CONCENTRATIONS OF NINE TRACE METALS IN GROUND WATER AT THE IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO

by Larry J. Mann and LeRoy L. Knobel

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CONVERSION FACTORS

For readers who prefer to use International System units, rather than inch-pound terms, the following conversion factors may be used:

Multiply	By	To obtain
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
gallon (gal)	3.785	liter (L)
square mile (mi^2)	2.590	square kilometer (km^2)

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ABSTRACT

Reconnaissance-level sampling for nine trace metals in ground water was conducted at the Idaho National Engineering Laboratory during June to November 1987. Water samples from 81 wells that tap the Snake River Plain aquifer and that are equipped with dedicated pumps were collected and analyzed for arsenic, barium, beryllium, cadmium, chromium, lead, mercury, selenium and silver; one sample from a discontinuous perched-water zone was collected with a thief sampler and analyzed for beryllium. The ground-water samples were analyzed at the U.S. Geological Survey's National Water Quality Laboratory in Arvada, Colorado. Methods used to collect the water samples and quality assurance instituted for the sampling program are described in detail.

Except for beryllium and chromium, the concentration of the trace metals in water from the 82 wells were less than their respective maximum contaminant level for drinking water established by the U.S. Environmental Protection Agency. The maximum concentration of beryllium was 0.7 μg/L (micrograms per liter) which is near the reporting level; no maximum contaminant level has been established for beryllium. The chromium concentrations in water from wells that tap the Snake River Plain aquifer ranged from less than 1 to 280 μg/L. Water from 2 of the 81 wells contained 50 μg/L or more, which is the maximum contaminant level for chromium; in water from the 30 production wells, the largest chromium concentration was 20 μg/L.

INTRODUCTION

The INEL (Idaho National Engineering Laboratory) includes about 890 mi^2 of the eastern Snake River Plain in southeastern Idaho (fig. 1). The INEL was established in 1949 and is used by the U.S. Department of Energy to test different types of nuclear reactors. The INEL is one of the main centers in the United States for developing peacetime uses of atomic energy, and is a leading center for nuclear safety research, defense programs, nuclear-waste technology and development of advanced energy concepts.

During June to November 1987, a reconnaissance-level sampling program was conducted to document the concentration of nine trace metals--arsenic, barium, beryllium, cadmium, chromium, lead, mercury, selenium and silver--in ground water at the INEL. Water samples were collected from 30 production wells and 52 ground-water quality monitoring wells; 81 of these wells obtain water from the Snake River Plain aquifer and 1 is completed in a perched-water zone. Compounds containing trace metals such as chromium and mercury historically have been used as corrosion inhibitors, in the reprocessing of spent fuels, or at support facilities. Additionally, large quantities of

