature	11	14.5	19.0	15.8	16.0	1.52	-1.27	0.030	–
CWP 3	433455112572501	pH	25	7.55	9.40	8.11	8.17	0.338	-0.131	0.233	none
		Specific conductance	25	390	1,038	647	664	219	0.557	0.548	none
		Temperature	25	11.6	21.5	17.3	16.8	2.46	-0.911	0.018	–
CWP 4	433454112572601	pH	14	7.91	9.40	8.47	8.47	0.471	0.131	0.618	none
		Specific conductance	14	231	615	393	395	120	-2.32	0.077	none
		Temperature	14	11.5	20.5	17.5	17.2	2.13	-0.145	0.823	none
CWP 5	433455112572901	pH	9	7.63	8.61	8.06	8.02	0.295	0.294	0.377	none
		Specific conductance	9	327	980	491	588	248	-3.17	0.367	none
		Temperature	9	12.0	21.7	17.5	17.4	3.18	0.534	0.758	none
CWP 8	433500112573001	pH	23	7.39	8.57	7.99	8.04	0.310	-0.097	0.371	none
		Specific conductance	23	269	756	418	427	107	-0.356	0.586	none
		Temperature	23	13.4	23.3	17.0	17.6	3.28	-0.877	0.070	none
PW 7	433446112574602	pH	14	7.36	8.55	7.96	7.91	0.344	-0.028	0.976	none
		Specific conductance	14	379	670	520	529	72.4	-9.42	0.000	–
		Temperature	14	10.0	15.0	11.0	11.6	1.74	-1.20	0.696	none
PW 8	433456112572001	pH	60	7.26	9.24	7.73	7.75	0.270	0.021	0.777	none
		Specific conductance	60	281	914	750	716	140	0.099	0.854	none
		Temperature	60	13.5	19.0	17.0	16.9	1.11	-0.401	0.009	–
PW 9	433500112575401	pH	59	7.24	8.19	7.73	7.72	0.130	-0.039	0.302	none
		Specific conductance	59	475	663	610	612	34.4	-0.272	0.036	–
		Temperature	59	11.0	19.0	16.5	16.2	1.25	0.002	0.990	none

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells—Continued											
Advanced Test Reactor Complex—Continued											
TRA A 13	433502112572802	pH	20	6.83	8.92	7.25	7.35	0.424	0.175	0.566	none
		Specific conductance	20	405	944	733	712	156	-0.324	0.814	none
		Temperature	20	14.0	21.0	17.1	16.9	1.93	-1.28	0.026	–
TRA A 77	433507112573801	pH	22	8.00	9.85	9.19	9.06	0.573	-1.35	0.021	–
		Specific conductance	22	48.0	342	69.5	118	93.7	21.0	0.000	+
		Temperature	21	12.5	25.0	18.5	18.2	3.23	-4.60	0.002	–
USGS 53	433503112573401	pH	14	6.89	7.72	7.64	7.53	0.257	-0.345	0.005	–
		Specific conductance	14	320	835	637	619	161	0.119	0.908	none
		Temperature	14	14.9	18.0	16.8	16.5	0.988	-0.587	0.006	–
USGS 54	433503112572801	pH	55	7.32	7.94	7.74	7.72	0.128	-0.136	0.000	–
		Specific conductance	55	447	965	706	697	157	-0.574	0.278	none
		Temperature	55	11.6	21.0	17.7	17.8	1.35	-0.531	0.004	–
USGS 55	433508112573001	pH	31	7.26	7.68	7.47	7.48	0.123	0.012	0.787	none
		Specific conductance	31	445	849	635	634	77.0	-0.680	0.036	–
		Temperature	31	12.2	15.5	13.5	13.7	0.871	0.776	0.000	+
USGS 56	433509112573501	pH	17	7.36	8.38	7.93	7.88	0.259	-0.085	0.432	none
		Specific conductance	17	330	2,420	606	763	532	0.174	0.925	none
		Temperature	17	13.1	17.5	15.9	15.6	1.33	-0.900	0.002	–
USGS 60	433456112571901	pH	44	7.28	7.95	7.74	7.71	0.126	-0.100	0.011	–
		Specific conductance	44	451	885	681	687	123	-0.049	0.911	none
		Temperature	44	14.0	19.0	16.1	16.2	1.14	-0.623	0.000	–
USGS 61	433453112571601	pH	38	7.54	7.99	7.85	7.82	0.109	-0.079	0.029	–
		Specific conductance	38	477	718	622	621	66.7	0.090	0.751	none
		Temperature	38	11.5	15.8	13.5	13.3	0.882	0.864	0.000	+
USGS 62	433446112570701	pH	38	7.28	8.99	7.73	7.72	0.262	-0.301	0.000	–
		Specific conductance	38	486	882	751	724	106	0.443	0.274	none
		Temperature	38	12.0	17.5	16.4	16.2	1.05	0.622	0.001	+
USGS 63	433455112574001	pH	38	7.32	7.85	7.71	7.67	0.121	-0.136	0.001	–
		Specific conductance	38	467	843	764	715	103	0.178	0.651	none
		Temperature	38	16.8	21.0	18.3	18.3	0.828	-0.213	0.055	none

Table 4. Summary statistics and trend analyses for field measurements of pH, specific conductance, and water temperature for aquifer and perched groundwater wells after installation of dedicated pumps at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Field measurement**: pH is in standard units; specific conductance is in microsiemens per centimeter at 25 degrees Celsius; temperature is in degrees Celsius. **Slope:** In percent change per year. ***p* value:** for linear trend over time. **Trend**: +, increasing; –, decreasing]

Local name	Site identifier	Field measurement	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells—Continued											
Advanced Test Reactor Complex—Continued											
USGS 66	433436112564801	pH	27	6.59	8.23	7.68	7.68	0.295	-0.248	0.017	–
		Specific conductance	27	517	860	710	698	74.9	-0.003	0.991	none
		Temperature	27	11.0	14.8	12.4	12.4	1.02	0.259	0.220	none
USGS 68	433516112573901	pH	44	6.57	7.28	7.04	7.03	0.175	0.195	0.001	+
		Specific conductance	44	1.60	7,010	5,555	4,871	1,800	-11.4	0.000	–
		Temperature	44	11.0	17.7	14.0	14.0	1.08	0.503	0.004	+
USGS 69	433450112573001	pH	28	7.55	8.20	7.89	7.86	0.157	-0.198	0.000	–
		Specific conductance	28	421	682	567	565	71.9	-1.16	0.000	–
		Temperature	28	12.5	16.5	15.4	15.2	0.936	0.516	0.002	+
USGS 70	433504112571001	pH	38	7.40	8.03	7.76	7.73	0.144	-0.140	0.003	–
		Specific conductance	38	445	808	661	661	81.2	-0.231	0.488	none
		Temperature	38	12.6	16.0	13.5	13.5	0.655	0.014	0.907	none
USGS 71	433439112571501	pH	33	7.08	8.20	7.91	7.85	0.225	-0.002	0.977	none
		Specific conductance	33	564	870	640	649	50.0	0.193	0.290	none
		Temperature	33	10.0	16.8	11.8	12.0	1.59	-0.171	0.594	none
USGS 72	433519112574601	pH	25	6.64	7.97	7.68	7.68	0.259	-0.199	0.033	–
		Specific conductance	25	458	860	604	593	87.3	-0.360	0.331	none
		Temperature	25	13.6	19.5	15.7	15.7	1.59	-0.749	0.000	–
USGS 73	433502112575401	pH	37	7.40	8.22	7.81	7.81	0.196	-0.101	0.108	none
		Specific conductance	37	432	1,030	569	578	98.2	0.329	0.370	none
		Temperature	37	14.0	18.0	15.8	15.8	1.00	-0.368	0.020	–
USGS 78	433413112573501	pH	18	7.12	8.30	8.07	7.99	0.303	-0.122	0.469	none
		Specific conductance	18	321	419	350	352	19.9	0.139	0.550	none
		Temperature	18	9.10	12.7	10.2	10.5	1.12	-1.01	0.024	–
Radioactive Waste Management Complex											
USGS 92	433000113025301	pH	22	7.63	8.70	8.02	8.02	0.265	-0.012	0.902	none
		Specific conductance	22	770	1,080	961	957	66.6	0.058	0.789	none
		Temperature	22	8.10	17.5	9.8	10.2	1.90	-0.815	0.067	none

Table 5. Summary statistics and trend test results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1981–2012.

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Tritium and strontium-90 in picocuries per liter. **Minimum:** Value of 0 indicates a concentration and uncertainty that is less than three times the sample standard deviation or reporting level; other values represent smallest concentration without uncertainty that was greater than the reporting level. **Trend**: +, increasing; –, decreasing, NAC could not be calculated because of lack of convergence so no trend is interpreted. **Slope:** In percent change per year. ***p* value:** For linear trend over time. NA, value could not be calculated]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
					Aquifer wells						
Idaho Nuclear Technology and Engineering Center											
CPP 1	433433112560201	Tritium	75	0	51,700	1.2	NA	NA	-102	0.000	–
		Strontium-90	73	0	26	NA	NA	NA	NA	NA	NAC
CPP 2	433432112560801	Tritium	63	0	15,500	0.0	NA	NA	-179	0.103	none
		Strontium-90	63	0	22	NA	NA	NA	NA	NA	NAC
RIFLE RANGE	433243112591101	Tritium	14	420	3,250	1,070	NA	NA	-6.94	0.000	–
		Strontium-90	13	0	5.0	NA	NA	NA	NA	NA	NAC
USGS 20	433253112545901	Tritium	56	2,420	17,700	8,595	NA	NA	-6.00	0.000	–
		Strontium-90	56	0	14	NA	NA	NA	NA	NA	NAC
USGS 34	433334112565501	Tritium	54	0	11,600	3,723	NA	NA	-7.23	0.000	–
		Strontium-90	52	0	11	3.3	NA	NA	-2.73	0.000	–
USGS 35	433339112565801	Tritium	54	0	21,500	4,476	NA	NA	-6.28	0.000	–
		Strontium-90	53	0	16	NA	NA	NA	NA	NA	NAC
USGS 36	433330112565201	Tritium	72	900	48,700	7,347	NA	NA	-13.9	0.000	–
		Strontium-90	72	0	30	12	NA	NA	-5.56	0.000	–
USGS 37	433326112564801	Tritium	72	1,210	83,800	24,508	NA	NA	-13.2	0.000	–
		Strontium-90	71	0	23	14	NA	NA	-5.09	0.000	–
USGS 38	433322112564301	Tritium	54	780	91,100	15,494	NA	NA	-15.4	0.000	–
		Strontium-90	53	0	38	18	NA	NA	-3.43	0.000	–
USGS 39	433343112570001	Tritium	73	0	8,700	2,933	NA	NA	-4.00	0.000	–
		Strontium-90	73	0	13	NA	NA	NA	NA	NA	NAC
USGS 40	433411112561101	Tritium	91	750	425,000	8,753	NA	NA	-13.8	0.000	–
		Strontium-90	89	0	210	33	NA	NA	-9.08	0.000	–
USGS 41	433409112561301	Tritium	56	0	136,000	4,459	NA	NA	-12.2	0.000	–
		Strontium-90	53	5	100	18	NA	NA	-6.22	0.000	–
USGS 42	433404112561301	Tritium	56	0	210,000	3,415	NA	NA	-11.3	0.000	–
		Strontium-90	54	0	129	14	NA	NA	-4.72	0.000	–
USGS 43	433415112561501	Tritium	54	600	200,000	6,442	NA	NA	-9.63	0.000	–
		Strontium-90	53	0	39	1.6	NA	NA	-14.5	0.000	–
USGS 44	433409112562101	Tritium	55	0	396,000	89	NA	NA	-41.8	0.000	–
		Strontium-90	54	0	180	3.7	NA	NA	-17.3	0.000	–
USGS 45	433402112561801	Tritium	56	0	189,000	1,695	NA	NA	-12.5	0.000	–
		Strontium-90	55	0	64	1.1	NA	NA	-21.3	0.000	–
USGS 46	433407112561501	Tritium	55	0	365,000	2,831	NA	NA	-18.0	0.000	–
		Strontium-90	53	0	140	14	NA	NA	-9.89	0.000	–

Table 5. Summary statistics and trend test results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1981–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Tritium and strontium-90 in picocuries per liter. **Minimum:** Value of 0 indicates a concentration and uncertainty that is less than three times the sample standard deviation or reporting level; other values represent smallest concentration without uncertainty that was greater than the reporting level. **Trend**: +, increasing; –, decreasing, NAC could not be calculated because of lack of convergence so no trend is interpreted. **Slope:** In percent change per year. ***p* value:** For linear trend over time. NA, value could not be calculated]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 47	433407112560301	Tritium	79	340	292,000	8,436	NA	NA	-10.2	0.000	–
		Strontium-90	77	6	128	54	NA	NA	-3.55	0.000	–
USGS 48	433401112560301	Tritium	57	0	77,700	5,879	NA	NA	-9.18	0.000	–
		Strontium-90	55	0	56	21	NA	NA	-2.79	0.000	–
USGS 51	433350112560601	Tritium	53	4,130	39,800	17,684	NA	NA	-5.12	0.000	–
		Strontium-90	53	0	15	NA	NA	NA	NA	NA	NAC
USGS 52	433414112554201	Tritium	55	520	169,000	6,167	NA	NA	-11.63	0.000	–
		Strontium-90	55	0	76	13	NA	NA	-8.09	0.000	–
USGS 57	433344112562601	Tritium	80	800	173,000	16,813	NA	NA	-15.04	0.000	–
		Strontium-90	79	0	80	33	NA	NA	-7.06	0.000	–
USGS 59	433354112554701	Tritium	53	0	79,500	5,256	NA	NA	-12.82	0.000	–
		Strontium-90	53	0	30	13	NA	NA	-2.69	0.000	–
USGS 67	433344112554101	Tritium	50	2,700	173,000	22,553	NA	NA	-11.80	0.000	–
		Strontium-90	49	6	57	21	NA	NA	-5.17	0.000	–
USGS 77	433315112560301	Tritium	54	3,040	85,900	27,085	NA	NA	-9.81	0.000	–
		Strontium-90	53	0	13	NA	NA	NA	NA	NA	NAC
USGS 82	433401112551001	Tritium	72	0	40,400	250	NA	NA	-28.57	0.000	–
		Strontium-90	72	0	14	NA	NA	NA	NA	NA	NAC
USGS 84	433356112574201	Tritium	52	0	9,400	2,566	NA	NA	-4.79	0.000	–
		Strontium-90	26	0	6.0	NA	NA	NA	NA	NA	NAC
USGS 85	433246112571201	Tritium	55	1,220	31,100	9,712	NA	NA	-11.39	0.000	–
		Strontium-90	55	0	12	NA	NA	NA	NA	NA	NAC
USGS 111	433331112560501	Tritium	56	2,310	149,000	17,247	NA	NA	-13.22	0.000	–
		Strontium-90	56	0	19	NA	NA	NA	NA	NA	NAC
USGS 112	433314112563001	Tritium	76	770	80,700	14,697	NA	NA	-16.66	0.000	–
		Strontium-90	76	6	41	25	NA	NA	-6.46	0.000	–
USGS 113	433314112561801	Tritium	74	1,720	96,000	14,815	NA	NA	-15.88	0.000	–
		Strontium-90	73	0	27	14	NA	NA	-4.663	0.000	–
USGS 114	433318112555001	Tritium	74	6,240	34,100	21,613	NA	NA	-6.389	0.000	–
		Strontium-90	74	0	14	NA	NA	NA	NA	NA	NAC
USGS 115	433320112554101	Tritium	74	600	18,200	5,004	NA	NA	-11.20	0.000	–
		Strontium-90	74	0	12	NA	NA	NA	NA	NA	NAC
USGS 116	433331112553201	Tritium	73	1,200	21,600	6,481	NA	NA	-10.80	0.000	–
		Strontium-90	73	0	10	NA	NA	NA	NA	NA	NAC

