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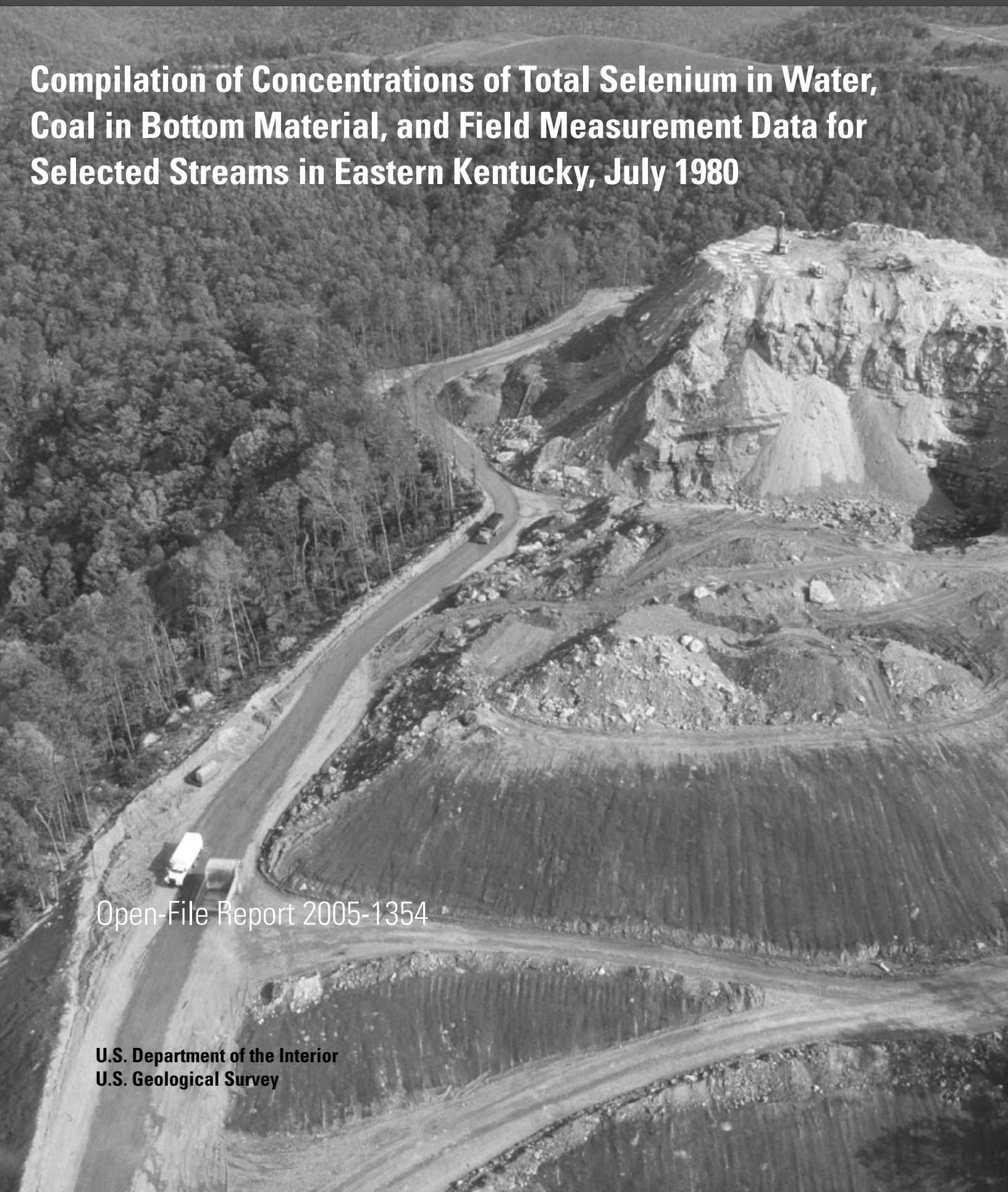
Compilation of Concentrations of Total Selenium in Water, Coal in Bottom Material, and Field Measurement Data for Selected Streams in Eastern Kentucky, July 1980



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

Compilation of Concentrations of Total Selenium in Water, Coal in Bottom Material, and Field Measurement Data for Selected Streams in Eastern Kentucky, July 1980

By Maureen A. Downing-Kunz, Michael D. Unthank, and Angela S. Crain

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Conversion Factors and Abbreviations

SI to Inch/Pound

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
	Volume	
liter (L)	33.82	ounce, fluid (fl. oz)
liter (L)	2.113	pint (pt)
liter (L)	1.057	quart (qt)
liter (L)	0.2642	gallon (gal)
	Flow rate	
cubic meter per second (m^3/s)	35.31	cubic foot per second (ft^3/s)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)
kilogram (kg)	2.205	pound avoirdupois (lb)
ton, short (2,000 lb)	0.9072	megagram (Mg)
ton, long (2,240 lb)	1.016	megagram (Mg)

