Tables

Table 2-1. Composition of Red Dog lead and zinc concentrates

	Concentrate	
Element/Compound	Lead	Zinc
Aluminum oxide[a]	2,600	1,300
Antimony[a]	1,600	400
Arsenic[a]	400	200
Barium[a]	2,400	2,700
Cadmium[a]	1,200	3,300
Calcium oxide[a]	600	500
Copper[a]	600	1,400
Iron[a]	53,000	50,000
Lead[a]	579,000	32,000
Manganese oxide[a]	100	100
Silicon oxide[a]	38,000	35,000
Sulfate[a]	4,000	4,500
Sulfur (total)[a]	205,000	317,000
Zinc[a]	108,000	552,000
Bismuth	6	8
Chloride	50	50
Chromium	677	537
Cobalt	77	98
Fluoride	64	56
Gallium	11	26
Germanium	17	79
Gold	0.22	0.209
Manganese	12	10
Mercury	18	94
Molybdenum	43	20
Nickel	45	16
Selenium	28	3
Silver	420	137
Strontium	11	10
Thallium	70	19
Tin	23	49
Vanadium	23	13

Source: DEC et al. (2002).

Note: All units are expressed in ppm (i.e., mg/kg dry weight basis).

[a] Values are based on dry weight; actual lead and zinc concentrates contain approximately 8.5 and 9.5 percent water, respectively.

Table 2-2. DMTS-related spills from DEC database

Spill Number	Spill Date	Spill Name	Quantity Released	Quantity Unit ID	Substance Type	Clean Up
93389921001	07/29/93	36,000 gal diesel (Tank #2)	36,000	gallons	Diesel	yes
98389915802	06/07/98		70	gallons	Diesel	yes
98389933101	11/27/98		55	gallons	Diesel	yes
97389925701	09/14/97		30	gallons	Diesel	yes
98389915702	06/06/98		20	gallons	Diesel	yes
98389908201	03/23/98		15	gallons	Diesel	yes
99389935401	12/20/99		10	gallons	Diesel	yes
00389907901	03/19/00		10	gallons	Diesel	yes
00389923201	08/19/00		10	gallons	Diesel	yes
96389929601	10/22/96		15	gallons	Engine lube oil	yes
98389921901	08/07/98		10	gallons	Engine lube oil	yes
01389919601	07/15/01		90	gallons	Hydraulic oil	yes
98389921601	08/04/98		45	gallons	Hydraulic oil	yes
01389903101	01/31/01		30	gallons	Hydraulic oil	yes
97389917301	06/22/97		25	gallons	Hydraulic oil	yes
00389915601	06/04/00		25	gallons	Hydraulic oil	yes
97389922401	08/12/97	Port old CSB-column 47	20	gallons	Hydraulic oil	yes
99389933702	12/03/99		20	gallons	Hydraulic oil	yes
95389934901	12/15/95		20	gallons	Hydraulic oil	no
97389931801	11/14/97		15	gallons	Hydraulic oil	yes
96389933401	11/29/96		10	gallons	Hydraulic oil	yes
98389915203	06/01/98		10	gallons	Hydraulic oil	yes
97389927803	10/05/97		65	gallons	Other[a]	yes
98389921301	08/01/98	Port CSB	76,000	pounds	Lead concentrate	yes
99389902101	01/21/99	Port Road mile 9	60,000	pounds	Lead concentrate	yes
00389928301	10/09/00	Port Road mile post 31	52,000	pounds	Lead concentrate	yes
99389910101	04/11/99	Port CSB	150	pounds	Lead concentrate	yes
98389931402	11/10/98		200	pounds	Other[b]	yes
98389903801	02/07/98	Zinc at mile post 27.25	140,000	pounds	Zinc concentrate	yes
00389936301	12/28/00	Port Road mile post 45	88,100	pounds	Zinc concentrate	yes
97389923301	08/21/97	Port site entrance to racetrack	70,000	pounds	Zinc concentrate	yes
98389932501	11/21/98	Port Road mile 41.75 by MS-11	70,000	pounds	Zinc concentrate	yes
99389900601	01/06/99	Port Road mile 45	50,000	pounds	Zinc concentrate	yes
97389900201	01/02/97	40,000 lb zinc at mile post 27	40,000	pounds	Zinc concentrate	yes
98389901701	01/17/98	Port Road mile 35 (near MS-9)	37,760	pounds	Zinc concentrate	yes
98389919301	07/12/98	Mile post 42	26,500	pounds	Zinc concentrate	yes
96389915901	06/07/96	6,743 lb zinc conc. at MS-2	2,000	pounds	Zinc concentrate	yes
98389910701	04/17/98	Port Road 150 ft south of Tutak Bridge	800	pounds	Zinc concentrate	yes
00389923402	08/21/00	Port - Conveyor P-10 drive house	750	pounds	Zinc concentrate	yes
01389920101	07/20/01	Red Dog Mine zinc spill MP 38.3	20,000	pounds	Zinc concentrate	yes

Note: CSB - concentrate storage building
DEC - Alaska Department of Environmental Conservation

Data were provided by DEC from its Prevention and Early Response & Preparation database.
Table includes spills greater than or equal to 10 gallons or 10 pounds.
Database does not include spills that occurred prior to 1995, except for July 29, 1993, spill.

[a] Uncertain, but possible match with process water spill at the mine mill on October 5, 1997.

[b] Uncertain, but possible match with 1 gallon spill of ethylene glycol at the mine (Hagy 2003, pers. comm.)

Table 2-3. DMTS haul truck spill sites summary information

Spill Site	Date of Spill	Spill Type	Tons Spilled	DMTS Mile Post	Grid Reference Monument Location		
					Monument Site	Latitude (North)	Longitude (West)
SP-01	01/12/90	Zinc	15	41.85	SP01-001	67.94109	163.05006
SP-02	01/17/90	Zinc	72	48.1	SP02-001	68.01279	162.93477
SP-03	08/02/90	Zinc	36	4.1	SP03-019	67.60539	163.94122
SP-04	09/03/90	Zinc	35	29.4	SP04-001	67.82995	163.34785
SP-05	09/18/90	Zinc	36	4.95	SP05-001	67.61495	163.92287
SP-06	12/01/91	Lead	30	40.3	SP06-001	67.93362	163.09655
SP-07	02/20/92	Lead	72	8.5	SP07-002	67.63837	163.80674
SP-08	03/20/92	Lead	15	21.1	SP08-010	67.76672	163.56600
SP-09	07/29/92	Zinc	37	48.85	SP09-001	68.02160	162.93450
SP-10	07/14/93	Zinc	35	51.3	SP10-001	68.04481	162.86582
SP-11	12/15/93	Zinc	28	26.65	SP11-001	67.80349	163.42157
SP-12	09/06/94	Zinc	36	48.75	SP12-001/007	68.01966	162.93574
SP-13	08/05/96	Zinc	35	32.3	SP13-001	67.86341	163.29792
SP-14	12/10/96	Zinc	37	48.65	SP14-014	68.01856	162.93419
SP-15	01/02/97	Zinc	17	27	SP15-002	67.80696	163.41252
SP-16	08/19/97	Zinc	15	51.05	SP16/26-001	68.04253	162.87135
SP-17	08/21/97	Zinc	10	1	SP17-001	67.58687	164.02718
SP-18	01/17/98	Zinc	17	35	SP18-001	67.89438	163.24367
SP-19	02/07/98	Zinc	45	27.25	SP19-001	67.80876	163.40421
SP-20	04/17/98	Zinc	0.4	32.6	SP20-001	67.86890	163.29753
SP-21	07/11/98	Zinc	20	42.4	SP21-001	67.93950	163.07366
SP-22	08/01/98	Lead	76	RT	SP22-001	67.94109	163.05007
SP-23	11/21/98	Zinc	40	41.75	SP23-001	67.94623	163.04388
SP-24	01/06/99	Zinc	72.5	45	SP24-001	67.97663	162.98434
SP-25	01/21/99	Lead	38	9.02	SP25-008	67.64293	163.79299
SP-26	07/19/99	Lead	66	51.05	SP16/26-001	68.04253	162.87135
SP-27	10/09/00	Lead	30	32.5	Station "4"	67.92447	163.10250
SP-28	12/22/00	Zinc	40	44.7	Station "3"	67.97392	162.99184
SP-29	02/16/01	Zinc	14	42.2	Station "104"	67.94592	163.04355
SP-30	07/20/01	Zinc	10	39.25	Station "102"	67.92447	163.10250
SP-31A	03/22/98	Zinc	1 [a]	48-53	SP31A-001	68.01159	162.93434
SP-31B	03/22/98	Zinc	1 [a]	48-53	Road Side	68.01533	162.93524
SP-31C	03/22/98	Zinc	1 [a]	48-53	Road Side	68.01619	162.93483

Source: Teck Cominco (2003e).

[a] Total tonnage spilled at site SP-31 was estimated at 1 ton, distributed among three subsites.

Table 2-4. Concentrate truck spill evaluation summary

Spill ID	Date of Spill	Closeout Date of Spill Re-evaluation	Re-evaluation Document
SP-01	January 12, 1990	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-02	January 17, 1990	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-03	August 9, 1990	May 2003	Concentrate Spill Site Recovery and Restoration Report for SP-03[b]
SP-04	September 3, 1990	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-05	September 18, 1990	May 2003	Concentrate Spill Site Recovery and Restoration Report for SP-05[c]
SP-06	December 1, 1991	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-07	February 20, 1992	February 2003	Report on the 2002 Spill Site Characterization Sampling Program[d]
SP-08	March 20, 1992	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-09	July 29, 1992	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-10	July 14, 1993	February 2004	2002–2003 DMTS Concentrate Spill Site Characterization Report for SP-10[e]
SP-11	December 16, 1993	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-12	September 6, 1994	February 2003	Report on the 2002 Spill Site Characterization Sampling Program[d]
SP-13	August 5, 1996	February 2004	2002–2003 DMTS Concentrate Spill Site Characterization Report for SP-13[f]
SP-14	December 10, 1996	February 2003	Report on the 2002 Spill Site Characterization Sampling Program[d]
SP-15	January 2, 1997	February 2004	2002–2003 DMTS Concentrate Spill Site Characterization Report for SP-15[g]
SP-16	August 19, 1997	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-17	August 21, 1997	February 2004	2002–2003 DMTS Concentrate Spill Site Characterization Report for SP-17[h]
SP-18	January 17, 1998	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-19	February 7, 1998	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-20	April 17, 1998	February 2003	Report on the 2002 Spill Site Characterization Sampling Program[d]
SP-21	July 11, 1998	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-22	August 1, 1998	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]

Table 2-4. (cont.)

Spill ID	Date of Spill	Closeout Date of Spill Re-evaluation	Re-evaluation Document
SP-23	November 21, 1998	February 2003	Report on the 2002 Spill Site Characterization Sampling Program[d]
SP-24	January 6, 1999	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-25	January 21, 1999	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-26	July 19, 1997	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-27	October 9, 2000	February 2004	2002–2003 DMTS Concentrate Spill Site Characterization Report for SP-27[i]
SP-28	December 28, 2000	May 2005	Close out letter from TCAK to ADEC, Div. of Spill Prevention and Response[a]
SP-29	February 16, 2001	February 2004	2002–2003 DMTS Concentrate Spill Site Characterization Report for SP-29[j]
SP-30	July 20, 2001	February 2004	2002–2003 DMTS Concentrate Spill Site Characterization Report for SP-30[k]
SP-31	March 22, 1998	February 2003	Report on the 2002 Spill Site Characterization Sampling Program[d]

[a] Teck Cominco (2005a).

[b] Teck Cominco (2003c).

[c] Teck Cominco (2003d).

[d] Teck Cominco (2003e).

[e] Teck Cominco (2004a).

[f] Teck Cominco (2004b).

[g] Teck Cominco (2004c).

[h] Teck Cominco (2004d).

[i] Teck Cominco (2004e).

[j] Teck Cominco (2004f).

[k] Teck Cominco (2004g).

Table 2-5. Relative importance of potential human exposure pathways[a]

	Human Exposure Pathways			
Metal	Inhalation	Dermal	Ingestion	Cumulative PRG
Aluminum	2,882,040		78,214	76,142
Antimony			31	31
Arsenic (cancer)	588	4.5	0.43	0.39
Arsenic (noncancer)		279	23	21.6
Barium	294,086		5,475	5,375
Cadmium (cancer)	1,405			1,404
Cadmium (noncancer)		698	39	37
Chromium VI (cancer)	30			30
Chromium VI (noncancer)	4,529		235	223
Cobalt (cancer)	903			903
Cobalt (noncancer)	11,734		1,564	1,380
Copper			3,129	3,129
Fluoride		16,760	4,693	3,666
Iron			23,464	23,463
Lead[b]				
Manganese	28,820		1,877	1,762
Mercury			23	23
Molybdenum			391	391
Nickel			1,564	1,564
Selenium			391	391
Silver			391	391
Strontium			46,929	46,924
Thallium			5.2	5.2
Tin			46,929	46,924
Vanadium			78	78
Zinc			23,464	23,463

Note: Units are in mg/kg.

EPA - U.S. Environmental Protection Agency
PRG - preliminary remediation goal

[a] The screening values listed above are U.S. EPA (2003c) Region 9 PRGs for residential soil. This table is not meant to provide screening concentrations for the DMTS risk assessment. Rather, the PRGs listed above are provided to illustrate the relative contribution of inhalation, dermal contact, and ingestion exposure. The PRGs were derived assuming a risk level of $1x10^{-6}$ for cancer and a hazard quotient of 1.0 for noncancer endpoints. Higher PRGs indicate relatively lower contribution to risk, and vice versa. These PRGs suggest that dermal contact is at least an order of magnitude lower risk than ingestion, and that inhalation is several orders of magnitude lower risk than ingestion.

[b] Lead risks are evaluated using separate models that do not predict a hazard quotient, thus they are not directly comparable to risks from other metals.

Table 2-6. Subsistence resource categories and representative receptors

Subsistence Resource[a]	Inupiat Name[b]	Scientific Name	Representative Receptors
Fish			**Fish**
Bluecod			**Note:** Risk to fish evaluated by comparison of chemical concentrations in sediment and water to effects ranges reported in the literature
Bullhead	kanayuq	*Myoxocephalus quadricornis*	
Burbot/mudshark	tittaaliq	*Lota lota*	
Char (arctic)	aqalukpik	*Salvelinus alpinus*	
Dolly Varden		*Salvelinus malma*	
Grayling (arctic)	suluppaugaq	*Thymallus arcticus*	
Herring (Pacific)	uqsruqtuuq	*Clupea pallasi*	
Pike (northern)	siilik	*Esox lucius*	
Salmon (king)		*Oncorhynchus tshawytscha*	
Salmon (pink)	qalugruaq	*Onchorynchus gorbuscha*	
Salmon (silver)		*Oncorhynchus kisutch*	
Sheefish	sii	*Stenodus leucichthys*	
Smelt (rainbow)	ijhuabniq	*Osmerus mordax dentex*	
Tomcod (arctic cod)	uugaq	*Boreogadus saida*	
Whitefish	qalupiat, quptik, qaalbiq, qalusraaq	*Coregonis* spp., *Prosopium* spp.	
Shellfish			**Shellfish**
Crab	putyuun	*Paralithodes* spp., *Lithodes aequispinus, Cancer magister, Chionoecetes* spp.	**Note:** Risk to shellfish evaluated by comparison of chemical concentrations in sediment and water to effects ranges reported in the literature
Shrimp	putuguqsiuyuk	*Pandalus* spp., *Pandalopsis* spp.	
Sea Mammals			**Sea Mammals**
Seal (bearded)	ugruk	*Erignathus barbatus*	Bearded seal (invertebrate-eater)
Seal (ribbon)	qaigullik	*Phoca fasciata*	Ringed seal (fish- and invertebrate-eater)
Seal (spotted)	qasigiaq	*Phoca largha*	
Walrus	aiviq	*Odobenus rosemarus*	
Whale (Beluga)	sisuaq	*Delphinapterus leucas*	
Whale (bowhead)	abviq	*Balaena mysticetus*	
Large Mammals			**Large Mammals**
Bear (black)	iyyabriq	*Ursus americanus*	Caribou (plant-eater)
Bear (brown/grizzly)	akjaq	*Ursus horribilis*	Moose (plant-eater)
Caribou	tuttu	*Rangifer tarandus*	Polar bear (marine animal-eater)
Moose	tiniikaq	*Alces alces*	
Muskox	imummak	*Ovibus moschatus*	
Sheep (dall)	ipnaiq	*Ovis dalli dalli*	
Small Mammals			**Small Mammals**
Beaver	aqu	*Castor canadensis*	Arctic fox (terrestrial animal-eater)
Fox (arctic)	qujhaaq	*Alopex lagopus*	Muskrat (freshwater plant-eater)
Fox (red)	kavviaq	*Vulpes fulva*	River otter (freshwater fish-eater)
Muskrat	kigvaluk	*Ondatra zibethicus*	Tundra shrew (terrestrial invertebrate-eater)
Otter (river)	pamiuqtuuq	*Lutra canadensis*	Tundra vole (terrestrial plant-eater)
Porcupine	ixuqutaq	*Erethizon dorsatum*	
Rabbit (Alaska hare)	ukallisugruk	*Lepus othus*	
Rabbit (snowshoe hare)	ukalliuraq	*Lepus americanus*	
Squirrel (ground)	siksrik	*Citellus parryi*	
Squirrel (red/tree)	saqalataayiq	*Tamiasciurus hudsonicus*	
Wolverine	qapvik	*Gulo luscus*	
Birds			**Birds**
Crane (sandhill)	tatirgaq	*Grus canadensis*	Black-bellied plover (marine insect-eater)
Ducks	qaugak	Multiple species	Brant (marine plant-eater)
Geese		Multiple species	Common snipe (freshwater invertebrate-eater)
Grouse (spruce)		*Falcipennis canadensis*	Green-winged teal (freshwater plant-eater)
Owl (snowy)	ukpik	*Nyctea scandiaca*	Lapland longspur (terrestrial insect-eater)
Ptarmigan (mountain)			Red-throated loon (freshwater and marine fish-eater)
Ptarmigan (willow)	aqargiq	*Lagopus lagopus*	Snowy owl (terrestrial animal-eater)
Swans (tundra, formerly whistling)	qugruk	*Cygnus columbianus*	Willow ptarmigan (terrestrial plant-eater)

Table 2-6. (cont.)

Subsistence Resource[a]	Inupiat Name[b]	Scientific Name	Representative Receptors
Vegetation			**Vegetation**
Blueberry	asriavik	*Vaccinium uliginosum*	**Note:** Risk to plants evaluated by comparison of chemical concentrations in soil and plants to effects ranges reported in the literature
Coast greens sura (fresh willow leaf)		*Salix* spp.	
Cow parsnip		*Heracleum lanatum (Umbelliferae)*	
Cranberry (bog)	qunmun asriaq	*Vaccinium oxycoccus*	
Cranberry (highbush)	uqpifeaq	*Viburnum edule*	
Cranberry (lowbush)	kikmieeaq	*Vaccinium vitis idaea*	
Crowberry (black berry)	paunbaq	*Empetrum nigrum*	
Eskimo (labrador/tundra) tea		*Ledum decubens*	
Eskimo/wild potato	masru	*Hedysarum alpinum*	
Herbal tea		Species unknown	
Matsu sura		Species unknown	
Raspberry	tuunbaum asriaq	*Rubus pendantus*	
Salmonberry/cloudberry	aqpik	*Rubus chamaemorus*	
Sourdock	quabaq	*Rumex arcticus*	
Spring tea		Species unknown	
Stinkweed		*Thlaspi arvense*	
Wild celery	ikuusuk	*Angelica lucida*	
Wild onions/chives	paatitaaq	*Allium schoenoprasum sibiricum*	
Wild rhubarb	qusrimmak	*Polygonum alaskanum*	
Wild tea		Species unknown	

[a] Sundet (2002a,b, pers. comm.).

[b] Webster and Zibell (2003).

