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Water and Sediment Quality in the Yukon River Basin, Alaska, During Water Year 2001

Open-File Report 03-427

National Research Program
National Stream Quality Accounting Network

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

Cover photo—Yukon River, looking north near Grayling, Alaska. *Photo by Paul F. Schuster, 2003.*

WATER AND SEDIMENT QUALITY IN THE YUKON RIVER BASIN, ALASKA, DURING WATER YEAR 2001

Edited by Paul F. Schuster

U.S. GEOLOGICAL SURVEY

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U.S. DEPARTMENT OF THE INTERIOR

Gale A. Norton, Secretary

U.S. GEOLOGICAL SURVEY

Charles G. Groat, Director

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CONVERSION FACTORS, DATUM, AND ABBREVIATIONS

Multiply	*by*	*To obtain*
	Length	
nanometer (nm)	3.937×10^{-8}	inch
micrometer (µm)	3.937×10^{-5}	inch
millimeter (mm)	3.937×10^{-2}	inch
centimeter (cm)	3.937×10^{-1}	inch
meter (m)	3.281	foot (ft)
	Area	
square kilometer (km^2)	3.861×10^{-1}	square mile
	Flow	
cubic meter per second (m^3/s)	35.31	cubic foot per second (ft^3/s)
	Volume	
microliter (µL)	3.382×10^{-5}	once, fluid
milliliter (mL)	3.382×10^{-2}	once, fluid
liter (L)	2.642×10^{-1}	gallon
	Mass	
microgram (µg)	3.527×10^{-8}	ounce, avoirdupois
milligram (mg)	3.527×10^{-5}	ounce, avoirdupois

Degree Celsius (^oC) may be converted to degree Fahrenheit (^oF) by using the following equation:

$$F=1.8\ (^oC) + 32$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88)

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)

The following terms and abbreviations were also used in this report:

AU	Atomic Unit
N	Normal
Fld	Field
NTU	Nephelometric turbidity unit
µS/cm	micro Seimens per centimeter
NM	Nanometer
Wtr Flt	Water, Filtered
Dis IT	Dissolved incremental titration
Dis tot IT	Dissolved total Incremental Titration
Dis fet	Dissolved fixed-end titration
Min	minute
DOC	Dissolved Organic Carbon

DIC	Dissolved Inorganic Carbon
SUVA	Specific Ultra Violet Absorbance
UV	Ultraviolet
ICP-AES	Inductively Coupled Plasma-Atomic Emissions Spectrometry
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
FTHg	Filtered Total mercury
PTHg	Particulate Total mercury
FMHg	Filtered Methymercury
PMHg	Particulate Methylmercury
UMHg	Unfiltered Methylmercury
UTHg	Unfiltered Total mercury
OM	Organic Matter
M	Molar
XRD	X-ray Diffraction
PAH	Poly Aromatic Hydrocarbons
PCB	Poly Chlorinated Biphenyls
EDTA	Ethylenediaminetetraacetic acid
RF	Radio Frequency
UAR	Uranium Activity Ratio

OVERVIEW

This report contains water-quality and sediment-quality data from samples collected in the Yukon River Basin during water year 2001 (October 2000 through September 2001). A broad range of chemical and biological analyses from three sets of samples are presented. First, samples were collected throughout the year at five stations in the basin (three on the mainstem Yukon River, one each on the Tanana and Porcupine Rivers). Second, fecal indicators were measured on samples from drinking-water supplies collected near four villages. Third, sediment cores from five lakes throughout the Yukon Basin were sampled to reconstruct historic trends in the atmospheric deposition of trace elements and hydrophobic organic compounds.

ACKNOWLEDGMENTS

The USGS Nation Stream Quality Accounting Network (NASQAN) and the National Research Program would like to thank the USGS Alaska District office in Anchorage and the Field office in Fairbanks. Without their field expertise and continuous logistical support this work would not have been possible. A.M. Shiller's participation was partly supported by the National Science Foundation (EAR-0001049).

CHAPTER 1 - Introduction

***by* Richard P. Hooper**

Much of the permafrost south of the Yukon River is expected to melt in the next 20 to 30 years if present warming trends continue. Such large-scale environmental changes can be expected to have important consequences for the hydrology and water quality of the Yukon River and its major tributaries. Water quality data for the Yukon River drainage basin is sparse (Brabets, et al., 2000). The U.S. Geological Survey's (USGS) National Stream Quality Accounting Network (NASQAN) began a 5-year study of the Yukon River basin in water year (WY) 2001 (Landa and Hooper, 2001). The objectives of this study are to develop a 'baseline' characterization of water quality in this remote basin, against which future changes in water quality can be compared.

The approach taken includes water-quality sampling and discharge measurements throughout the year at a set of five stations across the basin (Figure 1). With these data, constituent loads can be calculated and used as a tool to measure changes in baseline chemistry. At three of the fixed-station sites and one additional site on the Yukon River, samples were collected during two separate field campaigns in the initial year of the study to examine fecal indicators in drinking water. Sediment cores were collected at five additional sites within the basin to assess historical trends in atmospheric deposition of trace elements and hydrophobic organic compounds. In addition to this work, intensive sampling campaigns of three different reaches of the river during high flow in early June and low flow in late August for the years 2002-2004 will address process-based questions about the water quality of the basin.

For the fixed-station samples, along with sediment load and concentrations, a broad range of constituents were measured, including major ions, nutrients, dissolved and sediment-associated trace elements, biological indicators (such as chlorophyll-*a* and the stable isotopic composition of nitrogen, carbon, and sulfur of particulate organic matter), and various forms of organic carbon. Because of its extensive wetlands, the Yukon River exhibits high organic carbon concentrations in contrast to other large rivers. Both the chemical composition and concentration of organic carbon are expected to change with melting permafrost.

This report contains the water-quality and sediment-quality data collected by the USGS during WY2001. The sample-collection methods and the laboratory analytical methods also are described. The report is organized into three sections, corresponding to the sample-collection methodology: fixed-station samples, fecal-indicator samples, and sediment-core samples.
The purpose of this report is two-fold; 1) to describe methods of collection and analysis, and 2) to compile and report the water-quality and sediment-quality data collected during the WY 2001 into one source. Many of the results are not contained in the USGS National Water Information System (NWIS) database and would, otherwise, not be available to the public. This report is being released both in paper and electronic format to meet both archival and data dissemination objectives.

CHAPTER 2 - Fixed-Station Samples

***by* Timothy P. Brabets**

The following section provides a description of the measurement and analytical methods used at the five fixed-station sampling locations in the collection of various water quality constituents. A summary of the site characteristics (longitude, latitude, drainage area, and gage elevation) is provided in table 1. The data provided in this section also are available from the USGS NWIS database.

Table 1. Summary of site characteristics at five fixed stations in the Yukon River Basin

[Station ID, USGS station identification, stream flow and water-quality measurements collected at the same station; ID on Figure 1, refer to Figure 1 for station ID locations; sq.mi., square miles; NAD 83, North American Datum of 1983; NAVD 88, North American Vertical Datum of 1988]

Station ID	ID on Figure 1	Station Name	Latitude (NAD 83)	Longitude (NAD 83)	Drainage Area (sq. mi.)	Datum (feet above NAVD88)
15356000	1	Yukon River at Eagle, Alaska	64°47’22”	141°47’22”	113,500	850
15389000	2	Porcupine River near Fort Yukon, Alaska	66°59’26”	143°08’16”	29,500	520
15453500	3	Yukon River near Stevens Village, Alaska	65°52’32”	149°43’04”	196,300	240
15515500	4	Tanana River at Nenana, Alaska	64°33’55”	149°05’30”	25,600	338.5
15565447	5	Yukon River at Pilot Station, Alaska	61°56’04”	162°52’50”	321,000	20

Sample Collection and Processing

Standard USGS protocols, described by Edwards and Glysson (1988), were used for the collection of depth- and width-integrated samples at all stations. A minimum of two-person field teams collected samples to reduce the opportunity for contamination of low-concentration analytes, following the protocols of Horowitz and others (1994). Samples were processed according to established USGS protocols (USGS, 1997-99).

Sample Analyses and Results

The USGS National Water Quality Laboratory (NWQL) in Denver, Colorado, analyzed all fixed-station samples for dissolved and whole-water constituents using documented USGS methods and quality-assurance practices. A summary of the standard analytical methods used and associated references are provided in table 2. Suspended-sediment concentrations were analyzed by the USGS Cascades Volcano Observatory in Vancouver, Washington. Data for each fixed station are presented in tables 3 to 7.

Table 2. Summary of standard analytical methods and references

[UV, Ultraviolet; Dis fet lab, Dissolved fixed end point lab analysis; $CaCO_3$, calcium carbonate; Dis tot IT field, dissolved total incremental titration on site]

Parameter	Publication	Method of Analysis
Solids, Residue, dissolved	Fishman and others (1994)	Gravimetric, Residue on Evaporation @ 180ºC
Turbidity	Fishman & Friedman (1989)	Nephelometry
Sediment, suspended	Guy (1969)	Gravimetric, separation by filtration/evaporation
Oxygen, dissolved	USGS (1997-99)	Amperometric
pH, whole water	USGS (1997-99)	Electrometric electrode
Specific Conductance	USGS (1997-99)	Wheatstone Bridge
UV Absorbance, 254 nm	Chin and others (1994)	UV Absorbance, 254 mn
UV Absorbance, 280 mn	Chin and others (1994)	UV Absorbance, 280 mn
Major ions		
Calcium, dissolved	Fishman (1993)	Inductively Coupled Plasma - Atomic Emission Spectrometry
Magnesium, dissolved	Fishman (1993)	Inductively Coupled Plasma - Atomic Emission Spectrometry
Potassium, dissolved	Fishman and Friedman (1989)	Flame Atomic absorption
Sodium, dissolved	Fishman (1993)	Inductively Coupled Plasma - Atomic Emission Spectrometry
Alkalinity Dis fet lab, as CaCO3	USGS (1997-99)	Fixed end point titration
Alkalinity, Dis tot IT, field	USGS (1997-99)	Incremental endpoint point titration
Bicarbonate Dis IT, field	USGS (1997-99)	Calculated
Carbonate Dis IT, field	USGS (1997-99)	Calculated
Chloride, dissolved	Fishman and Friedman (1989)	Ion Chromatography
Fluoride, dissolved	Fishman and Friedman (1989)	Automated Segmented Flow-Ion-Selective Electrode
Silica, dissolved	Fishman (1993)	Inductively Coupled Plasma-Atomic Emission Spectrometry
Sulfate, dissolved	Fishman and Friedman (1989)	Ion Chromatography
Nutrients		
Nitrogen, ammonia dissolved	Fishman (1993)	Colorimetry, Automated Segmented Flow - Salicylate-hypochlorite
Nitrogen, ammonia+organic dissolved	Patton and Truitt (2000)	Colorimetry, Automated Segmented Flow - Microkjeldahl Digestion
Nitrogen, ammonia+organic total	Fishman and others (1994)	Colorimetry, Block digestor Salicylate-hypochlorite
Nitrogen, nitrite+nitrate, dissolved	Fishman (1993)	Colorimetry, Automated Segmented Flow - Cadmium Reduction-Diazotization
Nitrogen, nitrite, dissolved	Fishman and Friedman (1989)	Ion Chromatography

Table 2. Summary of standard analytical methods and references--continued

Parameter	Publication	Method of Analysis
Nitrogen, particulate, Suspended (TPN)	Zimmerman and others (1997)	Elemental analysis
Phosphorus, dissolved	Patton and Truitt (1992)	Colorimetry, Automated Segmented Flow - Microkjeldahl Digestion
Ortho-phosphorus	Fishman (1993)	Colorimetry, Automated Segmented Flow - Phosphomolybdate
Phosphorus, total	Patton and Truitt (1992)	Colorimetry, Automated Segmented Flow - Microkjeldahl Digestion
Carbon, inorganic+organic, Particulate total (TPC)	Zimmerman and others (1997)	Elemental analysis
Carbon, inorganic, Particulate total (PIC)	Zimmerman and others (1997)	Elemental analysis
Carbon, organic, Dissolved (DOC)	Brenton and Arnett (1993)	Wet-Chemical Oxidation, Nondispersive Infrared Detector
Carbon, organic, Particulate (POC)	Zimmerman and others (1997)	Elemental analysis
Trace Elements		
Aluminum, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Antimony, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Arsenic, dissolved	Garbarino (1999)	Inductively Coupled Plasma - Mass Spectrometry
Barium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Beryllium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Boron, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Cadmium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Chromium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Cobalt, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Copper, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Iron, dissolved	Fishman (1993)	Inductively Coupled Plasma - Atomic Emission Spectrometry
Lead, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Lithium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Manganese, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Molybdenum, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Nickel, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Selenium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Silver, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Strontium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Vanadium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Zinc, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry
Uranium, dissolved	Faires (1993)	Inductively Coupled Plasma - Mass Spectrometry

Table 3. USGS National Water Quality Laboratory analyses- Yukon River at Eagle, Alaska

[cfs, cubic feet per second; mg/L, milligram per liter; NTU, Nephelometric turbidity unit; <; less then detection limit; --, missing value; mm, millimeter; µS/cm, microsiemen per centimeter at 25 degrees Celsius; cm, centimeter; C, Celsius; UV, ultraviolet; NM, nanometer; Flt, filtered; NO_2, nitrite; NO_3, nitrate; wat flt susp., water filtered suspended; µg/L, microgram per liter; Dis fet lab, Dissolved fixed end-point titration in laboratory; Dis tot IT, Dissolved total Incremental Titration; Dis IT field, Dissolved Incremental Titration in the field; %, percent]

Station ID	Date/Time	Discharge (cfs)	Solids, Residue at 180° C, Dissolved (mg/L)	Turbidity Lab Hach (NTU)	Barometric Pressure (mm of Hg)	Oxygen, dissolved (mg/L)	pH, Field (Standard Units)	pH, Lab (Standard Units)
15356000	10/4/00 15:30	180,000	141	42	750	--	8.2	7.9
15356000	3/23/01 11:40	21,300	153	4.2	767	10.8	7.4	7.9
15356000	6/4/01 19:00	219,000	114	180	745	10.8	7.9	7.9
15356000	6/20/01 13:30	355,000	130	270	746	9.5	7.9	8
15356000	7/11/01 12:10	230,000	128	0.5	747	9.1	8	8
15356000	8/9/01 11:45	188,000	130	--	754	9.5	7.6	8.1
15356000	9/11/01 11:40	140,000	132	63	751	11	8.1	7.8

Station ID	Date/Time	Specific Conductance, Lab (µS/cm)	Specific Conductance Fld (µS/cm)	Air Temp (°C)	Water Temp. (°C)	UV Absorbance 254 NM, Flt (per cm)	UV Absorbance 280 NM, Flt (per cm)	Calcium (mg/L)	Magnesium (mg/L)
15356000	10/4/00 15:30	220	208	-1	1	0.204	0.151	27.3	8
15356000	3/23/01 11:40	279	244	-23	0	0.04	0.028	34.1	9.21
15356000	6/4/01 19:00	172	163	16.5	10	0.4	0.302	22.1	6.12
15356000	6/20/01 13:30	195	184	--	13.6	0.173	0.129	25.2	7.09
15356000	7/11/01 12:10	206	202	18	14	--	--	26.1	7.51
15356000	8/9/01 11:45	221	216	17.5	14.6	0.108	0.078	28.3	8.06
15356000	9/11/01 11:40	215	187	--	8.4	0.192	0.140	27.4	8.04

Table 3. USGS National Water Quality Lab Analyses- Yukon River at Eagle, Alaska-continued

Station ID	Date/Time	Potassium (mg/L)	Sodium (mg/L)	Alkalinity, Dis fet lab, as CaCO3 (mg/L)	Alkalinity, Dis tot IT, Field (mg/L)	Bicarbonate, Dis IT Field (mg/L)	Carbonate, Dis IT, Field (mg/L)
15356000	10/4/00 15:30	0.92	2.2	79	76	93	0
15356000	3/23/01 11:40	1.16	2.7	106	99	121	0
15356000	6/4/01 19:00	1.08	1.8	61	55	67	0
15356000	6/20/01 13:30	0.87	1.7	67	64	78	0
15356000	7/11/01 12:10	1.17	2.1	72	66	81	0
15356000	8/9/01 11:45	1.55	2.5	80	76	92	0
15356000	9/11/01 11:40	1.06	2.3	76	69	84	0

Station ID	Date/Time	Chloride (mg/L)	Fluoride (mg/L)	Silica (mg/L)	Sulfate (mg/L)	Nitrogen, Ammonia dissolved (mg/L)	Nitrogen, Ammonia + Organic, dissolved (mg/L)	Nitrogen, Ammonia + Organic Total (mg/L)
15356000	10/4/00 15:30	0.5	< 0.1	7.7	29.7	0.007	0.18	0.31
15356000	3/23/01 11:40	0.8	< 0.1	6.5	30.7	0.056	0.06	0.08
15356000	6/4/01 19:00	0.4	< 0.1	5.4	19.5	0.004	0.26	0.68
15356000	6/20/01 13:30	0.4	< 0.1	6	26.2	0.005	0.09	0.59
15356000	7/11/01 12:10	0.6	< 0.1	6.3	28.9	0.007	0.12	0.41
15356000	8/9/01 11:45	0.9	< 0.1	6.3	31.5	<0.002	0.11	< 0.38
15356000	9/11/01 11:40	0.5	< 0.1	7.1	32.2	< 0.004	< 0.14	< 0.28

Station ID	Date/Time	Nitrogen, NO2+ NO3, dissolved (mg/L)	Nitrogen, Nitrite dissolved (mg/L)	Nitrogen, particulate wat flt susp. (mg/L)	Phosphorus (mg/L)	Ortho-phosphorus (mg/L)	Phosphorus, Total (mg/L)	Carbon Inorg. + Organic Partic. Total (mg/L)
15356000	10/4/00 15:30	0.042	0.001	0.186	<0.006	0.001	--	2.2
15356000	3/23/01 11:40	1.03	0.008	<0.022	<0.006	<0.007	0.004	<0.1
15356000	6/4/01 19:00	0.029	0.001	0.628	0.007	<0.007	0.931	16
15356000	6/20/01 13:30	0.033	<0.001	0.253	0.006	<0.007	0.825	7.3
15356000	7/11/01 12:10	0.024	0.001	0.174	<0.006	<0.007	0.503	8.3
15356000	8/9/01 11:45	0.021	<0.001	0.162	<0.006	<0.007	0.764	15
15356000	9/11/01 11:40	< 0.025	< 0.002	< 0.12	<0.006	<0.007	< 0.24	< 3.9

Table 3. USGS National Water Quality Lab Analyses- Yukon River at Eagle, Alaska-continued

Station ID	Date/Time	Carbon Inorganic, Partic. Total (mg/L)	Carbon, Organic dissolved (mg/L)	Carbon, Organic Particulate Total (mg/L)	Aluminum (µg/L)	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)
15356000	10/4/00 15:30	<0.1	5.9	2.2	21	0.12	<2	36.7
15356000	3/23/01 11:40	<0.1	1.7	<0.1	2	0.1	0.4	52
15356000	6/4/01 19:00	<0.1	10	16	45	0.14	0.6	33.4
15356000	6/20/01 13:30	1.8	4.5	5.5	25	0.17	0.7	39.5
15356000	7/11/01 12:10	4.9	4.8	3.5	30	0.18	0.5	36
15356000	8/9/01 11:45	11	3.3	3.8	23	0.2	0.6	40
15356000	9/11/01 11:40	< 0.2	< 6.0	< 3.6	34	0.13	0.5	38

Station ID	Date/Time	Beryllium (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Lithium (µg/L)	Manganese (µg/L)
15356000	10/4/00 15:30	<0.06	<16	0.04	0.6	0.14	2	30	0.04	<3.9	5.9
15356000	3/23/01 11:40	<0.06	12	0.03	<0.8	0.06	0.9	< 5	0.1	2.3	1.5
15356000	6/4/01 19:00	<0.06	6	0.03	<0.8	0.12	3.6	100	0.05	1.6	7.2
15356000	6/20/01 13:30	<0.06	8	<0.04	<0.8	0.08	2.5	30	<0.08	2	5.1
15356000	7/11/01 12:10	0.04	8	<0.04	<0.8	0.07	2.2	20	<0.08	2.7	3
15356000	8/9/01 11:45	<0.06	6	<0.04	<0.8	0.06	1.2	< 9	<0.08	2.7	1.5
15356000	9/11/01 11:40	<0.06	12	< 0.02	< 0.4	0.08	2.1	36	<0.08	2.5	4.2

Station ID	Date/Time	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Strontium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Uranium, natural (µg/L)	Sediment, Susp. (Sieve diam. % < 0.062 mm)	Sediment, Susp. (mg/L)
15356000	10/4/00 15:30	1	2.5	<2.4	<1	129	<10	2	0.75	45	187
15356000	3/23/01 11:40	1.3	0.74	0.7	<1	171	0.6	3	1.02	--	2
15356000	6/4/01 19:00	0.7	2.02	0.4	<1	102	0.5	1	0.66	62	883
15356000	6/20/01 13:30	0.8	1.35	0.5	<1	108	0.5	1	0.67	67	873
15356000	7/11/01 12:10	1	0.99	0.2	<1	124	0.5	5	0.75	68	554
15356000	8/9/01 11:45	1.3	0.29	0.5	<1	136	0.4	<1	0.89	79	730
15356000	9/11/01 11:40	1.1	0.77	0.4	<1	131	0.4	1	0.805	55	207

Table 4. USGS National Water Quality Lab Analyses- Porcupine River near Fort Yukon, Alaska

[cfs, cubic feet per second; mg/L, milligram per liter; NTU, Nephelometric turbidity unit; <; less then detection limit; --, missing value; mm, millimeter; µS/cm, microsiemen per centimeter at 25 degrees Celsius; cm, centimeter; C, Celsius; UV, ultraviolet; NM, nanometer; Flt, filtered; NO_2, nitrite; NO_3, nitrate; wat flt susp., water filtered suspended; µg/L, microgram per liter; Dis fet lab, Dissolved fixed end-point titration in laboratory; Dis tot IT, Dissolved total Incremental Titration; Dis IT field, Dissolved Incremental Titration in the field; %, percent]

Station ID	Date/Time	Inst Q (cfs)	Solids, Residue at 180° C, Dissolved (mg/L)	Turbidity Lab Hach (NTU)	Barometric Pressure (mm of Hg)	Oxygen, dissolved (mg/L)	pH, Field (Standard Units)	pH, Lab (Standard Units)
15389000	3/29/01 16:30	1,090	233	3.9	758	5.2	7.6	7.7
15389000	6/30/01 16:00	20,500	131	17	734	8.9	7.7	7.5
15389000	7/16/01 14:00	24,200	125	18	752	9	7.3	7.9
15389000	8/7/01 13:30	16,700	144	10	--	10.5	7.9	8.1
15389000	8/27/01 15:00	18,800	168	14	752	10.2	7.6	8
15389000	9/17/01 13:20	18,900	142	26	756	11.6	7.7	7.7

Station ID	Date/Time	Specific Conductance, Lab (µS/cm)	Specific Conductance Fld (µS/cm)	Air Temp (°C)	Water Temp (°C)	UV Absorbance 254 NM, Flt (per cm)	UV Absorbance 280 NM, Flt (per cm)	Calcium (mg/L)	Magnesium (mg/L)
15389000	3/29/01 16:30	404	376	-21	0	0.047	0.034	58.9	12.1
15389000	6/30/01 16:00	176	173	24	16.5	0.377	0.276	26.1	5.15
15389000	7/16/01 14:00	165	154	19.5	16	--	--	22.8	5.00
15389000	8/7/01 13:30	248	244	--	13.1	0.185	0.135	33.7	7.72
15389000	8/27/01 15:00	230	224	14	11.2	0.237	0.173	31.8	7.13
15389000	9/17/01 13:20	190	182	--	7.2	0.451	0.333	26.1	5.97

Table 4. USGS National Water Quality Lab Analyses- Porcupine River near Fort Yukon, Alaska-continued

Station ID	Date/Time	Chloride (mg/L)	Fluoride (mg/L)	Silica (mg/L)	Sulfate (mg/L)	Nitrogen, Ammonia dissolved (mg/L)	Nitrogen, Ammonia + Organic Dissolved (mg/L)	Nitrogen, Ammonia + Organic Total (mg/L)
15389000	3/29/01 16:30	4.2	<0.2	4.1	35.1	0.008	0.08	0.07
15389000	6/30/01 16:00	0.8	< 0.1	3.2	23	0.003	0.28	0.36
15389000	7/16/01 14:00	0.6	<0.2	3.6	23	0.005	0.32	0.42
15389000	8/7/01 13:30	1.1	<0.2	3.2	44.6	<0.002	0.18	0.22
15389000	8/27/01 15:00	0.8	0.1	3.6	39	<0.002	0.22	0.27
15389000	9/17/01 13:20	0.8	<0.2	4.6	33	0.007	0.32	0.34

Station ID	Date/Time	Potassium (mg/L)	Sodium (mg/L)	Alkalinity, Dis fet lab, as CaCO3 (mg/L)	Alkalinity, Dis tot IT Field (mg/L)	Bicarbonate, Dis IT Field (mg/L)	Carbonate, Dis IT Field (mg/L)
15389000	3/29/01 16:30	0.57	4.5	171	141	171	0
15389000	6/30/01 16:00	0.54	2.2	64	55	68	0
15389000	7/16/01 14:00	0.48	2.0	54	50	61	0
15389000	8/7/01 13:30	0.52	2.9	76	73	89	0
15389000	8/27/01 15:00	0.42	2.3	74	71	86	0
15389000	9/17/01 13:20	0.44	2.3	60	58	70	0

Station ID	Date/Time	Nitrogen, NO2+ NO3, dissolved (mg/L)	Nitrogen, Nitrite dissolved (mg/L)	Nitrogen, particulate wat flt susp (mg/L)	Phosphorus (mg/L)	Ortho-phosphorus (mg/L)	Phosphorus, Total (mg/L)	Carbon Inorg. + Organic Partic. Total (mg/L)
15389000	3/29/01 16:30	0.204	<0.001	<0.02	<0.006	<0.007	0.003	<0.1
15389000	6/30/01 16:00	0.017	0.002	0.06	0.007	<0.007	0.037	0.9
15389000	7/16/01 14:00	0.014	0.001	0.02	0.007	<0.007	0.03	0.6
15389000	8/7/01 13:30	0.013	0.001	0.13	<0.006	<0.007	0.016	1
15389000	8/27/01 15:00	0.035	<0.001	0.05	0.004	<0.007	0.024	0.6
15389000	9/17/01 13:20	0.029	0.002	0.06	0.005	<0.007	0.032	1.2

Table 4. USGS National Water Quality Lab Analyses- Porcupine River near Fort Yukon, Alaska-continued

Station ID	Date/Time	Beryllium (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Lithium (µg/L)	Manganese (µg/L)
15389000	3/29/01 16:30	<0.06	10	<0.04	<0.8	0.12	0.7	10	<0.08	6.2	10.9
15389000	6/30/01 16:00	<0.06	< 6	<0.04	< 0.4	0.09	2.4	194	0.22	3.1	2.7
15389000	7/16/01 14:00	<0.06	7	< 0.03	< 0.6	0.09	2.8	219	0.10	2.9	2.7
15389000	8/7/01 13:30	<0.06	9	<0.04	<0.8	0.08	1.9	70	< 0.06	4.1	2.4
15389000	8/27/01 15:00	<0.06	< 7	<0.04	< 0.6	0.09	1.6	90	< 0.06	3.9	2.5
15389000	9/17/01 13:20	<0.06	< 4	< 0.03	< 0.6	0.15	2.9	347	0.09	4.5	4.9

Station ID	Date/Time	Carbon Inorganic, Partic. Total (mg/L)	Carbon, Organic dissolved mg/L)	Carbon, Organic Particulate Total (mg/L)	Aluminum (µg/L)	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)
15389000	3/29/01 16:30	<0.1	1.9	<0.1	2	0.05	0.2	91
15389000	6/30/01 16:00	<0.1	11	0.9	32	0.13	0.4	54
15389000	7/16/01 14:00	<0.1	13	0.6	49	0.11	0.4	57
15389000	8/7/01 13:30	<0.1	6	1	24	0.09	0.3	67
15389000	8/27/01 15:00	<0.1	6.8	0.6	25	0.09	0.3	57
15389000	9/17/01 13:20	<0.1	12	1.2	103	0.10	0.3	51

Station ID	Date/Time	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Strontium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Uranium, natural (µg/L)	Sediment, Susp. (Sieve diam. % < 0.062mm)	Sediment, Susp. (mg/L)
15389000	3/29/01 16:30	0.6	0.69	0.4	<1	155	1	2	0.74	--	0
15389000	6/30/01 16:00	0.4	2.04	<0.3	<1	76.7	0.5	1	0.32	94	24
15389000	7/16/01 14:00	0.3	2.36	<0.3	<1	73.8	0.3	2	0.24	95	25
15389000	8/7/01 13:30	0.5	0.98	0.4	<1	127	< 0.2	1	0.43	97	12
15389000	8/27/01 15:00	0.4	1.39	< 0.2	<1	104	0.3	2	0.38	94	15
15389000	9/17/01 13:20	0.3	3.81	< 0.2	<1	82.2	0.5	3	0.29	97	26

Table 5. USGS National Water Quality Lab Analyses- Yukon River near Stevens Village, Alaska

[cfs, cubic feet per second; mg/L, milligram per liter; NTU, Nephelometric turbidity unit; <; less then detection limit; --, missing value; mm, millimeter; µS/cm, microsiemen per centimeter at 25 degrees Celsius; cm, centimeter; C, Celsius; UV, ultraviolet; NM, nanometer; Flt, filtered; NO_2, nitrite; NO_3, nitrate; wat flt susp., water filtered suspended; µg/L, microgram per liter; Dis fet lab, Dissolved fixed end-point titration in laboratory; Dis tot IT, Dissolved total Incremental Titration; Dis IT field, Dissolved Incremental Titration in the field; %, percent]

Station ID	Date/Time	Inst Q (cfs)	Solids, Residue at 180° C, Dissolved (mg/L)	Turbidity Lab Hach (NTU)	Barometric Pressure (mm of Hg)	Oxygen, dissolved (mg/L)	pH, Field (Standard Units)	pH, Lab (Standard Units)
15453500	10/2/00 15:50	260,000	135	120	763	13.2	8.1	7.9
15453500	3/21/01 16:30	23,600	173	3.7	787	8.5	7.2	7.8
15453500	6/2/01 18:00	423,000	115	150	762	10.1	7.5	7.6
15453500	6/18/01 16:20	480,000	121	180	764	9.5	7.8	7.8
15453500	7/13/01 14:30	296,000	131	300	761	8.9	7.6	8.1
15453500	8/14/01 15:15	214,000	152	4.3	762	9.5	7.7	8
15453500	9/21/01 12:30	152,000	142	27	753	11.1	7.7	7.6

Station ID	Date/Time	Specific Conductance, Lab (µS/cm)	Specific Conductance Fld (µS/cm)	Air Temp (°C)	Water Temp (°C)	UV Absorbance 254 NM, Flt (per cm)	UV Absorbance 280 NM, Flt (per cm)	Calcium (mg/L)	Magnesium (mg/L)
15453500	10/2/00 15:50	212	196	-0.5	2.5	--	--	28.5	7.79
15453500	3/21/01 16:30	303	267	-23	0	0.045	0.032	42.3	10.1
15453500	6/2/01 18:00	139	125	15	9.2	0.636	0.48	19.7	3.98
15453500	6/18/01 16:20	178	180	24	14.3	0.236	0.174	25.7	5.92
15453500	7/13/01 14:30	206	206	21	15.4	0.178	0.131	27.2	7.19
15453500	8/14/01 15:15	232	227	--	14.1	0.12	0.086	30.3	8.14
15453500	9/21/01 12:30	236	233	15	7.6	0.17	0.121	30.1	8.14

Table 5. USGS National Water Quality Lab Analyses- Yukon River near Stevens Village, Alaska-continued

Station ID	Date/Time	Nitrogen, NO2+ NO3, dissolved (mg/L)	Nitrogen, Nitrite dissolved (mg/L)	Nitrogen, particulate wat flt susp (mg/L)	Phosphorus (mg/L)	Ortho-phosphorus (mg/L)	Phosphorus, Total (mg/L)	Carbon Inorg. + Organic Partic. Total (mg/L)
15453500	10/2/00 15:50	0.062	0.001	0.059	0.003	<0.001	0.313	--
15453500	3/21/01 16:30	<0.005	0.001	<0.022	0.003	0.07	0.016	0.3
15453500	6/2/01 18:00	0.021	0.002	0.418	0.015	<0.007	0.59	7.3
15453500	6/18/01 16:20	0.033	0.001	0.371	0.016	<0.007	0.523	8.1
15453500	7/13/01 14:30	0.04	0.002	0.133	<0.006	<0.007	0.489	7.2
15453500	8/14/01 15:15	0.029	<0.001	0.184	<0.006	<0.007	0.467	10
15453500	9/21/01 12:30	0.028	0.001	0.08	<0.006	<0.007	0.161	2.3

Station ID	Date/Time	Potassium (mg/L)	Sodium (mg/L)	Alkalinity Wat. Dis fet lab CaCO3 (mg/L)	Alkalinity, Dis tot IT Field (mg/L)	Bicarbonate, Dis IT Field (mg/L)	Carbonate, Dis IT Field (mg/L)
15453500	10/2/00 15:50	0.91	2.5	76	72	88	0
15453500	3/21/01 16:30	1.13	2.8	120	113	138	0
15453500	6/2/01 18:00	0.89	0.7	52	47	58	0
15453500	6/18/01 16:20	0.92	1.5	67	63	77	0
15453500	7/13/01 14:30	1.21	2.1	73	--	--	--
15453500	8/14/01 15:15	1.53	2.7	83	78	95	0
15453500	9/21/01 12:30	0.94	2.4	84	78	95	0

Station ID	Date/Time	Chloride (mg/L)	Fluoride (mg/L)	Silica (mg/L)	Sulfate (mg/L)	Nitrogen, Ammonia dissolved (mg/L)	Nitrogen, Ammonia + Organic Dissolved (mg/L)	Nitrogen, Ammonia + Organic Total (mg/L)
15453500	10/2/00 15:50	0.6	<0.1	7.3	28.1	<0.002	0.2	0.42
15453500	3/21/01 16:30	1.1	0.1	6.8	33.1	<0.002	0.07	0.05
15453500	6/2/01 18:00	0.5	0.1	3.2	12.9	0.004	0.43	0.92
15453500	6/18/01 16:20	0.4	<0.2	4.6	22.1	0.003	0.23	0.72
15453500	7/13/01 14:30	0.4	0.1	5.7	28.3	0.003	0.14	0.29
15453500	8/14/01 15:15	0.8	0.2	6.1	33.5	0.012	0.22	0.41
15453500	9/21/01 12:30	0.5	<0.2	6.0	35.2	0.002	0.13	0.23

Table 5. USGS National Water Quality Lab Analyses- Yukon River near Stevens Village, Alaska-continued

Station ID	Date/Time	Carbon Inorganic, Partic. Total (mg/L)	Carbon, Organic dissolved (mg/L)	Carbon, Organic Particulate Total (mg/L)	Aluminum (µg/L)	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)
15453500	10/2/00 15:50	--	7.2	--	22	0.14	<2	42.1
15453500	3/21/01 16:30	<0.1	1.9	0.2	2	0.09	0.3	64.8
15453500	6/2/01 18:00	2.2	17	5.1	65	0.11	0.5	32.6
15453500	6/18/01 16:20	2.4	6.6	5.7	23	0.19	0.6	44.3
15453500	7/13/01 14:30	1.1	5.9	6.1	26	0.19	0.6	43.8
15453500	8/14/01 15:15	4.4	3.5	6	20	0.2	0.6	49.5
15453500	9/21/01 12:30	0.6	5.0	1.7	20	0.15	0.6	42.0