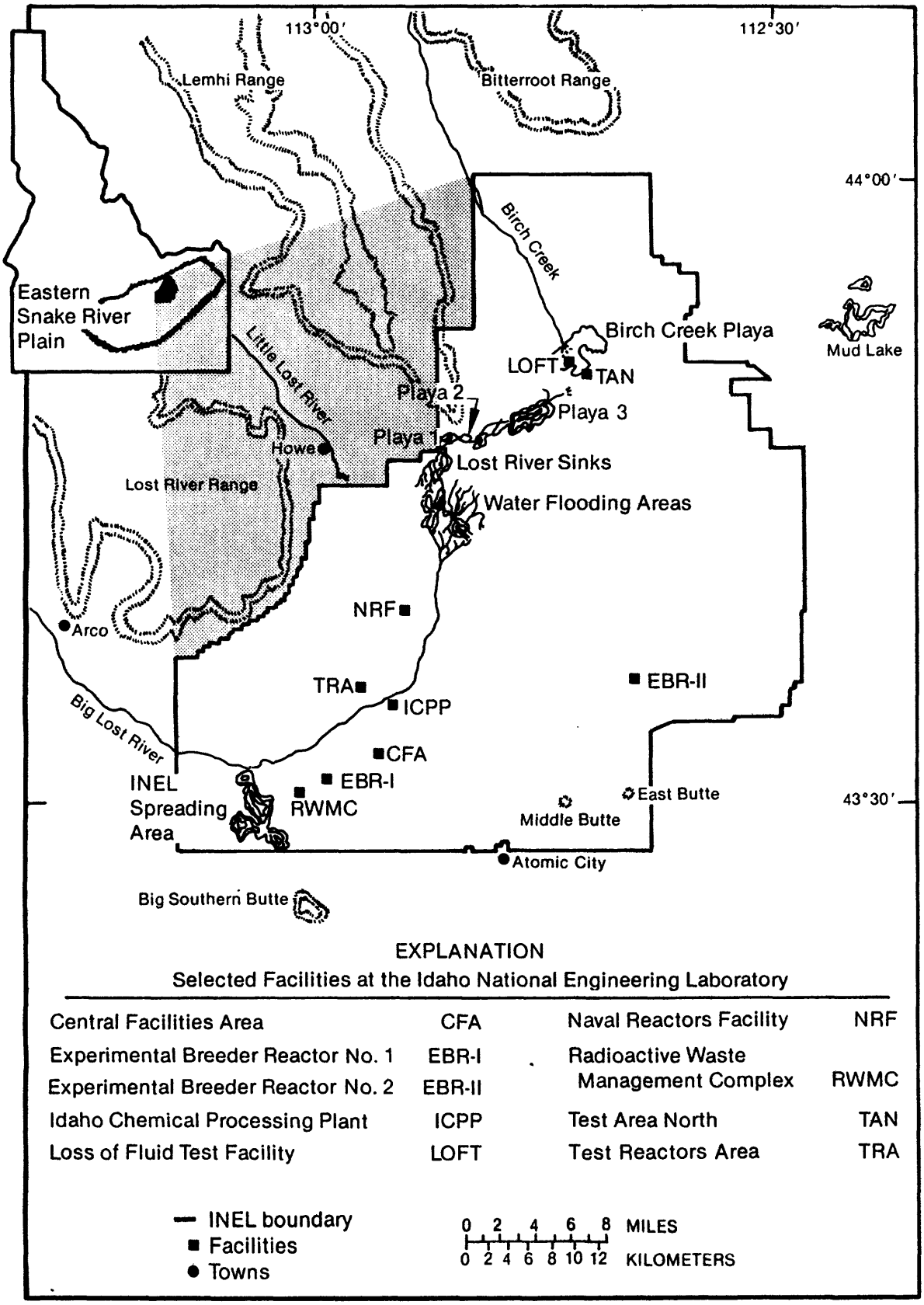

Figure 1.--Location of the Idaho National Engineering Laboratory and selected facilities.

lead are used to insulate workers and the environment from radiation associated with reactor operation. This report describes the methods used to collect the water samples and the quality assurance instituted for the sampling program, and summarizes the concentrations of the nine trace metals detected in the water samples. The sampling program was conducted by the U.S. Geological Survey in cooperation with the U.S. Department of Energy.

Geohydrologic Setting

The eastern Snake River Plain is a northeast trending structural basin about 200 mi long and 50 to 70 mi wide. The plain is underlain by a layered sequence of basaltic lava flows and cinder beds intercalated with alluvium and lakebed sedimentary deposits. Individual flows range from 10 to 50 ft in thickness, although the average thickness may be from 20 to 25 ft (Mundorff and others, 1964, p. 143). The sedimentary deposits consist mainly of lenticular beds of sand, silt, and clay with lesser amounts of gravel. Locally, rhyolitic lava flows and tuffs are exposed at the land surface or occur at depth. The basaltic lava flows and intercalated sedimentary deposits combine to form the Snake River Plain aquifer, which is the main source of ground water on the plain. The depth to water in the aquifer ranges from about 200 ft in the northern part of the INEL to more than 900 ft in the southern part.

The INEL obtains its entire water supply from the aquifer. From 1952 to 1983, aqueous chemical and radioactive wastes generated at the INEL were discharged to ponds and wells. Since 1983, most of the aqueous wastes have been discharged to unlined infiltration ponds. Many of the waste constituents enter the aquifer indirectly following percolation through the unsaturated zone; prior to 1984, much of the waste was injected directly into the aquifer using deep wells.

Previous Investigations

The U.S. Geological Survey has conducted geologic, hydrologic and water-quality investigations at the INEL since it was selected as a reactor testing area in 1949. Ground-water quality studies routinely include selected common ions, trace elements, and radionuclides. Selected trace metals--mainly chromium--in ground water were first investigated in the 1960's; results of the investigations are described by Robertson and others (1974), Barraclough and Jensen (1976), Barraclough and others (1982), and Lewis and Jensen (1985).

Acknowledgments

The authors gratefully acknowledge the many employees of the Department of Energy and its contractors at the INEL who aided in the sampling program. A large part of the administrative coordination was provided by T.F. Gesell and Isamu Aoki of the Department of Energy's Idaho Operations Office and by J.L. Clark and W.L. Bodily of EG&G Idaho, Inc., a Department of Energy contractor at the INEL. Special thanks are due to Messrs. A.C. Miskin and

R.E. Prine, and Ms. D.G. Avery of EG&G for their participation in collecting the samples and documenting field conditions.

METHODS AND QUALITY ASSURANCE

The methodology used in sampling for the nine trace metals generally followed the guidelines established by Wood (1981), Claassen (1982), and Feltz and others (1985). Methods used in the field and quality assurance practices are outlined in following sections.

Sample Containers and Preservatives

Sample containers and preservatives were supplied by the U.S. Geological Survey's National Water Quality Laboratory in Arvada, Colorado. Acid rinsed 500-mL polyethylene bottles were used to collect water samples for all of the nine trace metals except mercury. Mercury samples were collected in acid rinsed 250-mL glass bottles. After the bottles were filled with water, 2 mL of nitric acid were added to the polyethylene bottle and 10 mL of a nitric acid-potassium dichromate solution were added to the glass bottle to stabilize the trace metals.