Table 2-7. Summary of preliminary assessment endpoints, representative receptors, and measurement endpoints[a]

Environment	Assessment Endpoint	Representative Receptor	Measurement Endpoint
Terrestrial	Structure and function of **terrestrial plant communities**	Terrestrial plant communities	Range of CoPC concentrations in soil relative to ecological screening benchmarks
Terrestrial	Structure and function of **terrestrial fauna communities**	Soil fauna communities	Range of CoPC concentrations in soil relative to ecological screening benchmarks
Terrestrial	Survival, growth, and reproduction of **terrestrial avian herbivore populations**	Willow ptarmigan	Range of modeled total dietary exposures relative to avian TRVs
Terrestrial	Survival, growth, and reproduction of **terrestrial mammalian herbivore populations**	Tundra vole; caribou; moose	Range of modeled total dietary exposures relative to mammalian TRVs
Terrestrial	Survival, growth, and reproduction of **terrestrial avian invertivore populations**	Lapland longspur	Range of modeled total dietary exposures relative to avian TRVs
Terrestrial	Survival, growth, and reproduction of **terrestrial mammalian invertivore populations**	Tundra shrew	Range of modeled total dietary exposures relative to mammalian TRVs
Terrestrial	Survival, growth, and reproduction of **terrestrial avian carnivore populations**	Snowy owl	Range of modeled total dietary exposures relative to avian TRVs
Terrestrial	Survival, growth, and reproduction of **terrestrial mammalian carnivore populations**	Arctic fox	Range of modeled total dietary exposures relative to mammalian TRVs
Freshwater Aquatic	Structure and function of **freshwater aquatic and wetland plant communities**	Freshwater aquatic and wetland plant communities	Range of CoPC concentrations in freshwater sediment and water relative to ecological screening benchmarks
Freshwater Aquatic	Structure and function of **freshwater aquatic invertebrate communities**	Freshwater aquatic invertebrate communities	Range of CoPC concentrations in freshwater sediment relative to ecological screening benchmarks
Freshwater Aquatic	Structure and function of **freshwater fish communities**	Freshwater fish communities	Range of CoPC concentrations in freshwater relative to ecological screening benchmarks
Freshwater Aquatic	Survival, growth, and reproduction of **freshwater avian herbivore populations**	Green-winged teal	Range of modeled total dietary exposures relative to avian TRVs
Freshwater Aquatic	Survival, growth, and reproduction of **freshwater mammalian herbivore populations**	Muskrat	Range of modeled total dietary exposures relative to mammalian TRVs
Freshwater Aquatic	Survival, growth, and reproduction of **freshwater avian invertivore populations**	Common snipe	Range of modeled total dietary exposures relative to avian TRVs

Table 2-7. (cont.)

Environment	Assessment Endpoint	Representative Receptor	Measurement Endpoint
Freshwater Aquatic	Survival, growth, and reproduction of **freshwater avian piscivore populations**	Red-throated loon	Range of modeled total dietary exposures relative to avian TRVs
Freshwater Aquatic	Survival, growth, and reproduction of **freshwater mammalian piscivore populations**	River otter	Range of modeled total dietary exposures relative to mammalian TRVs
Marine	Structure and function of **marine aquatic and wetland plant communities**	Marine aquatic and wetland plant communities	Range of CoPC concentrations in marine sediment and water relative to ecological screening benchmarks
Marine	Structure and function of **marine aquatic invertebrate communities**	Marine aquatic invertebrate communities	Range of CoPC concentrations in marine sediment and water relative to ecological screening benchmarks
Marine	Structure and function of **marine fish communities**	Marine fish communities	Range of CoPC concentrations in marine water relative to ecological screening benchmarks
Marine	Survival, growth, and reproduction of **marine avian herbivore populations**	Brant	Range of modeled total dietary exposures relative to avian TRVs
Marine	Survival, growth, and reproduction of **marine avian invertivore populations**	Black-bellied plover	Range of modeled total dietary exposures relative to avian TRVs
Marine	Survival, growth, and reproduction of **marine mammalian invertivore populations**	Bearded seal	Range of modeled total dietary exposures relative to mammalian TRVs
Marine	Survival, growth, and reproduction of **marine avian piscivore populations**	Red-throated loon	Range of modeled total dietary exposures relative to avian TRVs
Marine	Survival, growth, and reproduction of **marine mammalian piscivore populations**	Ringed seal	Range of modeled total dietary exposures relative to mammalian TRVs
Marine	Survival, growth, and reproduction of **marine mammalian carnivore populations**	Polar bear	Range of modeled total dietary exposures relative to mammalian TRVs

Note: CoPC - chemical of potential concern
TRV - toxicity reference value

[a] A refined version of this table was developed following CoPC screening and is presented later in this document.

Table 3-1. Target chemical list

Aluminum
Antimony
Arsenic
Barium
Cadmium
Chromium
Cobalt
Copper
Fluoride
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Strontium
Thallium
Tin
Vanadium
Zinc

Table 3-2. Overview of prior studies

Lead Organization	Study Type	Citation	Study Dates	Analytical Data Available						
				Moss	Soil	Water	Sediment	Plants	Fish	Caribou
Pre-Mine/Baseline										
Teck Cominco	Environmental baseline study	Dames & Moore (1983a,b)	1981–1983			●	●		●	
General Crude Oil and Minerals	Environmental baseline study	Ward and Olson (1980)	1978–1979			●			●	
Alaska Department of Environmental Conservation	Aquatic baseline study	EVS and Ott Water (1983)	1982						●	
U.S. Fish and Wildlife Service	Baseline study for Selawik NWR	Mueller et al. (1993)	1987–1988			●	●		●	
Post-Mine										
Teck Cominco	Port site monitoring	ENSR (1990, 1991, 1993, 1996); RWJ (1997)	1990–1996		●	●	●			
	Transportation corridor monitoring	ENSR (1991)	1991–1992		●	●				
	Vegetation and soil monitoring	RWJ (1998)	1992, 1993, 1997		●					
	Fugitive dust study	Exponent (2002a); DEC et al. (2002)	2001	●	●	●		●		
	Kivalina drinking water study	RWJ (1997); ADPH (2001); (Kulas 2003, pers. comm.)	1991–2003			●				
	Supplemental road sampling	Exponent (2002b)	2002		●					
	Caribou evaluation	Exponent (2002e)	1996, 2002							●
	Port site characterization	Exponent (2003c)	2002		●	●	●			
	Phase I risk assessment field sampling program	Exponent (2003e) and Appendix A of this document	2003	●	●	●	●			
Alaska Industrial Development and Export Authority	Sediment quality survey	Cominco et al. (1999)	1998		●		●			
Alaska Department of Environmental Conservation	Subsistence foods investigation	E&E (2002); ADPH (2001)	2001			●		●		
Alaska Department of Fish and Game	NPDES monitoring, expanded scope	Weber-Scannell and Ott (2001)	1994–2001			●			●	
	Juvenile fish tissue study	Morris and Ott (2001); ADPH (2001)	1993, 1998–2001						●	
National Park Service	DMTS road dustfall study	Ford and Hasselbach (2001)	2000	●	●					
		Hasselbach et al. (2005)	2001	●	●					
Kivalina Village	Kivalina drinking water sampling	ADPH (2001)	1995, 1996, 2001			●				
United States Geological Survey	Cape Krusenstern trace elements study	Brabets (2003, pers. comm.)	2002			●	●			
	Willow study	Gough (2003, pers. comm.)	2002					●		
	Soil study	Kelley and Hudson (2003)	2002		●					

Table 3-3. Analytical data summary for screening chemicals of potential concern

				Numbers of Samples by Analyte[a]																				
Environment	Medium	Site/ Reference	Survey Name	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Fluoride	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Strontium	Thallium	Tin	Vanadium	Zinc
Terrestrial	Soil	Site	PHASE1RA, PSCHAR, FUGDST01, SUPPRSS, TECK03	51	40	75	40	478	40	40	40	12	51	479	40	12	40	40	30	40	20	12	27	40	479
		Reference	PHASE1RA, FUGDST01	10	5	10	5	10	5	5	5	5	10	10	5	5	5	5	5	5	5	5	5	5	10
	Tundra Soil	Site	PHASE1RA, PSCHAR, ENSR92	31	25	31	25	224	25	25	25	12	31	264	25	12	25	25	25	25	17	12	17	25	264
		Reference	PHASE1RA	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Stream	Sediment	Site	PHASE1RA	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
		Reference	PHASE1RA	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Water	Site	TECK03, TECK01, USGS02	230	14	14	14	229	18	14	18	31	230	230	18	14	14	14	29	14	14	29	14	14	230
		Reference	PHASE1RA	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Tundra Pond	Sediment	Site	PHASE1RA	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Reference	PHASE1RA	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Water	Site	PHASE1RA	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		Reference	PHASE1RA	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Lagoon	Sediment	Site	PHASE1RA, PSCHAR	8	8	8	8	34	8	8	8	11	8	26	8	8	8	8	8	8	8	8	11	8	26
		Reference	PHASE1RA, PSCHAR, ENSR91, ENSR92, ENSR95, ENSR96	3	3	3	3	13	3	3	3	3	3	28	3	3	3	3	3	3	3	3	3	3	28
	Water	Site	PHASE1RA, PSCHAR	8	8	8	8	14	8	8	8	8	8	14	8	8	8	8	8	8	8	8	8	8	14
		Reference	PHASE1RA, PSCHAR	3	3	3	3	5	3	3	3	3	3	5	3	3	3	3	3	3	3	3	3	3	5
Marine	Sediment	Site	PHASE1RA, PSCHAR, CORPS00, DMTP98	18	17	69	69	129	69	18	69	16	18	129	18	16	18	18	17	69	17	17	17	41	129
		Reference	PHASE1RA, DMTP98, BASLIN82	15	9	21	21	21	21	9	21	9	15	21	9	9	9	15	15	21	9	9	9	9	21
	Water	Site	PHASE1RA	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
		Reference	PHASE1RA	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Note: Survey names and citations:

PHASE1RA	Exponent (2003e) and Appendix A of this document
PSCHAR	Exponent (2003c)
FUGDST01	Exponent (2002a)
SUPPRSS	Exponent (2002b)
TECK03	Teck Cominco (2003a); Hall (2003, pers. comm.)
TECK01	Exponent (2002a)
ENSR91	ENSR (1992)
ENSR92	ENSR (1993)
ENSR95	ENSR (1996)
ENSR96	RWJ (1997)
DMTP98	Cominco et al. (1999)
CORPS00	Corps (2001)
BASLIN82	Dames & Moore (1983a)
USGS02	Brabets (2003, pers. comm.)

[a] The numbers of samples shown are for the data to be used in the assessment, processed according to the data usability criteria listed in Section 3.2 of the main text.

Table 3-4. Statistical comparison of site and reference soil data

	Reference					Site					Site >	*p*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	10	1,640	12,400	6,963	4,351	51	1,180	16,600	7,392	3,281	no	0.38	0.42
Antimony											≥50% ND Site		
Arsenic	10	4.2	35.0	12.6	9.8	75	1.3	93.6	12.2	15.1	no	0.76	0.47
Barium	5	109	622	249	213	40	357	7,090	2,137	1,830	**yes**	0.0002	<0.0001
Cadmium	10	0.24	3.6	1.1	1.1	478	0.40	388	25.2	37.8	**yes**	<0.0001	<0.0001
Chromium	5	4.9	19.3	11.8	5.7	40	4.9	24.0	15.0	5.1	no	0.12	0.16
Cobalt	5	7.3	20.6	13.5	5.1	40	4.2	27.0	11.3	5.0	no	0.86	0.32
Copper	5	14.3	46.5	23.7	13.0	40	9.8	109	36.0	20.3	**yes**[c]	0.067	0.17
Fluoride	5	0.30	0.50	0.42	0.084	12	0.40	1.3	0.73	0.30	**yes**	0.018	0.025
Iron	10	5,750	72,600	29,872	18,432	51	2,650	35,000	20,682	7,572	no	0.99	0.20
Lead	10	8.8	142	38.5	38.5	479	8.5	48,300	1,157	2,795	**yes**	<0.0001	<0.0001
Manganese	5	250	4,080	1,489	1,589	40	280	1,000	513	186	no	0.76	0.0076 [d]
Mercury	5	0.050	0.18	0.11	0.053	12	0.10	1.7	0.45	0.51	**yes**	0.012	0.030
Molybdenum											≥50% ND Site		
Nickel	5	23.5	51.4	34.2	12.6	40	17.3	56.8	29.1	10.0	no	0.80	0.28
Selenium											≥50% ND Site		
Silver	5	0.050	0.25	0.13	0.089	40	0.14	8.3	2.2	2.0	**yes**	0.0004	<0.0001
Strontium	5	9.3	63.6	31.0	21.2	20	36.2	90.1	63.2	15.5	**yes**	0.0054	0.0001
Thallium	5	0.10	0.24	0.16	0.055	12	0.11	1.3	0.47	0.36	**yes**	0.026	0.041
Tin											≥50% ND Site		
Vanadium	5	5.6	19.2	11.9	5.4	40	7.9	31.8	14.7	4.8	**yes**[e]	0.15	0.098
Zinc	10	72.5	753	181	204	479	37.4	64,300	4,140	6,201	**yes**	<0.0001	<0.0001

Note: Concentrations are given in mg/kg dry weight.

Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.

Field replicates were averaged prior to statistical analysis.

ANOVA - analysis of variance
CoPC - chemical of potential concern
ND - not detected

[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p*-values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

Table 3-4. (cont.)

[c] Assumptions of ANOVA model were not met, thus conclusions result from non-parametric *p*-value.

[d] ANOVA *p*-value indicates reference mean is significantly higher than site mean concentration.

[e] Assumptions of ANOVA model were met, thus conclusions result from parametric *p*-value.

Table 3-5. Statistical comparison of site and reference tundra soil data

	Reference					Site					Site >	*p*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	10	368	11,300	3,651	3,347	31	358	18,900	5,329	4,822	no	0.22	0.39
Antimony	10	0.11	0.28	0.17	0.062	25	0.15	25.8	6.2	6.1	[c]	<0.0001	<0.0001
Arsenic	10	0.40	6.8	2.3	1.9	31	0.30	150	17.7	26.6	**yes**	0.0002	0.0003
Barium	10	108	624	315	196	25	53.0	5,810	945	1,306	[c]	0.032	0.10
Cadmium	10	0.12	0.88	0.35	0.22	224	0.30	438	15.3	31.7	**yes**	0.0016	0.0002
Chromium	10	1.6	19.7	6.8	6.1	25	1.0	33.2	10.4	8.7	no	0.19	0.33
Cobalt	10	0.96	28.3	8.6	10.6	25	0.50	35.0	11.0	9.3	[c]	0.14	0.36
Copper	10	4.3	16.9	8.2	4.0	25	2.9	58.3	21.0	15.5	**yes**	0.0027	0.0050
Fluoride											≥50% ND Site		
Iron	10	912	45,100	12,909	13,600	31	593	181,000	26,417	35,855	no[d]	0.095	0.19
Lead	10	2.9	23.3	8.9	6.7	264	7.0	16,000	665	1,816	**yes**	<0.0001	<0.0001
Manganese	10	33.5	6,620	918	2,013	25	28.6	3,400	825	882	[c]	0.078	0.27
Mercury	10	0.070	0.15	0.11	0.026	12	0.10	4.2	0.71	1.2	[c]	0.0003	0.0015
Molybdenum	10	0.34	2.3	0.85	0.60	25	0.59	3.9	1.5	0.91	**yes**	0.0048	0.013
Nickel	10	4.3	36.8	16.2	10.6	25	1.6	37.5	18.7	10.7	no	0.32	0.76
Selenium											≥50% ND Site		
Silver	10	0.020	0.35	0.14	0.13	25	0.040	14.7	2.5	3.3	[c]	<0.0001	<0.0001
Strontium	10	7.3	39.6	16.1	11.3	17	4.8	150	52.2	40.2	**yes**	0.0027	0.0031
Thallium	10	0.024	0.12	0.062	0.032	12	0.014	1.6	0.45	0.50	[c]	0.0031	0.0074
Tin											≥50% ND Site		
Vanadium	10	1.3	24.7	9.7	7.6	25	0.70	46.5	14.5	12.4	[c]	0.19	0.52
Zinc	10	47.8	111	66.1	24.2	264	22.3	82,700	2,127	4,880	**yes**	<0.0001	<0.0001

Note: Concentrations are given in mg/kg dry weight.
Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.
Field replicates were averaged prior to statistical analysis.
ANOVA - analysis of variance
CoPC - chemical of potential concern
ND - not detected

[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p*-values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

[c] Comparison not made because 90 percent confidence interval for the site mean concentration spans zero, due to small sample size and/or high variability.

[d] Assumptions of ANOVA model were met, thus conclusions result from parametric *p*-value.

Table 3-6. Statistical comparison of site and reference stream sediment data

	Reference					Site					Site >	*p* -values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	5	3,620	12,100	6,848	3,652	14	4,080	17,100	7,846	3,560	no	0.27	0.46
Antimony	5	0.030	0.050	0.036	0.0089	14	0.050	0.64	0.20	0.16	**yes**	0.0008	0.0002
Arsenic	5	3.5	8.1	5.1	1.8	14	3.3	11.4	7.8	2.1	**yes**	0.023	0.023
Barium	5	135	483	291	146	14	91.2	922	302	260	no	0.76	0.68
Cadmium	5	0.070	0.30	0.22	0.088	14	0.18	1.4	0.49	0.34	**yes**	0.017	0.030
Chromium	5	7.2	19.9	12.7	5.0	14	7.4	22.6	14.6	4.9	no	0.20	0.46
Cobalt	5	7.3	11.0	9.3	1.4	14	7.9	17.6	12.3	2.9	**yes**	0.013	0.031
Copper	5	6.0	18.5	11.3	4.6	14	9.7	28.2	15.9	4.8	**yes**	0.039	0.041
Fluoride											≥50% ND Site		
Iron	5	21,300	27,300	24,500	2,279	14	22,800	45,700	30,479	5,898	**yes**	0.015	0.030
Lead	5	5.1	9.2	7.6	1.7	14	8.2	142	31.7	44.4	**yes**	0.0013	0.032
Manganese	5	268	859	548	259	14	471	2,140	995	542	**yes**	0.029	0.040
Mercury											≥50% ND Site		
Molybdenum	5	0.28	0.52	0.37	0.094	14	0.34	2.3	0.82	0.54	**yes**	0.0054	0.014
Nickel	5	20.8	35.0	29.7	5.3	14	24.8	57.3	40.4	8.8	**yes**	0.015	0.020
Selenium	5	0.10	0.70	0.44	0.22	14	0.40	2.5	1.2	0.65	**yes**	0.0078	0.0049
Silver	5	0.030	0.12	0.068	0.036	14	0.050	0.42	0.19	0.12	**yes**	0.0087	0.011
Strontium	5	4.9	15.0	11.6	4.1	14	11.0	155	45.5	42.6	**yes**	0.057	0.033
Thallium	5	0.023	0.070	0.050	0.019	14	0.031	0.322	0.10	0.076	**yes**	0.048	0.079
Tin											≥50% ND Site		
Vanadium	5	10.7	24.8	18.2	5.1	14	8.8	27.1	16.7	5.9	no	0.63	0.55
Zinc	5	43.7	69.7	62.4	10.7	14	58.4	259	139	52.0	**yes**	0.0024	0.0004

Note: Concentrations are given in mg/kg dry weight.
Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.
Field replicates were averaged prior to statistical analysis.