Table 5. Summary statistics and trend test results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1981–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Tritium and strontium-90 in picocuries per liter. **Minimum:** Value of 0 indicates a concentration and uncertainty that is less than three times the sample standard deviation or reporting level; other values represent smallest concentration without uncertainty that was greater than the reporting level. **Trend**: +, increasing; –, decreasing, NAC could not be calculated because of lack of convergence so no trend is interpreted. **Slope:** In percent change per year. ***p* value:** For linear trend over time. NA, value could not be calculated]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 123	433352112561401	Tritium	33	2,610	31,400	12,358	NA	NA	-12.82	0.000	–
		Strontium-90	33	0	41	16	NA	NA	-19.79	0.000	–
USGS 128	433250112565601	Tritium	11	1,050	3,400	2,004	NA	NA	-10.04	0.001	–
		Strontium-90	11	0	7.8	5.1	NA	NA	-6.77	0.125	none
Advanced Test Reactor Complex											
MTR TEST	433520112572601	Tritium	46	0	3,500	280	NA	NA	-14.6	0.001	–
TRA Disposal	433506112572301	Tritium	57	1,260	27,000	6,747	NA	NA	-4.17	0.000	–
		Strontium-90	33	0	9.0	NA	NA	NA	NA	NA	NAC
USGS 58	433500112572502	Tritium	49	380	16,100	2,489	NA	NA	-4.99	0.000	–
		Strontium-90	31	0	400	NA	NA	NA	NA	NA	NAC
USGS 65	433447112574501	Tritium	96	3,070	132,000	36,216	NA	NA	-12.4	0.000	–
		Strontium-90	96	0	12	NA	NA	NA	NA	NA	NAC
USGS 76	433425112573201	Tritium	77	0	8,800	2,600	NA	NA	-5.31	0.000	–
		Strontium-90	77	0	21	NA	NA	NA	NA	NA	NAC
USGS 79	433505112581901	Tritium	55	0	1,800	NA	NA	NA	NA	NA	NAC
Central Facilities Area wells											
CFA 1	433204112562001	Tritium	95	4,200	38,500	19,185	NA	NA	-6.73	0.000	–
		Strontium-90	53	0	10	NA	NA	NA	NA	NA	NAC
CFA 2	433144112563501	Tritium	91	3,770	29,100	15,486	NA	NA	-5.70	0.000	–
		Strontium-90	51	0	9.0	NA	NA	NA	NA	NA	NAC
CFA LF 3-9	433216112571001	Tritium	13	4,500	24,700	NA	NA	NA	NA	NA	NAC
		Strontium-90	13	0	5.0	NA	NA	NA	NA	NA	NAC
CFA LF 2-10	433216112563301	Tritium	31	770	7,700	3,533	NA	NA	-8.04	0.000	–
		Strontium-90	29	0	5.0	NA	NA	NA	NA	NA	NAC
USGS 127	433058112572201	Tritium	18	0	540	NA	NA	NA	NA	NA	NAC
		Strontium-90	17	0	5.2	NA	NA	NA	NA	NA	NAC
Radioactive Waste Management Complex											
RWMC M3S	433008113021801	Tritium	21	640	1,400	NA	NA	NA	NA	NA	NAC
		Strontium-90	21	0	6.0	NA	NA	NA	NA	NA	NAC
RWMC M7S	433023113014801	Tritium	21	0	1,700	1,144	NA	NA	-3.35	0.113	none
		Strontium-90	21	0	6.0	NA	NA	NA	NA	NA	NAC

Table 5. Summary statistics and trend test results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1981–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Tritium and strontium-90 in picocuries per liter. **Minimum:** Value of 0 indicates a concentration and uncertainty that is less than three times the sample standard deviation or reporting level; other values represent smallest concentration without uncertainty that was greater than the reporting level. **Trend**: +, increasing; –, decreasing, NAC could not be calculated because of lack of convergence so no trend is interpreted. **Slope:** In percent change per year. ***p* value:** For linear trend over time. NA, value could not be calculated]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Radioactive waste management complex—Continued											
RWMC M11S	433058113010401	Tritium	15	0	500	NA	NA	NA	NA	NA	NAC
RWMC M12S	433118112593401	Tritium	14	670	1,100	NA	NA	NA	NA	NA	NAC
RWMC M13S	433037113002701	Tritium	15	0	500	NA	NA	NA	NA	NA	NAC
RWMC M14S	433052113025001	Tritium	15	600	1,310	1,318	NA	NA	-4.46	0.009	–
RWMC Production	433002113021701	Tritium	100	0	2,700	NA	NA	NA	NA	NA	NAC
		Strontium-90	96	0	12	NA	NA	NA	NA	NA	NAC
USGS 87	433013113024201	Tritium	98	0	2,900	822	NA	NA	0.513	0.004	+
		Strontium-90	97	0	13	NA	NA	NA	NA	NA	NAC
USGS 88	432940113030201	Tritium	96	0	1,800	NA	NA	NA	NA	NA	NAC
		Strontium-90	95	0	10	NA	NA	NA	NA	NA	NAC
USGS 89	433005113032801	Tritium	98	0	1,100	NA	NA	NA	NA	NA	NAC
		Strontium-90	97	0	11	NA	NA	NA	NA	NA	NAC
USGS 120	432919113031501	Tritium	69	0	1,100	NA	NA	NA	NA	NA	NAC
		Strontium-90	68	0	11	NA	NA	NA	NA	NA	NAC
South of facilities											
USGS 104	432856112560801	Tritium	90	0	2,200	1,242	NA	NA	-0.071	0.879	none
USGS 105	432703113001801	Tritium	62	0	1,690	15	NA	NA	-24.1	0.328	none
USGS 106	432959112593101	Tritium	76	0	5,300	2,048	NA	NA	-5.79	0.000	–
USGS 108	432659112582601	Tritium	54	0	1,700	5	NA	NA	-25.9	0.435	none
USGS 124	432307112583101	Tritium	31	0	640	NA	NA	NA	NA	NA	NAC
Perched groundwater wells											
Idaho Nuclear Technology and Engineering Center											
PW 1	433349112560701	Tritium	55	0	179,000	90.6	NA	NA	-75.3	0.000	–
		Strontium-90	55	0	25	5.01	NA	NA	-21.3	0.000	–
PW 2	433344112555601	Tritium	44	0	180,000	1,034	NA	NA	-72.2	0.000	–
		Strontium-90	44	0	17	0.847	NA	NA	-44.5	0.125	none
PW 3	433351112555701	Tritium	42	0	294,000	963	NA	NA	-67.6	0.000	–
		Strontium-90	42	0	23	6.64	NA	NA	-16.7	0.000	–
PW 4	433348112554901	Tritium	61	0	141,000	1,292	NA	NA	-27.7	0.000	–
		Strontium-90	61	0	16	2.48	NA	NA	-6.90	0.044	–
PW 5	433348112555701	Tritium	40	0	212,000	492	NA	NA	-69.2	0.000	–
		Strontium-90	40	0	23	4.88	NA	NA	-23.4	0.001	–

Table 5. Summary statistics and trend test results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1981–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Tritium and strontium-90 in picocuries per liter. **Minimum:** Value of 0 indicates a concentration and uncertainty that is less than three times the sample standard deviation or reporting level; other values represent smallest concentration without uncertainty that was greater than the reporting level. **Trend**: +, increasing; –, decreasing, NAC could not be calculated because of lack of convergence so no trend is interpreted. **Slope:** In percent change per year. ***p* value:** For linear trend over time. NA, value could not be calculated]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells											
Idaho Nuclear Technology and Engineering Center—Continued											
PW 6	433353112562201	Tritium	41	5,900	34,300	19,166	NA	NA	-8.78	0.000	–
		Strontium-90	41	0	12	0.026	NA	NA	-31.0	0.448	none
USGS 50	433419112560201	Tritium	75	15,000	230,000	93,663	NA	NA	-9.59	0.000	–
		Strontium-90	74	95	550	273	NA	NA	-5.83	0.000	–
Advanced test reactor complex											
CWP 1	433459112572601	Tritium	41	0	1,200	NA	NA	NA	NA	NA	NAC
		Strontium-90	25	0	7.3	NA	NA	NA	NA	NA	NAC
CWP 3	433455112572501	Tritium	40	0	1,100	NA	NA	NA	NA	NA	NAC
		Strontium-90	24	0	10	NA	NA	NA	NA	NA	NAC
CWP 4	433454112572601	Tritium	28	0	1,130	NA	NA	NA	NA	NA	NAC
		Strontium-90	13	0	6.2	NA	NA	NA	NA	NA	NAC
CWP 5	433455112572901	Tritium	17	0	1,000	NA	NA	NA	NA	NA	NAC
CWP 8	433500112573001	Tritium	37	0	1,400	NA	NA	NA	NA	NA	NAC
		Strontium-90	24	0	6.8	1.02	NA	NA	4.45	0.539	none
PW 8	433456112572001	Tritium	70	0	359,000	1,825	NA	NA	-26.2	0.000	–
		Strontium-90	55	0	23	12.3	NA	NA	-3.81	0.000	–
PW 9	433500112575401	Tritium	67	9,900	271,000	122,398	NA	NA	-13.5	0.000	–
		Strontium-90	54	0	23	NA	NA	NA	NA	NA	NAC
TRA A 13	433502112572802	Tritium	49	0	152,000	23.2	NA	NA	-103	0.000	–
		Strontium-90	18	18.8	283	54.4	NA	NA	-15.3	0.000	–
TRA A 77	433507112573801	Tritium	60	0	5,570,000	937,465	NA	NA	-22.2	0.000	–
		Strontium-90	19	1,000	38,800	2,746	NA	NA	19.1	0.034	+
USGS 53	433503112573401	Tritium	32	320	2,010,000	452,225	NA	NA	-23.3	0.000	–
		Strontium-90	14	17.9	139	83.6	NA	NA	-5.25	0.000	–
USGS 54	433503112572801	Tritium	90	0	1,860,000	3,251	NA	NA	-36.9	0.000	–
		Strontium-90	51	29	170	82.8	NA	NA	-6.28	0.000	–
USGS 55	433508112573001	Tritium	53	0	495,000	12,535	NA	NA	-0.98	0.651	none
		Strontium-90	32	0	65.1	17.2	NA	NA	12.3	0.000	+
USGS 56	433509112573501	Tritium	35	1,400	1,910,000	542,473	NA	NA	-19.2	0.000	–
		Strontium-90	17	0	74	33.0	NA	NA	3.46	0.126	none

Table 5. Summary statistics and trend test results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1981–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Tritium and strontium-90 in picocuries per liter. **Minimum:** Value of 0 indicates a concentration and uncertainty that is less than three times the sample standard deviation or reporting level; other values represent smallest concentration without uncertainty that was greater than the reporting level. **Trend**: +, increasing; –, decreasing, NAC could not be calculated because of lack of convergence so no trend is interpreted. **Slope:** In percent change per year. ***p* value:** For linear trend over time. NA, value could not be calculated]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells—Continued											
Advanced test reactor complex—Continued											
USGS 60	433456112571901	Tritium	74	0	529,000	243	NA	NA	-24.4	0.000	–
		Strontium-90	40	0	12.4	0.985	NA	NA	-0.69	0.908	none
USGS 61	433453112571601	Tritium	53	1,180	314,000	15,435	NA	NA	-15.3	0.000	–
		Strontium-90	37	0	8.2	NA	NA	NA	NA	NA	NAC
USGS 62	433446112570701	Tritium	53	0	253,000	690	NA	NA	-32.5	0.000	–
		Strontium-90	36	0	10	NA	NA	NA	NA	NA	NAC
USGS 63	433455112574001	Tritium	54	0	135,000	87.3	NA	NA	-38.4	0.000	–
		Strontium-90	37	0	17	3.69	NA	NA	-5.99	0.000	–
USGS 66	433436112564801	Tritium	40	0	125,000	8,293	NA	NA	-20.0	0.000	–
		Strontium-90	27	0	8.1	NA	NA	NA	NA	NA	NAC
USGS 68	433516112573901	Tritium	80	0	4,500	NA	NA	NA	NA	NA	NAC
		Strontium-90	42	0	12	NA	NA	NA	NA	NA	NAC
USGS 69	433450112573001	Tritium	43	0	1,100	NA	NA	NA	NA	NA	NAC
		Strontium-90	27	0	9.0	NA	NA	NA	NA	NA	NAC
USGS 70	433504112571001	Tritium	56	500	382,000	27,748	NA	NA	-18.2	0.000	–
		Strontium-90	38	2.6	63	42.1	NA	NA	-2.23	0.024	–
USGS 71	433439112571501	Tritium	45	380	112,000	8,009	NA	NA	-17.9	0.000	–
		Strontium-90	31	0	9.0	NA	NA	NA	NA	NA	NAC
USGS 72	433519112574601	Tritium	33	0	2,300	19.5	NA	NA	-1.27	0.881	none
		Strontium-90	23	0	9.0	NA	NA	NA	NA	NA	NAC
USGS 73	433502112575401	Tritium	55	1,660	491,000	59,970	NA	NA	-12.4	0.000	–
		Strontium-90	37	0	9.0	NA	NA	NA	NA	NA	NAC
USGS 78	433413112573501	Tritium	20	0	900	NA	NA	NA	NA	NA	NAC
		Strontium-90	18	0	5.5	NA	NA	NA	NA	NA	NAC
Radioactive Waste Management Complex											
USGS 92	433000113025301	Tritium	42	0	1,200	NA	NA	NA	NA	NA	NAC
		Strontium-90	40	0	10.2	NA	NA	NA	NA	NA	NAC

Table 6. Summary of water-quality results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho.