Sampling Locations and Decontamination Procedures

Samples were collected at 82 locations as follows: 28 production wells equipped with sample delivery lines at the well head; 2 production wells equipped with water spigots, located downstream from pressure tanks; 51 ground-water quality monitoring wells equipped with dedicated submersible pumps; and 1 well completed in a perched-water zone that required the use of a thief sampling device. The 30 production wells are equipped with dedicated pumps and supply lines and did not require decontamination. To divert excess flow and facilitate sample collection, monitoring wells equipped with dedicated pumps were fitted with a portable discharge line about 2.5 ft long. The discharge line was 1.5 in. I.D. (inside diameter) galvanized-steel pipe equipped with a brass valve to control the flow rate. A galvanized T-joint was inserted into the line between the well head and the control valve and a series of galvanized pipes, a brass valve to control the flow rate of the sampling port, and galvanized connectors were attached to the T-joint to reduce the diameter so that a 9/32 in. I.D. stainless steel delivery pipe could be attached as a sampling point. The 9/32 in. I.D. stainless-steel pipe was bent 90 degrees to facilitate sample collection. All fittings and pipes were rinsed with deionized water before installation at the well head. Subsequent flushing by several hundred to thousands of gallons of water pumped from the well ensured that the portable discharge line was as clean of the nine trace metals as reasonably possible. The thief sampler used for sampling the well completed in the perched-water zone was washed with hot water and detergent and rinsed with deionized water prior to use. A detailed discussion of techniques used for obtaining samples from wells that represent aquifer water chemistry is presented by Claassen (1982).

Sample Collection

To ensure that water representative of the Snake River Plain aquifer was sampled, a volume of water equivalent to a minimum of three well-bore volumes was pumped from each well; at most wells, 5 to 10 well-bore volumes were pumped prior to collecting the samples. The diameter of the well bore, rather than the volume of the casing, was used to calculate the minimum volume because of the potentially large difference between the two. In addition, temperature, specific conductance, and pH were monitored during pumping, using methods described by Wood (1981). When these measurements stabilized, indicating probable hydraulic and chemical stability, a water sample was collected using the following protocol:

1. Field person responsible for collecting the water sample wore disposable vinyl gloves and stood upwind from the point of collection.

2. The outside of the sample delivery line was rinsed thoroughly with well water.

3. Two 4-liter polyethylene containers were thoroughly rinsed with water pumped from the well before being filled with water.

4. The 4-liter sample containers were taken into a mobile field laboratory consisting of a truck mounted camper; the field laboratory minimized the possibility of the sample being contaminated by particulate matter transported by the wind.

5. One sample container was used to rinse the exterior of an inert tubing intake for a peristaltic pump.

6. The tubing was then inserted into the second sample container and the peristaltic pump was started to rinse the interior of the tubing and a new 0.45 micron membrane filter contained in an acrylic filter holder.

7. After several volumes were pumped through the tubing and membrane filter, the acid rinsed bottles were filled with water and the preservatives added.

8. The bottles were then capped and the caps were sealed with laboratory film.

9. The water samples were stored in the field laboratory until they could be transferred to a secured storage area. After a sufficient number of samples were collected, they were transported to the National Water Quality Laboratory for analysis. They were transported in a sealed ice chest by overnight-delivery mail and usually were received by the laboratory within 15 days of collection.

Conditions at the well 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 laboratory. These records are

available for inspection at the U.S. Geological Survey Project Office at the INEL.

Quality Assurance

A detailed description of internal quality control and of the overall quality assurance practices used by the U.S. Geological Survey's National Water Quality Laboratory is provided in a report by Friedman and Erdmann (1982). Additional quality assurance instituted for this sampling program included: four blind replicates--duplicate samples with a different sample identification number that were sent to the laboratory; and two blank samples containing deionized water. Ground-water and quality-assurance samples were analyzed by the National Water Quality Laboratory using methods prescribed by Skougstad and others (1979), and Barnett and Mallory (1981).

The two blank samples prepared with deionized water contained 1 and 4 μg/L (micrograms per liter) of chromium. The remainder of the trace metals were less than their respective reporting levels; a reporting level is the lowest measured concentration of a constituent that may be reliably reported using a given analytical method (Feltz and others, 1985). The chromium may be a contaminant from the stainless-steel components of the demineralization system (D.R. Percival, Dept. of Energy, written commun., 1988). The differences in the chromium concentrations contained in the two blank samples may be related to the residence time of the water in the demineralizer.

The concentration of trace metals in the four replicate samples either had identical values or differed by 1 μg/L. All concentrations were identical except the barium concentration in the replicate sample from well 105 and the chromium concentration in the replicate sample from the NPR test well; these concentrations differed by 1 μg/L.

CONCENTRATIONS OF NINE TRACE METALS IN GROUND WATER

Eighty-one wells that tap the Snake River Plain aquifer at the INEL and that are equipped with dedicated submersible or turbine pumps were sampled for nine trace metals. Well 92, which taps a shallow, discontinuous perched-water zone at the Radioactive Waste Management Complex, was sampled for beryllium with a thief sampler. The nine trace metals for which analyses were performed, the maximum contaminant levels for drinking water as established by the U.S. Environmental Protection Agency (1983), and the reporting level of the National Water Quality Laboratory are shown on table 1. The locations of wells that were sampled are shown on figures 2 and 3. Concentrations of the nine trace metals in ground water are included in table 2 at the end of this report.