ANOVA - analysis of variance
CoPC - chemical of potential concern
ND - not detected

[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p* -values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

Table 3-7. Statistical comparison of site and reference stream surface water data

	Reference					Site					Site >	*P*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	StDev	Reference?[a]	non-para.	parametric
Aluminum	3	17.3	2,770	937	1,588	229	2.5	4,060	90.7	414	no	0.88	0.039 [d]
Antimony											>50%ND Site		
Arsenic											>50%ND Site		
Barium	3	86.1	222	159	68.5	13	12.2	266	88.1	74.8	[c]	0.93	0.15
Cadmium											>50%ND Site		
Chromium											>50%ND Site		
Cobalt	3	0.12	2.7	1.0	1.5	13	0.010	0.33	0.13	0.097	no	0.94	0.067 [d]
Copper	3	0.60	5.4	2.2	2.7	17	0.11	1.2	0.76	0.34	no	0.62	0.17
Fluoride	3	30.0	40.0	36.7	5.8	30	40.0	120	57.3	17.2	**yes**	0.0050	0.010
Iron	3	64.2	6,710	2,295	3,823	229	2.6	10,300	320	1,080	[c]	0.83	0.10
Lead											>50%ND Site		
Manganese	3	4.9	128	46.0	71.0	17	0.48	36.0	6.0	8.3	no	0.90	0.065 [d]
Mercury											>50%ND Site		
Molybdenum	3	0.020	0.17	0.080	0.079	13	0.18	2.3	0.77	0.70	**yes**	0.0052	0.0014
Nickel	3	1.1	10.5	4.5	5.2	13	0.26	6.7	2.1	1.8	no	0.75	0.35
Selenium											100%ND Ref		
Silver											>50%ND Site		
Strontium	3	32.5	81.1	54.9	24.5	13	19.4	172	82.4	57.5	no	0.31	0.65
Thallium											>50%ND Site		
Tin											>50%ND Site		
Vanadium											>50%ND Site		
Zinc											>50%ND Site		

Note: Concentrations are given in μg/L unfiltered.
Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.
Field replicates were averaged prior to statistical analysis.

ANOVA - analysis of variance
CoPC - chemical of potential concern
ND - not detected

[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p*-values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

[c] Comparison not made because 90 percent confidence interval for the site mean concentration spans zero, due to small sample size and/or high variability.

[d] ANOVA *p*-value indicates reference mean is significantly higher than site mean concentration.

Table 3-8. Statistical comparison of site and reference pond sediment data

	Reference					Site					Site >	*p*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	5	3,730	17,100	9,908	5,750	4	1,920	4,330	3,288	1,214	no	0.97	0.039 [d]
Antimony	5	0.030	0.11	0.062	0.036	4	0.19	9.0	2.4	4.4	**yes**	0.0097	0.033
Arsenic	5	2.6	13.0	6.6	4.2	4	2.6	7.5	4.7	2.1	no	0.69	0.53
Barium	5	121	772	430	257	4	281	498	372	95.3	no	0.73	0.96
Cadmium	5	0.27	0.66	0.39	0.16	4	0.93	101	26.2	49.9	**yes**	0.010	0.056
Chromium	5	9.6	28.0	19.4	8.6	4	9.0	13.0	10.3	1.8	no	0.97	0.078 [d]
Cobalt	5	1.8	21.9	10.3	7.4	4	2.7	24.1	14.2	10.7	[c]	0.36	0.70
Copper	5	8.0	20.7	14.8	4.8	4	6.5	45.5	23.4	16.6	no	0.27	0.51
Fluoride											≥50% ND Site		
Iron	5	17,900	43,700	27,140	11,232	4	16,000	51,900	29,300	15,682	no	0.45	0.88
Lead	5	7.5	20.3	11.6	5.0	4	9.0	1,810	484	885	[c]	0.070	0.10
Manganese	5	15.9	1,870	515	766	4	79.8	745	290	312	[c]	0.73	0.98
Mercury	5	0.030	0.070	0.054	0.018	4	0.060	1.1	0.35	0.50	[c]	0.042	0.080
Molybdenum	5	0.38	1.4	0.70	0.40	4	1.1	2.4	1.7	0.66	**yes**	0.033	0.024
Nickel	5	12.0	70.3	39.0	21.0	4	17.6	38.9	27.6	8.7	no	0.86	0.52
Selenium	5	0.50	3.1	1.2	1.1	4	0.75	3.0	1.6	0.97	no	0.14	0.35
Silver											≥50% ND Site		
Strontium	5	4.2	25.4	12.2	8.1	4	17.1	86.0	37.5	32.5	**yes**	0.056	0.053
Thallium	5	0.056	0.17	0.12	0.051	4	0.021	1.6	0.43	0.81	no	0.91	0.74
Tin											≥50% ND Site		
Vanadium	5	14.9	94.5	40.8	31.1	4	12.2	28.3	17.8	7.2	no	0.94	0.11
Zinc	5	23.4	138	76.7	41.7	4	143	21,900	5,623	10,851	**yes**	0.010	0.083

Note: Concentrations are given in mg/kg dry weight.
Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.
Field replicates were averaged prior to statistical analysis.

ANOVA - analysis of variance
CoPC - chemical of potential concern
ND - not detected

[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p*-values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

[c] Comparison not made because 90 percent confidence interval for the site mean concentration spans zero, due to small sample size and/or high variability.

[d] ANOVA *p*-value indicates reference mean is significantly higher than site mean concentration.

Table 3-9. Statistical comparison of site and reference pond surface water data

	Reference					Site					Site >	*p*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	3	14.5	170	91.9	77.8	4	11.4	177	102	73.6	no	0.57	0.91
Antimony	3	0.020	0.10	0.057	0.040	4	0.020	0.20	0.085	0.083	[c]	0.50	0.78
Arsenic	3	0.50	0.90	0.63	0.23	4	0.40	1.3	0.70	0.41	no	0.57	0.93
Barium	3	48.4	133	91.6	42.3	4	39.4	73.6	57.5	17.0	no	0.94	0.23
Cadmium	3	0.0050	0.060	0.038	0.029	4	0.020	0.27	0.10	0.11	[c]	0.18	0.33
Chromium	3	0.18	2.0	0.96	0.92	4	0.44	5.2	2.2	2.1	[c]	0.30	0.33
Cobalt	3	0.19	0.70	0.37	0.29	4	0.13	1.6	0.76	0.61	no	0.30	0.46
Copper	3	0.70	2.5	1.9	1.0	4	0.40	2.7	1.3	0.98	no	0.70	0.48
Fluoride	3	10.0	50.0	26.7	20.8	4	20.0	60.0	32.5	18.9	no	0.29	0.57
Iron	3	361	1,500	808	608	4	685	1,220	1,021	238	no	0.30	0.35
Lead	3	0.060	0.56	0.37	0.27	4	0.44	1.6	0.95	0.52	no	0.11	0.15
Manganese	3	4.2	71.2	32.1	34.9	4	2.9	132	53.5	58.5	[c]	0.57	0.82
Mercury											≥50% ND Site		
Molybdenum	3	0.020	0.22	0.097	0.11	4	0.020	0.090	0.060	0.032	no	0.57	0.84
Nickel	3	2.1	6.4	3.6	2.4	4	3.0	5.3	4.3	1.1	no	0.30	0.44
Selenium											≥50% ND Site		
Silver											≥50% ND Site		
Strontium	3	10.6	27.5	18.7	8.5	4	10.4	422	114	205	no	0.70	0.68
Thallium											≥50% ND Site		
Tin											≥50% ND Site		
Vanadium	3	0.17	2.4	1.2	1.1	4	0.24	0.64	0.37	0.18	no	0.81	0.33
Zinc	3	0.59	5.0	2.8	2.2	4	6.1	99.0	36.7	42.9	[c]	0.026	0.048

Note: Concentrations are given in μg/L unfiltered.
Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.
Field replicates were averaged prior to statistical analysis.

ANOVA - analysis of variance
CoPC - chemical of potential concern
ND - not detected

[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p*-values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

[c] Comparison not made because 90 percent confidence interval for the site mean concentration spans zero, due to small sample size and/or high variability.

Table 3-10. Statistical comparison of site and reference lagoon sediment data

	Reference					Site					Site >	*p*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	3	7,440	14,800	11,147	3,680	8	2,450	14,300	7,574	4,548	no	0.91	0.25
Antimony	3	0.010	0.12	0.077	0.059	8	0.070	0.27	0.16	0.073	**yes**[c]	0.11	0.071
Arsenic	3	2.6	4.9	4.0	1.2	8	5.3	17.9	7.8	4.2	**yes**	0.0093	0.042
Barium	3	164	271	226	55.5	8	54.1	350	234	97.8	no	0.38	0.87
Cadmium	13										≥50% ND Site		
Chromium	3	12.5	24.9	19.6	6.4	8	4.1	27.2	13.8	8.6	no	0.82	0.29
Cobalt	3	5.0	9.7	6.8	2.5	8	3.9	11.8	7.1	2.8	no	0.62	0.96
Copper	3	9.9	18.7	14.7	4.5	8	3.0	28.2	14.2	8.6	no	0.54	0.66
Fluoride	3										≥50% ND Site		
Iron	3	14,000	22,200	19,233	4,546	8	10,100	75,000	27,150	21,985	no	0.62	0.71
Lead	28	2.4	31.0	11.1	6.6	26	4.7	302	44.4	68.8	**yes**	0.0017	0.0008
Manganese	3	75.5	129	99.9	27.1	8	97.9	274	158	55.9	**yes**	0.041	0.069
Mercury	3	0.030	0.060	0.050	0.017	8	0.0040	0.096	0.049	0.032	no	0.38	0.63
Molybdenum	3	0.46	0.98	0.77	0.28	8	0.41	3.4	1.4	1.2	no	0.30	0.48
Nickel	3	18.7	37.0	27.2	9.2	8	12.0	39.0	24.2	10.0	no	0.76	0.58
Selenium	3	0.60	1.4	1.1	0.44	8	0.10	2.2	1.0	0.69	no	0.73	0.58
Silver	3	0.010	0.11	0.067	0.051	8	0.020	0.27	0.12	0.083	no	0.15	0.32
Strontium	3	20.9	40.0	31.9	9.9	8	10.4	108	51.8	32.6	no	0.30	0.53
Thallium	3	0.038	0.10	0.081	0.037	8	0.018	0.18	0.075	0.056	no	0.73	0.65
Tin	3										≥50% ND Site		
Vanadium	3	16.8	31.5	25.2	7.6	8	8.5	35.1	21.7	10.7	no	0.73	0.51
Zinc	28	16.0	371	92.7	63.8	26	36.0	1,590	242	319	**yes**	0.0033	0.0026

Note: Concentrations are given in mg/kg dry weight.
Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.
Field replicates were averaged prior to statistical analysis.

ANOVA - analysis of variance
CoPC - chemical of potential concern
ND - not detected

[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p*-values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

[c] Assumptions of ANOVA model were met, thus conclusions result from parametric *p*-value.

Table 3-11. Statistical comparison of site and reference lagoon surface water data

	Reference					Site					Site >	*p*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	3	53.5	434	182	218	8	19.7	247	81.6	77.6	no	0.91	0.34
Antimony	3	0.11	0.13	0.12	0.010	8	0.19	0.63	0.32	0.15	**yes**	0.0093	0.0059
Arsenic	3	52.9	98.8	76.3	23.0	8	4.5	126	56.2	48.4	no	0.76	0.32
Barium	3	144	168	156	12.0	8	112	413	233	118	no	0.13	0.35
Cadmium	5	0.050	0.26	0.15	0.10	14	0.040	0.30	0.13	0.10	no	0.65	0.66
Chromium	3	6.0	8.2	7.2	1.1	8	1.7	4.5	2.7	1.1	no	0.99	0.0017 [c]
Cobalt	3	3.7	5.4	4.4	0.86	8	0.45	1.4	0.90	0.35	no	0.99	0.0002 [c]
Copper	3	0.40	1.4	0.80	0.53	8	0.50	1.4	0.96	0.29	no	0.27	0.35
Fluoride	3	10.0	20.0	13.3	5.8	8	50.0	200	114	73.3	**yes**	0.0083	0.0010
Iron	3	290	693	427	230	8	200	723	445	211	no	0.62	0.97
Lead	5	0.095	0.85	0.29	0.32	14	0.40	2.3	1.0	0.72	**yes**	0.0091	0.0015
Manganese	3	492	801	598	176	8	13.9	277	84.5	98.3	[d]	0.99	0.0043 [c]
Mercury											≥50% ND Site		
Molybdenum	3	0.070	0.090	0.080	0.010	8	0.30	2.4	1.2	0.85	**yes**	0.0095	0.0009
Nickel	3	9.2	15.2	11.5	3.2	8	3.5	10.6	7.1	2.7	no	0.96	0.077 [c]
Selenium											100% ND Ref.		
Silver	3	0.020	0.030	0.023	0.0058	8	0.010	0.25	0.11	0.092	[d]	0.090	0.14
Strontium	3	991	1,470	1,157	271	8	505	1,850	1,226	546	no	0.46	0.92
Thallium											≥50% ND Site		
Tin											≥50% ND Site		
Vanadium											100% ND Ref.		
Zinc	5	17.0	30.1	21.3	5.3	14	3.1	110	25.1	32.6	no	0.83	0.33

Note: Concentrations are given in µg/L unfiltered, except for cadmium, lead, and zinc, which are µg/L dissolved.
Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.
Field replicates were averaged prior to statistical analysis.

ANOVA - analysis of variance
CoPC - chemical of potential concern
ND - not detected

[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p*-values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

[c] ANOVA *p*-value indicates reference mean is significantly higher than site mean concentration.

[d] Comparison not made because 90 percent confidence interval for the site mean concentration spans zero, due to small sample size and/or high variability.

Table 3-12. Statistical comparison of site and reference marine sediment data

	Reference					Site					Site >	*p*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	15	1,970	8,000	5,043	1,731	18	1,990	6,070	4,700	1,164	no	0.72	0.75
Antimony											≥50% ND Site		
Arsenic	21	5.6	13.0	8.7	1.9	69	3.1	14.5	7.3	1.8	no	1.0	0.0047 [c]
Barium	21	22.0	431	207	100	69	79.5	639	239	98.0	**yes**[d]	0.15	0.048
Cadmium	21	0.020	0.23	0.068	0.044	129	0.020	52.9	1.0	4.7	**yes**	<0.0001	<0.0001
Chromium	21	1.4	18.0	11.9	4.4	69	2.4	33.5	14.6	5.7	**yes**	0.092	0.055
Cobalt	9	4.2	8.7	7.2	1.7	18	3.2	8.9	6.8	1.3	no	0.80	0.57
Copper	21	3.0	10.2	6.4	1.7	69	3.7	34.8	7.8	4.4	**yes**	0.064	0.067
Fluoride	9	0.40	2.0	1.3	0.51	16	0.40	1.5	1.1	0.29	no	0.74	0.55
Iron	15	8,150	22,700	15,149	4,973	18	9,960	19,300	15,987	2,570	no	0.21	0.33
Lead	21	2.7	11.2	5.3	1.7	129	1.6	5,620	58.5	494	[e]	<0.0001	0.0003
Manganese	9	187	389	301	71.7	18	161	363	276	59.6	no	0.77	0.42
Mercury											≥50% ND Site		
Molybdenum	9	0.44	0.83	0.57	0.12	18	0.37	1.4	0.58	0.26	no	0.77	0.77
Nickel	15	9.8	34.8	22.5	7.2	18	11.3	33.3	24.3	6.3	no	0.21	0.43
Selenium											≥50% ND Site		
Silver	21	0.020	0.49	0.12	0.17	69	0.030	2.1	0.50	0.61	**yes**	0.0007	0.013
Strontium	9	13.0	29.0	24.0	5.5	17	24.4	33.8	28.0	2.5	**yes**	0.073	0.018
Thallium	9	0.025	0.052	0.037	0.0096	17	0.026	1.1	0.098	0.27	no	0.66	0.65
Tin											≥50% ND Site		
Vanadium	9	13.0	33.9	22.2	6.6	41	9.1	46.0	27.9	9.7	no[d]	0.045	0.19
Zinc	21	25.0	56.8	42.2	8.5	129	5.5	2,550	87.3	237	**yes**	0.0032	0.070

Note: Concentrations are given in mg/kg dry weight.

Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.

Field replicates were averaged prior to statistical analysis.

ANOVA - analysis of variance

CoPC - chemical of potential concern

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[a] Results of statistical comparison. Bold indicates chemicals for which statistical testing indicated site concentrations to be greater than reference concentrations at a significance level of alpha = 0.10.

[b] *p*-values associated with comparison of site and reference mean concentrations.

Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.

Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

[c] ANOVA *p*-value indicates reference mean is significantly higher than site mean concentration.

[d] Assumptions of ANOVA model were met, thus conclusions result from parametric *p*-value.

[e] Comparison not made because 90 percent confidence interval for the site mean concentration spans zero, due to small sample size and/or high variability.

Table 3-13. Statistical comparison of site and reference marine surface water data

	Reference					Site					Site >	*p*-values[b]	
Chemical	N	Min	Max	Mean	Stdev	N	Min	Max	Mean	Stdev	Reference?[a]	non-para.	parametric
Aluminum	6	25.0	336	170	148	9	25.0	205	102	69.7	no	0.74	0.66
Antimony	6	0.20	1.7	0.70	0.62	9	0.20	1.9	0.64	0.55	no	0.52	0.97
Arsenic	6	1.1	7.5	3.8	2.9	9	1.5	6.0	3.2	1.7	no	0.57	0.91
Barium	6	9.9	38.1	23.2	14.1	9	12.1	39.4	21.3	10.6	no	0.38	0.96
Cadmium	6	2.3	4.7	3.5	1.2	9	1.6	4.6	2.9	1.3	no	0.94	0.34
Chromium											≥50% ND Site		
Cobalt	6	4.0	4.5	4.3	0.17	9	3.9	4.6	4.2	0.22	no	0.76	0.61
Copper											≥50% ND Site		
Fluoride	6	600	800	700	110	9	500	900	733	158	no	0.31	0.75
Iron	6	33.6	643	314	306	9	52.3	375	171	133	no	0.52	0.80
Lead	6	0.76	1.3	0.99	0.18	9	0.80	1.3	1.0	0.21	no	0.48	0.88
Manganese	6	10.1	25.5	17.0	7.3	9	13.1	31.9	19.2	5.9	no	0.34	0.40
Mercury											≥50% ND Site		
Molybdenum	6	8.3	10.6	9.5	0.93	9	8.4	11.0	9.9	1.1	no	0.14	0.47
Nickel											≥50% ND Site		
Selenium	6	0.20	0.50	0.28	0.12	9	0.20	1.0	0.49	0.24	**yes**	0.027	0.047
Silver	6	0.10	0.27	0.18	0.066	9	0.10	0.95	0.40	0.28	**yes**[c]	0.082	0.11
Strontium	6	4,530	5,290	4,900	369	9	4,420	5,600	5,128	444	**yes**[c]	0.088	0.33
Thallium											≥50% ND Site		
Tin											≥50% ND Site		
Vanadium											≥50% ND Site		
Zinc											≥50% ND Site		

Note: Concentrations are given in μg/L unfiltered.
Undetected values are included at one-half the detection limit. In cases where greater than or equal to 50 percent of the site values or 100 percent of the reference values were undetected, statistical analyses were not performed. Further summary information is provided in the CoPC screening tables, including detection limits and detection frequencies.
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[b] *p*-values associated with comparison of site and reference mean concentrations.
Non-para. - Wilcoxon rank-sum one-sided test for determining if the site mean is significantly greater than the reference mean concentration.
Parametric - overall ANOVA model for determining if the site and reference mean concentrations are significantly different (higher or lower).

[c] Assumptions of ANOVA model were not met, thus conclusions result from non-parametric *p*-value.