[See figures 2 and 3 for well locations. Data available at http://waterdata.usgs.gov/nwis. **Local name**: Local well identifier used in this study. **Constituent**: Concentrations in picocuries per liter. **Concentration ranges**: For values equal to or greater than the reporting level (three sample standard deviations) and year concentration was sampled. Uncertainty is one sample standard deviation; ±, plus or minus; N/A, no values greater than reporting level]

Local name	Constituent	Number of samples	Number greater than reporting level	Period of record	Concentration range greater than reporting level
			Aquifer wells		
Idaho Nuclear Technology and Engineering Center					
CPP 1	Tritium	93	33	1972–2012	180 ± 60 in 2010 to 54,100 ± 800 in 1981
	Strontium-90	88	10	1972–2012	1.4 ± 0.3 in 1986 to 28 ± 3 in 1974
	Cesium-137	33	1	1982–2012	100 ± 30 in 1986
	Plutonium-239, 240	30	0	1985–2012	N/A
	Plutonium-238	30	0	1985–2012	N/A
	Americium-241	30	0	1985–2012	N/A
	Gross alpha	31	1	1982–2012	3.5 ± 1 in 2009
	Gross beta	31	5	1982–2012	5.4 ± 1 in 2012 to 19 ± 1.7 in 2009
CPP 2	Tritium	79	9	1972–2012	600 ± 200 in 1978 to 16,700 ± 400 in 1981
	Strontium-90	79	0	1972–2012	N/A
Rifle Range	Tritium	14	14	1988–2012	720 ± 70 in 2011 to 3,700 ± 150 in 1988
	Strontium-90	14	0	1988–2012	N/A
	Cesium-137	13	0	1988–2012	N/A
USGS 20	Tritium	82	81	1966–2012	2,810 ± 130 in 2012 to 339,000 ± 4,000 in 1966
	Strontium-90	67	0	1966–2012	N/A
USGS 34	Tritium	81	79	1966–2012	520 ± 150 in 2000 to 24,900 ± 700 in 1978
	Strontium-90	65	15	1968–2012	2.4 ± 0.8 in 2003 to 33 ± 3 in 1979
	Cesium-137	30	0	1969–2012	N/A
	Plutonium-239, 240	29	0	1990–2012	N/A
	Plutonium-238	29	0	1990–2012	N/A
	Americium-241	29	0	1990–2012	N/A
	Gross alpha	28	0	1994–2012	N/A
	Gross beta	28	5	1994–2012	3.9 ± 1.1 in 2010 to 5.5 ± 1 in 2009
USGS 35	Tritium	71	67	1972–2012	470 ± 140 in 2000 to 24,200 ± 900 in 1987
	Strontium-90	63	6	1972–2012	3.6 ± 0.8 in 1996 to 20 ± 2 in 1987
USGS 36	Tritium	100	100	1966–2012	1,240 ± 90 in 2012 to 91,000 ± 3,000 in 1968
	Strontium-90	82	82	1973–2012	3.6 ± 0.6 in 2009 to 40 ± 4 in 1985
USGS 37	Tritium	106	106	1966–2012	1,000 ± 200 in 1977 to 160,000 ± 3,000 in 1968
	Strontium-90	94	83	1968–2012	4.2 ± 0.7 in 2007 to 34 ± 3 in 1980
	Cesium-137	27	0	1969–2012	N/A
	Plutonium-239, 240	31	0	1982–2012	N/A
	Plutonium-238	31	0	1982–2012	N/A
	Americium-241	30	1	1982–2012	0.09 ± 0.03 in 1992
USGS 38	Tritium	81	81	1966–2012	1,020 ± 80 in 2012 to 264,000 ± 3,000 in 1966
	Strontium-90	63	62	1968–2012	5.4 ± 0.7 in 2012 to 41.4 ± 1.3 in 2006
	Cesium-137	30	0	1969–2012	N/A
	Plutonium-239, 240	29	0	1990–2012	N/A
	Plutonium-238	29	0	1990–2012	N/A
	Americium-241	29	0	1990–2012	N/A
	Gross alpha	28	0	1994–2012	N/A
	Gross beta	28	4	1994–2012	9.4 ± 1.3 in 2010 to 16.5 ± 1.6 in 2008
USGS 39	Tritium	90	86	1972–2012	630 ± 150 in 2000 to 10,600 ± 400 in 1980
	Strontium-90	83	0	1972–2012	N/A
USGS 40	Tritium	130	130	1972–2010	1,230 ± 160 in 2000 to 824,000 ± 4,000 in 1974
	Strontium-90	123	123	1972–2010	9.2 ± 1.4 in 1997 to 410 ± 20 in 1979
	Cesium-137	92	14	1978–2010	100 ± 30 in 1987 to 237 ± 45 in 1983

Table 6. Summary of water-quality results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho.—Continued

[See figures 2 and 3 for well locations. Data available at http://waterdata.usgs.gov/nwis. **Local name**: Local well identifier used in this study. **Constituent**: Concentrations in picocuries per liter. **Concentration ranges**: For values equal to or greater than the reporting level (three sample standard deviations) and year concentration was sampled. Uncertainty is one sample standard deviation; ±, plus or minus; N/A, no values greater than reporting level]

Local name	Constituent	Number of samples	Number greater than reporting level	Period of record	Concentration range greater than reporting level
Aquifer wells—Continued					
Idaho Nuclear Technology and Engineering Center—Continued					
USGS 40	Plutonium-239, 240	77	4	1982–2010	0.036 ± 0.005 in 1982 to 5.5 ± 0.4 in 1987
—Continued	Plutonium-238	77	7	1982–2010	0.11 ± 0.03 in 1983 to 1.31 ± 0.09 in 1983
	Americium-241	67	1	1983–2010	1 ± 0.2 in 1987
USGS 41	Tritium	81	80	1972–2012	540 ± 160 in 1999 to 142,000 ± 2,000 in 1983
	Strontium-90	69	69	1972–2012	7.7 ± 0.8 in 2009 to 200 ± 10 in 1980
USGS 42	Tritium	82	75	1972–2012	510 ± 140 in 1999 to 216,000 ± 2,000 in 1983
	Strontium-90	70	66	1972–2012	3.3 ± 0.8 in 1999 to 150 ± 7 in 1983
USGS 43	Tritium	73	71	1972–2012	1,200 ± 200 in 1988 to 366,000 ± 2,000 in 1977
	Strontium-90	63	21	1972–2012	2.3 ± 0.7 in 2003 to 127 ± 8 in 1977
	Cesium-137	53	1	1978–2012	138 ± 41 in 1978
	Plutonium-239, 240	26	0	1982–2012	N/A
	Plutonium-238	27	0	1982–2012	N/A
	Americium-241	25	0	1986–2012	N/A
USGS 44	Tritium	73	28	1967–2012	500 ± 100 in 1988 to 402,000 ± 2,000 in 1981
	Strontium-90	64	44	1972–2012	2.2 ± 0.7 in 2003 to 210 ± 10 in 1981
	Cesium-137	54	2	1981–2012	50 ± 14 in 2010 to 60 ± 15 in 1988
USGS 45	Tritium	74	57	1972–2012	410 ± 130 in 1998 to 195,000 ± 2,000 in 1981
	Strontium-90	66	29	1972–2012	2 ± 0.6 in 2004 to 79 ± 5 in 1982
USGS 46	Tritium	72	68	1972–2012	320 ± 70 in 2010 to 371,000 ± 2,000 in 1981
	Strontium-90	63	58	1972–2012	3.3 ± 0.7 in 2010 to 240 ± 10 in 1980
	Cesium-137	52	0	1981–2012	N/A
USGS 47	Tritium	116	116	1972–2012	520 ± 60 in 2011 to 301,000 ± 3,000 in 1981
	Strontium-90	104	104	1972–2012	15 ± 3 in 1986 to 152 ± 8 in 1981
	Cesium-137	77	3	1978–2012	90 ± 30 in 1985 to 200 ± 50 in 1984
	Plutonium-239, 240	34	2	1974–2012	0.003 ± 0.0007 in 1975 to 0.03 ± 0.008 in 1974
	Plutonium-238	34	5	1974–2012	0.006 ± 0.001 in 1975 to 0.5 ± 0.06 in 1983
	Americium-241	33	0	1974–2012	N/A
USGS 48	Tritium	81	81	1972–2012	950 ± 160 in 2,000 to 123,000 ± 2,000 in 1974
	Strontium-90	72	72	1972–2012	9.9 ± 0.8 in 2000 to 62 ± 2 in 1989
USGS 51	Tritium	76	76	1972–2012	3,200 ± 400 in 1977 to 57,000 ± 2,000 in 1972
	Strontium-90	69	5	1972–2012	2.5 ± 0.7 in 2008 to 20 ± 3 in 1973
USGS 52	Tritium	72	72	1972–2012	760 ± 80 in 2012 to 245,000 ± 2,000 in 1978
	Strontium-90	65	65	1973–2012	3.9 ± 0.8 in 2010 to 104 ± 6 in 1980
USGS 57	Tritium	107	107	1972–2012	800 ± 200 in 1977 to 239,000 ± 2,000 in 1977
	Strontium-90	102	102	1973–2012	7.5 ± 0.7 in 1998 to 105 ± 7 in 1979
	Cesium-137	14	0	1997–2012	N/A
USGS 59	Tritium	78	78	1972–2012	500 ± 70 in 2012 to 81,900 ± 800 in 1981
	Strontium-90	70	66	1972–2012	6 ± 2 in 1974 to 39 ± 3 in 1981
USGS 67	Tritium	67	67	1972–2012	3,120 ± 140 in 2011 to 462,000 ± 2,000 in 1977
	Strontium-90	60	59	1972–2012	8.8 ± 0.6 in 2002 to 69 ± 4 in 1982
USGS 77	Tritium	79	79	1966–2012	3,490 ± 150 in 2011 to 241,000 ± 3,000 in 1966
	Strontium-90	67	7	1968–2012	2 ± 0.5 in 1998 to 7 ± 2 in 1988
	Cesium-137	28	0	1969–2012	N/A
	Plutonium-239, 240	27	0	1990–2012	N/A
	Plutonium-238	27	0	1990–2012	N/A

Table 6. Summary of water-quality results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho.—Continued

[See figures 2 and 3 for well locations. Data available at http://waterdata.usgs.gov/nwis. **Local name**: Local well identifier used in this study. **Constituent**: Concentrations in picocuries per liter. **Concentration ranges**: For values equal to or greater than the reporting level (three sample standard deviations) and year concentration was sampled. Uncertainty is one sample standard deviation; ±, plus or minus; N/A, no values greater than reporting level]

Local name	Constituent	Number of samples	Number greater than reporting level	Period of record	Concentration range greater than reporting level
			Aquifer wells—Continued		
Idaho Nuclear Technology and Engineering Center—Continued					
USGS 77 —Continued	Americium-241	27	0	1990–2012	N/A
	Gross alpha	24	1	1995–2012	4 ± 1 in 2008
	Gross beta	24	5	1995–2012	8.4 ± 1 in 2009 to 14.6 ± 1.4 in 2008
USGS 82	Tritium	87	45	1972–2012	500 ± 130 in 1997 to 42,800 ± 800 in 1983
	Strontium-90	80	3	1972–2012	2.4 ± 0.7 in 2008 to 8 ± 2 in 1991
USGS 84	Tritium	69	66	1972–2012	540 ± 60 in 2011 to 12,000 ± 2,000 in 1973
	Strontium-90	26	0	1994–2012	N/A
	Cesium-137	28	0	1981–2012	N/A
	Plutonium-239, 240	28	0	1994–2012	N/A
	Plutonium-238	28	0	1994–2012	N/A
	Americium-241	28	0	1994–2012	N/A
	Gross alpha	28	1	1994–2012	4.2 ± 1 in 2008
	Gross beta	28	12	1994–2012	2.4 ± 0.8 in 2012 to 4.4 ± 0.59 in 2001
USGS 85	Tritium	81	81	1966–2012	1,520 ± 100 in 2012 to 55,900 ± 900 in 1978
	Strontium-90	68	29	1968–2012	2.1 ± 0.6 in 1998 to 9 ± 3 in 1977
USGS 111	Tritium	56	56	1985–2012	2,700 ± 130 in 2012 to 164,000 ± 5,000 in 1986
	Strontium-90	56	2	1985–2012	11 ± 2 in 1987 to 28 ± 3 in 1989
USGS 112	Tritium	76	76	1985–2012	1,010 ± 80 in 2012 to 88,200 ± 2,500 in 1986
	Strontium-90	76	76	1985–2012	8.6 ± 0.8 in 2006 to 53 ± 4 in 1987
USGS 113	Tritium	74	74	1985–2012	2,050 ± 110 in 2012 to 108,000 ± 4,000 in 1986
	Strontium-90	73	72	1985–2012	5.9 ± 0.8 in 2010 to 30 ± 3 in 1986
	Cesium-137	16	0	1994–2012	N/A
USGS 114	Tritium	74	74	1985–2012	7,020 ± 260 in 2011 to 37,700 ± 1,200 in 1986
	Strontium-90	74	2	1985–2012	2.1 ± 0.6 in 2003 to 8 ± 2 in 1987
USGS 115	Tritium	74	74	1985–2012	1,150 ± 80 in 2008 to 20,600 ± 800 in 1985
	Strontium-90	74	1	1985–2012	2.5 ± 0.7 in 2008
USGS 116	Tritium	73	73	1985–2012	1,800 ± 200 in 2002 to 24,300 ± 900 in 1985
	Strontium-90	73	0	1985–2012	N/A
USGS 123	Tritium	33	33	1991–2012	2,940 ± 110 in 2012 to 33,800 ± 800 in 1993
	Strontium-90	33	25	1991–2012	2.9 ± 0.7 in 2005 to 53 ± 4 in 1991
USGS 128	Tritium	11	11	2001–2012	1,290 ± 80 in 2012 to 4,300 ± 300 in 2001
	Strontium-90	11	11	2001–2012	3.5 ± 0.7 in 2011 to 9.6 ± 0.8 in 2004
Advanced Test Reactor Complex					
MTR Test	Tritium	58	21	1972–2012	420 ± 140 in 2007 to 4,400 ± 300 in 1991
TRA Disposal	Tritium	57	57	1985–2012	1,530 ± 90 in 2011 to 29,100 ± 700 in 1992
	Strontium-90	33	1	1987–2012	4.1 ± 0.9 in 2004
	Cesium-137	50	0	1986–2012	N/A
USGS 58	Tritium	87	82	1962–2012	590 ± 70 in 2012 to 140,000 ± 20,000 in 1967
	Strontium-90	40	1	1969–2012	155 ± 8 in 1980
	Cesium-137	37	0	1969–2012	N/A
USGS 65	Tritium	133	133	1969–2012	3,550 ± 160 in 2012 to 206,000 ± 3,000 in 1972
	Strontium-90	119	4	1972–2012	2.1 ± 0.7 in 2000 to 18 ± 3 in 1976
	Cesium-137	89	1	1981–2012	120 ± 20 in 1988
	Plutonium-239, 240	31	0	1982–2012	N/A
	Plutonium-238	32	0	1982–2012	N/A

Table 6. Summary of water-quality results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho.—Continued

[See figures 2 and 3 for well locations. Data available at http://waterdata.usgs.gov/nwis. **Local name**: Local well identifier used in this study. **Constituent**: Concentrations in picocuries per liter. **Concentration ranges**: For values equal to or greater than the reporting level (three sample standard deviations) and year concentration was sampled. Uncertainty is one sample standard deviation; ±, plus or minus; N/A, no values greater than reporting level]