Station ID	Date/Time	Beryllium (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Lithium (µg/L)	Manganese (µg/L)
15453500	10/2/00 15:50	<0.06	<16	0.03	0.5	0.12	2.6	50	0.04	<3.9	4.5
15453500	3/21/01 16:30	<0.06	9	<0.04	<0.8	0.07	0.8	10	<0.08	2.5	8.9
15453500	6/2/01 18:00	<0.06	5	0.02	<0.8	0.22	4.4	230	0.14	2.4	18.5
15453500	6/18/01 16:20	<0.06	6	0.03	<0.8	0.09	2.9	60	0.08	2	4.8
15453500	7/13/01 14:30	<0.06	8	0.03	<0.8	0.1	2.8	20	0.07	2.5	2.4
15453500	8/14/01 15:15	<0.06	20	<0.04	<0.8	0.07	2	< 7	<0.08	3	3.1
15453500	9/21/01 12:30	<0.06	7	<0.04	<0.8	2	2	52	<0.17	2.9	6.2

Table 5. USGS National Water Quality Lab Analyses- Yukon River near Stevens Village, Alaska-continued

Station ID	Date/Time	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Strontium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Uranium, natural (µg/L)	Sediment, Susp. (Sieve diam. % <0.062mm)	Sediment, Susp. (mg/L)
15453500	10/2/00 15:50	0.9	2.03	<2.4	<1	127	<10	<1	0.75	80	302
15453500	3/21/01 16:30	1.1	0.25	0.6	<1	176	0.5	2	1.03	--	11
15453500	6/2/01 18:00	0.4	3.15	<0.3	<1	61.2	1.1	1	0.37	71	622
15453500	6/18/01 16:20	0.7	1.49	0.4	<1	97	0.7	<1	0.64	79	504
15453500	7/13/01 14:30	0.9	1.22	0.4	<1	123	0.5	<1	0.75	79	507
15453500	8/14/01 15:15	1.2	0.38	<0.3	<1	145	0.4	<1	0.84	83	466
15453500	9/21/01 12:30	0.9	0.93	0.5	<1	128	0.5	2	0.76	48	168

Table 6. USGS National Water Quality Lab Analyses- Tanana River at Nenana, Alaska

[cfs, cubic feet per second; mg/L, milligram per liter; NTU, Nephelometric turbidity unit; <; less then detection limit; --, missing value; mm, millimeter; µS/cm, microsiemen per centimeter at 25 degrees Celsius; cm, centimeter; C, Celsius; UV, ultraviolet; NM, nanometer; Flt, filtered; NO_2, nitrite; NO_3, nitrate; wat flt susp., water filtered suspended; µg/L, microgram per liter; Dis fet lab, Dissolved fixed end-point titration in laboratory; Dis tot IT, Dissolved total Incremental Titration; Dis IT field, Dissolved Incremental Titration in the field; %, percent]

Station ID	Date/Time	Inst Q (cfs)	Solids, Residue at 180°C, Dissolved (mg/L)	Turbidity Lab Hach (NTU)	Barometric Pressure (mm of Hg)	Oxygen, dissolved (mg/L)	pH, Field (Standard Units)	pH, Lab (Standard Units)
15515500	10/3/00 16:00	36,600	165	98	762	13.3	7.9	7.9
15515500	3/20/01 16:40	7,550	192	3.7	775	9.6	7.2	8.2
15515500	5/31/01 18:20	27,500	151	89	758	10.3	7.8	7.7
15515500	6/22/01 15:00	53,400	141	640	764	8.8	7.8	8
15515500	7/9/01 14:40	54,400	142	550	759	10.2	8	7.8
15515500	8/2/01 16:30	98,800	134	730	758	10	7.7	7.8
15515500	9/13/01 15:10	35,200	176	67	752	10.9	7.6	7.5

Station ID	Date/Time	Specific Conductance, Lab (µS/cm)	Specific Conductance Fld (µS/cm)	Air Temp. (ºC)	Water Temp. (ºC)	UV Absorbance 254 NM, Flt (per cm)	UV Absorbance 280 NM, Flt (per cm)	Calcium (mg/L)	Magnesium (mg/L)
15515500	10/3/00 16:00	261	242	0	0	--	--	34.4	8.38
15515500	3/20/01 16:40	310	287	-9	0	0.029	0.021	45.8	9.28
15515500	5/31/01 18:20	226	216	12.5	10	0.243	0.182	30.2	6.87
15515500	6/22/01 15:00	246	239	--	17.2	0.065	0.047	31.4	7.72
15515500	7/9/01 14:40	231	224	18	12.5	0.075	0.054	28.8	7.04
15515500	8/2/01 16:30	215	207	--	13.5	0.415	0.104	27.4	6.22
15515500	9/13/01 15:10	252	257	--	8.3	0.11	0.08	35.6	8.68

Table 6. USGS National Water Quality Lab Analyses- Tanana River at Nenana, Alaska-continued

Station ID	Date/Time	Potassium (mg/L)	Sodium (mg/L)	Alkalinity, Dis fet lab, as CaCO3 (mg/L)	Alkalinity, Dis tot IT Field (mg/L)	Bicarbonate, Dis IT Field (mg/L)	Carbonate, Dis IT Field (mg/L)
15515500	10/3/00 16:00	1.4	3.9	88	83	101	0
15515500	3/20/01 16:40	2.28	4	131	121	148	0
15515500	5/31/01 18:20	1.64	3.3	81	76	93	0
15515500	6/22/01 15:00	2.12	3.3	77	89	90	0
15515500	7/9/01 14:40	1.78	3.4	73	65	80	0
15515500	8/2/01 16:30	1.89	2.9	71	68	83	0
15515500	9/13/01 15:10	1.68	3.8	96	91	111	0

Station ID	Date/Time	Chloride (mg/L)	Fluoride (mg/L)	Silica (mg/L)	Sulfate (mg/L)	Nitrogen, Ammonia dissolved (mg/L)	Nitrogen, Ammonia + Organic Dissolved (mg/L)	Nitrogen, Ammonia + Organic Total (mg/L)
15515500	10/3/00 16:00	1.5	0.1	10.1	38.1	0.01	0.17	0.34
15515500	3/20/01 16:40	1.3	< 0.1	14.4	33.2	0.048	0.1	0.14
15515500	5/31/01 18:20	1.4	< 0.1	8.7	27.6	<0.002	0.19	0.43
15515500	6/22/01 15:00	<0.1	< 0.1	6.6	38.7	0.003	<0.1	0.61
15515500	7/9/01 14:40	1.8	< 0.1	6.5	36.3	0.006	0.07	0.43
15515500	8/2/01 16:30	1.1	< 0.1	6.7	31.1	0.002	0.14	0.7
15515500	9/13/01 15:10	1.8	< 0.1	--	--	0.01	0.12	0.3

Table 6. USGS National Water Quality Lab Analyses- Tanana River at Nenana, Alaska-continued

Station ID	Date/Time	Nitrogen, NO2+ NO3, dissolved (mg/L)	Nitrogen, Nitrite dissolved (mg/L)	Nitrogen, particulate wat flt susp (mg/L)	Phosphorus (mg/L)	Ortho-phosphorus (mg/L)	Phosphorus, Total (mg/L)	Carbon Inorg. + Organic Partic. Total (mg/L)
15515500	10/3/00 16:00	0.171	0.001	0.033	0.005	0.005	0.509	--
15515500	3/20/01 16:40	0.162	0.002	<0.022	<0.006	<0.007	0.028	0.3
15515500	5/31/01 18:20	0.066	0.001	0.242	0.007	<0.007	0.331	2.1
15515500	6/22/01 15:00	0.085	0.001	0.305	0.005	<0.007	1.15	5.3
15515500	7/9/01 14:40	0.075	0.001	0.249	0.003	<0.007	0.695	5.5
15515500	8/2/01 16:30	0.062	0.002	0.694	0.004	<0.007	1.86	12
15515500	9/13/01 15:10	0.089	0.002	0.059	0.003	<0.007	0.512	2.3

Station ID	Date/Time	Carbon Inorganic, Partic. Total (mg/L)	Carbon, Organic dissolved (mg/L)	Carbon, Organic Particulate Total (mg/L)	Aluminum (µg/L)	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)
15515500	10/3/00 16:00	--	5.6	--	18	0.2	<2	27.9
15515500	3/20/01 16:40	<0.1	1.1	0.2	1	0.16	0.5	47.3
15515500	5/31/01 18:20	<0.1	6.5	2	19	0.19	1	29.4
15515500	6/22/01 15:00	1.1	1.9	4.2	21	0.35	1.1	34.8
15515500	7/9/01 14:40	0.8	2.2	4.7	17	0.28	0.9	30
15515500	8/2/01 16:30	2	3.9	9.5	20	0.36	1.1	31.4
15515500	9/13/01 15:10	0.3	3.4	2	12	0.22	0.9	32.0

Table 6. USGS National Water Quality Lab Analyses- Tanana River at Nenana, Alaska-continued

Station ID	Date/Time	Beryllium (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Lithium (µg/L)	Manganese (µg/L)
15515500	10/3/00 16:00	<0.06	23	0.03	<0.8	0.2	2.9	80	0.06	< 2.9	30
15515500	3/20/01 16:40	<0.06	20	0.02	<0.8	0.21	0.8	40	<0.08	2.8	86
15515500	5/31/01 18:20	<0.06	19	0.02	0.5	0.15	3.9	130	0.09	2.5	20.5
15515500	6/22/01 15:00	<0.06	25	<0.04	0.5	0.08	1.7	10	<0.08	4.2	3.3
15515500	7/9/01 14:40	<0.06	19	< 0.03	<0.8	0.1	1.8	< 9	0.14	3.6	10
15515500	8/2/01 16:30	<0.06	15	< 0.02	<0.8	0.12	2.8	20	0.06	3.4	14.5
15515500	9/13/01 15:10	<0.06	18	< 0.02	<0.8	0.14	2.6	40	0.11	3.5	25.4

Station ID	Date/Time	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Strontium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Uranium, natural (µg/L)	Sediment, Susp. (Sieve diam. % <0.062mm)	Sediment, Susp. (mg/L)
15515500	10/3/00 16:00	1	1.4	<2.4	<1	157	<10	<1	0.72	24	802
15515500	3/20/01 16:40	1.1	0.76	0.7	<1	192	0.6	<1	0.69	--	16
15515500	5/31/01 18:20	0.8	0.4	0.4	<1	137	0.6	<1	0.64	36	484
15515500	6/22/01 15:00	1.1	0.47	0.5	<1	144	0.5	<1	0.89	74	1440
15515500	7/9/01 14:40	1	0.56	0.4	<1	132	0.5	<1	0.77	65	1550
15515500	8/2/01 16:30	1	0.67	0.4	<1	120	0.5	2	0.77	65	3450
15515500	9/13/01 15:10	1	0.19	0.5	<1	158	0.6	1	0.80	--	709

Table 7. USGS National Water Quality Lab Analyses- Yukon River at Pilot Station, Alaska

[cfs, cubic feet per second; mg/L, milligram per liter; NTU, Nephelometric turbidity unit; <; less then detection limit; --, missing value; mm, millimeter; µS/cm, microsiemen per centimeter at 25 degrees Celsius; cm, centimeter; C, Celsius; UV, ultraviolet; NM, nanometer; Flt, filtered; NO_2, nitrite; NO_3, nitrate; wat flt susp., water filtered suspended; µg/L, microgram per liter; Dis fet lab, Dissolved fixed end-point titration in laboratory; Dis tot IT, Dissolved total Incremental Titration; Dis IT field, Dissolved Incremental Titration in the field; %, percent]

Station ID	Date/Time	Inst Q (cfs)	Solids, Residue at 180° C, Dissolved (mg/L)	Turbidity Lab Hach (NTU)	Barometric Pressure (mm of Hg)	Oxygen, dissolved (mg/L)	pH, Field (Standard Units)	pH, Lab (Standard Units)
15565447	4/19/01 19:40	47,400	200	8.6	760	3	7.3	7.5
15565447	7/5/01 18:20	680,000	131	150	762	8.1	8.3	7.8
15565447	7/25/01 10:30	441,000	129	250	769	8.6	8	7.7
15565447	8/14/01 21:30	448,000	132	430	764	9.9	7.9	7.7
15565447	8/30/01 11:30	466,000	130	100	743	9.4	7.8	7.7
15565447	9/21/01 14:00	340,000	146	68	744	10	7.7	7.6

Station ID	Date/Time	Specific Conductance, Lab (µS/cm)	Specific Conductance Fld (µS/cm)	Air Temp (°C)	Water Temp (°C)	UV Absorbance 254 NM, Flt (per cm)	UV Absorbance 280 NM, Flt (per cm)	Calcium (mg/L)	Magnesium (mg/L)
15565447	4/19/01 19:40	332	312	2	0	0.07	0.052	47.1	10.7
15565447	7/5/01 18:20	189	186	11	15	--	--	27	5.63
15565447	7/25/01 10:30	213	208	18	16.5	0.17	0.126	27.3	6.7
15565447	8/14/01 21:30	220	214	14.5	14	0.222	0.163	28.2	6.77
15565447	8/30/01 11:30	221	214	14.5	13.5	0.185	0.135	29.5	7.19
15565447	9/21/01 14:00	228	223	9	10	0.179	0.132	31	8.01

Table 7. USGS National Water Quality Lab Analyses- Yukon River at Pilot Station, Alaska-continued

Station ID	Date/Time	Potassium (mg/L)	Sodium (mg/L)	Alkalinity, Dis fet lab, as CaCO3 (mg/L)	Alkalinity, Dis tot IT Field (mg/L)	Bicarbonate, Dis IT Field (mg/L)	Carbonate, Dis IT Field (mg/L)
15565447	4/19/01 19:40	1.34	3.3	145	133	162	0
15565447	7/5/01 18:20	1.21	1.9	72	66	79	0
15565447	7/25/01 10:30	1.26	2.3	78	75	92	0
15565447	8/14/01 21:30	1.5	2.6	78	72	86	0
15565447	8/30/01 11:30	1.41	2.8	78	75	91	0
15565447	9/21/01 14:00	1.34	2.8	84	77	92	0

Station ID	Date/Time	Nitrogen, NO2+ NO3, dissolved (mg/L)	Nitrogen, Nitrite dissolved (mg/L)	Nitrogen, particulate wat flt susp (mg/L)	Phosphorus (mg/L)	Ortho-phosphorus (mg/L)	Phosphorus, Total (mg/L)	Carbon Inorg. + Organic Partic. Total (mg/L)
15565447	4/19/01 19:40	0.206	0.003	<0.022	<0.006	<0.007	0.027	0.5
15565447	7/5/01 18:20	0.048	0.001	0.32	0.007	<0.007	0.338	6.3
15565447	7/25/01 10:30	0.068	0.002	0.18	0.008	<0.007	0.312	< 6.1
15565447	8/14/01 21:30	0.065	0.001	0.255	< 0.005	< 0.004	0.51	8.7
15565447	8/30/01 11:30	0.073	0.001	0.373	0.006	<0.007	0.441	8.1
15565447	9/21/01 14:00	0.071	0.002	--	0.005	<0.007	0.257	--

Station ID	Date/Time	Chloride (mg/L)	Fluoride (mg/L)	Silica (mg/L)	Sulfate (mg/L)	Nitrogen, Ammonia dissolved (mg/L)	Nitrogen, Ammonia + Organic Dissolved (mg/L)	Nitrogen, Ammonia + Organic Total (mg/L)
15565447	4/19/01 19:40	1.3	0.1	11.4	27.1	0.054	0.15	0.17
15565447	7/5/01 18:20	0.7	0.1	5.6	22.2	0.003	0.17	0.59
15565447	7/25/01 10:30	0.9	0.1	6.2	27.1	0.004	0.13	< 0.43
15565447	8/14/01 21:30	0.9	0.2	6.5	29	0.006	0.19	0.57
15565447	8/30/01 11:30	0.8	<0.2	6.5	29.4	0.005	0.2	0.46
15565447	9/21/01 14:00	0.8	<0.2	7.3	29.8	0.004	0.14	0.41

Table 7. USGS National Water Quality Lab Analyses- Yukon River at Pilot Station, Alaska-continued

Station ID	Date/Time	Carbon Inorganic, Partic. Total (mg/L)	Carbon, Organic dissolved (mg/L)	Carbon, Organic Particulate Total (mg/L)	Aluminum (µg/L)	Antimony (µg/L)	Arsenic (µg/L)	Barium (µg/L)
15565447	4/19/01 19:40	<0.1	2.2	0.4	1	0.14	0.4	77
15565447	7/5/01 18:20	0.2	--	6.1	13	0.23	1	45.1
15565447	7/25/01 10:30	<0.1	4.6	< 6	13	0.27	0.9	43.4
15565447	8/14/01 21:30	3.3	6.2	5.3	15	0.29	0.8	47.4
15565447	8/30/01 11:30	1.3	5.4	6.8	14	0.25	0.9	46.9
15565447	9/21/01 14:00	--	4.9	--	11	0.23	0.9	43.8

Station ID	Date/Time	Beryllium (µg/L)	Boron (µg/L)	Cadmium (µg/L)	Chromium (µg/L)	Cobalt (µg/L)	Copper (µg/L)	Iron (µg/L)	Lead (µg/L)	Lithium (µg/L)	Manganese (µg/L)
15565447	4/19/01 19:40	<0.06	17	<0.04	<0.8	0.2	1	80	<0.08	3	95.8
15565447	7/5/01 18:20	<0.06	6	0.03	<0.8	0.1	2.9	170	0.29	1.9	12.6
15565447	7/25/01 10:30	<0.06	9	0.02	<0.8	0.07	2.4	110	0.15	2.5	3.5
15565447	8/14/01 21:30	<0.06	20	<0.04	<0.8	0.08	3.9	50	0.2	2.7	2.9
15565447	8/30/01 11:30	<0.06	9	<0.04	<0.8	0.06	2.8	90	0.2	2.5	4.1
15565447	9/21/01 14:00	<0.06	9	<0.04	<0.8	0.09	2.3	150	0.06	2.7	9.9

Station ID	Date/Time	Molybdenum (µg/L)	Nickel (µg/L)	Selenium (µg/L)	Silver (µg/L)	Strontium (µg/L)	Vanadium (µg/L)	Zinc (µg/L)	Uranium, natural (µg/L)	Sediment, Susp. (Sieve diam. % < 0.062mm)	Sediment, Susp. (mg/L)
15565447	4/19/01 19:40	0.9	0.47	0.4	<1	205	1	2	1.01	--	4
15565447	7/5/01 18:20	0.8	0.82	0.4	<1	103	0.7	<1	0.51	67	463
15565447	7/25/01 10:30	0.9	0.43	0.5	<1	115	0.6	<1	0.68	--	--
15565447	8/14/01 21:30	1.1	0.74	<0.3	<1	121	0.6	<1	0.77	82	927
15565447	8/30/01 11:30	1	0.25	0.6	3	121	0.6	1	0.7	85	500
15565447	9/21/01 14:00	0.9	0.33	0.5	<1	130	0.6	<1	0.77	81	302

CHAPTER 3 - Dissolved Organic Carbon (DOC) Characterization

***by* George R. Aiken**

In addition to the dissolved organic carbon (DOC) analyses performed by the NWQL, DOC, ultraviolet (UV) absorbance spectroscopy, specific UV absorbance (SUVA), and DOC fractionation analyses were carried out at the USGS National Research program Laboratory in Boulder, Colorado. All of the reagents referred to in the following analytical procedures were reagent grade or better.

Sample Collection and Processing

Two methods of collection were used for DOC characterization studies. In the first method, Alaska District personnel using NASQAN sampling protocols collected samples periodically at fixed stations on the Yukon, Porcupine, and Tanana Rivers (see Chapter 2). For DOC, SUVA and DOC fractionation analyses, 3 L of sample was filtered in the field with Gelman AquaPrep 600™ capsule filters (0.45-µm) into 1-L burned, amber glass pesticide bottles having Teflon™-lined caps. These samples were immediately refrigerated and shipped on ice overnight to the USGS Boulder laboratory. At the lab, samples were refrigerated at the lab and analyzed within 2 weeks of arrival.

In the second method of collection, miscellaneous grab samples were collected for DOC, SUVA and DOC fractionation analysis in 1-L burned, amber glass bottles. These samples were subsequently filtered within 4 hours with Gelman AquaPrep 600™ capsule filters (0.45 µm) into 1-liter, burned, amber glass bottles. Smaller volume samples for DOC and SUVA analyses were filtered on-site using a 60-mL Becton Dickinson™ plastic syringe with Luer-lok™ fitting and a 25-mm Gelman Acrodisk™ filter with 0.45-µm SUPOR™ membrane into 40- mL baked, brown glass vials with Teflon™-lined caps. After filtration, all samples were handled as described for the first method of collection.

Sample Analyses and Results

The analytical methods used to determine DOC concentration and characterization are described. Results are given in table 8.

DOC Concentrations. DOC measurements using the platinum catalysed persulfate wet oxidation method were made on an O.I. Analytical Model 700 TOC Analyzer™ (Aiken, 1992). The instrument was warmed up for 24-hours before analyzing samples. Samples and standards were loaded onto an autosampler for analysis and introduced into the reaction vessel by means of a fixed-volume sample loop. The volume of the sample loop was kept small, usually 1 mL, to maintain linear instrument response (0-50 µg of carbon). The standard, automated analytical conditions called for 0.5 mL of 5 percent by volume phosphoric acid to be added to the sample. The sample was then purged for 2.0 minutes with nitrogen to remove inorganic carbon, after which 0.5 mL of 0.42 M sodium persulfate solution was added. The standard reaction time of 5 minutes was used for the persulfate oxidation step. The instrument was calibrated with solutions

of reagent-grade potassium hydrogen phthalate in distilled water. The standard curve, consisting of a minimum of five standards over the range of interest, was repeated for every 8 water samples analyzed in duplicate. Reported values are the averages of duplicate analyses (table 8). Standard deviation for the DOC measurement was determined to be ±0.2 mg carbon/L.

Ultraviolet-Visible Light Absorption Analyses (UV-Vis). UV-Vis measurements were made on a Hewlett-Packard Model 8453™ photo-diode array spectrophotometer between λ=200 nm and λ=800 nm with distilled water as the blank utilizing a 1-cm path-length quartz cell. Results are reported for the λ=254 nm in dimensionless absorbance units. The wavelength of λ=254 nm was chosen because it is the wavelength commonly associated with the aromatic moieties in a sample (Chin and others, 1994). Filtered samples at room temperature were analyzed using a quartz cell in the manual mode. The cell was rinsed with a small volume of sample before adding sample for analysis. The cell was then rinsed with distilled water before analyzing the next sample. Standard deviation for a UV measurement at 254 nm is ±0.002 AU.

Specific UV Absorbance (SUVA). SUVA, defined as the UV absorbance of a sample measured at a given wavelength divided by the DOC concentration, is an "average" molar absorptivity for all the molecules that comprise the DOC in a water sample. SUVA is, therefore, a parameter that indicates the nature or "quality" of DOC in a given sample and has been used as a surrogate measurement of DOC aromaticity (Chin and others, 1994). SUVA values at 254 nm ($SUVA_{254}$) are reported in this report because natural organic matter absorbs strongly at this wavelength, thereby giving increased sensitivity, and because of the strong correlation with the aromatic carbon content of natural organic matter at this wavelength. $SUVA_{254}$ was determined for each sample in this study by dividing the UV absorbance determined at λ=254 nm by the DOC concentration of the sample. SUVA values are reported in units of [L/(mg carbon * m)] and have a standard deviation of ±0.1 [L/(mg carbon * m)].

DOC Fractionation utilizing Amberlite XAD™ resins. The DOC present in select samples was chromatographically fractionated into 5 fractions (hydrophobic acids, hydrophobic neutrals, transphilic neutrals (not reported in table 8), hydrophilic organic matter, and transphilic acids) using XAD-8 and XAD-4 resins. The distribution of organic matter in these fractions is a "fingerprint" of dissolved organic matter (DOM) in the system and can provide information about how various processes affect the chemistry of the DOM. DOC fractionation is utilized to break the DOC down into groups and determine what mass percent of each group is contained in the overall DOC pool. The XAD-8 resin retains the hydrophobic acid fraction (which is the most aromatic fraction) containing the humic and fulvic acids, and the hydrophobic neutrals. The XAD-4 resin retains the transphilic acids and transphilic neutrals, while the XAD-4 effluent contains the low molecular weight hydrophilic acids, as well as any other compounds that are not retained by either resin. The method is a modified version of the XAD-8/XAD-4 methods used to isolate organic matter from water samples (Aiken and others, 1992).

Column Preparation. Amberlite XAD-8™ and XAD-4™ resins were obtained from Rohm and Haas™ and exhaustively cleaned with methanol and acetonitrile by soxhlet extraction. The resins were then packed into 20-mL glass columns fitted with Teflon stopcocks to within 1-2 cm of the top of the column. A minimum of 1 L of distilled water was passed through each column at a rate of 4 mL/min to insure that methanol was thoroughly rinsed from the resin. The columns

were further cleaned with two successive 0.1N sodium hydroxide-0.1N hydrochloric acid rinses at 4 mL/min for 10 minutes each immediately before using. A third and final rinse sequence consisted of 0.1N sodium hydroxide followed by 0.1N phosphoric acid. These rinses were collected to determine column blanks in acid and base.

Fractionation on XAD-8. A filtered water sample in excess of 1 L was acidified to pH 1.85-1.99 with concentrated phosphoric acid and degassed by sparging with He passed through a fritted glass bubbler. The sparged sample was then transferred to a tared 1-L volumetric flask. Excess sample was retained for DOC and UV (λ=254nm) absorbance analyses (DOC1). The 1 L sample was then passed through the XAD-8 column at a flow rate of 4 mL/min until the entire sample was pumped out of the volumetric flask and through the pump tubing. The first 12 mL, essentially the void volume of the column, was discarded and the remaining column effluent retained in a tared 1-L bottle, the mass of the effluent recorded, and a 50-mL aliquot of the effluent retained for DOC and UV absorbance analyses (DOC2). The organic matter retained on the XAD-8 resin was back-eluted with 0.1N NaOH at a flow rate of 2 mL/min. One hundred mL of the eluate was collected, acidified to pH 2 with concentrated phosphoric acid and retained for DOC and UV absorbance analyses (DOC3). After elution, the resin was re-acidified by passing 0.1N HCl through the column until the effluent was acidic.

Fractionation on XAD-4. The effluent from the XAD-8 column, less 50 mL, was then passed through the XAD-4 column at a flow rate of 4 mL/min. After discarding the first 12 mL that passed through the column, the column effluent was retained in a tared 1 L bottle, and the DOC concentration and UV absorbance measured (DOC4). As for the case with XAD-8 fractionation, the remaining effluent was passed through the XAD-4 column. The XAD-4 column was then back-eluted with 0.1N sodium hydroxide at 2.0 mL/min; 100 mL of the eluate were collected, acidified to pH 2 with concentrated phosphoric acid and retained for DOC and UV absorbance analyses (DOC5). After elution, the resin was re-acidified by passing 0.1N hydrochloric acid through the column until the effluent was acidic.

Calculations. DOC concentration and UV absorbances (λ=254nm) were determined for each of the samples (DOC1-DOC5) collected during the fractionation steps. These data, combined with the mass of sample in each fraction, were used to calculate the percentage, based on mass, of organic matter in each fraction. The hydrophobic neutral fraction was defined as that material that was retained on the XAD-8 at pH 2 but was not eluted with 0.1N sodium hydroxide. The amount of this fraction was determined as the difference between the mass of material in DOC1 and that in DOC2+DOC3. Similarly, the hydrophilic neutral fraction, defined as material sorbed to the XAD-4 resin that was not recovered in the 0.1N NaOH elution, was determined as the difference in mass of organic matter contained in DOC2 and the sum of material in DOC4 and DOC5. Data are reported as the percentages, based on mass, of organic matter in each fraction. SUVA data were determined for the whole water (DOC1), hydrophobic acid fraction (DOC3), transphilic acid fraction (DOC5), and hydrophilic fraction (DOC4) for each sample fractionated. Samples were run in duplicate and the average values reported. The standard deviation for the mass percentages of the fractionation analysis is ±2 percent..

Table 8. Dissolved organic carbon concentrations from fixed sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; DOC, dissolved organic carbon; mg C/L, milligrams carbon per liter; UV (abs @ 254 nm), Ultraviolet absorbance at the 254 nanometer wavelength; SUVA, Specific UV absorbance; [L/(mg C*m)], liters per milligram carbon times a one meter path length; %, percent]

Station ID	Date	Whole Water DOC (mg C/L)	Whole Water UV (abs @ 254nm)	Whole Water SUVA [L/(mg C*m)]	Hydrophobic Acid SUVA [L/(mg C*m)]	Hydrophobic Acid (%)	Hydrophobic Neutrals (%)	Hydrophilic organic matterSUVA [L/(mg C*m)]	Hydrophilic organic matter (%)	Transphylic Acids SUVA [L/(mg C*m)]	Transphylic Acids (%)
15389000	3/29/01	1.8	0.046	2.5	3.1	39	4	1.2	33	2.2	21
15389000	6/30/01	10.7	0.374	3.5	4	50	12	2.2	16	3.1	20
15389000	7/16/01	13.9	0.501	3.6	4.2	41	22	2.6	12	3.2	18
15389000	8/27/01	8.1	0.239	3.0	3.7	47	15	2	16	2.8	19
15389000	9/17/01	13.0	0.443	3.4	3.8	49	13	2.7	15	3.1	19
15515500	10/3/00	5.1	0.168	3.3	3.5	52	5	2	21	2.4	22
15515500	3/20/01	1.3	0.028	2.1	2.6	45	-22	0.8	48	2.1	33
15515500	5/31/01	7.0	0.234	3.3	4.3	47	15	1.8	17	3.2	17
15515500	6/22/01	2.2	0.065	3.0	3.6	46	6	1.5	24	2.4	21
15515500	7/9/01	2.2	0.071	3.2	3.7	46	-2	1.3	28	2.7	26
15515500	9/13/01	4.1	0.106	2.6	3.6	42	19	1.7	19	2.9	19
15356000	10/4/00	6.1	0.195	3.2	3.8	48	11	1.4	19	2.6	19
15356000	6/4/01	10.7	0.380	3.5	4.4	52	11	2.2	14	3.2	15
15356000	6/20/01	5.5	0.174	3.2	4.2	44	17	1.6	16	3	17
15356000	7/11/01	4.7	0.165	3.5	3.8	55	-1	1.1	23	3.1	22
15356000	8/9/01	3.2	0.105	3.3	3.5	56	-7	2.1	16	2.9	26
15356000	9/11/01	6.6	0.189	2.9	3.9	42	21	1.7	16	3	19
15565447	4/19/01	2.8	0.065	2.3	3.1	38	20	1.1	34	2.3	19
15565447	7/5/01	6.3	0.230	3.6	4.1	51	9	3.3	18	3.3	18
15565447	7/25/01	4.5	0.151	3.5	3.8	56	-2	2	20	3.1	22
15565447	8/30/01	6.0	0.185	3.1	3.8	46	13	1.8	19	3	21
15453500	10/2/00	7.3	0.231	3.2	3.8	49	10	1.9	17	2.6	19
15453500	3/20/01	2.1	0.051	2.3	2.7	45	-1	1.2	39	2.2	25
15453500	6/2/01	16.3	0.603	3.7	4.3	51	9	1.7	17	3.2	15
15453500	6/18/01	7.0	0.238	3.4	4.2	49	12	1.7	17	3	17
15453500	7/13/01	5.1	0.177	3.5	4	49	5	1.5	19	3	23
15453500	9/21/01	5.4	0.163	3.0	3.6	46	12	1.7	19	3	21

CHAPTER 4 - Dissolved Trace Metals

***by* Howard E. Taylor, David A. Roth, and Ronald C. Antweiler**

Sample Collection and Processing

Using the procedures described in Chapter 2, splits (125 mL) of composited samples were transported to the USGS National Research Program Laboratory in Boulder, Colorado, in nitric acid-rinsed 1-L polytetrafluoroethylene (PTFE) bottles. A sample for dissolved trace element analysis was filtered through a 0.40-µm pore-size Nucleopore polycarbonate membrane filter, using a vacuum filter apparatus made from PTFE (Kelly and Taylor, 1996). According to the protocol, the procedure used for the filtration (to minimize artifactual contamination) included: (1) the filter apparatus was thoroughly cleaned and rinsed with deionized water; (2) a new 0.40-µm pore size, 47-mm-diameter polycarbonate-membrane filter was placed on the filter support and precleaned by drawing 50 mL of 0.1 percent (volume/volume) ultrapure nitric acid rinse solution through the filter into a waste bottle; (3) the filter was then rinsed by drawing 100 mL of deionized water through it into a waste bottle; (4) about 25 mL of a subsample of the composite was then filtered to prerinse the sample receiving bottle and discarded (this step also effectively preloads the filter with particulates); (5) the balance of the subsample was filtered into the sample bottle; and (6) the filtered sample was preserved with the addition of 1 mL of concentrated ultrapure nitric acid to 250 mL of sample (or to a pH less than 2) using a PTFE dispensing bottle (Brinton and others, 1995). Only one filter membrane per sample was used for the entire filtration process.

Due to uncontrollable delays in transporting samples from the field to the laboratory (such as weather factors and shipping complications) where the filtration processing was performed, confidence in the quality of data from this sampling was compromised. Because of this problem, data are only reported for the following elements, which are unlikely to be affected by the problem with delayed sample processing: barium, bromide, calcium, chloride, cesium, potassium, lithium, magnesium, sodium, rubidium, strontium, and uranium.

Sample Analysis and Results

Elements present at relatively high concentration levels (mg/L), including calcium, magnesium, and sodium, were determined by inductively coupled plasma-atomic emission spectrometric (ICP-AES) techniques utilizing a Perkin Elmer Optima 3300™, dual view emission spectrometer operating in the radial view mode. Descriptions of the analysis conditions and general procedures for this methodology are reported by Garbarino and Taylor (1979), and Mitko and Bebek (1999, 2000). Potassium also was determined by an ICP-AES technique using the same instrumentation operating in the axial-view mode. All samples were determined in triplicate so as to provide a measure of the analysis variability.

Trace element determinations (excluding mercury) were performed with a Perkin Elmer Elan Model 6000™, inductively coupled plasma-mass spectrometer (ICP-MS). Aerosols of nitric acid acidified aqueous samples were introduced into the spectrometer with a cone-spray pneumatic nebulizer. Multiple internal standards (indium, iridium, rhodium), covering the entire mass range, were used to normalize the system for drift. Details of the specific analysis

techniques, procedures and instrumental settings are described elsewhere (Garbarino and Taylor, 1995; and Taylor, 2001). All samples were determined in triplicate, to provide a measure of the variability of the analysis. Average values and their standard deviations are reported in table 9.