Table 1.--Trace metals for which analyses were performed on ground-water samples

Constituent	*Maximum contaminant level (micrograms per liter)	Reporting level (micrograms per liter)
Arsenic	50	1
Barium	1,000	2
Beryllium	Not established	0.5 or 10
Cadmium	10	1
Chromium	50	1 to 7
Lead	50	5 or 10
Mercury	2	0.1
Selenium	10	1
Silver	50	1

* From U.S. Environmental Protection Agency, 1983

Analyses indicated that water in the Snake River Plain aquifer locally contained detectable concentrations of the nine trace metals. The concentrations of arsenic, barium, cadmium, lead, mercury, selenium and silver were 20 percent or less than their respective maximum contaminant levels (tables 1 and 2). The maximum contaminant level for beryllium has not been established, however, the maximum concentration was 0.7 µg/L--slightly greater than the reporting level for beryllium (tables 1 and 2).

The concentration of chromium ranged from less than 1 to 280 µg/L. Chromium was the only one of the nine trace metals which equaled or exceeded its respective maximum contaminant level of 50 µg/L. Four ground-water quality monitoring wells yielded water containing more than 25 µg/L of chromium--wells 65, 88, 89, and 119--and two of these wells yielded water containing 50 µg/L or more--wells 65 and 89 (table 2); the maximum concentration in the production wells was 20 µg/L. Well 65 is about 500 ft south of the TRA (Test Reactors Area). From 1952 to 1964, an estimated 11,000 kilograms of chromium were contained in waste water disposed to an unlined infiltration pond at the TRA; from 1965 to 1972, an estimated 14,100 kilograms of chromium were contained in waste water injected directly into