Local name	Constituent	Number of samples	Number greater than reporting level	Period of record	Concentration range greater than reporting level
			Aquifer wells—Continued		
Advanced Test Reactor Complex—Continued					
USGS 65 —Continued	Americium-241	31	0	1984–2012	N/A
	Gross alpha	29	0	1994–2012	N/A
	Gross beta	29	6	1994–2012	3.2 ± 0.55 in 2007 to 6.8 ± 1.1 in 2009
USGS 76	Tritium	110	107	1972–2012	570 ± 70 in 2012 to 8,000 ± 2,000 in 1972
	Strontium-90	94	4	1975–2012	6 ± 2 in 1975 to 30 ± 3 in 1987
	Cesium-137	72	1	1981–2012	57.7 ± 17 in 1982
USGS 79	Tritium	80	10	1972–2012	420 ± 140 in 2000 to 900 ± 300 in 1987
Central Facilities Area					
CFA 1	Tritium	138	138	1966–2012	4,770 ± 190 in 2012 to 118,000 ± 2,000 in 1968
	Strontium-90	59	2	1968–2012	1.9 ± 0.6 in 2012 to 8 ± 2 in 1979
CFA 2	Tritium	126	126	1966–2012	4,280 ± 170 in 2011 to 76,000 ± 2,000 in 1974
	Strontium-90	55	0	1968–2012	N/A
CFA LF 2-10	Tritium	31	31	1993–2012	1,220 ± 150 in 2007 to 9,200 ± 500 in 1993
	Strontium-90	29	2	1993–2012	2.1 ± 0.7 in 2003 to 2.4 ± 0.7 in 2008
	Cesium-137	30	0	1994–2012	N/A
	Gross alpha	29	1	1994–2012	3 ± 1in 2009
	Gross beta	29	5	1994–2012	3.7 ± 1 in 2008 to 5.9±1 in 2009
CFA LF 3-9	Tritium	13	13	1993–2007	5,400 ± 300 in 2007 to 28,000 ± 1,100 in 1993
	Strontium-90	13	2	1993–2007	2.5 ± 0.8 in 2005 to 2.6 ± 0.7 in 1995
USGS 127	Tritium	18	0	2000–2012	N/A
	Strontium-90	17	1	2000–2012	3.1 ± 0.7 in 2003
	Cesium-137	18	0	2000–2012	N/A
	Gross alpha	18	1	2000–2012	3.5 ± 1 in 2009
	Gross beta	18	5	2000–2012	3.4 ± 0.9 in 2007 to 4.5 ± 0.68 in 2005
Radioactive Waste Management Complex					
RWMC M1S	Plutonium-239, 240	22	1	1993–2012	0.006 ± .001 in 2001
	Plutonium-238	22	0	1993–2012	N/A
	Americium-241	22	0	1993–2012	N/A
RWMC M3S	Tritium	21	21	1993–2012	900 ± 70 in 2011 to 2,000 ± 300 in 1996
	Strontium-90	21	0	1993–2012	N/A
RWMC M7S	Tritium	21	21	1993–2012	760 ± 70 in 2011 to 1,600 ± 200 in 1998
	Strontium-90	21	1	1993–2012	2.3 ± 0.7 in 2008
RWMC M11S	Tritium	15	0	2000–2012	N/A
	Cesium-137	14	1	2000–2012	27 ± 9 in 2012
	Gross alpha	15	1	2000–2012	2.7 ± 0.8 in 2008
	Gross beta	15	8	2000–2012	2.5 ± 0.8 in 2009 to 5.6 ± 0.8 in 2010
RWMC M12S	Tritium	14	14	2000–2012	890 ± 70 in 2012 to 1,700 ± 200 in 2001
	Cesium-137	14	1	2000–2012	30 ± 10 in 2004
	Gross alpha	14	1	2000–2012	3.2 ± 0.9 in 2008
	Gross beta	14	6	2000–2012	3.5 ± 0.8 in 2009 to 4.9 ± 0.8 in 2010
RWMC M13S	Tritium	15	0	2000–2012	N/A
	Cesium-137	15	0	2000–2012	N/A
	Gross alpha	15	1	2000–2012	2.3 ± 0.7 in 2008
	Gross beta	15	6	2000–2012	2.8 ± 0.8 in 2009 to 4.44 ± 0.765 in 2001

Table 6. Summary of water-quality results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho.—Continued

[See figures 2 and 3 for well locations. Data available at http://waterdata.usgs.gov/nwis. **Local name**: Local well identifier used in this study. **Constituent**: Concentrations in picocuries per liter. **Concentration ranges**: For values equal to or greater than the reporting level (three sample standard deviations) and year concentration was sampled. Uncertainty is one sample standard deviation; ±, plus or minus; N/A, no values greater than reporting level]

Local name	Constituent	Number of samples	Number greater than reporting level	Period of record	Concentration range greater than reporting level
			Aquifer wells—Continued		
Radioactive Waste Management Complex—Continued					
RWMC M14S	Tritium	15	15	2000–2012	910 ± 70 in 2012 to 1,800 ± 200 in 2001
	Cesium-137	15	0	2000–2012	N/A
	Gross alpha	15	1	2000–2012	3.2 ± 0.9 in 2008
	Gross beta	15	8	2000–2012	2.8 ± 0.8 in 2009 to 5.6 ± 1in 2008
RWMC production	Tritium	113	113	1975–2012	780 ± 70 in 2011 to 2,300 ± 400 in 1988
	Strontium-90	106	1	1977–2012	6 ± 2 in 1987
	Cesium-137	63	1	1977–2012	34 ± 11 in 2012
	Plutonium-239, 240	62	0	1975–2012	N/A
	Plutonium-238	65	0	1975–2012	N/A
	Americium-241	65	1	1975–2012	0.003 ± 0.001 in 2001
USGS 87	Tritium	148	111	1972–2012	600 ± 200 in 1976 to 7,000 ± 2,000 in 1973
	Strontium-90	140	9	1972–2012	2.8 ± 0.7 in 2003 to 23 ± 4 in 1987
	Cesium-137	124	4	1972–2012	30 ± 10 in 1974 to 90 ± 30 in 1986
	Plutonium-239, 240	117	1	1972–2012	0.03 ± 0.008 in 1974
	Plutonium-238	120	3	1972–2012	0.029 ± 0.008 in 1973 to 0.04 ± 0.009 in 1973
	Americium-241	119	4	1972–2012	0.04 ± 0.01 in 1972 to 0.3 ± 0.02 in 1973
	Gross alpha	30	0	1972–2012	N/A
	Gross beta	29	10	1994–2012	3.3 ± 0.9 in 2009 to 4.6 ± 0.9 in 2012
USGS 88	Tritium	149	2	1972–2011	900 ± 300 in 1986 to 6,000 ± 2,000 in 1973
	Strontium-90	141	7	1972–2011	6 ± 2 in 1979 to 58 ± 4 in 1973
	Cesium-137	124	2	1972–2011	24 ± 5 in 1972 to 30 ± 9 in 1987
	Plutonium-239, 240	119	2	1972–2011	0.04 ± 0.009 in 1974 to 0.04 ± 0.01 in 1976
USGS 88	Plutonium-238	122	5	1972–2011	0.028 ± 0.007 in 1973 to 0.27 ± 0.03 in 1973
	Americium-241	121	8	1972–2011	0.02 ± 0.006 in 1982 to 0.13 ± 0.02 in 1973
USGS 89	Tritium	152	2	1972–2012	1,000 ± 200 in 1977 to 10,000 ± 2,000 in 1973
	Strontium-90	144	4	1972–2012	2.5 ± 0.7 in 2008 to 6 ± 2 in 1975
	Cesium-137	102	5	1981–2012	24 ± 7 in 1976 to 90 ± 10 in 1972
	Plutonium-239, 240	99	5	1972–2012	0.03 ± 0.01 in 1974 to 0.29 ± 0.02 in 1973
	Plutonium-238	101	3	1972–2012	0.021 ± 0.006 in 1973 to 0.04 ± 0.01 in 1974
	Americium-241	102	7	1972–2012	0.011 ± 0.002 in 1973 to 5 ± 1 in 1972
USGS 120	Tritium	69	3	1987–2012	240 ± 60 in 2009 to 290 ± 60 in 2010
	Strontium-90	68	0	1987–2012	N/A
	Cesium-137	67	0	1987–2012	N/A
	Plutonium-239, 240	62	0	1989–2012	N/A
	Plutonium-238	65	0	1987–2012	N/A
	Americium-241	65	1	1987–2012	0.06 ± 0.02 in 1993
	Gross alpha	27	1	1994–2012	3.7 ± 1 in 2008
	Gross beta	27	9	1994–2012	2.7 ± 0.7 in 2009 to 7 ± 1.1 in 2008
South of facilities					
USGS 104	Tritium	91	79	1980–2012	740 ± 110 in 2007 to 2,400 ± 400 in 1984
USGS 105	Tritium	63	11	1980–2007	150 ± 50 in 1999 to 1,960 ± 90 in 1983
	Cesium-137	23	0	1987–2007	N/A
	Gross alpha	23	0	1987–2007	N/A
	Gross beta	23	5	1987–2007	4 ± 1 in 2004 to 4.4 ± 0.65 in 1998
USGS 106	Tritium	78	78	1980–2012	500 ± 60 in 2011 to 6,500 ± 400 in 1983

Table 6. Summary of water-quality results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho.—Continued

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Local name	Constituent	Number of samples	Number greater than reporting level	Period of record	Concentration range greater than reporting level
			Aquifer wells—Continued		
South of facilities—Continued					
USGS 108	Tritium	55	1	1980–2008	1,800 ± 100 in 1983
	Cesium-137	24	0	1989–2008	N/A
	Gross alpha	23	0	1994–2008	N/A
	Gross beta	23	8	1994–2008	4 ± 1 for several to 4.46 ± 0.83 in 2001
USGS 124	Tritium	31	6	1994–2012	180 ± 60 in 2000 to 340 ± 80 in 1995
			Perched groundwater wells		
Idaho Nuclear Technology and Engineering Center					
PW 1	Tritium	55	25	1987–2002	600 ± 200 in 1994 to 194,000 ± 5,000 in 1988
	Strontium-90	55	30	1987–2002	2.6 ± 0.8 in several to 34 ± 3 in 1988
	Cesium-137	14	0	1987–2002	N/A
PW 2	Tritium	44	34	1987–2002	390 ± 130 in 1998 to 195,000 ± 5,000 in 1988
	Strontium-90	44	17	1987–2002	2.1 ± 0.5 in 1998 to 16 ± 2 in 1988
	Cesium-137	15	0	1987–2002	N/A
PW 3	Tritium	42	26	1987–2002	450 ± 140 in 2002 to 318,000 ± 8,000 in 1988
	Strontium-90	42	30	1987–2002	2 ± 0.5 in 1998 to 22 ± 2 in 1988
	Cesium-137	15	0	1987–2002	N/A
PW 4	Tritium	61	48	1987–2006	480 ± 140 in 1999 to 14,900 ± 500 in 1988
	Strontium-90	61	43	1987–2006	1.8 ± 0.6 in 1997 to 18 ± 2 in 1988
	Cesium-137	19	0	1987–2006	N/A
PW 5	Tritium	40	21	1987–2002	600 ± 200 in 1992 to 230,000 ± 6,000 in 1988
	Strontium-90	40	26	1987–2002	2.5 ± 0.8 in 2000 to 25 ± 3 in 1989
	Cesium-137	15	0	1987–2002	N/A
PW 6	Tritium	41	41	1987–2000	7,100 ± 400 in 1997 to 36,700 ± 800 in 1988
	Strontium-90	41	3	1987–2000	5.7 ± 1.5 in 1997 to 21 ± 3 in 1990
	Cesium-137	10	0	1987–2000	N/A
USGS 50	Tritium	112	112	1967–2008	15,900 ± 300 in 2008 to 2,526,000 ± 10,000 in 1968
	Strontium-90	107	107	1972–2008	101 ± 2 in 2007 to 820 ± 30 in 1972
	Cesium-137	69	1	1981–2008	26.3 ± 6.8 in 1981
Advanced Test Reactor Complex					
CWP 1	Tritium	41	0	1982–2012	N/A
	Strontium-90	25	2	1989–2012	2 ± 0.6 in 2004 to 3.1 ± 0.7 in 1999
CWP 2	Tritium	21	0	1983–2001	N/A
	Strontium-90	9	0	1990–2001	N/A
CWP 3	Tritium	40	0	1982–2012	N/A
	Strontium-90	24	1	1989–2012	3 ± 0.7 in 2011
CWP 4	Tritium	28	0	1982–2010	N/A
	Strontium-90	13	0	1989–2010	N/A
CWP 5	Tritium	17	0	1982–2001	N/A
	Strontium-90	8	0	1989–2001	N/A
CWP 8	Tritium	37	1	1982–2012	800 ± 200 in 1988
	Strontium-90	24	2	1989–2012	5.4 ± 0.8 in 2009 to 6.4 ± 1.2 in 2003
PW 8	Tritium	70	61	1987–2012	240 ± 70 in 2009 to 377,000 ± 6,000 in 1992
	Strontium-90	55	53	1989–2012	2.5 ± 0.7 in 2003 to 24.7 ± 1.4 in 1995
	Cesium-137	26	0	1987–2012	N/A

Table 6. Summary of water-quality results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho.—Continued

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Local name	Constituent	Number of samples	Number greater than reporting level	Period of record	Concentration range greater than reporting level
			Perched groundwater wells—Continued		
Advanced Test Reactor Complex—Continued					
PW 9	Tritium	67	67	1987–2012	10,500 ± 200 in 2012 to 295,000 ± 8,000 in 1987
	Strontium-90	54	4	1989–2012	2.1 ± 0.7 in 2008 to 14 ± 3 in 1990
	Cesium-137	26	0	1987–2012	N/A
TRA A 13	Tritium	78	43	1972–2001	900 ± 200 in 1983 to 718,000 ± 6,000 in 1972
	Strontium-90	24	24	1972–2001	22.1 ± 1.1 in 2001 to 339 ± 4 in 1972
	Cesium-137	29	1	1980–2001	1,000 ± 200 in 1972
TRA A 77	Tritium	92	92	1972–1997	560 ± 130 in 1997 to 5,630,000 ± 20,000 in 1983
	Strontium-90	25	25	1972–1997	170 ± 10 in 1972 to 43,000 ± 1,400 in 1995
	Cesium-137	31	28	1972–1997	180 ± 50 in 1933 to 42,300 ± 1,800 in 1996
USGS 53	Tritium	53	53	1968–2012	530 ± 70 in 2012 to 2,040,000 ± 10,000 in 1983
	Strontium-90	19	18	1972–2012	20.9 ± 1 in 2011 to 368 ± 2.5 in 1972
	Cesium-137	19	1	1980–2012	118 ± 37 in 1983
USGS 54	Tritium	147	130	1962–2012	180 ± 60 in 2009 to 1,890,000 ± 10,000 in 1983
	Strontium-90	58	58	1972–2012	6 ± 1 in 1980 to 817 ± 8 in 1972
	Cesium-137	38	0	1980–2012	N/A
USGS 55	Tritium	78	78	1962–2012	900 ± 200 in 1994 to 537,000 ± 14,000 in 1986
	Strontium-90	37	36	1972–2012	6 ± 2 in 1993 to 70.5 ± 1.8 in 2006
	Cesium-137	30	0	1981–2012	N/A
USGS 56	Tritium	61	60	1962–2012	1,670 ± 90 in 2012 to 1,970,000 ± 20,000 in 1983
	Strontium-90	21	19	1972–2012	0.011 ± 0.001 in 1972 to 89 ± 5 in 1991
	Cesium-137	22	0	1980–2012	N/A
USGS 60	Tritium	109	71	1966–2011	410 ± 130 in 1997 to 973,000 ± 7,000 in 1970
	Strontium-90	46	21	1970–2011	0.014 ± 0.001 in 1972 to 11 ± 3 in 1976
	Cesium-137	34	0	1970–2011	N/A
USGS 61	Tritium	71	71	1966–2011	1,480 ± 100 in 2012 to 546,000 ± 5,000 in 1971
	Strontium-90	41	4	1972–2012	1.6 ± 0.5 in 1998 to 180 ± 10 in 1973
	Cesium-137	32	1	1982–2012	12 ± 4 in 2010
USGS 62	Tritium	78	59	1962–2012	300 ± 100 in 2000 to 692,000 ± 5,000 in 1969
	Strontium-90	39	17	1972–2012	2.2 ± 0.7 in 2003 to 4.4 ± 0.7 in 2011
	Cesium-137	33	0	1980–2012	N/A
USGS 63	Tritium	71	40	1962–2012	180 ± 60 in 2006 to 673,000 ± 5,000 in 1969
	Strontium-90	42	25	1970–2012	2.1 ± 0.6 in 2002 to 13 ± 2 in 1991
	Cesium-137	32	1	1970–2012	32 ± 10 in 2008
USGS 66	Tritium	60	60	1966–2012	240 ± 60 in 2011 to 258,000 ± 3,000 in 1974
	Strontium-90	30	1	1972–2012	3.5 ± 0.9 in 2004
	Cesium-137	21	1	1980–2012	31 ± 0.5 in 1980
USGS 68	Tritium	108	5	1972–2012	190 ± 60 in 2005 to 47,400 ± 900 in 1979
	Strontium-90	46	2	1972–2012	4 ± 1 in 1972 to 6 ± 2 in 1991
	Cesium-137	37	2	1972–2012	27 ± 9 in 2012 to 310±90 in 1972
	Gross alpha	18	0	1999–2012	N/A
	Gross beta	18	7	1999–2012	3.2 ± 0.2 in 2007 to 8.5 ± 1.1 in 2012
USGS 69	Tritium	65	23	1967–2012	230 ± 60 in 2012 to 260,000 ± 20,000 in 1967
	Strontium-90	31	2	1970–2012	2.4 ± 0.8 in 2004 to 7 ± 2 in 1976
	Cesium-137	22	0	1970–2012	N/A