Table 9. Selected dissolved trace elements from fixed sampling locations in the Yukon River Basin

[See text for qualification of the accuracy of these data; Lab ID, internal laboratory identification number; Field ID, refer to table 1 for description and figure 1 for location; µg/L, microgram per liter; Avg, average; SD, standard deviation; Ba, barium, Br, bromide; Ca, calcium; Cl, chloride; Cs, cesium; K, potassium; Li, lithium; Mg, magnesium; Na, sodium, Rb, rubidium; Sr, strontium; U, uranium; *, replicate samples collected in the field; BLANK, deionized water blank processed in field]

Station ID	Sample Date	Replicate Type	Ba µg/L			Br µg/L			Ca mg/L		
			Avg		SD	Avg		SD	Avg		SD
15389000	3/29/2001	1 of 1	75	±	1.3	1.6	±	0.4	33	±	0.5
15389000	6/30/2001	1 of 2	53	±	0.6	2.0	±	0.0	27	±	0.4
15389000	6/30/2001	2 of 2	56	±	0.8	1.2	±	0.2	27	±	0.3
15389000	7/16/2001	1 of 2	58	±	0.3	1.4	±	0.1	24	±	1.4
15389000	7/16/2001	2 of 2	59	±	0.1	1.4	±	0.0	23	±	0.1
15389000	8/7/2001	1 of 2	61	±	0.2	1.3	±	0.2	35	±	0.0
15389000	8/7/2001	2 of 2	62	±	1.4	1.2	±	0.2	35	±	0.5
15389000	8/7/2001*	1 of 2	62	±	0.1	2.7	±	0.1	35	±	0.2
15389000	8/7/2001*	2 of 2	60	±	0.4	2.1	±	0.5	35	±	0.1
15389000	8/27/2001	1 of 2	54	±	0.0	2.1	±	0.1	33	±	0.6
15389000	8/27/2001	2 of 2	53	±	2.2	2.6	±	0.2	34	±	0.5
15389000	9/17/2001	1 of 2	55	±	0.1	1.7	±	0.4	28	±	0.2
15389000	9/17/2001	2 of 2	54	±	0.3	1.5	±	0.1	28	±	0.2
15515500	10/3/2000	1 of 1	29	±	0.7	1.7	±	0.0	36	±	0.1
15515500	3/20/2001	1 of 2	47	±	0.4	1.7	±	0.1	46	±	0.0
15515500	3/20/2001	2 of 2	46	±	1.3	1.5	±	0.0	45	±	0.0
15515500	5/31/2001	1 of 2	32	±	0.2	2.1	±	0.3	31	±	0.2
15515500	5/31/2001	2 of 2	31	±	0.3	1.8	±	0.1	31	±	0.0
15515500	6/22/2001	1 of 2	36	±	0.2	1.8	±	0.0	33	±	0.2
15515500	6/22/2001	2 of 2	35	±	0.7	1.6	±	0.2	33	±	0.1
15515500	7/9/2001	1 of 2	30	±	0.3	1.8	±	0.3	30	±	0.2
15515500	7/9/2001	2 of 2	31	±	0.4	1.6	±	0.1	30	±	0.4
15515500	8/2/2001	1of 2	34	±	1.0	2.3	±	0.4	29	±	0.3
15515500	8/2/2001	2 of 2	32	±	0.5	2.0	±	0.1	29	±	0.4
15515500	8/2/2001*	1 of 2	32	±	0.0	1.3	±	0.2	29	±	0.0
15515500	8/2/2001*	2 of 2	33	±	0.9	1.3	±	0.3	29	±	0.0
15515500	9/13/2001	1 of 2	33	±	0.5	1.7	±	0.4	38	±	0.3
15515500	9/13/2001	2 of 2	33	±	0.2	1.4	±	0.0	37	±	0.1
15356000	3/23/2001	1 of 1	50	±	0.5	1.4	±	0.3	36	±	0.3
15356000	6/4/2001	1 of 2	36	±	0.7	0.9	±	0.2	23	±	0.4
15356000	6/4/2001	2 of 2	36	±	0.0	1.2	±	0.3	24	±	0.2
15356000	7/11/2001	1 of 2	39	±	1.5	0.8	±	0.1	27	±	0.0
15356000	7/11/2001	2 of 2	40	±	0.5	0.8	±	0.2	27	±	0.1
15356000	8/9/2001	1 of 2	41	±	0.3	1.5	±	0.1	29	±	0.3
15356000	8/9/2001	2 of 2	40	±	0.6	2.0	±	0.0	29	±	0.1
15356000	8/9/2001*	1 of 2	38	±	0.3	0.8	±	0.2	30	±	0.2
15356000	8/9/2001*	2 of 2	40	±	0.6	0.9	±	0.3	29	±	0.2
15356000	9/11/2001	1 of 2	39	±	0.8	0.9	±	0.3	29	±	0.1
15356000	9/11/2001	2 of 2	38	±	0.3	1.1	±	0.4	29	±	0.1
15565447	4/19/2001	1 of 1	74	±	0.6	1.7	±	0.2	48	±	0.8
15565447	7/5/2001	1 of 2	44	±	1.0	1.0	±	0.1	28	±	0.3
15565447	7/5/2001	2 of 2	45	±	1.1	1.1	±	0.1	28	±	0.2
15565447	8/14/2001	1 of 2	46	±	0.3	2.4	±	0.4	31	±	0.4
15565447	8/14/2001	2 of 2	46	±	0.4	2.3	±	0.6	29	±	0.8
15565447	8/30/2001	1 of 2	45	±	0.7	1.1	±	0.1	30	±	0.4
15565447	8/30/2001	2 of 2	46	±	0.7	1.0	±	0.2	31	±	0.0
15565447	9/21/2001	1 of 2	44	±	0.5	1.2	±	0.0	32	±	0.5
15565447	9/21/2001	2 of 2	47	±	0.5	1.3	±	0.1	31	±	0.0
15565447	9/21/2001*	1 of 2	44	±	0.6	1.3	±	0.2	32	±	0.3
15565447	9/21/2001*	2 of 2	44	±	0.9	1.4	±	0.0	31	±	0.1
15453500	10/2/2000	1 of 1	41	±	0.5	1.5	±	0.3	29	±	0.3
15453500	3/21/2001	1 of 2	65	±	0.4	1.2	±	0.0	42	±	0.6
15453500	3/21/2001	2 of 2	65	±	1.9	1.0	±	0.2	42	±	0.5
15453500	6/2/2001	1 of 2	37	±	0.5	1.3	±	0.3	21	±	0.2
15453500	6/2/2001	2 of 2	38	±	0.7	1.1	±	0.3	21	±	0.1
15453500	6/18/2001	1 of 2	46	±	0.0	1.0	±	0.3	27	±	0.3
15453500	6/18/2001	2 of 2	44	±	0.6	1.1	±	0.0	26	±	0.1
15453500	7/13/2001	1 of 2	46	±	0.5	1.5	±	0.2	28	±	0.4
15453500	7/13/2001	2 of 2	45	±	0.8	0.9	±	0.3	28	±	0.1
15453500	8/14/2001	1 of 2	48	±	0.4	2.5	±	0.3	32	±	0.2
15453500	8/14/2001	2 of 2	47	±	0.8	2.3	±	0.5	32	±	0.7
15453500	9/21/2001	1 of 2	47	±	1.1	1.0	±	0.3	33	±	0.4
15453500	9/21/2001	2 of 2	46	±	0.3	1.1	±	0.4	33	±	0.7
15453500	9/19/2001	BLANK	0.11	±	0.0	< 0.5	±	0.2	0.02	±	0.0

Table 9. Selected Dissolved Trace Elements from Fixed Sampling Locations in the Yukon River Basin (see text for qualifications of the accuracy of these data)- continued.

Station ID	Sample Date	Replicate Type	Cs µg/L Avg		Cs µg/L SD	K mg/L Avg		K mg/L SD
15389000	3/29/2001	1 of 1	0.005	±	0.002	0.62	±	0.01
15389000	6/30/2001	1 of 2	0.005	±	0.002	0.60	±	0.01
15389000	6/30/2001	2 of 2	0.008	±	0.003	0.62	±	0.02
15389000	7/16/2001	1 of 2	0.005	±	0.002	0.45	±	0.00
15389000	7/16/2001	2 of 2	< 0.005	±	0.003	0.46	±	0.00
15389000	8/7/2001	1 of 2	0.006	±	0.000	0.56	±	0.02
15389000	8/7/2001	2 of 2	0.005	±	0.003	0.59	±	0.02
15389000	8/7/2001*	1 of 2	< 0.006	±	0.005	0.55	±	0.01
15389000	8/7/2001*	2 of 2	< 0.006	±	0.002	0.55	±	0.00
15389000	8/27/2001	1 of 2	0.005	±	0.004	0.47	±	0.02
15389000	8/27/2001	2 of 2	0.010	±	0.003	0.48	±	0.01
15389000	9/17/2001	1 of 2	< 0.005	±	0.007	0.45	±	0.01
15389000	9/17/2001	2 of 2	< 0.005	±	0.002	0.44	±	0.02
15515500	10/3/2000	1 of 1	0.020	±	0.002	1.5	±	0.02
15515500	3/20/2001	1 of 2	0.020	±	0.003	2.2	±	0.04
15515500	3/20/2001	2 of 2	0.020	±	0.005	2.3	±	0.05
15515500	5/31/2001	1 of 2	0.030	±	0.005	1.7	±	0.07
15515500	5/31/2001	2 of 2	0.020	±	0.004	1.7	±	0.08
15515500	6/22/2001	1 of 2	0.030	±	0.008	2.3	±	0.13
15515500	6/22/2001	2 of 2	0.030	±	0.003	2.1	±	0.05
15515500	7/9/2001	1 of 2	0.030	±	0.006	1.8	±	0.03
15515500	7/9/2001	2 of 2	0.030	±	0.007	1.8	±	0.15
15515500	8/2/2001	1of 2	0.016	±	0.004	2.1	±	0.04
15515500	8/2/2001	2 of 2	0.018	±	0.002	2.1	±	0.01
15515500	8/2/2001*	1 of 2	0.030	±	0.005	2.0	±	0.11
15515500	8/2/2001*	2 of 2	0.030	±	0.000	2.0	±	0.12
15515500	9/13/2001	1 of 2	0.030	±	0.003	1.7	±	0.08
15515500	9/13/2001	2 of 2	0.020	±	0.004	1.7	±	0.06
15356000	3/23/2001	1 of 1	0.010	±	0.004	1.1	±	0.03
15356000	6/4/2001	1 of 2	0.020	±	0.005	1.0	±	0.03
15356000	6/4/2001	2 of 2	0.020	±	0.002	1.0	±	0.02
15356000	7/11/2001	1 of 2	0.020	±	0.006	1.1	±	0.02
15356000	7/11/2001	2 of 2	0.030	±	0.003	1.2	±	0.09
15356000	8/9/2001	1 of 2	0.011	±	0.006	1.6	±	0.04
15356000	8/9/2001	2 of 2	0.009	±	0.003	1.6	±	0.02
15356000	8/9/2001*	1 of 2	0.010	±	0.001	1.6	±	0.05
15356000	8/9/2001*	2 of 2	0.020	±	0.003	1.6	±	0.06
15356000	9/11/2001	1 of 2	0.020	±	0.001	1.1	±	0.05
15356000	9/11/2001	2 of 2	0.030	±	0.019	1.1	±	0.02
15565447	4/19/2001	1 of 1	0.008	±	0.003	1.5	±	0.02
15565447	7/5/2001	1 of 2	0.011	±	0.003	1.2	±	0.01
15565447	7/5/2001	2 of 2	0.010	±	0.002	1.2	±	0.03
15565447	8/14/2001	1 of 2	0.020	±	0.005	1.7	±	0.04
15565447	8/14/2001	2 of 2	0.020	±	0.011	1.7	±	0.03
15565447	8/30/2001	1 of 2	0.008	±	0.002	1.3	±	0.01
15565447	8/30/2001	2 of 2	0.020	±	0.005	1.4	±	0.02
15565447	9/21/2001	1 of 2	0.010	±	0.003	1.2	±	0.01
15565447	9/21/2001	2 of 2	< 0.010	±	0.005	1.2	±	0.02
15565447	9/21/2001*	1 of 2	0.020	±	0.006	1.2	±	0.04
15565447	9/21/2001*	2 of 2	0.030	±	0.004	1.2	±	0.01
15453500	10/2/2000	1 of 1	0.010	±	0.006	0.98	±	0.04
15453500	3/21/2001	1 of 2	< 0.005	±	0.000	1.1	±	0.04
15453500	3/21/2001	2 of 2	0.008	±	0.005	1.1	±	0.00
15453500	6/2/2001	1 of 2	0.006	±	0.002	1.0	±	0.03
15453500	6/2/2001	2 of 2	0.007	±	0.002	0.95	±	0.01
15453500	6/18/2001	1 of 2	0.007	±	0.002	1.0	±	0.02
15453500	6/18/2001	2 of 2	0.006	±	0.001	0.99	±	0.02
15453500	7/13/2001	1 of 2	0.009	±	0.000	1.2	±	0.05
15453500	7/13/2001	2 of 2	0.009	±	0.002	1.2	±	0.00
15453500	8/14/2001	1 of 2	0.025	±	0.008	1.5	±	0.04
15453500	8/14/2001	2 of 2	0.014	±	0.001	1.5	±	0.02
15453500	9/21/2001	1 of 2	0.009	±	0.003	0.93	±	0.02
15453500	9/21/2001	2 of 2	0.010	±	0.002	0.94	±	0.00
15453500	9/19/2001	BLANK	< 0.005	±	0.004	0.007	±	0.01

Table 9. Selected Dissolved Trace Elements from Fixed Sampling Locations in the Yukon River Basin (see text for qualifications on accuracy of this data)-continued.

Station ID	Sample Date	Replicate Type	Li µg/L Avg		SD	Mg mg/L Avg		SD	Na mg/L Avg		SD
15389000	3/29/2001	1 of 1	6.4	±	0.2	12	±	0.01	4.5	±	0.21
15389000	6/30/2001	1 of 2	3.4	±	0.1	5.1	±	0.07	1.9	±	0.07
15389000	6/30/2001	2 of 2	3.4	±	0.0	5.2	±	0.10	1.9	±	0.05
15389000	7/16/2001	1 of 2	3.4	±	0.1	5.2	±	0.34	1.9	±	0.06
15389000	7/16/2001	2 of 2	3.4	±	0.1	5.0	±	0.01	1.8	±	0.01
15389000	8/7/2001	1 of 2	4.7	±	0.0	7.8	±	0.06	2.7	±	0.23
15389000	8/7/2001	2 of 2	5.0	±	0.0	7.8	±	0.05	2.7	±	0.05
15389000	8/7/2001*	1 of 2	5.0	±	0.2	8.1	±	0.08	2.8	±	0.14
15389000	8/7/2001*	2 of 2	5.0	±	0.1	8.0	±	0.05	2.7	±	0.11
15389000	8/27/2001	1 of 2	4.4	±	0.1	7.2	±	0.11	2.0	±	0.12
15389000	8/27/2001	2 of 2	4.5	±	0.0	7.3	±	0.14	2.1	±	0.10
15389000	9/17/2001	1 of 2	4.5	±	0.1	6.0	±	0.03	2.1	±	0.06
15389000	9/17/2001	2 of 2	4.6	±	0.1	6.0	±	0.03	2.1	±	0.07
15515500	10/3/2000	1 of 1	3.2	±	0.0	8.5	±	0.06	4.0	±	0.03
15515500	3/20/2001	1 of 2	2.8	±	0.1	9.4	±	0.02	4.1	±	0.02
15515500	3/20/2001	2 of 2	2.9	±	0.1	9.3	±	0.00	4.2	±	0.02
15515500	5/31/2001	1 of 2	2.7	±	0.1	7.0	±	0.06	3.0	±	0.05
15515500	5/31/2001	2 of 2	2.7	±	0.1	6.9	±	0.02	3.0	±	0.03
15515500	6/22/2001	1 of 2	4.7	±	0.2	7.8	±	0.07	3.2	±	0.00
15515500	6/22/2001	2 of 2	4.6	±	0.1	7.7	±	0.01	3.0	±	0.06
15515500	7/9/2001	1 of 2	4.2	±	0.1	7.1	±	0.06	3.1	±	0.11
15515500	7/9/2001	2 of 2	4.3	±	0.2	7.2	±	0.12	3.1	±	0.18
15515500	8/2/2001	1of 2	4.1	±	0.1	6.4	±	0.06	2.7	±	0.05
15515500	8/2/2001	2 of 2	4.0	±	0.0	6.4	±	0.10	2.9	±	0.16
15515500	8/2/2001*	1 of 2	3.9	±	0.0	6.4	±	0.00	2.8	±	0.06
15515500	8/2/2001*	2 of 2	3.8	±	0.0	6.4	±	0.06	2.8	±	0.02
15515500	9/13/2001	1 of 2	3.7	±	0.1	8.9	±	0.07	3.6	±	0.03
15515500	9/13/2001	2 of 2	3.6	±	0.1	8.8	±	0.07	3.6	±	0.04
15356000	3/23/2001	1 of 1	2.4	±	0.1	9.6	±	0.24	3.4	±	0.10
15356000	6/4/2001	1 of 2	1.9	±	0.1	6.0	±	0.11	1.6	±	0.03
15356000	6/4/2001	2 of 2	1.9	±	0.1	6.1	±	0.06	1.6	±	0.02
15356000	7/11/2001	1 of 2	2.6	±	0.1	7.6	±	0.02	2.0	±	0.01
15356000	7/11/2001	2 of 2	2.6	±	0.1	7.7	±	0.02	2.0	±	0.03
15356000	8/9/2001	1 of 2	3.1	±	0.0	8.3	±	0.00	2.4	±	0.08
15356000	8/9/2001	2 of 2	3.1	±	0.0	8.1	±	0.06	2.4	±	0.05
15356000	8/9/2001*	1 of 2	2.9	±	0.0	8.2	±	0.06	2.4	±	0.04
15356000	8/9/2001*	2 of 2	3.0	±	0.1	8.1	±	0.05	2.4	±	0.01
15356000	9/11/2001	1 of 2	2.5	±	0.1	8.1	±	0.02	2.2	±	0.01
15356000	9/11/2001	2 of 2	2.5	±	0.1	8.2	±	0.02	2.2	±	0.04
15565447	4/19/2001	1 of 1	2.9	±	0.1	11	±	0.17	3.6	±	0.10
15565447	7/5/2001	1 of 2	2.0	±	0.1	5.7	±	0.04	1.7	±	0.05
15565447	7/5/2001	2 of 2	2.0	±	0.1	5.6	±	0.03	1.7	±	0.04
15565447	8/14/2001	1 of 2	3.0	±	0.0	7.3	±	0.07	2.5	±	0.02
15565447	8/14/2001	2 of 2	2.9	±	0.1	6.9	±	0.17	2.3	±	0.15
15565447	8/30/2001	1 of 2	2.6	±	0.0	7.3	±	0.01	2.4	±	0.08
15565447	8/30/2001	2 of 2	2.8	±	0.1	7.3	±	0.01	2.4	±	0.00
15565447	9/21/2001	1 of 2	2.7	±	0.2	8.0	±	0.16	2.6	±	0.06
15565447	9/21/2001	2 of 2	2.5	±	0.0	7.9	±	0.04	2.6	±	0.02
15565447	9/21/2001*	1 of 2	2.7	±	0.1	8.0	±	0.08	2.6	±	0.03
15565447	9/21/2001*	2 of 2	2.7	±	0.1	8.0	±	0.01	2.6	±	0.06
15453500	10/2/2000	1 of 1	2.6	±	0.1	7.6	±	0.08	2.7	±	0.08
15453500	3/21/2001	1 of 2	2.7	±	0.1	10	±	0.07	3.0	±	0.10
15453500	3/21/2001	2 of 2	2.8	±	0.1	10	±	0.18	2.9	±	0.07
15453500	6/2/2001	1 of 2	1.7	±	0.0	4.1	±	0.08	1.1	±	0.03
15453500	6/2/2001	2 of 2	1.7	±	0.0	4.1	±	0.15	1.1	±	0.06
15453500	6/18/2001	1 of 2	2.1	±	0.1	5.9	±	0.09	1.3	±	0.04
15453500	6/18/2001	2 of 2	2.0	±	0.0	5.8	±	0.03	1.4	±	0.01
15453500	7/13/2001	1 of 2	2.8	±	0.1	7.2	±	0.02	2.1	±	0.02
15453500	7/13/2001	2 of 2	2.7	±	0.1	7.2	±	0.03	2.0	±	0.08
15453500	8/14/2001	1 of 2	3.2	±	0.1	8.3	±	0.05	2.4	±	0.08
15453500	8/14/2001	2 of 2	3.2	±	0.1	8.3	±	0.20	2.4	±	0.11
15453500	9/21/2001	1 of 2	3.0	±	0.1	8.7	±	0.10	2.3	±	0.10
15453500	9/21/2001	2 of 2	3.3	±	0.1	8.8	±	0.14	2.3	±	0.11
15453500	9/19/2001	BLANK	< 0.009	±	0.006	< 0.02	±	0.01	0.050	±	0.02

Table 9. Selected Dissolved Trace Elements from Fixed Sampling Locations in the Yukon River Basin (see text for qualifications on accuracy of this data)-continued.

Station ID	Sample Date	Replicate Type	Rb µg/L Avg		SD	Sr µg/L Avg		SD	U µg/L Avg		SD
15389000	3/29/2001	1 of 1	0.35	±	0.00	150	±	0.000	0.67	±	0.02
15389000	6/30/2001	1 of 2	0.30	±	0.00	79	±	0.099	0.31	±	0.00
15389000	6/30/2001	2 of 2	0.30	±	0.01	81	±	1.040	0.33	±	0.00
15389000	7/16/2001	1 of 2	0.23	±	0.00	75	±	0.831	0.24	±	0.01
15389000	7/16/2001	2 of 2	0.24	±	0.00	75	±	0.802	0.24	±	0.01
15389000	8/7/2001	1 of 2	0.29	±	0.01	120	±	0.000	0.40	±	0.01
15389000	8/7/2001	2 of 2	0.30	±	0.01	130	±	0.000	0.40	±	0.01
15389000	8/7/2001*	1 of 2	0.29	±	0.01	130	±	0.000	0.41	±	0.00
15389000	8/7/2001*	2 of 2	0.29	±	0.01	130	±	0.000	0.40	±	0.02
15389000	8/27/2001	1 of 2	0.23	±	0.00	110	±	0.000	0.38	±	0.00
15389000	8/27/2001	2 of 2	0.23	±	0.01	110	±	0.000	0.39	±	0.00
15389000	9/17/2001	1 of 2	0.25	±	0.00	90	±	1.335	0.31	±	0.01
15389000	9/17/2001	2 of 2	0.25	±	0.00	90	±	0.082	0.31	±	0.01
15515500	10/3/2000	1 of 1	1.5	±	0.00	160	±	0.000	0.80	±	0.01
15515500	3/20/2001	1 of 2	1.3	±	0.01	200	±	0.000	0.83	±	0.01
15515500	3/20/2001	2 of 2	1.3	±	0.02	200	±	0.000	0.84	±	0.00
15515500	5/31/2001	1 of 2	1.5	±	0.01	140	±	0.000	0.70	±	0.00
15515500	5/31/2001	2 of 2	1.5	±	0.00	140	±	0.000	0.70	±	0.03
15515500	6/22/2001	1 of 2	2.9	±	0.01	150	±	0.000	0.92	±	0.02
15515500	6/22/2001	2 of 2	2.8	±	0.01	150	±	0.000	0.92	±	0.01
15515500	7/9/2001	1 of 2	2.4	±	0.04	140	±	0.000	0.83	±	0.00
15515500	7/9/2001	2 of 2	2.4	±	0.01	130	±	0.000	0.84	±	0.00
15515500	8/2/2001	1of 2	3.2	±	0.03	130	±	0.000	0.79	±	0.02
15515500	8/2/2001	2 of 2	3.1	±	0.10	130	±	0.000	0.80	±	0.01
15515500	8/2/2001*	1 of 2	2.9	±	0.02	130	±	0.000	0.83	±	0.01
15515500	8/2/2001*	2 of 2	2.9	±	0.02	130	±	0.000	0.81	±	0.03
15515500	9/13/2001	1 of 2	1.9	±	0.00	170	±	0.000	0.88	±	0.01
15515500	9/13/2001	2 of 2	1.9	±	0.02	170	±	0.000	0.88	±	0.01
15356000	3/23/2001	1 of 1	0.84	±	0.01	170	±	0.000	1.1	±	0.00
15356000	6/4/2001	1 of 2	1.1	±	0.02	100	±	0.000	0.71	±	0.02
15356000	6/4/2001	2 of 2	1.1	±	0.01	100	±	0.000	0.72	±	0.02
15356000	7/11/2001	1 of 2	1.7	±	0.03	130	±	0.000	0.82	±	0.00
15356000	7/11/2001	2 of 2	1.7	±	0.02	130	±	0.000	0.82	±	0.02
15356000	8/9/2001	1 of 2	2.5	±	0.00	140	±	0.000	0.89	±	0.00
15356000	8/9/2001	2 of 2	2.5	±	0.01	140	±	0.000	0.90	±	0.02
15356000	8/9/2001*	1 of 2	2.3	±	0.01	140	±	0.000	0.91	±	0.02
15356000	8/9/2001*	2 of 2	2.3	±	0.01	140	±	0.000	0.92	±	0.01
15356000	9/11/2001	1 of 2	1.3	±	0.01	140	±	0.000	0.91	±	0.02
15356000	9/11/2001	2 of 2	1.2	±	0.02	140	±	0 .000	0.90	±	0.00
15565447	4/19/2001	1 of 1	1.4	±	0.03	200	±	0.000	0.87	±	0.01
15565447	7/5/2001	1 of 2	1.2	±	0.01	100	±	0.000	0.54	±	0.01
15565447	7/5/2001	2 of 2	1.2	±	0.01	100	±	0.000	0.55	±	0.01
15565447	8/14/2001	1 of 2	1.8	±	0.03	120	±	0.000	0.80	±	0.00
15565447	8/14/2001	2 of 2	1.8	±	0.01	120	±	0.000	0.82	±	0.01
15565447	8/30/2001	1 of 2	1.5	±	0.01	130	±	0.000	0.76	±	0.02
15565447	8/30/2001	2 of 2	1.6	±	0.03	120	±	0.000	0.73	±	0.01
15565447	9/21/2001	1 of 2	1.3	±	0.02	130	±	0.000	0.83	±	0.01
15565447	9/21/2001	2 of 2	1.3	±	0.01	130	±	0.000	0.85	±	0.01
15565447	9/21/2001*	1 of 2	1.3	±	0.00	130	±	0.000	0.84	±	0.00
15565447	9/21/2001*	2 of 2	1.4	±	0.02	130	±	0.000	0.85	±	0.01
15453500	10/2/2000	1 of 1	1.1	±	0.01	130	±	0.000	0.75	±	0.03
15453500	3/21/2001	1 of 2	0.96	±	0.01	170	±	0.000	1.1	±	0.01
15453500	3/21/2001	2 of 2	0.96	±	0.02	170	±	0.000	1.1	±	0.03
15453500	6/2/2001	1 of 2	0.79	±	0.01	69	±	0.197	0.42	±	0.00
15453500	6/2/2001	2 of 2	0.80	±	0.01	69	±	0.194	0.41	±	0.00
15453500	6/18/2001	1 of 2	1.0	±	0.01	98	±	0.165	0.59	±	0.01
15453500	6/18/2001	2 of 2	1.0	±	0.00	97	±	0.496	0.60	±	0.00
15453500	7/13/2001	1 of 2	1.5	±	0.00	120	±	0.000	0.77	±	0.02
15453500	7/13/2001	2 of 2	1.5	±	0.02	120	±	0.000	0.75	±	0.02
15453500	8/14/2001	1 of 2	2.1	±	0.01	140	±	0.000	0.88	±	0.00
15453500	8/14/2001	2 of 2	2.1	±	0.01	140	±	0.000	0.90	±	0.01
15453500	9/21/2001	1 of 2	0.98	±	0.00	140	±	0.000	0.82	±	0.01
15453500	9/21/2001	2 of 2	0.98	±	0.02	140	±	0.000	0.81	±	0.01
15453500	9/19/2001	BLANK	0.015	±	0.00	0.05	±	0.007	< 0.009	±	0.00

CHAPTER 5 - Dissolved and Colloidal Trace Elements

***by* Alan M. Shiller**

Sample Collection and Processing

Surface grab samples were collected in the centroid of flow, when the sampling locations were ice-free,. The surface grab samples were collected off the bow of a small work boat that was headed slowly into the current. An acid-cleaned polyethylene bottle was immersed below the surface, rinsed several times, and filled by a worker wearing polyethylene gloves. When sampling locations were ice-covered, samples were obtained from a parastaltic pump through C-flex™ tubing.

Samples were kept in the dark until filtered, generally within 6 hours of sample collection. Two aliquots were syringe filtered using acid cleaned polyethylene/polypropylene syringes. One aliquot was filtered through an acid-cleaned 0.45-µm pore size, 25-mm-diameter polypropylene filter (Whatman Puradisc PP™); the other aliquot was filtered through an acid-cleaned 0.02 µm pore size, 25-mm-diameter alumina matrix filter (Whatman Anotop™) (Shiller, 2003). After filtration, samples (typically 15 mL) were kept cool and in the dark until received at the Center for Trace Analysis at the University of Southern Mississippi. In the laboratory, samples were acidified to pH < 2 using ultrapure 6 M hydrochloric acid (Seastar™).

Sample Analysis and Results

Dissolved trace elements were determined in the filtered samples by direct aspiration of the slightly diluted sample into the plasma of a double-focusing inductively coupled plasma mass spectrometer (ThermoFinnigan Element 2™). The slight sample dilution (approximately 30 percent) was due to the addition of dilute nitric acid with added internal standards (approximately 2 µg/L scandium, indium, and thorium). A low flow (100 µL/min) self-aspirating nebulizer was utilized. Calibrations were performed using standards made in dilute nitric acid. Several samples also were calibrated by the method of additions. No significant difference was noted for the two calibration methods. Results for dissolved trace metals are given in tables 10 and 11.

Table 10. Dissolved trace elements in 0.45-µm filtered samples from five fixed sampling locations in the Yukon River Basin

[data are in micrograms per liter; *, replicate samples collected in the field]

Station ID	Date	Lithium	Vanadium	Manganese	Iron	Nickel	Copper	Zinc	Rubidium	Strontium	Molybdenum	Barium	Uranium
15356000	10/04/00	2.45	0.52	7.7	78	2.28	1.67	1.50	0.78	134	0.97	42	0.83
15356000	03/22/01	2.58	0.25	1.4	4	0.84	0.53	1.09	0.85	157	1.32	55	1.06
15356000	06/04/01	2.15	0.96	13.4	240	2.68	3.85	2.14	1.00	112	0.68	40	0.74
15356000	06/20/01	2.42	1.22	12.7	279	1.96	2.55	2.00	1.41	116	0.72	46	0.67
15356000	07/11/01	2.98	1.31	9.5	328	1.72	2.27	1.60	1.75	128	1.02	45	0.77
15356000	08/09/01*	3.31	1.50	8.6	420	1.62	2.08	1.33	2.63	131	1.25	47	0.86
15356000	08/09/01*	3.29	1.01	5.3	165	1.38	1.93	0.80	2.36	136	1.18	43	0.85
15356000	08/09/01*	3.33	1.19	4.7	222	1.61	1.85	0.82	2.53	140	1.29	42	0.85
15356000	09/11/01	2.70	0.54	6.1	68	1.55	1.70	0.67	1.05	143	1.18	41	0.85
15389000	03/29/01	6.90	0.11	12.7	7	0.74	0.34	0.68	0.33	164	0.74	97	0.78
15389000	06/30/01	3.55	0.48	3.2	205	2.36	2.13	0.83	0.26	82	0.40	56	0.33
15389000	07/16/01	3.68	0.47	3.9	279	2.84	2.73	1.06	0.23	81	0.34	61	0.25
15389000	08/07/01	5.36	0.19	1.8	59	1.75	1.19	0.48	0.27	134	0.48	63	0.39
15389000	08/27/01	4.80	0.25	2.8	100	2.10	1.13	0.64	0.24	114	0.36	55	0.37
15389000	09/17/01	4.99	0.36	5.0	339	4.32	2.77	1.89	0.21	96	0.37	54	0.33
15453500	10/02/00	2.78	0.72	6.3	141	2.06	2.67	0.90	0.93	132	0.85	44	0.71
15453500	06/03/01	1.89	1.08	20.9	489	18.88	4.09	3.95	0.76	71	0.36	41	0.46
15453500	06/18/01	2.26	0.99	10.1	140	1.94	2.84	1.60	0.87	102	0.55	46	0.59
15453500	07/13/01	3.28	1.78	10.9	472	1.89	2.70	4.13	1.89	127	1.00	54	0.74
15453500	08/14/01	3.69	1.27	9.5	248	1.42	2.10	0.99	2.24	143	1.13	53	0.84
15453500	08/14/01	3.58	1.23	8.9	259	1.39	2.05	1.02	2.26	136	1.23	54	0.85
15453500	08/14/01	3.80	1.22	8.4	202	1.45	2.23	0.92	2.17	145	1.13	52	0.83
15453500	09/21/01	3.29	0.49	8.1	69	1.52	1.51	0.37	0.94	136	1.05	48	0.79
15515500	10/03/00	3.70	0.84	34.3	157	1.41	2.95	1.00	1.34	153	0.89	33	0.71
15515500	05/31/01	2.74	0.74	23.7	179	1.37	3.53	0.47	1.43	125	0.84	33	0.69
15515500	06/22/01	5.01	0.60	5.9	1	0.69	1.38	0.29	2.54	152	1.22	35	0.81
15515500	07/09/01	4.72	0.96	14.3	147	1.09	1.81	0.63	2.26	141	1.14	34	0.76
15515500	08/02/01	4.26	1.14	20.9	224	1.83	3.44	1.01	2.53	128	1.00	36	0.72
15515500	09/13/01	4.21	0.83	33.7	94	1.28	2.17	0.37	1.77	180	1.19	36	0.79

Table 10. Dissolved Trace Elements in 0.45 µm Filtered Samples from Five Fixed Sampling Locations in the Yukon River Basin:-continued

Station ID	Date	Lithium	Vanadium	Manganese	Iron	Nickel	Copper	Zinc	Rubidium	Strontium	Molybdenum	Barium	Uranium
15565447	04/19/01	3.35	0.07	108.1	92	1.00	0.65	0.23	1.48	230	0.98	86	0.82
15565447	07/05/01	2.23	1.15	19.8	341	1.37	3.07	1.15	1.18	106	0.69	49	0.52
15565447	07/25/01	3.09	1.31	10.7	390	1.40	2.78	1.04	1.61	133	0.87	50	0.67
15565447	08/14/01	3.53	1.41	12.2	375	1.70	4.49	1.79	1.90	141	0.95	56	0.74
15565447	08/30/01	3.12	1.23	10.7	318	1.30	3.11	1.05	1.60	133	0.98	50	0.70
15565447	09/21/01	3.03	0.95	14.3	256	1.05	2.17	0.51	1.38	144	1.06	50	0.77

Table 11. Dissolved trace elements in 0.02 µm filtered samples from five fixed sampling locations in the Yukon River Basin
[data are in micrograms per liter; --, no data; *, replicate samples collected in the field]

Station ID	Date	Lithium	Vanadium	Manganese	Iron	Nickel	Copper	Zinc	Rubidium	Strontium	Molybdenum	Barium	Uranium
15356000	10/04/00	2.26	0.93	5.0	12	1.95	1.39	0.12	0.75	130	1.00	37	0.82
15356000	03/22/01	2.31	0.31	1.3	1	0.79	0.49	0.17	0.87	164	1.35	49	1.12
15356000	06/04/01	1.68	0.40	6.0	40	--	4.05	0.33	0.79	93	0.67	31	0.60
15356000	06/20/01	1.94	0.49	3.5	6	--	1.69	0.02	1.07	103	0.89	36	0.63
15356000	07/11/01	2.30	0.48	4.3	8	--	1.62	0.54	1.41	127	1.17	36	0.75
15356000	08/09/01*	3.25	0.61	1.9	3	1.10	1.45	0.03	2.19	138	1.34	37	0.86
15356000	08/09/01*	3.25	0.61	1.5	3	1.12	1.45	0.09	2.17	139	1.32	37	0.85
15356000	08/09/01*	3.19	0.57	1.4	2	0.98	1.46	0.03	2.16	147	1.39	39	0.82
15356000	09/11/01	2.78	0.47	4.1	13	1.61	1.51	0.08	1.08	128	1.10	36	0.82
15389000	03/29/01	5.76	0.10	11.3	2	0.82	0.36	0.22	0.34	145	0.68	87	0.78
15389000	06/30/01	2.99	0.24	1.8	30	--	1.78	0.08	0.26	79	0.42	52	0.32
15389000	07/16/01	3.09	0.21	2.1	62	--	2.12	0.10	0.19	75	0.36	54	0.24
15389000	08/07/01	4.50	0.14	1.3	5	--	1.01	0.11	0.24	131	0.46	57	0.34
15389000	08/27/01	4.95	0.19	1.9	10	1.96	1.12	0.09	0.22	122	0.35	48	0.36
15389000	09/17/01	4.85	0.17	2.9	80	4.06	2.32	0.26	0.21	92	0.36	49	0.31
15453500	10/02/00	2.74	0.57	2.9	16	1.83	2.25	0.06	0.95	128	0.93	38	0.73
15453500	06/03/01	1.45	0.40	10.7	73	--	3.14	1.30	0.66	59	0.42	29	0.38
15453500	06/18/01	2.26	0.59	3.2	11	1.62	2.19	0.08	0.81	101	0.69	36	0.58
15453500	07/13/01	2.30	0.46	1.7	6	--	1.71	1.46	1.25	112	1.00	40	0.71
15453500	08/14/01	3.42	0.67	3.2	2	0.99	1.54	0.01	1.92	129	1.21	43	0.86

Table 11. Dissolved trace elements in 0.02-µm filtered samples from five fixed sampling locations in the Yukon River Basin-continued

Station ID	Date	Lithium	Vanadium	Manganese	Iron	Nickel	Copper	Zinc	Rubidium	Strontium	Molybdenum	Barium	Uranium
15453500	08/14/01	3.43	0.65	2.9	2	1.02	1.55	0.03	1.83	129	1.20	43	0.85
15453500	08/14/01	3.40	0.64	3.2	2	0.97	1.45	0.03	1.93	116	1.20	43	0.77
15453500	09/21/01	3.23	0.45	6.0	7	1.48	1.32	0.03	0.95	133	0.99	43	0.79
15515500	10/01/00	3.55	0.60	27.0	11	1.25	2.39	0.05	1.20	152	0.97	27	0.71
15515500	05/31/01	2.30	0.41	18.9	15	--	2.58	0.03	1.27	119	0.84	27	0.64
15515500	06/22/01	4.11	0.58	5.1	1	--	1.14	0.10	2.50	136	1.18	33	0.76
15515500	07/09/01	4.79	0.61	9.6	2	0.93	1.31	0.08	2.25	135	1.12	28	0.76
15515500	08/02/01	3.50	0.59	14.5	5	--	2.16	<0.01	2.29	131	1.19	28	0.62
15515500	09/13/01	3.95	0.65	28.1	3	1.20	1.56	0.02	1.83	160	1.12	33	0.78
15565447	04/19/01	3.00	0.06	109.3	4	1.00	0.57	0.20	1.44	194	0.94	75	0.83
15565447	07/05/01	1.89	0.53	12.6	10	--	2.23	0.23	1.05	99	0.83	42	0.49
15565447	07/25/01	2.35	0.60	3.9	20	--	2.06	1.42	1.35	118	1.02	42	0.57
15565447	08/14/01	2.57	0.58	2.1	7	--	2.95	0.06	1.59	119	1.14	42	0.71
15565447	08730/01	2.17	0.51	3.7	5	--	2.35	0.47	1.44	111	0.85	41	0.54
15565447	09/21/01	2.53	0.53	10.0	6	--	1.62	0.01	1.23	142	1.04	44	0.74

CHAPTER 6 - Mercury Analyses

***by* John F. DeWild and Mark L. Olson**

Sample Collection and Processing

Surface grab samples were collected in the centroid of flow off the bow of a small work boat that was headed slowly into the current. An acid-cleaned 1-L Teflon bottle was immersed below the surface, rinsed several times, and filled by a worker wearing polyethylene gloves. Samples were placed on ice and shipped by overnight carrier to the USGS Wisconsin District Mercury Laboratory (WDML) in Madison, Wisconsin, for processing.