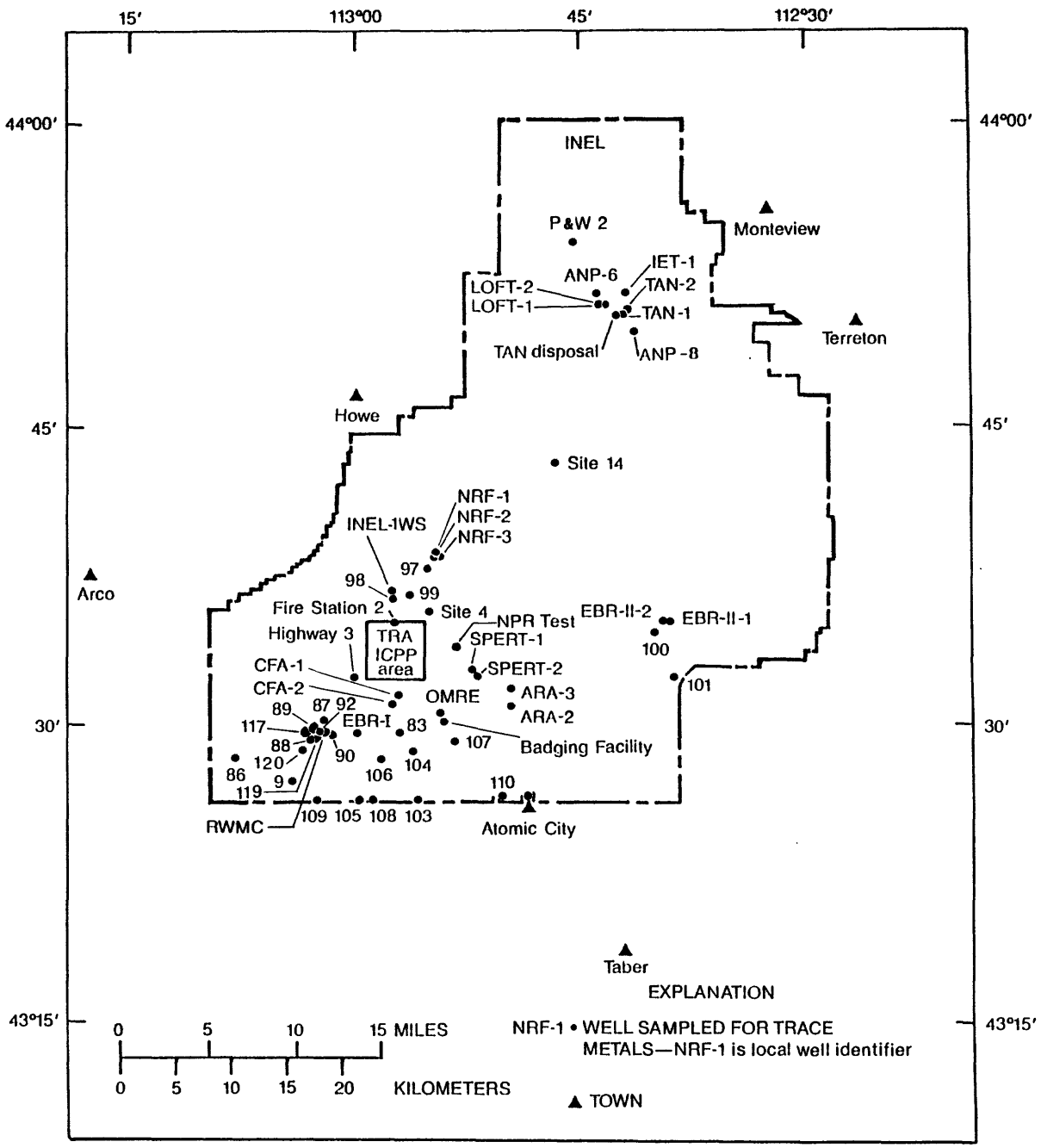

Figure 2.--Locations of wells sampled for selected trace metals, June to November 1987.

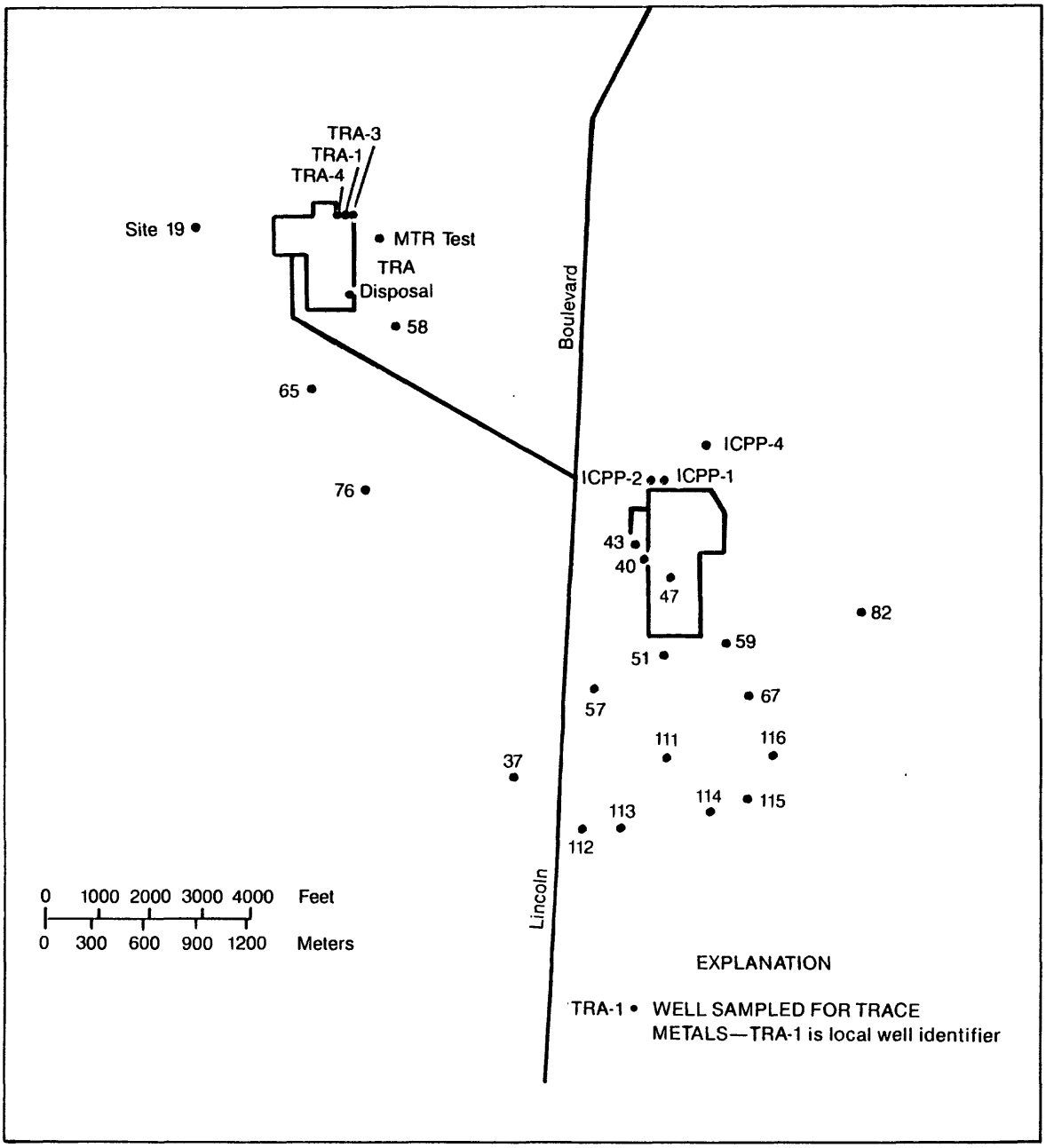

Figure 3.--Locations of wells sampled for selected trace metals in the TRA-ICPP area.

the Snake River Plain aquifer through a disposal well (R.N. Beatty, EG&G Idaho, Inc., written commun., 1986). Chromium concentrations in water from well 65 have been monitored on a three to six month frequency since the 1960's. The occurrence of chromium in the water is attributed to the past practices of waste-water disposal at the TRA (see Robertson and others, 1974; Barraclough and Jensen, 1976; Barraclough and others, 1982; and Lewis and Jensen, 1985). The source of the chromium in water from well 89 is not known. Samples collected in 1984 and 1986 from well 89 contained about 55 μg/L of chromium which is comparable to the 50 μg/L that the water contained in 1987. However, water from other wells near well 89 contain significantly smaller concentrations of chromium (see figure 1 and table 2).