Table 6. Summary of water-quality results for selected radiochemical constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho.—Continued

[See figures 2 and 3 for well locations. Data available at http://waterdata.usgs.gov/nwis. **Local name**: Local well identifier used in this study. **Constituent**: Concentrations in picocuries per liter. **Concentration ranges**: For values equal to or greater than the reporting level (three sample standard deviations) and year concentration was sampled. Uncertainty is one sample standard deviation; ±, plus or minus; N/A, no values greater than reporting level]

Local name	Constituent	Number of samples	Number greater than reporting level	Period of record	Concentration range greater than reporting level
			Perched groundwater wells—Continued		
Advanced Test Reactor Complex—Continued					
USGS 70	Tritium	84	84	1962–2012	710 ± 70 in 2011 to 900,000 ± 6,000 in 1970
	Strontium-90	41	41	1972–2012	5 ± 0.8 in 2006 to 78 ± 5 in 1989
	Cesium-137	34	1	1981–2012	27 ± 9 in 2012
USGS 71	Tritium	66	66	1962–2012	590 ± 70 in 2011 to 338,000 ± 3,000 in 1972
	Strontium-90	34	1	1970–2012	3.7 ± 0.8 in 2004
	Cesium-137	27	0	1970–2012	N/A
USGS 72	Tritium	37	3	1974–2012	450 ± 70 in 2012 to 2,900 ± 200 in 1989
	Strontium-90	26	1	1974–2012	17 ± 3 in 1974
	Cesium-137	21	0	1984–2012	N/A
	Gross alpha	12	0	1999–2012	N/A
	Gross beta	12	5	1999–2012	3.4 ± 1 in 2008 to 5.6 ± 1 in 2009
USGS 73	Tritium	86	85	1962–2012	1,930 ± 90 in 2012 to 533,000 ± 14,000 in 1986
	Strontium-90	40	3	1970–2012	2.1 ± 0.7 in 2011 to 4.4 ± 0.9 in 2004
	Cesium-137	35	0	1970–2012	N/A
USGS 78	Tritium	24	0	1972–2012	N/A
	Strontium-90	19	2	1972–2012	2.6 ± 0.7 in 2008 to 3.1 ± 0.8 in 2004
	Cesium-137	11	0	1986–2012	N/A
Radioactive Waste Management Complex					
USGS 92	Tritium	49	10	1972–2012	300 ± 100 in 2000 to 580 ± 70 in 2012
	Strontium-90	47	2	1972–2012	7.2 ± 1 in 1998 to 9 ± 2 in 1980
	Cesium-137	48	3	1972–2012	60 ± 10 in 1972 to 200 ± 10 in 1972
	Plutonium-239, 240	43	0	1972–2012	N/A
	Plutonium-238	47	2	1972–2012	0.025 ± 0.008 in 1974 to 0.39 ± 0.05 in 1994
	Americium-241	45	2	1974–2012	0.041 ± 0.012 in 1976 to 0.14 ± 0.04 in 1992

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
					Aquifer wells						
Idaho Nuclear Technology and Engineering Center											
CPP 1	433433112560201	Chloride	46	12.6	23.0	16.4	16.4	2.21	-1.39	0.000	–
		Sodium	46	7.60	9.76	8.20	8.26	0.410	0.123	0.264	none
		Sulfate	32	21.2	29.0	23.6	23.7	1.58	-0.613	0.002	–
		Nitrate plus nitrite as N	35	0.779	1.23	0.961	0.994	0.118	-0.907	0.002	–
		Orthophosphate as P	35	0.010	0.035	0.021	0.022	0.005	0.951	0.134	none
		Fluoride	32	0.100	0.300	0.229	0.229	0.039	1.02	0.069	none
		Chromium	42	0.000	14.0	5.84	NA	NA	1.30	0.036	+
		Total organic carbon	18	0.000	4.58	0.430	NA	NA	-0.768	0.832	none
CPP 2	433432112560801	Chloride	39	10.3	20.0	15.4	15.2	2.30	-1.56	0.000	–
		Sodium	39	7.10	9.00	7.83	7.85	0.387	0.100	0.382	none
		Sulfate	9	17.2	29.0	24.0	24.1	3.12	-3.58	0.001	–
		Nitrate plus nitrite as N	22	0.732	1.50	0.870	0.910	0.155	-1.13	0.002	–
		Orthophosphate as P	22	0.010	0.064	0.020	0.024	0.011	2.65	0.004	+
		Chromium	35	0.000	14.0	5.45	NA	NA	0.942	0.075	none
RIFLE RANGE	433243112591101	Chloride	13	8.78	42.4	28.8	26.0	12.4	13.2	0.000	+
		Sodium	12	8.23	16.4	13.1	12.7	3.17	6.95	0.001	+
		Sulfate	13	30.2	33.1	31.2	31.5	1.02	-0.638	0.011	–
		Chromium	13	5.01	20.5	10.1	11.7	4.43	-9.02	0.000	–
USGS 20	433253112545901	Chloride	39	21.0	35.5	27.7	26.9	3.23	1.48	0.000	+
		Sodium	26	7.80	9.56	8.47	8.53	0.438	0.501	0.000	+
		Sulfate	20	17.0	23.0	19.9	19.8	1.42	-0.007	0.978	none
		Nitrate plus nitrite as N	26	0.420	1.43	1.10	1.14	0.216	1.89	0.001	+
		Orthophosphate as P	26	0.000	0.025	0.012	NA	NA	2.76	0.010	+
USGS 34	433334112565501	Chloride	37	9.33	25.0	14.0	15.0	4.40	-2.89	0.000	–
		Sodium	33	7.73	15.5	9.44	9.82	1.57	-1.11	0.002	–
		Sulfate	29	21.3	44.8	29.0	32.5	8.06	3.14	0.000	+
		Nitrate plus nitrite as N	33	0.570	1.50	1.04	1.03	0.192	-0.701	0.196	none
		Fluoride	28	0.184	0.300	0.202	0.216	0.026	-0.360	0.329	none
		Orthophosphate as P	33	0.000	0.033	0.020	NA	NA	2.47	0.000	+
		Chromium	29	0.000	30.3	17.1	NA	NA	4.05	0.002	+
		Total organic carbon	18	0.000	2.10	0.535	NA	NA	-3.99	0.328	none

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 35	433339112565801	Chloride	37	6.75	32.0	12.0	14.8	6.39	-3.61	0.000	–
		Sodium	24	7.02	18.0	9.11	9.71	2.47	-1.69	0.002	–
		Sulfate	19	23.8	46.5	40.1	38.0	8.16	2.76	0.000	+
		Nitrate plus nitrite as N	24	0.658	2.20	1.04	1.12	0.353	-2.05	0.004	–
		Orthophosphate as P	24	0.016	0.030	0.024	0.024	0.005	-0.044	0.942	none
USGS 36	433330112565201	Chloride	55	13.0	81.3	41.0	41.8	20.8	-7.73	0.000	–
		Sodium	24	9.29	26.6	16.1	16.8	6.29	-4.91	0.000	–
		Sulfate	20	23.9	41.2	29.3	32.5	6.42	2.26	0.000	+
		Nitrate plus nitrite as N	25	0.978	3.00	1.60	1.74	0.682	-5.23	0.000	–
		Orthophosphate as P	25	0.000	0.040	0.024	NA	NA	0.258	0.681	none
USGS 37	433326112564801	Chloride	39	18.7	147	78.0	79.7	44.8	-8.46	0.000	–
		Sodium	23	14.4	49.5	32.0	31.3	13.0	-5.49	0.000	–
		Sulfate	19	26.3	39.4	31.0	33.0	4.57	1.73	0.000	+
		Nitrate plus nitrite as N	24	1.12	3.40	2.76	2.22	0.904	-5.93	0.000	–
		Ammonia	24	0.000	0.140	0.009	NA	NA	-6.97	0.127	none
		Orthophosphate as P	24	0.000	0.230	0.019	NA	NA	-1.48	0.394	none
USGS 38	433322112564301	Chloride	37	15.4	192	110	108	62.2	-11.6	0.000	–
		Sodium	33	11.7	93.0	46.7	45.8	23.1	-8.63	0.000	–
		Sulfate	29	25.0	38.0	30.0	31.2	3.88	0.844	0.024	+
		Nitrate plus nitrite as N	32	0.190	3.60	2.64	2.24	0.970	-3.96	0.020	–
		Fluoride	29	0.100	0.300	0.228	0.232	0.041	1.36	0.032	+
		Orthophosphate as P	32	0.000	0.032	0.019	NA	NA	2.18	0.013	+
		Chromium	29	0.000	19.4	9.85	NA	NA	6.39	0.000	+
		Total organic carbon	18	0.000	1.74	0.418	NA	NA	0.282	0.940	none
USGS 39	433343112570001	Chloride	56	6.46	68.0	11.2	11.9	7.87	-1.12	0.128	none
		Sodium	23	6.66	9.48	8.24	8.21	0.775	0.579	0.026	+
		Sulfate	18	23.3	45.9	40.1	37.7	8.08	2.47	0.000	+
		Nitrate plus nitrite as N	23	0.624	1.06	0.954	0.908	0.125	0.674	0.104	none
		Orthophosphate as P	23	0.014	0.030	0.021	0.022	0.005	0.343	0.614	none
USGS 40	433411112561101	Chloride	56	16.3	39.0	24.0	25.0	5.88	-2.62	0.000	–
		Sodium	22	9.50	20.0	13.7	13.8	2.25	-0.648	0.221	none
		Sulfate	18	23.1	29.0	24.5	24.9	1.56	-0.575	0.020	–

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 40		Nitrate plus nitrite as N	22	2.187	11.0	5.36	5.29	1.88	1.03	0.393	none
		Ammonia	22	0.000	0.041	0.011	NA	NA	-0.268	0.927	none
		Orthophosphate as P	22	0.000	0.041	0.020	NA	NA	-0.135	0.917	none
USGS 41	433409112561301	Chloride	37	16.9	32.0	19.8	21.4	3.80	-1.92	0.000	–
		Sodium	24	8.70	14.0	10.7	10.9	1.43	0.013	0.972	none
		Sulfate	19	22.5	30.0	24.6	24.6	1.69	-0.725	0.003	–
		Nitrate plus nitrite as N	24	1.47	6.31	2.95	3.03	1.13	-0.064	0.951	none
		Orthophosphate as P	24	0.018	0.120	0.029	0.031	0.020	-0.665	0.513	none
USGS 42	433404112561301	Chloride	37	15.0	31.0	20.0	21.4	4.22	-1.66	0.000	–
		Sodium	24	8.05	13.1	10.4	10.3	1.46	0.082	0.846	none
		Sulfate	19	22.3	27.0	23.8	24.2	1.18	-0.534	0.005	–
		Nitrate plus nitrite as N	23	1.11	3.90	2.10	2.35	0.851	-0.071	0.950	none
		Orthophosphate as P	23	0.010	0.038	0.022	0.024	0.006	2.04	0.010	+
		Ammonia	23	0.000	0.041	0.006	NA	NA	-7.61	0.261	none
USGS 43	433415112561501	Chloride	36	19.9	34.0	25.2	25.2	3.38	-1.35	0.000	–
		Sodium	23	11.0	20.0	15.3	15.5	2.11	-0.069	0.866	none
		Sulfate	18	21.9	25.6	23.4	23.6	0.950	-0.300	0.054	none
		Nitrate plus nitrite as N	23	3.88	20.6	6.10	7.11	3.40	-1.15	0.254	none
		Ammonia	23	0.000	0.041	0.010	NA	NA	-2.73	0.169	none
		Orthophosphate as P	23	0.000	0.032	0.017	NA	NA	2.19	0.065	none
USGS 44	433409112562101	Chloride	46	9.76	26.0	15.6	16.0	4.19	-3.13	0.000	–
		Sodium	24	7.01	9.10	8.04	8.10	0.499	-0.520	0.005	–
		Sulfate	19	20.5	24.3	22.8	22.8	1.00	-0.296	0.094	none
		Nitrate plus nitrite as N	24	0.715	1.20	0.859	0.935	0.154	-1.94	0.000	–
		Orthophosphate as P	24	0.010	0.055	0.023	0.024	0.008	1.33	0.135	none
USGS 45	433402112561801	Chloride	44	13.9	23.0	19.0	19.0	2.43	-0.883	0.002	–
		Sodium	24	8.11	12.1	9.48	9.64	1.06	0.516	0.077	none
		Sulfate	19	20.8	25.4	23.5	23.4	1.15	-0.421	0.025	–
		Nitrate plus nitrite as N	24	0.947	1.51	1.17	1.17	0.142	-0.457	0.174	none
		Orthophosphate as P	24	0.010	0.030	0.021	0.021	0.005	1.55	0.032	+
USGS 46	433407112561501	Chloride	48	14.0	30.0	19.0	19.3	3.99	-2.06	0.000	–
		Sodium	23	8.00	15.0	9.43	9.92	1.58	-0.817	0.045	–

