CHEMICAL AND RADIOCHEMICAL CONSTITUENTS IN WATER FROM WELLS IN THE VICINITY OF THE NAVAL REACTORS FACILITY, IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO, 1994-95

By Roy C. Bartholomay, LeRoy L. Knobel, and Betty J. Tucker

U.S. GEOLOGICAL SURVEY

Open-File Report 97-806

Prepared in cooperation with the
U.S. DEPARTMENT OF ENERGY

science for a changing world

Idaho Falls, Idaho
December 1997

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Mark Schaefer, Acting Director

For additional information write to:

U.S. Geological Survey
INEEL, MS 4148
P.O. Box 2230
Idaho Falls, ID 83403

Copies of this report can be purchased from:

U.S. Geological Survey
Information Services
Box 25286, Federal Center
Denver, CO 80225

CONTENTS

FIGURES

TABLES

CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED UNITS

Multiply	By	To obtain
foot (ft)	0.3048	meter
inch (in)	25.4	millimeter
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer
acre-foot (acre-ft)	1,233	cubic meter
foot per mile (ft/mi)	0.1894	meter per kilometer
picocurie per liter (pCi/L)	0.037	becquerel per liter

For temperature, degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) by using the equation:
°F = (1.8)(°C) + 32.

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviated units used in report: mg/L (milligram per liter); µg/L (microgram per liter).

CHEMICAL AND RADIOCHEMICAL CONSTITUENTS IN WATER FROM WELLS IN THE VICINITY OF THE NAVAL REACTORS FACILITY, IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO, 1994–95

by **Roy C. Bartholomay, LeRoy L. Knobel, and Betty J. Tucker**

Abstract

The U.S. Geological Survey, in response to a request from the U.S. Department of Energy's Pittsburgh Naval Reactors Office, Idaho Branch Office, sampled water from 14 wells during 1994–95 as part of a long-term project to monitor water quality of the Snake River Plain aquifer in the vicinity of the Naval Reactors Facility, Idaho National Engineering Laboratory, Idaho. Water samples were analyzed for naturally occurring constituents and manmade contaminants. A total of 111 samples were collected from 10 monitoring wells and 4 production wells. Twelve quality-assurance samples also were collected and analyzed; 1 was a blank sample and 11 were replicate samples. The blank sample contained concentrations of one inorganic constituent, one organic constituent, and five radioactive constituents that were greater than the reporting levels. Concentrations of other constituents in the blank sample were less than their respective reporting levels. The 11 replicate samples and their respective primary samples generated 293 pairs of analytical results for a variety of chemical and radiochemical constituents. Of the 293 data pairs, 258 were statistically equivalent at the 95-percent confidence level; about 88 percent of the analytical results were in agreement.

INTRODUCTION

The Idaho National Engineering Laboratory (INEL), encompassing about 890 mi^2 of the eastern Snake River Plain in southeastern Idaho (fig. 1), is operated by the U.S. Department of Energy (DOE). INEL facilities are used in the development of peacetime atomic-energy applications, nuclear safety research, defense programs, and advanced energy concepts. At the Naval Reactors Facility (NRF), one facility at the INEL, small amounts of some constituents have been released to the environment as described in the NRF environmental summary report (Bettis Atomic Power Laboratory, 1994).

This study was conducted by the U.S. Geological Survey (USGS) in cooperation with the DOE's Pittsburgh Naval Reactors Office, Idaho Branch Office (IBO). IBO is responsible for the NRF at the INEL. The IBO requires information about the mobility of radionuclide- and chemical-waste constituents in the Snake River Plain aquifer. Waste-constituent mobility is determined principally by (1) the rate and direction of ground-water flow; (2) the locations, quantities, and methods of waste disposal; (3) waste-constituent chemistry; and (4) the geochemical processes taking place in the aquifer (Orr and Cecil, 1991, p.2).

Purpose and Scope

In 1989, the IBO of the Pittsburgh Naval Reactors Office, DOE, requested that the USGS initiate a water-quality data-collection program in the vicinity of the NRF at the INEL (fig. 1). The purpose of the data-collection program is to provide the IBO with water-chemistry data to evaluate the effect of NRF activities on the water quality of the Snake River Plain aquifer.

To date, the data-collection program has consisted of three rounds of sample collection.

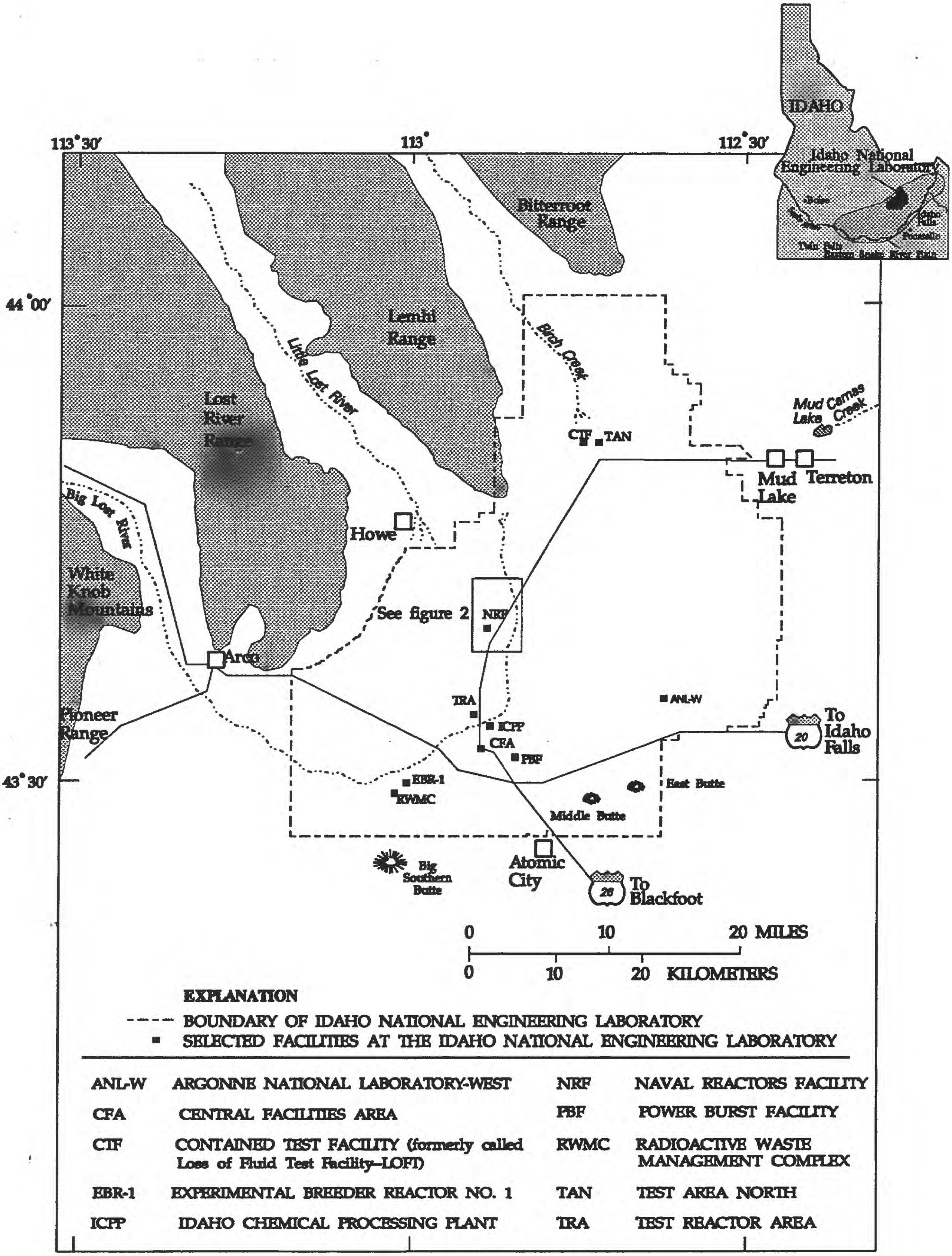

Figure 1. Location of the Idaho National Engineering Laboratory, Naval Reactors Facility, and other selected facilities.

Round one was a one-time sampling of each well for a comprehensive suite of chemical constituents that approximates those contained in the U.S. Environmental Protection Agency's Ground-Water Monitoring List—Appendix IX (U.S. Environmental Protection Agency, 1989, p. 636-642). Round two consisted of bimonthly collection of five samples from each well that were analyzed for the chemical constituents listed in Appendix III-EPA Interim Primary Drinking Water Standards, the constituents listed as parameters establishing ground-water quality, and selected measurements used as indicators of ground-water contamination (U.S. Environmental Protection Agency, 1989, p. 660-661, 730). Additional constituents analyzed for in round-two samples included copper, nickel, zinc, and extractable acid and base/neutral compounds. Round three samples were collected quarterly through 1995. Constituents analyzed for in 1994 included chloride, chromium, iron, lead, mercury, nickel, nitrate as nitrogen, silver, sodium, and sulfate. Other round-three measurements were gross alpha- and gross beta-particle radioactivity, pH, specific conductance, and total organic carbon (TOC). The round-three sampling program was expanded in 1995 to include analyses for aluminum, antimony, arsenic, barium, beryllium, cadmium, copper, manganese, selenium, thallium, tritium, and zinc. As a result of expanded laboratory procedures, all three rounds of the sample-collection program included analyses for constituents in addition to those listed above.

This report presents a compilation of round-three water-chemistry data collected during 1994–95. Results of analyses of rounds 1-3 samples collected prior to 1994 are presented by Knobel, Bartholomay, and others (1992), Bartholomay and others (1993), and Tucker and others (1995). In 1996, a fourth round of sampling was initiated; results for that program will be discussed in subsequent reports.

Hydrologic Conditions

The Snake River Plain aquifer is one of the most productive aquifers in the United States (U.S. Geological Survey, 1985, p. 193). The aquifer underlies the eastern Snake River Plain and consists of a thick sequence of basalts and sedimentary interbeds filling a large, arcuate, structural basin in southeastern Idaho (fig. 1).

Surface Water

The Big Lost River drains more than 1,400 mi^2 of mountainous area that includes parts of the Lost River Range and the Pioneer Range west of the INEL (fig. 1). Flow in the Big Lost River infiltrates to the Snake River Plain aquifer along its channel and in sinks and playas near the river's terminus. Since 1958, excess runoff has been diverted to spreading areas in the southwestern part of the INEL where much of the water rapidly infiltrates to the aquifer. Other surface drainages that provide recharge to the Snake River Plain aquifer at the INEL include the Little Lost River, Birch Creek, and Camas Creek (fig. 1) (Bartholomay and others, 1995, p. 18).

Ground Water

Recharge to the Snake River Plain aquifer is principally from infiltration of applied irrigation water, infiltration of streamflow, and ground-water inflow from adjoining mountain drainage basins. Some recharge may be from direct infiltration of precipitation, although the small amount of annual precipitation on the plain (8 in. at the INEL), evapotranspiration, and the great depth to water (in places exceeding 900 ft) probably minimize this source of recharge (Orr and Cecil, 1991, p. 22-23).

Water in the Snake River Plain aquifer moves principally through fractures and interflow zones in the basalt. Most ground water moves through the upper 800 ft of saturated rocks. Hydraulic conductivities of basalt in the upper 800 ft of the aquifer, estimated from INEL-wide transmissivity data, are from 0.0086 to 5,500 ft/day (Ackerman, 1991, p. 30). Estimated hydraulic conductivities in a 10,365-ft deep test hole near NRF are smaller; at depths exceeding 1,500 ft, hydraulic conductivities are from 0.002 to 0.03 ft/day. The effective base of the Snake River Plain aquifer at the INEL is from about 815 to 1,710 ft below land surface (Anderson and others, 1996, table 3, p. 23).

Depth to water in wells completed in the Snake River Plain aquifer is from about 200 ft below land surface in the northern part of the INEL to more than 900 ft in the southeastern part; in the vicinity of NRF, depth to water is about 375 ft below land surface. In March-May 1995, the altitude of the water table was about 4,575 ft above sea level near Test Area North and about 4,425 ft above sea level near the Radioactive Waste Management Complex; near the NRF, the water table was about 4,475 ft above sea level. Water flowed southward and southwestward beneath the INEL at an average hydraulic gradient of about 4 ft/mi; beneath the NRF, water generally flowed southward. Locally, the hydraulic gradient was from about 1 to 15 ft/mi. From March-May 1991 to March-May 1995, water-level changes in INEL wells ranged from a 8.5-ft decline north of the NRF to a 2.5-ft decline in wells in the southern part of the INEL; near the NRF, the water-level decline was about 6 to 8 ft. Water levels generally declined at the INEL during 1992–95 because of drought (Bartholomay and others, 1997, p. 20-25).

Ground water moves southwestward from the INEL and eventually discharges as springs along the Snake River downstream from Twin Falls, about 100 mi southwest of the INEL. Approximately 3.7 million acre-ft of ground water was discharged in 1995 (C.E. Berenbrock, USGS, written commun., 1996).

Guidelines for Interpreting Results of Radiochemical Analyses

Concentrations of radionuclides are reported with an estimated sample standard deviation, **s**, that is obtained by propagating sources of analytical uncertainty in measurements. The following guidelines for interpreting analytical results are based on an extension of a method proposed by Currie (1984).

In the analysis for a particular radionuclide, laboratory measurements are made on a target sample and a prepared blank. Instrument signals for the sample and the blank vary randomly. Therefore, it is essential to distinguish between two key aspects of the problem of detection: (1) the instrument signal for the sample must be larger than the signal observed for the blank before the decision can be made that the radionuclide was detected; and (2) an estimation must be made of the minimum radionuclide concentration that will yield a sufficiently large observed signal before the correct decision can be made for detection or nondetection of the radionuclide. The first aspect of the problem is a qualitative decision based on an observed signal and a definite criterion for detection. The second aspect of the problem is an estimation of the detection capabilities of a given measurement process.

In the laboratory, instrument signals must exceed a critical level of 1.6**s** before the qualitative decision can be made as to whether the radionuclide was detected. At 1.6**s**, there is a 95-percent probability that the correct conclusion—not detected—will be made. Given a large number of samples, as many as 5 percent of the samples with measured concentrations larger than or equal to 1.6**s**, which were concluded as being detected, might not contain the radionuclide. These measurements are referred to as false positives and are errors of the first kind in hypothesis testing.

Once the critical level of 1.6**s** has been defined, the minimum detectable concentration may be determined. Radionuclide concentrations that equal 3s represent a measurement at the minimum detectable concentration. For true concentrations of 3s or larger, there is a 95-percent or larger probability that the radionuclide was detected in a sample. In a large number of samples, the conclusion—not detected—will be made in 5 percent of the samples that contain true concentrations at the minimum detectable concentration of 3s. These measurements are referred to as false negatives and are errors of the second kind in hypothesis testing.

True radionuclide concentrations between 1.6s and 3s have larger errors of the second kind. That is, there is a larger-than-5-percent probability of false negative results for samples with true concentrations between 1.6s and 3s. Although the radionuclide might have been detected, such detection may not be considered reliable; at 1.6s, the probability of a false negative is about 50 percent.

The critical level and minimum detectable concentration are based on counting statistics alone and do not include systematic or random errors inherent in laboratory procedures. The values 1.6s and 3s vary slightly with background or blank counts, with the number of gross counts for individual analyses, and for different radionuclides. In this report, radionuclide concentrations less than 3s are considered to be below a "reporting level." The critical level, minimum detectable concentration, and reporting level aid the reader in the interpretation of analytical results and do not represent absolute concentrations of radioactivity which may or may not have been detected.

Many analytical results of environmental radioactivity measurements are at or near zero. If the true concentration for a given radionuclide is zero, a given set of analytical results for that radionuclide should be distributed about zero, with an equal number of negative and positive measurements. Negative analytical results occur if the radioactivity of a water sample is less than the background radioactivity or the radioactivity of the prepared blank sample in the laboratory (American Society for Testing and Materials, 1992, p. 126; Knobel, Orr, and Cecil, 1992, p. 51).

Guidelines for Interpreting Results of Inorganic and Organic Analyses

The term "reporting level" used for radiochemical analyses should not be confused with the term "minimum reporting level," which is used for inorganic and organic analyses. In this report, the term "minimum reporting level" is the smallest measured concentration of a nonradioactive constituent that may be reliably reported using a given analytical method (Timme, 1995, p. 92). Because of unpredictable matrix effects on detection limits, the laboratory reporting levels are set somewhat higher than the analytical method detection limits (Pritt and Jones, 1989).

Acknowledgments

Kent R. Shelley, Kevin L. Hudman, and Kelly D. Willie of Westinghouse Electric Corporation provided logistical support during sample collection. The authors are grateful to Michael J. Liszewski of the USGS and Adolfo Sierra and Kelly D. Willie of Westinghouse Electric Corporation for technically reviewing the manuscript.

METHODS AND QUALITY ASSURANCE

The methods used for collecting water samples generally followed the guidelines established by the USGS (Goerlitz and Brown, 1972; Stevens and others, 1975; Wood, 1981; Claassen, 1982; W.L. Bradford, USGS, written commun., 1985; Wershaw and others, 1987; Fishman and Friedman, 1989; Hardy and others, 1989; Faires, 1992; Fishman, 1993). The methods used in the field and the quality-assurance practices are described in following sections.