SUMMARY

Reconnaissance-level sampling for nine trace metals in ground water at the INEL was conducted by the U.S. Geological Survey during June to November 1987. The sampling was done in cooperation with the U.S. Department of Energy. Water samples from the Snake River Plain aquifer were collected at 81 wells and 1 sample was collected from a discontinuous perched-water zone at the Radioactive Waste Management Complex. The samples were analyzed for nine trace metals--arsenic, barium, beryllium, cadmium, chromium, lead, mercury, selenium and silver.

A field logbook was maintained to record conditions at the well during sample collection and a chain-of-custody record was used to track samples from the time of collection until delivery to the U.S. Geological Survey's National Water Quality Laboratory in Arvada, Colorado for analysis. Methods used to collect the water samples and the quality assurance procedures instituted for the sampling program are described in detail.

The concentrations of arsenic, barium, cadmium, lead, mercury, selenium and silver were less than their respective maximum contaminant levels for drinking water established by the U.S. Environmental Protection Agency. Although a maximum contaminant level has not been established for beryllium, the largest concentration was 0.7 μg/L which is slightly greater than the reporting level of 0.5 μg/L.

The maximum contaminant level for chromium in drinking water is 50 μg/L. Water from two ground-water quality monitoring wells contained chromium at concentrations of 50 μg/L or more; the largest concentration in the production wells was 20 μg/L. Well 65 yielded water containing 280 μg/L of chromium and water from well 89 contained 50 μg/L.

SELECTED REFERENCES

Barnett, P.R. and Mallory, E.C., 1981, Determination of minor elements in water by emission spectroscopy: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chap. A2, 31 p.

Barraclough, J.T., and Jensen, R.G., 1976, Hydrologic data for the Idaho National Engineering Laboratory site, Idaho, 1971 to 1973: U.S. Geological Survey Open-File Report 75-318, 52 p.

Barraclough, J.T., Lewis, B.D., and Jensen, R.G., 1982, Hydrologic conditions at the Idaho National Engineering Laboratory, Idaho--emphasis: 1974-1978: U.S. Geological Survey Water-Supply Paper 2191, 52 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.

Feltz, H.R., Duncan, S.S., and Zepp, Ann, eds., 1985, 1986-87-88 National Water Quality Laboratory Services Catalog: U.S. Geological Survey Open-File Report 86-232.

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.

Lewis, B.D., and Jensen, R.G., 1985, Hydrologic conditions at the Idaho National Engineering Laboratory, Idaho: 1979-1981 update: U.S. Geological Survey Hydrologic Investigations Atlas HA-674, 2 sheets.

Mundorff, M.J., Crosthwaite, E.G., and Kilburn, Chabot, 1964, Ground water for irrigation in the Snake River Basin in Idaho: U.S. Geological Survey Water-Supply Paper 1654, 224 p.

Robertson, J.B., Schoen, Robert, and Barraclough, J.T., 1974, The influence of liquid waste disposal on the geochemistry of water at the National Reactor Testing Station, Idaho: 1952-1970: U.S. Geological Survey Open-File Report, IDO-22053, 231 p.

Skougstad, M.W., Fiskman, M.J., Friedman, L.C., Erdmann, D.E., and Duncan, S.S., eds., 1979, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chap. A1, 626 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 1, Chap. D1, 65 p.

U.S. Environmental Protection Agency, 1983, Protection of Environment, subpart B of part 141: U.S. Code of Federal Regulations, Title 40, parts 100-149, revised as of July 1, 1983, p. 233

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 2.--Concentrations of selected trace metals in ground water

[Analyses by U.S. Geological Survey's National Water Quality Laboratory, Arvada, Colorado. Analytical results in μg/L (micrograms per liter); <0.5 indicates the concentration was less than the reporting level of 0.5 μg/L. Continued on following page.]