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 46		Sulfate	19	21.6	27.0	23.7	23.8	1.28	-0.480	0.022	–
		Nitrate plus nitrite as N	23	1.07	5.30	1.72	2.04	0.946	-3.01	0.002	–
		Orthophosphate as P	23	0.019	0.036	0.026	0.026	0.005	0.750	0.150	none
		Ammonia	23	0.000	0.041	0.007	NA	NA	-5.85	0.174	none
USGS 47	433407112560301	Chloride	44	11.4	44.0	27.5	27.7	6.80	-2.39	0.000	–
		Sodium	23	7.39	22.0	14.0	14.1	3.33	-1.75	0.004	–
		Sulfate	19	22.6	31.0	25.5	26.4	2.65	-1.18	0.001	–
		Nitrate plus nitrite as N	23	0.817	10.4	3.47	4.31	2.05	-1.19	0.414	none
		Orthophosphate as P	23	0.000	0.043	0.029	NA	NA	1.77	0.032	+
USGS 48	433401112560301	Chloride	38	13.1	50.0	26.6	26.4	6.22	-1.75	0.000	–
		Sodium	24	7.98	20.0	14.0	13.9	2.68	-1.03	0.059	none
		Sulfate	19	22.7	29.0	25.9	25.8	1.66	-0.708	0.005	–
		Nitrate plus nitrite as N	24	0.936	5.20	2.63	2.59	0.903	-1.10	0.304	none
		Orthophosphate as P	24	0.000	0.038	0.025	NA	NA	1.22	0.132	none
USGS 51	433350112560601	Chloride	35	62.0	194	139	129	39.0	4.28	0.000	+
		Sodium	23	20.0	50.8	31.3	30.9	7.21	2.52	0.000	+
		Sulfate	19	24.0	30.3	28.2	28.1	1.49	0.574	0.008	+
		Nitrate plus nitrite as N	24	2.07	3.80	2.91	2.97	0.532	-2.36	0.000	–
		Ammonia	24	0.000	0.092	0.015	NA	NA	-8.73	0.007	–
		Orthophosphate as P	24	0.000	0.031	0.011	NA	NA	4.97	0.000	+
USGS 52	433414112554201	Chloride	38	20.4	33.0	27.8	26.9	3.48	-1.37	0.000	–
		Sodium	24	11.7	19.2	14.3	14.3	2.11	-0.686	0.074	none
		Sulfate	19	23.0	28.0	26.0	25.9	1.14	-0.281	0.098	none
		Nitrate plus nitrite as N	24	1.90	4.50	2.90	3.05	0.753	-0.531	0.445	none
		Orthophosphate as P	24	0.000	0.031	0.021	NA	NA	1.76	0.026	+
USGS 57	433344112562601	Chloride	57	20.7	200	139	125	53.8	-7.09	0.000	–
		Sodium	23	12.2	78.1	42.0	42.9	23.0	-6.86	0.000	–
		Sulfate	19	23.3	36.0	29.9	28.4	3.98	-1.92	0.000	–
		Nitrate plus nitrite as N	23	1.73	3.70	3.00	2.87	0.713	-3.02	0.000	–
		Orthophosphate as P	23	0.000	0.171	0.024	NA	NA	0.720	0.653	none
USGS 59	433354112554701	Chloride	36	17.1	210	41.9	63.9	55.7	-5.97	0.001	–
		Sodium	23	9.99	75.0	12.3	24.2	19.2	-5.37	0.001	–

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 59		Sulfate	18	23.6	31.3	25.1	25.8	1.94	-0.730	0.010	–
		Nitrate plus nitrite as N	23	1.03	3.00	1.36	1.53	0.522	-2.15	0.002	–
		Ammonia	23	0.000	0.040	0.013	NA	NA	-5.51	0.003	–
		Orthophosphate as P	23	0.000	0.035	0.021	NA	NA	2.06	0.006	+
USGS 67	433344112554101	Chloride	30	46.4	171	118	116	45.2	-3.76	0.000	–
		Sodium	19	24.7	54.0	39.0	38.5	10.2	-3.09	0.000	–
		Sulfate	18	27.5	31.5	29.2	29.3	1.37	-0.617	0.000	–
		Nitrate plus nitrite as N	20	2.53	5.57	4.33	4.29	1.02	1.78	0.011	+
		Orthophosphate as P	20	0.000	0.041	0.020	NA	NA	1.71	0.167	none
USGS 77	433315112560301	Chloride	37	71.7	162	130	125	23.5	-1.61	0.001	–
		Sodium	32	32.0	46.0	35.3	36.4	3.77	0.295	0.283	none
		Sulfate	27	27.9	33.0	31.0	30.8	1.37	-0.616	0.000	–
		Nitrate plus nitrite as N	32	2.20	4.90	3.31	3.52	0.741	-2.40	0.000	–
		Fluoride	27	0.164	0.279	0.203	0.210	0.023	0.996	0.001	+
		Orthophosphate as P	32	0.000	0.041	0.015	NA	NA	2.83	0.003	+
		Chromium	27	0.000	16.4	11.3	NA	NA	-2.37	0.001	–
		Total organic carbon	17	0.000	2.1	0.424	NA	NA	-2.41	0.499	none
USGS 82	433401112551001	Chloride	54	15.0	26.1	17.5	17.9	1.69	-0.557	0.004	–
		Sodium	23	10.0	11.6	10.5	10.6	0.442	-0.317	0.015	–
		Sulfate	19	20.0	23.0	21.4	21.5	0.697	0.051	0.687	none
		Nitrate plus nitrite as N	24	0.500	0.800	0.550	0.569	0.071	-0.719	0.016	–
		Ammonia	24	0.000	0.041	0.004	NA	NA	-11.89	0.164	none
		Orthophosphate as P	24	0.000	0.076	0.017	NA	NA	0.845	0.538	none
USGS 84	433356112574201	Chloride	35	5.79	15.0	9.70	9.48	2.26	-0.423	0.505	none
		Sodium	32	6.86	10.0	8.55	8.63	0.980	0.193	0.559	none
		Sulfate	28	23.6	38.0	31.6	31.2	4.21	0.061	0.891	none
		Nitrate plus nitrite as N	28	0.626	1.10	0.866	0.875	0.141	0.908	0.095	none
		Aluminum	28	2.51	9.19	4.79	4.75	1.61	-1.39	0.212	none
		Molybdenum	28	1.00	2.29	1.68	1.68	0.419	-0.572	0.535	none
		Barium	28	74.6	96.0	82.1	83.7	6.36	0.141	0.586	none
		Uranium	28	1.00	2.00	1.65	1.65	0.221	-0.485	0.318	none
		Orthophosphate as P	28	0.000	0.030	0.018	NA	NA	3.68	0.000	+

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 84		Total organic carbon	18	0.000	2.65	0.399	NA	NA	-0.608	0.881	none
		Chromium	34	0.000	33.0	13.9	NA	NA	-1.34	0.410	none
		Nickel	28	0.000	4.00	0.617	NA	NA	-7.58	0.021	–
		Lead	28	0.000	19.0	4.39	NA	NA	-44.4	0.000	–
		Copper	28	0.000	2.36	1.31	NA	NA	-7.42	0.001	–
		Cobalt	28	0.000	1.00	0.109	NA	NA	-8.77	0.015	–
		Cadmium	28	0.000	1.00	0.165	NA	NA	-25.3	0.000	–
		Arsenic	28	0.000	3.00	1.35	NA	NA	1.95	0.024	+
		Antimony	28	0.000	1.00	0.118	NA	NA	-0.856	0.689	none
		Manganese	28	0.000	1.00	0.233	NA	NA	0.802	0.771	none
		Selenium	28	0.000	2.60	1.26	NA	NA	1.44	0.068	none
		Zinc	28	0.000	472	131	NA	NA	-39.7	0.000	–
USGS 85	433246112571201	Chloride	38	14.8	74.0	34.8	38.1	17.9	-7.32	0.000	–
		Sodium	26	10.5	27.0	17.0	17.7	5.29	-4.11	0.000	–
		Sulfate	20	25.3	40.2	31.4	32.9	5.25	1.89	0.000	+
		Nitrate plus nitrite as N	26	1.05	3.10	1.56	1.76	0.658	-4.94	0.000	–
		Orthophosphate as P	26	0.000	0.034	0.020	NA	NA	1.94	0.013	+
USGS 111	433331112560501	Chloride	40	14.0	162	110	116	27.2	-0.440	0.623	none
		Sodium	23	21.3	39.5	25.3	27.8	6.00	-1.83	0.000	–
		Sulfate	19	26.6	37.0	28.8	29.2	2.18	-0.677	0.013	–
		Nitrate plus nitrite as N	24	2.27	3.80	2.41	2.63	0.454	-1.70	0.000	–
		Orthophosphate as P	24	0.000	0.023	0.010	NA	NA	2.25	0.024	+
USGS 112	433314112563001	Chloride	61	21.6	200	130	127	54.2	-8.52	0.000	–
		Sodium	25	15.6	78.7	47.0	44.6	21.5	-6.33	0.000	–
		Sulfate	21	27.8	40.0	29.8	30.8	3.25	-0.872	0.005	–
		Nitrate plus nitrite as N	25	1.35	4.30	2.68	2.58	0.923	-4.94	0.000	–
		Orthophosphate as P	25	0.010	0.033	0.021	0.022	0.005	2.19	0.000	+
USGS 113	433314112561801	Chloride	59	15.7	240	190	175	58.4	-6.14	0.000	–
		Sodium	23	25.4	98.7	74.9	66.2	26.1	-6.06	0.000	–
		Sulfate	21	26.8	43.0	31.0	31.8	4.46	-1.66	0.000	–
		Orthophosphate as P	24	0.000	0.036	0.019	NA	NA	2.77	0.003	+
		Nitrate plus nitrite as N	24	0.000	5.10	2.14	NA	NA	0.998	0.638	none

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
USGS 114	433318112555001	Chloride	59	64.0	101	81.0	81.8	8.31	0.857	0.000	+
		Sodium	25	19.6	23.8	22.0	22.2	0.975	0.172	0.173	none
		Sulfate	21	25.0	29.0	27.3	27.3	1.07	0.186	0.177	none
		Nitrate plus nitrite as N	25	2.53	4.10	3.43	3.43	0.504	-1.94	0.000	–
		Orthophosphate as P	25	0.000	0.021	0.012	NA	NA	-0.575	0.604	none
USGS 115	433320112554101	Chloride	59	33.0	54.3	38.0	38.8	4.69	0.856	0.000	+
		Sodium	24	9.72	19.4	15.0	14.9	1.95	0.677	0.065	none
		Sulfate	20	20.0	26.0	22.4	22.7	1.79	0.539	0.046	+
		Nitrate plus nitrite as N	24	0.962	1.57	1.38	1.37	0.123	-0.211	0.448	none
		Orthophosphate as P	24	0.000	0.021	0.010	NA	NA	-0.616	0.542	none
USGS 116	433331112553201	Chloride	58	12.0	131	92.9	91.4	18.7	1.93	0.005	+
		Sodium	24	24.8	35.2	29.0	29.6	2.76	0.490	0.060	none
		Sulfate	20	30.1	38.0	34.0	33.6	2.19	-0.907	0.000	–
		Nitrate plus nitrite as N	24	2.18	3.20	2.80	2.72	0.286	-0.997	0.000	–
		Orthophosphate as P	24	0.000	0.027	0.013	NA	NA	1.37	0.191	none
USGS 123	433352112561401	Chloride	33	20.0	150	105	88.1	44.8	-10.1	0.000	–
		Sodium	22	9.41	56.0	39.5	32.6	18.2	-9.69	0.000	–
		Sulfate	18	20.7	31.0	28.0	25.9	4.20	-2.74	0.000	–
		Nitrate plus nitrite as N	22	0.763	5.00	3.74	2.71	1.65	-9.33	0.000	–
		Orthophosphate as P	22	0.000	0.605	0.028	NA	NA	2.07	0.428	none
USGS 128	433250112565601	Chloride	11	14.4	53.3	15.2	19.7	11.5	-8.74	0.000	–
		Nitrate plus nitrite as N	11	1.05	2.18	1.15	1.25	0.319	-4.48	0.000	–
		Orthophosphate as P	11	0.016	0.029	0.023	0.023	0.005	5.57	0.000	+
Advanced Test Reactor Complex											
MTR TEST	433520112572601	Chloride	37	9.24	16.0	10.9	11.7	1.82	-1.66	0.000	–
		Sodium	37	8.85	42.4	15.0	17.8	8.72	-5.51	0.000	–
		Sulfate	27	20.4	160	34.8	55.2	42.6	-10.0	0.000	–
		Nitrate plus nitrite as N	24	0.938	1.40	1.06	1.09	0.124	-1.36	0.000	–
		Orthophosphate as P	24	0.000	0.027	0.015	NA	NA	3.45	0.000	+
		Chromium	36	0.000	25.8	5.14	NA	NA	-1.33	0.252	none
TRA Disposal	433506112572301	Chloride	41	6.80	15.0	11.0	11.1	1.34	-0.177	0.517	none
		Sodium	21	9.97	12.0	10.9	10.8	0.672	-0.410	0.021	–

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Advanced Test Reactor Complex—Continued											
TRA Disposal		Sulfate	17	27.9	45.0	32.5	34.5	5.23	-1.82	0.000	–
		Nitrate plus nitrite as N	21	0.978	1.20	1.07	1.10	0.073	-0.666	0.000	–
		Orthophosphate as P	21	0.027	0.084	0.048	0.049	0.011	-0.009	0.989	none
		Chromium	37	7.73	23.0	10.3	11.5	3.19	-0.401	0.484	none
USGS 58	433500112572502	Chloride	35	10.2	13.3	12.0	11.9	0.777	0.140	0.451	none
		Sodium	22	8.96	11.1	10.0	9.96	0.515	0.415	0.016	+
		Sulfate	18	26.1	35.0	30.6	30.7	2.78	1.27	0.003	+
		Chromium	34	8	22.9	12.2	12.3	3.00	0.634	0.331	none
USGS 65	433447112574501	Chloride	60	12.0	24.0	18.7	18.8	1.68	-0.200	0.326	none
		Sodium	37	11.6	16.2	14.0	14.0	1.07	0.632	0.002	+
		Sulfate	33	140	167	155	153	7.41	0.473	0.001	+
		Nitrate plus nitrite as N	35	1.20	1.72	1.54	1.56	0.094	0.197	0.258	none
		Chromium	57	77.8	210	174	160	35.1	-4.18	0.000	–
		Barium	30	44.9	56.0	49.6	49.5	3.01	-0.805	0.000	–
		Uranium	29	1.73	3.15	2.00	2.20	0.442	2.82	0.000	+
		Orthophosphate as P	35	0.000	0.080	0.012	NA	NA	4.34	0.001	+
		Total organic carbon	18	0.000	1.33	0.437	NA	NA	-1.84	0.511	none
		Nickel	30	0.000	10.0	0.976	NA	NA	2.84	0.474	none
		Molybdenum	30	0.000	10.0	2.59	NA	NA	1.72	0.000	+
		Lead	30	0.000	10.0	0.750	NA	NA	-31.1	0.000	–
		Copper	30	0.000	10.0	0.973	NA	NA	-3.56	0.053	none
		Cobalt	30	0.000	3.00	0.202	NA	NA	-7.80	0.008	–
		Cadmium	30	0.000	1.00	0.030	NA	NA	-6.98	0.000	–
		Arsenic	30	0.000	2.00	1.02	NA	NA	2.26	0.000	+
		Aluminum	30	0.000	10.2	4.68	NA	NA	-0.735	0.616	none
		Antimony	29	0.000	1.00	0.165	NA	NA	-0.330	0.820	none
		Manganese	30	0.000	3.00	0.292	NA	NA	-1.38	0.727	none
		Selenium	30	0.000	2.60	1.79	NA	NA	0.782	0.203	none
		Zinc	30	0.000	420	83.2	NA	NA	-40.0	0.000	–
USGS 76	433425112573201	Chloride	41	9.90	15.0	12.0	12.1	1.16	0.232	0.298	none
		Sodium	24	9.01	10.5	9.63	9.66	0.442	0.506	0.000	+
		Sulfate	22	26.0	31.9	27.9	28.8	2.21	0.886	0.000	+
		Nitrate plus nitrite as N	25	1.00	2.22	1.11	1.17	0.230	-0.085	0.845	none