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

$°F=(1.8\times°C)+32$

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

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

Abbreviations

ppb – parts per billion

AAS - atomic absorption spectrometry

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Abstract

Selenium is a naturally occurring element that is both an essential micronutrient and is toxic to aquatic wildlife at concentrations exceeding sufficiency. Industrial activities such as surface mining may result in selenium concentrations exceeding regulatory criteria for the protection of wildlife, which is currently (2005) 5 micrograms per liter (µg/L). During July 1980, selected streams in eastern Kentucky were sampled as part of the Coal Hydrology Monitoring program. Water samples were collected at 105 streamgaging stations in regions with mineable coal reserves. These water samples were analyzed for concentration of total selenium, as well as other constituents. Additionally, streambed-sediment samples were collected at 87 of these stations and were analyzed for concentration of coal. Concentration of total selenium in water, concentration of coal in bottom material, and field-measurement data for these samples were compiled from the U.S. Geological Survey Kentucky Water Science Center water-quality database and associated project files and are tabulated in this report. Of the 105 stream-water samples, 30 samples had concentrations of total selenium greater than the minimum detection level of 1 µg/L. The maximum value reported for concentration of total selenium in stream water was 6 µg/L. Coal was present in all 87 streambed-sediment samples collected with values ranging from 1 to 60 grams per kilogram.

Introduction

In May 2003, the Mountaintop Mining/Valley Fill Draft Programmatic Environmental Impact Statement (EIS) was released jointly by the U.S. Army Corps of Engineers (USACE), the U.S. Environmental Protection Agency (USEPA), the U.S. Department of the Interior–Office of Surface Mining, the U.S. Department of the Interior–Fish and Wildlife Service (USFWS), and the West Virginia Department of Environmental Protection. These agencies share a common goal to reduce adverse environmental effects of mountaintop-mining operations in Appalachian coal regions. The purpose of the EIS is to evaluate options for improving agency programs that contribute to this goal. One objective stated in the EIS is to compile similar data mandated by different regulatory programs to achieve multiple program goals while minimizing the duplication of data collection and analysis between agencies (U.S. Environmental Protection Agency, Region III, Mountaintop Mining/Valley Fill Draft Environmental Impact Statement, online at <*http://www.epa.gov/region03/mtntop/eis.htm*>, written commun., 2003). In accordance with this EIS objective, the U.S. Geological Survey (USGS) Kentucky Water Science Center has compiled

coal-hydrology data for selected streams in eastern Kentucky from its project files and water-quality database.

The focus of this report is to document concentrations of total selenium in water, and amounts of coal in bottom material for samples collected in the 1980 water year[1]. Selenium is a naturally occurring element that is both an essential micronutrient and toxic to aquatic wildlife at concentrations exceeding sufficiency. Industrial activities such as surface mining may result in concentrations of selenium exceeding regulatory criteria for the protection of wildlife, which is currently (2005) 5 micrograms per liter (µg/L). Surface-mining operations in Appalachian coal-mining regions have been identified as actions capable of introducing excessive concentrations of selenium into water bodies, primarily because of the prevalence of selenium in overburden soils exposed during mining activities (U.S. Environmental Protection Agency, Draft Selenium Aquatic Life Criterion – Questions and Answers, online at *http://www.epa.gov/waterscience/criteria/selenium/questions.htm*, written commun., 2005). Sampling results reported in the EIS show elevated concentrations of selenium and other analytes in stream water at sampling stations below mined/filled sites. (See Appendix D of U.S. Environmental Protection Agency, Region III, Mountaintop Mining/Valley Fill Draft Environmental Impact Statement, online at <*http://www.epa.gov/region03/mtntop/appendix.htm#appd*>, written commun., 2003.)

The data included in this report were collected as a result of Public Law 95-87, legislation passed by Congress in 1977 requiring the hydrologic monitoring of actual and proposed surface-mined areas. The goal of this law—Surface Mining Control and Reclamation Act of 1977—is to establish environmental regulations to protect the environment from the consequences of surface-mining operations (Doyle, 1981). Surface-mining operations permits require an evaluation of the prevailing hydrologic conditions of the mine-plan and adjacent areas. As the Federal agency specializing in hydrologic monitoring, the USGS played a lead role in the collection of regional hydrologic data in the major coal provinces of the United States in the years following the enactment of the legislation.

In Kentucky, 225 coal-hydrology monitoring stations were established in 1978 and later expanded to 232 sites in 1979. These sites were concentrated in the two major coal-mining regions of the State, with 159 sites located in eastern Kentucky and 73 sites located in western Kentucky. This report contains data from water samples collected during the 1980 water year at 105 sites in eastern Kentucky (U.S. Geological Survey, 1980). Each site was visited once, where field parameters were measured and samples for trace metals were collected for further analysis.

Purpose and Scope

This report presents results of hydrologic monitoring at streamgaging stations in eastern Kentucky during water year 1980. The monitoring was designed to provide hydrologic data in regions where coal mining is prevalent, in accordance with Public Law 95-87. Concentrations of total selenium in water, along with standard field parameters, are tabulated for samples collected at 105 sites in July 1980. Concentrations of coal in bottom material are tabulated for samples collected at 87 of the 105 sites.

[1]Water year is the 12-month period from October 1 through September 30. The water year is designated by the calendar in which it ends.