Well identifier	Date Sampled	Arsenic (dissolved)	Barium (dissolved)	Beryllium (dissolved)	Cadmium (dissolved)
9	10/05/87	2	41	0.7	<1
37	10/05/87	2	130	<0.5	<1
40	10/13/87	1	71	<0.5	<1
43	10/05/87	1	86	<0.5	<1
47	10/26/87	1	72	<0.5	<1
51	10/13/87	1	80	<0.5	<1
57	10/09/87	1	120	<0.5	<1
58	10/08/87	2	69	<0.5	<1
59	10/06/87	2	83	<0.5	<1
65	10/14/87	1	58	<0.5	<1
67	10/06/87	1	130	<0.5	<1
76	10/08/87	2	71	<0.5	<1
82	10/06/87	2	57	<0.5	<1
83	10/14/87	2	29	<0.5	<1
86	10/06/87	1	21	<0.5	<1
87	09/23/87	2	29	<0.5	<1
88	09/22/87	3	21	<0.5	<1
89	09/22/87	3	18	<0.5	<1
90	09/23/87	1	34	<0.5	<1
92	06/03/87	--	--	<10	--
97	10/14/87	2	130	<0.5	<1
98	10/14/87	2	41	<0.5	<1
99	10/14/87	2	98	<0.5	<1
100	10/20/87	2	31	<0.5	<1
101	10/20/87	2	17	<0.5	<1
103	09/24/87	3	40	<0.5	<1
104	09/24/87	2	29	<0.5	<1
105	09/28/87	2	37	<0.5	<1
		2	38	<0.5	<1
106	10/06/87	2	44	<0.5	<1
		2	44	<0.5	<1
107	10/09/87	3	49	<0.5	<1
108	09/28/87	2	36	<0.5	<1
109	10/05/87	2	31	<0.5	<1
110	10/09/87	3	36	<0.5	<1
111	09/25/87	2	96	<0.5	<1

Table 2.--Concentrations of selected trace metals in ground water--Continued

[Well identifier: see figures 2 and 3 for location of wells; Blank--indicates sample bottle contained deionized water. Remarks: QA Replicate--indicates a second sample submitted for analysis using a different identifier.]

Well identifier	Chromium (dissolved)	Lead (dissolved)	Mercury (dissolved)	Selenium (dissolved)	Silver (dissolved)	Remarks
9	5	<5	<0.1	1	<1	
37	10	<5	0.2	1	<1	
40	4	<5	0.1	1	<1	
43	10	<5	<0.1	1	<1	
47	7	6	0.4	1	<1	
51	10	<5	<0.1	1	<1	
57	7	<5	0.2	1	<1	
58	10	<5	<0.1	1	<1	
59	10	<5	<0.1	1	<1	
65	280	<5	<0.1	1	<1	
67	5	9	<0.1	2	<1	
76	10	7	<0.1	1	1	
82	10	<5	<0.1	1	<1	
83	20	<5	<0.1	1	<1	
86	<1	<5	<0.1	2	<1	
87	20	<5	<0.1	1	<1	
88	30	<5	<0.1	3	<1	
89	50	<10	<0.1	3	<1	
90	20	<5	<0.1	1	<1	
92	--	--	--	--	--	
97	8	<5	0.1	2	<1	
98	5	<5	<0.1	1	<1	
99	6	<5	<0.1	1	<1	
100	3	<5	<0.1	<1	<1	
101	2	<5	<0.1	<1	<1	
103	<7	<5	<0.1	1	<1	
104	<7	<5	<0.1	1	<1	
105	<5	<5	<0.1	1	<1	
	<5	<5	<0.1	1	<1	QA Replicate
106	10	<5	<0.1	1	<1	
	10	<5	<0.1	1	<1	QA Replicate
107	10	<5	<0.1	1	<1	
108	9	<5	<0.1	1	<1	
109	8	<5	<0.1	1	<1	
110	7	<5	<0.1	1	<1	
111	20	<5	<0.1	2	<1	

Table 2.--Concentrations of selected trace metals in ground water--Continued

Well identifier	Date Sampled	Arsenic (dissolved)	Barium (dissolved)	Beryllium (dissolved)	Cadmium (dissolved)
112	09/25/87	2	170	<0.5	<1
113	10/02/87	1	190	<0.5	<1
114	10/09/87	1	110	<0.5	<1
115	10/09/87	2	58	<0.5	<1
116	10/28/87	1	120	<0.5	<1
117	10/19/87	3	18	<0.5	<1
		3	18	<0.5	<1
119	11/06/87	2	26	<0.5	<1
120	11/18/87	3	49	<0.5	<1
ANP-6	10/28/87	3	60	<0.5	<1
ANP-8	10/25/87	2	86	<0.5	<1
ARA-2	10/28/87	2	35	<0.5	<1
ARA-3	10/28/87	3	56	<0.5	<1
Atomic City	10/29/87	3	29	<0.5	<1
Badging Facility	10/24/87	2	32	<0.5	<1
CFA-1	10/15/87	1	83	<0.5	<1
CFA-2	10/14/87	1	67	<0.5	<1
EBR-I	10/14/87	2	20	<0.5	<1
EBR-II-1	10/15/87	2	34	<0.5	<1
EBR-II-2	10/15/87	2	35	<0.5	<1
Fire Station 2	11/03/87	1	70	<0.5	<1
Highway-3	10/29/87	1	53	<0.5	<1
ICPP-1	10/22/87	2	82	<0.5	<1
ICPP-2	10/22/87	2	86	<0.5	<1
ICPP-4	10/22/87	2	81	<0.5	<1
IET-1	10/27/87	2	110	<0.5	<1
INEL-1WS	10/26/87	1	83	<0.5	<1
LOFT-1	10/25/87	2	80	<0.5	<1
LOFT-2	10/26/87	2	68	<0.5	<1
MTR Test	10/07/87	1	59	<0.5	<1
NPR Test	10/15/87	2	72	<0.5	<1
	10/15/87	2	72	<0.5	<1
NRF-1	10/29/87	2	130	<0.5	<1
NRF-2	10/29/87	2	130	<0.5	<1
NRF-3	10/29/87	2	130	<0.5	<1
OMRE	10/30/87	2	51	<0.5	<1
P&W-2	10/16/87	2	45	<0.5	<1
	10/23/87	2	44	<0.5	<1
RWMC	10/14/87	2	36	<0.5	<1
Site 4	11/03/87	1	91	<0.5	<1