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Advanced Test Reactor Complex—Continued											
USGS 76		Orthophosphate as P	25	0.000	0.080	0.020	NA	NA	0.954	0.434	none
		Chromium	37	0.000	18.7	11.3	NA	NA	-0.324	0.472	none
USGS 79	433505112581901	Chloride	38	10.7	17.0	12.4	12.6	1.35	-1.15	0.000	–
		Sodium	24	7.70	12.5	8.64	8.74	0.876	0.075	0.773	none
		Sulfate	19	22.0	29.8	23.5	24.5	2.43	-0.683	0.068	none
		Chromium	36	0.000	14.0	6.12	NA	NA	-0.578	0.284	none
Central Facilities Area											
CFA 1	433204112562001	Chloride	61	17.0	120	99.5	95.6	17.0	0.572	0.324	none
		Sodium	61	14.0	35.3	26.0	25.3	5.21	0.388	0.419	none
		Sulfate	41	26.1	37.0	30.9	30.7	2.31	-0.603	0.007	–
		Nitrate plus nitrite as N	23	2.57	4.50	3.30	3.37	0.575	-1.81	0.000	–
		Orthophosphate as P	23	0.000	0.030	0.016	NA	NA	0.159	0.883	none
		Chromium	23	0.000	22.0	14.6	NA	NA	-0.726	0.651	none
CFA 2	433144112563501	Chloride	55	70.0	145	104	107	19.1	2.50	0.000	+
		Sodium	55	16.0	39.4	24.1	24.3	6.09	3.55	0.000	+
		Sulfate	35	33.0	52.7	46.7	45.4	4.67	1.37	0.000	+
		Nitrate plus nitrite as N	19	2.70	4.10	3.71	3.50	0.458	1.45	0.000	+
		Orthophosphate as P	19	0.000	0.026	0.014	NA	NA	1.84	0.115	none
		Chromium	20	0.000	21.0	11.6	NA	NA	0.805	0.571	none
CFA LF 2-10	433216112563301	Chloride	29	21.5	35.8	30.9	29.8	4.35	-0.410	0.433	none
		Sodium	28	10.0	13.8	12.0	12.1	0.843	0.554	0.026	+
		Nitrate plus nitrite as N	30	1.2	2.0	1.5	1.5	0.236	-1.33	0.004	–
		Chromium	27	7.9	18.3	12.0	11.9	2.25	-1.59	0.007	–
		Orthophosphate as P	30	0.014	0.034	0.020	0.020	0.005	1.34	0.074	none
		Ammonia	30	0.000	0.041	0.010	NA	NA	-7.76	0.089	none
		Total organic carbon	18	0.000	2.0	0.474	NA	NA	-3.24	0.368	none
CFA LF 3-9	433216112571001	Chloride	13	94.0	157	114	116	16.8	1.57	0.032	+
		Nitrate plus nitrite as N	13	2.9	4.1	3.4	3.5	0.377	-2.16	0.001	–
		Ammonia	13	0.000	0.040	0.017	NA	NA	2.16	0.518	none
		Orthophosphate as P	13	0.000	0.040	0.015	NA	NA	-5.17	0.082	none
USGS 127	433058112572201	Chloride	18	13.4	16.4	14.9	14.9	0.750	0.555	0.076	none
		Sodium	18	7.6	8.9	8.3	8.3	0.343	0.630	0.015	+

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Central Facilities Area—Continued											
USGS127		Nitrate plus nitrite as N	18	0.527	0.589	0.556	0.559	0.019	0.265	0.201	none
		Chromium	18	8.9	12.8	10.6	10.5	1.13	-1.37	0.039	–
		Orthophosphate as P	18	0.000	0.030	0.015	NA	NA	4.63	0.001	+
Radioactive Waste Management Complex											
RWMC M3S	433008113021801	Chloride	20	11.8	14.9	13.2	13.2	1.06	1.19	0.000	+
		Nitrate plus nitrite as N	21	0.690	0.920	0.814	0.813	0.042	0.075	0.683	none
		Orthophosphate as P	21	0.009	0.040	0.019	0.019	0.007	-0.581	0.637	none
RWMC M7S	433023113014801	Chloride	20	10.9	14.4	12.1	12.3	1.14	1.38	0.000	+
		Nitrate plus nitrite as N	21	0.550	0.778	0.698	0.694	0.058	1.11	0.000	+
		Orthophosphate as P	21	0.012	0.060	0.020	0.022	0.010	-1.83	0.137	none
RWMC M11S	433058113010401	Chloride	15	13.2	33.1	17.6	19.7	5.59	-1.03	0.504	none
		Sodium	15	10.9	13.1	11.4	11.7	0.737	-0.088	0.816	none
		Nitrate plus nitrite as N	15	0.427	0.605	0.513	0.510	0.056	0.715	0.271	none
		Orthophosphate as P	15	0.000	0.025	0.014	NA	NA	6.32	0.000	+
		Chromium	15	0.000	13.0	9.17	NA	NA	0.906	0.519	none
		Total organic carbon	12	0.000	0.745	0.361	NA	NA	-10.3	0.001	–
RWMC M12S	433118112593401	Chloride	14	15.0	17.4	16.0	16.2	0.769	1.04	0.001	+
		Sodium	14	8.00	10.5	8.25	8.46	0.642	0.013	0.978	none
		Nitrate plus nitrite as N	14	0.838	0.998	0.930	0.922	0.044	0.997	0.001	+
		Chromium	14	12.7	20.6	13.8	15.1	2.39	-2.35	0.001	–
		Orthophosphate as P	14	0.014	0.033	0.021	0.021	0.005	4.00	0.002	+
		Total organic carbon	11	0.000	3.63	0.560	NA	NA	-22.5	0.016	–
RWMC M13S	433037113002701	Chloride	15	5.60	6.52	6.02	6.02	0.242	0.143	0.560	none
		Sodium	15	9.94	12.0	11.3	11.2	0.477	0.362	0.176	none
		Nitrate plus nitrite as N	15	0.328	0.413	0.360	0.363	0.019	0.465	0.151	none
		Chromium	15	7.78	11.3	8.79	9.20	1.05	-1.32	0.054	none
		Orthophosphate as P	15	0.009	0.079	0.016	0.020	0.017	1.55	0.634	none
		Total organic carbon	12	0.000	1.67	0.417	NA	NA	-14.1	0.027	–
RWMC M14S	433052113025001	Chloride	15	14.1	16.7	15.4	15.3	0.733	0.234	0.425	none
		Sodium	15	8.32	9.68	9.01	8.96	0.333	-0.088	0.701	none
		Nitrate plus nitrite as N	14	0.831	0.964	0.893	0.901	0.041	0.336	0.251	none
		Chromium	15	11.6	19.1	13.6	14.5	2.01	-1.91	0.004	–

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
Radioactive Waste Management Complex—Continued											
RWMC M14S		Orthophosphate as P	14	0.010	0.025	0.018	0.017	0.004	3.95	0.001	+
		Total organic carbon	12	0.000	1.77	0.403	NA	NA	-18.8	0.022	–
RWMC Production	433002113021701	Chloride	63	11.0	23.4	16.6	16.8	2.65	2.18	0.000	+
		Sodium	24	7.20	9.56	8.49	8.47	0.504	0.520	0.002	+
		Sulfate	20	24.3	29.0	27.0	27.0	1.37	0.311	0.054	none
		Nitrate plus nitrite as N	25	0.140	0.962	0.840	0.808	0.179	-0.472	0.653	none
		Orthophosphate as P	25	0.000	0.074	0.018	NA	NA	6.42	0.000	+
USGS 87	433013113024201	Chloride	63	11.0	37.7	14.0	15.7	5.19	2.89	0.000	+
		Sodium	35	8.54	18.5	10.1	11.4	2.53	1.94	0.000	+
		Sulfate	21	22.9	29.0	25.4	25.2	1.40	-0.107	0.546	none
		Nitrate plus nitrite as N	35	0.438	1.60	0.743	0.741	0.187	-1.41	0.007	–
		Chromium	30	1.63	18.6	13.5	11.4	4.24	-6.55	0.000	–
		Orthophosphate as P	35	0.000	0.198	0.011	NA	NA	2.60	0.123	none
		Total organic carbon	18	0.000	3.10	0.501	NA	NA	-7.42	0.150	none
USGS 88	432940113030201	Chloride	61	29.0	111	84.2	84.5	9.65	0.223	0.524	none
		Sodium	24	40.7	48.0	44.0	44.2	1.69	-0.215	0.050	–
		Sulfate	18	27.4	64.0	58.2	55.0	9.36	-2.11	0.000	–
		Nitrate plus nitrite as N	24	0.184	1.80	1.35	1.25	0.418	-4.89	0.000	–
		Ammonia	23	0.000	0.398	0.033	NA	NA	5.89	0.075	none
		Orthophosphate as P	24	0.000	0.029	0.006	NA	NA	0.759	0.712	none
USGS 89	433005113032801	Chloride	62	13.0	46.3	39.0	38.6	4.04	0.462	0.157	none
		Sodium	24	13.0	21.5	19.2	19.3	1.56	0.353	0.160	none
		Nitrate plus nitrite as N	25	1.63	2.10	1.76	1.78	0.119	-0.581	0.001	–
		Orthophosphate as P	25	0.000	0.060	0.010	NA	NA	1.65	0.142	none
		Sulfate	20	0.000	38.0	35.1	NA	NA	-0.118	0.346	none
USGS 120	432919113031501	Chloride	63	14.8	30.0	21.8	21.9	3.64	-2.25	0.000	–
		Sodium	34	13.8	47.6	26.2	28.4	9.52	-2.74	0.000	–
		Sulfate	19	28.8	53.4	37.0	38.4	7.73	-1.75	0.001	–
		Nitrate plus nitrite as N	34	0.563	1.10	0.841	0.809	0.110	-0.260	0.488	none
		Orthophosphate as P	34	0.000	0.030	0.015	NA	NA	1.49	0.064	none
		Total organic carbon	17	0.000	3.22	1.14	NA	NA	-4.75	0.060	none
		Chromium	30	0.000	14.0	8.82	NA	NA	-0.013	0.984	none

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Aquifer wells—Continued											
South of facilities											
USGS 104	432856112560801	Chloride	59	10.0	17.0	12.0	12.5	1.09	0.549	0.002	+
		Sodium	23	8.10	9.30	8.55	8.61	0.390	0.337	0.013	+
		Nitrate plus nitrite as N	23	0.660	0.869	0.776	0.770	0.069	1.22	0.000	+
		Orthophosphate as P	23	0.000	0.041	0.013	NA	NA	2.41	0.059	none
USGS 105	432703113001801	Chloride	33	11.7	22.0	13.3	13.9	2.03	-1.66	0.000	–
		Sodium	27	11.6	14.0	13.0	13.1	0.660	-0.486	0.016	–
		Nitrate plus nitrite as N	22	0.580	0.727	0.644	0.649	0.044	0.892	0.013	+
		Orthophosphate as P	22	0.000	0.020	0.011	NA	NA	2.09	0.218	none
		Total organic carbon	13	0.000	2.20	0.552	NA	NA	-6.93	0.088	none
		Chromium	22	0.000	14.0	8.04	NA	NA	1.16	0.248	none
USGS 106	432959112593101	Chloride	42	12.0	18.0	14.9	14.7	1.07	0.260	0.126	none
		Sodium	24	6.73	8.43	7.77	7.77	0.426	0.368	0.022	+
USGS 108	432659112582601	Chloride	34	13.0	20.0	14.3	14.5	1.14	-0.062	0.789	none
		Sodium	28	10.0	12.0	11.0	11.0	0.394	0.119	0.380	none
		Nitrate plus nitrite as N	24	0.600	1.10	0.708	0.717	0.090	0.173	0.719	none
		Orthophosphate as P	24	0.000	0.018	0.011	NA	NA	1.92	0.035	+
		Total organic carbon	14	0.000	3.52	0.431	NA	NA	10.5	0.178	none
		Chromium	24	0.000	14.0	7.74	NA	NA	-0.053	0.955	none
USGS 124	432307112583101	Chloride	30	12.9	16.0	14.8	14.7	0.752	0.534	0.003	+
		Sodium	21	8.66	10.3	9.35	9.45	0.421	0.154	0.357	none
		Nitrate plus nitrite as N	21	0.660	0.869	0.794	0.780	0.053	0.686	0.010	+
		Orthophosphate as P	21	0.000	0.024	0.012	NA	NA	4.71	0.000	+
Perched groundwater wells											
Idaho Nuclear Technology and Engineering Center											
PW 1	433349112560701	Chloride	44	134	386	259	245	58.7	-5.57	0.000	–
		Sodium	11	105	210	160	164	30.2	-2.73	0.087	none
PW 2	433344112555601	Chloride	34	148	311	259	247	39.7	-2.73	0.000	–
		Sodium	14	106	190	160	152	25.7	-3.36	0.000	–
		Sulfate	10	23.0	41.0	26.8	29.1	5.93	0.861	0.548	none
PW 3	433351112555701	Chloride	31	150	337	270	262	43.5	-2.25	0.003	–
		Sodium	10	127	184	170	166	16.2	-1.22	0.178	none