Upon receipt at the WDML, samples were well mixed and filtered through a 47-mm-diameter quartz fiber filter (QFF) with a nominal pore size of 0.7 µm using a vacuum filtration chamber. From each 1-L whole water sample, four samples were collected: filtered total mercury, filtered methyl mercury, particulate total mercury, and particulate methyl mercury. Approximately 500 mL of sample was filtered, the filtrate collected into a 500-mL acid-cleaned Teflon bottle, and the filter saved in a Teflon petri dish for subsequent analyses for filtered total mercury (FTHg) and particulate total mercury (PTHg), respectively. The remainder of the sample was filtered and 250-mL of filtrate was collected into a 250-mL acid-cleaned Teflon™ bottle and the filter saved in a Teflon™ petri dish for subsequent analyses for filtered methyl mercury (FMHg) and particulate methyl mercury (PMHg), respectively. Each Teflon bottle was triple rinsed with small amounts (~10-20 mL) of filtrate before filling the bottle to the shoulder. The FTHg and FMHg samples were preserved with 10 mL and 5mL of low-mercury 6 N hydrochloric acid, respectively. The particulate samples were frozen until analysis. All sample processing and preservation were performed in the WDML clean laboratory observing clean hands/dirty hands protocols (U.S. Geological Survey, 1997-1999). A number of samples were received at the WDML more than 72 hours after sample collection, which could result in significant adsorption of Hg to the vessel walls. These samples were simply acidified with 20 mL of 6 N HCl upon receipt and run as unfiltered samples.

Sample Analysis and Results

All mercury analyses were performed at the WDML. Analyses for filtered total Hg were performed with Dual Amalgamation Cold Vapor Atomic Fluorescence Spectrometry (U.S. Environmental Protection Agency, Method 1631, 1999) with slight modifications for particulate analyses. A bromine monochloride (BrCl) solution was added to the water samples to oxidize all mercury in the sample to Hg(II). After the addition of the BrCl, the samples were placed in a 50ºC oven for a minimum of 3 days to ensure complete oxidation. When samples were highly stained or contained large amounts of organic carbon, they were first placed near a UV source until they became colorless. Just prior to analysis, a small amount of hydroxylamine hydrochloride (NH_2OH-HCl) was added to the sample to destroy free halogens. An aliquot of sample was then reduced with stannous chloride ($SnCl_2$) to convert Hg(II) to volatile Hg(0). The Hg(0) was purged from the sample aliquot with N_2 gas onto a gold-coated glass bead trap. Mercury was thermally desorbed from the sample trap in an Argon gas stream and collected on a second gold trap (analytical trap), thermally desorbed from the analytical trap in the same gas stream and carried into the cell of a cold vapor atomic fluorescence spectrometer (CVAFS) for detection.

The modification of this method for particulate samples consisted of transferring the filter from the petri dish to a Teflon™ bottle and adding 100 mL of 5 percent BrCl in reagent water. The particulate samples were then treated as water samples. This modification can be used to determine the total mercury (HgT) concentrations in particulate samples with a method detection limit (MDL) of 0.060 ng of mercury on a filter. The amount of mercury on a filter is dependant on the sediment load in the sample and volume of sample filtered.

Methyl mercury analyses were performed using USGS method numbers I-1045-02 (filtered water) and I-3045 02 (unfiltered water) (DeWild and others, 2001) with slight modifications for particulate samples. Water samples were distilled to remove potential matrix interferences. The pH of the distillate was adjusted to 4.9 (to maximize ethylation potential) using acetate buffer. The distillate then was ethylated using sodium tetraethyl borate ($NaBEt_4$) and allowed to react for 15 minutes. After reaction with $NaBEt_4$, the distillate was purged with nitrogen gas (N_2) for 20 minutes and the ethylated mercury species were collected on a sample trap containing Carbotrap. These ethylated mercury species were desorbed thermally from the sample trap, separated using a gas chromatographic (GC) column, reduced using a pyrolytic column, and detected using a cold vapor atomic fluorescence spectrometry (CVAFS) detector.

Particulate samples were distilled by adding 50 mL of reagent grade water and 2 mL of a combined reagent consisting of 20 percent potassium chloride, 50 percent sulfuric acid, and 1M Copper sulfate in a ratio of 1:2:2. The distillates were then treated as water samples for detection. This modification can be used to determine methyl mercury concentrations in particulate samples with a method detection limit of 0.010 ng of mercury on a filter. The amount of mercury on a filter is dependant on the sediment load in the sample and volume of sample filtered. Results for mercury and methylmercury analyses are given in table 12.

Table 12. Mercury and methymercury concentrations from fixed sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; Clear Cr, Jarvis Cr, Little Chena, and Shaw Cr, no assigned Station ID at time of publication (2003); Hg, mercury; ng/L, nanogram per liter; FMHg, Filtered Methylmercury; QA flag, Quality Assurance flag; FTHg, Filtered Total mercury; PMHg, Particulate Methylmercury; PTHg, Particulate Total mercury; UMHg, Unfiltered Methylmercury; UTHg, Unfiltered Total mercury; S2; percent recovery of either the matrix spike or matrix spike duplicate exceed the data quality objectives (value is less than 75% or greater than 125%) but the difference between the pair is less than 25%; CAL, calibration drift during the day exceeds data quality objectives of R_2 = 0.995; --, no sample collected; <, less than; E, estimated value (value is less then the daily detection limit but greater than the method detection limit)]

Station ID	Date	Time	Filtered Methyl-Hg (FMHg) (ng/L)	QA flag	Filtered Total-Hg (FTHg) (ng/L)	Particulate Methyl-Hg (PMHg) (ng/L)	Particulate Total-Hg (PTHg) (ng/L)	Unfiltered Methyl-Hg (UMHg) (ng/L)	Unfiltered Total-Hg (UTHg) (ng/L)
Clear Cr	6/20/01	12:48	< 0.04		0.29	< 0.009	0.225	--	--
Jarvis Cr	6/20/01	11:05	< 0.04		0.91	0.025	20.66	--	--
Little Chena	6/22/01	13:40	0.06		2.27	< 0.009	0.832	--	--
Shaw Cr	6/20/01	18:38	0.06		1.57	0.019	0.863	--	--
15389000	6/30/01	16:00	--		--	--	--	--	4.55
15389000	8/27/01	15:00	< 0.04	S2, CAL	1.34	< 0.022	1.51	--	--
15389000	9/17/01	13:20	0.04		2.76	--	2.47	--	--
15389000	7/16/01	14:00	0.04		3.3	< 0.07	--	--	--
15389000	8/7/01	13:30	< 0.04		1.25	< 0.025	1.40	--	--
15515500	10/3/00	16:00	--		--	--	--	E 0.047	44.1
15515500	5/31/01	18:20	--		--	--	--	--	19.1
15515500	6/22/01	14:45	< 0.04		2.17	0.098	34.89	--	--
15515500	7/9/01	15:35	< 0.04		0.81	0.054	11.59	--	--
15515500	8/2/01	16:30	< 0.04		1.57	0.16	99.63	--	--
15515500	9/13/01	15:10	< 0.04		0.95	--	15.58	--	--
15356000	10/4/00	15:30	--		--	--	--	0.05	9.73
15356000	6/4/01	19:00	--		--	--	--	--	39.7
15356000	6/20/01	11:38	< 0.04		2.84	0.051	14.04	--	--
15356000	7/11/01	12:10	< 0.04		1.76	0.049	18.49	--	--
15356000	8/9/01	11:45	< 0.04		1.3	0.031	24.10	--	--
15356000	9/11/01	11:40	< 0.04		1.46	--	6.28	--	--
15565447	7/5/01	18:30	0.1		2.01	0.096	14.66	--	--
15565447	7/25/01	10:30	--		--	--		0.07	16.1
15565447	8/14/01	21:30	< 0.04		1.01	0.063	31.52	--	--
15565447	8/30/01	11:30	< 0.04	S2, CAL	1.32	0.053	22.29	--	--
15565447	9/21/01	14:00	< 0.04		1.22	0.06	16.17	--	--
15453500	10/2/00	15:50	--		--	--	--	0.058	12.9
15453500	6/2/01	18:00	--		--	--	--	--	31.8
15453500	6/18/01	16:19	0.06		2.89	0.057	8.590	--	--
15453500	6/18/01	16:19	< 0.04		3.23	0.102	17.74	--	--

Table 12. Mercury and Methymercury Concentrations from Fixed Sampling Locations in the Yukon River Basin-continued

Station ID	Date	Time	Filtered Methyl-Hg (FMHg) (ng/L)	QA flag	Filtered Total-Hg (FTHg) (ng/L)	Particulate Methyl-Hg (PMHg) (ng/L)	Particulate Total-Hg (PTHg) (ng/L)	Unfiltered Methyl-Hg (UMHg) (ng/L)	Unfiltered Total-Hg (UTHg) (ng/L)
15453500	9/21/01	12:30	< 0.04		1.11	--	5.00	--	--
15453500	7/13/01	14:55	< 0.04		2.41	0.078	9.98	--	--
15453500	8/14/01	15:15	< 0.04		1.4	0.048	17.51	--	--

CHAPTER 7 - Dissolved Gasses and Dissolved Inorganic Carbon

***by* Robert G. Striegl and Mark M. Dornblaser**

Sample Collection and Processing

Partial pressures of carbon dioxide (P_{CO2}) and methane (P_{CH4}) were directly measured on river-water samples collected from near the centroid of flow. Thirty milliliters of bubble-free water were collected at 0.2-m depth using a 60-mL polypropylene syringe. Fifteen mL of sample was injected from the syringe through a disposable 13-mm-diameter, 0.45 µm Whatman™ glass membrane syringe filter, and into each of two 37-mL serum bottles having nitrogen headspace and containing 2 g carbonate-free potassium chloride preservative.

Comments from the field personnel suggest that not all samples were filtered prior to injection of the sample into the serum bottles. Consequently, some of the 2001 samples may have been compromised by the presence of carbonate sediment particles, resulting in greater than natural values reported for total dissolved inorganic carbon (DIC). Unfortunately, we were unable to determine which of the samples were contaminated in this manner, and are reporting all laboratory values with this caveat.

Sample Analysis and Results

Four 0.5-mL replicates of equilibrated headspace were analyzed using a Li-Cor 6252™ CO_2 analyzer fitted with a sample injection port and nitrogen carrier gas (Striegl and others, 2001). Headspace CO_2 concentration was determined as the average of the four measurements; river water P_{CO2} was calculated using the appropriate Henry's Law constant corrected for temperature and atmospheric pressure (Plummer and Busenberg, 1982). One 3.0-mL subsample of the equilibrated headspace from the same serum bottle was next analyzed for CH_4 content on a gas chromatograph having a flame ionization detector, a Porapak-N column, and nitrogen carrier gas (Striegl and Michmerhuizen, 1998). River water P_{CH4} was calculated using the appropriate Henry's Law constant corrected for temperature and atmospheric pressure (Yamamoto and others, 1976). The identical split of the sample collected in the second serum bottle was acidified to convert dissolved bicarbonate and carbonate anions to carbon dioxide (CO_2), and four 0.5-mL replicates of the headspace were analyzed using the Li-Cor™ 6252 CO_2 analyzer to determine total dissolved inorganic carbon (DIC). Results for dissolved gasses and inorganic carbon are reported in table 13.

Table 13. Carbon dioxide, methane, and dissolved inorganic carbon concentrations from fixed sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; CO_2, Carbon dioxide; µmol/L, micromole per liter; P_{CO2}, partial pressure of CO_2; uatmos, microatmospheres; CH_4, methane; P_{CH4}, partial pressure of CH_4 ; DIC, dissolved inorganic carbon; --, not available]

Station ID	Date	CO_2 (µmol/L)	Corrected P_{CO2} (uatmos)	CH_4 (µmol/L)	Corrected P_{CH4} (uatmos)	DIC (µmol/L)
15356000	10/4/2000	51.6	668	0.26	5.6	1,949
15356000	3/23/2001	--	--	--	--	--
15356000	6/4/2001	--	--	--	--	--
15356000	6/20/2001	56.1	1,141	0.21	4.7	1,666
15356000	7/11/2001	7.4	153	0.16	3.7	1,820
15356000	8/9/2001	6.2	130	0.11	2.4	2,600
15356000	9/11/2001	52.3	892	0.14	3.1	1,658
15389000	3/29/2001	--	--	--	--	--
15389000	6/30/2001	66.1	1,490	0.16	3.8	1,140
15389000	7/16/2001	73.9	1,641	0.10	2.3	1,030
15389000	8/7/2001	45.7	926	0.11	2.5	1,707
15389000	8/27/2001	54.7	1,057	0.15	3.4	1,738
15389000	9/17/2001	65.7	1,087	0.16	3.4	1,402
15453500	10/2/2000	19.3	271	0.24	5.2	1,662
15453500	3/21/2001	--	--	--	--	--
15453500	6/2/2001	43.2	770	0.27	6.1	814
15453500	6/18/2001	11.7	248	0.24	5.4	1,752
15453500	7/13/2001	7.3	162	0.14	3.1	1,625
15453500	8/14/2001	9.0	191	0.23	5.1	2,640
15453500	9/21/2001	44.5	754	0.29	6.5	1,839
15515500	10/3/2000	72.2	916	1.86	39.4	2,124
15515500	3/20/2001	--	--	--	--	--
15515500	5/31/2001	72.6	1,334	1.23	27.4	1,329
15515500	6/22/2001	22.5	522	0.32	7.3	1,401
15515500	7/9/2001	27.9	557	0.43	9.7	1,432
15515500	8/2/2001	17.0	351	0.31	7.0	1,788
15515500	9/13/2001	57.1	989	1.40	31.0	2,148
15565447	4/19/2001	--	--	--	--	--
15565447	7/5/2001	47.9	1,048	0.24	5.4	1,412
15565447	7/25/2001	11.5	265	0.20	4.5	1,911
15565447	8/14/2001	9.1	193	0.22	5.1	2,302
15565447	8/30/2001	12.1	254	0.27	6.0	1,974
15565447	9/21/2001	26.9	500	0.33	7.3	2,063

CHAPTER 8 - Sediment Chemistry

***by* Arthur J. Horowitz**

Sample Collection and Processing

Representative cross-sectional water-quality and sediment samples were collected from the river systems using standard USGS depth- and width-integrated isometric sampling procedures. The resulting "large" volume samples (20-40 L of water) were shipped to the USGS Sediment Laboratory, Atlanta, Georgia, for subsequent processing, where they were dewatered using a flow-through centrifuge. The concentrated solids were quantitatively removed from the centrifuge bowl, and oven dried at 105°C. Representative aliquots were analyzed for a variety of trace elements, nutrients, and carbon. A description of sample collection and processing is given in Chapter 2.

Sample Analysis and Results

All sediment chemistry analyses are performed at the USGS Sediment Laboratory in Atlanta, Georgia. Suspended sediment is separated from whole-water samples using a flow-through centrifuge. Analytical methods are described fully in Horowitz and Elrick (1985) and Elrick and Horowitz (1986, 1987). Results for suspended sediment chemistry are given in table 14.

Table 14. Sediment chemistry data from fixed sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; L, liter; mg/L, milligram per liter; :g/g; microgram per gram; %, percent; Sets A & B indicate duplicate samples]

Station ID	Date/ Time	Volume (L)	Weight (g)	Suspended Sediment (mg/L)	Silver (µg/g)	Copper (µg/g)	Lead (µg/g)	Zinc (µg/g)	Cadmium (µg/g)
15356000	10/4/00 15:30	12.2	2.14	175	<0.5	28	11	120	0.6
15356000	6/4/01 19:00	10.1	8.25	817	<0.5	33	14	110	0.7
15356000	6/20/01 13:30	12.5	10.39	831	0.6	35	10	110	0.6
15356000	7/11/01 12:10	13.6	7.09	521	0.5	35	9	100	0.5
15356000 (Set A)	8/9/01 11:45	12.1	8.75	723	<0.5	34	10	97	0.5
15356000 (Set B)	8/9/01 11:55	11.9	8.59	722	<0.5	35	10	97	0.4
15356000	9/11/01 11:40	12.8	2.62	205	<0.5	31	10	100	0.6
15389000	6/30/01 16:00	30.5	0.64	21	<1	34	22	240	0.8
15389000	7/16/01 14:00	27.6	0.57	21	1.4	37	26	310	0.6
15389000 (Sets A & B)	8/7/01 13:35	54.8	0.62	11	<1	39	37	340	1.4
15389000	8/27/01 15:00	34.1	0.49	14	<1	33	32	250	0.8
15389000	9/17/01 13:20	35.2	0.64	18	<0.5	41	26	480	1.6
15453500	10/2/00 15:50	10.8	3.29	305	<0.5	35	10	100	0.5
15453500	6/2/01 18:00	13.6	8.14	599	<0.5	28	17	110	0.6
15453500	6/18/01 16:20	10.5	5.07	483	<0.5	36	13	130	0.6
15453500	7/13/01 14:30	13.2	6.62	502	0.5	37	11	110	0.6
15453500	8/14/01 15:15	12.0	5.43	453	<0.5	36	13	110	0.6
15453500	9/21/01 12:30	12.9	2.12	164	<0.5	28	10	110	0.7
15515500	10/3/00 16:00	9.6	6.34	660	<0.5	29	10	68	0.3
15515500 (Set A)	5/31/01 18:20	13.3	5.71	429	<0.5	33	14	77	0.2
15515500 (Set B)	5/31/01 18:30	13.1	6.05	462	<0.5	33	15	75	0.3
15515500	6/22/01 15:00	12.8	17.84	1394	<0.5	55	18	110	0.2
15515500	7/9/01 14:40	13.7	20.09	1466	<0.5	46	15	98	0.3
15515500	8/2/01 16:30	12.4	34.86	2811	<0.5	42	15	96	0.4
15515500 (Set A)	9/13/01 15:10	13.4	10.13	756	<0.5	35	13	79	0.3
15515500 (Set B)	9/13/01 15:20	13.5	9.76	723	<0.5	36	13	80	0.4
15565447	7/5/01 18:30	13.0	6.39	492	0.5	35	12	110	0.4
15565447	7/27/01 10:30	10.0	2.96	296	<0.5	46	15	130	0.5
15565447	8/14/01 21:30	14.6	8.48	581	<0.5	47	16	130	0.5
15565447 (Set A)	8/30/01 11:30	11.9	6.08	511	<0.5	42	16	120	0.6
15565447 (Set B)	8/30/01 11:40	7.6	3.84	505	<0.5	44	16	130	0.6
15565447	9/21/01 14:00	13.1	3.49	266	<0.5	46	18	130	0.6

Table 14. Sediment chemistry data from fixed sampling locations in the Yukon River Basin-continued

Station ID	Date/ Time	Chromium (µg/g)	Cobalt (µg/g)	Nickel (µg/g)	Barium (µg/g)	Vanadium (µg/g)	Lithium (µg/g)	Beryllium (µg/g)	Molybdenum (µg/g)
15356000	10/4/00 15:30	95	13	48	960	120	22	1.3	<5
15356000	6/4/01 19:00	93	16	46	930	130	22	1.5	2
15356000	6/20/01 13:30	97	18	47	910	130	27	1.6	2
15356000	7/11/01 12:10	98	18	51	830	120	27	1.5	3
15356000 (Set A)	8/9/01 11:45	94	17	49	700	120	25	1.3	2
15356000 (Set B)	8/9/01 11:55	97	18	52	700	130	25	1.3	2
15356000	9/11/01 11:40	110	15	56	890	120	23	1.4	4
15389000	6/30/01 16:00	130	19	81	1000	200	65	2.5	4
15389000	7/16/01 14:00	160	22	100	1200	220	73	2.5	7
15389000 (Sets A & B)	8/7/01 13:35	170	26	110	1100	220	59	2.3	8
15389000	8/27/01 15:00	170	21	94	1000	210	63	2.3	7
15389000	9/17/01 13:20	140	25	140	1500	260	79	2.7	4
15453500	10/2/00 15:50	96	17	53	850	120	24	1.3	<5
15453500	6/2/01 18:00	100	15	48	900	140	32	1.6	2
15453500	6/18/01 16:20	99	18	54	980	140	33	1.7	2
15453500	7/13/01 14:30	96	18	55	800	120	30	1.5	3
15453500	8/14/01 15:15	96	17	52	760	130	29	1.3	3
15453500	9/21/01 12:30	100	15	53	950	120	24	1.4	3
15515500	10/3/00 16:00	87	14	42	710	100	18	1.1	<5
15515500 (Set A)	5/31/01 18:20	89	15	44	710	100	19	1.3	3
15515500 (Set B)	5/31/01 18:30	82	15	40	690	100	20	1.2	2
15515500	6/22/01 15:00	110	22	54	950	140	31	1.8	2
15515500	7/9/01 14:40	90	19	49	820	110	27	1.6	2
15515500	8/2/01 16:30	91	18	44	870	130	23	1.5	2
15515500 (Set A)	9/13/01 15:10	88	15	42	760	110	20	1.3	2
15515500 (Set B)	9/13/01 15:20	84	15	41	780	110	20	1.3	2
15565447	7/5/01 18:30	98	18	54	910	130	30	1.6	2
15565447	7/27/01 10:30	110	20	63	950	150	34	1.6	3
15565447	8/14/01 21:30	110	21	58	990	150	32	1.6	2
15565447 (Set A)	8/30/01 11:30	110	19	47	1000	140	33	1.6	2
15565447 (Set B)	8/30/01 11:40	120	19	50	1000	140	34	1.6	3
15565447	9/21/01 14:00	93	18	44	990	130	34	1.5	2

Table 14. Sediment chemistry data from fixed sampling locations in the Yukon River Basin-continued

Station ID	Date/ Time	Phosphorus (µg/g)	Strontium (µg/g)	Arsenic (µg/g)	Antimony (µg/g)	Selenium (µg/g)	Mercury (µg/g)	Thallium (µg/g)	Uranium (µg/g)
15356000	10/4/00 15:30	830	350	8.9	1.0	0.5	0.05	<50	<50
15356000	6/4/01 19:00	980	330	12	1.5	0.6	0.05	<50	<50
15356000	6/20/01 13:30	1000	320	11	1.6	0.5	0.05	<50	<50
15356000	7/11/01 12:10	960	330	11	1.6	0.5	0.06	<50	<50
15356000 (Set A)	8/9/01 11:45	1000	360	13	1.7	0.4	0.01	<50	<50
15356000 (Set B)	8/9/01 11:55	1000	360	12	1.6	0.4	0.02	<50	<50
15356000	9/11/01 11:40	910	390	11	1.3	0.5	0.03	<50	<50
15389000	6/30/01 16:00	1100	150	17	1.8	1.2	0.22	<100	<100
15389000	7/16/01 14:00	1200	140	17	1.7	1.7	0.19	<100	<100
15389000 (Sets A & B)	8/7/01 13:35	1200	140	26	1.8	1.9	0.16	<100	<100
15389000	8/27/01 15:00	1300	150	20	1.4	1.4	0.09	<100	<100
15389000	9/17/01 13:20	1200	160	20	2.0	1.9	0.03	<50	<50
15453500	10/2/00 15:50	880	310	11	0.9	0.5	0.04	<50	<50
15453500	6/2/01 18:00	940	260	11	1.3	0.7	0.05	<50	<50
15453500	6/18/01 16:20	1000	270	12	1.5	0.5	0.15	<50	<50
15453500	7/13/01 14:30	970	290	12	1.7	0.5	0.08	<50	<50
15453500	8/14/01 15:15	1000	310	14	1.9	0.5	0.04	<50	<50
15453500	9/21/01 12:30	850	350	11	1.4	0.5	0.03	<50	<50
15515500	10/3/00 16:00	625	240	9.9	0.8	0.2	0.02	<50	<50
15515500 (Set A)	5/31/01 18:20	650	230	12	1.2	0.3	0.03	<50	<50
15515500 (Set B)	5/31/01 18:30	630	220	12	1.1	0.3	0.04	<50	<50
15515500	6/22/01 15:00	760	210	19	1.6	0.4	0.09	<50	<50
15515500	7/9/01 14:40	710	220	14	1.5	0.3	0.06	<50	<50
15515500	8/2/01 16:30	790	240	18	1.7	0.5	0.05	<50	<50
15515500 (Set A)	9/13/01 15:10	660	250	12	1.1	0.2	0.02	<50	<50
15515500 (Set B)	9/13/01 15:20	670	250	13	1.3	0.2	0.02	<50	<50
15565447	7/5/01 18:30	920	220	12	1.4	0.4	0.09	<50	<50
15565447	7/27/01 10:30	1100	280	19	2.2	0.7	0.06	<50	<50
15565447	8/14/01 21:30	1000	280	19	2.1	0.7	0.05	<50	<50
15565447 (Set A)	8/30/01 11:30	890	230	17	1.7	0.6	0.06	<50	<50
15565447 (Set B)	8/30/01 11:40	890	240	17	1.7	0.6	0.05	<50	<50
15565447	9/21/01 14:00	970	230	17	1.5	0.7	0.06	<50	<50

Table 14. Sediment chemistry data from fixed sampling locations in the Yukon River Basin-continued

Station ID	Date/ Time	Iron (%)	Manganese (µg/g)	Aluminum (%)	Titanium (%)	Total Organic Carbon (%)	Total Carbon (%)	Total Nitrogen (%)
15356000	10/4/00 15:30	3.3	720	6.5	0.41	1.0	2.3	0.10
15356000	6/4/01 19:00	3.8	850	6.5	0.46	1.1	2.3	<0.1
15356000	6/20/01 13:30	3.8	840	6.7	0.49	0.8	2.1	<0.1
15356000	7/11/01 12:10	3.8	780	6.5	0.46	1.0	2.2	<0.1
15356000 (Set A)	8/9/01 11:45	4.3	760	6.8	0.46	0.6	2.6	<0.1
15356000 (Set B)	8/9/01 11:55	4.3	770	6.7	0.45	0.6	2.5	<0.1
15356000	9/11/01 11:40	3.6	760	6.6	0.43	1.0	2.2	<0.1
15389000	6/30/01 16:00	4.3	940	8.6	0.47	--	4.1	--
15389000	7/16/01 14:00	4.5	890	7.8	0.47	--	4.2	--
15389000 (Sets A & B)	8/7/01 13:35	4.9	1300	7.6	0.47	--	--	--
15389000	8/27/01 15:00	4.8	1000	7.9	0.47	--	--	--
15389000	9/17/01 13:20	5.2	930	8.4	0.46	4.7	5.0	0.44
15453500	10/2/00 15:50	3.8	730	6.6	0.42	1.1	2.1	0.08
15453500	6/2/01 18:00	3.6	720	6.6	0.44	1.5	2.2	0.13
15453500	6/18/01 16:20	3.8	840	6.5	0.47	1.3	2.2	0.12
15453500	7/13/01 14:30	4.0	770	6.4	0.44	1.1	2.6	<0.1
15453500	8/14/01 15:15	4.3	780	6.7	0.43	1.0	2.5	<0.1
15453500	9/21/01 12:30	3.2	740	6.2	0.40	1.2	2.0	<0.1
15515500	10/3/00 16:00	3.2	670	6.2	0.39	0.4	0.5	0.03
15515500 (Set A)	5/31/01 18:20	3.5	730	6.4	0.39	0.5	0.7	<0.1
15515500 (Set B)	5/31/01 18:30	3.5	760	6.5	0.37	0.5	0.7	<0.1
15515500	6/22/01 15:00	4.6	890	8.0	0.46	0.5	0.6	<0.1
15515500	7/9/01 14:40	4.0	750	7.2	0.43	0.4	0.6	<0.1
15515500	8/2/01 16:30	4.1	760	7.4	0.44	0.4	0.3	<0.1
15515500 (Set A)	9/13/01 15:10	3.4	700	6.5	0.41	0.5	0.6	<0.1
15515500 (Set B)	9/13/01 15:20	3.4	720	6.5	0.41	0.6	0.6	<0.1
15565447	7/5/01 18:30	3.9	810	6.6	0.45	1.1	1.3	<0.1
15565447	7/27/01 10:30	4.9	1000	7.5	0.48	1.1	2.0	0.12
15565447	8/14/01 21:30	4.9	950	7.7	0.47	0.9	1.6	0.10
15565447 (Set A)	8/30/01 11:30	4.6	860	7.5	0.44	0.9	1.5	0.10
15565447 (Set B)	8/30/01 11:40	4.7	880	7.6	0.45	1.1	1.6	0.10
15565447	9/21/01 14:00	4.5	880	7.3	0.44	1.5	2.1	0.10

CHAPTER 9 - Sediment Mineralogy

***by* Dennis D. Eberl**

Sample Collection and Processing

A description of sample collection and processing is given in Chapter 2 and 8. Splits of samples sent to the USGS Sediment Laboratory, in Atlanta, Georgia (1 to 2 g) were sent to USGS National Research Program Laboratory in Boulder, Colorado, for quantitative X-ray mineralogical analysis.

Sample Analysis and Results

Samples were prepared for X-ray diffraction (XRD) analysis according to the method described in Srodon and others (2001). Samples were mixed with an internal XRD standard (ZnO) in a weight ratio of 1.000 g sample to 0.111 g ZnO. The mixture was ground with about 4 mL of methanol in a McCrone mill for 5 minutes, dried at 85°C overnight, and sieved (500-µm sieve). To ensure sample randomness, the mixture was then side-packed into an XRD holder against frosted glass by tapping the holder on a hard surface. Samples were X-rayed from 5 to 65 degrees two-theta using Cu K-alpha radiation, with a step size of 0.02 degrees two theta, and a count time of at least two seconds per step. The data then was analyzed using the RockJock computer program (Eberl, 2003), which converts XRD intensities into weight percent minerals (table 15).