Table 2.--Concentrations of selected trace metals in ground water--Continued

Well identifier	Chromium (dissolved)	Lead (dissolved)	Mercury (dissolved)	Selenium (dissolved)	Silver (dissolved)	Remarks
112	8	<5	0.3	2	<1	
113	10	<5	0.2	1	<1	
114	10	<5	<0.1	1	<1	
115	7	<5	<0.1	4	<1	
116	7	<5	<0.1	2	<1	
117	20	<5	<0.1	1	<1	
	20	<5	<0.1	1	<1	QA Replicate
119	30	<5	<0.1	3	1	
120	6	<5	<0.1	1	1	
ANP-6	1	<5	<0.1	2	<1	
ANP-8	4	<5	<0.1	2	<1	
ARA-2	2	<5	<0.1	1	<1	
ARA-3	4	<5	<0.1	1	<1	
Atomic City	2	<5	<0.1	<1	<1	
Badging Facility	10	<5	<0.1	1	<1	
CFA-1	20	<5	0.1	1	<1	
CFA-2	10	<5	<0.1	3	<1	
EBR-I	7	<5	<0.1	5	1	
EBR-II-1	2	<5	<0.1	<1	<1	
EBR-II-2	3	<5	<0.1	<1	<1	
Fire Station	4	<5	<0.1	1	<1	
Highway-3	<1	<5	<0.1	<1	<1	
ICPP-1	5	<5	<0.1	1	1	
ICPP-2	5	<5	0.1	1	2	
ICPP-4	6	<5	<0.1	1	<1	
IET-1	1	<5	<0.1	<1	1	
INEL-1WS	10	<5	0.1	3	<1	
LOFT-1	3	<5	<0.1	1	<1	
LOFT-2	3	<5	<0.1	1	1	
MTR Test	6	<5	<0.1	1	<1	
NPR Test	6	<5	<0.1	1	<1	
	7	<5	<0.1	1	<1	QA Replicate
NRF-1	7	<5	<0.1	1	<1	
NRF-2	10	<5	0.1	2	<1	
NRF-3	8	<5	<0.1	2	<1	
OMRE	7	<5	<0.1	1	<1	
P&W-2	2	<5	<0.1	1	<1	
	<1	<5	<0.1	1	<1	
RWMC	20	<5	<0.1	1	<1	
Site 4	7	<5	0.1	2	<1	

Table 2.--Concentrations of selected trace metals in ground water--Continued

Well identifier	Date Sampled	Arsenic (dissolved)	Barium (dissolved)	Beryllium (dissolved)	Cadmium (dissolved)
Site 14	10/14/87	4	59	<0.5	<1
Site 19	10/07/87	2	50	<0.5	<1
SPERT-1	10/24/87	2	49	<0.5	<1
SPERT-2	10/24/87	2	59	<0.5	<1
TAN-1	10/23/87	2	95	<0.5	<1
TAN-2	10/23/87	2	90	<0.5	<1
TAN Disposal	10/27/87	<1	140	<0.5	<1
TRA-1	10/30/87	2	48	<0.5	<1
TRA-3	10/27/87	2	54	<0.5	<1
TRA-4	10/30/87	2	49	<0.5	<1
TRA Disposal	10/28/87	2	54	<0.5	<1
Blank	10/07/87	<1	<2	<0.5	<1
	10/15/87	<1	<2	<0.5	<1

Table 2.--Concentrations of selected trace metals in ground water--Continued

Well identifier	Chromium (dissolved)	Lead (dissolved)	Mercury (dissolved)	Selenium (dissolved)	Silver (dissolved)	Remarks
Site 14	5	<5	<0.1	1	<1	
Site 19	10	<5	<0.1	1	<1	
SPERT-1	6	<5	<0.1	1	<1	
SPERT-2	6	<5	<0.1	1	<1	
TAN-1	4	<5	<0.1	2	<1	
TAN-2	4	<5	<0.1	2	<1	
TAN Disposal	1	<5	<0.1	1	1	
TRA-1	3	<5	<0.1	1	<1	
TRA-3	3	<5	<0.1	1	<1	
TRA-4	4	<5	<0.1	1	<1	
TRA Disposal	9	<5	<0.1	1	<1	
Blank	4	<5	<0.1	<1	<1	
	1	<5	<0.1	<1	<1	