Table 3-14. Human health screening results for surface soil

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening[a]	Reference Range[b]	Residential Screening Toxicity Value[c]		Frequency of Detected Values Exceeding Criteria	Frequency of Reference Values Exceeding Criteria	Non-Residential Screening Toxicity Value[d]		CoPC Flag (Y/N)	Rationale for Selection or Deletion
All Site Surface Soil																	
	Aluminum	1,180	16,600	mg/kg	RF-05	51/51	--	16,600	1,640–12,400	13,688	N	2/51	0/10	255,500	N	No	REF
	Antimony	0.38 *J*	14.8	mg/kg	CAG-W29	13/40	9.0–51.0	14.8	0.17–0.60	5.5	N	1/40	0/5	102	N	Yes	ASL
	Arsenic	1.3	93.6	mg/kg	CAG-H30	54/75	20.0–102	93.6	4.2–35.0	0.8	C	54/75	10/10	77	C	No	REF
	Barium	357	7,090	mg/kg	RF-07	40/40	--	7,090	109–622	960	N	35/40	0/5	17,885	N	Yes	ASL
	Cadmium	1.0	388 *J*	mg/kg	CAG-H30	430/474	0.70–5.0	388	0.24–3.6	14	N	236/478	0/10	256	N	Yes	ASL
	Chromium	4.9	24.0	mg/kg	RF-05	40/40	--	24.0	4.9–19.3	41	N	0/40	0/5	767	N	No	REF/BSL
	Cobalt	4.2	27.0	mg/kg	RF-05	39/40	10.0	27.0	7.3–20.6	274	N	0/40	0/5	5,110	N	No	REF/BSL
	Copper	9.8	109	mg/kg	RAT5-0NA	40/40	--	109	14.3–46.5	548	N	0/40	0/5	10,220	N	No	BSL
	Fluoride	0.50 *J*	1.3 *J*	mg/kg	RF-16	9/12	0.70	1.3	0.30–0.50	821	N	0/12	0/5	15,330	N	No	BSL
	Iron	2,650	35,000	mg/kg	CAG-W29	51/51	--	35,000	5,750–72,600	4,106	N	49/51	10/10	76,650	N	No	REF
	Lead	13.5	48,300	mg/kg	1007468	467/479	17.0–24.0	48,300	8.8–142	400	N	279/479	0/10	1,000	N	Yes	ASL
	Manganese	280	1,000	mg/kg	170_C1	40/40	--	1,000	250–4,080	329	N	37/40	4/5	6,132	N	No	REF
	Mercury	0.10	1.7	mg/kg	RF-107	12/12	--	1.7	0.050–0.18	2.6	N	0/12	0/5	77	N	No	BSL
	Molybdenum	0.35	3.3	mg/kg	RF-07	16/40	1.8–10.2	3.3	0.27–2.8	68	N	0/40	0/5	1,278	N	No	BSL
	Nickel	17.3	56.8	mg/kg	RC-06-A	40/40	--	56.8	23.5–51.4	270	N	0/40	0/5	5,110	N	No	REF/BSL
	Selenium	0.30 *J*	3.0 *J*	mg/kg	RF-107	12/30	20.0–102	3.0	0.5–1	68	N	0/30	0/5	1,278	N	No	BSL
	Silver	0.14	8.3	mg/kg	RAT5-0NA	21/40	1.8–10.2	8.3	0.050–0.25	68	N	0/40	0/5	1,278	N	No	BSL
	Strontium	36.2	90.1	mg/kg	RF-16	20/20	--	90.1	9.3–63.6	8,213	N	0/20	0/5	153,300	N	No	BSL
	Thallium	0.11	1.3	mg/kg	RF-32	12/12	--	1.3	0.10–0.24	0.9	N	1/12	0/5	17	N	Yes	ASL
	Tin	3.9 *J*	6.0 *J*	mg/kg	RF-27	2/27	4.5–51.0	6.0	ND	8,213	N	0/27	0/5	153,300	N	No	BSL
	Vanadium	7.9	31.8	mg/kg	RF-05	40/40	--	31.8	5.6–19.2	96	N	0/40	0/5	1,789	N	No	BSL
	Zinc	37.4	64,300	mg/kg	CAG-H30	479/479	--	64,300	72.5–753	4,100	N	158/479	0/10	76,650	N	Yes	ASL

Note: All results reported as dry weight.
For the purposes of screening, field replicates have been averaged.
-- - not applicable
C - carcinogenic based on a cancer risk of 1×10^{-6}
CoPC - chemical of potential concern
J - estimated value
N - noncarcinogenic based on hazard quotient of 0.1
ND - not detected

Rationale Codes:
Selection Reason:
ASL - above screening levels
Deletion Reason:
BSL - below screening level
REF - below or consistent with reference levels

[a] The maximum detected soil concentration was used for screening CoPCs.

[b] The reference range corresponds to road material site soil samples from areas not affected by fugitive dust.

[c] Residential screening toxicity values represent arctic zone soil cleanup levels (from 18 AAC 75.341, Table B1) divided by 10. Where no Table B1 value exists, screening values were calculated based on residential formulas and input parameters provided in DEC (2002).

[d] Non-residential screening toxicity values using industrial formulas and input parameters provided in DEC (2000).

Table 3-15. Human health screening results for drinking water ingestion in stream surface water

Scenario Timeframe: Current/Future
Medium: Water
Exposure Medium: Stream Surface Water for Drinking Water Ingestion

Exposure Point	Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening[a]	Reference Range[b]	Screening Toxicity Value[c]		Potential ARAR/TBC Value	Potential ARAR/TBC Source[d]	Frequency of Detected Values Exceeding Criteria	Frequency of Reference Values Exceeding Criteria	CoPC Flag (Y/N)	Rationale for Selection or Deletion
All Site Stream Surface Water																	
	Aluminum	6.5	4,060	µg/L	StrRd	125/229	5.0–62.1	4,060	17.3–2,770	3,650	N	50–200	MCL	2/229	0/3	No	REF
	Antimony	0.14	0.63	µg/L	NHDowRd	6/13	0.13	0.63	ND–0.080	0.60	N	6	MCL	1/13	0/3	Yes	BSL
	Arsenic	ND	ND	µg/L	--	0/13	0.96	ND	ND–2.2	5.0	C	50	MCL	ND	0/3	No	ND/REF[e]
	Barium	12.2	266	µg/L	NHNFUp	13/13	--	266	86.1–222	200	N	2,000	MCL	1/13	1/3	No	REF
	Cadmium	0.030	0.40	µg/L	Various	24/228	0.040–0.50	0.40	ND–0.070	0.5	N	5	MCL	0/228	0/3	No	BSL
	Chromium	ND	ND	µg/L	--	0/17	0.79–0.80	ND	0.17–3.7	10	N	100	MCL	ND	0/3	No	ND/BSL
	Cobalt	0.090	0.33	µg/L	NHRoad	10/13	0.020–0.030	0.33	0.12–2.7	73	N	--	--	0/13	0/3	No	BSL/REF
	Copper	0.30	1.2	µg/L	OmiDowRd	15/17	0.21	1.2	0.60–5.4	130	N	1,300	MCL	0/17	0/3	No	BSL/REF
	Fluoride	40.0	120	µg/L	NHRoad	26/30	100	120	30.0–40.0	219,000	N	--	--	0/30	0/3	No	BSL
	Iron	6.0	10,300	µg/L	StrRd	185/229	5.1–50.0	10,300	64.2–6,710	1,095	N	300	MCL	11/229	1/3	No	REF
	Lead	0.018	7.3	µg/L	StrDowRd	84/229	0.040–0.80	7.3	0.020–1.9	1.5	N	15	MCL	5/229	1/3	Yes	ASL
	Manganese	0.72	36.0	µg/L	MudLkCr	16/17	0.95	36.0	4.9–128	87.6	N	50	MCL	0/17	1/3	No	BSL/REF[e]
	Mercury	ND	ND	µg/L	--	0/13	0.036	ND	ND	0.2	N	2	MCL	ND	ND	No	ND/BSL
	Molybdenum	0.37	2.3	µg/L	NHDowRd	9/13	0.36–0.48	2.3	ND–0.17	18.25	N	--	--	0/13	0/3	No	BSL
	Nickel	0.26	6.7	µg/L	NHRoad	13/13	--	6.7	1.1–10.5	10	N	100	MCL	0/13	1/3	No	BSL/REF
	Selenium	0.067	1.2	µg/L	TutMth	14/28	0.04	1.2	ND	5	N	50	MCL	0/28	ND	No	BSL
	Silver	ND	ND	µg/L	--	0/13	0.046	ND	ND–0.03	18	N	100	MCL	ND	0/3	No	ND/BSL
	Strontium	19.4	172	µg/L	NHDowRd	13/13	--	172	32.5–81.1	2,190	N	--	--	0/13	0/3	No	BSL/REF
	Thallium	0.040	0.55	µg/L	AufRd	4/28	0.031–0.29	0.55	ND–0.014	0.2	N	2	MCL	1/28	0/3	Yes	ASL
	Tin	1.2	5.3	µg/L	OmiNFUp	5/13	1.2	5.3	ND	2,190	N	--	--	0/13	ND	No	BSL
	Vanadium	0.67	0.93	µg/L	ARC-U	4/13	0.67	0.93	0.16–5.6	26	N	--	--	0/13	0/3	No	BSL/REF[e]
	Zinc	1.0	60.1	µg/L	TutDowRd	106/229	1.0–10.0	60.1	0.31–9.8	1,100	N	5,000	MCL	0/229	0/3	No	BSL

Note: All results reported as unfiltered.
For the purposes of screening, field replicates have been averaged.

-- - not applicable
ARAR - applicable or relevant and appropriate requirement
C - carcinogenic based on a cancer risk of 1×10^{-6}
CoPC - chemical of potential concern
J - estimated value
MCL - maximum contaminant level
N - noncarcinogenic based on hazard quotient of 0.1
ND - not detected
TBC - to be considered

Rationale Codes:

Selection Reason:
ASL - above screening levels

Deletion Reason:
BSL - below screening level
ND - not detected in any site sample
REF - below or consistent with reference levels

[a] The maximum detected stream surface water concentration was used for screening CoPCs.

[b] The reference range corresponds to stream surface water samples taken from areas not affected by fugitive dust.

[c] Screening toxicity values represent arctic zone drinking water cleanup levels (from 18 AAC 75.345, Table C) divided by 10. Where no Table C value exists, screening values were calculated based on residential drinking water formulas and input parameters provided in DEC (2002).

[d] An ARAR listed as an MCL is a maximum contaminant level derived by EPA, and is considered protective of the water body for use as the sole domestic drinking water source.

[e] The maximum site concentration of the analyte was less than the maximum reference concentration.

Table 3-16. Human health screening results for fish consumption in stream surface water

Scenario Timeframe: Current/Future
Medium: Water
Exposure Medium: Stream Surface Water for Fish Consumption

Exposure Point	Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening[a]	Reference Range[b]	Screening Toxicity Value[c]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[d]	Frequency of Detected Values Exceeding Criteria	Frequency of Reference Values Exceeding Criteria	CoPC Flag (Y/N)	Rationale for Selection or Deletion
All Site Stream Surface Water																
	Aluminum	6.5	4,060	µg/L	StrRd	125/229	5.0–62.1	4,060	17.3–2,770	--	--	--	--	--	No	REF
	Antimony	0.14	0.63	µg/L	NHDowRd	6/13	0.13	0.63	ND–0.080	1.4 N	--	--	0/13	0/3	No	BSL
	Arsenic	ND	ND	µg/L	--	0/13	0.96	ND	ND–2.2	0.018 C	0.00982	WDOE	ND	1/3	No	ND/REF[e]
	Barium	12.2	266	µg/L	NHNFUp	13/13	--	266	86.1–222	--	--	--	--	--	No	REF
	Cadmium	0.030	0.40	µg/L	Various	24/228	0.040–0.50	0.40	ND–0.070	--	5.06	WDOE	--	--	No	BWC
	Chromium	ND	ND	µg/L	--	0/17	0.79–0.80	ND	0.17–3.7	--	203	WDOE	--	--	No	ND/BWC
	Cobalt	0.090	0.33	µg/L	NHRoad	10/13	0.020–0.030	0.33	0.12–2.7	--	--	--	--	--	No	REF
	Copper	0.30	1.2	µg/L	OmiDowRd	15/17	0.21	1.2	0.60–5.4	130 N	2,660	WDOE	0/17	0/3	No	BSL/REF
	Fluoride	40.0	120	µg/L	NHRoad	26/30	100	120	30.0–40.0	--	--	--	--	--	No	NSC
	Iron	6.0	10,300	µg/L	StrRd	185/229	5.1–50.0	10,300	64.2–6,710	--	--	--	--	--	No	REF
	Lead	0.018	7.3	µg/L	StrDowRd	84/229	0.040–0.80	7.3	0.020–1.9	--	--	--	--	--	No	NSC
	Manganese	0.72	36.0	µg/L	MudLkCr	16/17	0.95	36.0	4.9–128	5 N	--	--	--	--	No	REF[e]
	Mercury	ND	ND	µg/L	--	0/13	0.036	ND	ND	0.005 N	--	--	--	--	No	ND
	Molybdenum	0.37	2.3	µg/L	NHDowRd	9/13	0.36–0.48	2.3	ND–0.17	--	--	--	--	--	No	NSC
	Nickel	0.26	6.7	µg/L	NHRoad	13/13	--	6.7	1.1–10.5	61 N	1,100	WDOE	0/13	1/3	No	BSL/REF
	Selenium	0.067	1.2	µg/L	TutMth	14/28	0.040	1.2	ND	17 N	--	--	0/28	ND	No	BSL
	Silver	ND	ND	µg/L	--	0/13	0.046	ND	ND–0.03	--	6,480	WDOE	--	--	No	ND/BWC
	Strontium	19.4	172	µg/L	NHDowRd	13/13	--	172	32.5–81.1	--	--	--	--	--	No	REF
	Thallium	0.040	0.55	µg/L	AufRd	4/28	0.031–0.29	0.55	ND–0.014	0.17 N	1.56	WDOE	3/28	0/3	Yes	ASL
	Tin	1.2	5.3	µg/L	OmiNFUp	5/13	1.2	5.3	ND	--	--	--	--	--	No	NSC
	Vanadium	0.67	0.93	µg/L	ARC-U	4/13	0.67	0.93	0.16–5.6	--	--	--	--	--	No	REF[e]
	Zinc	1.0	60.1	µg/L	TutDowRd	106/229	1.0–10.0	60.1	0.31–9.8	910 N	16,500	WDOE	0/229	0/3	No	BSL

Note: All results reported as unfiltered.
For the purposes of screening, field replicates have been averaged.

-- - not applicable
ARAR - applicable or relevant and appropriate requirement
AWQC - Alaska water quality criteria
C - carcinogenic based on a cancer risk of 1×10^{-6}
CoPC - chemical of potential concern
J - estimated value
N - noncarcinogenic based on hazard quotient of 0.1
ND - not detected
TBC - to be considered
WDOE - Washington State Department of Ecology

Rationale Codes:

Selection Reason:
ASL - above screening levels

Deletion Reason:
BSL - below screening level
BWC - no AWQC available, but below WDOE surface water criteria for bioaccumulation in fish
ND - not detected in any site sample
NSC - no screening criteria
REF - below or consistent with reference levels

[a] The maximum detected stream surface water concentration was used for screening CoPCs.

[b] The reference range corresponds to stream surface water samples taken from areas not affected by fugitive dust.

[c] Screening toxicity values represent the AWQC protective for human consumption of fish/shellfish and domestic drinking water usage from the water body (DEC 2003a). The AWQC were modified, when necessary, to assume a target hazard quotient of 0.1. The arsenic screening toxicity value is a federal ambient water quality criteria (U.S. EPA 2002c) and assumes a target risk of 10^{-6}. The ARAR represents the Washington State cleanup level for surface water and is protective of bioaccumulation into, and human consumption of, seafood (WDOE 1996).

[d] The ARARs represent the Washington State Department of Ecology cleanup level for surface water and are protective of bioaccumulation into, and human consumption of, fish (WDOE 1996).

[e] The maximum site concentration of the analyte was less than the maximum reference concentration.

Table 3-17. Human health screening results for lagoon water

Scenario Timeframe: Current/Future
Medium: Lagoon Water
Exposure Medium: Lagoon Water

Exposure Point	Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening[a]	Reference Range[b]	Screening Toxicity Value[c]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[d]	Frequency of Detected Values Exceeding Criteria	Frequency of Reference Values Exceeding Criteria	CoPC Flag (Y/N)	Rationale for Selection or Deletion
Lagoon Water																
	Aluminum	19.7	247	µg/L	IP-04	8/8	--	247	53.5–434	--	--	--	--	--	No	REF
	Antimony	0.19	0.63	µg/L	PLNL	8/8	--	0.63	0.11–0.13	430 N	--	--	0/8	0/3	No	BSL
	Arsenic	4.5	126	µg/L	IP-04	8/8	--	126	52.9–98.8	0.14 C	0.00982	WDOE	8/8	3/3	No	REF
	Barium	112	413	µg/L	PLNL	8/8	--	413	144–168	--	--	--	--	--	No	REF
	Cadmium	0.040 *J*	0.30	µg/L	NLH	11/14	0.10	0.30	ND–0.26	--	5.06	WDOE	--	--	No	REF/BWC
	Chromium	1.7	4.5	µg/L	IP-04	8/8	--	4.5	6.0–8.2	--	203	WDOE	--	--	No	REF/BWC
	Cobalt	0.45	1.4	µg/L	PLNL	8/8	--	1.4	3.7–5.4	--	--	--	--	--	No	REF
	Copper	0.50 *J*	1.4	µg/L	IP-03	8/8	--	1.4	0.40–1.4	--	2,660	WDOE	--	--	No	REF/BWC
	Fluoride	50.0 *J*	200	µg/L	IP-01,IP-02,IP-04	8/8	--	200	ND–20.0	--	--	--	--	--	No	NSC
	Iron	200	723	µg/L	PLNN	8/8	--	723	290–693	--	--	--	--	--	No	REF
	Lead	0.40	2.3	µg/L	PLNP	14/14	--	2.3	0.10–0.85	--	--	--	--	--	No	NSC
	Manganese	13.9	277	µg/L	PLNN	8/8	--	277	492–801	10 N	--	--	--	--	No	REF[e]
	Mercury	ND	ND	µg/L	ND	0/8	0.10	ND	ND	0.005 N	--	--	--	--	No	ND
	Molybdenum	0.30	2.4	µg/L	IP-04	8/8	--	2.4	0.070–0.090	--	--	--	--	--	No	NSC
	Nickel	3.5	10.6	µg/L	IP-01	8/8	--	10.6	9.9–15.2	460 N	1,100	WDOE	0/8	0/3	No	REF/BSL
	Selenium	0.30 *J*	0.60 *J*	µg/L	PLNN	5/8	0.30	0.60	ND	1,100 N	--	--	0/8	0/3	No	BSL
	Silver	0.010 *J*	0.25	µg/L	PLNL	7/8	0.10	0.25	0.020–0.030	--	6,480	WDOE	--	--	No	BWC
	Strontium	505	1,850	µg/L	PLNN	8/8	--	1,850	991–1,470	--	--	--	--	--	No	REF
	Thallium	0.0070 *J*	0.070 *J*	µg/L	NLF,PLNL	4/8	).025-0.05(	0.070	0.0060–0.009(	0.63 N	1.56	WDOE	0/8	0/3	No	BSL
	Tin	23.7 *J*	23.7 *J*	µg/L	NLF	1/8	20.0	23.7	ND	--	--	--	--	--	No	NSC
	Vanadium	0.22	0.85 *J*	µg/L	IP-04	5/8	0.35-0.70	0.85	ND	--	--	--	--	--	No	NSC
	Zinc	3.1 *J*	110	µg/L	NLH	14/14	--	110	17.0–30.1	6,900 N	16,500	WDOE	0/14	0/3	No	REF/BSL

Note: All results reported as unfiltered.
For the purposes of screening, field replicates have been averaged.

-- - not applicable
ARAR - applicable or relevant and appropriate requirement
AWQC - ambient water quality criteria
C - carcinogenic based on a cancer risk of 1×10^{-6}
CoPC - chemical of potential concern
J - estimated value
N - noncarcinogenic based on hazard quotient of 0.1
ND - not detected
TBC - to be considered
WDOE - Washington State Department of Ecology

Rationale Codes:

Selection Reason:
ASL - above screening levels

Deletion Reason:
BSL - below screening level
BWC - no AWQC available, but below WDOE surface water criteria for bioaccumulation in fish
ND - not detected in any site sample
NSC - no screening criteria
REF - below or consistent with reference levels

[a] The maximum detected lagoon surface water concentration was used for screening CoPCs.

[b] The reference range corresponds to lagoon surface water samples taken from areas not affected by fugitive dust.

[c] Screening toxicity values represent the AWQC protective for human consumption of fish/shellfish and domestic drinking water usage from the water body (DEC 2003a). The AWQC were modified, when necessary, to assume a target hazard quotient of 0.1. The arsenic screening toxicity value is a federal ambient water quality criterion (U.S. EPA 2002c) and assumes a target risk of 10^{-6}. The ARAR represents the Washington State cleanup level for surface water and is protective of bioaccumulation into, and human consumption of, seafood (WDOE 1996).

[d] The ARARs represent the Washington State Department of Ecology cleanup level for surface water and are protective of bioaccumulation into, and human consumption of, fish (WDOE 1996).

[e] The maximum site concentration of the analyte was less than the maximum reference concentration.