Sample Containers and Preservatives

Sample containers and preservatives differed depending on the constituent(s) for which analyses were requested. Samples analyzed by the USGS National Water Quality Laboratory (NWQL) were placed in containers and preserved in accordance with laboratory requirements specified by Timme (1995). Containers and preservatives were supplied by the NWQL and had undergone a rigorous quality-control procedure (Pritt, 1989, p. 75) to eliminate sample contamination. The containers and preservatives used for this study are listed in table 1 (all tables located at the end of report).

Sampling Locations and Sample Collection

Samples were collected from 14 wells (fig. 2): 10 monitoring wells (NRF-6, -7, USGS 12, 15, 17, 97–99, 102, and Water Supply INEL-1), and 4 production wells (NRF-1, -2, -3, and -4). The monitoring wells were equipped with dedicated submersible pumps and the production wells were equipped with line-shaft turbine pumps. The production wells are located within the NRF boundary; USGS 102 is west of the boundary; NRF-6, -7, USGS 12, 15, and 17 are upgradient of the NRF; and the remaining monitoring wells are downgradient (fig. 2).

Samples were collected from a portable sampling apparatus at the wells with dedicated submersible pumps and from sampling ports on the discharge lines of the turbine pumps. All portable equipment was decontaminated before sampling at each site. After collection, sample containers were sealed with laboratory film, labeled, and stored under secured conditions. Water samples were placed in ice chests, sealed, and shipped as soon as possible to the NWQL.

Conditions at the sampling site during sample collection were recorded in a field logbook and a chain-of-custody record was used to track samples from the time of collection until delivery to the NWQL. These records are available for inspection at the USGS Project Office at the INEL. The results of field measurements for pH, specific conductance, and water temperature are listed in table 2.

Quality Assurance

Internal quality control and the overall quality-assurance practices used by the NWQL are described in reports by Friedman and Erdmann (1982), Jones (1987), and Pritt and Raese (1992). The water samples were collected by personnel assigned to the INEL Project Office in accordance with a quality-assurance plan for quality-of-water activities; the plan was finalized in June 1989, revised in March 1992 and in 1996 (Mann, 1996) and is available from the USGS Project Office at the INEL. Comparative studies to determine agreement between analytical results for water-sample pairs by laboratories involved in the INEL Project Office's quality-assurance program are summarized by Wegner (1989), Williams (1996), and Williams (1997). Additional quality assurance instituted for this sampling program included a blank sample prepared with inorganic-free and organic-free water, and 11 replicate samples. Concentrations in the blank sample were not included in the computation of statistical parameters. After collection of the primary sample, a replicate sample was immediately collected. The replicate-sample analytical results then were compared with the primary-sample analytical results to evaluate the combined effects of laboratory reproducibility in analytical measurements and consistency in field-collection

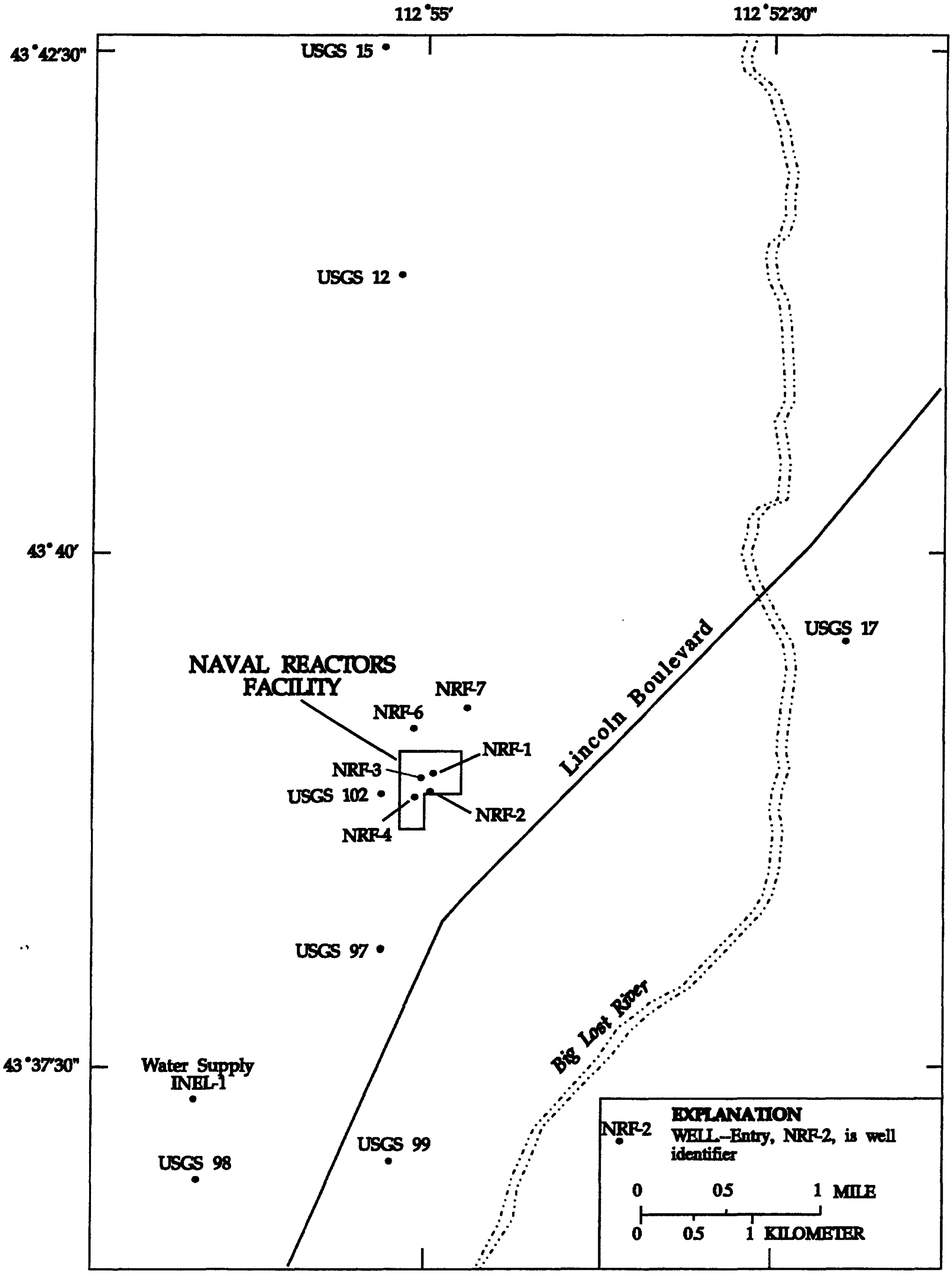

Figure 2. Location of wells, Naval Reactors Facility and vicinity, Idaho National Engineering Laboratory

methods. Many organizations use the term "sequential replicate" in place of "replicate" sample. Analytical results for primary and replicate water samples in this report are statistically compared in a study of the quality-assurance and quality-control data collected by the USGS at the INEL during 1994–95 (Williams, 1997).

On October 1, 1994, the USGS stopped preserving nutrient samples with mercuric chloride. As part of the INEL Project Office's Quality-Assurance Program, a study was conducted by Bartholomay and Williams (1996) to determine if the nutrient data collected before and after that date were comparable. NRF samples collected from October 27 to November 10, 1994, were included in that study. The results indicated that nutrient data collected previous to and subsequent to October 1, 1994, are comparable.

If standard deviations of primary- and replicate-sample results are known, it is possible to determine—within specified confidence limits—whether the results of a pair of samples are statistically equivalent. This can be done using an adaptation of the equation to determine the standard deviate or the number of standard deviations that the variable deviates from the mean (Volk, 1969, p. 55), where Z is the ratio of the absolute value of the difference of the two results and the pooled standard deviation (Taylor, 1987, p. 29). In that way, a comparison can be made of two analytical results on the basis of the precision—or an approximation of the precision—associated with each of the results:

$$Z = \frac{|x-y|}{\sqrt{(S_x)^2 + (S_y)^2}}, \qquad (1)$$

where

x = result of the primary (routine) sample,

y = result of the replicate (quality-assurance) sample,

S_x = standard deviation of x, and

S_y = standard deviation of y.

If the Z value is less than or equal to 1.96, the analytical results of the primary and replicate pair are considered statistically equivalent at the 95-percent confidence limit.

Equation 1 cannot be applied directly to the results for which no standard deviations or uncertainties are reported. The NWQL does not report standard deviations with analytical results for nonradiochemical constituents; however, the USGS Branch of Quality Assurance conducts a Blind Sample Program (BSP) (Maloney and others, 1993) that allows the calculation of a most probable deviation (MPD) at any concentration for most constituents. A minimum MPD has been established for a few constituents that are generally present at small concentrations (Maloney and others, 1993, p. 4). Linear regression equations generated from BSP data can be used to determine if the analytical results of the primary and replicate samples are statistically equivalent by calculating an MPD for each result and substituting them for the standard deviations in equation 1 (Williams, 1997). Analytical results for the quality-assurance samples will be discussed, along with similar data, in subsequent sections of this report.

Calculation of Estimated Experimental Standard Errors

The analytical results for radionuclides are presented with calculated analytical uncertainties. There is about a 67-percent probability that the true radionuclide concentration is in a range of the reported concentration plus or minus the uncertainty. The uncertainties are expressed as one sample standard deviation (s).

The associated uncertainties presented with mean concentrations are experimental standard errors and are an estimate of the uncertainty of the mean concentration. The estimated experimental standard errors (EESE) were calculated using the following equation (Iman and Conover, 1983, p. 158):

$$EESE = \sigma/(n)^{0.5}, \quad (2)$$

where

σ = population standard deviation, and
n = sample size.

The population standard deviation, σ, is customarily estimated by s (Iman and Conover, 1983, p. 106). The s is the square root of the sample variance (Iman and Conover, 1983, p. 100-101).

ANALYTICAL RESULTS

During the period beginning in March 1994 and ending in November 1995, eight sets of quarterly water samples were collected for round three of the NRF sampling program (table 2). All wells were sampled eight times except NRF-6, which was not sampled in September 1994 because the pump was removed for repairs. A quality-assurance blank sample (QAS-39) and 11 replicate samples were collected as follows: NRF-1 (QAS-34), NRF-2 (QAS-44), NRF-3 (QAS-41), NRF-6 (QAS-40), NRF-7 (QAS-36), USGS 15 (QAS-38), USGS 17 (QAS-45), USGS 98 (QAS-42), USGS 99 (QAS-37), USGS 102 (QAS-43), and Water Supply INEL-1 (QAS-35).

Dissolved Anions and Total Recoverable Sodium

Water samples were analyzed for concentrations of dissolved bromide, chloride, fluoride, and sulfate, and concentrations of total recoverable sodium (table 3). Statistical parameters for these constituents are provided by well in table 4 and were calculated using the data presented in this report.

All concentrations in the blank sample (QAS-39) were less than the respective laboratory reporting levels. Fifty-three of 55 replicate-sample concentrations listed in table 3 were statistically equivalent to their primary-sample concentrations. The bromide concentration in QAS-34 (0.08 mg/L) was not statistically equivalent to the bromide concentration in the primary sample NRF-1 (0.05 mg/L). The sodium concentration in QAS-40 (110 mg/L) was not statistically equivalent to the sodium concentration in the primary sample NRF-6 (73 mg/L).

Total Recoverable Trace Elements and Dissolved Thallium

Water samples collected in 1994 were analyzed for concentrations of total recoverable chromium, iron, lead, mercury, nickel, and silver (table 5). As part of a special request, analyses for total aluminum, antimony, arsenic, barium, beryllium, cadmium, copper, manganese, selenium, and zinc were added in March 1995 and dissolved thallium was added in June 1995 (table 5). Statistical parameters for selected constituents are provided by well in table 6 and were calculated using the data presented in this report.

The concentrations of all constituents except iron in the blank sample (QAS-39) were less than the minimum reporting levels. Of 131 replicate-sample concentrations (table 5), 120 were statistically equivalent to their primary-sample concentrations. The statistical equivalence of the aluminum concentrations in QAS-44 (<10 µg/L) and primary sample NRF-2 (10 µg/L) was uncertain. Concentrations of aluminum in QAS-41 (30 µg/L) and QAS-42 (40 µg/L) were not statistically equivalent to concentrations in their respective primary samples, NRF-3 (<10 µg/L) and USGS-98 (20 µg/L). The concentration of copper in QAS-44 (19 µg/L) was not statistically equivalent to the concentration in the primary sample, NRF-2 (1 µg/L). The iron concentration in seven replicate samples were not statistically equivalent to the iron concentrations in their respective primary samples: QAS-41 (460 µg/L) and NRF-3 (320 µg/L);

QAS-40 (410 μg/L) and NRF-6 (800 μg/L); QAS-36 (1,200 μg/L) and NRF-7 (4,800 μg/L); QAS-42 (670 μg/L) and USGS 98 (1,300 μg/L); QAS-37 (580 μg/L) and USGS 99 (360 μg/L); QAS-43 (600 μg/L) and USGS 102 (450 μg/L); and QAS-35 (2,600 μg/L) and Water Supply INEL-1 (4,000 μg/L).

Dissolved and Total Recoverable Nutrients

Filtered water samples were analyzed for concentrations of ammonia as nitrogen, nitrite as nitrogen, nitrite plus nitrate as nitrogen, and orthophosphate as phosphorus (table 7). Beginning with the March 1995 sample-collection round, total concentrations of ammonia plus organic nitrogen as nitrogen and phosphorus as phosphorus were requested instead of ammonia and orthophosphate (table 7). Statistical parameters for these constituents are provided by well in table 8 and were calculated using the data presented in this report.

Concentrations of all constituents in the blank sample (QAS-39) were less than the laboratory reporting levels. Thirty-nine of 44 replicate-sample concentrations for nitrogen and phosphorus compounds listed in table 7 were statistically equivalent to their primary-sample concentrations. The total phosphorus as phosphorus concentration in QAS-44 (0.07 mg/L) was not statistically equivalent to the concentration in primary sample NRF-2 (<0.01 mg/L). The statistical equivalence of nitrite as nitrogen concentrations in QAS-34 (<0.01 mg/L) and primary sample NRF-1 (0.01 mg/L) was uncertain. The statistical equivalence of orthophosphate as phosphorus concentrations in QAS-36 (<0.01 mg/L), QAS-38 (0.02 mg/L), and QAS-35 (0.01 mg/L) and primary samples NRF-7 (0.01 mg/L), USGS-15 (0.01 mg/L), and Water Supply INEL-1 (0.02 mg/L) was uncertain.

Total Organic Carbon

Water samples were analyzed for concentrations of TOC (table 7). Statistical parameters for TOC are provided by well in table 8 and were calculated using the data presented in this report.

The concentration of TOC in the blank sample (QAS-39) was 0.2 mg/L, the laboratory reporting level was 0.1 mg/L. Concentrations of TOC in 5 of 11 replicate samples listed in table 7 were statistically equivalent to their primary-sample concentrations. The concentrations of TOC in QAS-34 (0.4 mg/L), QAS-44 (0.4 mg/L), QAS-40 (2.1 mg/L), QAS-45 (0.2 mg/L), QAS-37 (1.2 mg/L), and QAS-43 (6.1 mg/L) were not statistically equivalent to the concentrations in their respective primary water samples, NRF-1 (0.9 mg/L), NRF-2 (1.5 mg/L), NRF-6 (0.2 mg/L), USGS 17 (1.0 mg/L), USGS 99 (0.6 mg/L), and USGS 102 (4.6 mg/L).

Gross Alpha- and Gross Beta-Particle Radioactivity

Water samples were analyzed for concentrations of dissolved gross alpha- and gross beta-particle radioactivity by the NWQL using a residue procedure. Concentrations of radioactive constituents greater than or equal to 3 times the 1s uncertainty are considered to be above the reporting level in this report. All analytical measurements are listed in table 9. For a more detailed discussion of reporting levels for radioactive constituents and measurements, see the section of this report titled "Guidelines for Interpreting Results of Radiochemical Analyses."

Gross alpha-particle radioactivity.—Gross alpha-particle radioactivity is a measure of the total radioactivity given off as alpha particles during the radioactive decay process. For convenience, laboratories report the radioactivity as if it all were given off by one radionuclide. In this report, concentrations are reported two ways: as natural uranium in micrograms per liter and as thorium-230 in picocuries per liter. Concentrations of dissolved gross alpha-particle radioactivity are listed in table 9. Statistical parameters are provided by well in table 10 and were calculated using the data presented in this report.

In the blank sample (QAS-39), concentrations of gross alpha-particle radioactivity as uranium (**1.05±0.287** µg/L) and as thorium-230 (**1.16±0.316** pCi/L) were greater than the reporting levels. Eighteen of the 22 replicate-sample concentrations listed in table 9 were statistically equivalent to their primary-sample concentrations. The concentrations as dissolved uranium in QAS-41 (3.40±2.14 µg/L) and QAS-40 (**24.1±6.20** µg/L) were not statistically equivalent to the concentrations in their respective primary samples, NRF-3 (**13.1±3.02** µg/L) and NRF-6 (4.96±6.10 µg/L). The concentrations as dissolved thorium-230 in QAS-41 (2.06±1.30 pCi/L) and QAS-40 (**14.9±3.75** pCi/L) also were not statistically equivalent to the concentrations in their respective primary samples, NRF-3 (**9.08±2.04** pCi/L) and NRF-6 (2.94±3.61 pCi/L).

Gross beta-particle radioactivity.—Gross beta-particle radioactivity is a measure of the total radioactivity given off as beta particles during the radioactive decay process. For convenience, laboratories report the radioactivity as if it all were given off by one radionuclide or a chemically similar pair of radionuclides in equilibrium. In this report, concentrations are reported in two ways: as strontium-90 in equilibrium with yttrium-90 (Sr^{90}/Y^{90}) in picocuries per liter, and as cesium-137 in picocuries per liter. Concentrations of dissolved gross beta-particle radioactivity are listed in table 9. Statistical parameters are provided by well in table 10 and were calculated using the data presented in this report.