Table 15. Sediment mineralogy data from fixed sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; %, percent; *, replicates collected in the field]

Station ID:	15565447	15515500	15515500	15515500	15515500
Date	7/5/01	5/31/01*	5/31/01*	6/22/01	7/9/01
	Weight %	Weight %	Weight %	Weight %	Weight %
NON-CLAYS:					
Quartz	33.6	38.8	39.9	27.4	30.5
ordered Microcline	2.6	0.8	1.0	0.1	0.8
intermediate Microcline	0.1	0.0	0.0	0.0	0.0
Sanidine	2.3	0.8	0.8	0.4	0.7
Orthoclase	0.0	0.0	0.0	0.0	0.0
Anorthoclase	3.1	7.0	8.7	9.2	10.6
Albite	5.7	5.8	6.3	5.7	5.9
Oligoclase	1.8	2.2	0.6	1.3	0.0
Andesine	0.4	3.2	4.0	5.8	6.0
Labradorite	11.1	6.2	4.8	1.6	3.0
Bytownite	0.0	1.2	1.3	1.6	2.4
Anorthite	0.0	0.0	0.7	0.0	0.6
Calcite	0.1	0.2	0.3	0.3	0.5
Mg-calcite	0.8	1.1	0.8	1.5	1.0
Dolomite	1.4	0.6	0.7	0.8	0.9
Amphibole	1.9	0.6	1.1	2.0	1.3
Pyroxene	1.1	0.7	1.0	1.1	1.1
Magnetite	0.7	0.0	0.0	0.0	0.0
Hematite	0.1	0.2	0.1	0.1	0.1
Total non-clays:	66.9	69.4	72.1	58.8	65.3
CLAYS:					
Goethite	0.4	0.0	0.0	0.0	0.2
disordered kaolinite	0.0	1.2	0.8	0.0	0.0
Ferruginous smectite	0.0	0.0	0.0	2.4	2.0
Illite + smectite	7.9	6.4	4.9	10.1	6.0
Chlorite	31.5	25.7	23.8	28.1	26.1
Total Clays:	39.7	33.3	29.5	40.7	34.3
Total:	106.5	102.7	101.6	99.5	99.7
Full Pattern degree of fit:	0.101344	0.090637	0.096498	0.080267	0.092838
Clay region degree of fit:	0.048088	0.044569	0.042639	0.03831	0.043224

Table 15. Sediment mineralogy data from fixed sampling locations in the Yukon River Basin-continued

Station ID:	15453500	15453500	15453500	15356000	15356000
Date	6/2/01	6/18/01	7/13/01	6/4/01	6/20/01
Mineral	Weight %	Weight %	Weight %	Weight %	Weight %
NON-CLAYS:					
Quartz	31.6	29.0	20.5	25.1	24.9
ordered Microcline	1.1	0.9	2.1	2.6	2.2
intermediate Microcline	0.0	1.0	0.0	0.6	0.2
Sanidine	2.2	2.1	2.3	1.8	3.8
Orthoclase	0.0	0.0	0.0	0.0	0.0
Anorthoclase	7.3	8.2	8.3	4.4	5.2
Albite	4.3	4.1	3.7	4.6	5.9
Oligoclase	2.3	2.9	3.0	6.4	5.1
Andesine	0.0	0.0	0.5	4.3	0.0
Labradorite	6.6	5.5	5.7	4.7	10.1
Bytownite	0.4	0.7	1.0	2.6	0.4
Anorthite	0.0	0.0	0.8	0.5	0.0
Calcite	1.5	2.7	7.7	4.1	8.8
Mg-calcite	1.0	0.9	1.0	1.1	0.8
Dolomite	3.3	3.3	4.5	3.7	4.3
Amphibole	1.4	0.9	1.9	1.9	1.6
Pyroxene	0.4	0.6	0.3	1.1	1.4
Magnetite	0.0	0.0	0.0	0.2	0.7
Hematite	0.3	0.3	0.3	0.3	0.3
Total non-clays:	63.6	63.1	63.7	70.1	75.6
CLAYS:					
Goethite	0.0	0.0	0.0	0.2	0.0
disordered kaolinite	0.7	0.2	0.7	3.2	1.2
Ferruginous smectite	4.0	4.8	6.8	4.6	7.6
Illite + smectite	9.6	8.4	1.3	4.3	4.9
Chlorite	19.5	20.4	21.0	11.3	20.6
Total Clays:	33.8	33.8	29.8	23.6	35.2
Total:	97.3	96.9	93.5	93.7	110.8
Full Pattern degree of fit:	0.07256	0.065116	0.083515	0.064916	0.095603
Clay region degree of fit:	0.037958	0.034031	0.042825	0.029017	0.052382

Table 15. Sediment mineralogy data from fixed sampling locations in the Yukon River Basin-continued

Station ID:	15356000	15565447	15515500	15356000	15356000
Date	**7/11/01**	**7/27/01**	**8/2/01**	**8/9/01***	**8/9/01***
Mineral	**Weight %**	**Weight %**	**Weight %**	**Weight %**	**Weight %**
NON-CLAYS:					
Quartz	21.2	20.5	31.1	15.1	15.4
ordered Microcline	3.1	1.5	0.5	2.6	2.6
intermediate Microcline	0.7	0.6	1.2	1.2	0.0
Sanidine	1.8	1.9	0.8	1.6	1.9
Orthoclase	0.0	0.0	0.0	0.0	0.0
Anorthoclase	6.3	7.1	8.5	7.8	8.9
Albite	6.1	4.1	6.3	5.7	5.9
Oligoclase	2.2	3.8	1.3	3.1	2.6
Andesine	0.0	0.0	2.4	0.0	0.7
Labradorite	10.7	7.4	7.4	8.3	7.9
Bytownite	1.1	0.2	1.2	0.8	0.0
Anorthite	0.5	0.2	0.1	0.4	1.2
Calcite	8.2	4.2	0.5	10.4	10.7
Mg-calcite	1.0	1.3	1.2	0.8	0.8
Dolomite	4.7	3.1	0.8	4.9	5.1
Amphibole	2.0	1.4	2.0	1.6	1.5
Pyroxene	1.4	0.7	1.3	1.1	0.9
Magnetite	0.1	0.0	0.0	0.0	0.1
Hematite	0.4	0.2	0.0	0.4	0.3
Total non-clays:	71.6	58.0	66.6	65.9	66.4
CLAYS:					
Goethite	0.1	0.0	0.1	0.0	0.0
disordered kaolinite	0.0	0.4	0.0	0.0	1.7
Ferruginous smectite	7.2	7.0	6.4	6.4	8.5
Illite + smectite	0.2	3.7	4.6	0.0	0.0
Chlorite	21.5	21.0	22.9	19.2	20.8
Total Clays:	28.9	32.4	34.2	25.5	31.1
Total:	100.6	90.4	100.8	91.4	97.5
Full Pattern region degree of fit:	0.093528	0.084227	0.080223	0.092917	0.091872
Clay region degree of fit:	0.048309	0.041661	0.034485	0.049318	0.055962

Table 15. Sediment mineralogy data from fixed sampling locations in the Yukon River Basin-continued

Station ID:	15453500	15565447
Date	**8/14/01**	**8/14/01**
Mineral	**Weight %**	**Weight %**
NON-CLAYS:		
Quartz	18.7	19.8
ordered Microcline	3.2	0.8
intermediate Microcline	0.0	0.0
Sanidine	1.5	1.7
Orthoclase	0.0	0.0
Anorthoclase	9.2	7.0
Albite	3.8	5.0
Oligoclase	4.3	2.4
Andesine	0.0	4.0
Labradorite	7.3	4.5
Bytownite	0.7	0.7
Anorthite	0.2	0.3
Calcite	9.1	4.1
Mg-calcite	0.7	1.1
Dolomite	4.3	2.6
Amphibole	0.9	1.0
Pyroxene	0.3	1.1
Magnetite	0.0	0.0
Hematite	0.3	0.3
Total non-clays:	64.3	56.6
CLAYS:		
Goethite	0.0	0.0
disordered kaolinite	1.1	0.0
Ferruginous. smectite	6.8	8.1
Illite + smectite	0.0	3.6
Chlorite	20.4	21.5
Total Clays:	28.3	33.2
Total:	92.7	89.8
Full Pattern degree of fit:	0.079752	0.083122
Clay region degree of fit:	0.036098	0.046766

CHAPTER 10 - Sediment Concentration and Percent Organic Matter (OM) Analyses

***by* Paul F. Schuster and Michael M. Reddy**

Sample Collection and Processing

NASQAN program sampling protocols were used for the collection and processing of samples for sediment concentration and percent OM analyses samples (see Chapter 2). Two 1-L Teflon™ bottles were filled with unfiltered water. Using a vacuum pump connected to an acrylic filter funnel holder, well-mixed water from a Teflon sample bottle was filtered through a pre-weighed 25-mm glass fiber filter (GFF) with a nominal pore size of 0.7 µm. A sufficient volume (50 to 250 mL) was filtered to load enough material on the filter surface for analysis. All samples were collected in duplicate. The filters were secured in plastic petri dishes and kept chilled until analysis.

Sample Analysis and Results

Pre-weighed filters loaded with sediment were sent in duplicate to Huffman laboratories, Golden, Colorado for analysis of sediment concentration and percent OM. The filters were transferred to conditioned and tared porcelain crucibles and dried at 105ºC for 24 hours. The filters, sample, and crucible were cooled in a dessicator and weighed. Sediment mass was determined by weight difference and concentrations were calculated by dividing the amount of dried sediment by the volume of water sample run through the filter. The percent of OM in the sediment was determined by Loss on Ignition (LOI) at 550ºC. Method blanks (crucible blanks) were randomly interspersed within each sample batch and taken through the entire process. Differential weights for samples are reliable to 0.1 mg as validated by the method blanks. Results are listed in table 16.

Table 16. Suspended sediment concentrations and percent organic matter in sediment from fixed sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; mg/L, milligram per liter; OM, Organic Matter; NA, Not Available]

Station ID	Date	Sediment concentration (mg/L)	Percent OM in sediment
15356000	6/4/2001	503	9.7
15356000	7/11/2001	414	6.0
15356000	8/9/2001	695	6.4
15356000	9/11/2001	101	10.1
15389000	3/29/2001	1	NA
15389000	6/30/2001	17	NA
15389000	7/16/2001	16	NA
15389000	8/7/2001	9	NA
15389000	8/27/2001	3	NA
15389000	9/17/2001	18	NA
15453500	10/2/2000	228	11.4
15453500	3/21/2001	10	35.1
15453500	6/2/2001	491	10.0
15453500	6/18/2001	345	11.0
15453500	7/13/2001	294	6.5
15453500	8/14/2001	399	7.9
15453500	9/21/2001	47	15.1
15515500	10/3/2000	234	7.5
15515500	3/20/2001	14	NA
15515500	5/31/2001	127	8.2
15515500	6/22/2001	994	5.7
15515500	7/9/2001	559	4.2
15515500	8/2/2001	1145	4.5
15515500	9/13/2001	509	3.6
15565447	4/19/2001	5	NA
15565447	7/5/2001	535	8.3
15565447	8/14/2001	507	7.3
15565447	8/30/2001	429	6.2
15565447	9/12/2001	159	11.2
15565447	9/21/2001	161	8.9

CHAPTER 11 - Particulate Carbon (PC) and Particulate Nitrogen (PN)

***by* Paul F. Schuster and Michael M. Reddy**

Sample Collection and Processing

NASQAN program sampling protocols were used to collect the PC/PN samples (see Chapter 2). Two 1-L Teflon bottles were filled with unfiltered water. Using a vacuum pump connected to an acrylic filter funnel holder, well-mixed water from a Teflon™ sample bottle was filtered through a 25-mm glass fiber filter (GFF) with a nominal pore size of 0.7 µm. A sufficient volume (50 mL to 250 mL) was filtered to acquire enough material on the filter surface for PC/PN analysis. All samples were collected in duplicate. The filters were folded into aluminum foil and kept chilled until analysis.

Sample Analysis and Results

Filters were sent in duplicate to the Nutrient Analytical Services Laboratory (NASL) at the Chesapeake Bay Laboratories, (CBL), Maryland, for analysis of PC and PN using by high temperature combustion where the combustion products (water vapor, carbon dioxide and nitrogen gas) are analyzed by a series of thermal conductivity cells and compared to a known standard (Zimmerman and others, 1997). This analysis does not distinguish between particulate organic and particulate inorganic components of a sample. Results are given in table 17. Many studies have shown that the carbon and nitrogen particulate component is almost entirely organic in natural waters (Keefe, 1994). A complete discussion of quality assurance/quality control procedures for PC/PN analyses can be found at http://cbl.umces.edu/nasl/index.htm

Table 17. Particulate carbon and particulate nitrogen concentrations from fixed sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; PC, particulate carbon; PN, particulate nitrogen; mg/L, milligram per liter; Concentrations averaged from duplicate samples; <, less than]

Station ID	Date	PC (mg/L)	PN (mg/L)
15356000	6/4/2001	18.85	0.61
15356000	7/11/2001	8.69	0.22
15356000	8/9/2001	18.95	0.31
15356000	9/11/2001	3.84	0.12
15389000	3/29/2001	<0.06	<0.01
15389000	6/30/2001	0.95	0.08
15389000	7/16/2001	0.89	0.07
15389000	8/7/2001	0.76	0.06
15389000	8/27/2001	0.72	0.05
15389000	9/17/2001	1.25	0.09
15453500	10/2/2000	2.77	0.11
15453500	3/21/2001	0.37	0.02
15453500	6/2/2001	12.85	0.69
15453500	6/18/2001	10.34	0.46
15453500	7/13/2001	10.35	0.30
15453500	8/14/2001	11.30	0.27
15453500	9/21/2001	1.77	0.05
15515500	10/3/2000	3.22	0.15
15515500	3/20/2001	0.26	0.02
15515500	5/31/2001	1.99	0.13
15515500	6/22/2001	9.49	0.50
15515500	7/9/2001	6.43	0.37
15515500	8/2/2001	12.25	0.64
15515500	9/13/2001	3.07	0.17
15565447	4/19/2001	0.69	0.03
15565447	7/5/2001	9.64	0.56
15565447	8/14/2001	11.35	0.56
15565447	8/30/2001	6.51	0.34
15565447	9/12/2001	6.34	0.31
15565447	9/21/2001	4.63	0.26

CHAPTER 12 - Isotopic Analysis of Suspended Sediments

***by* Steven R. Silva and Carol Kendall**

Sample Collection and Processing

Standard USGS protocols, described by Edwards and Glysson (1988), were used for the collection of depth- and width-integrated samples at all stations. Suspended sediment was separated from whole-water samples using a flow-through centrifuge. Analytical methods are described fully in Horowitz and Elrick (1985) and Elrick and Horowitz (1986, 1987). Sample splits of suspended sediments, analyzed and reported in Chapter 8, were sent to the USGS Isotope Tracers Project in Menlo Park, California for organic carbon and total nitrogen elemental and isotopic analysis.

Sample Analyses and Results

Dry samples were weighed into 3 X 5 millimeter silver capsules and acidified by the method of Yamamuro and Kayanne (1995). Acidification prior to analysis is necessary to eliminate inorganic carbon. In brief, the contents of the capsules were moistened with a few microliters of deionized water, the capsules were placed in a Teflon™ tray, and the tray was placed in a desiccator above 500 mL of 12 N hydrochloric acid for 18 hours. The capsules were then removed, dried for 3 hours at 50°C, crimp-sealed, and then stored in a desiccator with a silica gel desiccant until analyzed.

The samples were analyzed for carbon and nitrogen isotopic and elemental composition on a Carlo Erba 1500 or 2500™ elemental analyzer attached to a Micromass Optima™ or Micromass Isoprime™ mass spectrometer, in computer-controlled runs of 50 to 100 analyses each. A working standard material, ethylenediaminetetraacetic acid (EDTA), was analyzed with every run in a spectrum of sizes to bracket the sample yield in terms of nitrogen and carbon, allowing for correction for sample-size linearity of the instrument. The EDTA also was analyzed at ten-sample intervals to correct for instrumental drift over time. Empty silver capsules were analyzed as blanks at the beginning and end of the run. About 10 percent of the samples were analyzed in duplicate. The EDTA standard was calibrated through a set of international standards, to atmospheric air for $\delta^{15}N$ and to the international carbon standard, Vienna PeeDee Belemnite (VPDB) for $\delta^{13}C$. Nitrogen and carbon isotopic compositions are expressed in per mil (‰) relative to atmospheric air and VPDB respectively.

$$\delta^{15}N_{Air} = \{[(^{15}N/^{14}N)_X/(^{15}N/^{14}N)_{Air}]-1\}*1000; \text{ and } \delta^{13}C_{VPDB} = \{[(^{13}C/^{12}C)_X/(^{13}C/^{12}C)_{VPDB}]-1\}*1000$$

where x = sample, Air is the international nitrogen standard, and VPDB is the international carbon standard. Analytical precision (1σ) for standards is about ± 0.15‰ for $\delta^{13}C$ and $\delta^{15}N$.

Table 18. Suspended sediment isotopic data from fixed sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; C, carbon; N, nitrogen; Stdev, standard deviation; Avg, average; %, percent; --, no data; *, replicate samples collected in the field]

Station ID	Date	Avg %C	Stdev %C	Avg %N	Stdev %N	C:N	Avg $\Delta^{13}C$	Stdev $\Delta^{13}C$	Avg $\Delta^{15}N$	Stdev $\Delta^{15}N$
15356000	10/4/2000	1.05	0.04	0.08	0.01	15.3	-26.4	0.2	0.5	0.0
15356000	6/4/2001	0.93	0.11	0.06	0.00	18.1	-26.4	0.2	0.4	0.4
15356000	6/20/2001	0.82	0.15	0.05	0.01	19.1	-26.2	0.3	0.1	0.1
15356000	7/11/2001	0.68	0.03	0.06	0.01	13.2	-25.7	0.5	0.8	0.0
15356000	8/9/2001*	0.44	--	0.03	--	17.1	-25.2	--	0.2	
15356000	8/9/2001*	0.51	0.05	0.04	0.00	14.9	-25.2	0.3	0.3	0.3
15356000	9/11/2001	0.77	--	0.05	--	18.0	-25.9	--	0.8	--
15389000	9/17/2001	4.83	--	0.40	--	14.1	-26.9	--	2.2	--
15453500	10/2/2000	0.30	0.00	0.03	0.00	11.7	-26.7	0.1	-0.2	0.5
15453500	6/2/2001	1.33	0.04	0.09	0.01	17.2	-26.5	0.1	1.3	0.2
15453500	6/18/2001	1.37	0.08	0.11	0.04	14.5	-26.4	0.1	0.8	0.2
15453500	7/13/2001	0.91	--	0.06	--	17.7	-26.3	--	1.1	--
15453500	8/14/2001	0.96	--	0.07	--	16.0	-25.6	--	1.2	--
15453500	9/21/2001	0.77	0.08	0.06	0.00	15.0	-26.3	0.1	1.0	0.6
15515500	10/3/2000	0.76	--	0.06	--	14.8	-26.3	--	0.5	--
15515500	5/31/2001	0.49	0.00	0.04	0.01	14.3	-27.0	0.0	0.6	0.1
15515500	5/31/2001	0.45	0.05	0.03	0.01	17.5	-26.6	0.5	0.9	0.4
15515500	6/22/2001	0.92	--	0.08	--	13.4	-26.3	--	2.1	--
15515500	7/9/2001	0.25	--	0.02	--	14.6	-27.0	--	-0.8	--
15515500	8/2/2001	0.37	--	0.02	--	21.6	-25.0	--	0.7	--
15515500	9/13/2001	0.41	--	0.03	--	15.9	-26.2	--	0.9	--
15515500	9/13/2001	0.34	--	0.02	--	19.8	-26.1	--	1.5	--
15565447	7/5/2001	0.97	--	0.07	--	16.2	-26.5	--	1.2	--
15565447	7/27/2001	1.23	--	0.10	--	14.4	-26.7	--	1.4	--
15565447	8/14/2001	0.92	--	0.06	--	17.9	-25.9	--	0.8	--
15565447	8/30/2001	0.88	--	0.06	--	17.1	-26.2	--	0.8	--
15565447	8/30/2001	0.91	--	0.08	--	13.3	-26.0	--	1.8	--
15565447	9/21/2001	1.35	--	0.10	--	15.8	-26.7	--	0.5	--

CHAPTER 13 - Uranium Isotopes

***by* Thomas F. Kraemer**

Sample Collection and Processing

NASQAN program sampling protocols were used to collect the uranium isotope samples (see Chapter 2).

Sample Analysis and Results

Uranium Concentration Uranium analyses were conducted at the USGS Common Use Laboratory in Reston, Virginia, using a Perkin-Elmer Elan 6000™ quadrupole ICP-MS in elemental analysis mode using U.S. Environmental Protection Agency method 200.8 (1994) modified to use a 236U spike instead of terbium as an internal standard. A 10-mL aliquot was removed from each sample bottle and placed in a 15-mL autosampler vial. Spike was mixed with the samples to bring the 236U concentrations in each vial to 2 µg/L before placing in the tray for analysis. A Scott type spray chamber and cross flow nebulizer were used to introduce sample at a rate of 1.2 mL/min at an operating plasma radio frequency power of 1000 watts.

^{234}U/^{238}U Isotopic Activity Ratio The ^{234}U/^{238}U isotopic activity ratio (UAR) was determined using a Perkin-Elmer Elan 6000™ quadrupole ICP-MS in isotope analysis mode, as described by Kraemer and others (2002). A sample (1 to 2 L) was evaporated to dryness after the addition of nitric acid and hydrogen peroxide to help break down organic matter. The residue was treated one or two more times in the same manner with nitric acid and hydrogen peroxide. The residue was then dissolved in 8 N hydrochloric acid, filtered, and placed on a 1-mL anion exchange resin column. The uranium adsorbs while most other elements flow through. The uranium was released from the resin with 30 mL of distilled water and collected in a plastic vial. The sample was introduced into an ultrasonic nebulizer-desolvator and then into the ICP-MS for isotopic analysis.

The instrument was calibrated using NBS 4321B natural uranium standard with a certified UAR value of 0.963±0.003. Instrument performance was monitored by periodically running the standard or a uranium ore solution of UAR = 1.000, usually after every third sample. Each sample was run in triplicate, with each replicate consisting of five scans of the ^{234}U and ^{235}U peaks. The resulting ^{234}U/^{235}U mass ratios were converted to ^{234}U/^{238}U mass ratios based on the known constant ^{235}U/^{238}U mass ratio of natural uranium of 7.253×10^{-3} (Browne and Firestone, 1982). The UAR of the sample was then calculated by dividing its ^{234}U/^{238}U mass ratio by 5.591×10^{-5}, the ^{234}U/^{238}U mass ratio that corresponds to a UAR of 1.000. Individual measurement calculations, including error estimation, were carried out using the instrument software. Propagated error of measurement for a completed analysis was usually less than 2 percent, and values at or below 1 percent were routinely achieved, especially at uranium concentrations of around 1.0 µg/L or greater. Results are given in table 19.

Table 19. Uranium concentration and $^{234}U/^{238}U$ isotopic activity ratio analyses from fixed-sampling locations in the Yukon River Basin

[Station ID, refer to table 1 for description and figure 1 for location; µg/L; microgram per liter; U, Uranium; -- not available]

Station ID	Date and time	U (µg/L)	$^{234}U/^{238}U$ activity ratio (±1 sigma uncertainty)
15389000	3/29/01 1630	0.85	2.472±0.025
	6/30/01 1600	0.32	2.002±0.033
	7/16/01 1400	0.24	1.896±0.036
	8/7/01 1330	0.41	2.073±0.021
	8/13/01 --	0.45	2.018±0.034
	8/27/01 1500	0.37	2.126±0.027
	9/17/01 1320	0.31	1.969±0.011
15515500	10/3/00 1000	0.77	1.293±0.007
	3/20/01 1640	0.83	1.361±0.012
	5/31/01 1820	0.69	1.340±0.005
	6/22/01 1500	0.87	1.180±0.009
	7/9/01 1440	0.79	1.162±0.014
	8/2/01 1630	0.76	1.158±0.006
	9/18/01 1520	0.85	1.240±0.018
15356000	10/4/00 1000	0.86	1.424±0.012
	6/4/01 1900	0.68	1.474±0.008
	6/20/01 1330	0.69	1.424±0.009
	7/11/01 1210	0.80	1.402±0.019
	8/9/01 1145	0.88	1.401±0.010
	9/11/01 1140	0.91	1.416±0.012
15565447	4/19/01 1940	0.89	1.408±0.020
	7/5/01 1820	0.54	1.397±0.014
	7/25/01 1030	0.71	1.395±0.015
	8/14/01 2130	0.80	1.363±0.008
	8/30/01 1130	0.74	1.365±0.011
	9/21/01 1400	0.82	1.379±0.009
15453500	10/2/00 1000	0.76	1.486±0.010
	3/20/01 1630	1.09	1.475±0.030
	6/2/01 1800	0.43	1.521±0.022
	7/13/01 1430	0.77	1.438±0.020

CHAPTER 14 - Fecal-Indicator Samples

***by* Mary A. Voytek and Lisa Reynolds Fogarty**

Sample Collection and Processing

Water samples were collected from the Yukon River, Tanana River and Porcupine River August 6-14, 2001 for fecal-indicator analysis. Samples were collected near the shoreline, and when possible, from the center of the main channel of flow upstream and downstream from four villages: Circle, Eagle, Fort Yukon, Nenana, and Stevens Village (Figure 1). Water was collected as a grab sample in 1-L polypropylene bottles and filtered as described below within 6 hours of collection. Sediment cores were collected by coring of surface mud with sterile polypropylene sleeves (3.4-cm diameter). Approximately 5 grams of sediment from the top 5 to 6 cm was removed, combined with 50 mL Phosphate Buffered Saline (PBS), and vortexed. Samples were processed according to established USGS protocols (U.S. Geological Survey, 1997-99).

Drinking-water source samples also were collected from each village. These sources include: non-treated wells, chlorine-treated wells, central water points, home with piped water, storage containers within the home collected from the central water point, and rainwater collection barrels. Samples from watering points and homes with a watering tap were collecting by flushing the tap 4-5 minutes before collecting a sample in 1-L polypropylene bottles. Samples from storage barrels were collected as a grab sample in 1-L polypropylene bottles.

Sample Analysis and Results

Fecal indicator bacteria were quantified using membrane filtration techniques (Franson and others, 1998; Parker, 2000) (tables 20-22). Water samples were filtered onto a 0.45-µm gridded cellulose nitrate membrane filters (Advantec MFS, Inc., Pleasanton, CA) in 100-mL, 10-mL, and 1-mL volumes. Filters were placed on m-FC/Rosolic acid media (HACH, Loveland, CO) and incubated at 44.5ºC for 24 hours, after which fecal coliforms (blue colonies) were counted. *E. coli* was distinguished from other fecal coliforms by transferring the filter membrane to a Nutrient Agar containing 4-methylumbelliferyl-β-D-glucuronide (Na-MUG agar; DIFCO, Sparks, MD) and incubating for 4 hours at 37ºC and counting the number of colonies with blue fluorescent halos. A second membrane filter for each volume of filtered water was place on mEI agar as described by U.S. Environmental Protection Agency (2000) and incubated at 41.5ºC for 24 hours, after which enterococci colonies (blue halo colonies) were counted. Sediment:PBS mixtures were filtered in 10-mL, 1 mL and 0.1-mL volumes and processed as above for water samples. USEPA recommended drinking water standards for fecal indication bacteria concentrations are given in table 23.

Table 20. Fecal indicator bacteria concentrations in river water samples from selected locations in the Yukon River Basin

[Figure #, refers to sample site location shown on figure 1; CFU, colony-forming units; mL milliliters]

Date	Location/Figure #	Fecal coliforms CFU/100ml	E. coli CFU/100ml	Enterococci CFU/100ml
	Tanana River at Nenana, AK/4			
8/7/2001	Along bank of river near downstream edge of village	19[a]	19[a]	80[b]
8/7/2001	Along bank of river near upstream edge from village	22[a]	22[a]	31[a]
8/7/2001	Center of main channel of flow downstream of village	29[a]	29[a]	70[b]
8/7/2001	Center of main channel of flow upstream from village	35[a]	30[a]	100[b]
	Porcupine River near Fort Yukon, AK/6			
8/7/2001	Center of main channel of flow upstream from Fort Yukon	5[a]	5[a]	10[b]
8/13/2001	Along bank of river near village	2[a]	2[a]	6[a]
	Yukon River at Eagle, AK/1			
8/9/2001	Center of main channel of flow upstream from village	70[b]	70[b]	4[a]
8/9/2001	Center of main channel of flow downstream of village	16[a]	16[a]	3[a]
8/9/2001	Along bank of river near upstream edge from village	17[a]	17[a]	2[a]
8/9/2001	Along bank of river near downstream edge of village	30[a]	28[a]	4[a]
	Yukon River near Fort Yukon, AK/6			
8/13/2001	Along bank of river near downstream edge of village	15[a]	16[a]	21[a]
8/13/2001	Along bank of slough in village near town well	13[a]	14[a]	13[a]
8/13/2001	Along bank of river near upstream edge from village	9[a]	10[a]	24[a]
	Yukon River near Stevens Village/3			
8/14/2001	Along bank of river near the center of village	15[a]	18[a]	50[b]
8/14/2001	Along bank of river near downstream edge of village	14[a]	14[a]	5[a]
8/14/2001	Along bank of river near upstream edge from village	40[b]	40[b]	990

[a] Not an optimal plate count; filter contained a lot of silt
[b] Results based on 10-mL sample volume; not an optimal plate count, less than 20 colonies per filter

Table 21. Fecal indicator bacteria concentrations in village domestic water supplies and other samples from selected locations in the Yukon River Basin

[Figure #, refers to sample site location shown on figure 1; CFU, colony-forming units; mL, milliliters; NT, not detected; DNR, Division of Natural Resources]

Date	Village/Figure #	Location	Fecal coliforms CFU*/100mL	E. coli CFU/100mL	Enterococci CFU/100mL
8/7/2001	Nenana/4	Chlorinated sewage prior to discharge	2	2	0
8/7/2001	Nenana/4	Drinking water after chlorine treatment	0	0	0
8/7/2001	Nenana/4	Drinking water before water treatment-well	0	0	0
8/9/2001	Eagle/1	Pressurized bladder storage-well water source	0	0	0
8/9/2001	Eagle/1	Kitchen tap, homeowner well water source	0	0	0
8/9/2001	Eagle/1	Kitchen tap, homeowner well water source	0	0	0
8/9/2001	Eagle/1	Storage barrel filled from watering point	0	0	0
8/9/2001	Eagle/1	Central village watering point well	0	0	0
8/13/2001	Fort Yukon/6	Storage barrel filled from watering point	16	2	0
8/13/2001	Fort Yukon/6	Kitchen tap piped from town well	0	0	0
8/13/2001	Fort Yukon/6	Kitchen tap piped from town well	0	0	0
8/13/2001	Fort Yukon/6	Bathroom tap piped from town well	0	0	0
8/13/2001	Fort Yukon/6	Swimming hole	0	0	0
8/13/2001	Fort Yukon/6	Central well, watering point (fluoride treated)	0	0	0
8/14/2001	Stevens Village/3	Town well, chlorine treated central watering point	0	0	0
8/14/2001	Stevens Village/3	Rainwater primarily used for washing	0	0	300
8/14/2001	Stevens Village/3	Pitcher filtered rainwater	0	0	0
8/14/2001	Stevens Village/3	Rainwater collection used for drinking	0	0	4
8/14/2001	Stevens Village/3	DNR office building	0	0	0
8/14/2001	Stevens Village/3	Rainwater in barrel with cloth covering	41	10	65
8/14/2001	Stevens Village/3	Storage barrel filled from watering point	0	0	0

Table 22. Fecal indicator bacteria concentrations in river sediments from selected locations in the Yukon River Basin

[Figure #, refers to sample site location shown on figure 1; CFU, colony-forming units; g, grams]

Date	Location/Figure #	Fecal coliforms CFU/1 g sediment wet weight	E. coli CFU/1 g sediment wet weight	Enterococci CFU/1 g sediment wet weight
8/7/2001	Nenana upstream bank/4	15.17	10.93	26.1
8/9/2001	Eagle downstream bank/1	4.35[a]	4.35	0
8/9/2001	Eagle upstream bank/1	2.77[a]	2.77	0
8/13/2001	Fort Yukon downstream bank/6	1.82[a]	0	2.73[a]
8/14/2001	Stevens Village upstream bank/3	12.71	12.71[a]	4.4
8/14/2001	Stevens Village town bank/3	4.39	4.39	1.47

[a] Not an optimal plate count; filter contained a lot of sediment

Table 23. U.S. Environmental Protection Agency recommended drinking water standards
[CFU, colony-forming units; mL, milliliters]

Water Use	*E. coli* CFU per 100 mL	Enterococci CFU per 100 mL
Recreational waters	235	33
Moderate full body contact	298	No standard
Lightly full body contact	406	No standard
Infrequent used full body contact	576	No standard
Drinking Water	0	0

Source: http://www.epa.gov./safewater/mcl.html

CHAPTER 15 - Sediment-Core Samples

***by* Peter Van Metre and Jennifer T. Wilson**

This section provides a description of the measurement and analytical methods used during the collection of sediment-core samples from five lakes in the Yukon River Basin. A summary of the site characteristics (longitude, latitude, drainage area, and water depth) is provided in table 24.

Table 24. Summary of sediment-coring station characteristics

[Station ID, USGS Station Identification number; Figure #, refer to figure 1 for site location]

Station ID	Station Name/Figure #	Latitude	Longitude	Sample Collection Date	Water Depth at Coring Site (meters)
614042161040300	Russian Mission Lake near Portage Sl. near Russian Mission, Alaska/7	61°40'41.5"	161°04'03.3"	8/28/2001	2.5
631600148081000	Stickwan Lake near Cantwell, Alaska/8	63°15'59.7"	148°08'10.1"	8/29/2001	0.8
672754150155100	Nolan Creek Lake near Wiseman, Alaska/9	67°27'54.4"	150°15'50.6"	9/2/2001	1.2
653018144343000	Little Medicine Lake near Central, Alaska/10	65°30'18.3"	144°34'29.9"	9/5/2001	0.9
603010135080800	Little Coal Lake near Whitehorse, Yukon Territory (Canada)/11	60°30'09.5"	135°08'08.4"	9/9/2001	3.5

Sample Collection and Processing

Sediment core samples were collected from five lakes in the Yukon River Basin. The lakes were chosen to evaluate atmospheric fallout across the basin and at different altitudes. Lakes sampled had no buildings, roads, or other development in their watersheds. All five lakes were shallow (less than about 4 meters deep) and underlain by permafrost.

Cores were collected from the deepest part of the lake using a 30-cm aluminum box corer. Cores were sectioned into vertically discrete subsamples on site and transferred into ziplock bags for analysis of inorganic constituents and baked glass jars for analysis of organic constituents. Sub-sampling equipment that contacted the samples included the plastic core liners, thin stainless-steel plates used to slice each interval, Teflon™-coated knives, and the sample containers. The sampling tools were rinsed in ambient lake water, soaked in 0.2-percent phosphate-free detergent, and rinsed again in ambient lake water between subsamples. All samples were chilled until shipment to the USGS office in Austin, Texas, for freeze-drying (major and trace elements and radionuclide samples only), splitting, and submittal to the laboratories.

Sample Analyses and Results

Analyses include major and trace elements, Cesium-137, lead-210, organochlorine pesticides, Polychlorinated Biphenyls (PCBs), and Polyaromatic Hydrocarbons (PAHs). In the laboratory, sediment samples for elemental analysis were weighed, frozen, freeze-dried, weighed again, and then ground to a fine power. Wet and dry weights (not included in tables) for all

samples were used, along with measured density of solids for selected samples from each core, to calculate porosity mass accumulation rates in the cores.

Samples for analysis of elemental concentrations were digested using a mixture of hydrochloric, nitric, perchloric, and hydrofluoric acids and analyzed by inductively-coupled plasma/mass spectrometry (ICP/MS) at the USGS Geologic Discipline Laboratory (GD lab) in Denver, Colorado, (Arbogast, 1996). Mercury was analyzed by cold vapor atomic absorption spectrometry (AAS), also at the GD lab (Arbogast, 1996). Quality assurance was provided by determining the elemental concentrations for duplicate samples and a variety of soil, lake, and marine sediment standard reference materials *(*Arbogast, 1996).

Organochlorine pesticides, PCBs, PAHs and alkyl-substituted PAHs (alkyl-PAHs) were extracted, isolated, and analyzed using a variation of the procedures of Foreman and others (1995) and Furlong and others (1996). Briefly described here, wet bottom sediment was extracted overnight with dichloromethane in a Soxhlet apparatus. The extract was reduced in volume and filtered. Two aliquots of the sample extract were quantitatively injected into a polystyrene-divinylbenzene gel permeation column (GPC) and eluted with dichloromethane to remove sulfur and to partially isolate the target analytes from coextracted high-molecular-weight interferences such as humic substances. The first aliquot was analyzed for PAHs and alkyl-PAHs by capillary-column gas chromatography (GC) with detection by selected ion monitoring (SIM) mass spectrometry (MS). The use of SIM, a variation on the procedure of Furlong and others (1996), reduces chemical interferences and improves detection limits. Parent PAHs were identified and quantified by comparison to authentic standards. Individual alkyl-PAHs were quantified when authentic alkyl-substituted standards were available. The multiple isomeric alkyl- PAHs were quantified from SIM mass chromatograms as the sum of all isomers at each alkylation level (C1-naphthalene, C2-naphthalene, etc.). When authentic alkyl-substituted standards were unavailable, a parent PAH was used as the standard for quantitation. Nineteen parent PAHs, 10 specific alkyl-PAHs, and the homologous series of alkyl-PAHs were determined for this study.