Description of Study Area

The study area (fig. 1) includes streamgaging stations on streams in eastern Kentucky. This region has appreciable coal-mining operations in portions of five river basins in eastern Kentucky: Big Sandy; Kentucky; Licking; Middle Ohio-Raccoon; and Upper Cumberland. These river basins are identified in figure 1 as 6-digit hydrologic units.

The study area lies in the Eastern Coal province of the United States, specifically in the Eastern Coal Field in Kentucky. Shale and sandstone of the Breathitt and Lee Formation of Pennsylvanian age and shale and limestone of Mississippian and Devonian age underlie the study area (Leist and others, 1981). Coal occurs in the rocks of Pennsylvanian age with most of the coal occurring in the Breathitt Formation at depths of as much as 2,500 ft. As many as 30 coal beds or coal zones are present in the Breathitt Formation and range in thickness from less than 6 in. to as much as 19 ft; the coal beds are irregular in shape. Coal production for the study area in 1980 totaled approximately 106.3 million tons with 58.9 million tons produced from underground mines and 47.4 million tons produced from surface-mining operations. In 1999, production for the study area had increased to approximately 113.3 million tons with 65.0 million tons being produced from underground mines and 48.3 million tons produced from surface-mining operations (Kentucky Coal Production, 1790–2001, Kentucky Geological Survey, online at <*http://www.uky.edu/KGS/coal/production/kycoal01.htm*>, written commun., 2005.).

Methods of Investigation

In July 1980, USGS field personnel sampled water and streambed sediment at 105 streamgaging stations in eastern Kentucky (fig. 1). The streams drain areas containing coal beds and (or) mining sites. The locations of the sampling sites are described in table 1. Field parameters monitored at the time of sampling include: instantaneous streamflow; specific conductance; pH; water temperature; and alkalinity.

Measurements of streamflow were made in accordance with standard USGS procedures (Buchanan and Somers, 1969). Field specific conductance readings were determined using Beckman RB-5 meters; field pH measurements were recorded using Orion 201 meters. Alkalinity was determined on unfiltered samples by titration to a fixed endpoint of 4.5 following standard methods described in Brown and others, 1970. Water-quality samples were collected from stream cross-sections using depth-integrated samplers and processed using methods described in Brown and others (1970). All water-quality samples were unfiltered. Streambed sediments were composited using methods described in Guy and Norman (1970).

Water and bottom-material samples were analyzed at the USGS Central Laboratory in Atlanta, Georgia. Concentrations of total selenium in water samples were determined using atomic absorption spectrometry (AAS). Detection limits for concentrations of total selenium using AAS were 1 µg/L. Analytical methods for water samples are described in Skougstad and others (1978). Heavy-mined separations were based on a standard laboratory technique of gravity separation. The separation of coal from bottom material was accomplished using a mixture of bromoform and acetone with an adjusted specific gravity of 1.95 (Guy, 1969).