In the blank sample (QAS-39), concentrations of gross beta-particle radioactivity as Sr^{90}/Y^{90} (**3.10±0.90** pCi/L) and as cesium-137 (**1.93±0.50** pCi/L) were greater than their reporting levels. Eighteen of the 22 replicate-sample concentrations listed in table 9 were statistically equivalent to their primary-sample concentrations. The concentrations as Sr^{90}/Y^{90} in QAS-41 (1.65±1.54 pCi/L) and QAS-38 (**3.98±0.64** pCi/L) were not statistically equivalent to the concentrations in the respective primary samples NRF-3 (**5.17±0.69** pCi/L) and USGS 15 (1.50±0.73 pCi/L). Their concentrations as cesium-137 in QAS-41 (2.46±2.30 pCi/L) and QAS-38 (**7.91±1.50** pCi/L) also were not statistically equivalent to the concentrations in their respective primary samples NRF-3 (**11.8±2.04** pCi/L) and USGS 15 (1.89±0.92 pCi/L).

Tritium

Water samples were analyzed for tritium by liquid scintillation (table 9). Statistical parameters for tritium are provided by well in table 10 and were calculated using the data presented in this report. The concentration of tritium in the blank sample (QAS-39) was **48±12.8** pCi/L. Replicate-sample concentrations of five of the eight samples listed in table 9 were statistically equivalent to their primary-sample concentrations. The concentrations in QAS-40 (**80±16** pCi/L), QAS-38 (35.2±16 pCi/L) and QAS-37 (**86.4±12.8** pCi/L) were not statistically equivalent to the concentrations in their respective primary samples NRF-6 (**124.8±12.8** pCi/L), USGS 15 (-16±12.8 pCi/L) and USGS 99 (32±12.8 pCi/L).

SUMMARY

The USGS, in response to a request from the U.S. Department of Energy's Pittsburgh Naval Reactors Office, Idaho Branch Office, sampled 14 wells during 1994–95 as part of a long-term project to monitor water quality of the Snake River Plain aquifer in the vicinity of the NRF, INEL, Idaho. Water samples were collected and analyzed for naturally occurring constituents and manmade contaminants. A total of 111 samples were collected from 10 monitoring wells and 4 production wells. Twelve quality-assurance samples also were collected and analyzed: 1 blank sample and 11 replicate samples. Concentrations of iron, total organic carbon, gross alpha- and beta-particle radioactivity, and tritium in the quality-assurance blank sample were greater than the laboratory reporting levels. Concentrations of other constituents in the blank sample were less than the respective reporting levels. The 11 replicate samples and their respective primary samples generated 293 pairs of analytical results for a variety of chemical and radiochemical constituents. Of the 293 data pairs, 258 were statistically equivalent at the 95-percent confidence level; about 88 percent of the analytical results were in agreement. The 30 data pairs that were not statistically equivalent included: 2 aluminum, 1 bromide, 1 copper, 2 gross alpha-particle radioactivity as thorium-230, 2 gross alpha-particle radioactivity as uranium, 2 gross beta-particle radioactivity as Sr^{90}/Y^{90}, 2 gross beta-particle radioactivity as cesium-137, 7 iron, 1 total phosphorus as phosphorus, 1 sodium, 6 TOC, and 3 tritium. The statistical equivalence of five data pairs was uncertain.

SELECTED REFERENCES

Ackerman, D.J., 1991, Transmissivity of the Snake River Plain aquifer at the Idaho National Engineering Laboratory, Idaho: U.S. Geological Survey Water-Resources Investigations Report 91-4058 (DOE/ID-22097), 35 p.

American Society for Testing and Materials, 1992, ASTM standards on precision and bias for various applications: Philadelphia, Pa., American Society for Testing and Materials Publication code number (PCN) 03-511092-34, 478 p.

Anderson, S.R., Ackerman, D.J., Liszewski, M.J., and Freiburger, R.M., 1996, Stratigraphic data for wells at and near the Idaho National Engineering Laboratory, Idaho: U.S. Geological Survey Open-File Report 96-248 (DOE/ID-22127), 27 p., 1 diskette.

Bartholomay, R.C., Knobel, L.L., and Tucker, B.J., 1993, Chemical constituents in water from wells in the vicinity of the Naval Reactors Facility, Idaho National Engineering Laboratory, Idaho, 1990–91: U.S. Geological Survey Open-File Report 93-94 (DOE/ID-22106), 70 p.

Bartholomay, R.C., Orr, B.R., Liszewski, M.J., and Jensen, R.G., 1995, Hydrologic conditions and distribution of selected radiochemical and chemical constituents in water, Snake River Plain aquifer, Idaho National Engineering Laboratory, Idaho, 1989 through 1991: U.S. Geological Survey Water-Resources Investigations Report 95-4175 (DOE/ID-22123), 47 p.

Bartholomay, R.C., Tucker, B.J., Ackerman, D.J., and Liszewski, M.J., 1997, Hydrologic conditions and distribution of selected radiochemical and chemical constituents in water, Snake River Plain aquifer, Idaho National Engineering Laboratory, Idaho, 1992 through 1995: U.S. Water-Resources Investigations Report 97-4086 (DOE/ID-22137), 57 p.

Bartholomay, R.C., and Williams, L.M., 1996, Evaluation of preservation methods for selected nutrients in ground water at the Idaho National Engineering Laboratory, Idaho: U.S. Geological Survey Water-Resources Investigations Report 96-4260 (DOE/ID-22131), 16 p.

Bettis Atomic Power Laboratory Naval Reactors Facility, 1994, Remedial investigation/feasibility study for the external industrial waste ditch, operable unit 8-07: Westinghouse Electric Corporation NRFRC-EC-1046, 26 p.

Claassen, H.C., 1982, Guidelines and techniques for obtaining water samples that accurately represent the water chemistry of an aquifer: U.S. Geological Survey Open-File Report 82-1024, 49 p.

Currie, L.A., 1984, Lower limit of detection—Definition and elaboration of a proposed position for radiological effluent and environmental measurements: U.S. Nuclear Regulatory Commission NUREG/CR-4077, 139 p.

Faires, L.M., 1992, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of metals in water by inductively coupled plasma—mass spectrometry: U.S. Geological Survey Open-File Report 92-634, 28 p.

Fishman, M.J., ed., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93-125, 217 p.

Fishman, M.J., and Friedman, L.C., eds., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p.

Friedman, L.C., and Erdmann, D.E., 1982, Quality assurance practices for the chemical and biological analyses of water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A6, 181 p.

Goerlitz, D.F., and Brown, Eugene, 1972, Methods for analysis of organic substances in water: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A3, 40 p.

Hardy, M.A., Leahy, P.P., and Alley, W.M., 1989, Well installation and documentation, and ground-water sampling protocols for the pilot national water-quality assessment program: U.S. Geological Survey Open-File Report 89-396, 36 p.

Iman, R.L., and Conover, W.J., 1983, A modern approach to statistics: New York, John Wiley & Sons, Inc., 497 p.

Jones, B.E., 1987, Quality control manual of the U.S. Geological Survey's National Water Quality Laboratory: U.S. Geological Survey Open-File Report 87-457, 17 p.

Knobel, L.L., Bartholomay, R.C., Wegner, S.J., and Edwards, D.D., 1992, Chemical constituents in water from wells in the vicinity of the Naval Reactors Facility, Idaho National Engineering Laboratory, Idaho, 1989–90: U.S. Geological Survey Open-File Report 92-156 (DOE/ID-22103), 38 p.

Knobel, L.L., Orr, B.R., and Cecil, L.D., 1992, Summary of background concentrations of selected radiochemical and chemical constituents in groundwater from the Snake River Plain aquifer, Idaho; estimated from an analysis of previously published data: Journal of the Idaho Academy of Science, v. 28, no. 1, p. 48-61.

Maloney, T.J., Ludtke, A.S., Krizman, T.L., 1993, Quality-assurance data for routine water analysis in the laboratories of the U.S. Geological Survey for water year 1990: U.S. Geological Survey Water-Resources Investigations Report 93-4082, 145 p.

Mann, L.J., 1986, Hydraulic properties of rock units and chemical quality of water for INEL-1—a 10,365-foot deep test hole drilled at the Idaho National Engineering Laboratory, Idaho: U.S. Geological Survey Water-Resources Investigations Report 86-4020 (DOE/ID-22070), 23 p.

----- 1989, Tritium concentrations in flow from selected springs that discharge to the Snake River, Twin Falls-Hagerman area, Idaho: U.S. Geological Survey Water-Resources Investigations Report 89-4156 (DOE/ID-22084), 20 p.

----- 1996, Quality-assurance plan and field methods for quality-of-water activities, U.S. Geological Survey, Idaho National Engineering Laboratory, Idaho: U.S. Geological Survey Open-File Report 96-615 (DOE/ID-22132), 37 p.

Orr, B.R., and Cecil, L.D., 1991, Hydrologic conditions and distribution of selected chemical constituents in water, Snake River Plain aquifer, Idaho National Engineering Laboratory, Idaho, 1986 to 1988: U.S. Geological Survey Water-Resources Investigations Report 91-4047 (DOE/ID-22096), 56 p.

Pritt, J.W., 1989, Quality assurance of sample containers and preservatives at the U.S. Geological Survey National Water Quality Laboratory, *in* Pederson, G.L., and Smith, M.M., compilers, U.S. Geological Survey, second national symposium on water quality—abstracts of the technical sessions: U.S. Geological Survey Open-File Report 89-409, p. 75.

Pritt, Jeffrey, and Jones, B.E., eds., 1989, 1990 National Water Quality Laboratory services catalog: U.S. Geological Survey Open-File Report 89-386, unnumbered.

Pritt, Jeffrey, and Raese, J.W., eds., 1992, Quality assurance/quality control manual, National Water Quality Laboratory: U.S. Geological Survey Open-File Report 92-495, 33 p.

Stevens, H.H., Jr., Ficke, J.F., and Smoot, G.F., 1975, Water temperature—influential factors, field measurement, and data presentation: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. D1, 65 p.

Taylor, J.K., 1987, Quality assurance of chemical measurements: Chelsea, Mich., Lewis Publishers, Inc., 328 p.

Thatcher, L.L., Janzer, V.J., and Edwards, K.W., 1977, Methods for determination of radioactive substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A5, 95 p.

Timme, P.J., 1995, National Water Quality Laboratory, 1995 services catalog: U.S. Geological Survey Open-File Report 95-352, 120 p.

Tucker, B.J., Knobel, L.L., and Bartholomay, R.C., 1995, Chemical constituents in water from wells in the vicinity of the Naval Reactors Facility, Idaho National Engineering Laboratory, Idaho, 1991–93: U.S. Geological Survey Open-File Report 95-725 (DOE/ID-22125), 94 p.

U.S. Environmental Protection Agency, 1989, Protection of Environment, Code of Federal Regulations 40: Office of the Federal Register, National Archives and Records Administration, pts. 190 to 299, 1,027 p.

U.S. Geological Survey, 1985, National water summary, 1984—Hydrologic events, selected water-quality trends, and ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, 467 p.

Volk, William, 1969, Applied statistics for engineers (2d ed.): New York, McGraw-Hill Book Company, 415 p.

Wegner, S.J., 1989, Selected water quality assurance data for water samples collected by the U.S. Geological Survey, Idaho National Engineering Laboratory, Idaho, 1980 to 1988: U.S. Geological Survey Water-Resources Investigations Report 89-4168 (DOE/ID-22085), 91 p.

Wershaw, R.L., Fishman, M.J., Grabbe, R.R., and Lowe, L.E., 1987, Method for the determination of organic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A3, 80 p.

Williams, L.M., 1996, Evaluation of quality assurance/quality control data collected by the U.S. Geological Survey for water-quality activities at the Idaho National Engineering Laboratory, Idaho, 1989 through 1993: U.S. Geological Survey Water-Resources Investigations Report 96-4148 (DOE/ID-22129), 116 p.

----- 1997, Evaluation of quality assurance/quality control data collected by the U.S. Geological Survey for water-quality activities at the Idaho National Engineering Laboratory, Idaho, 1994 through 1995: U.S. Geological Survey Water-Resources Investigations Report 97-4058 (DOE/ID-22136), 87 p.

Wood, W.W., 1981, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, 24 p.

Table 1.—***Containers and preservatives used for water samples, Naval Reactors Facility and vicinity***

[Analyses by U.S. Geological Survey National Water Quality Laboratory. Abbreviations: L, liter; mL, milliliter; $HgCl_2$, mercuric chloride; NaCl, sodium chloride; HNO_3, nitric acid; $K_2Cr_2O_7$, potassium dichromate; H_2SO_4, sulfuric acid; °C, degrees Celsius. Samples were shipped by overnight-delivery mail]

Type of constituent	Container		Preservative		Other treatment
	Type	Size	Type	Volume	
Anions	Polyethylene	250 mL	None	None	Filter
Sodium, total recoverable	Polyethylene, acid-rinsed	250 mL	HNO_3	1 mL	None
Trace elements, total recoverable	Polyethylene, acid-rinsed	500 mL	HNO_3	2 mL	None
	Polyethylene, acid-rinsed	250 mL	HNO_3	1 mL	None
Mercury, total recoverable	Glass, acid-rinsed	250 mL	$K_2Cr_2O_7/HNO_3$	10 mL	None
Thallium, dissolved	Polyethylene, acid-rinsed	250 mL	HNO_3	1 mL	Filter
Nutrients, dissolved	Polyethylene, brown	125mL	$HgCl_2$/NaCl	.5 mL	Filter, chill 4°C
Nutrients, dissolved	Polyethylene, brown	125 mL	H_2SO_4	1 mL	Filter, chill 4°C
Nutrients, dissolved	Polyethylene, brown	125 mL	None	None	Filter, chill 4°C
Nutrients, total recoverable	Polyethylene, brown	125 mL	H_2SO_4	1 mL	Chill 4°C
Total organic carbon	Glass, baked	125 mL	None	None	Chill 4°C
Gross alpha- and beta-particle radioactivity	Polyethylene, acid-rinsed	1 L	HNO_3	4 mL	Filter
Tritium	Polyethylene, acid-rinsed	250 mL	None	None	None
	Polyethylene	125 mL	None	None	None

Table 2.—***Results of field measurements for pH, specific conductance, and temperature of water, Naval Reactors Facility and vicinity***

[Sample identifier: see figure 2 for well locations; Blank - indicates sample was inorganic- and organic-free water from the U.S. Geological Survey National Water Quality Laboratory. Date sampled: (m/d/y) indicates month/day/year. Units: pH, negative base-10 logarithm of hydrogen ion activity in moles per liter; specific conductance, microsiemens per centimeter at 25°C (degrees Celsius); temperature,°C. Remarks: QAS indicates quality-assurance sample (values for field measurements for each pair of primary and replicate samples are the same measurement)]

Sample identifier	Date sampled (m/d/y)	Time	pH	Specific conductance	Temperature	Remarks
Blank	11/10/94	1600	7.5	1	21.5	QAS-39
NRF-1	3/10/94	1010	7.8	603	12.0	
	3/10/94	1000	7.8	603	12.0	QAS-34, replicate
	6/15/94	1025	7.8	603	11.5	
	9/7/94	1031	8.0	600	12.0	
	11/8/94	1022	7.9	604	11.5	
	3/14/95	1105	7.6	612	11.5	
	6/8/95	1342	7.9	618	12.0	
	9/13/95	0932	8.0	611	12.0	
	11/7/95	1038	8.0	606	11.0	
NRF-2	3/10/94	0858	7.8	658	12.0	
	6/15/94	0957	7.8	646	12.0	
	9/7/94	1121	8.0	629	12.5	
	11/8/94	0930	7.8	644	12.0	
	3/14/95	1334	8.0	651	12.0	
	6/8/95	1135	7.9	643	12.0	
	9/13/95	0915	8.0	660	12.0	
	11/7/95	0910	8.0	662	11.5	
	11/7/95	0900	8.0	662	11.5	QAS-44, replicate
NRF-3	3/10/94	0935	7.8	608	11.0	
	6/15/94	1109	7.8	606	11.5	
	9/7/94	1100	8.0	604	11.5	
	11/8/94	0955	7.8	609	11.0	
	3/14/95	1135	7.8	613	11.5	

Table 2.—***Results of field measurements for pH, specific conductance, and temperature of water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Time	pH	Specific conductance	Temperature	Remarks
NRF-3	6/8/95	1405	8.0	618	11.5	
	6/8/95	1400	8.0	618	11.5	QAS-41, replicate
	9/13/95	1100	8.0	614	11.5	
	11/7/95	0950	8.0	616	10.5	
NRF-4	3/10/94	1042	7.9	666	11.5	
	6/15/94	0925	7.5	662	11.5	
	9/7/94	0915	7.8	660	11.5	
	11/10/94	0835	7.8	674	11.5	
	3/14/95	1218	7.9	663	11.5	
	6/8/95	1109	7.9	681	11.5	
	9/13/95	0852	7.9	650	11.5	
	11/7/95	1253	8.0	634	11.0	
NRF-6	3/10/94	1320	7.8	1,420	11.5	
	6/9/94	1430	7.9	1,360	12.0	
	12/21/94	1410	7.7	1,620	11.5	
	3/16/95	1055	7.8	1,600	11.5	
	3/16/95	1200	7.8	1,600	11.5	QAS-40, replicate
	6/9/95	1410	7.8	1,640	11.5	
	9/13/95	1220	7.9	1,530	11.5	
	11/7/95	1520	7.9	1,480	11.0	
NRF-7	3/15/94	1255	8.1	243	15.5	
	6/13/94	1300	8.1	240	16.0	
	6/13/94	1330	8.1	240	16.0	QAS-36, replicate
	9/12/94	1150	8.3	250	15.0	
	11/4/94	1255	8.3	254	14.5	
	3/17/95	1145	8.1	238	14.5	
	6/9/95	1235	8.2	243	14.5	
	9/14/95	1050	8.5	248	15.0	