The second aliquot was split into two sample fractions by combined alumina/silica adsorption chromatography, followed by Florisil adsorption chromatography for further cleanup of the second fraction. Both fractions were analyzed by dual capillary-column gas chromatography with electron capture detection (GC-ECD) for the determination of the organochlorine pesticides and PCBs. The organochlorine pesticides were reported as individual compounds with the exception of chlordane which was reported as technical chlordane. PCBs were reported as individual Aroclor (1242, 1254, or 1260) equivalents. Quality assurance was provided by analyzing duplicate samples, laboratory blanks, spiked reagent samples, and monitoring recovery of surrogate compounds.

Cesium-137, lead-210, and radium-226 activities (not included in tables) were measured to determine sediment mass accumulation rates for age-dating the cores. Analyses were performed at the USGS National Research Program laboratory in Menlo Park, California. Sediment cesium-137, lead-210, and radium-226 activities were measured by counting freeze-dried sediments with a high-resolution, intrinsic germanium well detector gamma-spectrometer. The method is based on the standard method outlined by the American Society for Testing and Materials (1998) and is similar to that reported by Callender and Robbins (1993). Results are given in tables 25-29.

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin

[Station ID, USGS site identification number; "RUS.2", second core collected at Russian Mission Lake"; interval that follows RUS.2 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters, µg/g, microgram per gram; repl., replicate; --, no data; "RUS.1", first core collected at Russian Mission Lake interval that follows RUS.1 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters; CO_2; Carbon Dioxide; CO_3^{2-} carbonate; µg/kg, microgram per kilogram; E, Estimated; <, less than; pCi/g, picoCuries per gram; std. dev, standard deviation; dpm/g, disintegrations per minute per gram]

Station ID	Field ID	Aluminum (µg/g)	Calcium (µg/g)	Iron (µg/g)	Potassium (µg/g)	Magnesium (µg/g)	Sodium (µg/g)	Phosphorus (µg/g)
614042161040300	RUS.2 0-0.5	40,000	16,400	125,000	9,150	8,370	6,530	3,610
614042161040300	RUS.2 0.5-1	43,600	13,000	105,000	9,750	7,140	5,910	2,820
614042161040300	RUS.2 1-1.5	45,900	9,580	98,000	10,100	7,610	6,100	2,750
614042161040300	RUS.2 1.5-2	50,200	10,200	89,800	11,500	9,840	7,850	2,560
614042161040300	RUS.2 2-2.5	49,900	10,100	87,700	11,400	7,930	6,630	2,260
614042161040300	RUS.2 2.5-3	52,700	9,980	84,800	11,700	8,380	6,660	2,280
614042161040300	RUS.2 3-3.5	50,100	9,740	81,300	11,200	8,080	6,460	2,190
614042161040300	RUS.2 3.5-4	49,800	9,600	78,300	11,300	8,050	6,520	2,160
614042161040300	RUS.2 4-4.5	50,300	9,980	77,400	11,400	7,920	6,310	2,170
614042161040300	RUS.2 4.5-5	56,000	10,100	76,800	12,600	10,400	8,550	2,320
614042161040300	RUS.2 5-5.5	57,100	10,200	74,500	12,600	10,800	8,730	2,240
614042161040300	RUS.2 5.5-6	53,600	10,300	73,800	12,000	8,490	7,010	1,970
614042161040300	RUS.2 6-6.5	59,100	10,400	67,200	12,800	11,200	9,340	1,920
614042161040300	RUS.2 6.5-7	60,300	10,500	67,100	13,200	12,100	10,000	2,000
614042161040300	RUS.2 7-8	54,800	10,400	59,600	12,500	8,770	7,410	1,630
614042161040300	RUS.2 8-9	53,500	10,500	57,800	12,100	8,580	7,300	1,720
614042161040300	RUS.2 9-10	57,300	10,600	54,900	13,100	8,960	7,840	1,540
614042161040300	RUS.2 10-11	66,400	11,500	55,000	14,900	13,100	11,700	1,560
614042161040300	RUS.2 11-12	66,600	11,800	51,600	15,000	13,300	11,900	1,440
614042161040300	RUS.2 11-12 repl.	59,000	11,000	50,400	13,300	9,030	8,160	1,260
614042161040300	RUS.2 11-12 repl.	57,900	10,700	49,800	12,800	9,060	8,160	1,240
614042161040300	RUS.2 12-13	67,800	11,900	48,200	15,000	12,800	11,500	1,250
614042161040300	RUS.2 13-14	60,600	11,500	40,700	13,200	9,350	8,770	1,100

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	Titanium (µg/g)	Arsenic (µg/g)	Barium (µg/g)	Beryllium (µg/g)	Cadmium (µg/g)	Cobalt (µg/g)	Chromium (µg/g)
614042161040300	RUS.2 0-0.5	2,070	189	863	1.18	0.419	13.0	53.0
614042161040300	RUS.2 0.5-1	2,250	127	816	1.18	0.495	15.7	62.5
614042161040300	RUS.2 1-1.5	2,440	102	788	1.32	0.505	15.9	66.3
614042161040300	RUS.2 1.5-2	2,360	79.4	840	1.38	0.581	16.9	71.7
614042161040300	RUS.2 2-2.5	2,700	65.6	802	1.46	0.599	19.6	72.3
614042161040300	RUS.2 2.5-3	2,480	59.2	799	1.53	0.631	20.7	74.3
614042161040300	RUS.2 3-3.5	2,190	54.5	787	1.44	0.631	20.1	71.9
614042161040300	RUS.2 3.5-4	2,550	52.8	772	1.43	0.615	19.5	73.6
614042161040300	RUS.2 4-4.5	2,460	52.8	784	1.48	0.646	19.7	73.4
614042161040300	RUS.2 4.5-5	2,420	49.0	805	1.58	0.629	19.5	74.6
614042161040300	RUS.2 5-5.5	2,490	46.1	815	1.54	0.657	19.9	76.1
614042161040300	RUS.2 5.5-6	2,260	46.0	757	1.53	0.663	20.6	76.3
614042161040300	RUS.2 6-6.5	2,480	40.1	827	1.63	0.689	19.7	78.3
614042161040300	RUS.2 6.5-7	2,730	39.8	862	1.76	0.681	20.1	77.8
614042161040300	RUS.2 7-8	2,490	32.4	817	1.55	0.682	20.0	77.2
614042161040300	RUS.2 8-9	2,390	30.2	818	1.54	0.642	19.4	77.0
614042161040300	RUS.2 9-10	2,810	26.5	865	1.72	0.652	18.7	82.7
614042161040300	RUS.2 10-11	2,890	24.4	935	1.75	0.667	18.5	84.2
614042161040300	RUS.2 11-12	3,070	21.8	996	1.78	0.682	18.8	86.1
614042161040300	RUS.2 11-12 repl.	2,920	22.1	904	1.76	0.629	18.8	85.1
614042161040300	RUS.2 11-12 repl.	2,880	21.8	862	1.73	0.646	18.6	82.3
614042161040300	RUS.2 12-13	3,190	18.6	1,040	1.73	0.646	17.6	85.2
614042161040300	RUS.2 13-14	3,050	15.5	894	1.77	0.591	15.1	79.8

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	Copper (µg/g)	Mercury (µg/g)	Lithium (µg/g)	Manganese (µg/g)	Nickel (µg/g)	Lead (µg/g)	Scandium (µg/g)
614042161040300	RUS.2 0-0.5	55.1	0.06	21.0	1,620	26.1	13.4	8.90
614042161040300	RUS.2 0.5-1	38.6	0.09	21.5	1,120	32.8	14.3	10.9
614042161040300	RUS.2 1-1.5	38.3	0.10	22.4	1,010	33.3	14.6	11.3
614042161040300	RUS.2 1.5-2	41.6	0.10	28.1	925	36.0	16.1	12.0
614042161040300	RUS.2 2-2.5	43.5	0.10	25.1	866	38.8	16.3	12.7
614042161040300	RUS.2 2.5-3	46.8	0.11	25.7	884	40.6	16.6	13.0
614042161040300	RUS.2 3-3.5	48.0	0.13	25.9	854	39.9	17.4	12.7
614042161040300	RUS.2 3.5-4	46.5	0.11	25.1	813	39.9	16.7	12.7
614042161040300	RUS.2 4-4.5	48.8	0.11	25.3	820	40.4	17.1	12.7
614042161040300	RUS.2 4.5-5	44.7	0.10	29.1	806	39.1	17.5	12.7
614042161040300	RUS.2 5-5.5	46.0	0.11	30.1	773	40.3	18.4	13.2
614042161040300	RUS.2 5.5-6	54.1	0.11	26.3	760	42.4	17.3	12.9
614042161040300	RUS.2 6-6.5	68.0	0.11	31.4	725	44.9	18.5	13.2
614042161040300	RUS.2 6.5-7	49.4	0.10	33.1	731	40.5	18.0	13.7
614042161040300	RUS.2 7-8	57.0	0.10	28.1	674	41.6	17.3	13.6
614042161040300	RUS.2 8-9	48.8	0.09	27.2	677	40.9	17.5	13.5
614042161040300	RUS.2 9-10	48.5	0.09	28.7	637	41.4	17.0	14.6
614042161040300	RUS.2 10-11	47.4	0.09	34.4	610	41.4	17.3	15.0
614042161040300	RUS.2 11-12	47.0	0.09	35.1	612	42.7	17.8	14.8
614042161040300	RUS.2 11-12 repl.	48.8	- -	30.0	590	42.9	17.6	14.6
614042161040300	RUS.2 11-12 repl.	48.3	- -	29.5	588	42.4	18.0	13.9
614042161040300	RUS.2 12-13	47.1	0.08	35.1	587	44.2	18.1	15.0
614042161040300	RUS.2 13-14	48.5	0.08	29.7	571	41.4	16.6	14.2

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	Strontium (µg/g)	Vanadium (µg/g)	Zinc (µg/g)
614042161040300	RUS.2 0-0.5	116	88.0	98.1
614042161040300	RUS.2 0.5-1	114	103	112
614042161040300	RUS.2 1-1.5	111	107	113
614042161040300	RUS.2 1.5-2	121	116	118
614042161040300	RUS.2 2-2.5	120	118	126
614042161040300	RUS.2 2.5-3	116	121	129
614042161040300	RUS.2 3-3.5	115	120	136
614042161040300	RUS.2 3.5-4	117	120	129
614042161040300	RUS.2 4-4.5	118	124	134
614042161040300	RUS.2 4.5-5	125	122	124
614042161040300	RUS.2 5-5.5	128	125	127
614042161040300	RUS.2 5.5-6	119	127	136
614042161040300	RUS.2 6-6.5	130	127	134
614042161040300	RUS.2 6.5-7	130	126	127
614042161040300	RUS.2 7-8	123	127	134
614042161040300	RUS.2 8-9	126	127	128
614042161040300	RUS.2 9-10	134	133	131
614042161040300	RUS.2 10-11	144	136	127
614042161040300	RUS.2 11-12	144	141	129
614042161040300	RUS.2 11-12 repl.	141	136	135
614042161040300	RUS.2 11-12 repl.	136	135	132
614042161040300	RUS.2 12-13	150	138	124
614042161040300	RUS.2 13-14	143	130	118

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	Total carbon, %	Inorganic carbon, as $CO_2 + CO_3^{2-}$, %	Organic carbon, %
614042161040300	RUS.1 0-0.5	12.8	0.48	12.7
614042161040300	RUS.1 0.5-1	12.9	0.54	12.8
614042161040300	RUS.1 1-1.5	12.7	0.41	12.6
614042161040300	RUS.1 1.5-2	13.2	0.14	13.1
614042161040300	RUS.1 2-2.5	13.2	0.41	13.1
614042161040300	RUS.1 2.5-3	13.1	0.17	12.9
614042161040300	RUS.1 3-3.5	13.4	0.16	13.2
614042161040300	RUS.1 3.5-4	13.5	0.11	13.4
614042161040300	RUS.1 4-4.5	13.3	0.11	13.2
614042161040300	RUS.1 4.5-5	14.0	0.11	13.9
614042161040300	RUS.1 5.5-6	13.2	0.15	13.0
614042161040300	RUS.1 6.5-7	13.0	0.09	12.9
614042161040300	RUS.1 8-9	12.9	0.10	12.8
614042161040300	RUS.1 10-11	12.5	0.09	12.4
614042161040300	RUS.1 12-13	11.6	0.06	11.5
614042161040300	RUS.1 14-15	11.4	0.08	11.3
614042161040300	RUS.1 16-17	13.6	0.08	13.5

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	Naphthalene (µg/kg)	C1-128 isomers (µg/kg)	2-ethyl-naphthalene (µg/kg)	2,6-dimethyl-naphthalene (µg/kg)	1,6-dimethyl-naphthalene (µg/kg)	C2-128 isomers (µg/kg)	Acenaph-thylene (µg/kg)
614042161040300	RUS.1 0-0.5	<50	E27.0	<50	421	82.3	608	<50
614042161040300	RUS.1 1-1.5	E3.3	E12.0	<15	335	36.6	446	<15
614042161040300	RUS.1 2-2.5	<25	E18.6	<25	492	76.4	680	<25
614042161040300	RUS.1 3-3.5	E6.2	130	<10	299	36.4	424	<10
614042161040300	RUS.1 4-4.5	E8.5	180	<15	404	53.2	592	<15
614042161040300	RUS.1 5.5-6	E7.8	120	<10	245	35.1	338	<10
614042161040300	RUS.1 6.5-7	E9.8	190	E3.1	442	58.6	590	E2.7
614042161040300	RUS.1 8-9	E6.0	20.3	<20	406	42	530	<20
614042161040300	RUS.1 10-11	E7.5	104	<10	227	42.8	314	<10

Station ID	Field ID	1,2-dimethyl-naphthalene (µg/kg)	Acenaph-thene (µg/kg)	C3-128 isomers (µg/kg)	2,3,6-trimethyl-naphthalene (µg/kg)	9H-Fluorene (µg/kg)	C4-128 isomers (µg/kg)
614042161040300	RUS.1 0-0.5	E36.2	<50	<250	<50	E22.8	<50
614042161040300	RUS.1 1-1.5	17.4	<15	<120	<15	E8.8	<15
614042161040300	RUS.1 2-2.5	<25	<25	<200	<25	<25	<25
614042161040300	RUS.1 3-3.5	E6.9	<10	146	E3.8	E4.4	<60
614042161040300	RUS.1 4-4.5	E12.7	<15	174	E5.2	E6.7	<90
614042161040300	RUS.1 5.5-6	<10	<10	142	E4.0	E4.7	<60
614042161040300	RUS.1 6.5-7	E14.2	E5.5	231	E7.2	E6.9	<80
614042161040300	RUS.1 8-9	<20	<20	190	E7.4	E7.9	<20
614042161040300	RUS.1 10-11	E8.9	<10	148	E4.9	E5.6	<40

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	1-methyl-9H-Fluorene (µg/kg)	Phenan-threne (µg/kg)	Anthracene (µg/kg)	C5-128 isomers (µg/kg)	2-methyl-anthracene (µg/kg)	4,5-methylene-phenanthrene (µg/kg)	C1-178 isomers (µg/kg)
614042161040300	RUS.1 0-0.5	E41.7	E24.1	<50	<50	<50	<50	E46.8
614042161040300	RUS.1 1-1.5	19.2	22.2	E5.9	<15	<15	<15	<15
614042161040300	RUS.1 2-2.5	40	E21.5	<25	<25	<25	<25	39.1
614042161040300	RUS.1 3-3.5	<10	10.3	<10	<10	<10	<10	19.2
614042161040300	RUS.1 4-4.5	<15	E13.5	<15	<15	<15	<15	41.1
614042161040300	RUS.1 5.5-6	<10	10.5	<10	<10	<10	<10	14.3
614042161040300	RUS.1 6.5-7	41.60	18.40	E6.3	<15	<15	<15	92.6
614042161040300	RUS.1 8-9	<50	25.6	E8.6	<20	E10.2	<20	54.4
614042161040300	RUS.1 10-11	<10	15.6	<10	<10	<10	<10	49.2

Station ID	Field ID	1-methyl-phenanthrene (µg/kg)	C2-178 isomers (µg/kg)	Fluoranthene (µg/kg)	Pyrene (µg/kg)	C3-178 isomers (µg/kg)	C4-178 isomers (µg/kg)	1-methyl-pyrene (µg/kg)
614042161040300	RUS.1 0-0.5	<50	E40.0	E13.2	E13.1	<50	<50	<50
614042161040300	RUS.1 1-1.5	<15	<15	E4.1	E4.4	<15	<15	<15
614042161040300	RUS.1 2-2.5	<25	29	E7.4	E7.6	<25	<25	<25
614042161040300	RUS.1 3-3.5	<10	21.2	E3.8	E3.9	10.1	<40	<10
614042161040300	RUS.1 4-4.5	<15	31	E5.2	E5.4	<15	<60	<15
614042161040300	RUS.1 5.5-6	<10	22.2	E4.2	E4.3	10.4	<40	<10
614042161040300	RUS.1 6.5-7	<15	35.20	E5.5	E6.1	16.8	<60	<15
614042161040300	RUS.1 8-9	E11.5	35.6	E8.5	E9.0	<60	<70	<20
614042161040300	RUS.1 10-11	<10	27.6	E5.0	E5.1	12.9	<40	<10

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	C1-202 isomers (µg/kg)	C2-202 isomers (µg/kg)	C5-178 isomers (µg/kg)	Benz(a)-anthracene (µg/kg)	Chrysene (µg/kg)	C3-202 isomers (µg/kg)	C1-228 isomers (µg/kg)
614042161040300	RUS.1 0-0.5	<50	<50	<50	<50	E6.2	<50	<50
614042161040300	RUS.1 1-1.5	<15	<15	<15	<15	E4.6	<15	E13.9
614042161040300	RUS.1 2-2.5	<25	<25	<25	<25	E7.4	<25	<25
614042161040300	RUS.1 3-3.5	<10	<15	<10	<10	E4.4	<10	E8.8
614042161040300	RUS.1 4-4.5	<15	<30	<15	E2.8	E6.3	<15	E13.6
614042161040300	RUS.1 5.5-6	<10	<20	<10	E2.5	E5.7	<10	E9.7
614042161040300	RUS.1 6.5-7	<20	<35	<15	<15	E9.3	<15	E12.0
614042161040300	RUS.1 8-9	24.4	<50	<20	E5.5	E8.4	<20	<60
614042161040300	RUS.1 10-11	<15	<25	<10	<10	E7.2	<10	11.9

Station ID	Field ID	C4-202 isomers (µg/kg)	C5-202 isomers (µg/kg)	C2-228 isomers (µg/kg)	Benzo(b)-fluoranthene (µg/kg)	Benzo(k)-fluoranthene (µg/kg)	Benzo(e)-pyrene (µg/kg)	Benzo(a)-pyrene (µg/kg)
614042161040300	RUS.1 0-0.5	<50	<50	115	E25.8	<50	E11.7	<50
614042161040300	RUS.1 1-1.5	<15	<15	69.3	<15	<15	E5.4	15.8
614042161040300	RUS.1 2-2.5	<25	<25	123	<25	<25	<25	<25
614042161040300	RUS.1 3-3.5	<10	<10	<60	E5.4	<10	E4.0	<10
614042161040300	RUS.1 4-4.5	<15	<15	<100	E8.1	<15	E5.8	<15
614042161040300	RUS.1 5.5-6	<10	<10	<80	E6.0	<10	<10	<10
614042161040300	RUS.1 6.5-7	<15	<15	<140	E10.0	<15	E6.0	E14.2
614042161040300	RUS.1 8-9	<20	<20	<200	E11.1	E7.4	E9.3	E9.3
614042161040300	RUS.1 10-11	<10	<10	<120	E6.9	<10	E4.6	<10

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	Perylene (µg/kg)	C1-252 isomers (µg/kg)	C3-228 isomers (µg/kg)	C2-252 isomers (µg/kg)	C4-228 isomers (µg/kg)	Benzo-(g,h,i)-perylene (µg/kg)	Indeno-(1,2,3-c,d)-pyrene (µg/kg)	Dibenzo-(a,h)-anthracene (µg/kg)
614042161040300	RUS.1 0-0.5	385	<50	<50	<50	<50	<50	<50	<50
614042161040300	RUS.1 1-1.5	283	E10.2	E10.5	<15	<15	<15	<15	<15
614042161040300	RUS.1 2-2.5	520	<25	<25	<25	<25	<25	<25	<25
614042161040300	RUS.1 3-3.5	317	<10	<10	<10	<10	E4.1	E6.8	E5.5
614042161040300	RUS.1 4-4.5	531	<15	<15	<15	<15	<15	E9.6	<15
614042161040300	RUS.1 5.5-6	557	<10	<10	<10	<10	E4.8	E6.9	<10
614042161040300	RUS.1 6.5-7	1030	29.10	<15	<15	<15	<15	<15	<15
614042161040300	RUS.1 8-9	1290	33.4	<20	21.3	<20	<20	E9.3	<20
614042161040300	RUS.1 10-11	933	25.4	<10	<10	<10	<10	<10	<10

Station ID	Field ID	C3-252 isomers (µg/kg)	C4-252 isomers (µg/kg)	C5-228 isomers (µg/kg)	C5-252 isomers (µg/kg)	Coronene (µg/kg)
614042161040300	RUS.1 0-0.5	<50	<50	<50	<50	<50
614042161040300	RUS.1 1-1.5	<15	<350	<15	<15	<15
614042161040300	RUS.1 2-2.5	<25	<50	<25	<25	<25
614042161040300	RUS.1 3-3.5	<10	<10	<10	<10	<10
614042161040300	RUS.1 4-4.5	<15	<15	<15	<15	E8.7
614042161040300	RUS.1 5.5-6	<10	<10	<10	<10	E5.2
614042161040300	RUS.1 6.5-7	<15	<15	<15	<15	E5.5
614042161040300	RUS.1 8-9	<20	<20	<20	<20	<20
614042161040300	RUS.1 10-11	<10	<10	<10	<10	<10

Table 25. Sediment coring results for Russian Mission Lake, Yukon River Basin-continued

Station ID	Field ID	Cs-137 (pCi/g)	Cs-137 uncertainty, 1 std. dev.	Pb-210 (dpm/g)	Pb-210 uncertainty, 1 std. dev.	Ra-226 (dpm/g)	Ra-226 uncertainty, 1 std. dev.
614042161040300	RUS.2 0-0.5	1.503	0.074	14.43	1.01	1.35	0.40
614042161040300	RUS.2 0.5-1	1.429	0.085	16.03	1.30	1.02	0.23
614042161040300	RUS.2 1-1.5	1.665	0.074	15.15	0.98	1.41	0.38
614042161040300	RUS.2 1.5-2	1.951	0.129	20.52	2.11	1.75	0.39
614042161040300	RUS.2 2-2.5	2.349	0.152	20.19	2.19	1.48	0.42
614042161040300	RUS.2 2.5-3	2.266	0.123	13.88	1.32	1.44	0.27
614042161040300	RUS.2 3-3.5	2.418	0.175	11.31	2.11	1.72	0.49
614042161040300	RUS.2 3.5-4	2.663	0.138	11.47	1.28	1.00	0.27
614042161040300	RUS.2 4-4.5	2.545	0.122	8.61	0.88	1.42	0.21
614042161040300	RUS.2 4.5-5	2.351	0.113	7.43	0.82	1.47	0.20
614042161040300	RUS.2 5-5.5	2.000	0.099	8.11	0.80	1.38	0.20
614042161040300	RUS.2 5.5-6	1.771	0.114	8.22	1.27	1.68	0.32
614042161040300	RUS.2 6-6.5	1.365	0.052	5.00	0.45	2.01	0.25
614042161040300	RUS.2 6.5-7	1.254	0.083	5.82	0.89	1.88	0.28
614042161040300	RUS.2 7-8	0.792	0.050	4.77	0.61	1.59	0.45
614042161040300	RUS.2 8-9	0.650	0.041	3.94	0.50	1.30	0.29
614042161040300	RUS.2 9-10	0.547	0.037	4.13	0.51	1.87	0.29
614042161040300	RUS.2 10-11	0.198	0.029	4.28	0.47	1.51	0.27
614042161040300	RUS.2 11-12	0.080	0.030	1.87	0.45	1.78	0.28
614042161040300	RUS.2 12-13	0.137	0.031	1.96	0.50	1.88	0.30
614042161040300	RUS.2 13-14	0.060	0.026	1.48	0.41	1.87	0.26

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin

[Station ID, USGS site identification number; "STK.2", second core collected at Stickwan Lake"; interval that follows STK.2 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters, µg/g, microgram per gram; repl., replicate; --, no data; "STK.1", first core collected at Stickwan Lake interval that follows STK.1 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters; CO_2; Carbon Dioxide; CO_3^{2-} carbonate; µg/kg, microgram per kilogram; E, Estimated; <, less than; pCi/g, picoCuries per gram; std. dev, standard deviation; dpm/g, disintegrations per minute per gram]

Station ID	Field ID	Aluminum (µg/g)	Calcium (µg/g)	Iron (µg/g)	Potassium (µg/g)	Magnesium (µg/g)	Sodium (µg/g)	Phosphorus (µg/g)
631600148081000	STK.2 0-0.5	16,500	12,700	10,100	3,040	3,940	3,960	799
631600148081000	STK.2 0.5-1	8,590	8,810	10,900	2,240	1,920	1,960	450
631600148081000	STK.2 1-1.5	27,600	24,100	19,100	7,420	5,530	6,900	1,250
631600148081000	STK.2 1.5-2	20,200	12,200	9,680	5,350	3,890	5,240	769
631600148081000	STK.2 2-2.5	20,600	13,400	10,500	4,170	4,390	5,450	899
631600148081000	STK.2 2.5-3	30,800	17,400	13,900	5,110	5,960	8,370	952
631600148081000	STK.2 3-3.5	36,900	21,800	19,300	5,400	7,520	9,690	960
631600148081000	STK.2 3.5-4	32,200	18,600	16,000	5,230	6,410	8,040	912
631600148081000	STK.2 4-4.5	28,200	16,400	14,300	4,690	6,100	6,600	945
631600148081000	STK.2 4.5-5	25,300	14,900	13,100	4,730	5,530	5,530	840
631600148081000	STK.2 5-5.5	24,600	13,900	12,500	4,940	5,440	5,720	799
631600148081000	STK.2 5.5-6	25,700	14,500	13,000	4,660	5,720	5,780	850
631600148081000	STK.2 6-6.5	30,000	13,800	13,400	6,870	5,750	6,920	598
631600148081000	STK.2 6.5-7	24,300	13,600	12,400	4,430	5,390	5,200	821
631600148081000	STK.2 7-8	26,800	14,500	12,500	5,440	5,510	6,260	821
631600148081000	STK.2 8-9	29,900	15,200	14,200	5,280	6,540	6,730	677
631600148081000	STK.2 9-10	25,800	14,400	13,000	4,740	5,720	5,650	848
631600148081000	STK.2 10-11	29,000	14,900	14,000	5,040	6,320	6,550	738
631600148081000	STK.2 11-12	31,600	15,200	14,700	5,420	6,690	7,050	676
631600148081000	STK.2 12-13	26,400	14,400	12,900	4,790	5,970	5,970	792
631600148081000	STK.2 13-14	28,800	14,500	14,000	5,160	6,380	6,690	666
631600148081000	STK.2 13-14 dup.	27,700	14,000	13,500	4,960	5,790	5,870	618
631600148081000	STK.2 14-15	29,300	14,900	14,100	5,170	6,490	6,810	683
631600148081000	STK.2 15-16	30,400	15,100	14,400	5,430	6,520	7,100	692
631600148081000	STK.2 16-17	29,300	14,100	12,900	6,150	5,860	6,820	666
631600148081000	STK.2 17-18	28,100	14,100	13,100	4,850	5,770	6,110	628
631600148081000	STK.2 17-18 dup.	26,600	13,900	12,700	4,730	5,320	5,770	605
631600148081000	STK.2 18-19	27,900	13,400	12,200	5,280	5,580	6,560	616
631600148081000	STK.2 19-20	28,100	13,700	13,000	4,650	5,970	6,330	657

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin -continued

Station ID	Field ID	Titanium (µg/g)	Arsenic (µg/g)	Barium (µg/g)	Beryllium (µg/g)	Cadmium (µg/g)	Cobalt (µg/g)	Chromium (µg/g)
631600148081000	STK.2 0-0.5	1,190	3.15	319	0.434	0.310	3.94	17.3
631600148081000	STK.2 0.5-1	564	2.78	241	0.185	0.160	1.91	9.58
631600148081000	STK.2 1-1.5	1,720	5.52	697	0.648	0.450	5.36	25.5
631600148081000	STK.2 1.5-2	1,310	2.90	516	0.332	0.320	3.85	14.7
631600148081000	STK.2 2-2.5	1,440	3.59	398	0.442	0.412	4.86	17.0
631600148081000	STK.2 2.5-3	1,860	3.73	426	0.494	0.427	6.27	18.8
631600148081000	STK.2 3-3.5	2,350	3.44	437	0.578	0.446	8.23	22.3
631600148081000	STK.2 3.5-4	2,180	3.81	449	0.525	0.470	7.76	25.5
631600148081000	STK.2 4-4.5	1,980	4.40	454	0.617	0.653	7.89	30.7
631600148081000	STK.2 4.5-5	1,860	4.46	460	0.608	0.606	7.59	32.8
631600148081000	STK.2 5-5.5	1,820	4.40	487	0.613	0.606	7.12	32.2
631600148081000	STK.2 5.5-6	1,860	4.08	472	0.595	0.662	7.37	33.8
631600148081000	STK.2 6-6.5	1,990	4.03	626	0.707	0.701	7.08	35.7
631600148081000	STK.2 6.5-7	1,900	4.38	453	0.586	0.643	7.05	33.7
631600148081000	STK.2 7-8	1,970	4.50	532	0.641	0.614	6.99	33.6
631600148081000	STK.2 8-9	2,180	4.30	519	0.728	0.733	7.81	38.7
631600148081000	STK.2 9-10	1,850	4.74	476	0.549	0.639	7.58	34.5
631600148081000	STK.2 10-11	2,250	4.59	510	0.703	0.703	7.86	37.7
631600148081000	STK.2 11-12	2,200	5.13	541	0.768	0.718	8.09	42.1
631600148081000	STK.2 12-13	1,890	4.14	486	0.606	0.658	7.33	34.6
631600148081000	STK.2 13-14	2,230	4.62	506	0.671	0.716	7.63	37.5
631600148081000	STK.2 13-14 dup.	2,240	4.79	512	0.645	0.723	7.31	37.2
631600148081000	STK.2 14-15	2,210	5.45	524	0.706	0.769	7.66	39.4
631600148081000	STK.2 15-16	2,120	4.69	526	0.748	0.763	7.83	38.4
631600148081000	STK.2 16-17	1,940	4.50	570	0.701	0.666	7.38	34.4
631600148081000	STK.2 17-18	2,190	5.09	479	0.644	0.686	7.19	37.7
631600148081000	STK.2 17-18 dup.	2,180	5.34	484	0.682	0.676	7.04	36.1
631600148081000	STK.2 18-19	1,740	4.36	512	0.634	0.696	7.26	31.8
631600148081000	STK.2 19-20	1,780	4.83	459	0.668	0.797	8.04	33.1

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin -continued

Station ID	Field ID	Copper (µg/g)	Mercury (µg/g)	Lithium (µg/g)	Manganese (µg/g)	Nickel (µg/g)	Lead (µg/g)	Scandium (µg/g)
631600148081000	STK.2 0-0.5	19.5	- -	5.89	206	15.1	4.42	3.42
631600148081000	STK.2 0.5-1	58.7	0.03	3.31	266	7.93	3.89	1.70
631600148081000	STK.2 1-1.5	36.3	- -	10.1	372	23.4	8.09	5.18
631600148081000	STK.2 1.5-2	25.0	0.03	7.12	202	13.9	5.26	3.52
631600148081000	STK.2 2-2.5	28.5	0.05	7.87	224	15.8	4.98	4.20
631600148081000	STK.2 2.5-3	31.5	0.04	9.62	316	15.7	5.51	5.84
631600148081000	STK.2 3-3.5	35.2	0.04	10.7	434	17.1	5.55	7.07
631600148081000	STK.2 3.5-4	30.8	0.04	10.5	340	19.2	5.43	6.86
631600148081000	STK.2 4-4.5	30.1	0.05	11.7	275	23.0	6.02	6.41
631600148081000	STK.2 4.5-5	28.6	0.05	11.7	241	23.3	5.51	6.28
631600148081000	STK.2 5-5.5	30.3	0.05	11.8	226	22.5	5.74	6.08
631600148081000	STK.2 5.5-6	30.3	0.05	12.2	231	24.1	5.85	6.26
631600148081000	STK.2 6-6.5	32.6	0.03	13.6	239	23.6	6.40	6.76
631600148081000	STK.2 6.5-7	29.0	0.04	12.3	225	23.4	5.54	6.09
631600148081000	STK.2 7-8	36.2	0.05	12.2	224	23.2	6.33	6.14
631600148081000	STK.2 8-9	31.0	0.04	14.0	257	25.2	5.94	7.18
631600148081000	STK.2 9-10	39.0	0.05	12.9	234	24.6	5.58	6.38
631600148081000	STK.2 10-11	32.3	0.05	13.9	253	25.7	5.96	6.93
631600148081000	STK.2 11-12	46.5	0.04	14.8	268	26.5	6.18	7.41
631600148081000	STK.2 12-13	28.7	0.05	13.0	230	24.3	5.43	6.34
631600148081000	STK.2 13-14	29.7	0.05	14.1	250	25.4	5.96	7.05
631600148081000	STK.2 13-14 dup.	28.4	- -	13.5	246	24.2	5.87	6.80
631600148081000	STK.2 14-15	31.0	0.04	14.8	256	25.8	5.73	7.20
631600148081000	STK.2 15-16	31.8	0.03	14.1	256	26.2	5.77	7.08
631600148081000	STK.2 16-17	29.9	0.04	12.7	225	24.4	5.96	6.48
631600148081000	STK.2 17-18	27.6	0.05	13.6	249	23.2	5.21	6.75
631600148081000	STK.2 17-18 dup.	27.2	- -	12.8	242	23.3	5.30	6.48
631600148081000	STK.2 18-19	30.1	0.03	12.3	217	23.9	5.41	6.03
631600148081000	STK.2 19-20	31.5	0.04	12.8	230	25.8	5.25	6.29

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin –continued

Station ID	Field ID	Strontium (µg/g)	Vanadium (µg/g)	Zinc (µg/g)
631600148081000	STK.2 0-0.5	126	35.0	51.7
631600148081000	STK.2 0.5-1	78.7	19.5	47.7
631600148081000	STK.2 1-1.5	234	52.5	74.6
631600148081000	STK.2 1.5-2	147	33.7	50.0
631600148081000	STK.2 2-2.5	139	39.1	63.2
631600148081000	STK.2 2.5-3	183	49.8	73.7
631600148081000	STK.2 3-3.5	224	68.4	82.7
631600148081000	STK.2 3.5-4	203	58.8	83.6
631600148081000	STK.2 4-4.5	173	54.3	93.2
631600148081000	STK.2 4.5-5	161	51.6	94.8
631600148081000	STK.2 5-5.5	157	49.0	90.6
631600148081000	STK.2 5.5-6	159	51.7	93.2
631600148081000	STK.2 6-6.5	180	52.3	95.6
631600148081000	STK.2 6.5-7	150	49.2	89.9
631600148081000	STK.2 7-8	169	49.4	91.8
631600148081000	STK.2 8-9	172	55.6	104
631600148081000	STK.2 9-10	157	50.7	97.0
631600148081000	STK.2 10-11	168	54.6	101
631600148081000	STK.2 11-12	179	58.1	109
631600148081000	STK.2 12-13	158	50.3	94.2
631600148081000	STK.2 13-14	169	55.1	99.8
631600148081000	STK.2 13-14 dup.	162	54.7	96.5
631600148081000	STK.2 14-15	169	56.5	103
631600148081000	STK.2 15-16	174	56.3	105
631600148081000	STK.2 16-17	175	49.8	96.3
631600148081000	STK.2 17-18	163	53.7	92.7
631600148081000	STK.2 17-18 dup.	164	51.4	92.9
631600148081000	STK.2 18-19	164	46.8	100
631600148081000	STK.2 19-20	158	48.8	109