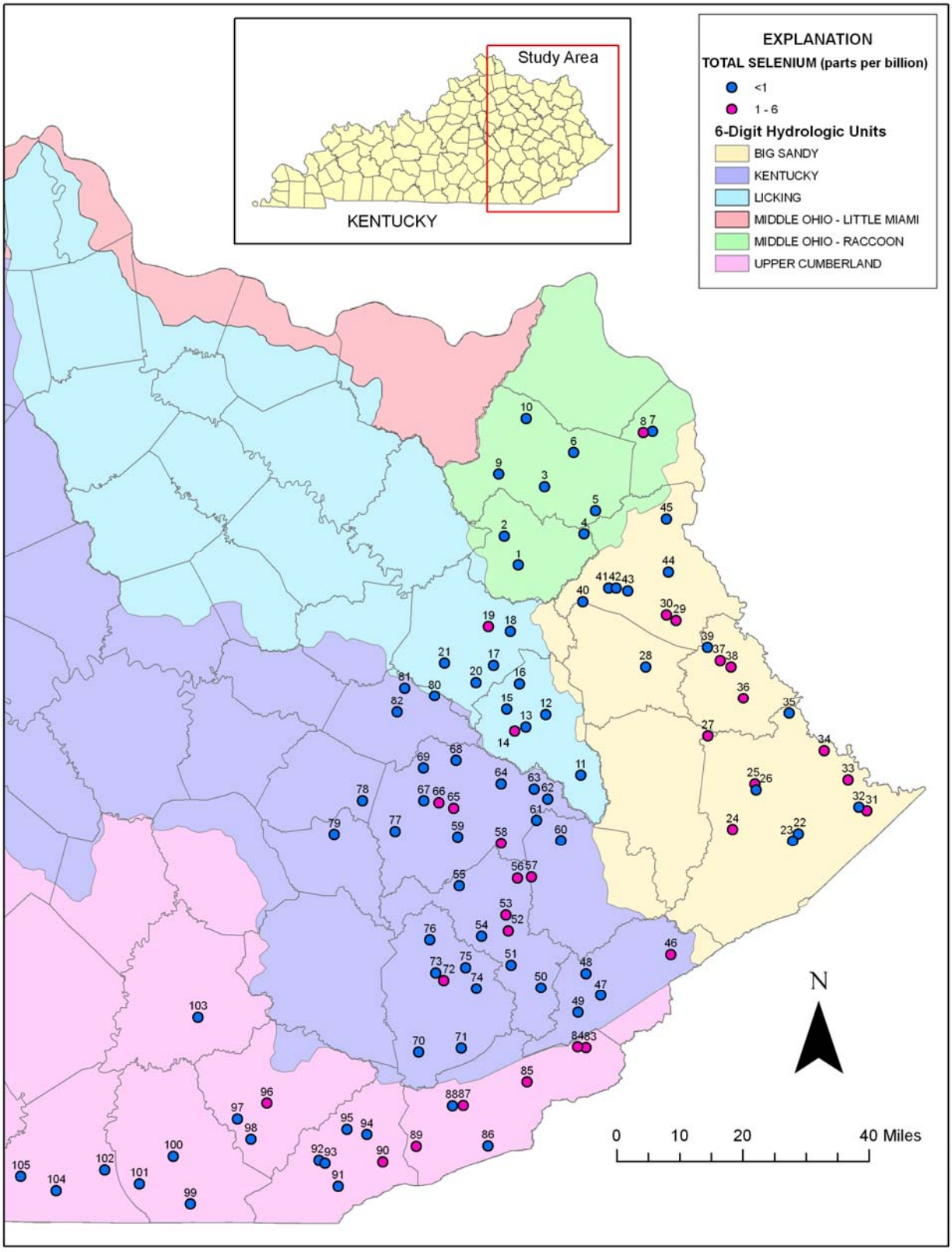

Figure 1. Locations of streamgaging stations in eastern Kentucky sampled for concentrations of total selenium in July 1980. (See table 1 for information associated with cross-reference numbers identifying each station in this figure.)

Table 1. Identification numbers, location, field-parameter data, coal in bottom material, and concentrations of total selenium at streamgaging stations in eastern Kentucky in July 1980.

[LT, left; RT, right; FK, fork; DMS, degrees minutes seconds; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; --, not tested; $CaCO_3$, calcium carbonate; g, grams; kg, kilograms; µg/L, micrograms per liter; ppb, parts per billion; Se, selenium]

Map number	Station number	Station name	North latitude (DMS)	West longitude (DMS)	Sample collection date	Sample collection time	Stream-flow, instant-aneous (ft^3/s)	Specific conduct-ance (µS/cm)	pH field (units)	Temper-ature, water (°C)	Alkal-inity (mg/L as $CaCO_3$)	Coal in bottom material (g/kg)	Selenium, total (µg/L or ppb as Se)[1]
					MIDDLE OHIO-RACCOON RIVER BASIN								
1	03216180	LITTLE SANDY RIVER	38°05'14"	83°07'28"	7/16/80	0820	0.28	378	7.2	23.5	82	7.00	0
2	03216230	BIG CANEY CREEK	38°09'22"	83°09'46"	7/16/80	1055	.66	240	7.3	26.5	100	2.00	0
3	03216370	BIG SINKING CREEK	38°16'03"	83°02'27"	7/17/80	1330	3.0	238	7.4	24.5	84	1.00	0
4	03216430	LITTLE SANDY RIVER	38°09'22"	82°55'49"	7/18/80	1645	1.8	220	7.0	26.0	40	3.00	0
5	03216450	DRY FK	38°12'30"	82°53'38"	7/17/80	1410	1.6	263	7.0	24.5	60	2.00	0
6	03216520	BERET CREEK	38°20'38"	82°57'09"	7/16/80	1450	3.1	302	7.2	26.5	80	--	0
7	03216558	EAST FK LITTLE SANDY	38°23'13"	82°43'14"	7/17/80	1740	15	466	7.2	26.0	57	3.00	0
8	03216567	WILLIAMS CREEK	38°23'04"	82°44'50"	7/17/80	1550	7.4	558	6.7	29.0	51	--	1
9	03216800	TYGARTS CREEK	38°17'57"	83°10'25"	7/17/80	1015	2.0	334	7.3	27.0	116	2.00	0
10	03216960	BUFFALO CREEK	38°25'30"	83°05'20"	7/18/80	1045	6.3	325	7.4	25.5	138	8.00	0
					LICKING RIVER BASIN								
11	03248165	LICKING RIVER	37°36'00"	82°57'36"	7/15/80	0915	6.9	240	7.6	25.5	54	--	0
12	03248380	BURNING FK	37°44'28"	83°03'22"	7/15/80	1230	2.1	1,700	7.4	27.5	55	3.00	0
13	03248520	LT FK MIDDLE FK	37°42'50"	83°06'57"	7/17/80	1530	3.3	210	7.4	27.0	68	4.00	0
14	03248530	RT FK MIDDLE FK	37°42'19"	83°08'53"	7/17/80	1350	1.2	210	7.6	32.5	62	18.0	1
15	03248560	JOHNSON CREEK	37°45'24"	83°10'10"	7/16/80	1230	2.2	175	7.5	28.0	56	4.00	0
16	03248580	LICK CREEK	37°48'55"	83°07'50"	7/16/80	1045	2.4	260	7.4	26.0	55	2.00	0
17	03248610	WHITE OAK CREEK	37°51'32"	83°12'13"	7/16/80	0900	.55	225	7.3	25.5	51	2.00	0
18	03248670	WILLIAMS CREEK	37°56'08"	83°09'10"	7/15/80	1700	.70	218	7.4	26.0	43	3.00	0
19	03248685	ELK FK	37°56'52"	83°12'57"	7/15/80	1500	4.1	280	6.8	25.0	18	3.00	1
20	03248710	CANEY CREEK	37°49'14"	83°15'21"	7/15/80	1245	.66	282	7.8	26.0	62	30.0	0
21	03248750	GRASSY CREEK	37°52'01"	83°20'45"	7/15/80	0830	.60	250	7.2	25.0	56	3.00	0
					BIG SANDY RIVER BASIN								
22	03207962	DICKS FK	37°26'57"	82°20'16"	7/17/80	0850	.10	88	7.0	25.0	24	5.00	0
23	03207965	GRAPEVINE CREEK	37°25'57"	82°21'14"	7/17/80	1700	.10	820	6.8	26.0	39	5.00	0
24	03209500	LEVISA FK	37°28'35"	82°31'05"	7/17/80	1400	268	420	7.3	30.0	80	--	1