Table 2.—***Results of field measurements for pH, specific conductance, and temperature of water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Time	pH	Specific conductance	Temperature	Remarks
NRF-7	11/8/95	1420	8.3	259	14.0	
USGS 12	3/11/94	1440	7.7	606	11.5	
	6/10/94	1435	7.8	605	12.0	
	9/9/94	1435	7.9	600	12.5	
	10/27/94	1305	7.8	600	11.5	
	3/20/95	1450	7.8	604	11.5	
	6/14/95	1505	7.8	602	12.0	
	9/12/95	1420	7.9	598	12.0	
	11/2/95	1405	8.0	604	11.0	
USGS 15	3/11/94	1215	7.9	311	11.5	
	6/10/94	1220	7.7	489	11.0	
	9/9/94	1215	8.0	437	11.5	
	11/7/94	1235	8.0	315	11.5	
	11/7/94	1300	8.0	315	11.5	QAS-38, replicate
	3/20/95	1230	7.9	302	11.5	
	6/14/95	1235	8.0	319	11.5	
	9/12/95	1205	7.9	465	11.0	
	11/2/95	1135	8.1	350	11.0	
USGS 17	3/10/94	1215	8.0	297	13.0	
	6/15/94	1240	8.0	303	13.0	
	9/7/94	1255	8.2	296	13.0	
	10/27/94	1010	8.1	300	13.0	
	3/16/95	0930	8.0	293	13.0	
	6/13/95	1425	8.2	298	13.5	
	9/11/95	1600	8.3	299	13.0	
	11/7/95	1410	8.2	301	12.0	
	11/7/95	1430	8.2	301	12.0	QAS-45, replicate
USGS 97	3/14/94	1445	7.7	600	11.5	

Table 2.—***Results of field measurements for pH, specific conductance, and temperature of water, Naval Reactors Facility and vicinity****—Continued*

Sample identifier	Date sampled (m/d/y)	Time	pH	Specific conductance	Temperature	Remarks
USGS 97	6/9/94	1245	7.9	595	11.5	
	9/8/94	1240	8.0	600	12.0	
	11/10/94	1020	7.9	602	11.0	
	3/16/95	1330	7.9	595	11.5	
	6/13/95	1120	7.9	597	11.5	
	9/11/95	1430	8.1	600	11.5	
	11/6/95	1550	8.0	604	11.0	
USGS 98	3/14/94	1200	7.8	405	12.0	
	6/9/94	1030	7.9	406	12.0	
	9/8/94	1110	8.1	408	12.5	
	11/9/94	1245	8.0	410	12.0	
	3/15/95	1205	7.8	399	12.0	
	6/12/95	1250	8.0	412	12.5	
	6/12/95	1315	8.0	412	12.5	QAS-42, replicate
	9/11/95	1130	8.1	434	12.5	
	11/6/95	1200	8.1	432	11.5	
USGS 99	3/14/94	1325	7.7	523	11.5	
	6/9/94	1130	7.8	520	11.5	
	9/7/94	1445	8.0	520	11.5	
	9/7/94	1330	8.0	520	11.5	QAS-37, replicate
	11/9/94	1420	7.9	525	11.5	
	3/15/95	1425	7.8	519	11.5	
	6/12/95	1435	7.9	528	12.0	
	9/11/95	1310	8.1	530	12.0	
	11/6/95	1410	8.0	531	11.0	
USGS 102	3/10/94	1420	7.8	588	11.5	
	6/9/94	1335	7.9	586	11.5	
	9/8/94	1400	8.0	589	12.0	

Table 2.—***Results of field measurements for pH, specific conductance, and temperature of water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Time	pH	Specific conductance	Temperature	Remarks
USGS 102	11/8/94	1345	7.9	591	11.0	
	3/16/95	1220	7.8	586	11.5	
	6/13/95	1250	7.9	590	11.5	
	9/13/95	1330	8.0	592	11.5	
	9/13/95	1300	8.0	592	11.5	QAS-43, replicate
	11/7/95	1610	8.0	595	10.5	
Water Supply INEL-1	3/14/94	1050	7.7	635	12.0	
	6/9/94	0925	7.7	639	12.0	
	6/9/94	1000	7.7	639	12.0	QAS-35, replicatc
	9/8/94	0955	8.0	683	12.0	
	11/9/94	1030	7.9	686	11.5	
	3/15/95	1055	7.7	628	12.0	
	6/12/95	1100	7.9	621	12.5	
	9/11/95	1015	8.0	612	12.0	
	11/6/95	1020	8.0	602	11.5	

Table 3.—***Concentrations of dissolved anions and total recoverable sodium in water, Naval Reactors Facility and vicinity***

[Analyses were performed by the U.S. Geological Survey National Water Quality Laboratory. Analytical results in milligrams per liter. Sample identifier: see figure 2 for well locations; QAS indicates quality-assurance sample, 39 is a blank sample, others are replicates. Date sampled: (m/d/y), month/day/year. Symbol: < indicates concentration is less than the specified laboratory reporting level. Abbreviation: AL, analysis lost]

Sample identifier	Date sampled (m/d/y)	Bromide	Chloride	Fluoride	Sulfate	Sodium
QAS-39	11/10/94	<0.01	<0.1	<0.1	<0.1	<0.1
NRF-1	3/10/94	.05	37	.2	39	15
QAS-34	3/10/94	.08	38	.2	39	14
NRF-1	6/15/94	.08	38	.2	38	15
	9/7/94	.08	42	.2	40	16
	11/8/94	.08	39	.2	37	15
	3/14/95	.09	42	.2	39	12
	6/8/95	.08	41	.2	40	17
	9/13/95	.09	40	.1	39	17
	11/7/95	.08	39	.2	38	16
NRF-2	3/10/94	.06	50	.2	49	19
	6/15/94	.08	46	.2	44	16
	9/7/94	.08	36	.2	37	14
	11/8/94	.09	48	.2	42	17
	3/14/95	.09	49	.2	44	16
	6/8/95	.09	43	.2	42	19
	9/13/95	.09	48	.1	46	19
	11/7/95	.08	51	.1	46	20
QAS-44	11/7/95	.09	50	.2	46	20
NRF-3	3/10/94	.05	37	.2	40	16
	6/15/94	.08	36	.2	38	15
	9/7/94	.08	36	.2	37	14
	11/8/94	.09	39	.2	38	15
	3/14/95	.09	42	.2	39	13
	6/8/95	.09	40	.2	39	17

Table 3.—***Concentrations of dissolved anions and total recoverable sodium in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Bromide	Chloride	Fluoride	Sulfate	Sodium
QAS-41	6/8/95	.08	39	.1	40	17
NRF-3	9/13/95	.09	40	.2	40	17
	11/7/95	.08	39	.2	38	16
NRF-4	3/10/94	.06	51	.2	50	20
	6/15/94	.09	51	.2	49	19
	9/7/94	.09	52	.2	50	20
	11/10/94	.08	55	.2	50	20
	3/14/95	.09	50	.2	47	13
	6/8/95	.09	53	.2	50	22
	9/13/95	.10	48	.2	46	19
	11/7/95	.08	42	.1	41	17
NRF-6	3/10/94	.09	200	.2	230	88
	6/9/94	.09	190	.2	220	86
	12/21/94	.11	250	.2	260	AL
	3/16/95	.10	250	.2	270	73
QAS-40	3/16/95	.10	250	.2	270	110
NRF-6	6/9/95	.10	250	.1	270	130
	9/13/95	.10	230	.2	240	120
	11/7/95	.10	220	.1	230	100
NRF-7	3/15/94	.01	5.0	.2	14	8.1
	6/13/94	.03	4.9	.2	14	8.3
QAS-36	6/13/94	.03	4.9	.2	14	8.2
NRF-7	9/12/94	.03	5.2	.2	14	8.6
	11/4/94	.03	4.9	.2	14	8.0
	3/17/95	.03	5.3	.2	13	4.5
	6/9/95	.03	4.8	.2	13	9.3
	9/14/95	.02	4.9	.2	13	9.4
	11/8/95	.03	4.9	.3	13	8.6

Table 3.—*Concentrations of dissolved anions and total recoverable sodium in water, Naval Reactors Facility and vicinity*—*Continued*

Sample identifier	Date sampled (m/d/y)	Bromide	Chloride	Fluoride	Sulfate	Sodium
USGS 12	3/11/94	.08	38	.2	37	15
	6/10/94	.08	21	.2	26	15
	9/9/94	.09	38	.2	36	15
	10/27/94	.09	39	.2	35	16
	3/20/95	.10	42	.2	35	13
	6/14/95	.09	38	.2	35	17
	9/12/95	.09	39	.1	36	17
	11/2/95	.09	40	.2	34	17
USGS 15	3/11/94	.02	6.4	.1	18	7.1
	6/10/94	.05	21	.1	25	17
	9/9/94	.05	18	.1	24	15
	11/7/94	.02	6.9	.1	17	7.6
QAS-38	11/7/94	.02	7.4	.1	17	7.4
USGS 15	3/20/95	.03	6.5	.1	16	7.0
	6/14/95	.02	7.1	.1	17	8.9
	9/12/95	.05	17	.1	23	17
	11/2/95	.03	9.3	.1	18	11
USGS 17	3/10/94	.02	5.7	.2	19	6.0
	6/15/94	.03	5.7	.2	18	6.4
	9/7/94	.02	6.0	.2	19	6.6
	10/27/94	.03	5.8	.3	18	6.3
	3/16/95	.03	6.1	.2	18	5.2
	6/13/95	.02	5.6	.2	18	6.4
	9/11/95	.03	5.7	.2	19	7.3
	11/7/95	.02	5.7	.3	18	6.3
QAS-45	11/7/95	.02	5.7	.3	18	6.7
USGS 97	3/14/94	.07	33	.2	35	14
	6/9/94	.08	35	.2	34	14

Table 3.—***Concentrations of dissolved anions and total recoverable sodium in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Bromide	Chloride	Fluoride	Sulfate	Sodium
USGS 97	9/8/94	.09	35	.2	35	14
	11/10/94	.08	35	.2	35	13
	3/16/95	.09	36	.2	34	12
	6/13/95	.08	33	.1	34	15
	9/11/95	.09	37	.1	35	15
	11/6/95	.09	35	.2	34	14
USGS 98	3/14/94	.04	13	.2	21	9.7
	6/9/94	.04	14	.2	21	9.9
	9/8/94	.04	14	.2	21	10
	11/9/94	.04	14	.2	20	9.5
	3/15/95	.05	14	.2	19	4.8
	6/12/95	.04	15	.2	20	11
QAS-42	6/12/95	.05	15	.2	21	9.9
USGS 98	9/11/95	.05	15	.1	21	9.5
	11/6/95	.05	14	.2	21	9.8
USGS 99	3/14/94	.05	20	.2	26	13
	6/9/94	.06	21	.1	25	13
	9/7/94	.07	21	.2	26	13
QAS-37	9/7/94	.06	21	.2	26	13
USGS 99	11/9/94	.06	21	.1	25	12
	3/15/95	.07	22	.1	25	12
	6/12/95	.06	21	.1	25	14
	9/11/95	.06	21	.1	26	15
	11/6/95	.06	21	.2	25	14
USGS 102	3/10/94	.08	32	.2	35	13
	6/9/94	.08	34	.2	35	13
	9/8/94	.09	35	.2	35	13
	11/8/94	.08	34	.2	34	13

Table 3.—***Concentrations of dissolved anions and total recoverable sodium in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Bromide	Chloride	Fluoride	Sulfate	Sodium
USGS 102	3/16/95	.08	36	.2	33	7.5
	6/13/95	.08	32	.1	34	14
	9/13/95	.09	34	.2	34	15
QAS-43	9/13/95	.09	35	.1	34	14
USGS 102	11/7/95	.08	34	.2	34	14
Water Supply INEL-1	3/14/94	.20	69	.1	41	14
	6/9/94	.23	74	.1	42	14
QAS-35	6/9/94	.22	70	.2	42	15
Water Supply INEL-1	9/8/94	.26	81	.2	46	16
	11/9/94	.25	81	.1	45	16
	3/15/95	.23	71	.1	40	10
	6/12/95	.21	66	.1	40	16
	9/11/95	.20	65	.1	40	14
	11/6/95	.19	61	.1	37	14

Table 4.—***Statistical parameters for dissolved anions and total recoverable sodium, by well***

[See figure 2 for well locations. Units are milligrams per liter. Values are derived from table 3. Quality-assurance replicates are included in the calculation of statistical parameters. Mean and median sample size: includes all samples with concentrations greater than laboratory reporting level]

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
			NRF-1			
Bromide	0.05	0.09	0.08	0.08	9	9
Chloride	37	42	39	40	9	9
Fluoride	.1	.2	.2	.2	9	9
Sulfate	37	40	39	39	9	9
Sodium	12	17	15	15	9	9
			NRF-2			
Bromide	.06	.09	.09	.08	9	9
Chloride	36	51	48	47	9	9
Fluoride	.1	.2	.2	.2	9	9
Sulfate	37	49	44	44	9	9
Sodium	14	20	19	18	9	9
			NRF-3			
Bromide	.05	.09	.08	.08	9	9
Chloride	36	42	39	39	9	9
Fluoride	.1	.2	.2	.2	9	9
Sulfate	37	40	39	39	9	9
Sodium	13	17	16	16	9	9
			NRF-4			
Bromide	.06	.10	.09	.08	8	8
Chloride	42	55	51	50	8	8
Fluoride	.1	.2	.2	.2	8	8
Sulfate	41	50	49.5	48	8	8
Sodium	13	22	19.5	19	8	8

Table 4.—***Statistical parameters for dissolved anions and total recoverable sodium, by well—****Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
			NRF-6			
Bromide	.09	.11	.10	.10	8	8
Chloride	190	250	240	230	8	8
Fluoride	.1	.2	.2	.2	8	8
Sulfate	220	270	250	250	8	8
Sodium	73	130	100	101	7	7
			NRF-7			
Bromide	.01	.03	.03	.03	9	9
Chloride	4.8	5.3	4.9	5.0	9	9
Fluoride	.2	.3	.2	.2	9	9
Sulfate	13	14	14	14	9	9
Sodium	4.5	9.4	8.3	8.1	9	9
			USGS 12			
Bromide	.08	.10	.09	.09	8	8
Chloride	21	42	38.5	37	8	8
Fluoride	.1	.2	.2	.2	8	8
Sulfate	26	37	35	34	8	8
Sodium	13	17	15.5	16	8	8
			USGS 15			
Bromide	.02	.05	.03	.03	9	9
Chloride	6.4	21	7.4	11	9	9
Fluoride	.1	.1	.1	.1	9	9
Sulfate	16	25	18	19	9	9
Sodium	7.0	17	8.9	11	9	9

Table 4.—***Statistical parameters for dissolved anions and total recoverable sodium, by well***—*Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
			USGS 17			
Bromide	.02	.03	.02	.02	9	9
Chloride	5.6	6.1	5.7	5.8	9	9
Fluoride	.2	.3	.2	.2	9	9
Sulfate	18	19	18	18	9	9
Sodium	5.2	7.3	6.4	6.4	9	9
			USGS 97			
Bromide	.07	.09	.085	.08	8	8
Chloride	33	37	35	35	8	8
Fluoride	.1	.2	.2	.2	8	8
Sulfate	34	35	34.5	34	8	8
Sodium	12	15	14	14	8	8
			USGS 98			
Bromide	.04	.05	.04	.04	9	9
Chloride	13	15	14	14	9	9
Fluoride	.1	.2	.2	.2	9	9
Sulfate	19	21	21	21	9	9
Sodium	4.8	11	9.8	9.3	9	9
			USGS 99			
Bromide	.05	.07	.06	.06	9	9
Chloride	20	22	21	21	9	9
Fluoride	.1	.2	.1	.1	9	9
Sulfate	25	26	25	25	9	9
Sodium	12	15	13	13	9	9

Table 4.—***Statistical parameters for dissolved anions and total recoverable sodium, by well***—*Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
			USGS 102			
Bromide	.08	.09	.08	.08	9	9
Chloride	32	36	34	34	9	9
Fluoride	.1	.2	.2	.2	9	9
Sulfate	33	35	34	34	9	9
Sodium	7.5	15	13	13	9	9
			Water Supply INEL-1			
Bromide	.19	.26	.22	.22	9	9
Chloride	61	81	70	71	9	9
Fluoride	.1	.2	.1	.1	9	9
Sulfate	37	46	41	41	9	9
Sodium	10	16	14	14	9	9

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

[Sample identifier: see figure 2 for well locations; QAS indicates quality-assurance sample, 39 is a blank sample, others are replicates. Analyses were performed by the U.S. Geological Survey National Water Quality Laboratory. Analytical results in micrograms per liter. Date sampled: (m/d/y), month/day/year. Symbols: < indicates concentration is less than the specified laboratory reporting level; NR indicates analysis not requested; AL, analysis lost; LM, indicates mixup with samples; BB, bottle broke]