Table 3-18. Human health screening results for marine surface water

Scenario Timeframe: Current/Future
Medium: Marine Water
Exposure Medium: Marine Surface Water

Exposure Point	Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening[a]	Reference Range[b]	Screening Toxicity Value[c]	Potential ARAR/TBC Value	Potential ARAR/TBC Source[d]	Frequency of Detected Values Exceeding Criteria	Frequency of Reference Values Exceeding Criteria	CoPC Flag (Y/N)	Rationale for Selection or Deletion
Marine Water																
	Aluminum	43.0	205	µg/L	NML	8/9	50	205	ND–336	--	--	--	--	--	No	REF
	Antimony	0.30 *J*	1.9 *J*	µg/L	NML	5/9	0.40–0.80	1.9	ND–1.7	430 N	--	--	0/9	0/6	No	REF/BSL
	Arsenic	1.5 *J*	6.0 *J*	µg/L	NMAA	7/9	5.0	6.0	ND–7.5	0.14 C	0.00982	WDOE	7/9	5/6	No	REF
	Barium	12.1	39.4	µg/L	NMK	9/9	--	39.4	9.9–38.1	--	--	--	--	--	No	REF
	Cadmium	1.6	4.6	µg/L	NML	9/9	--	4.6	2.3–4.7	--	5.06	WDOE	--	--	No	REF/BWC
	Chromium	ND	ND	µg/L	--	0/9	2.0–3.0	ND	ND	--	203	WDOE	--	--	No	ND/BSL
	Cobalt	3.9	4.6	µg/L	NMG	9/9	--	4.6	4.0–4.5	--	--	--	--	--	No	REF
	Copper	1.0	3.6	µg/L	NML	4/9	8.0	3.6	ND–2.6	--	2,660	WDOE	--	--	No	BWC
	Fluoride	500	900	µg/L	NMAA, NMG, NML	9/9	--	900	600–800	--	--	--	--	--	No	REF
	Iron	52.3	375	µg/L	NMAA	9/9	--	375	33.6–643	--	--	--	--	--	No	REF
	Lead	0.80 *J*	1.3	µg/L	NMAA	9/9	--	1.3	0.76–1.3	--	--	--	--	--	No	REF
	Manganese	13.1	31.9	µg/L	NMK	9/9	--	31.9	10.1–25.5	10 N	--	--	--	--	No	REF
	Mercury	ND	ND	µg/L	--	0/9	0.10	ND	ND	0.005 N	--	--	--	--	No	ND/BSL
	Molybdenum	8.4	11.0	µg/L	NMAA, NMG, NML	9/9	--	11.0	8.3–10.6	--	--	--	--	--	No	REF
	Nickel	ND	ND	µg/L	--	0/9	3.0–20.0	ND	ND	460 N	1,100	WDOE	0/9	0/6	No	ND/BSL
	Selenium	0.30 *J*	1.0 *J*	µg/L	NMG	8/9	0.30	1.0	ND–0.50	1,100 N	--	--	0/9	0/6	No	BSL
	Silver	0.40	0.95	µg/L	NMAA	5/9	0.20–0.40	0.95	ND–0.27	--	6,480	WDOE	--	--	No	BWC
	Strontium	4,420	5,600 *J*	µg/L	NMG, NML	9/9	--	5,600	4,530–5,290	--	--	--	--	--	No	NSC
	Thallium	0.090 *J*	0.090 *J*	µg/L	NMAA	1/9	0.10–0.20	0.090	ND–0.13	0.63 N	1.56	WDOE	0/9	0/6	No	BSL/REF[e]
	Tin	23.3 *J*	23.3 *J*	µg/L	NMAA	1/9	6.0–20.0	23.3	ND–26.4	--	--	--	--	--	No	REF[e]
	Vanadium	4.4 *J*	5.3 *J*	µg/L	NMK	2/9	2.8–4.0	5.3	ND–8.4	--	--	--	--	--	No	REF[e]
	Zinc	ND	ND	µg/L	--	0/9	2.0	ND	ND	6,900 N	16,500	WDOE	0/9	0/6	No	ND/BSL

Note: All results reported as unfiltered.
For the purposes of screening, field replicates have been averaged.

-- - not applicable
ARAR - applicable or relevant and appropriate requirement
AWQ - ambient water quality criteria
C - carcinogenic based on a cancer risk of 1×10^{-6}
CoPC - chemical of potential concern
J - estimated value
N - noncarcinogenic based on hazard quotient of 0.1
ND - not detected
TBC - to be considered
WDO - Washington State Department of Ecology

Rationale Codes:

Selection Reason:
ASL - above screening levels

Deletion Reason:
BSL - below screening level
BWC - no AWQC available, but below WDOE surface water criteria for bioaccumulation in fish
ND - not detected in any site sample
REF - below or consistent with reference levels

[a] The maximum detected marine surface water concentration was used for screening CoPCs.

[b] The reference range corresponds to marine surface water samples taken from areas not affected by fugitive dust.

[c] Screening toxicity values represent the AWQC protective for human consumption of fish/shellfish and domestic drinking water usage from the water body (DEC 2003a). The AWQC were modified, when necessar a target hazard quotient of 0.1. The arsenic screening toxicity value is a federal ambient water quality criterion (U.S. EPA 2002c) and assumes a target risk of 10^{-6}. The ARAR represents the Washington State cle surface water and is protective of bioaccumulation into, and human consumption of, seafood (WDOE 1996).

[d] The ARARs represent the Washington State Department of Ecology cleanup level for surface water and are protective of bioaccumulation into, and human consumption of, fish (WDOE 1996).

[e] The maximum site concentration of the analyte was less than the maximum reference concentration.

Table 3-19. Ecological screening results for tundra soil

Analyte	Detection Frequency	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Detection Limits (mg/kg)	Reference Concentration		Ecological Screening Benchmark			Detection Frequency Above Benchmark[a]		
					Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	ORNL Terrestrial Plants[b] (mg/kg)	ORNL Earthworms[c] (mg/kg)	ORNL Soil Microorganisms[c] (mg/kg)	ORNL Terrestrial Plants	ORNL Earthworms	ORNL Soil Microorganisms
Aluminum	32/32	358	18,900	-	368	11,300	50	--	600	32/32	--	29/32
Antimony	14/26	0.15	25.8	7-29	0.11	0.28	5	--	--	3/26	--	--
Arsenic	17/32	0.3	150	19–58	0.4	6.8	10	60	100	6/32	1/32	1/32
Barium	26/26	53	5,810	-	108	624	500	--	3,000	13/26	--	3/26
Cadmium	132/231	0.53	438	0.6–4.3	0.12	0.88	4	20	20	85/231	51/231	51/231
Chromium	24/26	1.03	33.2	5.8	1.57	19.7	1	0.4	10	24/26	24/26	9/26
Cobalt	25/26	0.5	35	5.8	0.96	28.3	20	--	1,000	4/26	--	0/26
Copper	26/26	2.88	58.3	-	4.34	16.9	100	50	100	0/26	3/26	0/26
Fluoride	1/13	3.8	3.8	0.7	0.4 [d]	0.4 [d]	200	--	30	0/13	--	0/13
Iron	32/32	593	181,000	-	912	45,100	--	--	200	--	--	32/32
Lead	175/271	12.1	16,000	14–110.9	2.9	23.3	50	500	900	122/271	54/271	43/271
Manganese	26/26	28.6	3,400	-	33.5	6,620	500	--	100	16/26	--	23/26
Mercury	13/13	0.1	4.16	-	0.07	0.15	0.3	0.1	30	6/13	12/13	0/13
Molybdenum	14/26	0.59	3.9	1.5–5.8	0.34	2.27	2	--	200	4/26	--	0/26
Nickel	25/26	1.58	37.5	11.5	4.33	36.8	30	200	90	6/26	0/26	0/26
Selenium	13/26	0.3	3.3	15–58	0.4	1	1	70	100	6/26	0/26	0/26
Silver	17/26	0.04	14.7	1.5–5.8	0.07	0.35	2	--	50	6/26	--	0/26
Strontium	18/18	4.8	150	-	7.3	39.6	--	--	--	--	--	--
Thallium	13/13	0.014	1.58	-	0.024	0.116	1	--	--	3/13	--	--
Tin	6/18	7.7	14	4.2–29	5	17.4	50	--	2,000	0/18	--	0/18
Vanadium	25/26	0.7	46.5	5.8	1.3	24.7	2	--	20	22/26	--	7/26
Zinc	271/271	15	82,700	-	47.8	111	50	200	100	244/271	135/271	181/271

Note: Field duplicates were screened separately.

- \- detected in all samples
-- \- no benchmark
ORNL \- Oak Ridge National Laboratory

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] Efroymson et al. (1997a).

[c] Efroymson et al. (1997b).

[d] Undetected; value listed is one-half of the detection limit.

Table 3-20. Ecological screening results for stream sediment

					Reference Concentration		Ecological Screening Benchmark			Detection Frequency Above Benchmark[a]		
Analyte	Detection Frequency	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Detection Limits (mg/kg)	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Threshold Effect Concentration[b] (mg/kg)	Probable Effect Concentration[b] (mg/kg)	No Effect Concentration[c] (mg/kg)	Threshold Effect Concentration	Probable Effect Concentration	No Effect Concentration
Aluminum	15/15	4,080	17,100	-	3,620	12,100	--	--	73,000	--	--	0/15
Antimony	15/15	0.05	0.64	-	0.03	0.05	--	--	--	--	--	--
Arsenic	15/15	3.3	11.4	-	3.5	8.1	9.79	33	100	1/15	0/15	0/15
Barium	15/15	91.2	922	-	135	483	--	--	--	--	--	--
Cadmium	15/15	0.18	1.38	-	0.07	0.3	0.99	4.98	8	1/15	0/15	0/15
Chromium	15/15	7.35	23.3	-	7.22	19.9	43.4	111	95	0/15	0/15	0/15
Cobalt	15/15	7.9	17.6	-	7.3	11	--	--	--	--	--	--
Copper	15/15	9.66	28.2	-	5.99	18.5	31.6	149	580	0/15	0/15	0/15
Fluoride	0/15	0.95 [d]	1.2 [d]	1.9–2.3	1.2 [d]	1.2 [d]	--	--	--	--	--	--
Iron	15/15	22,800	45,700	-	21,300	27,300	--	--	290,000	--	--	0/15
Lead	15/15	8.24	142	-	5.05	9.17	35.8	128	130	2/15	2/15	1/15
Manganese	15/15	471	2140	-	268	859	--	--	4,500	--	--	0/15
Mercury	15/15	0.02	0.089	-	0.02	0.04	0.18	1.06	--	0/15	0/15	--
Molybdenum	15/15	0.34	2.32	-	0.28	0.52	--	--	--	--	--	--
Nickel	15/15	24.8	57.3	-	20.8	35	22.7	48.6	43	15/15	1/15	7/15
Selenium	15/15	0.4	2.5	-	0.4	0.7	--	--	--	--	--	--
Silver	15/15	0.05	0.42	-	0.03	0.12	--	--	--	--	--	--
Strontium	15/15	11	155	-	4.9	15	--	--	--	--	--	--
Thallium	15/15	0.031	0.322	-	0.023	0.07	--	--	--	--	--	--
Tin	4/15	4.3	7.6	1–5	2 [d]	2.4 [d]	--	--	--	--	--	--
Vanadium	15/15	8.83	28.1	-	10.7	24.8	--	--	--	--	--	--
Zinc	15/15	58.4	259	-	43.7	69.7	121	459	1,300	7/15	0/15	0/15

Note: Field duplicates were screened separately.

- - detected in all samples
-- - no benchmark

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] MacDonald et al. (2000).

[c] Ingersoll et al. (1996).

[d] Undetected; value listed is one-half of the detection limit.

Table 3-21. Ecological screening results for stream surface water

Analyte	Detection Frequency	Minimum Detected Concentration (µg/L unfiltered)	Maximum Detected Concentration (µg/L unfiltered)	Detection Limits (µg/L)	Reference Concentration: Minimum Detected Concentration (µg/L unfiltered)	Reference Concentration: Maximum Detected Concentration (µg/L unfiltered)	Ecological Screening Benchmark: Freshwater Criteria Continuous Concentration[b] (µg/L total recoverable)	Ecological Screening Benchmark: Freshwater Criterion Maximum Concentration[b] (µg/L total recoverable)	Detection Frequency Above Benchmark[a]: Freshwater Criteria Continuous Concentration	Detection Frequency Above Benchmark[a]: Freshwater Criterion Maximum Concentration
Hardness	231/231	11,300	211,000	-	56,000	112,000	--	--	--	--
Aluminum	126/230	6.45	4060	5.04–62.1	17.3	2,770	87	750	29/230	3/230
Antimony	6/14	0.14	0.63	0.126	0.08	0.08	--	--	--	--
Arsenic	0/14	0.482 [c]	0.482 [c]	0.964	2.2	2.2	150	340	0/14[d]	0/14[d]
Barium	14/14	12.2	266	-	86.1	222	--	--	--	--
Cadmium	24/229	0.03	0.8	0.04–0.5	0.01	0.07	0.05–0.47 (0.27)[e]	0.23–4.6 (2.1)[e]	3/229	0/229
Chromium	0/18	0.396 [c]	0.4 [c]	0.791–0.8	0.17	3.71	11	16	0/18[d]	0/18[d]
Cobalt	11/14	0.03	0.33	0.02–0.03	0.12	2.72	--	--	--	--
Copper	16/18	0.3	1.23	0.21	0.6	5.4	1.4–18 (9.4)[e]	1.8–28 (14)[e]	0/18	0/18
Fluoride	27/31	40	120	100	30	40	--	--	--	--
Iron	186/230	6	10300	5.13–50	64.2	6,710	1,000	--	12/230	--
Lead	84/230	0.018	7.34	0.04–0.802	0.02	1.91	0.20–8.2 (3.2)[e]	5.1–211 (82)[e]	22/230	0/230
Manganese	17/18	0.56	36	0.95	4.87	128	--	--	--	--
Mercury	0/14	0.0179 [c]	0.0179 [c]	0.0358	0.05 [c]	0.05 [c]	0.91	1.6	0/14[d]	0/14[d]
Molybdenum	9/14	0.37	2.27	0.355–0.48	0.05	0.17	--	--	--	--
Nickel	14/14	0.26	6.71	-	1.06	10.5	8.2–98 (52)[e]	74–882 (470)[e]	0/14	0/14
Selenium	15/29	0.0666	1.24	0.0402	0.2 [c]	0.2 [c]	5.0	--	0/29	--
Silver	0/14	0.023 [c]	0.023 [c]	0.046	0.03	0.03	--	0.09–14 (3.8)[e]	--	0/14[d]
Strontium	14/14	19.4	172	-	32.5	81.1	--	--	--	--
Thallium	4/29	0.04	0.55	0.031–0.29	0.014	0.014	--	--	--	--
Tin	5/14	1.3	5.33	1.18	10 [c]	10 [c]	--	--	--	--
Vanadium	4/14	0.67	0.93	0.669	0.16	5.57	--	--	--	--
Zinc	107/230	1	60.1	1–10	0.31	9.84	19–226 (120)[e]	19–226 (120)[e]	1/230	1/230

Note: Field duplicates were screened separately.

- - detected in all samples
-- - no benchmark

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] U.S. EPA (2002c).

[c] Undetected; value listed is one-half of the detection limit.

[d] Undetected in all samples. Undetected values expressed as one-half of the detection limit are below the screening benchmark.

[e] Water quality criteria for this metal is hardness-dependent. The range shown was calculated using the minimum and maximum hardness values for stream surface water. EPA provides a default water quality criteria based on a hardness of 100 mg/L $CaCO_3$. This value is presented in parentheses.

Table 3-22. Ecological screening results for tundra pond sediment

Analyte	Detection Frequency	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Detection Limits (mg/kg)	Reference Concentration: Minimum Detected Concentration (mg/kg)	Reference Concentration: Maximum Detected Concentration (mg/kg)	Ecological Screening Benchmark: Threshold Effect Concentration[b] (mg/kg)	Ecological Screening Benchmark: Probable Effect Concentration[b] (mg/kg)	Ecological Screening Benchmark: No Effect Concentration[c] (mg/kg)	Detection Frequency Above Benchmark[a]: Threshold Effect Concentration	Detection Frequency Above Benchmark[a]: Probable Effect Concentration	Detection Frequency Above Benchmark[a]: No Effect Concentration
Aluminum	5/5	1,920	5,270	-	3,730	17,100	--	--	73,000	--	--	0/5
Antimony	5/5	0.19	10.9	-	0.03	0.11	--	--	--	--	--	--
Arsenic	5/5	2.6	8.7	-	2.6	13	9.79	33	100	0/5	0/5	0/5
Barium	5/5	281	626	-	121	772	--	--	--	--	--	--
Cadmium	5/5	0.93	119	-	0.27	0.66	0.99	4.98	8	3/5	2/5	2/5
Chromium	5/5	8.97	15.3	-	9.57	28	43.4	111	95	0/5	0/5	0/5
Cobalt	5/5	2.66	25.9	-	1.83	21.9	--	--	--	--	--	--
Copper	5/5	6.51	53.4	-	7.99	20.7	31.6	149	580	2/5	0/5	0/5
Fluoride	3/5	2.6	4.4	2.3	1.2 [d]	1.2 [d]	--	--	--	--	--	--
Iron	5/5	16,000	51,900	-	17,900	43,700	--	--	290,000	--	--	0/5
Lead	5/5	8.96	2,180	-	7.48	20.3	35.8	128	130	3/5	2/5	2/5
Manganese	5/5	60.2	745	-	15.9	1,870	--	--	4,500	--	--	0/5
Mercury	5/5	0.06	1.31	-	0.03	0.07	0.18	1.06	--	2/5	1/5	--
Molybdenum	5/5	1.05	2.84	-	0.38	1.35	--	--	--	--	--	--
Nickel	5/5	17.6	44.2	-	12	70.3	22.7	48.6	43	4/5	0/5	1/5
Selenium	4/5	1.2	3.5	1.5	0.5	3.1	--	--	--	--	--	--
Silver	3/5	0.09	3.76	0.1–0.15	0.06	0.18	--	--	--	--	--	--
Strontium	5/5	17.1	111	-	4.2	25.4	--	--	--	--	--	--
Thallium	4/5	0.021	1.92	0.046	0.056	0.174	--	--	--	--	--	--
Tin	3/5	18.2	41.2	15.4–21.3	2.1 [d]	6.3 [d]	--	--	--	--	--	--
Vanadium	5/5	10.2	28.3	-	14.9	94.5	--	--	--	--	--	--
Zinc	5/5	143	27,000	-	23.4	138	121	459	1,300	5/5	2/5	2/5

Note: Field duplicates were screened separately.

- - detected in all samples
-- - no benchmark

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] MacDonald et al. (2000).

[c] Ingersoll et al. (1996).

[d] Undetected; value listed is one-half of the detection limit.