Table 1. Identification numbers, location, field-parameter data, coal in bottom material, and concentrations of total selenium at streamgaging stations in eastern Kentucky in July 1980.—*Continued*

[LT, left; RT, right; FK, fork; DMS, degrees minutes seconds; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; --, not tested; $CaCO_3$, calcium carbonate; g, grams; kg, kilograms; µg/L, micrograms per liter; ppb, parts per billion; Se, selenium]

Map number	Station number	Station name	North latitude (DMS)	West longitude (DMS)	Sample collection date	Sample collection time	Stream-flow, instant-aneous (ft^3/s)	Specific conduct-ance (µS/cm)	pH field (units)	Temper-ature, water (°C)	Alkal-inity (mg/L as $CaCO_3$)	Coal in bottom material (g/kg)	Selenium, total (µg/L or ppb as Se)[1]
					BIG SANDY RIVER BASIN—*Continued*								
25	03210000	JOHNS CREEK	37°34'01"	82°27'29"	7/17/80	1140	7.9	600	7.0	30.0	54	--	1
26	03210060	RACCOON CREEK	37°33'12"	82°27'19"	7/15/80	1430	2.2	420	7.0	29.0	97	--	0
27	03210400	BRUSHY FK	37°40'50"	82°35'19"	7/15/80	1635	2.7	382	7.0	30.0	62	17.0	1
28	03212520	TOMS CREEK	37°50'42"	82°45'46"	7/15/80	1300	2.7	680	6.9	24.5	63	11.0	0
29	03212530	GEORGES CREEK	37°56'56"	82°40'13"	7/15/80	1755	1.7	320	6.9	26.5	74	4.00	1
30	03212535	RT FK CREEK	37°57'45"	82°41'49"	7/15/80	1600	2.5	282	6.9	25.5	59	3.00	1
31	03213670	LT FK PETER CREEK	37°29'44"	82°08'14"	7/16/80	0815	.50	395	7.1	24.0	82	--	1
32	03213680	RT FK PETER CREEK	37°30'17"	82°09'35"	7/16/80	0645	1.5	404	7.4	24.0	112	4.00	0
33	03213690	BLACKBERRY CREEK	37°34'06"	82°11'18"	7/16/80	1640	1.4	500	7.2	35.0	76	--	2
34	03213698	POND CREEK	37°38'14"	82°15'13"	7/16/80	1440	1.3	510	7.6	35.0	133	15.0	5
35	03213750	BIG CREEK	37°43'34"	82°21'06"	7/16/80	1145	1.2	510	6.8	30.0	47	20.0	0
36	03214300	WOLF CREEK	37°45'55"	82°28'55"	7/16/80	1240	7.6	900	7.9	25.0	99	53.0	6
37	03214600	MIDDLE FK ROCKCASTLE CREEK	37°51'14"	82°32'43"	7/17/80	1345	5.6	600	7.6	29.0	90	--	2
38	03214650	COLDWATER FK	37°50'17"	82°30'53"	7/16/80	1240	4.7	390	7.5	26.0	70	--	2
39	03214720	ROCKHOUSE FK	37°53'06"	82°34'55"	7/16/80	1400	7.6	630	7.1	27.0	20	--	0
40	03215250	LT FK BLAINE CREEK	37°59'56"	82°56'21"	7/19/80	1625	.13	26,000	6.6	31.5	17	--	0
41	03215367	CAINES CREEK	38°01'42"	82°51'45"	7/19/80	1345	.10	170	7.8	25.5	34	4.00	0
42	03215380	HOOD CREEK	38°01'40"	82°50'28"	7/18/80	1940	.17	201	6.9	25.5	46	--	0
43	03215420	BRUSHY CREEK	38°01'14"	82°48'26"	7/19/80	1055	.10	200	7.0	25.5	50	--	0
44	03215470	LITTLE BLAINE CREEK	38°03'38"	82°41'17"	7/14/80	1350	7.3	150	6.9	24.0	32	2.00	0
45	03215550	CAT FORK CREEK	38°11'03"	82°41'18"	7/14/80	1050	8.0	210	6.9	22.5	48	2.00	0
					KENTUCKY RIVER BASIN								
46	03277260	YONTS FK	37°10'53"	82°43'02"	7/15/80	0950	5.8	740	7.8	20.0	222	58.0	1
47	03277320	KINGS CREEK	37°05'29"	82°55'18"	7/15/80	1520	.46	275	8.6	29.5	88	7.00	0
48	03277361	ROCKHOUSE CREEK	37°08'36"	82°57'43"	7/15/80	1330	9.6	560	8.2	26.5	94	34.0	0