Constituent	Sample identifier and date sampled (m/d/y)									
	QAS-39 11/10/94	NRF-1 3/10/94	QAS-34 3/10/94	NRF-1 6/15/94	NRF-1 9/7/94	NRF-1 11/8/94	NRF-1 3/14/95	NRF-1 6/8/95	NRF-1 9/13/95	NRF-1 11/7/95
Aluminum	NR	NR	NR	NR	NR	NR	<10	<10	20	<10
Antimony	NR	NR	NR	NR	NR	NR	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	NR	NR	2	2	2	2
Barium	NR	NR	NR	NR	NR	NR	100	100	<100	<100
Beryllium	NR	NR	NR	NR	NR	NR	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	NR	NR	<1	<1	<1	<1
Chromium	AL	6.9	7.6	6.7	7.3	8.1	7.2	7.9	6.7	7.4
Copper	NR	NR	NR	NR	NR	NR	<1	<1	2	<1
Iron	10	30	<10	30	40	20	20	<10	10	<10
Lead	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Manganese	NR	NR	NR	NR	NR	NR	<10	<10	<10	<10
Mercury	<0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	<1	<1	<1	<1	<1	<1	<1	2	<1
Selenium	NR	NR	NR	NR	NR	NR	2	2	2	3
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	NR	NR	<10	<10	10	<10

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	NRF-2 3/10/94	NRF-2 6/15/94	NRF-2 9/7/94	NRF-2 11/8/94	NRF-2 3/14/95	NRF-2 6/8/95	NRF-2 9/13/95	NRF-2 11/7/95	QAS-44 11/7/95
Aluminum	NR	NR	NR	NR	10	<10	<10	10	<10
Antimony	NR	NR	NR	NR	<1	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	2	2	2	2	2
Barium	NR	NR	NR	NR	100	100	100	200	100
Beryllium	NR	NR	NR	NR	<10	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	<1	<1	<1	<1	<1
Chromium	9.9	8.3	6.0	12	11	9.9	9.6	11	12
Copper	NR	NR	NR	NR	1	1	1	1	19
Iron	30	20	150	20	<10	30	<10	<10	<10
Lead	<1	<1	<1	<1	<1	<1	<1	<1	<1
Manganese	NR	NR	NR	NR	<10	10	<10	<10	<10
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	.1
Nickel	<1	<1	<1	<1	<1	<1	<1	<1	<1
Selenium	NR	NR	NR	NR	3	1	2	2	<1
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	20	<10	10	<10	20

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	NRF-3 3/10/94	NRF-3 6/15/94	NRF-3 9/7/94	NRF-3 11/8/94	NRF-3 3/14/95	NRF-3 6/8/95	QAS-41 6/8/95	NRF-3 9/13/95	NRF-3 11/7/95
Aluminum	NR	NR	NR	NR	70	<10	30	30	10
Antimony	NR	NR	NR	NR	<1	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	2	2	1	2	2
Barium	NR	NR	NR	NR	100	200	<100	<100	100
Beryllium	NR	NR	NR	NR	<10	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	<1	<1	<1	<1	<1
Chromium	6.9	7.6	5.8	8.2	7.4	7.7	8.2	8.4	7.3
Copper	NR	NR	NR	NR	<1	3	4	15	1
Iron	50	1,200	20	70	140	320	460	3,500	40
Lead	<1	<1	5	<1	<1	2	1	4	<1
Manganese	NR	NR	NR	NR	<10	<10	<10	40	<10
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	1	2	<1	<1	<1	<1	8	<1
Selenium	NR	NR	NR	NR	2	2	2	2	2
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	10	<10	20	40	20

Table 5.—*Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity—Continued*

Constituent	Sample identifier and date sampled (m/d/y)							
	NRF-4 3/10/94	NRF-4 6/15/94	NRF-4 9/7/94	NRF-4 11/10/94	NRF-4 3/14/95	NRF-4 6/8/95	NRF-4 9/13/95	NRF-4 11/7/95
Aluminum	NR	NR	NR	NR	<10	<10	<10	10
Antimony	NR	NR	NR	NR	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	2	2	2	2
Barium	NR	NR	NR	NR	100	100	100	100
Beryllium	NR	NR	NR	NR	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	<1	<1	<1	<1
Chromium	11	12	12	AL	11	14	9.5	8.5
Copper	NR	NR	NR	NR	<1	<1	1	1
Iron	30	30	20	10	<10	<10	10	<10
Lead	<1	<1	<1	<1	<1	<1	<1	<1
Manganese	NR	NR	NR	NR	<10	<10	<10	<10
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	2	<1	<1	<1	<1	1	<1
Selenium	NR	NR	NR	NR	2	1	2	2
Silver	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	<10	<10	10	<10

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity****—Continued*

Constituent	Sample identifier and date sampled (m/d/y)							
	NRF-6 3/10/94	NRF-6 6/9/94	NRF-6 12/21/94	NRF-6 3/16/95	QAS-40 3/16/95	NRF-6 6/9/95	NRF-6 9/13/95	NRF-6 11/7/95
Aluminum	NR	NR	NR	<10	<10	40	20	10
Antimony	NR	NR	NR	<1	<1	<1	<1	<1
Arsenic	NR	NR	NR	3	4	4	4	4
Barium	NR	NR	NR	100	100	<100	<100	100
Beryllium	NR	NR	NR	<10	<10	<10	<10	<10
Cadmium	NR	NR	NR	<1	1	<1	<1	<1
Chromium	40	LM	33	37	31	38	34	35
Copper	NR	NR	NR	1	3	2	2	1
Iron	150	2,200	370	800	410	940	1,500	420
Lead	<1	<1	<1	<1	1	<1	<1	<1
Manganese	NR	NR	NR	10	10	<10	<10	<10
Mercury	<.1	<.1	<.1	<.2	<.2	<.1	BB	<.1
Nickel	23	47	4	12	12	9	40	34
Selenium	NR	NR	NR	2	3	3	2	3
Silver	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	<10	<10	<10	<10	<10

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)							
	USGS 12 3/11/94	USGS 12 6/10/94	USGS 12 9/9/94	USGS 12 10/27/94	USGS 12 3/20/95	USGS 12 6/14/95	USGS 12 9/12/95	USGS 12 11/2/95
Aluminum	NR	NR	NR	NR	<10	50	<10	10
Antimony	NR	NR	NR	NR	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	2	2	2	2
Barium	NR	NR	NR	NR	100	100	100	100
Beryllium	NR	NR	NR	NR	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	<1	<1	<1	<1
Chromium	7.3	8.0	7.3	7.0	6.7	7.0	6.5	7.0
Copper	NR	NR	NR	NR	<1	1	<1	<1
Iron	1,300	200	190	20	320	60	600	30
Lead	<1	<1	<1	<1	<1	<1	<1	<1
Manganese	NR	NR	NR	NR	<10	<10	<10	20
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	<1	<1	<1	<1	<1	<1	<1
Selenium	NR	NR	NR	NR	2	2	2	2
Silver	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	<10	80	<10	<10

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	NRF-7 3/15/94	NRF-7 6/13/94	QAS-36 6/13/94	NRF-7 9/12/94	NRF-7 11/4/94	NRF-7 3/17/95	NRF-7 6/9/95	NRF-7 9/14/95	NRF-7 11/8/95
Aluminum	NR	NR	NR	NR	NR	70	110	70	300
Antimony	NR	NR	NR	NR	NR	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	NR	2	2	2	<1
Barium	NR	NR	NR	NR	NR	<100	<100	<100	<100
Beryllium	NR	NR	NR	NR	NR	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	NR	<1	<1	<1	<1
Chromium	10	27	18	12	13	12	14	13	14
Copper	NR	NR	NR	NR	NR	<1	1	1	1
Iron	280	4,800	1,200	550	210	110	1,100	110	690
Lead	<1	<1	<1	<1	<1	<1	<1	<1	<1
Manganese	NR	NR	NR	NR	NR	<10	<10	<10	20
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	4	17	9	7	4	3	5	4	6
Selenium	NR	NR	NR	NR	NR	1	1	1	1
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	NR	<10	<10	<10	<10

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	USGS 15 3/11/94	USGS 15 6/10/94	USGS 15 9/9/94	USGS 15 11/7/94	QAS-38 11/7/94	USGS 15 3/20/95	USGS 15 6/14/95	USGS 15 9/12/95	USGS 15 11/2/95
Aluminum	NR	NR	NR	NR	NR	<10	10	10	<10
Antimony	NR	NR	NR	NR	NR	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	NR	2	2	2	2
Barium	NR	NR	NR	NR	NR	<100	<100	<100	<100
Beryllium	NR	NR	NR	NR	NR	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	NR	<1	<1	<1	<1
Chromium	7.8	8.2	22	12	9.6	7.3	7.9	6.0	7.3
Copper	NR	NR	NR	NR	NR	<1	<1	<1	1
Iron	50	290	14,000	480	540	240	60	20	110
Lead	<1	<1	7	<1	<1	1	<1	<1	<1
Manganese	NR	NR	NR	NR	NR	<10	<10	<10	30
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	2	31	2	2	<1	<1	<1	<1
Selenium	NR	NR	NR	NR	NR	2	1	1	1
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	NR	<10	<10	<10	10

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	USGS 17 3/10/94	USGS 17 6/15/94	USGS 17 9/7/94	USGS 17 10/27/94	USGS 17 3/16/95	USGS 17 6/13/95	USGS 17 9/11/95	USGS 17 11/7/95	QAS-45 11/7/95
Aluminum	NR	NR	NR	NR	40	30	50	20	10
Antimony	NR	NR	NR	NR	<1	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	2	2	2	2	2
Barium	NR	NR	NR	NR	<100	<100	<100	<100	<100
Beryllium	NR	NR	NR	NR	<10	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	<1	<1	<1	<1	<1
Chromium	2.2	1.9	2.3	2.4	1.9	1.8	1.9	1.9	1.9
Copper	NR	NR	NR	NR	<1	<1	<1	<1	<1
Iron	110	180	460	50	190	70	80	40	30
Lead	<1	<1	<1	<1	<1	<1	<1	<1	<1
Manganese	NR	NR	NR	NR	<10	<10	<10	<10	<10
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	<1	<1	<1	<1	<1	<1	<1	<1
Selenium	NR	NR	NR	NR	1	1	<1	1	1
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	<10	<10	<10	<10	<10

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)							
	USGS 97 3/14/94	USGS 97 6/9/94	USGS 97 9/8/94	USGS 97 11/10/94	USGS 97 3/16/95	USGS 97 6/13/95	USGS 97 9/11/95	USGS 97 11/6/95
Aluminum	NR	NR	NR	NR	20	30	20	<10
Antimony	NR	NR	NR	NR	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	2	2	2	2
Barium	NR	NR	NR	NR	100	100	<100	100
Beryllium	NR	NR	NR	NR	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	<1	<1	<1	<1
Chromium	6.7	8.9	6.5	AL	5.7	6.7	6.1	6.6
Copper	NR	NR	NR	NR	4	2	2	3
Iron	150	760	750	210	3,600	140	2,400	520
Lead	1	1	2	1	22	2	7	3
Manganese	NR	NR	NR	NR	20	<10	<10	<10
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	2	4	<1	<1	<1	<1	<1
Selenium	NR	NR	NR	NR	3	2	2	2
Silver	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	140	100	110	90

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	USGS 98 3/14/94	USGS 98 6/9/94	USGS 98 9/8/94	USGS 98 11/9/94	USGS 98 3/15/95	USGS 98 6/12/95	QAS-42 6/12/95	USGS 98 9/11/95	USGS 98 11/6/95
Aluminum	NR	NR	NR	NR	20	20	40	<10	20
Antimony	NR	NR	NR	NR	<1	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	2	2	2	2	1
Barium	NR	NR	NR	NR	<100	<100	<100	<100	<100
Beryllium	NR	NR	NR	NR	<10	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	<1	<1	<1	<1	<1
Chromium	6.4	6.0	5.7	6.7	5.9	6.3	5.9	5.6	6.2
Copper	NR	NR	NR	NR	3	4	6	1	5
Iron	380	2,400	430	90	270	1,300	670	180	2,700
Lead	9	15	12	9	10	9	9	10	8
Manganese	NR	NR	NR	NR	<10	<10	<10	<10	<10
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	2	<1	<1	<1	<1	1	<1	<1
Selenium	NR	NR	NR	NR	1	1	1	<1	1
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	210	200	210	210	190

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	USGS 99 3/14/94	USGS 99 6/9/94	USGS 99 9/7/94	QAS-37 9/7/94	USGS 99 11/9/94	USGS 99 3/15/95	USGS 99 6/12/95	USGS 99 9/11/95	USGS 99 11/6/95
Aluminum	NR	NR	NR	NR	NR	<10	10	<10	<10
Antimony	NR	NR	NR	NR	NR	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	NR	1	1	1	1
Barium	NR	NR	NR	NR	NR	100	100	<100	100
Beryllium	NR	NR	NR	NR	NR	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	NR	<1	<1	<1	<1
Chromium	5.3	5.3	5.3	5.4	AL	5.4	5.4	5.0	5.3
Copper	NR	NR	NR	NR	NR	1	4	1	1
Iron	190	660	360	580	310	580	340	2,200	80
Lead	2	3	2	5	1	2	2	2	1
Manganese	NR	NR	NR	NR	NR	<10	20	<10	<10
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	1	1	5	6	2	1	1	2	1
Selenium	NR	NR	NR	NR	NR	2	2	2	1
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	NR	100	90	100	90

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity***—*Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	USGS 102 3/10/94	USGS 102 6/9/94	USGS 102 9/8/94	USGS 102 11/8/94	USGS 102 3/16/95	USGS 102 6/13/95	USGS 102 9/13/95	QAS-43 9/13/95	USGS 102 11/7/95
Aluminum	NR	NR	NR	NR	10	10	20	20	<10
Antimony	NR	NR	NR	NR	<1	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	2	2	2	2	2
Barium	NR	NR	NR	NR	100	100	<100	<100	100
Beryllium	NR	NR	NR	NR	<10	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	<1	<1	<1	<1	<1
Chromium	7.0	LM	6.5	7.8	5.7	6.9	5.9	6.0	6.4
Copper	NR	NR	NR	NR	2	<1	2	<1	<1
Iron	100	12,000	80	870	940	300	450	600	30
Lead	<1	4	<1	<1	<1	<1	<1	<1	<1
Manganese	NR	NR	NR	NR	10	<10	<10	<10	<10
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	.9
Nickel	<1	3	2	<1	<1	<1	<1	<1	<1
Selenium	NR	NR	NR	NR	2	2	2	2	2
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	<.5	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	<10	<10	<10	<10	<10

Table 5.—***Concentrations of selected total recoverable trace elements and dissolved thallium in water, Naval Reactors Facility and vicinity****—Continued*

Constituent	Sample identifier and date sampled (m/d/y)								
	Water Supply INEL-1 3/14/94	Water Supply INEL-1 6/9/94	QAS-35 6/9/94	Water Supply INEL-1 9/8/94	Water Supply INEL-1 11/9/94	Water Supply INEL-1 3/15/95	Water Supply INEL-1 6/12/95	Water Supply INEL-1 9/11/95	Water Supply INEL-1 11/6/95
Aluminum	NR	NR	NR	NR	NR	20	30	<10	10
Antimony	NR	NR	NR	NR	NR	<1	<1	<1	<1
Arsenic	NR	NR	NR	NR	NR	1	<1	1	1
Barium	NR	NR	NR	NR	NR	<100	<100	<100	<100
Beryllium	NR	NR	NR	NR	NR	<10	<10	<10	<10
Cadmium	NR	NR	NR	NR	NR	<1	<1	<1	<1
Chromium	8.6	8.9	8.8	8.8	9.9	8.7	8.6	7.5	8.6
Copper	NR	NR	NR	NR	NR	4	4	1	2
Iron	580	4,000	2,600	510	280	160	5,700	310	260
Lead	1	4	4	<1	<1	<1	3	<1	<1
Manganese	NR	NR	NR	NR	NR	<10	30	<10	20
Mercury	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
Nickel	<1	<1	<1	<1	<1	<1	1	<1	<1
Selenium	NR	NR	NR	NR	NR	2	1	2	2
Silver	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium (dissolved)	NR	NR	NR	NR	NR	NR	<.5	<.5	<.5
Zinc	NR	NR	NR	NR	NR	160	180	150	160

Table 6.—***Statistical parameters for selected total recoverable trace elements, by well***

[See figure 2 for well locations. Units are micrograms per liter. Symbol: < indicates concentration is less than the specified laboratory reporting level. Values are derived from table 5. Quality-assurance replicates are included in the calculation of statistical parameters. Mean and median sample size: includes all samples with concentrations greater than laboratory reporting level]

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
			NRF-1			
Arsenic	2	2	2	2	4	4
Barium	<100	100	100	100	4	2
Chromium	6.7	8.1	7.3	7.3	9	9
Iron	<10	40	25	25	9	6
Selenium	2	3	2	2	4	4
			NRF-2			
Aluminum	<10	10	10	10	5	2
Arsenic	2	2	2	2	5	5
Barium	100	200	100	120	5	5
Chromium	6.0	12	9.9	10	9	9
Copper	1	19	1	5	5	5
Iron	<10	150	30	50	9	6
Selenium	1	3	2	2	5	5
Zinc	<10	20	20	20	5	3
			NRF-3			
Aluminum	<10	70	30	35	5	4
Arsenic	1	2	2	2	5	5
Barium	<100	200	100	130	5	3
Chromium	5.8	8.4	7.6	7.5	9	9
Copper	<1	15	3.5	6	5	4
Iron	20	3,500	140	640	9	9
Lead	<1	5	3	3	9	4
Nickel	<1	8	2	4	9	3
Selenium	2	2	2	2	5	5
Zinc	<10	40	20	20	5	4