Table 3-23. Ecological screening results for tundra pond surface water

Analyte	Detection Frequency	Minimum Detected Concentration (µg/L unfiltered)	Maximum Detected Concentration (µg/L unfiltered)	Detection Limits (µg/L)	Reference Concentration: Minimum Detected Concentration (µg/L unfiltered)	Reference Concentration: Maximum Detected Concentration (µg/L unfiltered)	Ecological Screening Benchmark: Freshwater Criteria Continuous Concentration[b] (µg/L total recoverable)	Ecological Screening Benchmark: Freshwater Criterion Maximum Concentration[b] (µg/L total recoverable)	Detection Frequency Above Benchmark[a]: Freshwater Criteria Continuous Concentration	Detection Frequency Above Benchmark[a]: Freshwater Criterion Maximum Concentration
Hardness	5/5	10,300	382,000	-	12,300	34,400	--	--	--	--
Aluminum	5/5	11.4	180	-	14.5	170	87	750	3/5	0/5
Antimony	3/5	0.03	0.2	0.04	0.02	0.1	--	--	--	--
Arsenic	5/5	0.4	1.7	-	0.5	0.9	150	340	0/5	0/5
Barium	5/5	39.4	74.5	-	48.4	133	--	--	--	--
Cadmium	5/5	0.02	0.27	-	0.05	0.06	0.05–0.73 (0.27)[c]	0.21–8.3 (2.1)[c]	1/5	0/5
Chromium	5/5	0.44	6.31	-	0.18	1.98	11	16	0/5	0/5
Cobalt	5/5	0.13	1.56	-	0.19	0.7	--	--	--	--
Copper	5/5	0.4	2.8	-	0.7	2.5	1.3–29 (9.4)[c]	1.6–49 (14)[c]	2/5	0/5
Fluoride	5/5	20	60	-	20	50	--	--	--	--
Iron	5/5	685	1,220	-	361	1,500	1,000	--	4/5	--
Lead	5/5	0.44	1.63	-	0.06	0.56	0.18–18 (3.2)[c]	4.5–450 (82)[c]	4/5	0/5
Manganese	5/5	2.87	132	-	4.22	71.2	--	--	--	--
Mercury	0/5	0.05[d]	0.05[d]	0.1	0.05[d]	0.05[d]	0.91	1.6	0/5[e]	0/5[e]
Molybdenum	4/5	0.05	0.09	0.03	0.05	0.22	--	--	--	--
Nickel	5/5	2.96	5.41	-	2.11	6.41	7.6–162 (52)[c]	69–1,458 (470)[c]	0/5	0/5
Selenium	0/5	0.2[d]	0.2[d]	0.3	0.3	0.5	5.0	--	0/5[e]	--
Silver	0/5	0.005[d]	0.01[d]	0.01–0.02	0.04	0.04	--	0.08–38 (3.8)[c]	--	0/5[e]
Strontium	5/5	10.4	422	-	10.6	27.5	--	--	--	--
Thallium	1/5	0.01	0.01	0.005–0.01	0.04	0.04	--	--	--	--
Tin	1/5	30	30	20	10[d]	10[d]	--	--	--	--
Vanadium	5/5	0.24	0.65	-	0.17	2.41	--	--	--	--
Zinc	5/5	6.08	99	-	0.59	5.01	17–373 (120)[c]	17–373 (120)[c]	1/5	1/5

Note: Field duplicates were screened separately.

- - detected in all samples
-- - no benchmark

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] U.S. EPA (2002c).

[c] Water quality criteria for this metal are hardness-dependent. The range shown was calculated using the minimum and maximum hardness values for tundra pond surface water. EPA provides default water quality criteria based on a hardness of 100 mg/L $CaCO_3$. This value is presented in parentheses.

[d] Undetected; value listed is one-half of the detection limit.

[e] Undetected in all samples. Undetected values expressed as one-half of the detection limit are below the screening benchmark.

Table 3-24. Ecological screening results for lagoon sediment

Analyte	Detection Frequency	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Detection Limits (mg/kg)	Reference Concentration: Minimum Detected Concentration (mg/kg)	Reference Concentration: Maximum Detected Concentration (mg/kg)	Ecological Screening Benchmark: Effects Range Low[b] (mg/kg)	Ecological Screening Benchmark: Effects Range Median[b] (mg/kg)	Ecological Screening Benchmark: Marine Sediment Quality Standards[c] (mg/kg)	Detection Frequency Above Benchmark[a]: Effects Range Low	Detection Frequency Above Benchmark[a]: Effects Range Median	Detection Frequency Above Benchmark[a]: Marine Sediment Quality Standards
Aluminum	9/9	2,450	15,300	-	7,440	14,800	--	--	--	--	--	--
Antimony	9/9	0.07	0.27	-	0.1	0.12	--	--	--	--	--	--
Arsenic	9/9	4.9	17.9	-	2.6	4.9	8.2	70	57	2/9	0/9	0/9
Barium	9/9	54.1	350	-	164	271	--	--	--	--	--	--
Cadmium	14/29	0.03	8.1	0.8–5.1	0.18	0.49	1.2	9.6	5.1	6/29	0/29	1/29
Chromium	9/9	4.08	27.2	-	12.5	24.9	81	370	260	0/9	0/9	0/9
Cobalt	9/9	3.85	11.8	-	4.97	9.68	--	--	--	--	--	--
Copper	9/9	3	28.2	-	9.87	18.7	34	270	390	0/9	0/9	0/9
Fluoride	2/9	5.1	8.6	1.9–2.3	1.2 [d]	1.2 [d]	--	--	--	--	--	--
Iron	9/9	10,100	75,000	-	14,000	22,200	--	--	--	--	--	--
Lead	28/29	4.66	302	21	3.2	23	46.7	218	450	8/29	1/29	0/29
Manganese	9/9	97.9	274	-	75.5	129	--	--	--	--	--	--
Mercury	8/9	0.01	0.096	0.008	0.03	0.06	0.15	0.71	0.41	0/9	0/9	0/9
Molybdenum	9/9	0.41	3.39	-	0.46	0.98	--	--	--	--	--	--
Nickel	9/9	12	39	-	18.7	37	20.9	51.6	--	5/9	0/9	--
Selenium	8/9	0.3	2.2	0.2	0.6	1.4	--	--	--	--	--	--
Silver	9/9	0.03	0.27	-	0.08	0.11	1.0	3.7	6.1	0/9	0/9	0/9
Strontium	9/9	10.4	108	-	20.9	40	--	--	--	--	--	--
Thallium	9/9	0.018	0.184	-	0.038	0.103	--	--	--	--	--	--
Tin	1/9	6.7	6.7	1.3–5.3	4.2	5.1	--	--	--	--	--	--
Vanadium	9/9	8.5	35.1	-	16.8	31.5	--	--	--	--	--	--
Zinc	29/29	36	1,590	-	16	370.6	150	410	410	14/29	5/29	5/29

Note: Field duplicates were screened separately.

- - detected in all samples
-- - no benchmark

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] Long et al. (1995).

[c] WAC 173-204-320.

[d] Undetected; value listed is one-half of the detection limit.

Table 3-25. Ecological screening results for lagoon surface water

Analyte	Detection Frequency	Minimum Detected Concentration (µg/L unfiltered)	Maximum Detected Concentration (µg/L unfiltered)	Detection Limits (µg/L)	Reference Concentration: Minimum Detected Concentration (µg/L unfiltered)	Reference Concentration: Maximum Detected Concentration (µg/L unfiltered)	Ecological Screening Benchmark: Saltwater Criteria Continuous Concentration[b] (µg/L total recoverable)	Ecological Screening Benchmark: Saltwater Criterion Maximum Concentration[b] (µg/L total recoverable)	Detection Frequency Above Benchmark[a]: Saltwater Criteria Continuous Concentration	Detection Frequency Above Benchmark[a]: Saltwater Criterion Maximum Concentration
Aluminum	9/9	19.7	247	-	53.5	434	--	--	--	--
Antimony	9/9	0.19	0.63	-	0.11	0.13	--	--	--	--
Arsenic	9/9	4.4	126	-	52.9	98.8	36	69	4/9	3/9
Barium	9/9	111	413	-	144	168	--	--	--	--
Cadmium	12/15	0.05	0.30	0.1	0.18	0.26	8.9	40	0/15	0/15
Chromium	9/9	1.63	4.49	-	5.96	8.22	50	1,100	0/9	0/9
Cobalt	9/9	0.44	1.38	-	3.7	5.35	--	--	--	--
Copper	9/9	0.5	1.4	-	0.4	1.4	3.7	5.8	0/9	0/9
Fluoride	9/9	50	200	-	20	20	--	--	--	--
Iron	9/9	200	723	-	290	693	--	--	--	--
Lead	15/15	0.4	2.3	-	0.1	0.85	8.5	220	0/15	0/15
Manganese	9/9	13.9	277	-	492	801	--	--	--	--
Mercury	0/9	0.05 [c]	0.05 [c]	0.1	0.05 [c]	0.05 [c]	1.1	2.1	0/9[d]	0/9[d]
Molybdenum	9/9	0.3	2.41	-	0.07	0.09	--	--	--	--
Nickel	9/9	3.42	10.6	-	9.19	15.2	8.3	75	2/9	0/9
Selenium	6/9	0.3	0.6	0.3	0.2 [c]	0.2 [c]	71	290	0/9	0/9
Silver	8/9	0.01	0.25	0.1	0.02	0.03	--	2.2	--	0/9
Strontium	9/9	503	1,850	-	991	1,470	--	--	--	--
Thallium	5/9	0.007	0.07	0.025–0.05	0.006	0.009	--	--	--	--
Tin	1/9	23.7	23.7	20	10 [c]	10 [c]	--	--	--	--
Vanadium	6/9	0.22	0.85	0.35–0.7	0.4 [c]	0.4 [c]	--	--	--	--
Zinc	15/15	3.09	110	-	17	30.1	86	95	1/15	1/15

Note: Field duplicates were screened separately.

- - detected in all samples
-- - no benchmark

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] U.S. EPA (2002c).

[c] Undetected; value listed is one-half of the detection limit.

[d] Undetected in all samples. Undetected values expressed as one-half of the detection limit are below the screening benchmark.

Table 3-26. Ecological screening results for marine sediment

					Reference Concentration		Ecological Screening Benchmark			Detection Frequency Above Benchmark[a]		
Analyte	Detection Frequency	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Detection Limits (mg/kg)	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Effects Range Low[b] (mg/kg)	Effects Range Median[b] (mg/kg)	Marine Sediment Quality Standards[c] (mg/kg)	Effects Range Low	Effects Range Median	Marine Sediment Quality Standards
Aluminum	20/20	1,990	6,070	-	1,970	8,000	--	--	--	--	--	--
Antimony	16/43	0.06	4.59	0.08–14	0.07	0.13	--	--	--	--	--	--
Arsenic	70/71	3.1	14.5	27	5.6	13	8.2	70	57	13/71	0/71	0/71
Barium	71/71	79.5	639	-	22	431	--	--	--	--	--	--
Cadmium	107/136	0.04	52.9	0.03–1.5	0.02	0.23	1.2	9.6	5.1	24/136	1/136	1/136
Chromium	71/71	2.4	33.5	-	1.4	18	81	370	260	0/71	0/71	0/71
Cobalt	20/20	3.15	8.89	-	4.2	8.71	--	--	--	--	--	--
Copper	71/71	3.7	34.8	-	3	10.2	34	270	390	1/71	0/71	0/71
Fluoride	18/18	0.4	1.5	-	0.4	2	--	--	--	--	--	--
Iron	20/20	9,960	19,300	-	8,150	22,700	--	--	--	--	--	--
Lead	136/136	1.59	5,620	-	2.7	11.2	46.7	218	450	5/136	1/136	1/136
Manganese	20/20	161	363	-	187	389	--	--	--	--	--	--
Mercury	35/69	0.01	0.58	0.01–0.2	0.01	0.02	0.15	0.71	0.41	1/69	0/69	1/69
Molybdenum	19/20	0.37	1.04	2.7	0.44	0.83	--	--	--	--	--	--
Nickel	20/20	11.3	33.6	-	9.8	34.8	20.9	51.6	--	15/20	0/20	--
Selenium	26/71	0.3	6	1–27	0.3	1.2	--	--	--	--	--	--
Silver	42/71	0.03	2.11	0.05–2.9	0.02	0.49	1.0	3.7	6.1	1/71	0/71	0/71
Strontium	19/19	24.4	33.8	-	13	29	--	--	--	--	--	--
Thallium	19/19	0.023	1.13	-	0.025	0.052	--	--	--	--	--	--
Tin	5/19	5.6	8.9	1.9–5	4.8	9.5	--	--	--	--	--	--
Vanadium	43/43	9.11	46	-	13	33.9	--	--	--	--	--	--
Zinc	136/136	5.5	2,550	-	25	56.8	150	410	410	7/136	3/136	3/136

Note: Field duplicates were screened separately.

- - detected in all samples
-- - no benchmark

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] Long et al. (1995).

[c] WAC 173-204-320.

Table 3-27. Ecological screening results for marine surface water

Analyte	Detection Frequency	Minimum Detected Concentration (µg/L unfiltered)	Maximum Detected Concentration (µg/L unfiltered)	Detection Limits (µg/L)	Reference Concentration: Minimum Detected Concentration (µg/L unfiltered)	Reference Concentration: Maximum Detected Concentration (µg/L unfiltered)	Ecological Screening Benchmark: Saltwater Criteria Continuous Concentration[b] (µg/L total recoverable)	Ecological Screening Benchmark: Saltwater Criterion Maximum Concentration[b] (µg/L total recoverable)	Detection Frequency Above Benchmark[a]: Saltwater Criteria Continuous Concentration	Detection Frequency Above Benchmark[a]: Saltwater Criterion Maximum Concentration
Aluminum	9/11	44	215	50	63.9	336	--	--	--	--
Antimony	6/11	0.47	2.79	0.4–0.8	0.44	1.67	--	--	--	--
Arsenic	8/11	1.5	6.3	5	1.1	7.5	36	69	0/11	0/11
Barium	11/11	12.1	39.4	-	9.91	38.1	--	--	--	--
Cadmium	11/11	1.58	4.62	-	2.27	4.69	8.9	40	0/11	0/11
Chromium	0/11	1 [c]	2 [c]	2-3	1 [c]	2 [c]	50	1,100	0/11[d]	0/11[d]
Cobalt	11/11	3.85	4.6	-	4.03	4.48	--	--	--	--
Copper	5/11	1	5.9	8	1	2.6	3.7	5.8	1/11	1/11
Fluoride	11/11	500	900	-	600	800	--	--	--	--
Iron	11/11	52.3	375	-	33.6	643	--	--	--	--
Lead	11/11	0.7	1.47	-	0.76	1.25	8.5	220	0/11	0/11
Manganese	11/11	13.1	31.9	-	10.1	25.5	--	--	--	--
Mercury	0/11	0.05 [c]	0.05 [c]	0.1	0.05 [c]	0.05 [c]	1.1	2.1	0/11[d]	0/11[d]
Molybdenum	11/11	8.1	11.1	-	8.26	10.6	--	--	--	--
Nickel	0/11	2 [c]	10 [c]	3–20	2 [c]	10 [c]	8.3	75	0/11[e]	0/11[e]
Selenium	9/11	0.3	1	0.3	0.3	0.5	71	290	0/11	0/11
Silver	5/11	0.51	0.95	0.2–0.4	0.27	0.27	--	2.2	--	0/11
Strontium	11/11	4,310	5,650	-	4,530	5,290	--	--	--	--
Thallium	1/11	0.09	0.09	0.1–0.2	0.111	0.133	--	--	--	--
Tin	1/11	23.3	23.3	6-20	26.4	26.4	--	--	--	--
Vanadium	2/11	4.44	5.27	2.8–4	3.77	8.44	--	--	--	--
Zinc	0/11	1 [c]	1 [c]	2	1 [c]	1 [c]	86	95	0/11[d]	0/11[d]

Note: Field duplicates were screened separately.

- - detected in all samples
-- - no benchmark

[a] Expressed as the ratio of the detected exceedances over the total analyses.

[b] U.S. EPA (2002c).

[c] Undetected; value listed is one-half of the detection limit.

[d] Undetected in all samples. Undetected values expressed as one-half of the detection limit are below the screening benchmark.

[e] Undetected in all samples. Five undetected values expressed as one-half of the detection limit exceed the benchmark.

Table 3-28. Toxicity reference values used for wildlife screening

	TRVs (mg/kg-day)					
	Avian			Mammalian		
CoPC	NOAEL	LOAEL	Citation	NOAEL	LOAEL	Citation
Aluminum	120	NA	Carriere et al. (1986)	1.9	19	Ondreicka et al. (1966)
Antimony	NA	NA	NA	0.66	NA	Schroeder et al. (1970)
Arsenic[a]	10	40	Stanley et al. (1994)	0.13	1.3	Schroeder and Mitchener (1971)
Barium	21	42	Johnson et al. (1960)	5.1	20	Perry et al. (1983); Borzelleca et al. (1988)
Cadmium	1.5	20	White and Finley (1978)	1.0	10	Sutou et al. (1980)
Chromium	0.86	4.3	Haseltine et al. (1985) as cited in Sample et al. (1996)	3.3	69	Mackenzie et al. (1958); Gross and Heller (1946)
Cobalt	NA	NA	NA	0.5	2.0	Nation et al. (1983)
Copper	47	62	Mehring et al. (1960)	12	15	Aulerich et al. (1982)
Fluoride	7.8	32	Pattee et al. (1988)	31	53	Aulerich et al. (1987)
Iron	NA	NA	NA	NA	NA	NA
Lead	3.9	NA	Pattee (1984)	11	90	Azar et al. (1973)
Manganese	980	NA	Laskey and Edens (1985)	88	280	Laskey et al. (1982)
Mercury[b]	0.032	0.064	Heinz (1974, 1976a,b, 1979)	0.032	0.16	Verschuuren et al. (1976)
Molybdenum	3.5	35	Lepore and Miller (1965)	0.26	2.6	Schroeder and Mitchener (1971)
Nickel	77	110	Cain and Pafford (1981)	40	80	Ambrose et al. (1976)
Selenium	0.40	0.80	Heinz et al. (1989)	0.20	0.33	Rosenfeld and Beath (1954)
Silver	NA	NA	NA	NA	NA	NA
Strontium	NA	NA	NA	263	NA	Skoryna (1981)
Thallium	0.24	24	Hudson et al. (1984)	0.074	0.74	Formigli et al. (1986)
Tin[c]	6.8	17	Schlatterer et al. (1993)	23	35	Davis et al. (1987)
Vanadium	11	NA	White and Dieter (1978)	0.21	2.1	Domingo et al. (1986)
Zinc	130	NA	Stahl et al. (1990)	160	320	Schlicker and Cox (1968)

Note: CoPC - chemical of potential concern
LOAEL - lowest-observed-adverse-effect level
NA - not available; no suitable TRV was derived
NOAEL - no-observed-adverse-effect level
TRV - toxicity reference value

[a] Avian TRVs were based on exposure to arsenic as arsenate; mammalian TRVs were based on exposure to arsenic as arsenite.

[b] Mercury TRVs were based on exposure to methylmercury.

[c] Tin TRVs were based on exposure to tributyltin.

Table 3-29. Ecological exposure assumptions for use in screening food-web models

Representative Receptor	Body Weight (kg)	Food Ingestion Rate kg/day (dry wt)	Soil/Sediment Ingestion Rate kg/day (dry wt)	Area Use Factor
Tundra vole	0.029 [a]	0.0060 [b]	0.00014 [c]	1
Common snipe	0.081 [d]	0.012 [e]	0.0012 [f]	1
Red-throated loon	1.15 [g]	0.079 [h]	0.0016 [i]	1
River otter	6.8 [j]	0.19 [k]	0.018 [l]	1
Black-bellied plover	0.19 [m]	0.026 [n]	0.0075 [o]	1

[a] Minimum female body weight from Bee and Hall (1956).

[b] Based on Nagy et al. (1999) allometric equation for Rodentia.

[c] Based on 2.4 percent soil in meadow vole diet from Beyer et al. (1994).

[d] Minimum female body weight from Tuck (1972).

[e] Based on Nagy et al. (1999) allometric equation for insectivores.

[f] Based on 10.4 percent soil in American woodcock diet from Beyer et al. (1994).

[g] Minimum body weight from Dunning (1993).

[h] Based on Nagy et al. (1999) allometric equation for all birds.

[i] Based on minimum soil ingestion rate from Beyer et al. (1994).

[j] Minimum body weight from DFG (2002).

[k] Based on Nagy et al. (1999) allometric equation for Carnivora.

[l] Based on 9.4 percent soil in raccoon diet from Beyer et al. (1994).

[m] Minimum female body weight for Alaska from Paulson (1995).

[n] Based on Nagy et al. (1999) allometric equation for Charadriiformes.

[o] Based on 29 percent sediment in black-bellied plover diet from Hui and Beyer (1998).