Table 1. Identification numbers, location, field-parameter data, coal in bottom material, and concentrations of total selenium at streamgaging stations in eastern Kentucky in July 1980.—*Continued*

[LT, left; RT, right; FK, fork; DMS, degrees minutes seconds; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; --, not tested; $CaCO_3$, calcium carbonate; g, grams; kg, kilograms; µg/L, micrograms per liter; ppb, parts per billion; Se, selenium]

Map number	Station number	Station name	North latitude (DMS)	West longitude (DMS)	Sample collection date	Sample collection time	Stream-flow, instant-aneous (ft^3/s)	Specific conduct-ance (µS/cm)	pH field (units)	Temper-ature, water (°C)	Alkal-inity (mg/L as $CaCO_3$)	Coal in bottom material (g/kg)	Selenium, total (µg/L or ppb as Se)[1]
						KENTUCKY RIVER BASIN—*Continued*							
49	03277370	LINE FK	37°06'10"	82°59'20"	7/15/80	1730	2.3	290	8.5	29.5	99	7.00	0
50	03277400	LEATHERWOOD CREEK	37°06'48"	83°05'33"	7/14/80	1820	3.8	420	8.3	29.0	94	7.00	0
51	03277415	RT FK MACYS CREEK	37°10'04"	83°10'37"	7/14/80	1600	.23	775	8.0	28.0	61	9.00	0
52	03277500	NORTH FK KENTUCKY RIVER	37°14'48"	83°10'55"	7/14/80	1100	147	335	7.8	27.0	69	9.00	1
53	03277515	LOTTS CREEK	37°17'01"	83°11'15"	7/16/80	1220	5.1	1,250	7.9	26.0	68	11.0	1
54	03277580	BIG CREEK	37°14'09"	83°15'33"	7/17/80	1630	.45	1,045	8.3	31.5	74	18.0	0
55	03277700	GRAPEVINE CREEK	37°21'11"	83°19'14"	7/17/80	0850	.98	605	7.8	24.0	97	4.00	0
56	03277850	TROUBLESOME CREEK	37°22'01"	83°09'05"	7/16/80	1650	4.6	720	8.3	32.0	97	10.0	1
57	03277900	BALLS FK	37°22'08"	83°06'43"	7/16/80	1445	2.4	290	8.9	32.0	60	9.00	1
58	03278100	BUCKHORN CREEK	37°26'55"	83°11'44"	7/17/80	1355	1.5	570	7.9	27.0	70	3.00	1
59	03279150	LOST CREEK	37°27'56"	83°19'14"	7/17/80	1045	6.7	765	7.8	25.5	75	4.00	0
60	03279250	LAUREL FK	37°27'04"	83°01'23"	7/17/80	1115	2.7	150	7.6	24.5	32	2.00	0
61	03279300	MIDDLE FK QUICKSAND CREEK	37°29'57"	83°05'29"	7/17/80	1325	2.8	82	7.3	26.5	21	2.00	0
62	03279368	QUICKSAND CREEK	37°32'51"	83°03'28"	7/17/80	1710	2.1	170	7.5	28.0	29	11.0	0
63	03279370	HAWLS FK	37°34'17"	83°05'48"	7/17/80	1530	1.9	260	8.1	30.0	67	13.0	0
64	03279430	CANEY CREEK	37°35'07"	83°11'28"	7/17/80	1920	1.8	235	7.6	28.0	50	3.00	0
65	03279650	SOUTH FK QUICKSAND CREEK	37°31'57"	83°19'48"	7/16/80	2130	3.7	641	8.1	28.0	146	1.00	1
66	03280000	NORTH FK KENTUCKY RIVER	37°33'05"	83°23'05"	7/16/80	1315	198	480	8.0	27.5	75	6.00	1
67	03280100	CANE CREEK	37°33'04"	83°24'57"	7/15/80	2035	.45	320	7.8	31.0	84	4.00	0
68	03280400	FROZEN CREEK	37°38'30"	83°19'11"	7/16/80	1625	.10	215	7.4	32.0	51	2.00	0
69	03280450	BOONE FK	37°37'34"	83°24'53"	7/16/80	1850	.27	200	7.7	33.5	53	4.00	0
70	03280520	MIDDLE FK KENTUCKY RIVER	36°58'19"	83°26'56"	7/22/80	1030	2.1	370	7.8	23.5	55	10.0	0
71	03280575	LAUREL FK	36°58'43"	83°19'35"	7/21/80	1745	.13	235	8.3	30.0	79	15.0	0
72	03280600	MIDDLE FK KENTUCKY RIVER	37°08'13"	83°22'17"	7/18/80	1030	5.6	280	8.4	29.0	68	4.00	1