Table 6.—***Statistical parameters for selected total recoverable trace elements, by well—Continued***

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
			NRF-4			
Arsenic	2	2	2	2	4	4
Barium	100	100	100	100	4	4
Chromium	8.5	14	11	11	7	7
Copper	<1	1	1	1	4	2
Iron	<10	30	20	20	8	5
Nickel	<1	2	1.5	2	8	2
Selenium	1	2	2	2	4	4
			NRF-6			
Aluminum	<10	40	20	20	5	3
Arsenic	3	4	4	4	5	5
Barium	<100	100	100	100	5	3
Chromium	31	40	35	35	7	7
Copper	1	3	2	2	5	5
Iron	150	2,200	610	850	8	8
Manganese	<10	10	10	10	5	2
Nickel	4	47	17.5	23	8	8
Selenium	2	3	3	3	5	5
			NRF-7			
Aluminum	70	300	90	140	4	4
Arsenic	<1	2	2	2	4	3
Chromium	10	27	13	15	9	9
Copper	<1	1	1	1	4	3
Iron	110	4,800	550	1,000	9	9
Nickel	3	17	5	7	9	9
Selenium	1	1	1	1	4	4
			USGS 12			
Aluminum	<10	50	30	30	4	2
Arsenic	2	2	2	2	4	4
Barium	100	100	100	100	4	4

Table 6.—***Statistical parameters for selected total recoverable trace elements, by well***—*Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
Chromium	6.5	8.0	7.0	7.1	8	8
Iron	20	1,300	195	340	8	8
Selenium	2	2	2	2	4	4
			USGS 15			
Aluminum	<10	10	10	10	4	2
Arsenic	2	2	2	2	4	4
Chromium	6	22	7.9	9.8	9	9
Iron	20	14,000	240	1,750	9	9
Lead	<1	7	4	4	9	2
Nickel	<1	31	2	9	9	4
Selenium	1	2	1	1	4	4
			USGS 17			
Aluminum	10	50	30	30	5	5
Arsenic	2	2	2	2	5	5
Chromium	1.8	2.4	1.9	2.0	9	9
Iron	30	460	80	130	9	9
Selenium	<1	1	1	1	5	4
			USGS 97			
Aluminum	<10	30	20	20	4	3
Arsenic	2	2	2	2	4	4
Barium	<100	100	100	100	4	3
Chromium	5.7	8.9	6.6	6.7	7	7
Copper	2	4	2.5	3	4	4
Iron	140	3,600	635	1,100	8	8
Lead	1	22	2	5	8	8
Nickel	<1	4	3	3	8	2
Selenium	2	3	2	2	4	4
Zinc	90	140	105	110	4	4

Table 6.—***Statistical parameters for selected total recoverable trace elements, by well***—*Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
			USGS 98			
Aluminum	<10	40	20	20	5	4
Arsenic	1	2	2	2	5	5
Chromium	5.6	6.7	6.0	8.7	9	9
Copper	1	6	4	4	5	5
Iron	90	2,700	430	940	9	9
Lead	8	15	9	10	9	9
Nickel	<1	2	1.5	2	9	2
Selenium	<1	1	1	1	5	4
Zinc	190	210	210	200	5	5
			USGS 99			
Arsenic	1	1	1	1	4	4
Barium	<100	100	100	100	4	3
Chromium	5.0	5.4	5.3	5.3	8	8
Copper	1	4	1	2	4	4
Iron	80	2,200	360	590	9	9
Lead	1	5	2	2	9	9
Nickel	1	6	1	2	9	9
Selenium	1	2	2	2	4	4
Zinc	90	100	95	100	4	4
			USGS 102			
Aluminum	<10	20	15	20	5	4
Arsenic	2	2	2	2	5	5
Barium	<100	100	100	100	5	3
Chromium	5.7	7.8	6.45	6.5	8	8
Copper	<1	2	2	2	5	2
Iron	30	12,000	450	1,700	9	9
Nickel	<1	3	2.5	2	9	2
Selenium	2	2	2	2	5	5

Table 6.—***Statistical parameters for selected total recoverable trace elements, by well***—*Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
			Water Supply INEL-1			
Aluminum	<10	30	20	20	4	3
Arsenic	<1	1	1	1	4	3
Chromium	7.5	9.9	8.7	8.7	9	9
Copper	1	4	3	3	4	4
Iron	160	5,700	510	1,600	9	9
Lead	<1	4	3.5	3	9	4
Manganese	<10	30	25	20	4	2
Selenium	1	2	2	2	4	4
Zinc	150	180	160	160	4	4

Table 7.—*Concentrations of dissolved and total nutrients and total organic carbon in water, Naval Reactors Facility and vicinity*

[Analyses were performed by the U.S. Geological Survey National Water Quality Laboratory. Analytical results are in milligrams per liter. Sample identifier: see figure 2 for well locations; QAS indicates quality-assurance sample, 39 is a blank sample, others are replicates. Date sampled: (m/d/y), month/day/year. Symbols: < indicates concentration is less than the specified laboratory reporting level. Abbreviation: NR indicates analysis not requested]

Sample identifier	Date sampled (m/d/y)	Ammonia (as nitrogen)	Ammonia plus organic nitrogen (as nitrogen) (total)	Nitrite (as nitrogen)	Nitrite plus nitrate (as nitrogen)	Ortho-phosphate (as phosphorus)	Phosphorus (as phosphorus) (total)	Total organic carbon
QAS-39	11/10/94	<0.01	NR	<0.01	<0.05	<0.01	NR	0.2
NRF-1	3/10/94	.02	NR	.01	1.9	.02	NR	.9
QAS-34	3/10/94	.03	NR	<.01	1.9	.02	NR	.4
NRF-1	6/15/94	<.01	NR	<.01	1.8	.02	NR	.9
	9/7/94	.02	NR	<.01	1.8	<.01	NR	1.1
	11/8/94	.01	NR	<.01	1.9	.02	NR	.6
	3/14/95	NR	<.2	<.01	1.8	NR	.03	.4
	6/8/95	NR	<.2	<.01	1.8	NR	.02	.5
	9/13/95	NR	<.2	<.01	1.9	NR	.02	2.5
	11/7/95	NR	<.2	<.01	1.8	NR	.05	1.7
NRF-2	3/10/94	.04	NR	<.01	2.1	.02	NR	.8
	6/15/94	<.01	NR	<.01	1.9	.02	NR	3.5
	9/7/94	.02	NR	<.01	1.8	.01	NR	1.2
	11/8/94	.02	NR	<.01	2.0	.02	NR	.6
	3/14/95	NR	<.2	<.01	1.9	NR	.02	2.1
	6/8/95	NR	<.2	<.01	1.9	NR	.02	.8

Table 7.—***Concentrations of dissolved and total nutrients and total organic carbon in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Ammonia (as nitrogen)	Ammonia plus organic nitrogen (as nitrogen) (total)	Nitrite (as nitrogen)	Nitrite plus nitrate (as nitrogen)	Ortho-phosphate (as phosphorus)	Phosphorus (as phosphorus) (total)	Total organic carbon
NRF-2	9/13/95	NR	<.2	<.01	2.1	NR	.02	1.5
	11/7/95	NR	<.2	<.01	2.0	NR	<.01	1.5
QAS-44	11/7/95	NR	<.2	<.01	2.3	NR	.07	.4
NRF-3	3/10/94	.03	NR	<.01	1.9	.02	NR	.7
	6/15/94	<.01	NR	<.01	1.8	.02	NR	1.4
	9/7/94	.02	NR	<.01	1.8	<.01	NR	1.3
	11/8/94	.02	NR	<.01	1.9	.02	NR	1.2
	3/14/95	NR	<.2	<.01	1.7	NR	.03	2.1
	6/8/95	NR	<.2	<.01	1.8	NR	.02	3.2
QAS-41	6/8/95	NR	<.2	<.01	1.8	NR	.02	3.4
NRF-3	9/13/95	NR	<.2	<.01	1.9	NR	.02	1.9
	11/7/95	NR	<.2	<.01	1.8	NR	.02	1.1
NRF-4	3/10/94	.03	NR	<.01	2.2	.03	NR	.5
	6/15/94	<.01	NR	<.01	2.0	.02	NR	1.3
	9/7/94	.02	NR	<.01	2.0	<.01	NR	1.6
	11/10/94	.01	NR	<.01	2.2	.02	NR	.6
	3/14/95	NR	<.2	<.01	2.0	NR	.03	.6
	6/8/95	NR	<.2	<.01	2.1	NR	.04	.6

Table 7.—*Concentrations of dissolved and total nutrients and total organic carbon in water, Naval Reactors Facility and vicinity*—*Continued*

Sample identifier	Date sampled (m/d/y)	Ammonia (as nitrogen)	Ammonia plus organic nitrogen (as nitrogen) (total)	Nitrite (as nitrogen)	Nitrite plus nitrate (as nitrogen)	Ortho-phosphate (as phosphorus)	Phosphorus (as phosphorus) (total)	Total organic carbon
NRF-4	9/13/95	NR	<.2	<.01	2.2	NR	.02	2.4
	11/7/95	NR	.2	<.01	2.0	NR	.05	.4
NRF-6	3/10/94	.04	NR	<.01	1.8	.07	NR	.7
	6/9/94	.01	NR	<.01	1.8	.07	NR	1.0
	12/21/94	<.015	NR	<.01	1.9	.09	NR	2.0
	3/16/95	NR	<.2	<.01	1.9	NR	.09	.2
QAS-40	3/16/95	NR	<.2	<.01	1.9	NR	.10	2.1
NRF-6	6/9/95	NR	<.2	<.01	1.9	NR	.08	.8
	9/13/95	NR	<.2	<.01	1.9	NR	.09	5.1
	11/7/95	NR	<.2	<.01	1.8	NR	.06	.7
NRF-7	3/15/94	.02	NR	<.01	.47	.01	NR	.2
	6/13/94	<.01	NR	<.01	.43	.01	NR	.1
QAS-36	6/13/94	<.01	NR	<.01	.45	<.01	NR	.2
NRF-7	9/12/94	<.01	NR	<.01	.46	<.01	NR	.1
	11/4/94	<.01	NR	<.01	.47	.01	NR	.1
	3/17/95	NR	<.2	<.01	.38	NR	<.01	.7
	6/9/95	NR	<.2	<.01	.45	NR	.01	.4
	9/14/95	NR	<.2	<.01	.50	NR	<.01	2.0

Table 7.—*Concentrations of dissolved and total nutrients and total organic carbon in water, Naval Reactors Facility and vicinity—Continued*

Sample identifier	Date sampled (m/d/y)	Ammonia (as nitrogen)	Ammonia plus organic nitrogen (as nitrogen) (total)	Nitrite (as nitrogen)	Nitrite plus nitrate (as nitrogen)	Ortho-phosphate (as phosphorus)	Phosphorus (as phosphorus) (total)	Total organic carbon
NRF-7	11/8/95	NR	<.2	<.01	.43	NR	.05	.3
USGS 12	3/11/94	.04	NR	<.01	2.2	.02	NR	.4
	6/10/94	.01	NR	<.01	2.1	.02	NR	.4
	9/9/94	.02	NR	<.01	2.0	.01	NR	.4
	10/27/94	.01	NR	<.01	2.0	.02	NR	.5
	3/20/95	NR	<.2	<.01	2.1	NR	<.01	.9
	6/14/95	NR	<.2	<.01	2.1	NR	.03	1.1
	9/12/95	NR	<.2	<.01	2.1	NR	.02	.4
	11/2/95	NR	<.2	<.01	2.0	NR	.07	.5
USGS 15	3/11/94	.03	NR	<.01	.34	<.01	NR	.4
	6/10/94	.01	NR	<.01	1.4	.02	NR	1.4
	9/9/94	.02	NR	<.01	1.1	.01	NR	2.9
	11/7/94	<.01	NR	<.01	.35	.01	NR	.2
QAS-38	11/7/94	.01	NR	<.01	.34	.02	NR	.2
USGS 15	3/20/95	NR	<.2	<.01	.26	NR	<.01	2.8
	6/14/95	NR	<.2	<.01	.38	NR	.02	.1
	9/12/95	NR	<.2	<.01	1.2	NR	.02	3.6
	11/2/95	NR	<.2	<.01	.57	NR	.01	.3

Table 7.—*Concentrations of dissolved and total nutrients and total organic carbon in water, Naval Reactors Facility and vicinity—Continued*

Sample identifier	Date sampled (m/d/y)	Ammonia (as nitrogen)	Ammonia plus organic nitrogen (as nitrogen) (total)	Nitrite (as nitrogen)	Nitrite plus nitrate (as nitrogen)	Ortho-phosphate (as phosphorus)	Phosphorus (as phosphorus) (total)	Total organic carbon
USGS 17	3/10/94	.03	NR	<.01	.39	.02	NR	.3
	6/15/94	.01	NR	<.01	.31	.02	NR	.1
	9/7/94	.02	NR	<.01	.25	<.01	NR	.6
	10/27/94	.02	NR	<.01	.31	.02	NR	.7
	3/16/95	NR	<.2	<.01	2.0	NR	.02	.2
	6/13/95	NR	<.2	<.01	.33	NR	.03	.3
	9/11/95	NR	<.2	<.01	.41	NR	<.01	2.3
	11/7/95	NR	<.2	<.01	.31	NR	.03	1.0
QAS-45	11/7/95	NR	<.2	<.01	.33	NR	.06	.2
USGS 97	3/14/94	.04	NR	<.01	2.0	.02	NR	.5
	6/9/94	.01	NR	<.01	2.0	.03	NR	.6
	9/8/94	.02	NR	<.01	2.0	.02	NR	.4
	11/10/94	<.01	NR	<.01	2.0	.02	NR	.4
	3/16/95	NR	<.2	<.01	.33	NR	<.01	.8
	6/13/95	NR	<.2	<.01	2.0	NR	.03	.5
	9/11/95	NR	<.2	<.01	2.1	NR	.01	1.3
	11/6/95	NR	<.2	<.01	1.9	NR	.03	.5
USGS 98	3/14/94	.04	NR	<.01	1.1	.01	NR	.4

Table 7.—*Concentrations of dissolved and total nutrients and total organic carbon in water, Naval Reactors Facility and vicinity—Continued*

Sample identifier	Date sampled (m/d/y)	Ammonia (as nitrogen)	Ammonia plus organic nitrogen (as nitrogen) (total)	Nitrite (as nitrogen)	Nitrite plus nitrate (as nitrogen)	Ortho-phosphate (as phosphorus)	Phosphorus (as phosphorus) (total)	Total organic carbon
USGS 98	6/9/94	.01	NR	<.01	1.1	.02	NR	.2
	9/8/94	.02	NR	<.01	1.0	.01	NR	.9
	11/9/94	.02	NR	<.01	1.1	.02	NR	.2
	3/15/95	NR	<.2	<.01	1.0	NR	<.01	.2
	6/12/95	NR	<.2	<.01	1.0	NR	.03	.3
QAS-42	6/12/95	NR	<.2	<.01	1.0	NR	.04	.2
USGS 98	9/11/95	NR	<.2	<.01	1.2	NR	.04	.6
	11/6/95	NR	<.2	<.01	1.1	NR	.05	1.1
USGS 99	3/14/94	.04	NR	<.01	1.6	.02	NR	.6
	6/9/94	.01	NR	<.01	1.6	.02	NR	1.5
	9/7/94	.02	NR	<.01	1.4	<.01	NR	.6
QAS-37	9/7/94	.02	NR	<.01	1.4	<.01	NR	1.2
USGS 99	11/9/94	<.01	NR	<.01	1.6	.02	NR	.6
	3/15/95	NR	<.2	<.01	1.6	NR	.02	.7
	6/12/95	NR	<.2	<.01	1.5	NR	.03	.5
	9/11/95	NR	<.2	<.01	1.6	NR	.02	3.8
	11/6/95	NR	<.2	<.01	1.5	NR	.06	1.0
USGS 102	3/10/94	.03	NR	<.01	2.0	.02	NR	1.1

Table 7.—***Concentrations of dissolved and total nutrients and total organic carbon in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Ammonia (as nitrogen)	Ammonia plus organic nitrogen (as nitrogen) (total)	Nitrite (as nitrogen)	Nitrite plus nitrate (as nitrogen)	Ortho-phosphate (as phosphorus)	Phosphorus (as phosphorus) (total)	Total organic carbon
USGS 102	6/9/94	<.01	NR	<.01	2.0	.02	NR	.8
	9/8/94	.01	NR	<.01	1.9	.01	NR	1.4
	11/8/94	<.01	NR	<.01	1.9	.02	NR	.4
	3/16/95	NR	<.2	<.01	1.8	NR	<.01	.9
	6/13/95	NR	<.2	<.01	1.9	NR	.03	.6
	9/13/95	NR	<.2	<.01	2.0	NR	.03	4.6
QAS-43	9/13/95	NR	<.2	<.01	1.9	NR	<.01	6.1
	11/7/95	NR	<.2	<.01	1.9	NR	.04	.4
Water Supply INEL-1	3/14/94	.04	NR	<.01	3.6	.02	NR	3.5
	6/9/94	.01	NR	<.01	1.4	.02	NR	.7
QAS-35	6/9/94	.02	NR	<.01	3.8	.01	NR	.5
Water Supply INEL-1	9/8/94	.02	NR	<.01	4.3	<.01	NR	.6
	11/9/94	.02	NR	<.01	4.2	.01	NR	.7
	3/15/95	NR	<.2	<.01	3.6	NR	.02	.6
	6/12/95	NR	<.2	<.01	3.4	NR	.04	1.1
	9/11/95	NR	<.2	<.01	3.2	NR	.02	.6
	11/6/95	NR	<.2	<.01	3.1	NR	.05	.8