Table 3-30. Screening-level food-web results for tundra vole

Analyte	Maximum Concentration Tundra Soil (mg/kg dw)	Maximum Concentration Moss (mg/kg dw)	Daily Exposure Tundra Soil (mg/day)	Daily Exposure Moss (mg/day)	Total Daily Intake (mg/day)	Body Weight Normalized Exposure (mg/kg-day)	TRV (mg/kg-day)	Hazard Quotient
Site								
Metals								
Aluminum	18,900	47,900	2.73	289	291	10,000	1.9	5,300
Antimony	25.8	4.58	0.00373	0.0276	0.0313	1.08	0.66	1.6
Arsenic	150	15.7	0.0217	0.0946	0.116	4.01	0.13	31
Barium	5,810	8,800	0.840	53.0	53.9	1,857	5.1	360
Cadmium	438	48.4	0.0633	0.292	0.355	12.2	1.0	12
Chromium	33.2	32.9	0.00480	0.198	0.203	7.00	3.3	2.1
Cobalt	35	9.35	0.00506	0.0563	0.0614	2.12	0.50	4.2
Copper	58.3	40.5	0.00843	0.244	0.252	8.71	12	0.73
Fluoride	3.8	NA	0.000550	NA	0.000550	0.0189	31	0.000611
Lead	16,000	1,720	2.31	10.4	12.7	437	11	40
Manganese	3,400	842	0.492	5.07	5.57	192	88	2.2
Mercury	4.16	1.04	0.000602	0.00627	0.00687	0.237	0.032	7.4
Molybdenum	3.9	2.4	0.000564	0.0145	0.0150	0.518	0.26	2.0
Nickel	37.5	31.6	0.00542	0.190	0.196	6.75	40	0.17
Selenium	3	1.5	0.000477	0.00904	0.00952	0.328	0.20	1.6
Strontium	150	107	0.0217	0.645	0.666	23.0	260	0.088
Thallium	1.58	1.84	0.000228	0.0111	0.0113	0.390	0.074	5.3
Tin	14	3.9	0.00202	0.0235	0.0255	0.880	23	0.038
Vanadium	46.5	14.7	0.00672	0.0886	0.0953	3.29	0.21	16
Zinc	82,700	8,120	12.0	48.9	60.9	2,100	160	13
Reference								
Metals								
Aluminum	11,300	713	1.63	4.30	5.93	204	1.9	110
Antimony	0.28	0.15	0.0000405	0.000904	0.000944	0.0326	0.66	0.049
Arsenic	6.8	0.3	0.000983	0.00181	0.00279	0.0962	0.13	0.74
Barium	624	119	0.0902	0.717	0.807	27.8	5.1	5.5
Cadmium	0.88	0.38	0.000127	0.00229	0.00242	0.0833	1.0	0.083
Chromium	19.7	2.96	0.00285	0.0178	0.0207	0.713	3.3	0.22
Cobalt	28.3	2.03	0.00409	0.0122	0.0163	0.563	0.50	1.1
Copper	16.9	4.35	0.00244	0.0262	0.0287	0.988	12	0.082
Fluoride	0.4	NA	0.0000578	NA	0.0000578	0.00199	31	0.000064
Lead	23.3	9.64	0.00337	0.0581	0.0615	2.12	11	0.19
Manganese	6,620	712	0.957	4.29	5.25	181	88	2.1
Mercury	0.15	0.067	0.0000217	0.000404	0.000425	0.0147	0.032	0.46
Molybdenum	2.27	0.3	0.000328	0.00181	0.00214	0.0737	0.26	0.28
Nickel	36.8	6.34	0.00532	0.0382	0.0435	1.50	40	0.038
Selenium	1	0.1	0.000145	0.000603	0.000747	0.0258	0.20	0.13
Strontium	39.6	11	0.00573	0.0663	0.0720	2.48	260	0.0096
Thallium	0.116	0.04	0.0000168	0.000241	0.000258	0.00889	0.074	0.12
Tin	17.4	1.1	0.00252	0.00663	0.00914	0.315	23	0.014
Vanadium	24.7	1.73	0.00357	0.0104	0.0140	0.483	0.21	2.3
Zinc	111	64	0.0161	0.386	0.402	13.9	160	0.087

Note: Hazard quotients greater than 1.0 are boxed.

NA - not available

TRV - toxicity reference value

Table 3-31. Screening-level food-web results for river otter

Analyte	Maximum Concentration Sediment (mg/kg dw)	Maximum Concentration Fish (mg/kg dw)	Daily Exposure Sediment (mg/day)	Daily Exposure Fish (mg/day)	Total Daily Intake	Body Weight Normalized Exposure	TRV (mg/kg-day)	Hazard Quotient
Aufeis Creek								
Metals								
Cadmium	0.31	0.17	0.00558	0.0325	0.0382	0.00562	1.0	0.0056
Lead	14.9	6	0.268	1.15	1.42	0.208	11	0.019
Selenium	2.5	7	0.0450	1.34	1.38	0.203	0.20	1.0
Zinc	136	121	2.45	23.1	25.7	3.77	160	0.024
Omikviorok River								
Metals								
Cadmium	0.59	0.14	0.0106	0.0268	0.0375	0.00551	1.0	0.0055
Lead	19	3.03	0.342	0.579	0.921	0.136	11	0.012
Selenium	0.7	3.4	0.0126	0.650	0.662	0.0974	0.20	0.49
Zinc	123	155	2.21	29.6	31.9	4.69	160	0.029
Anxiety Ridge Creek								
Metals								
Cadmium	1.38	0.39	0.0248	0.0745	0.0994	0.0146	1.0	0.015
Lead	142	2.86	2.56	0.547	3.10	0.456	11	0.041
Selenium	2.4	5.87	0.0432	1.12	1.17	0.171	0.20	0.86
Zinc	259	155 [a]	4.66	29.6	34.3	5.04	160	0.032

Note: Hazard quotients greater than 1.0 are boxed.

TRV - toxicity reference value

[a] No zinc tissue data available for Anxiety Ridge Creek; maximum concentration from Omikviorok River used in calculation.

Table 3-32. Screening-level food-web results for red-throated loon

Analyte	Maximum Concentration Sediment (mg/kg dw)	Maximum Concentration Fish (mg/kg dw)	Daily Exposure Sediment (mg/day)	Daily Exposure Fish (mg/day)	Total Daily Intake	Body Weight Normalized Exposure	TRV (mg/kg-day)	Hazard Quotient
Aufeis Creek								
Metals								
Cadmium	0.31	0.17	0.000488	0.0134	0.0139	0.0121	1.5	0.0080
Lead	14.9	6	0.0235	0.472	0.496	0.431	3.9	0.11
Selenium	2.5	7	0.00394	0.551	0.555	0.483	0.40	1.2
Zinc	136	121	0.214	9.52	9.74	8.47	130	0.065
Omikviorok River								
Metals								
Cadmium	0.59	0.14	0.000929	0.0110	0.0120	0.0104	1.5	0.0069
Lead	19	3.03	0.0299	0.238	0.269	0.234	3.9	0.060
Selenium	0.7	3.4	0.00110	0.268	0.269	0.234	0.40	0.58
Zinc	123	155	0.194	12.2	12.4	10.8	130	0.083
Anxiety Ridge Creek								
Metals								
Cadmium	1.38	0.39	0.00217	0.0307	0.0329	0.0286	1.5	0.019
Lead	142	2.86	0.224	0.225	0.449	0.390	3.9	0.10
Selenium	2.4	5.87	0.00378	0.462	0.466	0.405	0.40	1.0
Zinc	259	155 [a]	0.408	12.2	12.6	11.0	130	0.084

Note: Hazard quotients greater than 1.0 are boxed.

TRV - toxicity reference value

[a] No zinc tissue data available for Anxiety Ridge Creek; maximum concentration from Omikviorok River used in calculation.

Table 3-33. Screening-level food-web results for common snipe foraging in freshwater rivers and creeks

Analyte	Maximum Concentration Sediment (mg/kg dw)	Maximum Concentration Invertebrates (mg/kg dw)	Daily Exposure Sediment (mg/day)	Daily Exposure Invertebrates (mg/day)	Total Daily Intake	Body Weight Normalized Exposure	TRV (mg/kg-day)	Hazard Quotient
New Heart Creek								
Metals								
Aluminum	17,100	17,100	20.5	205	226	2,790	120	23
Arsenic	7.3	5.0	0.0088	0.0604	0.0692	0.85	10	0.09
Barium	293	293	0.352	3.52	3.87	47.7	21	2.3
Cadmium	0.77	6.15	0.000924	0.0738	0.0748	0.923	1.5	0.62
Chromium	15.6	7.30	0.0187	0.0876	0.106	1.31	0.86	1.5
Copper	14.2	74.6	0.0170	0.895	0.912	11.3	47	0.24
Fluoride	1.2	1.2	0.00144	0.0144	0.0158	0.196	7.8	0.025
Lead	23.8	14.4	0.0286	0.173	0.202	2.49	3.9	0.64
Manganese	939	939	1.13	11.3	12.4	153	980	0.16
Mercury	0.06	0.172	0.0000720	0.002100	0.00210	0.0264	0.032	0.82
Molybdenum	0.84	0.84	0.00101	0.0101	0.0111	0.137	3.5	0.039
Nickel	45.2	105	0.0542	1.258	1.313	16.2	77	0.21
Selenium	1.4	1.4	0.00168	0.0168	0.0185	0.228	0.4	0.57
Thallium	0.08	0.08	0.0000960	0.000960	0.00106	0.0130	0.24	0.055
Tin	7.6	7.6	0.00912	0.0912	0.100	1.24	6.8	0.18
Vanadium	13.8	13.8	0.0166	0.166	0.182	2.25	11	0.20
Zinc	206	1,551	0.247	18.6	18.9	233	130	1.8
Aufeis Creek								
Metals								
Aluminum	7,580	7,580	9.10	91.0	100	1,240	120	10
Arsenic	9.6	6.62	0.0115	0.079	0.91	1.12	10	0.11
Barium	172	172	0.206	2.06	2.27	28.0	21	1.3
Cadmium	0.31	2.48	0.000372	0.0297	0.0301	0.372	1.5	0.25
Chromium	22.1	10.3	0.0265	0.124	0.151	1.86	0.86	2.2
Copper	28.2	148	0.0338	1.777	1.810	22.4	47	0.48
Fluoride	1.2	1.2	0.00144	0.0144	0.0158	0.196	7.8	0.025
Lead	14.9	9.04	0.0179	0.109	0.126	1.56	3.9	0.40
Manganese	1,200	1,200	1.44	14.4	15.8	196	980	0.20
Mercury	0.06	0.17	0.0000720	0.00206	0.00214	0.0264	0.032	0.82
Molybdenum	1.01	1.01	0.00121	0.0121	0.0133	0.165	3.5	0.047
Nickel	107.9	108	0.0558	1.3	1.35	16.7	77	0.22
Selenium	2.5	2.5	0.00300	0.0300	0.0330	0.407	0.40	1.0
Thallium	0.115	0.115	0.000138	0.00138	0.00152	0.0187	0.24	0.079
Tin	6.4	6.4	0.00768	0.0768	0.0845	1.04	6.8	0.15
Vanadium	18.2	18.2	0.0218	0.218	0.240	2.97	11	0.27
Zinc	136	1,024	0.163	12.3	12.4	154	130	1.2

Table 3-33. (cont.)

Analyte	Maximum Concentration Sediment (mg/kg dw)	Maximum Concentration Invertebrates (mg/kg dw)	Daily Exposure Sediment (mg/day)	Daily Exposure Invertebrates (mg/day)	Total Daily Intake	Body Weight Normalized Exposure	TRV (mg/kg-day)	Hazard Quotient
Omikviorok River								
Metals								
Aluminum	14,900	14,900	17.9	179	197	2,430	120	20
Arsenic	9.4	6.49	0.0113	0.0778	0.089	1.10	10	0.11
Barium	484	484	0.581	5.81	6.39	78.9	21	3.8
Cadmium	0.59	4.71	0.000708	0.0566	0.0573	0.7071	1.5	0.47
Chromium	23.3	10.9	0.0280	0.131	0.159	1.96	0.86	2.3
Copper	15.6	81.9	0.0187	0.983	1.002	12.36	47	0.26
Fluoride	1.2	1.2	0.00144	0.0144	0.0158	0.196	7.8	0.025
Lead	19	11.5	0.0228	0.138	0.161	1.99	3.9	0.51
Manganese	2,140	2,140	2.57	25.7	28.2	349	980	0.36
Mercury	0.06	0.172	0.0000720	0.00206	0.00214	0.0264	0.032	0.82
Molybdenum	0.66	0.66	0.000792	0.00792	0.00871	0.108	3.5	0.031
Nickel	57.3	133	0.0688	0.0688	1.60	20.5	77	0.27
Selenium	0.7	0.7	0.000840	0.00840	0.00924	0.114	0.40	0.29
Thallium	0.141	0.141	0.000169	0.00169	0.00186	0.0230	0.24	0.097
Tin	5.7	5.7	0.00684	0.0684	0.0752	0.929	6.8	0.14
Vanadium	28.1	28.1	0.0337	0.337	0.371	4.58	11	0.42
Zinc	123	926	0.148	11.1	11.3	139	130	1.1
Anxiety Ridge Creek								
Metals								
Aluminum	8,310	8,310	9.97	99.7	110	1,354	120	11
Arsenic	11.4	7.87	0.0137	0.0944	0.108	1.33	10	0.13
Barium	922	922	1.11	11.1	12.2	150	21	7.2
Cadmium	1.38	11.0	0.00166	0.132	0.134	1.654	1.5	1.1
Chromium	14.6	6.83	0.0175	0.082	0.100	1.23	0.86	1.4
Copper	20.1	106	0.0241	1.27	1.29	15.9	47	0.339
Fluoride	0.95	0.95	0.00114	0.0114	0.0125	0.155	7.8	0.020
Lead	142	86.2	0.170	1.03	1.20	14.9	3.9	3.8
Manganese	2,100	2,100	2.52	25.2	27.7	342	980	0.35
Mercury	0.089	0.255	0.000107	0.00316	0.00317	0.0391	0.032	1.2
Molybdenum	2.32	2.32	0.00278	0.0278	0.0306	0.378	3.5	0.11
Nickel	45.6	106	0.0547	1.27	1.32	16.3	77	0.21
Selenium	2.4	2.4	0.00288	0.0288	0.032	0.391	0.40	0.98
Thallium	0.322	0.322	0.000386	0.00386	0.00425	0.0525	0.24	0.22
Tin	1.1	1.1	0.00132	0.0132	0.0145	0.179	6.8	0.026
Vanadium	20.5	20.5	0.0246	0.246	0.271	3.34	11	0.30
Zinc	259	1,949	0.311	23.4	23.7	293	130	2.3

Table 3-33. (cont.)

Analyte	Maximum Concentration Sediment (mg/kg dw)	Maximum Concentration Invertebrates (mg/kg dw)	Daily Exposure Sediment (mg/day)	Daily Exposure Invertebrates (mg/day)	Total Daily Intake	Body Weight Normalized Exposure	TRV (mg/kg-day)	Hazard Quotient
Reference Creeks								
Metals								
Aluminum	12,100	12,100	14.5	145	160	1,970	120	16
Arsenic	8.1	5.59	0.00972	0.0671	0.0768	0.948	10	0.095
Barium	483	483	0.580	5.80	6.38	78.7	21	3.7
Cadmium	0.3	2.40	0.000360	0.0288	0.0291	0.360	1.5	0.24
Chromium	19.9	9.3	0.0239	0.112	0.136	1.67	0.86	1.9
Copper	18.5	97.1	0.0222	1.17	1.19	14.7	47	0.31
Fluoride	1.2	1.2	0.00144	0.0144	0.0158	0.196	7.8	0.025
Lead	9.17	5.57	0.011	0.0668	0.0778	0.961	3.9	0.25
Manganese	859	859	1.03	10.3	11.3	140	980	0.14
Mercury	0.04	0.115	0.0000480	0.00138	0.00142	0.0176	0.032	0.55
Molybdenum	0.52	0.52	0.000624	0.00624	0.00686	0.0847	3.5	0.024
Nickel	35	81.2	0.0420	0.974	1.02	12.5	77	0.16
Selenium	0.7	0.7	0.000840	0.00840	0.00924	0.114	0.40	0.29
Thallium	0.07	0.07	0.0000840	0.000840	0.000924	0.0114	0.24	0.048
Tin	2.4	2.4	0.00288	0.0288	0.0317	0.391	6.8	0.058
Vanadium	24.8	24.8	0.0298	0.298	0.327	4.04	11	0.37
Zinc	69.7	525	0.0836	6.30	6.38	78.8	130	0.606

Note: Hazard quotients greater than 1.0 are boxed.

Invertebrate data are modeled based on maximum sediment concentrations and are not measured values.

TRV - toxicity reference value

Table 3-34. Screening-level food web results for common snipe foraging in tundra ponds

Analyte	Maximum Concentration		Daily Exposure		Body Weight			
	Sediment (mg/kg dw)	Invertebrates (mg/kg dw)	Sediment (mg/day)	Invertebrates (mg/day)	Total Daily Intake	Normalized Exposure	TRV (mg/kg-day)	Hazard Quotient
Site Tundra Ponds								
Metals								
Aluminum	5,270	5,270	6.32	63.2	69.6	859	120	7.2
Arsenic	8.7	6.00	0.0104	0.0720	0.0825	1.02	10	0.10
Barium	626	626	0.751	7.51	8.26	102	21	4.9
Cadmium	119	951	0.143	11.4	11.6	143	1.5	95
Chromium	15.3	7.16	0.0184	0.0859	0.104	1.29	0.86	1.5
Copper	53.4	280	0.0641	3.36	3.43	42.3	47	0.90
Fluoride	4.4	4.4	0.00528	0.0528	0.0581	0.717	7.8	0.092
Lead	2,180	1,323	2.62	15.9	18.5	228	3.9	59
Manganese	745	745	0.894	8.94	9.83	121	980	0.12
Mercury	1.31	3.76	0.00157	0.0451	0.0467	0.576	0.032	18
Molybdenum	2.84	2.84	0.00341	0.0341	0.0375	0.463	3.5	0.13
Nickel	44.2	103	0.0530	1.23	1.28	15.8	77	0.21
Selenium	3.5	3.5	0.00420	0.0420	0.0462	0.570	0.40	1.4
Thallium	1.92	1.92	0.00230	0.0230	0.0253	0.313	0.24	1.3
Tin	41.2	41.2	0.0494	0.494	0.544	6.71	6.8	0.99
Vanadium	28.3	28.3	0.0340	0.340	0.374	4.61	11	0.42
Zinc	27,000	203,229	32.4	2,439	2,471	30,508	130	235
Reference Ponds								
Metals								
Aluminum	17,100	17,100	20.5	205	226	2,790	120	23
Arsenic	13	8.97	0.0156	0.108	0.123	1.52	10	0.15
Barium	772	772	0.926	9.26	10.2	126	21	6.0
Cadmium	0.66	5.27	0.000792	0.0633	0.0641	0.791	1.5	0.53
Chromium	28	13	0.0336	0.157	0.191	2.36	0.86	2.7
Copper	20.7	109	0.0248	1.30	1.33	16.4	47	0.349
Fluoride	1.2	1.2	0.00144	0.0144	0.0158	0.196	7.8	0.025
Lead	20.3	12.3	0.0244	0.148	0.172	2.13	3.9	0.55
Manganese	1,870	1,870	2.24	22.4	24.7	305	980	0.31
Mercury	0.07	0.20	0.0000840	0.00241	0.00249	0.0308	0.032	0.96
Molybdenum	1.35	1.35	0.00162	0.0162	0.0178	0.220	3.5	0.063
Nickel	163	163	0.0844	1.96	2.04	25.3	77	0.33
Selenium	3.1	3.10	0.00372	0.0372	0.0409	0.505	0.40	1.3
Thallium	0.174	0.174	0.000209	0.00209	0.00230	0.0284	0.24	0.12
Tin	6.3	6.3	0.00756	0.0756	0.0832	1.03	6.8	0.15
Vanadium	94.5	94.5	0.113	1.13	1.25	15.4	11	1.4
Zinc	138	1,039	0.166	12.5	12.6	160	130	1.2

Note: Hazard quotients greater than 1.0 are boxed.

Invertebrate data are modeled based on maximum sediment concentrations and are not measured values.