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin -continued

Station ID	Field ID	Total carbon, %	Inorganic carbon, as CO_2 + CO_3, %	Organic carbon, %
631600148081000	STK.1 0-0.5	24.9	0.33	24.8
631600148081000	STK.1 0.5-1	23.6	0.39	23.5
631600148081000	STK.1 1-1.5	21.2	3.64	20.4
631600148081000	STK.1 1.5-2	20.4	0.01	20.4
631600148081000	STK.1 2-2.5	19.1	0.25	19.0
631600148081000	STK.1 2.5-3	20.5	0.01	20.5
631600148081000	STK.1 3-3.5	19.2	0.01	19.2
631600148081000	STK.1 3.5-4	16.9	0.01	16.9
631600148081000	STK.1 4-4.5	18.7	0.01	18.7
631600148081000	STK.1 4.5-5	20.1	0.01	20.1
631600148081000	STK.1 5.5-6	20.3	0.01	20.3
631600148081000	STK.1 6.5-7	20.4	0.02	20.4
631600148081000	STK.1 8-9	19.8	0.01	19.8
631600148081000	STK.1 10-11	17.9	0.01	17.9
631600148081000	STK.1 12-13	17.1	0.01	17.1
631600148081000	STK.1 14-15	18.6	0.01	18.6
631600148081000	STK.1 16-17	18.3	0.01	18.3

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin –continued

Station ID	Field ID	Naphthalene (µg/kg)	C1-128 isomers (µg/kg)	2-ethyl-naphthalene (µg/kg)	2,6-dimethyl-naphthalene (µg/kg)	1,6-dimethyl-naphthalene (µg/kg)	C2-128 isomers (µg/kg)	Acenaph-thylene (µg/kg)
631600148081000	STK.1 0.5-1	<30	<30	<30	700	91.2	883	<30
631600148081000	STK.1 1-1.5	<30	<30	<30	667	118	847	<30
631600148081000	STK.1 2-2.5	<25	<25	<25	517	81.4	696	<25
631600148081000	STK.1 3-3.5	<20	190	<20	196	37.3	307	<20
631600148081000	STK.1 4-4.5	E2.1	130	<20	249	35.8	361	<20
631600148081000	STK.1 4-4.5	<20	130	<20	167	25.1	242	<20
631600148081000	STK.1 5-5.6	E5.0	180	<20	266	48	396	<20

Station ID	Field ID	1,2-dimethyl-naphthalene (µg/kg)	Acenaphthene (µg/kg)	C3-128 isomers (µg/kg)	2,3,6-trimethyl-naphthalene (µg/kg)	9H-Fluorene (µg/kg)	C4-128 isomers (µg/kg)
631600148081000	STK.1 0.5-1	<30	<30	<150	<30	<30	<30
631600148081000	STK.1 1-1.5	<30	<30	<140	<30	E26.7	<30
631600148081000	STK.1 2-2.5	<25	<25	<100	<25	E22.5	<25
631600148081000	STK.1 3-3.5	<20	<20	131	<20	<20	<75
631600148081000	STK.1 4-4.5	E7.1	<20	<80	E3.3	<20	<40
631600148081000	STK.1 4-4.5	<20	<20	<80	<20	E4.7	<50
631600148081000	STK.1 5-5.6	E10.9	<20	115	<20	E10.0	<70

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin –continued

Station ID	Field ID	1-methyl-9H-Fluorene (µg/kg)	Phenan-threne (µg/kg)	Anthracene (µg/kg)	C5-128 isomers (µg/kg)	2-methyl-anthracene (µg/kg)	4,5-methylene-phenanthrene (µg/kg)	C1-178 isomers (µg/kg)
631600148081000	STK.1 0.5-1	<30	E7.2	<30	<30	<30	<30	<30
631600148081000	STK.1 1-1.5	<30	E5.6	<30	<30	<30	<30	<30
631600148081000	STK.1 2-2.5	E14.0	E7.5	<25	<25	<25	<25	<25
631600148081000	STK.1 3-3.5	<20	<20	<20	<20	<20	<20	<100
631600148081000	STK.1 4-4.5	<20	<20	<20	<20	<20	<20	<80
631600148081000	STK.1 4-4.5	<20	E2.4	E4.2	<20	<20	<20	<60
631600148081000	STK.1 5-5.6	<20	<20	<20	<20	<20	<20	<40

Station ID	Field ID	1-methyl-phenanthrene (µg/kg)	C2-178 isomers (µg/kg)	Fluoranthene (µg/kg)	Pyrene (µg/kg)	C3-178 isomers (µg/kg)	C4-178 isomers (µg/kg)	1-methyl-pyrene (µg/kg)
631600148081000	STK.1 0.5-1	<30	<30	<30	<30	<30	<30	<30
631600148081000	STK.1 1-1.5	<30	<30	<30	<30	<30	<30	<30
631600148081000	STK.1 2-2.5	<25	<25	<25	E6.1	<25	<25	<25
631600148081000	STK.1 3-3.5	<20	<100	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	<20	<80	E5.4	E3.6	<20	<20	<20
631600148081000	STK.1 4-4.5	<20	<60	E4.2	E2.6	<20	<20	<20
631600148081000	STK.1 5-5.6	<20	<100	E7.4	E4.8	<20	<20	<20

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin –continued

Station ID	Field ID	C1-202 isomers (µg/kg)	C2-202 isomers (µg/kg)	C5-178 isomers (µg/kg)	Benz(a)-anthracene (µg/kg)	Chrysene (µg/kg)	C3-202 isomers (µg/kg)	C1-228 isomers (µg/kg)
631600148081000	STK.1 0.5-1	<30	<30	<30	<30	<30	<30	<30
631600148081000	STK.1 1-1.5	<30	<30	<30	<30	<30	<30	<30
631600148081000	STK.1 2-2.5	<25	<25	<25	<25	<25	<25	<25
631600148081000	STK.1 3-3.5	<20	<20	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	<20	<20	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	<20	<20	<20	<20	<20	<20	<20
631600148081000	STK.1 5-5.6	<20	<20	<20	<20	<20	<20	<20

Station ID	Field ID	C4-202 isomers (µg/kg)	C5-202 isomers (µg/kg)	C2-228 isomers (µg/kg)	Benzo(b)-fluoranthene (µg/kg)	Benzo(k)-fluoranthene, (µg/kg)	Benzo(e)-pyrene (µg/kg)	Benzo(a)-pyrene (µg/kg)
631600148081000	STK.1 0.5-1	<30	<30	<30	<30	<30	<30	<30
631600148081000	STK.1 1-1.5	<30	<30	<30	<30	<30	<30	<30
631600148081000	STK.1 2-2.5	<25	<25	<25	<25	<25	<25	<25
631600148081000	STK.1 3-3.5	<20	<20	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	<20	<20	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	<20	<20	<20	<20	<20	<20	<20
631600148081000	STK.1 5-5.6	<20	<20	<20	<20	<20	<20	<20

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin –continued

Station ID	Field ID	Perylene, (µg/kg)	C1-252 isomers (µg/kg)	C3-228 isomers (µg/kg)	C2-252 isomers (µg/kg)	C4-228 isomers (µg/kg)	Benzo-(g,h,i)-perylene (µg/kg)	Indeno-(1,2,3-c,d)-pyrene (µg/kg)	Dibenzo-(a,h)-anthracene (µg/kg)
631600148081000	STK.1 0.5-1	E13.0	<30	<30	<30	<30	<30	<30	<30
631600148081000	STK.1 1-1.5	E19.4	<30	<30	<30	<30	<30	<30	<30
631600148081000	STK.1 2-2.5	31.2	<25	<25	<25	<25	E1.5	<25	E10.8
631600148081000	STK.1 3-3.5	E17.7	<20	<20	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	25.6	<20	<20	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	21.4	<20	<20	<20	<20	<20	E8.2	E7.8
631600148081000	STK.1 5-5.6	73.7	<20	<20	<20	<20	<20	<20	<20

Station ID	Field ID	C3-252 isomers (µg/kg)	C4-252 isomers (µg/kg)	C5-228 isomers (µg/kg)	C5-252 isomers (µg/kg)	Coronene (µg/kg)
631600148081000	STK.1 0.5-1	<30	<30	<30	<30	<30
631600148081000	STK.1 1-1.5	<30	<30	<30	<30	<30
631600148081000	STK.1 2-2.5	<25	<25	<25	<25	<25
631600148081000	STK.1 3-3.5	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	<20	<20	<20	<20	<20
631600148081000	STK.1 4-4.5	<20	<20	<20	<20	<20
631600148081000	STK.1 5-5.6	<20	<20	<20	<20	<20

Table 26. Sediment coring results for Stickwan Lake, Yukon River Basin –continued

Station ID	Field ID	Cs-137 (pCi/g)	Cs-137 uncertainty, 1 std. dev.	Pb-210 (dpm/g)	Pb-210 uncertainty, 1 std. dev.	Ra-226 (dpm/g)	Ra-226 uncertainty, 1 std. dev.
631600148081000	STK.2 0-0.5	0.713	0.101	18.11	1.71	0.10	0.31
631600148081000	STK.2 0.5-1	0.677	0.075	18.66	1.41	0.63	0.04
631600148081000	STK.2 1-1.5	0.642	0.079	15.40	1.39	0.78	0.91
631600148081000	STK.2 1.5-2	0.751	0.076	17.21	1.37	0.23	0.10
631600148081000	STK.2 2-2.5	0.887	0.067	16.56	1.17	0.63	0.02
631600148081000	STK.2 2.5-3	0.891	0.109	14.12	1.93	0.58	0.41
631600148081000	STK.2 3-3.5	1.142	0.080	13.89	1.17	0.35	0.01
631600148081000	STK.2 3.5-4	1.360	0.108	8.49	1.33	0.52	0.33
631600148081000	STK.2 4-4.5	1.569	0.063	7.56	0.59	0.68	0.14
631600148081000	STK.2 4.5-5	1.823	0.093	7.39	0.91	0.36	0.12
631600148081000	STK.2 5-5.5	1.599	0.078	5.61	0.76	0.62	0.44
631600148081000	STK.2 5.5-6	1.691	0.076	5.12	0.66	0.71	0.31
631600148081000	STK.2 6-6.5	0.504	0.041	1.78	0.51	1.15	0.19
631600148081000	STK.2 6.5-7	1.735	0.098	6.77	1.06	0.84	0.23
631600148081000	STK.2 7-8	1.741	0.081	6.68	0.75	0.88	0.16
631600148081000	STK.2 8-9	1.509	0.084	4.65	0.52	0.45	0.21
631600148081000	STK.2 9-10	1.700	0.086	4.61	0.81	0.57	0.35
631600148081000	STK.2 10-11	1.198	0.057	1.80	0.54	0.96	0.05
631600148081000	STK.2 11-12	0.405	0.044	1.46	0.58	0.65	0.50
631600148081000	STK.2 12-13	0.971	0.067	1.98	0.50	0.53	0.24
631600148081000	STK.2 13-14	0.351	0.035	1.12	0.46	1.03	0.35
631600148081000	STK.2 15-16	0.245	0.034	1.01	0.47	1.06	0.08
631600148081000	STK.2 17-18	0.092	0.032	1.21	0.45	0.82	0.10

Table 27. Sediment coring results for Nolan Creek Lake, Yukon River Basin

[Station ID, USGS site identification number; "NCL.2", second core collected at Nolan Creek Lake"; interval that follows NCL.2 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters, µg/g, microgram per gram; repl., replicate; --, no data; "NCL.1", first core collected at Nolan Creek Lake interval that follows NCL.1 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters; CO_2; Carbon Dioxide; CO_3^{2-} carbonate; µg/kg, microgram per kilogram; E, Estimated; <, less than; pCi/g, picoCuries per gram; std. dev, standard deviation; dpm/g, disintegrations per minute per gram]

Station ID	Field ID	Aluminum (µg/g)	Calcium (µg/g)	Iron (µg/g)	Potassium (µg/g)	Magnesium (µg/g)	Sodium (µg/g)	Phosphorus (µg/g)
672754150155100	NCL.2 0-0.5	111,000	14,900	91,700	32,600	23,000	7,290	780
672754150155100	NCL.2 0.5-1	105,000	21,300	92,600	32,600	20,800	6,430	776
672754150155100	NCL.2 1-1.5	106,000	17,600	91,200	31,900	20,600	6,560	734
672754150155100	NCL.2 1.5-2	109,000	20,200	95,500	32,500	20,900	6,900	753
672754150155100	NCL.2 2-2.5	101,000	24,900	92,700	31,800	19,700	6,330	730
672754150155100	NCL.2 2-2.5 dup	93,500	23,200	84,300	29,700	19,100	6,050	678
672754150155100	NCL.2 2.5-3	103,000	21,700	93,800	31,000	20,300	6,340	742
672754150155100	NCL.2 3-3.5	104,000	21,700	91,800	31,600	19,400	6,340	754
672754150155100	NCL.2 3.5-4	111,000	20,500	99,200	33,100	20,200	6,300	810
672754150155100	NCL.2 4-4.5	110,000	17,000	96,300	33,100	19,300	6,040	798
672754150155100	NCL.2 4.5-5	109,000	16,200	90,400	33,500	20,600	6,540	792
672754150155100	NCL.2 5-5.5	107,000	19,600	96,100	34,700	19,200	6,130	828
672754150155100	NCL.2 5.5-6	107,000	18,600	92,800	32,500	20,200	6,400	819
672754150155100	NCL.2 6-6.5	100,000	17,100	86,800	29,700	18,300	5,870	729
672754150155100	NCL.2 6.5-7	98,600	17,300	86,100	30,200	18,100	5,810	738
672754150155100	NCL.2 7-8	109,000	18,000	96,300	34,200	18,500	5,930	825
672754150155100	NCL.2 8-9	105,000	17,700	90,000	31,500	19,000	6,490	784
672754150155100	NCL.2 9-10	109,000	19,300	96,800	31,100	18,500	6,090	774
672754150155100	NCL.2 10-11	115,000	20,500	99,400	32,400	18,500	6,250	820
672754150155100	NCL.2 11-12	107,000	22,500	93,700	32,300	18,800	6,110	780
672754150155100	NCL.2 12-13	110,000	20,400	90,500	32,800	20,400	6,770	785
672754150155100	NCL.2 12-13 repl.	107,000	26,800	90,400	32,700	20,600	6,360	731
672754150155100	NCL.2 12-13 repl.	102,000	32,000	89,100	32,200	21,100	6,090	672

Table 27. Sediment coring results for Nolan Creek Lake, Yukon River Basin-continued

Station ID	Field ID	Titanium (µg/g)	Arsenic (µg/g)	Barium (µg/g)	Beryllium (µg/g)	Cadmium (µg/g)	Cobalt (µg/g)	Chromium (µg/g)
672754150155100	NCL.2 0-0.5	2,750	92.1	938	2.96	0.238	44.4	152
672754150155100	NCL.2 0.5-1	2,460	92.5	938	2.90	0.225	47.8	148
672754150155100	NCL.2 1-1.5	2,470	91.4	949	2.99	0.235	46.7	148
672754150155100	NCL.2 1.5-2	2,600	92.1	965	2.94	0.232	47.1	154
672754150155100	NCL.2 2-2.5	2,960	84.0	934	2.83	0.238	41.7	142
672754150155100	NCL.2 2-2.5 dup	2,950	81.0	857	2.71	0.220	38.1	132
672754150155100	NCL.2 2.5-3	2,510	97.0	932	2.90	0.259	47.1	142
672754150155100	NCL.2 3-3.5	2,840	96.8	956	2.86	0.266	47.8	139
672754150155100	NCL.2 3.5-4	2,740	108	993	2.84	0.278	51.5	148
672754150155100	NCL.2 4-4.5	2,940	113	989	2.94	0.284	50.7	155
672754150155100	NCL.2 4.5-5	2,870	111	1,020	2.92	0.294	48.0	148
672754150155100	NCL.2 5-5.5	3,540	114	1,000	2.85	0.304	50.8	155
672754150155100	NCL.2 5.5-6	3,210	113	976	2.89	0.305	50.3	145
672754150155100	NCL.2 6-6.5	2,840	108	938	2.91	0.303	46.2	142
672754150155100	NCL.2 6.5-7	3,200	109	943	2.68	0.293	46.5	140
672754150155100	NCL.2 7-8	2,900	120	988	2.80	0.302	52.9	154
672754150155100	NCL.2 8-9	2,780	110	970	2.99	0.301	48.3	143
672754150155100	NCL.2 9-10	2,650	119	940	2.84	0.308	52.0	144
672754150155100	NCL.2 10-11	2,860	118	964	2.92	0.324	51.0	148
672754150155100	NCL.2 11-12	3,040	103	958	2.86	0.337	49.4	151
672754150155100	NCL.2 12-13	2,980	90.3	997	3.01	0.337	46.1	153
672754150155100	NCL.2 12-13 repl.	3,460	81.7	964	2.77	0.375	44.9	153
672754150155100	NCL.2 12-13 repl.	3,680	80.1	957	2.71	0.413	40.8	152

Table 27. Sediment coring results for Nolan Creek Lake, Yukon River Basin-continued

Station ID	Field ID	Copper (µg/g)	Mercury (µg/g)	Lithium (µg/g)	Manganese (µg/g)	Nickel (µg/g)	Lead (µg/g)	Scandium (µg/g)
672754150155100	NCL.2 0-0.5	92.6	0.17	77.6	4,540	75.5	30.7	39.3
672754150155100	NCL.2 0.5-1	89.3	0.17	72.4	5,430	78.6	31.0	38.9
672754150155100	NCL.2 1-1.5	90.5	0.17	74.2	4,950	76.8	30.9	39.1
672754150155100	NCL.2 1.5-2	87.3	0.17	74.3	5,270	77.4	29.4	40.3
672754150155100	NCL.2 2-2.5	85.4	0.17	69.3	5,100	75.5	28.3	37.7
672754150155100	NCL.2 2-2.5 dup	81.6	- -	65.5	4,700	71.0	26.1	35.4
672754150155100	NCL.2 2.5-3	92.7	0.18	73.0	5,750	78.9	31.8	37.4
672754150155100	NCL.2 3-3.5	98.0	0.17	70.6	6,180	81.4	33.2	37.1
672754150155100	NCL.2 3.5-4	100	0.18	74.0	6,740	84.9	34.3	39.3
672754150155100	NCL.2 4-4.5	99.2	0.20	75.5	6,730	84.2	34.2	40.2
672754150155100	NCL.2 4.5-5	98.7	0.19	76.1	5,490	81.2	35.0	40.1
672754150155100	NCL.2 5-5.5	105	0.19	72.5	5,080	85.6	35.4	40.8
672754150155100	NCL.2 5.5-6	105	0.19	75.8	3,890	85.0	35.6	39.4
672754150155100	NCL.2 6-6.5	99.0	- -	71.1	3,770	80.3	32.3	36.4
672754150155100	NCL.2 6.5-7	97.9	- -	70.4	3,680	79.5	32.9	37.3
672754150155100	NCL.2 7-8	108	0.21	74.8	3,920	89.6	35.9	41.3
672754150155100	NCL.2 8-9	102	0.19	76.4	3,460	81.8	34.6	37.8
672754150155100	NCL.2 9-10	109	0.22	79.0	3,980	86.8	36.2	39.6
672754150155100	NCL.2 10-11	253	0.22	78.0	3,750	89.8	37.3	40.4
672754150155100	NCL.2 11-12	108	0.18	73.1	3,260	85.4	34.8	39.7
672754150155100	NCL.2 12-13	102	0.17	74.6	2,980	81.2	33.2	39.9
672754150155100	NCL.2 12-13 repl.	99.3	0.13	68.9	2,520	80.4	32.0	37.5
672754150155100	NCL.2 12-13 repl.	99.1	0.09	64.7	2,010	80.6	31.4	36.1

Table 27. Sediment coring results for Nolan Creek Lake, Yukon River Basin-continued

Station ID	Field ID	Strontium (µg/g)	Vanadium (µg/g)	Zinc (µg/g)
672754150155100	NCL.2 0-0.5	136	266	180
672754150155100	NCL.2 0.5-1	148	261	177
672754150155100	NCL.2 1-1.5	137	259	176
672754150155100	NCL.2 1.5-2	143	272	177
672754150155100	NCL.2 2-2.5	157	251	168
672754150155100	NCL.2 2-2.5 dup	148	236	162
672754150155100	NCL.2 2.5-3	148	247	176
672754150155100	NCL.2 3-3.5	148	240	179
672754150155100	NCL.2 3.5-4	145	258	190
672754150155100	NCL.2 4-4.5	133	272	190
672754150155100	NCL.2 4.5-5	133	262	190
672754150155100	NCL.2 5-5.5	141	275	198
672754150155100	NCL.2 5.5-6	142	253	193
672754150155100	NCL.2 6-6.5	129	242	184
672754150155100	NCL.2 6.5-7	130	245	181
672754150155100	NCL.2 7-8	135	266	200
672754150155100	NCL.2 8-9	139	243	189
672754150155100	NCL.2 9-10	139	246	196
672754150155100	NCL.2 10-11	145	250	241
672754150155100	NCL.2 11-12	142	257	192
672754150155100	NCL.2 12-13	140	261	186
672754150155100	NCL.2 12-13 repl.	150	261	180
672754150155100	NCL.2 12-13 repl.	156	260	171

Table 27. Sediment coring results for Nolan Creek Lake, Yukon River Basin-continued

Station ID	Field ID	Total carbon, %	Inorganic carbon, as CO_2 + CO_3, %	Organic carbon, %
672754150155100	NCL.1 0-0.5	3.92	1.53	3.59
672754150155100	NCL.1 0.5-1	4.32	2.86	3.71
672754150155100	NCL.1 1-1.5	3.84	2.10	3.39
672754150155100	NCL.1 1.5-2	3.62	0.42	3.20
672754150155100	NCL.1 2-2.5	3.55	1.93	3.14
672754150155100	NCL.1 2.5-3	3.28	0.37	2.91
672754150155100	NCL.1 3-3.5	3.30	0.40	2.90
672754150155100	NCL.1 3.5-4	3.14	0.35	2.79
672754150155100	NCL.1 4-4.5	3.41	0.43	2.98
672754150155100	NCL.1 4.5-5	3.35	0.49	2.86
672754150155100	NCL.1 5.5-6	3.29	0.46	2.83
672754150155100	NCL.1 6.5-7	3.18	0.35	2.83
672754150155100	NCL.1 8-9	4.24	0.69	3.55

Table 27. Sediment coring results for Nolan Creek Lake, Yukon River Basin-continued

Station ID	Field ID	Naphthalene (µg/kg)	C1-128 isomers (µg/kg)	2-ethyl-naphthalene (µg/kg)	2,6-dimethyl-naphthalene (µg/kg)	1,6-dimethyl-naphthalene (µg/kg)	C2-128 isomers (µg/kg)	Acenaph-thylene (µg/kg)
672754150155100	NCL.1 0-0.5	<10	<10	<10	263	28.7	308	<10

Station ID	Field ID	1,2-dimethyl-naphthalene (µg/kg)	Acenaph-thene (µg/kg)	C3-128 isomers (µg/kg)	2,3,6-trimethyl-naphthalene (µg/kg)	9H-Fluorene (µg/kg)	C4-128 isomers (µg/kg)
672754150155100	NCL.1 0-0.5	<10	<10	<60	<10	E7.1	<10

Station ID	Field ID	1-methyl-9H-Fluorene (µg/kg)	Phenan-threne (µg/kg)	Anthracene (µg/kg)	C5-128 isomers (µg/kg)	2-methyl-anthracene (µg/kg)	4,5-methylene-phenanthrene (µg/kg)	C1-178 isomers (µg/kg)
672754150155100	NCL.1 0-0.5	<10	E3.0	<10	<10	E4.6	<10	E9.2

Station ID	Field ID	1-methyl-phenanthrene (µg/kg)	C2-178 isomers (µg/kg)	Fluoranthene (µg/kg)	Pyrene (µg/kg)	C3-178 isomers (µg/kg)	C4-178 isomers (µg/kg)	1-methyl-pyrene (µg/kg)
672754150155100	NCL.1 0-0.5	E3.4	<10	<10	E2.4	<10	<10	<10

Table 27. Sediment coring results for Nolan Creek Lake, Yukon River Basin-continued

Station ID	Field ID	C1-202 isomers (µg/kg)	C2-202 isomers (µg/kg)	C5-178 isomers (µg/kg)	Benz(a)-anthracene (µg/kg)	Chrysene (µg/kg)	C3-202 isomers (µg/kg)	C1-228 isomers (µg/kg)
672754150155100	NCL.1 0-0.5	<10	<10	<10	E2.1	E1.0	<10	<10

Station ID	Field ID	C4-202 isomers (µg/kg)	C5-202 isomers (µg/kg)	C2-228 isomers (µg/kg)	Benzo(b)-fluoranthene (µg/kg)	Benzo(k)-fluoranthene (µg/kg)	Benzo(e)-pyrene (µg/kg)	Benzo(a)-pyrene (µg/kg)
672754150155100	NCL.1 0-0.5	<10	<10	<10	<10	<10	E1.4	E6.1

Station ID	Field ID	Perylene (µg/kg)	C1-252 isomers (µg/kg)	C3-228 isomers (µg/kg)	C2-252 isomers (µg/kg)	C4-228 isomers (µg/kg)	Benzo-(g,h,i)-perylene (µg/kg)	Indeno-(1,2,3-c,d)-pyrene (µg/kg)	Dibenzo-(a,h)-anthracene (µg/kg)
672754150155100	NCL.1 0-0.5	40.2	<10	<10	<10	<10	<10	<10	<10

Station ID	Field ID	C3-252 isomers (µg/kg)	C4-252 isomers (µg/kg)	C5-228 isomers (µg/kg)	C5-252 isomers (µg/kg)	Coronene (µg/kg)
672754150155100	NCL.1 0-0.5	<10	<10	<10	<10	<10

Table 27. Sediment coring results for Nolan Creek Lake, Yukon River Basin-continued

Station ID	Field ID	Cs-137 (pCi/g)	Cs-137 uncertainty, 1 std. dev.	Pb-210, (dpm/g)	Pb-210 uncertainty, 1 std. dev.	Ra-226, (dpm/g)	Ra-226 uncertainty, 1 std. dev.
672754150155100	NCL.2 1.5-2	0.022	0.022	3.08	0.52	1.80	0.17
672754150155100	NCL.2 2.5-3	0.028	0.025	2.71	0.56	1.91	0.20
672754150155100	NCL.2 3.5-4	0.100	0.026	4.26	0.60	1.96	0.20
672754150155100	NCL.2 6.5-7	0.091	0.037	3.19	0.88	1.92	0.26

Table 28. Sediment coring results for Little Medicine Lake, Yukon River Basin

[Station ID, USGS site identification number; "LML.2", second core collected at Little Medicine Lake"; interval that follows LML.2 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters, µg/g, microgram per gram; repl., replicate; --, no data; "LML.1", first core collected at Little Medicine Lake interval that follows LML.1 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters; CO_2; Carbon Dioxide; CO_3^{2-} carbonate; µg/kg, microgram per kilogram; E, Estimated; <, less than; pCi/g, picoCuries per gram; std. dev, standard deviation; dpm/g, disintegrations per minute per gram]

Station ID	Field ID	Aluminum (µg/g)	Calcium (µg/g)	Iron (µg/g)	Potassium (µg/g)	Magnesium (µg/g)	Sodium (µg/g)	Phosphorus (µg/g)
653018144343000	LML.2 0.5-1	59,500	20,600	45,000	12,700	10,000	10,500	1,390
653018144343000	LML.2 1-1.5	62,800	13,200	38,000	14,100	10,200	11,900	1,020
653018144343000	LML.2 1.5-2	64,900	14,700	41,000	13,800	10,600	11,500	1,040
653018144343000	LML.2 2-2.5	64,500	13,300	39,400	14,000	10,500	11,800	963
653018144343000	LML.2 2.5-3	64,300	13,000	38,100	13,700	10,600	11,700	933
653018144343000	LML.2 3-3.5	61,600	12,400	32,400	14,200	9,170	12,100	732
653018144343000	LML.2 3.5-4	64,700	12,300	36,000	14,000	9,980	11,800	850
653018144343000	LML.2 4-4.5	65,600	12,600	36,100	13,900	10,200	11,800	857
653018144343000	LML.2 4.5-5	66,100	13,200	38,100	14,100	10,400	11,400	943
653018144343000	LML.2 5-5.5	65,100	12,800	37,300	13,900	10,600	11,900	946
653018144343000	LML.2 5.5-6	58,500	11,600	31,800	13,300	8,740	10,800	751
653018144343000	LML.2 6-6.5	56,000	11,300	35,600	11,800	6,540	7,180	771
653018144343000	LML.2 6.5-7	63,200	12,400	36,400	13,500	9,920	11,000	888
653018144343000	LML.2 7-8	63,600	12,800	34,600	13,600	9,700	11,600	828
653018144343000	LML.2 8-9	56,200	11,300	33,300	12,800	6,380	7,290	771
653018144343000	LML.2 9-10	64,900	13,000	36,400	13,800	10,600	12,200	901
653018144343000	LML.2 10-11	63,900	12,600	36,700	13,900	10,700	12,000	928
653018144343000	LML.2 11-12	65,900	13,000	35,500	14,000	10,500	12,300	869
653018144343000	LML.2 12-13	66,200	12,900	35,700	14,200	10,500	12,000	884
653018144343000	LML.2 13-14	62,900	12,700	36,000	13,500	10,200	11,400	914
653018144343000	LML.2 14-15	64,800	13,200	36,400	13,800	10,300	11,300	925
653018144343000	LML.2 15-16	64,100	12,800	34,900	13,700	10,100	11,800	859
653018144343000	LML.2 16-17	61,000	12,000	33,100	13,700	9,170	10,800	824
653018144343000	LML.2 17-18	63,700	13,100	36,100	13,800	10,400	11,800	881
653018144343000	LML.2 18-19	61,700	12,700	33,800	13,300	9,040	10,800	780

Table 28. Sediment coring results for Little Medicine Lake, Yukon River Basin-continued

Station ID	Field ID	Titanium (µg/g)	Arsenic (µg/g)	Barium (µg/g)	Beryllium (µg/g)	Cadmium (µg/g)	Cobalt (µg/g)	Chromium (µg/g)
653018144343000	LML.2 0.5-1	4,010	85.2	791	2.02	0.765	17.7	74.3
653018144343000	LML.2 1-1.5	3,940	47.8	846	1.92	0.797	18.0	73.8
653018144343000	LML.2 1.5-2	3,860	50.8	830	2.11	0.796	18.8	77.8
653018144343000	LML.2 2-2.5	4,290	44.3	843	2.08	0.758	19.4	79.6
653018144343000	LML.2 2.5-3	4,500	39.7	824	2.28	0.747	18.8	80.1
653018144343000	LML.2 3-3.5	3,970	29.1	852	2.05	0.543	15.1	69.1
653018144343000	LML.2 3.5-4	4,010	35.8	831	2.05	0.693	17.8	75.9
653018144343000	LML.2 4-4.5	4,460	35.3	843	2.08	0.689	17.9	82.9
653018144343000	LML.2 4.5-5	4,190	40.4	840	2.30	0.795	20.0	80.5
653018144343000	LML.2 5-5.5	4,150	40.3	813	2.16	0.767	19.4	78.9
653018144343000	LML.2 5.5-6	3,840	31.6	820	1.90	0.644	16.6	69.6
653018144343000	LML.2 6-6.5	3,530	38.4	816	1.67	0.806	19.1	73.0
653018144343000	LML.2 6.5-7	4,130	39.2	811	2.10	0.755	18.9	76.8
653018144343000	LML.2 7-8	4,120	33.4	823	1.92	0.645	17.2	75.8
653018144343000	LML.2 8-9	3,580	35.9	899	1.84	0.828	17.9	74.0
653018144343000	LML.2 9-10	3,990	38.7	820	2.05	0.716	18.2	80.2
653018144343000	LML.2 10-11	4,100	41.5	813	2.20	0.749	18.8	79.0
653018144343000	LML.2 11-12	4,220	39.8	832	2.02	0.723	18.4	79.7
653018144343000	LML.2 12-13	4,140	38.8	844	2.29	0.711	18.7	79.0
653018144343000	LML.2 13-14	4,130	43.3	831	2.05	0.821	19.6	79.2
653018144343000	LML.2 14-15	4,240	41.9	830	2.05	0.794	19.4	80.0
653018144343000	LML.2 15-16	3,950	39.3	828	2.06	0.716	17.8	78.7
653018144343000	LML.2 16-17	3,810	37.2	850	1.87	0.714	17.2	73.8
653018144343000	LML.2 17-18	4,270	39.3	841	1.97	0.764	18.0	80.6
653018144343000	LML.2 18-19	4,220	37.0	831	1.95	0.731	18.6	76.9

Table 28. Sediment coring results for Little Medicine Lake, Yukon River Basin-continued

Station ID	Field ID	Copper (µg/g)	Mercury (µg/g)	Lithium (µg/g)	Manganese (µg/g)	Nickel (µg/g)	Lead (µg/g)	Scandium (µg/g)
653018144343000	LML.2 0.5-1	34.3	0.08	35.6	807	32.7	19.9	13.6
653018144343000	LML.2 1-1.5	52.0	0.08	34.6	607	30.8	21.7	13.7
653018144343000	LML.2 1.5-2	39.5	0.08	37.3	625	34.9	20.8	14.8
653018144343000	LML.2 2-2.5	36.2	0.06	37.5	629	33.9	20.8	14.6
653018144343000	LML.2 2.5-3	35.3	0.08	37.0	601	33.5	20.9	14.6
653018144343000	LML.2 3-3.5	29.5	0.06	32.5	513	27.9	17.3	12.9
653018144343000	LML.2 3.5-4	39.0	0.07	35.5	553	31.8	20.2	14.1
653018144343000	LML.2 4-4.5	42.7	0.06	35.9	553	32.6	20.2	14.4
653018144343000	LML.2 4.5-5	39.5	0.07	37.4	632	35.1	20.8	15.0
653018144343000	LML.2 5-5.5	36.1	0.07	36.6	604	34.0	20.6	14.8
653018144343000	LML.2 5.5-6	34.6	0.07	32.4	520	29.3	18.7	12.7
653018144343000	LML.2 6-6.5	45.9	0.1	29.8	602	34.0	21.1	13.2
653018144343000	LML.2 6.5-7	35.7	0.1	35.8	581	34.0	20.6	14.3
653018144343000	LML.2 7-8	37.9	0.08	34.0	549	31.4	19.1	13.8
653018144343000	LML.2 8-9	91.1	- -	30.2	539	33.0	22.6	13.0
653018144343000	LML.2 9-10	38.8	0.07	36.7	548	32.9	20.2	14.6
653018144343000	LML.2 10-11	35.4	0.1	36.8	580	33.5	20.4	14.6
653018144343000	LML.2 11-12	37.3	0.07	36.2	560	33.2	20.0	14.5
653018144343000	LML.2 12-13	34.8	0.06	36.0	566	32.2	20.3	14.2
653018144343000	LML.2 13-14	37.3	0.09	36.7	584	33.9	21.2	14.8
653018144343000	LML.2 14-15	37.2	0.08	36.1	581	34.2	20.6	14.6
653018144343000	LML.2 15-16	34.4	0.07	35.2	547	32.2	19.7	14.3
653018144343000	LML.2 16-17	33.4	0.07	33.1	522	30.5	19.8	13.4
653018144343000	LML.2 17-18	35.3	0.07	35.8	575	33.0	21.5	14.4
653018144343000	LML.2 18-19	46.2	0.09	32.8	562	31.9	20.5	14.0