Table 8.—***Statistical parameters for dissolved and total nutrients and total organic carbon, by well***

[See figure 2 for well locations. Units are milligrams per liter. Dissolved constituents unless otherwise indicated. Symbol: < indicates concentration is less than the specified laboratory reporting level. Values are derived from table 7. Quality-assurance replicates are included in the calculation of statistical parameters. Mean and median sample size: includes all samples with concentrations greater than laboratory reporting level. Abbreviation: ID, indicates indeterminate on the basis of analytical data]

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
				NRF-1		
Ammonia (as nitrogen)	<0.01	0.03	0.02	0.02	5	4
Nitrite plus nitrate (as nitrogen)	1.8	1.9	1.8	1.8	9	9
Orthophosphate (as phosphorus)	<.01	.02	.02	.02	5	4
Total phosphorus (as phosphorus)	.02	.05	.025	.03	4	4
Total organic carbon	.4	2.5	.9	1.1	9	9
				NRF-2		
Ammonia (as nitrogen)	<.01	.04	.02	.03	4	3
Nitrite plus nitrate (as nitrogen)	1.8	2.3	2.0	2.0	9	9
Orthophosphate (as phosphorus)	.01	.02	.02	.02	4	4
Total phosphorus (as phosphorus)	<.01	.07	.02	.03	5	4
Total organic carbon	.4	3.5	1.2	1.4	9	9
				NRF-3		
Ammonia (as nitrogen)	<.01	.03	.02	.02	4	3
Nitrite plus nitrate (as nitrogen)	1.7	1.9	1.8	1.8	9	9
Orthophosphate (as phosphorus)	<.01	.02	.02	.02	4	3
Total phosphorus (as phosphorus)	.02	.03	.02	.02	5	5
Total organic carbon	.7	3.4	1.4	1.8	9	9

Table 8.—***Statistical parameters for dissolved and total nutrients and total organic carbon, by well***—*Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
				NRF-4		
Ammonia (as nitrogen)	<.01	.03	.02	.02	4	3
Nitrite plus nitrate (as nitrogen)	2.0	2.2	2.05	2.1	8	8
Orthophosphate (as phosphorus)	<.01	.03	.02	.02	4	3
Total phosphorus (as phosphorus)	.02	.05	.035	.04	4	4
Total organic carbon	.4	2.4	.6	1.0	8	8
				NRF-6		
Ammonia (as nitrogen)	ID	.04	.025	.02	3	2
Nitrite plus nitrate (as nitrogen)	1.8	1.9	1.9	1.9	8	8
Orthophosphate (as phosphorus)	.07	.09	.07	.08	3	3
Total phosphorus (as phosphorus)	.06	.10	.09	.08	5	5
Total organic carbon	.2	5.1	.9	1.6	8	8
				NRF-7		
Nitrite plus nitrate (as nitrogen)	.38	.50	.45	.45	9	9
Orthophosphate (as phosphorus)	<.01	.01	.01	.01	5	3
Total phosphorus (as phosphorus)	<.01	.05	.03	.03	4	2
Total organic carbon	.1	2.0	.2	.5	9	9
				USGS 12		
Ammonia (as nitrogen)	.01	.04	.015	.02	4	4
Nitrite plus nitrate (as nitrogen)	2.0	2.2	2.1	2.1	8	8
Orthophosphate (as phosphorus)	.01	.02	.02	.02	4	4
Total phosphorus (as phosphorus)	<.01	.07	.03	.04	4	3
Total organic carbon	.4	1.1	.45	.6	8	8

Table 8.—***Statistical parameters for dissolved and total nutrients and total organic carbon, by well***—*Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
				USGS 15		
Ammonia (as nitrogen)	<.01	.03	.015	.02	5	4
Nitrite plus nitrate (as nitrogen)	.26	1.4	.38	.66	9	9
Orthophosphate (as phosphorus)	<.01	.02	.015	.02	5	4
Total phosphorus (as phosphorus)	<.01	.02	.02	.02	4	3
Total organic carbon	.1	3.6	.4	1.3	9	9
				USGS 17		
Ammonia (as nitrogen)	.01	.03	.02	.02	4	4
Nitrite plus nitrate (as nitrogen)	.25	2.0	.33	.52	9	9
Orthophosphate (as phosphorus)	<.01	.02	.02	.02	4	3
Total phosphorus (as phosphorus)	<.01	.06	.03	.04	5	4
Total organic carbon	.1	2.3	.3	.6	9	9
				USGS 97		
Ammonia (as nitrogen)	<.01	.04	.02	.02	4	3
Nitrite plus nitrate (as nitrogen)	.33	2.1	2.0	1.8	8	8
Orthophosphate (as phosphorus)	.02	.03	.02	.02	4	4
Total phosphorus (as phosphorus)	<.01	.03	.03	.02	4	3
Total organic carbon	.4	1.3	.5	.6	8	8
				USGS 98		
Ammonia (as nitrogen)	.01	.04	.02	.02	4	4
Nitrite plus nitrate (as nitrogen)	1.0	1.2	1.1	1.1	9	9
Orthophosphate (as phosphorus)	.01	.02	.015	.02	4	4

Table 8.—***Statistical parameters for dissolved and total nutrients and total organic carbon, by well***—*Continued*

Constituent	Statistical parameter					
	Minimum	Maximum	Median	Mean	Sample size	Mean and median sample size
				USGS 98 - cont.		
Total phosphorus (as phosphorus)	<.01	.05	.04	.04	5	4
Total organic carbon	.2	1.1	.3	.5	9	9
				USGS 99		
Ammonia (as nitrogen)	<.01	.04	.02	.02	5	4
Nitrite plus nitrate (as nitrogen)	1.4	1.6	1.6	1.5	9	9
Orthophosphate (as phosphorus)	<.01	.02	.02	.02	5	3
Total phosphorus (as phosphorus)	.02	.06	.025	.03	4	4
Total organic carbon	.5	3.8	.7	1.2	9	9
				USGS 102		
Ammonia (as nitrogen)	<.01	.03	.02	.02	4	2
Nitrite plus nitrate (as nitrogen)	1.8	2.0	1.9	1.9	9	9
Orthophosphate (as phosphorus)	.01	.02	.02	.02	4	4
Total phosphorus (as phosphorus)	<.01	.04	.03	.03	5	3
Total organic carbon	.4	6.1	.9	1.8	9	9
				Water Supply INEL-1		
Ammonia (as nitrogen)	.01	.04	.02	.02	5	5
Nitrite plus nitrate (as nitrogen)	1.4	4.3	3.6	3.4	9	9
Orthophosphate (as phosphorus)	<.01	.02	.015	.02	5	4
Total phosphorus (as phosphorus)	.02	.05	.03	.03	4	4
Total organic carbon	.5	3.5	.7	1.0	9	9

Table 9.—***Concentrations of gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium in water, Naval Reactors Facility and vicinity***

[Analyses were performed by the U.S. Geological Survey National Water Quality Laboratory using a residue procedure for gross alpha- and beta-particle radioactivity and liquid scintillation for tritium. Analytical results and uncertainties—for example, **1.05±0.287**—in indicated units. Analytical uncertainties are reported as 1s. Concentrations that meet or exceed the reporting level of 3 times the 1s value are shown in boldface type. Sample identifier: see figure 2 for well locations; QAS indicates quality-assurance samples, 39 is a blank sample, others are replicates. Date sampled: (m/d/y), month/day/year. Abbreviations: µg/L, microgram per liter; pCi/L, picocurie per liter; Sr-90/Y-90, strontium-90 in equilibrium with yttrium-90; NR indicates analysis not requested; SL indicates sample lost]

Sample identifier	Date sampled (m/d/y)	Gross alpha-particle radioactivity		Gross beta-particle radioactivity		Tritium (pCi/L)
		as Uranium (µg/L)	as Thorium-230 (pCi/L)	as Sr-90/Y-90 (pCi/L)	as Cesium-137 (pCi/L)	
QAS-39	11/10/94	**1.05±0.287**	**1.16±0.316**	**3.10±0.90**	**1.93±0.50**	**48±12.8**
NRF-1	3/10/94	**4.95±1.24**	**3.48±0.88**	**2.99±0.438**	**4.02±0.59**	NR
QAS-34	3/10/94	**4.54±1.30**	**2.91±0.84**	**2.73±0.398**	**3.63±0.53**	NR
NRF-1	6/15/94	**3.47±1.12**	**2.58±0.83**	**2.59±0.467**	**3.60±0.70**	NR
	9/7/94	**4.57±1.26**	**3.17±0.87**	**2.60±0.400**	**3.51±0.54**	**92.8±16**
	11/8/94	6.81±2.92	4.04±1.72	5.48±1.91	8.26±2.96	**96±16**
	3/14/95	6.76±2.26	**3.99±1.31**	3.55±1.68	5.37±2.58	**60.8±12.8**
	6/8/95	5.35±2.16	3.59±1.44	**5.10±0.79**	**10.7±1.99**	SL
	9/13/95	**3.84±1.13**	**2.69±0.78**	**2.23±0.396**	**2.92±0.52**	**67.2±12.8**
	11/7/95	2.88±0.98	2.08±0.70	**3.22±0.440**	**4.31±0.59**	**51.2±12.8**
NRF-2	3/10/94	**6.59±1.50**	**5.08±1.16**	**2.80±0.444**	**3.75±0.60**	NR
	6/15/94	**6.59±1.52**	**5.08±1.16**	**2.96±0.476**	**3.94±0.64**	NR
	9/7/94	**4.92±1.24**	**3.66±0.92**	**3.52±0.458**	**4.72±0.62**	**83.2±12.8**
	11/8/94	4.95±3.10	4.05±2.54	4.18±3.52	5.24±4.44	**76.8±12.8**
	3/14/95	**10.0±3.13**	**8.14±2.52**	3.75±2.00	5.53±2.98	**44.8±12.8**
	6/8/95	3.64±2.30	2.12±1.34	**4.87±0.94**	**10.7±2.34**	**83.2±12.8**

Table 9.—***Concentrations of gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Gross alpha-particle radioactivity		Gross beta-particle radioactivity		Tritium (pCi/L)
		as Uranium (µg/L)	as Thorium-230 (pCi/L)	as Sr-90/Y-90 (pCi/L)	as Cesium-137 (pCi/L)	
NRF-2	9/13/95	**5.95±1.44**	**3.80±0.92**	**3.63±0.458**	**3.99±0.60**	**38.4±12.8**
	11/7/95	**5.44±1.33**	**3.77±0.92**	**3.17±0.498**	**4.21±0.66**	**64.0±12.8**
QAS-44	11/7/95	**5.37±1.50**	**3.44±0.96**	**3.43±0.74**	**4.71±0.78**	**51.2±12.8**
NRF-3	3/10/94	**4.38±1.14**	**3.16±0.82**	**3.11±0.455**	**4.13±0.60**	NR
	6/15/94	**3.91±1.17**	**2.82±0.84**	**3.00±0.474**	**3.99±0.63**	NR
	9/7/94	**3.83±1.05**	**2.77±0.76**	**2.52±0.398**	**3.34±0.53**	**70.4±12.8**
	11/8/94	9.08±3.30	5.83±2.09	2.54±2.16	3.67±3.13	**99.2±12.8**
	3/14/95	**10.7±2.70**	**6.57±1.61**	3.71±1.68	5.49±2.53	**76.8±12.8**
	6/8/95	**13.1±3.02**	**9.08±2.04**	**5.17±0.69**	**11.8±2.04**	**92.8±12.8**
QAS-41	6/8/95	3.40±2.14	2.06±1.30	1.65±1.54	2.46±2.30	**64.0±12.8**
NRF-3	9/13/95	**3.59±1.04**	**2.59±0.74**	**2.22±0.425**	**2.93±0.56**	**73.6±12.8**
	11/7/95	2.86±1.00	**2.19±0.76**	**2.48±0.408**	**3.27±0.54**	**38.4±12.8**
NRF-4	3/10/94	**5.95±1.46**	**4.21±1.03**	**2.72±0.457**	**3.55±0.60**	NR
	6/15/94	3.45±1.22	2.49±0.88	**3.17±0.481**	**4.24±0.64**	NR
	9/7/94	**5.85±1.39**	**4.33±1.02**	**3.33±0.450**	**4.49±0.60**	**105.6±12.8**
	11/10/94	**13.0±3.83**	**8.57±2.52**	**9.37±2.61**	**11.1±3.10**	**137.6±16**
	3/14/95	4.17±3.12	2.88±2.15	2.77±1.40	4.94±2.54	**80±12.8**
	6/8/95	**15.3±3.58**	**9.70±2.20**	**5.35±0.80**	**12.1±2.23**	SL
	9/13/95	**4.13±1.23**	**3.19±0.94**	**3.42±0.487**	**4.56±0.65**	**67.2±12.8**

Table 9.—*Concentrations of gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium in water, Naval Reactors Facility and vicinity*—*Continued*

Sample identifier	Date sampled (m/d/y)	Gross alpha-particle radioactivity		Gross beta-particle radioactivity		Tritium (pCi/L)
		as Uranium (µg/L)	as Thorium-230 (pCi/L)	as Sr-90/Y-90 (pCi/L)	as Cesium-137 (pCi/L)	
NRF-4	11/7/95	**3.02±0.98**	**2.32±0.74**	**3.52±0.50**	**4.86±0.77**	**57.6±12.8**
NRF-6	3/10/94	7.27±2.68	5.17±1.90	**4.97±0.84**	**6.66±1.12**	NR
	6/9/94	7.25±2.60	5.24±1.87	**5.67±0.92**	**7.60±1.22**	NR
	12/21/94	12.4±5.25	7.31±3.07	**11.6±3.52**	**16.7±5.25**	**105.6±9.6**
	3/16/95	4.96±6.10	2.94±3.61	2.94±2.24	6.21±4.77	**124.8±12.8**
QAS-40	3/16/95	**24.1±6.20**	**14.9±3.75**	**5.97±1.72**	**12.3±3.78**	**80±16**
NRF-6	6/9/95	-2.27±3.30	-1.33±1.94	3.19±1.65	6.94±3.66	**96.0±12.8**
	9/13/95	1.50±1.71	1.05±1.20	**5.81±0.94**	**7.76±1.25**	**54.4±12.8**
	11/7/95	5.67±2.60	4.01±1.84	**5.82±0.94**	**7.70±1.24**	**60.8±12.8**
NRF-7	3/15/94	**2.15±0.62**	**1.52±0.434**	**2.82±0.368**	**3.72±0.56**	NR
	6/13/94	1.78±0.62	1.14±0.398	**2.96±0.380**	**3.89±0.58**	NR
QAS-36	6/13/94	**2.43±0.69**	**1.88±0.53**	**2.60±0.364**	**3.38±0.54**	NR
NRF-7	9/12/94	**2.62±0.66**	**1.85±0.468**	**2.78±0.465**	**3.61±0.56**	3.2±12.8
	11/4/94	**8.38±1.74**	**5.41±1.12**	**6.89±1.04**	**8.22±1.24**	-16±12.8
	3/17/95	**3.35±1.04**	**2.35±0.72**	**5.56±0.80**	**7.61±1.26**	-9.6±12.8
	6/9/95	**3.79±1.26**	**2.55±0.84**	**4.60±0.88**	**6.46±1.34**	-16.0±12.8
	9/14/95	**1.93±0.60**	**1.24±0.388**	**3.24±0.50**	**4.13±0.60**	-6.4±12.8
	11/8/95	**2.58±0.72**	**1.84±0.51**	**2.80±0.360**	**3.30±0.423**	9.6±12.8

Table 9.—***Concentrations of gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Gross alpha-particle radioactivity		Gross beta-particle radioactivity		Tritium (pCi/L)
		as Uranium (µg/L)	as Thorium-230 (pCi/L)	as Sr-90/Y-90 (pCi/L)	as Cesium-137 (pCi/L)	
USGS 12	3/11/94	**4.37±1.15**	**3.25±0.85**	**2.16±0.375**	**2.85±0.495**	NR
	6/10/94	**4.74±1.24**	**3.33±0.87**	**2.63±0.433**	**3.49±0.58**	NR
	9/9/94	**4.33±1.08**	**3.21±0.80**	**2.62±0.410**	**3.52±0.55**	32±16
	10/27/94	5.52±2.39	4.13±1.78	3.54±1.37	5.73±2.28	**86.4±12.8**
	3/20/95	2.74±2.75	1.85±1.86	1.57±2.34	2.19±3.28	**150.4±12.8**
	6/14/95	5.44±2.58	2.63±1.23	**3.66±1.10**	**6.20±1.95**	**64.0±12.8**
	9/12/95	**3.32±0.98**	**2.56±0.76**	**3.22±0.458**	**4.24±0.60**	35.2±12.8
	11/2/95	**4.68±1.30**	**2.99±0.84**	**3.58±0.50**	**4.92±0.78**	**38.4±12.8**
USGS 15	3/11/94	**3.22±0.74**	**2.48±0.57**	**2.10±0.332**	**2.81±0.50**	NR
	6/10/94	2.52 0.88	1.87±0.66	**2.05±0.352**	**2.73±0.470**	NR
	9/9/94	**3.86±0.92**	**2.79±0.66**	**1.92±0.336**	**2.53±0.442**	38.4±16
	11/7/94	**6.70±1.76**	**4.55±1.19**	1.50±0.73	1.89±0.92	-16±12.8
QAS-38	11/7/94	4.55±1.58	2.92±1.00	**3.98±0.64**	**7.91±1.50**	35.2±16
USGS 15	3/20/95	1.17±1.44	.788±0.96	**2.65±0.70**	**4.87±1.36**	0±9.6
	6/14/95	**5.09±1.66**	**4.22±1.36**	**2.15±0.381**	**4.64±0.96**	-3.2±12.8
	9/12/95	2.32±0.82	1.72±0.60	**1.87±0.336**	**2.47±0.442**	35.2±12.8
	11/2/95	**2.50±0.74**	**1.78±0.53**	**1.70±0.378**	**2.28±0.454**	-3.2±12.8
USGS 17	3/10/94	**3.37±0.76**	**2.37±0.54**	**2.76±0.494**	**3.67±0.56**	NR
.	6/15/94	**2.91±0.80**	**1.86±0.52**	**2.31±0.452**	**3.09±0.52**	NR