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells—Continued											
Idaho Nuclear Technology and Engineering Center—Continued											
PW 4	433348112554901	Chloride	51	79.0	325	270	254	59.2	-3.56	0.000	–
		Sodium	18	83.0	190	151	141	38.2	-4.52	0.000	–
		Sulfate	13	24.9	50.8	28.6	32.4	7.80	2.38	0.016	+
PW 5	433348112555701	Chloride	30	149	350	260	259	49.3	-1.48	0.122	none
		Sodium	12	127	190	161	164	18.6	-1.58	0.055	none
PW 6	433353112562201	Chloride	29	13	1,500	170	199	256	-2.87	0.499	none
USGS 50	433419112560201	Chloride	38	30.0	86.0	67.0	64.9	11.8	-2.38	0.000	–
		Sodium	17	20.0	69.0	62.0	60.0	11.0	-1.90	0.083	none
		Sulfate	13	25.0	44.0	39.3	38.1	5.73	0.599	0.478	none
		Nitrate plus nitrite as N	18	4	62.0	34.5	35.9	17.3	-6.57	0.024	–
		Orthophosphate as P	18	0.012	0.102	0.040	0.042	0.019	-1.18	0.517	none
		Ammonia	18	0.000	0.041	0.014	NA	NA	-11.1	0.028	–
Advanced Test Reactor Complex											
CWP 1	433459112572601	Chloride	26	8.70	31.6	14.4	19.2	8.30	0.338	0.783	none
		Sulfate	19	25.8	419	320	236	156	-7.06	0.045	–
		Chromium	24	0.000	14.0	2.61	NA	NA	-1.09	0.515	none
CWP 2	433458112572401	Chloride	11	5.70	24.0	15.0	15.5	5.34	-3.80	0.180	none
CWP 3	433455112572501	Chloride	25	10.0	29.1	18.9	18.4	6.55	0.853	0.400	none
		Sulfate	18	28.0	365	222	210	115	-3.18	0.315	none
		Chromium	23	0.000	14.0	1.83	NA	NA	-8.35	0.000	–
CWP 4	433454112572601	Chloride	14	8.00	20.0	12.0	13.0	3.49	-2.37	0.028	–
CWP 8	433500112573001	Chloride	23	4.66	91.0	12.5	16.1	16.9	-3.86	0.003	–
		Sulfate	17	26.6	240	68.9	85.9	58.4	-6.42	0.001	–
		Chromium	21	0.000	14.0	0.841	NA	NA	-3.32	0.078	none
PW 8	433456112572001	Chloride	60	5.90	25.7	20.0	19.2	3.89	0.934	0.089	none
		Sodium	23	12.0	19.4	16.1	15.8	2.10	0.324	0.420	none
		Sulfate	32	66.0	298	240	224	58.3	-1.98	0.049	–
		Chromium	56	0.000	40.0	9.87	NA	NA	-3.94	0.000	–
PW 9	433500112575401	Chloride	59	10.4	47.3	27.0	28.4	5.43	1.72	0.000	+
		Sodium	22	19.0	23.0	20.9	20.9	1.26	-0.429	0.015	–

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells—Continued											
Advanced Test Reactor Complex—Continued											
PW9		Sulfate	30	70.9	120	104	98.7	13.9	-1.22	0.003	–
		Chromium	55	5.95	240	79.9	93.5	66.2	-10.1	0.000	–
TRA A 13	433502112572802	Chloride	19	3.30	53.1	27.3	28.9	11.6	6.35	0.041	+
TRA A 77	433507112573801	Chloride	22	0.300	9.82	1.15	2.39	3.06	19.9	0.018	+
USGS 53	433503112573401	Chloride	14	5.70	35.0	17.0	18.2	8.14	0.058	0.974	none
		Sodium	9	9.00	30.8	15.0	17.4	7.53	1.98	0.154	none
		Chromium	12	0.000	590	43.0	NA	NA	-13.1	0.103	none
USGS 54	433503112572801	Chloride	55	9.40	29.0	18.5	18.6	4.92	-0.780	0.208	none
		Sodium	23	12.0	20.9	15.5	15.6	2.64	-0.574	0.256	none
		Sulfate	31	49.9	330	220	203	89.8	-5.84	0.000	–
		Chromium	51	0.000	66.0	9.08	NA	NA	-5.24	0.000	–
USGS 55	433508112573001	Chloride	31	12.0	32.0	20.0	21.3	5.81	-2.81	0.000	–
		Sodium	20	6.40	32.0	18.6	19.8	6.02	-1.55	0.157	none
		Sulfate	17	35.0	210	113	113	45.8	2.14	0.253	none
		Chromium	29	15.4	130	47.0	52.0	29.3	-4.13	0.012	–
USGS 56	433509112573501	Chloride	17	7.20	34.0	16.3	17.1	7.73	0.874	0.537	none
		Sodium	10	12.0	250	36.1	55.2	70.2	-0.542	0.865	none
		Chromium	15	27.9	200	86.4	97.9	48.6	-2.82	0.101	none
USGS 60	433456112571901	Chloride	44	10.2	110	18.6	20.3	14.4	-1.26	0.126	none
		Sodium	23	7.90	18.8	13.6	14.1	2.85	0.118	0.857	none
		Sulfate	19	53.9	283	158	189	79.6	-3.55	0.031	–
		Chromium	40	0.000	24.0	7.33	NA	NA	-2.54	0.017	–
USGS 61	433453112571601	Chloride	38	12.8	24.0	18.0	17.5	2.40	-0.308	0.387	none
		Sodium	24	11.3	17.0	13.9	13.6	1.28	-0.612	0.027	–
		Sulfate	19	77.0	190	162	150	34.9	-1.21	0.240	none
		Chromium	36	0.000	35.0	15.7	NA	NA	-5.31	0.000	–
USGS 62	433446112570701	Chloride	38	12.0	25.3	20.3	19.7	3.25	0.219	0.639	none
		Sodium	24	12.0	18.0	16.0	16.0	1.54	0.264	0.374	none
		Sulfate	19	81.1	270	223	212	50.7	-1.51	0.188	none
		Chromium	36	0.000	69.0	12.0	NA	NA	-5.71	0.000	–

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells—Continued											
Advanced Test Reactor Complex—Continued											
USGS 63	433455112574001	Chloride	38	11.0	25.0	19.9	19.4	3.20	-0.208	0.642	none
		Sodium	24	12.0	18.7	16.0	15.7	1.52	0.155	0.589	none
		Sulfate	19	90.6	272	214	198	52.7	-2.92	0.002	–
		Chromium	36	0.000	180	19.8	NA	NA	-8.94	0.000	–
USGS 66	433436112564801	Chloride	27	14.0	23.0	19.0	19.1	2.54	-0.258	0.476	none
		Sodium	23	14.0	17.6	15.3	15.5	0.901	0.020	0.910	none
		Sulfate	19	110	233	190	188	32.1	0.077	0.914	none
		Chromium	25	0.000	100	5.23	NA	NA	-7.61	0.069	none
USGS 68	433516112573901	Chloride	45	9.00	75.0	35.0	34.1	11.6	-1.51	0.047	–
		Sodium	24	146	1,300	642	675	340	-7.95	0.000	–
		Sulfate	20	467	4,300	1,511	1,937	1,119	-8.53	0.000	–
		Chromium	35	0.000	70.0	13.3	NA	NA	11.9	0.000	+
USGS 69	433450112573001	Chloride	28	12.4	28.0	17.1	17.7	3.24	-1.27	0.001	–
		Sodium	24	8.72	36.0	11.0	11.8	5.23	-1.31	0.063	none
		Sulfate	19	46.6	164	112	109	33.3	-3.75	0.000	–
		Chromium	25	0.000	14.0	1.95	NA	NA	-2.97	0.082	none
USGS 70	433504112571001	Chloride	38	11.7	31.0	18.1	18.8	3.41	-1.06	0.010	–
		Sodium	24	11.7	21.0	15.8	15.9	1.94	-0.537	0.123	none
		Sulfate	19	52.1	239	165	161	46.3	-2.45	0.053	none
		Chromium	36	0.000	55.0	21.3	NA	NA	-4.73	0.000	–
USGS 71	433439112571501	Chloride	33	16.0	23.0	18.6	18.7	1.57	-0.068	0.746	none
		Sodium	22	8.30	14.4	12.4	12.2	1.42	1.19	0.000	+
		Sulfate	18	140	181	169	165	12.7	0.561	0.065	none
		Chromium	31	0.000	87.0	30.8	NA	NA	-9.18	0.000	–
USGS 72	433519112574601	Chloride	25	10.9	83.0	16.3	19.8	14.0	-0.304	0.778	none
		Sodium	18	18.5	34.2	27.4	26.5	5.17	0.088	0.905	none
		Sulfate	16	25.1	38.0	27.5	29.2	4.14	-1.64	0.002	–
		Chromium	14	0.000	14.0	1.33	NA	NA	-5.71	0.735	none
USGS 73	433502112575401	Chloride	37	19.0	214	38.1	47.9	34.2	2.26	0.044	+
		Sodium	23	12.5	21.0	17.8	17.1	2.63	0.554	0.213	none
		Sulfate	18	43.0	83.5	56.4	59.0	9.94	0.521	0.391	none
		Chromium	35	0.000	100	42.2	NA	NA	-6.86	0.000	–

Table 7. Summary statistics and trend test results for selected constituents in water from aquifer and perched groundwater wells at and near the Idaho National Laboratory, Idaho, 1989–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituent**: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, uranium, and zinc in micrograms per liter. N, nitrogen; P, phosphorus. **Slope:** In percent change per year. ***p* value:** Is for linear trend over time. The minimum values listed as 0.000 are reported as less than a reporting level in the National Water Information System database. **Trend**: +, increasing; –, decreasing. NA, value could not be calculated because some values were less than a reporting level]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
Perched groundwater wells—Continued											
Advanced Test Reactor Complex—Continued											
USGS 78	433413112573501	Chloride	18	3.11	5.53	4.56	4.44	0.697	1.05	0.122	none
		Sodium	18	5.09	7.26	6.51	6.45	0.524	-0.693	0.057	none
		Sulfate	18	12.4	21.1	19.7	19.2	1.90	0.341	0.492	none
		Chromium	17	0.000	14.0	1.58	NA	NA	-11.5	0.000	–
Radioactive waste management complex											
USGS 92	433000113025301	Chloride	19	69.0	150	87.3	91.4	18.4	0.651	0.273	none

Table 8. Summary statistics and trend test results for volatile organic compounds in water from aquifer wells at and near the Idaho National Laboratory, Idaho, 1987–2012.

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituents**: All constituents in micrograms per liter. **Slope:** The linear trend over time in percent change per year. ***p* value:** Is for linear trend over time. **Trend**: +, increasing; –, decreasing; minimum values reported as 0.000 were reported as less than their reporting levels in the National Water Information System database. NA, value could not be calculated because some values less than reporting levels]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
					1987–2012						
Idaho Nuclear Technology and Engineering Center											
USGS 34	433334112565501	Dichlorodifluoromethane	29	0.000	0.200	0.150	NA	NA	-0.670	0.623	none
		1,1,1-Trichloroethane	29	0.000	0.400	0.151	NA	NA	-7.35	0.000	–
USGS 38	433322112564301	Dichlorodifluoromethane	29	0.000	0.200	0.150	NA	NA	-1.12	0.388	none
		1,1,1-Trichloroethane	29	0.000	0.600	0.169	NA	NA	-8.35	0.000	–
USGS 77	433315112560301	Dichlorodifluoromethane	27	0.000	0.200	0.130	NA	NA	-2.46	0.011	–
		1,1,1-Trichloroethane	27	0.000	0.600	0.234	NA	NA	-9.18	0.000	–
		1,1-Dichloroethene	27	0.000	0.200	0.143	NA	NA	-4.35	0.000	–
USGS 84	433356112574201	Dichlorodifluoromethane	28	0.000	0.200	0.125	NA	NA	-6.23	0.001	–
Advanced test reactor complex											
USGS 65	433447112574501	Dichlorodifluoromethane	31	0.000	0.675	0.159	NA	NA	-1.16	0.670	none
		1,1,1-Trichloroethane	31	0.000	1.1	0.256	NA	NA	-9.43	0.000	–
Radioactive waste management complex											
RWMC Production	433002113021701	Trichloroethene	289	0.400	4.88	2.39	2.37	1.11	7.45	0.000	+
		Carbon tetrachloride	289	1.00	11.6	5.05	5.07	2.42	7.26	0.000	+
		Trichloromethane	289	0.000	4.00	0.783	NA	NA	11.2	0.000	+
		Tetrachloroethene	289	0.000	0.467	0.232	NA	NA	4.17	0.000	+
		1,1,1-Trichloroethane	289	0.000	0.764	0.489	NA	NA	1.21	0.000	+
		Tribromomethane	289	0.000	2.76	0.008	NA	NA	19.9	0.000	+
		Orthophosphate as P	25	0.000	0.074	0.018	NA	NA	6.42	0.000	+
USGS 87	433013113024201	Trichloroethene	71	0.000	1.70	0.392	NA	NA	6.99	0.000	+
		Trichloromethane	71	0.000	0.353	0.120	NA	NA	5.36	0.000	+
		Dichlorodifluoromethane	71	0.000	1.87	0.094	NA	NA	13.0	0.000	+
		Tetrachloroethene	71	0.000	0.204	0.107	NA	NA	0.798	0.490	none
		Carbon tetrachloride	71	0.000	5.07	1.469	NA	NA	9.57	0.000	+
		1,1,1-Trichloroethane	71	0.000	0.243	0.193	NA	NA	0.049	0.830	none
		Total organic carbon	18	0.000	3.10	0.501	NA	NA	-7.42	0.150	none

Table 8. Summary statistics and trend test results for volatile organic compounds in water from aquifer wells at and near the Idaho National Laboratory, Idaho, 1987–2012.—Continued

[See figures 2 and 3 for well locations. **Local name**: Local well identifier used in this study. **Site identifier**: Unique numerical identifier used to access well data (http://waterdata.usgs.gov/nwis). **Constituents**: All constituents in micrograms per liter. **Slope:** The linear trend over time in percent change per year. ***p* value:** Is for linear trend over time. **Trend**: +, increasing; –, decreasing; minimum values reported as 0.000 were reported as less than their reporting levels in the National Water Information System database. NA, value could not be calculated because some values less than reporting levels]

Local name	Site identifier	Constituent	Sample size	Minimum	Maximum	Median	Mean	Standard deviation	Slope	*p* value	Trend
					1987–2012—Continued						
Radioactive waste management complex—Continued											
USGS 88	432940113030201	Trichloroethene	72	0.366	2.30	0.707	0.758	0.286	-3.82	0.000	–
		Trichloromethane	72	0.000	1.00	0.457	NA	NA	-0.405	0.303	none
		Carbon tetrachloride	72	0.500	6.10	1.60	1.76	0.879	-5.07	0.000	–
		1,1,1-Trichloroethane	72	0.000	0.900	0.211	NA	NA	-8.32	0.000	–
		Ammonia	23	0.000	0.398	0.033	NA	NA	5.89	0.075	none
		Orthophosphate as P	24	0.000	0.029	0.006	NA	NA	0.759	0.712	none
USGS 120	432919113031501	Carbon tetrachloride	69	0.400	7.02	1.10	1.88	1.63	4.92	0.001	+
		Trichloroethene	69	0.000	2.31	0.316	NA	NA	3.76	0.090	none
		Trichloromethane	69	0.000	1.25	0.125	NA	NA	8.88	0.004	+
		Tetrachloroethene	69	0.000	0.268	0.130	NA	NA	-1.84	0.028	–
		1,1,1-Trichloroethane	69	0.000	0.646	0.185	NA	NA	-0.265	0.855	none
					2005–2012						
RWMC production	433002113021701	Carbon tetrachloride	95	4.75	11.6	7.53	7.67	1.52	1.67	0.054	none

Appendixes

Appendixes A–E are PDFs and can be downloaded from http://pubs.usgs.gov/sir/2015/5003/.

Appendix A. Package 'Trends' and Processing Instructions for the 2014 Trend Analysis

Appendix B. Plots of Trend Analyses for pH, Specific Conductance, and Water Temperature from Selected Sites, 1989–201215

Appendix C. Plots of Trend Analyses for Selected Radiochemical Constituents from Selected Sites, 1981–2012

Appendix D. Plots of Trend Analyses for Selected Constituents from Selected Sites, 1989–2012

Appendix E. Plots of Trend Analyses for Volatile Organic Compounds from Selected Sites, 1987–2012

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