Table 28. Sediment coring results for Little Medicine Lake, Yukon River Basin-continued

Station ID	Field ID	Strontium (µg/g)	Vanadium (µg/g)	Zinc (µg/g)
653018144343000	LML.2 0.5-1	173	110	162
653018144343000	LML.2 1-1.5	183	110	170
653018144343000	LML.2 1.5-2	174	118	168
653018144343000	LML.2 2-2.5	179	121	159
653018144343000	LML.2 2.5-3	177	120	157
653018144343000	LML.2 3-3.5	193	103	132
653018144343000	LML.2 3.5-4	181	115	151
653018144343000	LML.2 4-4.5	184	120	154
653018144343000	LML.2 4.5-5	176	122	168
653018144343000	LML.2 5-5.5	176	119	159
653018144343000	LML.2 5.5-6	178	102	140
653018144343000	LML.2 6-6.5	173	108	168
653018144343000	LML.2 6.5-7	171	118	158
653018144343000	LML.2 7-8	188	112	151
653018144343000	LML.2 8-9	181	106	190
653018144343000	LML.2 9-10	178	120	156
653018144343000	LML.2 10-11	176	120	157
653018144343000	LML.2 11-12	186	120	153
653018144343000	LML.2 12-13	184	118	151
653018144343000	LML.2 13-14	177	120	162
653018144343000	LML.2 14-15	181	122	162
653018144343000	LML.2 15-16	179	114	150
653018144343000	LML.2 16-17	180	110	148
653018144343000	LML.2 17-18	188	120	157
653018144343000	LML.2 18-19	187	111	166

Table 28. Sediment coring results for Little Medicine Lake, Yukon River Basin-continued

Station ID	Field ID	Total carbon, %	Inorganic carbon, as CO_2 + CO_3, %	Organic carbon, %
653018144343000	LML.1 0-0.5	8.51	0.32	8.44
653018144343000	LML.1 0.5-1	8.11	0.18	8.07
653018144343000	LML.1 1-1.5	8.37	0.42	8.28
653018144343000	LML.1 1.5-2	8.51	0.05	8.46
653018144343000	LML.1 2-2.5	8.20	0.20	8.16
653018144343000	LML.1 2.5-3	7.56	0.04	7.52
653018144343000	LML.1 3-3.5	7.76	0.05	7.71
653018144343000	LML.1 3.5-4	6.95	0.04	6.91
653018144343000	LML.1 4-4.5	7.94	0.04	7.90
653018144343000	LML.1 4.5-5	7.52	0.03	7.49
653018144343000	LML.1 5.5-6	7.64	0.04	7.60
653018144343000	LML.1 6.5-7	8.49	0.04	8.45
653018144343000	LML.1 8-9	8.02	0.05	7.97
653018144343000	LML.1 10-11	7.56	0.05	7.51
653018144343000	LML.1 12-13	8.01	0.04	7.97
653018144343000	LML.1 14-15	7.74	0.05	7.69
653018144343000	LML.1 16-17	7.90	0.05	7.85
653018144343000	LML.1 18-19	7.98	0.03	7.95

Table 28. Sediment coring results for Little Medicine Lake, Yukon River Basin-continued

Station ID	Field ID	Naphthalene (µg/kg)	C1-128 isomers (µg/kg)	2-ethyl-naphthalene (µg/kg)	2,6-dimethyl-naphthalene, (µg/kg)	1,6-dimethyl-naphthalene (µg/kg)	C2-128 isomers (µg/kg)
653018144343000	LML.1 0-0.5	<20	E9.7	<20	308	44.1	418
653018144343000	LML.1 0.5-1	<10	<10	<10	288	40.3	366
653018144343000	LML.1 0.5-1 dup	E1.7	11.9	<10	344	34.9	403
653018144343000	LML.1 1-1.5	<15	E10.3	<15	342	50.3	429

Station ID	Field ID	Acenaph-thylene (µg/kg)	1,2-dimethyl-naphthalene (µg/kg)	Acenaph-thene (µg/kg)	C3-128 isomers (µg/kg)	2,3,6-trimethyl-naphthalene (µg/kg)	9H-Fluorene (µg/kg)
653018144343000	LML.1 0-0.5	<20	<20	E10.2	<100	<20	E9.4
653018144343000	LML.1 0.5-1	<10	<10	<10	<60	<10	E6.1
653018144343000	LML.1 0.5-1 dup	<10	<10	<10	<90	<10	E6.0
653018144343000	LML.1 1-1.5	<15	<15	<15	<100	<15	E7.1

Station ID	Field ID	C4-128 isomers (µg/kg)	1-methyl-9H-Fluorene (µg/kg)	Phenan-threne (µg/kg)	Anthra-cene (µg/kg)	C5-128 isomers (µg/kg)	2-methyl-anthracene, (µg/kg)	4,5-methylene-phenanthrene (µg/kg)
653018144343000	LML.1 0-0.5	<20	49.1	E8.3	E6.3	<20	<20	<20
653018144343000	LML.1 0.5-1	<10	43.1	E8.5	<10	<10	<10	<10
653018144343000	LML.1 0.5-1 dup	<10	46.6	10.1	<10	<10	<10	<10
653018144343000	LML.1 1-1.5	<15	50.2	E10.8	<15	<15	<15	<15

Station ID	Field ID	C1-178 isomers (µg/kg)	1-methyl-phenanthrene (µg/kg)	C2-178 isomers (µg/kg)	Fluoranthene (µg/kg)	Pyrene (µg/kg)	C3-178 isomers (µg/kg)	C4-178 isomers, (µg/kg)
653018144343000	LML.1 0-0.5	<20	<20	<20	<20	<20	<20	<20
653018144343000	LML.1 0.5-1	<10	<10	<10	<10	E3.1	<10	<10
653018144343000	LML.1 0.5-1 dup	<10	E9.9	<10	<10	E3.0	<10	<10
653018144343000	LML.1 1-1.5	<15	<15	<15	<15	<15	<15	<15

Table 28. Sediment coring results for Little Medicine Lake, Yukon River Basin –continued

Station ID	Field ID	1-methyl-pyrene (µg/kg)	C1-202 isomers (µg/kg)	C2-202 isomers (µg/kg)	C5-178 isomers, (µg/kg)	Benz(a)-anthracene, (µg/kg)	Chrysene, (µg/kg)	C3-202 isomers (µg/kg)
653018144343000	LML.1 0-0.5	<20	<20	<20	<20	<20	<20	<20
653018144343000	LML.1 0.5-1	<10	<10	<10	<10	<10	<10	<10
653018144343000	LML.1 0.5-1 dup	<10	<10	<10	<10	<10	<10	<10
653018144343000	LML.1 1-1.5	<15	<15	<15	<15	<15	<15	<15

Station ID	Field ID	C1-228 isomers (µg/kg)	C4-202 isomers (µg/kg)	C5-202 isomers (µg/kg)	C2-228 isomers (µg/kg)	Benzo(b)-fluoranthene (µg/kg)	Benzo(k)-fluoranthene (µg/kg)	Benzo(e)-pyrene (µg/kg)
653018144343000	LML.1 0-0.5	<20	<20	<20	<20	<20	<20	E3.4
653018144343000	LML.1 0.5-1	<10	<10	<10	<10	<10	<10	E2.6
653018144343000	LML.1 0.5-1 dup	<10	<10	<10	E9.0	<10	<10	E2.7
653018144343000	LML.1 1-1.5	<15	<15	<15	E11.9	<15	<15	<15

Station ID	Field ID	Benzo(a)-pyrene (µg/kg)	Perylene (µg/kg)	C1-252 isomers (µg/kg)	C3-228 isomers (µg/kg)	C2-252 isomers (µg/kg)	C4-228 isomers (µg/kg)	Benzo-(g,h,i)-perylene (µg/kg)	Indeno-(1,2,3-c,d)-pyrene (µg/kg)
653018144343000	LML.1 0-0.5	E7.2	E1,240	<20	<20	<20	<20	<20	<20
653018144343000	LML.1 0.5-1	16	E1,310	<10	<10	<10	<10	<10	<10
653018144343000	LML.1 0.5-1 dup	20.9	E1,306	<10	<10	<10	<10	<10	<10
653018144343000	LML.1 1-1.5	<15	E1,690	<15	<15	<15	<15	<15	<15

Station ID	Field ID	Dibenzo-(a,h)-anthracene (µg/kg)	C3-252 isomers (µg/kg)	C4-252 isomers (µg/kg)	C5-228 isomers (µg/kg)	C5-252 isomers (µg/kg)	Coronene (µg/kg)
653018144343000	LML.1 0-0.5	E4.5	<20	<20	<50	<20	<20
653018144343000	LML.1 0.5-1	<10	<10	<40	<10	<10	<10
653018144343000	LML.1 0.5-1 dup	<10	<10	<40	<10	<10	<10
653018144343000	LML.1 1-1.5	<15	<15	<40	<15	<15	<30

Table 28. Sediment coring results for Little Medicine Lake, Yukon River Basin –continued

Station ID	Field ID	Cs-137 (pCi/g)	Cs-137 uncertainty, 1 std. dev.	Pb-210 (dpm/g)	Pb-210 uncertainty, 1 std. dev.	Ra-226 (dpm/g)	Ra-226 uncertainty, 1 std. dev.
653018144343000	LML.2 0.5-1	0.446	0.052	7.40	1.24	2.17	0.32
653018144343000	LML.2 1-1.5	0.258	0.043	6.22	1.01	1.79	0.26
653018144343000	LML.2 1.5-2	0.326	0.042	3.92	0.96	1.78	0.26
653018144343000	LML.2 2-2.5	0.302	0.036	3.70	0.63	1.86	0.21
653018144343000	LML.2 2.5-3	0.426	0.036	3.71	0.56	1.98	0.20
653018144343000	LML.2 3-3.5	0.390	0.039	3.46	0.65	2.18	0.23
653018144343000	LML.2 3.5-4	0.307	0.037	3.95	0.80	2.01	0.24
653018144343000	LML.2 4-4.5	0.349	0.031	2.64	0.50	1.91	0.19
653018144343000	LML.2 4.5-5	0.354	0.033	3.91	0.55	2.08	0.20
653018144343000	LML.2 5.5-6	0.324	0.035	3.08	0.59	2.10	0.22
653018144343000	LML.2 6.5-7	0.360	0.042	2.69	0.68	2.15	0.25
653018144343000	LML.2 7-8	0.351	0.039	4.34	0.65	2.00	0.23
653018144343000	LML.2 8-9	0.438	0.032	3.78	0.48	2.08	0.18
653018144343000	LML.2 9-10	0.409	0.035	3.70	0.55	1.93	0.19

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin

[Station ID, USGS site identification number; "LCL.2", second core collected at Little Coal Lake"; interval that follows LCL.2 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters, µg/g, microgram per gram; repl., replicate; --, no data; "LCL.1", first core collected at Little Coial Lake interval that follows LCL.1 is the core interval, for example "0-0.5" signifies a core depth of 0 meters to 0.5 meters; CO_2; Carbon Dioxide; CO_3^{2-} carbonate; µg/kg, microgram per kilogram; E, Estimated; <, less than; pCi/g, picoCuries per gram; std. dev, standard deviation; dpm/g, disintegrations per minute per gram]

Station ID	Field ID	Aluminum (µg/g)	Calcium (µg/g)	Iron (µg/g)	Potassium (µg/g)	Magnesium (µg/g)	Sodium (µg/g)	Phosphorus (µg/g)
603010135080800	LCL.2 0-0.5	16,800	8,230	22,600	3,220	2,000	2,220	2,050
603010135080800	LCL.2 0.5-1	20,800	8,900	17,200	4,860	1,920	3,140	1,780
603010135080800	LCL.2 1-1.5	19,200	8,070	15,800	3,420	2,050	2,440	1,680
603010135080800	LCL.2 1.5-2	22,100	8,120	14,700	3,530	2,630	3,310	1,490
603010135080800	LCL.2 2-2.5	19,500	6,930	13,600	3,440	1,790	2,300	1,120
603010135080800	LCL.2 2.5-3	20,200	7,120	14,300	3,070	1,990	2,220	1,200
603010135080800	LCL.2 3-3.5	20,400	6,910	14,300	3,240	2,040	2,380	1,170
603010135080800	LCL.2 3.5-4	21,200	7,090	14,400	3,220	2,260	2,660	1,160
603010135080800	LCL.2 4-4.5	21,500	6,860	14,700	3,200	2,120	2,440	1,140
603010135080800	LCL.2 4.5-5	24,300	7,230	16,100	3,710	2,540	3,240	1,150
603010135080800	LCL.2 5-5.5	21,200	6,700	15,600	3,210	1,970	2,450	1,070
603010135080800	LCL.2 5.5-6	22,300	6,910	15,500	3,760	1,980	2,780	990
603010135080800	LCL.2 6-6.5	22,500	6,680	15,900	3,330	2,200	2,670	1,080
603010135080800	LCL.2 6.5-7	23,500	6,730	15,900	3,500	2,310	2,710	1,130
603010135080800	LCL.2 7-8	24,000	7,370	16,000	3,650	2,240	2,990	1,080
603010135080800	LCL.2 8-9	23,300	7,390	15,400	3,610	2,150	2,700	1,080
603010135080800	LCL.2 9-10	26,800	8,090	15,100	4,380	2,660	3,720	1,180
603010135080800	LCL.2 10-11	24,500	7,660	14,500	3,840	2,300	3,040	1,130
603010135080800	LCL.2 11-12	29,100	8,700	15,500	4,550	3,000	4,180	1,300
603010135080800	LCL.2 12-13	29,000	8,890	15,100	4,460	3,060	4,400	1,330
603010135080800	LCL.2 13-14	27,500	8,640	14,600	4,190	2,610	3,700	1,270
603010135080800	LCL.2 14-15	27,000	8,540	14,600	4,230	2,480	3,660	1,280
603010135080800	LCL.2 15-16	32,300	10,000	16,200	5,000	3,790	5,620	1,570
603010135080800	LCL.2 15-16 repl.	32,800	10,200	16,300	5,010	4,040	5,770	1,620
603010135080800	LCL.2 15-16 repl.	30,700	9,710	15,600	4,690	3,300	4,860	1,460
603010135080800	LCL.2 16-17	28,600	9,340	15,700	4,480	2,550	3,780	1,360

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	Titanium (µg/g)	Arsenic (µg/g)	Barium (µg/g)	Beryllium (µg/g)	Cadmium (µg/g)	Cobalt (µg/g)	Chromium (µg/g)
603010135080800	LCL.2 0-0.5	818	8.07	330	0.448	0.951	5.62	20.6
603010135080800	LCL.2 0.5-1	882	5.75	473	0.540	0.949	4.77	20.8
603010135080800	LCL.2 1-1.5	952	5.18	363	0.542	1.06	5.77	23.5
603010135080800	LCL.2 1.5-2	856	5.81	348	0.639	1.25	6.91	23.6
603010135080800	LCL.2 2-2.5	823	5.48	376	0.489	1.19	6.49	22.6
603010135080800	LCL.2 2.5-3	819	6.58	325	0.574	1.24	7.21	23.9
603010135080800	LCL.2 3-3.5	796	6.59	338	0.504	1.29	7.26	23.6
603010135080800	LCL.2 3.5-4	833	7.42	328	0.588	1.34	7.14	22.8
603010135080800	LCL.2 4-4.5	808	7.74	316	0.567	1.35	7.49	23.3
603010135080800	LCL.2 4.5-5	950	9.24	354	0.661	1.46	8.07	25.4
603010135080800	LCL.2 5-5.5	980	9.07	342	0.541	1.35	7.61	24.2
603010135080800	LCL.2 5.5-6	997	8.40	405	0.613	1.36	7.43	25.2
603010135080800	LCL.2 6-6.5	893	8.78	352	0.616	1.46	8.17	24.1
603010135080800	LCL.2 6.5-7	969	8.60	360	0.604	1.48	7.97	25.7
603010135080800	LCL.2 7-8	1,110	8.11	397	0.616	1.53	7.72	26.1
603010135080800	LCL.2 8-9	1,060	7.56	396	0.560	1.57	7.46	26.5
603010135080800	LCL.2 9-10	1,140	7.32	431	0.620	1.52	7.51	27.1
603010135080800	LCL.2 10-11	1,040	6.93	420	0.591	1.52	7.32	26.3
603010135080800	LCL.2 11-12	1,200	7.53	414	0.664	1.60	7.70	28.9
603010135080800	LCL.2 12-13	1,250	7.47	416	0.741	1.61	7.44	28.6
603010135080800	LCL.2 13-14	1,240	7.72	450	0.661	1.62	7.48	27.8
603010135080800	LCL.2 14-15	1,100	7.84	472	0.659	1.69	7.56	26.7
603010135080800	LCL.2 15-16	1,290	8.70	434	0.856	1.62	8.18	29.5
603010135080800	LCL.2 15-16 repl.	1,430	8.97	478	0.886	1.61	8.29	30.3
603010135080800	LCL.2 15-16 repl.	1,230	8.60	426	0.827	1.60	8.03	29.3
603010135080800	LCL.2 16-17	1,220	8.89	497	0.763	1.61	8.14	28.4

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	Copper (µg/g)	Mercury (µg/g)	Lithium (µg/g)	Manganese (µg/g)	Nickel (µg/g)	Lead (µg/g)	Scandium (µg/g)
603010135080800	LCL.2 0-0.5	23.4	0.12	4.44	904	16.5	8.51	4.60
603010135080800	LCL.2 0.5-1	26.3	0.12	4.88	401	15.7	8.72	4.66
603010135080800	LCL.2 1-1.5	28.0	0.12	4.52	344	18.0	7.89	4.96
603010135080800	LCL.2 1.5-2	30.8	0.12	7.14	306	19.8	7.11	5.47
603010135080800	LCL.2 2-2.5	30.4	0.12	5.04	281	19.5	8.60	5.09
603010135080800	LCL.2 2.5-3	29.1	0.11	5.59	310	20.9	6.78	5.44
603010135080800	LCL.2 3-3.5	32.7	0.12	5.88	326	20.4	6.96	5.38
603010135080800	LCL.2 3.5-4	30.1	0.13	6.31	302	20.3	7.71	5.39
603010135080800	LCL.2 4-4.5	35.5	0.12	6.04	307	20.5	6.72	5.48
603010135080800	LCL.2 4.5-5	33.8	0.11	7.60	282	22.8	6.71	6.04
603010135080800	LCL.2 5-5.5	30.3	0.12	5.76	284	21.3	6.75	5.38
603010135080800	LCL.2 5.5-6	31.0	0.12	6.04	283	20.6	7.16	5.32
603010135080800	LCL.2 6-6.5	30.7	0.11	6.45	296	22.2	6.66	5.66
603010135080800	LCL.2 6.5-7	30.9	0.10	6.89	294	21.9	6.94	5.86
603010135080800	LCL.2 7-8	35.6	0.11	6.61	295	21.4	7.10	5.86
603010135080800	LCL.2 8-9	31.9	0.12	6.48	288	22.0	6.97	5.92
603010135080800	LCL.2 9-10	32.8	0.09	7.72	300	22.2	6.96	6.25
603010135080800	LCL.2 10-11	34.1	0.11	6.84	285	21.7	7.12	6.02
603010135080800	LCL.2 11-12	35.5	0.10	8.65	298	23.0	7.37	6.36
603010135080800	LCL.2 12-13	34.0	0.10	8.80	301	22.3	7.28	6.42
603010135080800	LCL.2 13-14	36.8	0.08	7.70	286	22.9	7.25	6.35
603010135080800	LCL.2 14-15	33.8	0.08	7.12	288	22.7	7.81	6.19
603010135080800	LCL.2 15-16	36.7	0.10	10.7	324	23.9	7.82	6.76
603010135080800	LCL.2 15-16 repl.	36.8	- -	11.0	315	24.3	8.20	7.16
603010135080800	LCL.2 15-16 repl.	36.6	- -	9.13	307	23.6	8.01	6.63
603010135080800	LCL.2 16-17	35.6	0.09	7.34	300	23.8	7.72	6.61

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	Strontium (µg/g)	Vanadium (µg/g)	Zinc (µg/g)
603010135080800	LCL.2 0-0.5	108	32.5	80.8
603010135080800	LCL.2 0.5-1	138	32.3	75.9
603010135080800	LCL.2 1-1.5	110	35.3	92.5
603010135080800	LCL.2 1.5-2	106	38.9	106
603010135080800	LCL.2 2-2.5	100	36.2	101
603010135080800	LCL.2 2.5-3	91.4	37.3	101
603010135080800	LCL.2 3-3.5	95.0	36.6	103
603010135080800	LCL.2 3.5-4	95.4	37.1	107
603010135080800	LCL.2 4-4.5	92.9	36.8	108
603010135080800	LCL.2 4.5-5	109	39.5	113
603010135080800	LCL.2 5-5.5	101	37.2	108
603010135080800	LCL.2 5.5-6	113	36.8	110
603010135080800	LCL.2 6-6.5	99.0	37.9	116
603010135080800	LCL.2 6.5-7	99.7	38.6	115
603010135080800	LCL.2 7-8	117	40.1	117
603010135080800	LCL.2 8-9	115	40.4	121
603010135080800	LCL.2 9-10	125	41.6	120
603010135080800	LCL.2 10-11	121	41.7	122
603010135080800	LCL.2 11-12	131	44.8	131
603010135080800	LCL.2 12-13	132	45.2	133
603010135080800	LCL.2 13-14	133	45.2	130
603010135080800	LCL.2 14-15	142	44.2	135
603010135080800	LCL.2 15-16	140	50.5	141
603010135080800	LCL.2 15-16 repl.	141	50.5	143
603010135080800	LCL.2 15-16 repl.	139	48.5	137
603010135080800	LCL.2 16-17	146	47.4	135

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	Total carbon, %	Inorganic carbon, as CO_2 + CO_3, %	Organic carbon, %
603010135080800	LCL.1 0-0.5	14.7	0.22	14.7
603010135080800	LCL.1 0.5-1	13.9	0.17	13.9
603010135080800	LCL.1 1-1.5	13.3	0.13	13.3
603010135080800	LCL.1 1.5-2	12.9	0.03	12.9
603010135080800	LCL.1 2-2.5	12.7	0.11	12.7
603010135080800	LCL.1 2.5-3	12.6	0.03	12.6
603010135080800	LCL.1 3-3.5	12.3	0.03	12.3
603010135080800	LCL.1 3.5-4	12.0	0.03	12.0
603010135080800	LCL.1 4-4.5	11.6	0.03	11.6
603010135080800	LCL.1 4.5-5	11.5	0.03	11.5
603010135080800	LCL.1 5.5-6	11.0	0.04	11.0
603010135080800	LCL.1 6.5-7	11.0	0.03	11.0
603010135080800	LCL.1 8-9	10.7	0.03	10.7
603010135080800	LCL.1 10-11	10.6	0.03	10.6
603010135080800	LCL.1 12-13	10.9	0.03	10.9
603010135080800	LCL.1 14-15	11.4	0.04	11.4
603010135080800	LCL.1 16-17	11.6	0.04	11.6
603010135080800	LCL.1 18-19	11.2	0.03	11.2

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	Naphthalene (µg/kg)	C1-128 isomers (µg/kg)	2-ethyl-naphthalene (µg/kg)	2,6-dimethyl-naphthalene (µg/kg)	1,6-dimethyl-naphthalene (µg/kg)	C2-128 isomers (µg/kg)
603010135080800	LCL.1 3-3.5	<10	90	<10	273	25.9	355
603010135080800	LCL.1 4-4.5	E3.1	70	<10	238	25.9	298
603010135080800	LCL.1 5.5-6	E3.1	118	<10	301	34.2	382
603010135080800	LCL.1 6.5-7	E4.9	E8.2	<30	398	49.5	536
603010135080800	LCL.1 8-9	E2.6	E5.8	<15	218	19.1	276
603010135080800	LCL.1 11-12	<10	85	<10	184	18.5	231

Station ID	Field ID	Acenaph-thylene (µg/kg)	1,2-dimethyl-naphthalene (µg/kg)	Acenaph-thene (µg/kg)	C3-128 isomers (µg/kg)	2,3,6-trimethyl-naphthalene (µg/kg)	9H-Fluorene (µg/kg)
603010135080800	LCL.1 3-3.5	<10	<10	<10	58.3	<10	E3.6
603010135080800	LCL.1 4-4.5	<10	E3.1	<10	52.7	<10	E2.9
603010135080800	LCL.1 5.5-6	<10	E3.9	<10	63	<10	E3.8
603010135080800	LCL.1 6.5-7	<30	<30	<30	50	<30	<30
603010135080800	LCL.1 8-9	E5.8	E4.3	<15	<30	<15	<15
603010135080800	LCL.1 11-12	<10	E2.8	<10	41.2	<10	E2.3

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	C4-128 isomers (µg/kg)	1-methyl-9H-Fluorene (µg/kg)	Phenan-threne (µg/kg)	Anthra-cene (µg/kg)	C5-128 isomers (µg/kg)	2-methyl-anthracene (µg/kg)	4,5-methylene-phenanthrene (µg/kg)
603010135080800	LCL.1 3-3.5	<30	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 4-4.5	<10	<10	E3.0	<10	<10	<10	<10
603010135080800	LCL.1 5.5-6	<10	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 6.5-7	<30	<30	E8.4	E8.0	<30	<30	<30
603010135080800	LCL.1 8-9	<15	<15	E7.2	E6.3	<15	<15	<15
603010135080800	LCL.1 11-12	<10	<10	E4.1	<10	<10	<10	<10

Station ID	Field ID	C1-178 isomers (µg/kg)	1-methyl-phenanthrene (µg/kg)	C2-178 isomers (µg/kg)	Fluoranthene (µg/kg)	Pyrene (µg/kg)	C3-178 isomers (µg/kg)	C4-178 isomers (µg/kg)
603010135080800	LCL.1 3-3.5	<40	<10	<10	E3.5	E3.1	<10	<10
603010135080800	LCL.1 4-4.5	E8.1	<10	E6.4	E3.5	E2.9	E6.2	<10
603010135080800	LCL.1 5.5-6	E9.2	<10	E8.7	E4.1	E3.2	E7.8	<10
603010135080800	LCL.1 6.5-7	E22.2	<30	E26.2	E8.1	E7.1	<30	<30
603010135080800	LCL.1 8-9	E13.2	<15	E10.8	E5.1	E4.9	<15	<15
603010135080800	LCL.1 11-12	19	<10	E6.1	E3.3	E2.3	E6.3	<10

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	1-methyl-pyrene (µg/kg)	C1-202 isomers (µg/kg)	C2-202 isomers (µg/kg)	C5-178 isomers (µg/kg)	Benz(a)-anthracene (µg/kg)	Chrysene (µg/kg)	C3-202 somers (µg/kg)
603010135080800	LCL.1 3-3.5	<10	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 4-4.5	<10	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 5.5-6	<10	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 6.5-7	<30	<30	<30	<30	<30	<30	<30
603010135080800	LCL.1 8-9	<15	E9.0	<15	<15	<15	<15	<15
603010135080800	LCL.1 11-12	<10	<10	<10	<10	<10	E1.3	<10

Station ID	Field ID	C1-228 isomers (µg/kg)	C4-202 isomers (µg/kg)	C5-202 isomers (µg/kg)	C2-228 isomers (µg/kg)	Benzo(b)-fluoranthene (µg/kg)	Benzo(k)-fluoranthene (µg/kg)	Benzo(e)-pyrene (µg/kg)
603010135080800	LCL.1 3-3.5	<10	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 4-4.5	<10	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 5.5-6	<10	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 6.5-7	<30	<30	<30	<30	<30	<30	<30
603010135080800	LCL.1 8-9	<15	<15	<15	<15	<15	<15	E3.2
603010135080800	LCL.1 11-12	<10	<10	<10	<10	<10	<10	<10

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	Benzo(a)-pyrene (µg/kg)	Perylene (µg/kg)	C1-252 isomers (µg/kg)	C3-228 isomers (µg/kg)	C2-252 isomers (µg/kg)	C4-228 isomers (µg/kg)	Benzo(g,h,i)-perylene (µg/kg)	Indeno-(1,2,3-c,d)-pyrene (µg/kg)
603010135080800	LCL.1 3-3.5	<10	320	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 4-4.5	<10	377	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 5.5-6	<10	652	<10	<10	<10	<10	<10	E6.4
603010135080800	LCL.1 6.5-7	<30	950	E17.7	<30	<30	<30	<30	<30
603010135080800	LCL.1 8-9	E5.9	894	E12.6	<15	<15	<15	<15	<15
603010135080800	LCL.1 11-12	<10	1000	21.6	<10	<10	<10	<10	<10

Station ID	Field ID	Dibenzo-(a,h)-anthracene (µg/kg)	C3-252 isomers (µg/kg)	C4-252 isomers (µg/kg)	C5-228 isomers (µg/kg)	C5-252 isomers (µg/kg)	Coronene (µg/kg)
603010135080800	LCL.1 3-3.5	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 4-4.5	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 5.5-6	<10	<10	<10	<10	<10	<10
603010135080800	LCL.1 6.5-7	<30	<30	<30	<30	<30	<30
603010135080800	LCL.1 8-9	<15	<15	<15	<15	<15	E2.9
603010135080800	LCL.1 11-12	<10	<10	<10	<10	<10	<10

Table 29. Sediment coring results for Little Coal Lake, Yukon River Basin –continued

Station ID	Field ID	Cs-137 (pCi/g)	Cs-137 uncertainty, 1 std. dev.	Pb-210 (dpm/g)	Pb-210 uncertainty, 1 std. dev.	Ra-226 (dpm/g)	Ra-226 uncertainty, 1 std. dev.
603010135080800	LCL.2 0-0.5	1.893	0.107	26.94	1.96	0.46	0.22
603010135080800	LCL.2 0.5-1	2.405	0.192	31.26	3.47	0.14	0.50
603010135080800	LCL.2 1-1.5	2.413	0.162	25.17	2.41	0.86	0.35
603010135080800	LCL.2 1.5-2	2.865	0.172	17.39	1.93	0.33	0.29
603010135080800	LCL.2 2-2.5	3.018	0.148	14.02	1.21	0.48	0.19
603010135080800	LCL.2 2.5-3	2.898	0.163	18.27	1.70	0.49	0.26
603010135080800	LCL.2 3-3.5	2.641	0.139	15.30	1.37	0.50	0.22
603010135080800	LCL.2 3.5-4	2.236	0.112	13.18	1.13	0.53	0.16
603010135080800	LCL.2 4-4.5	1.911	0.121	11.55	1.48	0.47	0.25
603010135080800	LCL.2 4.5-5	0.959	0.073	6.41	1.08	0.30	0.21
603010135080800	LCL.2 5-5.5	1.160	0.090	8.47	1.36	0.70	0.26
603010135080800	LCL.2 5.5-6	0.581	0.059	4.59	0.94	0.80	0.20
603010135080800	LCL.2 6-6.5	0.539	0.059	5.32	1.05	0.53	0.22
603010135080800	LCL.2 6.5-7	0.449	0.044	4.28	0.81	0.70	0.16
603010135080800	LCL.2 7-8	0.388	0.041	3.28	0.62	0.75	0.18
603010135080800	LCL.2 8-9	0.417	0.052	2.10	0.80	0.73	0.24
603010135080800	LCL.2 9-10	0.268	0.037	1.32	0.59	0.84	0.19
603010135080800	LCL.2 10-11	0.247	0.034	0.57	0.48	0.34	0.31
603010135080800	LCL.2 11-12	0.186	0.033	0.49	0.37	0.65	0.17
603010135080800	LCL.2 12-13	0.203	0.032	1.34	0.47	0.72	0.30
603010135080800	LCL.2 14-15	0.137	0.023	0.48	0.32	0.94	0.21

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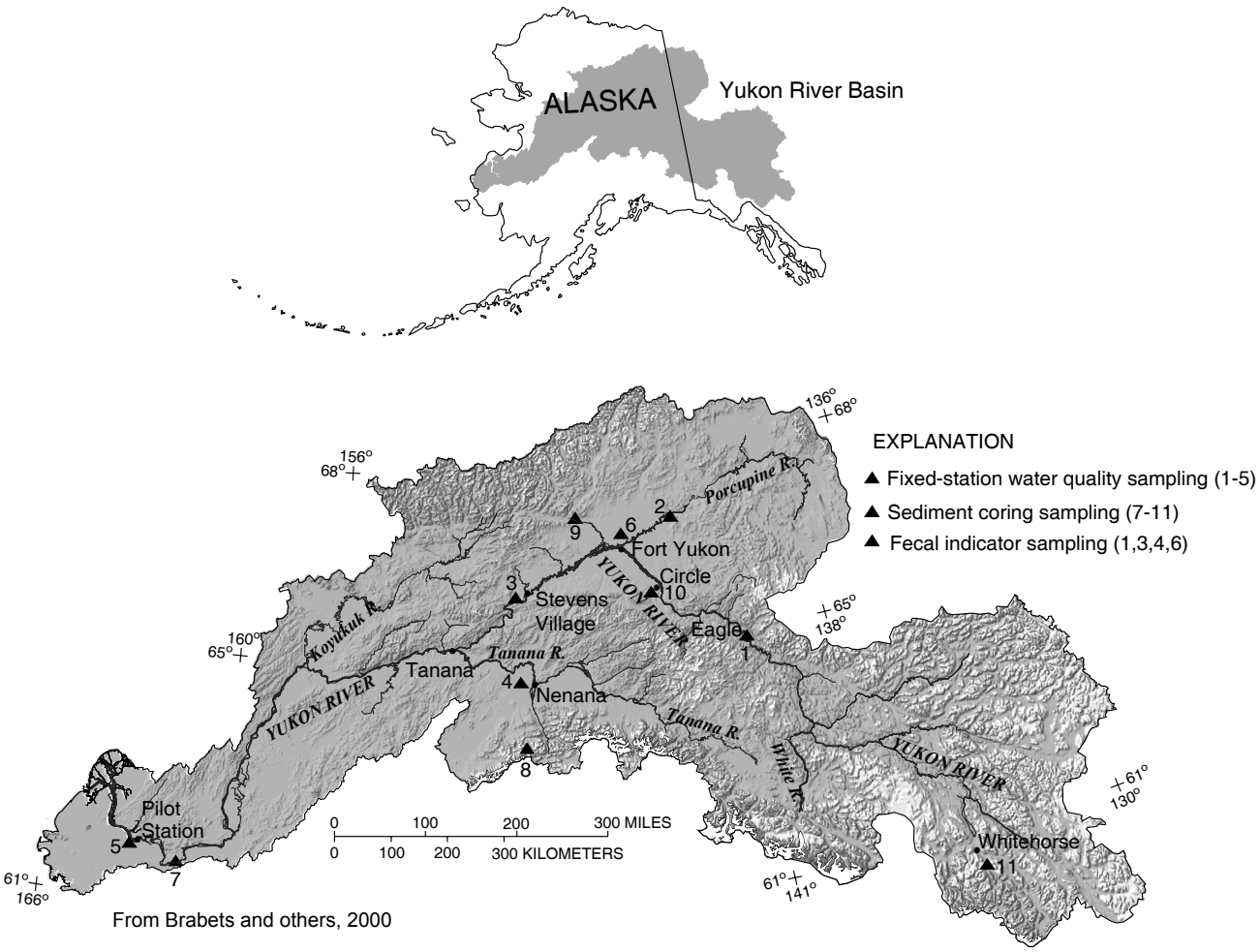

Figure 1. Location of fixed water-quality monitoring sites, lakes where bottom sediment cores were collected, and fecal indicator sampling sites along the Yukon River.