Table 1. Identification numbers, location, field-parameter data, coal in bottom material, and concentrations of total selenium at streamgaging stations in eastern Kentucky in July 1980.—*Continued*

[LT, left; RT, right; FK, fork; DMS, degrees minutes seconds; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; --, not tested; $CaCO_3$, calcium carbonate; g, grams; kg, kilograms; µg/L, micrograms per liter; ppb, parts per billion; Se, selenium]

Map number	Station number	Station name	North latitude (DMS)	West longitude (DMS)	Sample collection date	Sample collection time	Stream-flow, instant-aneous (ft^3/s)	Specific conduct-ance (µS/cm)	pH field (units)	Temper-ature, water (°C)	Alkal-inity (mg/L as $CaCO_3$)	Coal in bottom material (g/kg)	Selenium, total (µg/L or ppb as Se)[1]
					KENTUCKY RIVER BASIN—*Continued*								
73	03280630	ROCKHOUSE CREEK	37°09'18"	83°23'37"	7/22/80	1645	1.2	430	8.0	25.0	90	3.00	0
74	03280670	CUTSHIN CREEK	37°06'57"	83°16'42"	7/22/80	1400	.84	530	8.0	26.0	80	5.00	0
75	03280700	CUTSHIN CREEK	37°09'54"	83°18'29"	7/18/80	1245	1.4	450	8.0	27.0	96	--	0
76	03280750	HELL FOR CERTAIN CREEK	37°13'51"	83°24'30"	7/21/80	1225	.02	179	7.9	32.5	52	2.00	0
77	03280950	TURKEY CREEK	37°28'57"	83°30'04"	7/15/80	1710	.67	153	7.9	27.5	41	--	0
78	03281000	MIDDLE FK KENTUCKY RIVER	37°33'18"	83°35'38"	7/14/80	1710	51	195	7.4	27.0	38	5.00	0
79	03281500	SOUTH FK KENTUCKY RIVER	37°28'45"	83°40'38"	7/15/80	1320	79	275	7.6	29.0	31	14.0	0
80	03282400	RED RIVER	37°47'29"	83°22'40"	7/15/80	1045	2.7	150	7.6	24.0	43	4.00	0
81	03282500	RED RIVER	37°48'44"	83°27'50"	7/14/80	1430	6.5	140	7.6	30.0	46	--	0
82	03283000	STILLWATER CREEK	37°45'24"	83°29'12"	7/14/80	1100	.97	190	7.8	24.5	63	3.00	0
					UPPER CUMBERLAND RIVER BASIN								
83	03400480	LOONEY CREEK	36°58'17"	82°58'06"	7/17/80	1130	11	960	8.4	22.0	354	60.0	1
84	03400500	POOR FK	36°58'26"	82°59'35"	7/15/80	1630	17	700	8.7	29.5	260	18.0	1
85	03400650	CLOVER FK	36°53'48"	83°08'25"	7/17/80	0900	11	385	7.1	23.5	104	12.0	1
86	03400800	MARTINS FK	36°44'57"	83°14'52"	7/17/80	1445	6.6	160	7.5	30.0	24	10.0	0
87	03400990	CLOVER FK	36°50'50"	83°19'31"	7/15/80	0730	62	315	7.8	26.0	94	18.0	1
88	03401000	CUMBERLAND RIVER	36°50'48"	83°21'21"	7/15/80	1225	90	325	8.0	26.5	92	6.00	0
89	03401250	PUCKETT CREEK	36°45'19"	83°27'45"	7/14/80	1515	5.1	530	8.2	30.5	114	40.0	1
90	03401290	BROWNICE CREEK	36°43'18"	83°33'32"	7/14/80	1155	5.3	480	7.8	27.0	61	12.0	1
91	03402000	YELLOW CREEK	36°40'05"	83°41'19"	7/18/80	0945	8.8	1,050	7.4	28.5	113	15.0	0
92	03402400	CLEAR CREEK	36°43'42"	83°44'28"	7/18/80	1630	.98	95	7.3	27.5	37	4.00	0
93	03402450	LITTLE CLEAR CREEK	36°43'17"	83°43'27"	7/18/80	1415	1.3	550	8.4	29.0	96	7.00	0
94	03402800	STRAIGHT CREEK	36°47'06"	83°36'09"	7/22/80	1000	2.0	325	7.4	25.0	74	5.00	0
95	03402830	LT FK STRAIGHT CREEK	36°47'54"	83°39'36"	7/22/80	1240	1.9	1,040	7.7	25.0	84	32.0	0