Table 9.—*Concentrations of gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium in water, Naval Reactors Facility and vicinity*—*Continued*

Sample identifier	Date sampled (m/d/y)	Gross alpha-particle radioactivity		Gross beta-particle radioactivity		Tritium (pCi/L)
		as Uranium (µg/L)	as Thorium-230 (pCi/L)	as Sr-90/Y-90 (pCi/L)	as Cesium-137 (pCi/L)	
USGS 17	9/7/94	**2.67±0.71**	**2.05±0.54**	**2.79±0.384**	**3.57±0.491**	**51.2±12.8**
	10/27/94	4.04±1.46	3.02±1.08	**2.54±0.71**	**4.28±1.26**	**57.6±12.8**
	3/16/95	3.11±1.29	1.89±0.78	**2.93±0.83**	**4.36±1.29**	**86.4±12.8**
	6/13/95	1.87±1.17	1.60±1.00	**5.29±1.63**	**6.47±2.06**	**54.4±12.8**
	9/11/95	**2.44±0.72**	**1.74±0.52**	**2.39±0.340**	**3.18±0.51**	**54.4±12.8**
	11/7/95	**2.34±0.68**	**1.66±0.478**	**2.50±0.346**	**3.26±0.53**	**38.4±12.8**
QAS-45	11/7/95	**2.48±0.60**	**1.78±0.428**	**2.67±0.356**	**3.50±0.54**	**54.4±12.8**
USGS 97	3/14/94	**5.31±1.28**	**3.77±0.91**	**2.39±0.394**	**3.20±0.53**	NR
	6/9/94	**4.90±1.24**	**3.78±0.96**	**2.89±0.454**	**3.78±0.60**	NR
	9/8/94	**5.47±1.35**	**3.91±0.96**	**2.89±0.420**	**3.89±0.56**	**92.8±16**
	11/10/94	8.60±3.46	7.84±3.14	6.66±2.50	9.03±3.46	**105.6±16**
	3/16/95	2.58±1.71	1.65±1.09	**4.15±1.32**	**6.00±1.98**	**70.4±16**
	6/13/95	**9.91±3.16**	**4.86±1.50**	**4.00±1.11**	**6.72±1.96**	**60.8±12.8**
	9/11/95	2.82±0.96	1.98±0.67	**3.18±0.463**	**4.16±0.60**	**80.0±12.8**
	11/6/95	**3.79±1.16**	**2.43±0.75**	**2.40±0.389**	**3.17±0.52**	35.2±12.8
USGS 98	3/14/94	**3.10±0.78**	**2.24±0.56**	**2.39±0.366**	**3.28±0.56**	NR
	6/9/94	**4.27±1.08**	**3.04±0.77**	**2.11±0.349**	**2.93±0.54**	NR
	9/8/94	**3.24±0.94**	**2.27±0.66**	**2.84±0.396**	**3.75±0.52**	**51.2±16**
	11/9/94	4.08±1.57	2.88±1.10	1.25±1.69	1.71±2.31	9.6±9.6

Table 9.—***Concentrations of gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Gross alpha-particle radioactivity		Gross beta-particle radioactivity		Tritium (pCi/L)
		as Uranium (µg/L)	as Thorium-230 (pCi/L)	as Sr-90/Y-90 (pCi/L)	as Cesium-137 (pCi/L)	
USGS 98	3/15/95	-.199±1.04	-.152±0.80	.687±1.46	.897±1.91	**38.4±12.8**
	6/12/95	3.50±1.64	2.18±1.02	**3.47±1.08**	**5.09±1.64**	9.6±12.8
QAS-42	6/12/95	2.83±1.59	1.73±0.96	1.85±1.02	2.75±1.54	22.4±12.8
USGS 98	9/11/95	**3.25±0.84**	**2.25±0.58**	**1.68±0.335**	**2.31±0.489**	25.6±12.8
	11/6/95	2.05±0.76	1.46±0.54	**2.08±0.420**	**2.78±0.492**	0.0±12.8
USGS 99	3/14/94	**5.38±1.23**	**4.14±0.94**	**1.86±0.351**	**2.45±0.462**	NR
	6/9/94	**3.44±1.06**	**2.20±0.68**	**2.24±0.389**	**3.00±0.52**	NR
	9/7/94	**3.50±1.02**	**2.59±0.76**	**2.12±0.365**	**2.81±0.484**	32±12.8
QAS-37	9/7/94	**4.70±1.21**	**3.01±0.78**	**2.20±0.372**	**2.95±0.497**	**86.4±12.8**
USGS 99	11/9/94	**10.6±3.22**	**7.15±2.17**	**8.18±2.34**	**9.65±2.76**	**38.4±12.8**
	3/15/95	**6.80±2.13**	**5.27±1.64**	3.44±1.29	5.40±2.08	**38.4±12.8**
	6/12/95	3.99±2.04	2.15±1.10	2.48±1.06	3.94±1.71	35.2±12.8
	9/11/95	3.29±1.14	2.10±0.72	**1.88±0.378**	**2.45±0.493**	**44.8±12.8**
	11/6/95	.695±0.438	.501±0.316	**1.85±0.334**	**2.45±0.442**	-3.2±12.8
USGS 102	3/10/94	**6.36±1.39**	**4.90±1.06**	**2.41±0.390**	**3.24±0.52**	NR
	6/9/94	2.83±1.09	2.02±0.78	**2.88±0.488**	**3.81±0.64**	NR
	9/8/94	**5.49±1.30**	**4.23±1.00**	**2.80±0.414**	**3.72±0.55**	**70.4±16**
	11/8/94	**10.5±3.45**	**8.64±2.82**	**5.77±1.82**	**8.51±2.77**	**83.2±16**
	3/16/95	4.78±2.90	3.10±1.87	3.22±1.16	6.13±2.28	**60.8±9.6**

Table 9.—***Concentrations of gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium in water, Naval Reactors Facility and vicinity***—*Continued*

Sample identifier	Date sampled (m/d/y)	Gross alpha-particle radioactivity		Gross beta-particle radioactivity		Tritium (pCi/L)
		as Uranium (µg/L)	as Thorium-230 (pCi/L)	as Sr-90/Y-90 (pCi/L)	as Cesium-137 (pCi/L)	
USGS 102	6/13/95	5.40±2.38	2.78±1.21	3.17±1.08	5.18±1.82	**48.0±12.8**
	9/13/95	**3.10±0.96**	**2.19±0.68**	**2.53±0.420**	**3.34±0.56**	35.2±12.8
QAS-43	9/13/95	2.19±0.84	1.58±0.61	**3.05±0.454**	**4.08±0.60**	**57.6±12.8**
USGS 102	11/7/95	**4.03±1.20**	**2.86±0.85**	**3.07±0.446**	**4.01±0.58**	32.0±12.8
Water Supply INEL-1	3/14/94	**3.07±0.98**	**2.22±0.70**	**3.49±0.464**	**4.64±0.62**	NR
	6/9/94	2.62±1.08	1.84±0.76	**2.76±0.438**	**3.65±0.58**	NR
QAS-35	6/9/94	2.29±1.04	1.62±0.73	**2.74±0.452**	**3.66±0.60**	NR
Water Supply INEL-1	9/8/94	3.23±1.11	2.26±0.78	**3.59±0.466**	**4.75±0.62**	**48±16**
	11/9/94	6.11±2.94	3.65±1.74	3.65±1.84	5.48±2.80	**67.2±12.8**
	3/15/95	3.06±2.02	1.74±1.14	.668±1.24	1.03±1.92	**67.2±12.8**
	6/12/95	6.66±2.54	4.15±1.56	3.17±1.58	4.65±2.36	32.0±12.8
	9/11/95	2.56±0.92	1.79±0.64	**3.24±0.489**	**4.29±0.64**	**38.4±12.8**
	11/6/95	**2.90±0.92**	**2.05±0.66**	**2.97±0.422**	**3.91±0.56**	**38.4±12.8**

Table 10.—***Statistical parameters for gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium, by well***

[See figure 2 for well locations. Gross alpha-particle radioactivity is expressed as uranium in micrograms per liter and as thorium-230 in picocuries per liter. All other units are picocuries per liter. Gross beta-particle radioactivity is expressed as strontium-90 in equilibrium with yttrium-90 and as cesium-137. Values are derived from table 9. Quality-assurance replicates are included in the calculation of statistical parameters. See section on calculation of estimated experimental standard error for the estimated uncertainty of the mean concentration. Abbreviation: Sr-90/Y-90, strontium-90 in equilibrium with yttrium-90]

Radioactivity or radionuclide	Statistical parameter				
	Minimum	Maximum	Median	Mean	Sample size
			NRF-1		
Uranium	2.88±0.98	6.81±2.92	4..57±1.26	4.80±0.452	9
Thorium-230	2.08±0.70	4.04±1.72	3.17±0.87	3.17±0.222	9
Sr-90/Y-90	2.23±0.396	5.48±1.91	2.99±0.438	3.39±0.383	9
Cesium-137	2.92±0.52	10.7±1.99	4.02±0.59	5.15±0.87	9
Tritium	51.2±12.8	96±16	67.2±12.8	73.6±8.88	5
			NRF-2		
Uranium	3.64±2.30	10.0±3.13	5.44±1.33	5.94±0.59	9
Thorium-230	2.12±1.34	8.14±2.52	3.80±0.92	4.35±0.56	9
Sr-90/Y-90	2.80±0.444	4.87±0.94	3.52±0.458	3.59±0.212	9
Cesium-137	3.75±0.60	10.7±2.34	4.71±0.78	5.20±0.72	9
Tritium	38.4±12.8	83.2±12.8	64.0±12.8	63.1±7.04	7
			NRF-3		
Uranium	2.86±1.00	13.1±3.02	3.91±1.17	6.09±1.27	9
Thorium-230	2.06±1.30	9.08±2.04	2.82±0.84	4.12±0.82	9
Sr-90/Y-90	1.65±1.54	5.17±0.69	2.54±2.16	2.93±0.340	9
Cesium-137	2.46±2.30	11.8±2.04	3.67±3.13	4.56±0.95	9
Tritium	38.4±12.8	99.2±12.8	73.6±12.8	73.6±7.52	7
			NRF-4		
Uranium	3.02±0.98	15.3±3.58	5.01±1.71	6.86±1.65	8
Thorium-230	2.32±0.74	9.70±2.20	3.70±0.70	4.71±1.00	8
Sr-90/Y-90	2.72±0.457	9.37±2.61	3.375±0.332	4.21±0.79	8
Cesium-137	3.55±0.60	12.1±2.23	4.71±0.50	6.23±1.19	8
Tritium	57.6±12.8	137.6±16	80±12.8	89.6±14.5	5

Table 10.—***Statistical parameters for gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium, by well***—*Continued*

Radioactivity or radionuclide	Statistical parameter				
	Minimum	Maximum	Median	Mean	Sample size
			NRF-6		
Uranium	-2.27±3.30	24.1±6.20	6.46±1.84	7.61±2.81	8
Thorium-230	-1.33±1.94	14.9±3.75	4.59±1.32	4.91±1.71	8
Sr-90/Y-90	2.94±2.24	11.6±3.52	5.74±0.66	5.75±0.94	8
Cesium-137	6.21±4.77	16.7±5.25	7.65±0.87	8.98±1.29	8
Tritium	54.4±12.8	124.8±12.8	88±10.2	86.9±11.0	6
			NRF-7		
Uranium	1.78±0.62	8.38±1.74	2.58±0.72	3.22±0.68	9
Thorium-230	1.14±0.398	5.41±1.12	1.85±0.468	2.20±0.430	9
Sr-90/Y-90	2.60±0.364	6.89±1.04	2.96±0.380	3.81±0.51	9
Cesium-137	3.30±0.423	8.22±1.24	3.89±0.58	4.92±0.65	9
Tritium	-16±12.8	9.6±12.8	-8.0±9.1	-5.9±4.25	6
			USGS 12		
Uranium	2.74±2.75	5.52±2.39	4.525±0.87	4.39±0.340	8
Thorium-230	1.85±1.86	4.13±1.78	3.10±0.58	2.99±0.237	8
Sr-90/Y-90	1.57±2.34	3.66±1.10	2.925±0.315	2.87±0.268	8
Cesium-137	2.19±3.28	6.20±1.95	3.88±0.407	4.14±0.494	8
Tritium	32±16	150.4±12.8	51.2±9.1	67.7±18.6	6
			USGS 15		
Uranium	1.17±1.44	6.70±1.76	3.22±0.74	3.55±0.56	9
Thorium-230	.788±0.96	4.55±1.19	2.48±0.57	2.57±0.405	9
Sr-90/Y-90	1.50±0.73	3.98±0.64	2.05±0.352	2.21±0.245	9
Cesium-137	1.89±0.92	7.91±1.50	2.73±0.470	3.57±0.64	9
Tritium	-16±12.8	38.4±16	0±9.6	12.3±8.68	7
			USGS 17		
Uranium	1.87±1.17	4.04±1.46	2.67±0.71	2.80±0.214	9
Thorium-230	1.60±1.00	3.02±1.08	1.86±0.52	2.00±0.149	9
Sr-90/Y-90	2.31±0.452	5.29±1.63	2.67±0.356	2.91±0.305	9
Cesium-137	3.09±0.52	6.47±2.06	3.57±0.491	3.93±0.351	9
Tritium	38.4±12.8	86.4±12.8	54.4±12.8	56.7±5.49	7

Table 10.—***Statistical parameters for gross alpha-particle radioactivity, gross beta-particle radioactivity, and tritium, by well***—*Continued*

Radioactivity or radionuclide	Statistical parameter				
	Minimum	Maximum	Median	Mean	Sample size
			USGS 97		
Uranium	2.58±1.71	9.91±3.16	5.105±0.89	5.42±0.93	8
Thorium-230	1.65±1.09	7.84±3.14	3.775±0.66	3.78±0.70	8
Sr-90/Y-90	2.39±0.394	6.66±2.50	3.035±0.324	3.57±0.498	8
Cesium-137	3.17±0.52	9.03±3.46	4.025±0.410	4.99±0.735	8
Tritium	35.2±12.8	105.6±16	75.2±10.2	74.1±10.1	6
			USGS 98		
Uranium	-.199±1.04	4.27±1.08	3.24±0.94	2.90±0.445	9
Thorium-230	-.152±0.80	3.04±0.77	2.24±0.56	1.99±0.313	9
Sr-90/Y-90	.687±1.46	3.47±1.08	2.08±0.420	2.04±0.275	9
Cesium-137	.897±1.91	5.09±1.64	2.78±0.492	2.83±0.399	9
Tritium	0.0±12.8	51.2±16	22.4±12.8	22.4±6.77	7
			USGS 99		
Uranium	.695±0.438	10.6±3.22	3.99±2.04	4.71±0.92	9
Thorium-230	.501±0.316	7.15±2.17	2.59±0.76	3.23±0.66	9
Sr-90/Y-90	1.85±0.334	8.18±2.34	2.20±0.372	2.92±0.68	9
Cesium-137	2.45±0.493	9.65±2.76	2.95±0.497	3.90±0.79	9
Tritium	-3.2±12.8	86.4±12.8	38.4±12.8	38.9±9.9	7
			USGS 102		
Uranium	2.19±0.84	10.5±3.45	4.78±2.90	4.96±0.83	9
Thorium-230	1.58±0.61	8.64±2.82	2.86±0.85	3.59±0.72	9
Sr-90/Y-90	2.41±0.390	5.77±1.82	3.05±0.454	3.21±0.333	9
Cesium-137	3.24±0.52	8.51±2.77	4.01±0.58	4.67±0.57	9
Tritium	32.0±12.8	83.2±16	57.6±12.8	55.3±6.97	7
			Water Supply INEL-1		
Uranium	2.29±1.04	6.66±2.54	3.06±2.02	3.61±0.54	9
Thorium-230	1.62±0.73	4.15±1.56	2.05±0.66	2.37±0.301	9
Sr-90/Y-90	.668±1.24	3.65±1.84	3.17±1.58	2.92±0.303	9
Cesium-137	1.03±1.92	5.48±2.80	4.29±0.64	4.01±0.421	9
Tritium	32.0±12.8	67.2±12.8	43.2±10.2	48.5±6.26	6