Table 1. Identification numbers, location, field-parameter data, coal in bottom material, and concentrations of total selenium at streamgaging stations in eastern Kentucky in July 1980.—*Continued*

[LT, left; RT, right; FK, fork; DMS, degrees minutes seconds; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; --, not tested; $CaCO_3$, calcium carbonate; g, grams; kg, kilograms; µg/L, micrograms per liter; ppb, parts per billion; Se, selenium]

Map number	Station number	Station name	North latitude (DMS)	West longitude (DMS)	Sample collection date	Sample collection time	Stream-flow, instant-aneous (ft^3/s)	Specific conduct-ance (µS/cm)	pH field (units)	Temper-ature, water (°C)	Alkal-inity (mg/L as $CaCO_3$)	Coal in bottom material (g/kg)	Selenium, total (µg/L or ppb as Se)[1]
					UPPER CUMBERLAND RIVER BASIN—*Continued*								
96	03403500	CUMBERLAND RIVER	36°51'45"	83°53'13"	7/21/80	1810	105	395	7.8	30.0	82	15.0	1
97	03403550	LITTLE INDIAN CREEK	36°49'40"	83°58'21"	7/22/80	1740	4.4	530	7.4	23.5	82	6.00	0
98	03403590	FOURMILE BRANCH	36°46'48"	83°56'05"	7/22/80	1500	.03	485	7.7	24.5	104	5.00	0
99	03403910	CLEAR FK	36°38'02"	84°06'42"	7/19/80	1420	26	420	8.0	29.5	69	29.0	0
100	03404000	CUMBERLAND RIVER	36°44'38"	84°09'30"	7/19/80	1430	178	370	7.8	30.0	82	9.00	0
101	03404200	JELLICO CREEK	36°40'56"	84°15'20"	7/21/80	1225	4.7	185	7.3	28.0	28	9.00	0
102	03404350	MARSH CREEK	36°42'55"	84°21'18"	7/21/80	1510	.49	300	6.9	27.0	15	7.00	0
103	03404800	TRIBUTARY TO LAUREL RIVER	37°03'47"	84°04'47"	7/22/80	1145	1.8	580	7.1	24.0	148	4.00	0
104	03410530	ROARING PAUNCH CREEK	36°40'09"	84°29'39"	7/23/80	1500	2.7	160	7.3	23.0	37	--	0
105	03410560	ROCK CREEK	36°42'10"	84°35'44"	7/23/80	0855	.73	770	3.3	21.5	--	7.00	0

[1]Detection limit 1 µg/L, equal to 1 ppb.

Results

The concentrations of total selenium in water and the amount of coal in bottom material at sampling sites are tabulated in table 1. Also included in table 1 are field-parameter data monitored at time of sampling, including instantaneous streamflow, specific conductance, pH, water temperature, and alkalinity. All samples were collected in a 10-day period, July 14-23, 1980. The majority of the sites (75) show concentrations of total selenium below the detection limit of 1 μg/L (1 ppb); concentrations of total selenium below the detection limit are reported as <1 μg/L in the table. The maximum value of total selenium reported was 6 μg/L (6 ppb), located at station 03214300 (Wolf Creek) (map number 36, fig. 1). Regionally, selenium appears most prevalent in the Big Sandy River Basin (yellow shaded region in fig. 1), where the only concentrations of total selenium greater than 1 μg/L (1 ppb) were reported (table 1). All other river basins in the study area have reported concentrations of total selenium less than or equal to 1 μg/L (1 ppb). Frequency of detection for the five river basins ranged from 10 percent of samples with detectable concentrations of total selenium in Middle Ohio-Raccoon Creek Basin to 46 percent of samples in the Big Sandy River Basin. Frequencies for the other basins were 18 percent for the Licking River, 24 percent for the Kentucky River, and 30 percent for the Upper Cumberland River. Streambed sediment samples were collected at 87 of the 105 sites; coal in bottom material was present in all sites for which streambed sediment was sampled. The maximum value of coal in bottom material reported was 60.0 g/kg, located at station 03400480 (Looney Creek) (map number 83, fig. 1).

Summary

This report presents results of coal-hydrology monitoring for selected streams in eastern Kentucky in 1980. Water samples at 105 sites and streambed sediment samples at 87 sites were collected in regions with natural ore deposits and (or) surface-mining sites. Concentrations of total selenium in water and amounts of coal in bottom material at streamgaging stations, along with field-parameter data, were tabulated for the 1980 water year. Of the 105 water-sampling sites, 75 were reported with concentrations of total selenium below the 1 μg/L (1 ppb) detection limit. The Big Sandy River Basin had higher concentrations of total selenium than all other river basins in the study area; the Big Sandy River Basin was the only river basin with concentrations of total selenium greater than 1 μg/L (1 ppb). The maximum concentration of total selenium reported was 6 μg/L (6 ppb). Coal in bottom material was present in all 87 sites for which streambed sediment samples were collected. The maximum amount of coal in bottom material reported was 60.0 g/kg. The historic coal-hydrology data presented in this report can provide a foundation for future investigations in eastern Kentucky.

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