TRV - toxicity reference value

Table 3-35. Screening-level food-web results for black-bellied plover foraging in coastal lagoons

Analyte	Maximum Concentration		Daily Exposure		Total Daily Intake	Body Weight Normalized Exposure	TRV (mg/kg-day)	Hazard Quotient
	Sediment (mg/kg dw)	Invertebrates (mg/kg dw)	Sediment (mg/day)	Invertebrates (mg/day)				
Site Coastal Lagoons								
Metals								
Aluminum	15,300	15,300	115	398	513	2,660	120	22
Arsenic	17.9	12.4	0.135	0.321	0.456	2.36	10	0.24
Barium	350	350	2.64	9.09	11.7	60.8	21	2.9
Cadmium	8.1	64.7	0.061	1.68	1.74	9.03	1.5	6.02
Chromium	27.2	12.7	0.205	0.331	0.536	2.78	0.86	3.2
Copper	28.2	148	0.212	3.85	4.06	21.0	47	0.45
Fluoride	8.6	8.6	0.0648	0.223	0.288	1.49	7.8	0.19
Lead	302	183	2.28	4.76	7.0	36.5	3.9	9.4
Manganese	274	274	2.06	7.12	9.18	47.6	980	0.049
Mercury	0.096	0.275	0.000723	0.00715	0.00788	0.0408	0.032	1.3
Molybdenum	3.39	3.39	0.0255	0.0881	0.114	0.589	3.5	0.17
Nickel	39	90	0.294	2.35	2.64	13.7	77	0.18
Selenium	2.2	2.2	0.0166	0.0572	0.0737	0.382	0.40	0.96
Thallium	0.184	0.184	0.00139	0.00478	0.00617	0.0320	0.24	0.13
Tin	6.7	6.7	0.0505	0.174	0.225	1.16	6.8	0.17
Vanadium	35.1	35.1	0.264	0.912	1.18	6.10	11	0.55
Zinc	1,590	11,968	12.0	311	323	1,673	130	13
Reference Lagoons								
Metals								
Aluminum	14,800	14,800	112	385	496	2,570	120	21
Arsenic	4.9	3.38	0.0369	0.0879	0.125	0.647	10	0.065
Barium	271	271	2.04	7.04	9.08	47.1	21	2.2
Cadmium	0.49	3.92	0.00369	0.102	0.105	0.546	1.5	0.364
Chromium	24.9	11.7	0.188	0.303	0.490	2.54	0.86	3.0
Copper	18.7	98.2	0.141	2.55	2.69	13.9	47	0.30
Fluoride	1.2	1.2	0.00904	0.0312	0.0402	0.208	7.8	0.027
Lead	23	14	0.173	0.363	0.536	2.78	3.9	0.71
Manganese	129	129	0.972	3.35	4.32	22.4	980	0.023
Mercury	0.06	0.17	0.000452	0.00447	0.00492	0.0255	0.032	0.80
Molybdenum	0.98	0.98	0.00738	0.0255	0.0328	0.170	3.5	0.049
Nickel	37	86	0.279	2.230	2.51	13.0	77	0.169
Selenium	1.4	1.4	0.0105	0.0364	0.0469	0.243	0.40	0.61
Thallium	0.103	0.103	0.000776	0.00268	0.00345	0.0179	0.24	0.075
Tin	5.1	5.1	0.0384	0.133	0.171	0.886	6.8	0.13
Vanadium	31.5	31.5	0.237	0.818	1.06	5.47	11	0.50
Zinc	371	2,790	2.79	72.5	75.3	390	130	3.00

Note: Hazard quotients greater than 1.0 are boxed.

Invertebrate data are modeled based on maximum sediment concentrations and are not measured values.

TRV - toxicity reference value

Table 3-36. Results of screening against lowest ecological screening benchmarks

	Environment								
	Terrestrial	Streams		Ponds		Lagoons		Marine	
Chemical	Tundra Soil	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water
Aluminum	Fail	Pass	Fail	Pass	Fail	NB	NB	NB	NB
Antimony	Fail	NB	NB	NB	NB	NB	NB	NB	NB
Arsenic	Fail	Fail	ND[a]	Pass	Pass	Fail	Fail	Fail	Pass
Barium	Fail	NB	NB	NB	NB	NB	NB	NB	NB
Cadmium	Fail	Fail	Fail	Fail	Fail	Fail	Pass	Fail	Pass
Chromium	Fail	Pass	ND[a]	Pass	Pass	Pass	Pass	Pass	ND[a]
Cobalt	Fail	NB	NB	NB	NB	NB	NB	NB	NB
Copper	Fail	Pass	Pass	Fail	Fail	Pass	Pass	Fail	Fail
Fluoride	Pass	ND[b]	NB	NB	NB	NB	NB	NB	NB
Iron	Fail	Pass	Fail	Pass	Fail	NB	NB	NB	NB
Lead	Fail	Fail	Fail	Fail	Fail	Fail	Pass	Fail	Pass
Manganese	Fail	Pass	NB	Pass	NB	NB	NB	NB	NB
Mercury	Fail	Pass	ND[a]	Fail	ND[a]	Pass	ND[a]	Fail	ND[a]
Molybdenum	Fail	NB	NB	NB	NB	NB	NB	NB	NB
Nickel	Fail	Fail	Pass	Fail	Pass	Fail	Fail	Fail	ND[c]
Selenium	Fail	NB	Pass	NB	ND[a]	NB	Pass	NB	Pass
Silver	Fail	NB	ND[a]	NB	ND[a]	Pass	Pass	Fail	Pass
Strontium	NB	NB	NB	NB	NB	NB	NB	NB	NB
Thallium	Fail	NB	NB	NB	NB	NB	NB	NB	NB
Tin	Pass	NB	NB	NB	NB	NB	NB	NB	NB
Vanadium	Fail	NB	NB	NB	NB	NB	NB	NB	NB
Zinc	Fail	Fail	Fail	Fail	Fail	Fail	Fail	Fail	ND[a]

Note: Fail - maximum detected concentration exceeds the lowest benchmark
NB - no benchmark
ND - undetected in all samples
Pass - maximum detected concentration is below the lowest benchmark

[a] Maximum value expressed as one-half of the detection limit is below the screening benchmark.

[b] No benchmark.

[c] Maximum value expressed as one-half of the detection limit is above the screening benchmark.

Table 3-37. Results of statistical comparison with reference data

	Environment								
	Terrestrial	Streams		Ponds		Lagoons		Marine	
Chemical	Tundra Soil	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water
Aluminum	Pass	--	Pass	--	Pass	Pass	Pass	Pass	Pass
Antimony	NA	Fail	NA	Fail	NA	Fail	Fail	NA	Pass
Arsenic	Fail	Fail	--	--	--	Fail	Pass	Pass	--
Barium	NA	Pass	NA	Pass	Pass	Pass	Pass	Fail	Pass
Cadmium	Fail	Fail	NA	Fail	NA	NA	--	Fail	--
Chromium	Pass	--	--	--	--	--	--	--	--
Cobalt	NA	Fail	Pass	NA	Pass	Pass	Pass	Pass	Pass
Copper	Fail	--	--	Pass	Pass	--	--	Fail	NA
Fluoride	--	NA	Fail	NA	Pass	NA	Fail	Pass	Pass
Iron	Pass	--	Pass	--	Pass	Pass	Pass	Pass	Pass
Lead	Fail	Fail	NA	NA	Pass	Fail	--	NA	--
Manganese	NA	--	NA	--	NA	Fail	NA	Pass	Pass
Mercury	NA	--	--	NA	--	--	--	NA	--
Molybdenum	Fail	Fail	Fail	Fail	Pass	Pass	Fail	Pass	Pass
Nickel	Pass	Fail	--	Pass	--	Pass	Pass	Pass	NA
Selenium	NA	Fail	--	Pass	--	Pass	--	NA	--
Silver	NA	Fail	--	NA	--	--	--	Fail	--
Strontium	Fail	Fail	Pass	Fail	Pass	Pass	Pass	Fail	Fail
Thallium	NA	Fail	NA	Pass	NA	Pass	NA	Pass	NA
Tin	--	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	Pass	NA	Pass	Pass	Pass	NA	Pass	NA
Zinc	Fail	Fail	NA	Fail	NA	Fail	Pass	Fail	--

Note: -- - chemical passed earlier screening tier
Fail - site concentrations significantly greater than reference concentrations
NA - not applicable; no statistical comparison was made because of high frequency of undetected results; or the confidence interval for the site mean straddles zero as a result of small sample size or high variability
Pass - site concentrations not significantly greater than reference concentrations

Table 3-38. Chemicals of potential concern retained for ecological risk analysis

	Environment								
	Terrestrial	Streams		Ponds		Lagoons		Marine	
Chemical	Tundra Soil	Sediment	Water	Sediment	Water	Sediment	Water	Sediment	Water
Aluminum	--	--	--	--	--	--	--	--	--
Antimony	Fail	NB	NB	NB	NB	NB	NB	NB	--
Arsenic	Fail	Fail	--	--	--	Fail	--	--	--
Barium	Fail	--	NB	--	--	--	--	NB	--
Cadmium	Fail	Fail	Fail	Fail	Fail	Fail	--	Fail	--
Chromium	--	--	--	--	--	--	--	--	--
Cobalt	Fail	NB	--	NB	--	--	--	--	--
Copper	Fail	--	--	--	--	--	--	Fail	Fail
Fluoride	--	ND[a]	NB	NB	--	NB	NB	--	--
Iron	--	--	--	--	--	--	--	--	--
Lead	Fail	Fail	Fail	Fail	--	Fail	--	Fail	--
Manganese	Fail	--	NB	--	NB	NB	NB	--	--
Mercury	Fail	--	--	Fail	--	--	--	Fail	--
Molybdenum	Fail	NB	NB	NB	--	--	NB	--	--
Nickel	--	Fail	--	--	--	--	--	--	ND[b]
Selenium	Fail	NB	--	--	--	--	--	NB	--
Silver	Fail	NB	--	NB	--	--	--	Fail	--
Strontium	NB	NB	--	NB	--	--	--	NB	NB
Thallium	Fail	NB	NB	--	NB	--	NB	--	NB
Tin	--	NB	NB	NB	NB	NB	NB	NB	NB
Vanadium	Fail	--	NB	--	--	--	NB	--	NB
Zinc	Fail	Fail	Fail	Fail	Fail	Fail	--	Fail	--

Note: -- - chemical eliminated from further evaluation
Fail - chemical retained as a CoPC for the baseline ERA
NB - no benchmark; chemical retained as a CoPC for the baseline ERA
ND - undetected in all samples; chemical retained as a CoPC for the baseline ERA

[a] No benchmark.

[b] Maximum value expressed as one-half of the detection limit is above the screening benchmark.

Table 3-39. Data needs for the ecological risk assessment

Environment	Assessment Endpoint	Representative Receptor	Food Item	Data Need
Tundra	Structure and function of terrestrial plant communities	Terrestrial plant communities	NA	Tundra plant community surveys
Tundra	Structure and function of tundra soil fauna communities	Tundra soil fauna communities	NA	None. Not directly assessed; evaluated through terrestrial plant community analysis
Tundra	Survival, growth, and reproduction of terrestrial avian herbivore populations	Willow ptarmigan	Terrestrial plants (willow and sedge)	CoPCs in terrestrial plants[a]
Tundra	Survival, growth, and reproduction of terrestrial mammalian herbivore populations	Tundra vole; caribou; moose	Terrestrial plants (willow, sedge, and/or lichen)	CoPCs in terrestrial plants[a]
Tundra	Survival, growth, and reproduction of terrestrial avian invertivore populations	Lapland longspur	Terrestrial invertebrates	CoPCs in terrestrial invertebrates[a]
Tundra	Survival, growth, and reproduction of terrestrial mammalian invertivore populations	Tundra shrew	Terrestrial invertebrates	CoPCs in terrestrial invertebrates[a]
Tundra	Survival, growth, and reproduction of terrestrial avian carnivore populations	Snowy owl	Small mammals (voles or lemmings)	CoPCs in small mammals[a]
Tundra	Survival, growth, and reproduction of terrestrial mammalian carnivore populations	Arctic fox	Small mammals (voles or lemmings)	CoPCs in small mammals[a]
Streams	Structure and function of stream aquatic and wetland plant communities	Stream aquatic and wetland plant communities	NA	CoPCs in stream aquatic/wetland plants (arsenic, cadmium, lead, nickel, and zinc)
Streams	Structure and function of stream aquatic invertebrate communities	Stream aquatic invertebrate communities	NA	Stream aquatic invertebrate community surveys
Streams	Survival, growth, and reproduction of stream avian herbivore populations	Green-winged teal	Aquatic/wetland plants (sedge)	CoPCs in stream aquatic/wetland plants[a]
Streams	Survival, growth, and reproduction of stream mammalian herbivore populations	Muskrat	Aquatic/wetland plants (sedge)	CoPCs in stream aquatic/wetland plants[a]
Streams	Survival, growth, and reproduction of stream avian invertivore populations	Common snipe	Aquatic invertebrates	CoPCs in stream invertebrates (cadmium, lead, mercury, and zinc)[b]
Tundra ponds	Structure and function of tundra pond aquatic and wetland plant communities	Tundra pond aquatic and wetland plant communities	NA	Tundra pond and wetland plant community surveys[c]

Table 3-39. (cont.)

Environment	Assessment Endpoint	Representative Receptor	Food Item	Data Need
Tundra ponds	Structure and function of tundra pond aquatic invertebrate communities	Tundra pond aquatic invertebrate communities	NA	Tundra pond aquatic invertebrate community surveys[b]
Tundra ponds	Survival, growth, and reproduction of tundra pond avian herbivore populations	Green-winged teal	Aquatic/wetland plants (sedge)	CoPCs in tundra pond aquatic/wetland plants[a]
Tundra ponds	Survival, growth, and reproduction of tundra pond mammalian herbivore populations	Muskrat	Aquatic/wetland plants (sedge)	CoPCs in tundra pond aquatic/wetland plants[a]
Tundra ponds	Survival, growth, and reproduction of tundra pond avian invertivore populations	Common snipe	Aquatic invertebrates	CoPCs in tundra pond aquatic invertebrates (arsenic, barium, cadmium, lead, mercury, thallium, and zinc)[b]
Coastal lagoons	Structure and function of coastal lagoon aquatic and wetland plant communities	Coastal lagoon aquatic and wetland plant communities	NA	Coastal lagoon aquatic and wetland plant community surveys
Coastal lagoons	Structure and function of coastal lagoon aquatic invertebrate communities	Coastal lagoon aquatic invertebrate communities	NA	Coastal lagoon aquatic invertebrate community surveys
Coastal lagoons	Structure and function of coast lagoon fish communities	Coastal lagoon fish	NA	CoPCs in coastal lagoon fish[d]
Coastal lagoons	Survival, growth, and reproduction of coastal lagoon avian herbivore populations	Brant	Aquatic/wetland plants (sedge)	CoPCs in coastal lagoon aquatic/ wetland plants[a]
Coastal lagoons	Survival, growth, and reproduction of coastal lagoon avian invertivore populations	Black-bellied plover	Aquatic invertebrates	CoPCs in coastal lagoon aquatic invertebrates (cadmium, lead and zinc)
Coastal lagoons	Survival, growth, and reproduction of coastal lagoon avian piscivore populations	Red-throated loon	Fish	CoPCs in coastal lagoon fish[a]

Note: CoPC - chemical of potential concern
NA - not applicable

[a] CoPCs for all herbivores, terrestrial invertivores, terrestrial carnivores, and lagoon piscivores are aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, lead, mercury, molybdenum, selenium, thallium, vanadium, and zinc.

[b] Data for terrestrial invertebrate samples collected during the Phase II field event will be used to evaluate this assessment endpoint.

[c] Data for terrestrial plant community surveys collected during the Phase II field event will be used to evaluate this assessment endpoint.

[d] CoPCs for coastal lagoon fish are arsenic, cadmium, lead, and zinc.

Table 4-1. Overview of Phase II data

Assessment Endpoint	Station/ Transect	Distance (m)	Small Mammals	Ptarmigan	Terrestrial Invertebrate Tissue	Vegetation									Aquatic Invertebrates		Sediment		Water Quality Parameters
									Lichen										
						Willow	Birch	Sedge	Peltigera	Cladina	Salmon-berries	Sour-dock	Vegetation Plots	Tundra Soil	Tissue	Community Analysis	Chemistry	Toxicity Test	
Terrestrial																			
	TT5	10			X	X		X	X				X	X					
		20	X											X					
		100	[a]		X	X		X	X				X	X					
		1,000	X		X	X	X	X	X				X	X					
		2,000	X		X		X	X		X			X	X					
	TT2	10			X	X		X	X					X					
		20	[a]											X					
		100	X		X	X		X	X					X					
		1,000	X		X	X		X	X					X					
	TT8	10				X		X	X				X	X					
		20	[a]																
		50											X[b]	X					
		100	[a]			X		X	X				X	X					
		150											X[b]	X					
		200											X[b]	X					
		250											X[b]	X					
		300											X[b]	X					
		350											X[b]	X					
		400											X[b]	X					
		450											X[b]	X					
		500											X[b]	X					
		550											X[b]	X					
		600											X[b]	X					
		650											X[b]	X					
		700											X[b]	X					
		750											X[b]	X					
		800											X[b]	X					
		900											X[b]	X					
		1,000				X		X	X	X			X	X					
	TT3	10			X	X		X	X				X	X					
		20	X											X					
		100	X		X	X	X	X	X				X	X					
		1,000	X		X		X	X	X	X			X	X					
	TT6	10			X	X		X	X	X			X	X					
		20	[c]																
		100			X	X		X	X	X			X	X					
		1,000			X	X		X	X	X			X	X					
		2,000				X		X	X	X				X					
	TT7	10				X		X		X				X					
		1,000				X		X		X				X					
		2,000				X		X		X				X					

Table 4-1. (cont.)

Assessment Endpoint	Station/ Transect	Distance (m)	Small Mammals	Ptarmigan	Terrestrial Invertebrate Tissue	Vegetation: Willow	Vegetation: Birch	Vegetation: Sedge	Vegetation: Lichen: Peltigera	Vegetation: Lichen: Cladina	Salmon-berries	Sour-dock	Vegetation Plots	Tundra Soil	Aquatic Invertebrates: Tissue	Aquatic Invertebrates: Community Analysis	Sediment: Chemistry	Sediment: Toxicity Test	Water Quality Parameters
	TS-REF-5		X		X	X		X	X	X			X	X					
	TS-REF-7					X	X	X	X	X			X	X					
	TS-REF-11					X	X	X	X	X			X	X					
	TS-REF-12												X	X					
	Near the DMTS road			X															
	Terrestrial reference area			X															
	Site A										X[d]	X[d]							
	Site B										X[d]	X[d]							
	Site C										X[d]	X[d]							
Streams																			
	AC-R					X								X	X	X	X		X
	OR-R					X		X						X	X	X	X		X
	ARC-R					X		X						X	X	X	X		X
	ST-REF-3					X		X						X	X	X	X		X
	ST-REF-5					X		X						X		X			X
	ST-REF-6					X		X						X	X	X	X		X
Tundra Ponds																			
	TP1	100						X						X					X
		1,000						X						X					X
	TP3							X						X					X
	TP4							X						X					X
	TP-REF-2							X						X					X
	TP-REF-3							X						X					X
	TP-REF-5							X						X					X
Coastal Lagoons																			
	PLNL							X					X	X	X	X[e]	X	X	X
	NLK							X					X	X	X	X[e]	X	X	X
	NLF													X	X	X[e]	X	X	X
	CL-REF-1							X					X	X	X	X[e]	X	X	X
	CL-REF-2							X					X	X	X[f]	X[e]	X	X	X
	CL-REF-3													X		X[e]	X	X	X
Marine (Pre-shipping - June 2004)																			
	NMA																X		
	NMB																X		
	NMC																X		
	NMD																X		
	NME																X		
	NMF																X		
	NMG																X		
	NMH																X		
	NMJ																X		

Table 4-1. (cont.)

Assessment Endpoint	Station/ Transect	Distance (m)	Small Mammals	Ptarmigan	Terrestrial Invertebrate Tissue	Vegetation					Salmon-berries	Sour-dock	Vegetation Plots	Tundra Soil	Aquatic Invertebrates		Sediment		Water Quality Parameters
									Lichen						Tissue	Community Analysis	Chemistry	Toxicity Test	
						Willow	Birch	Sedge	Peltigera	Cladina									
	NMK																X		
	NML																X		
	NMM																X		
	NMN																X		
	NMO																X		
	NMP																X		
	NMQ																X		
	NMS																X		
	NMT																X		
	NMU																X		
	NMV																X		
	NMW																X		
	NMX																X		
	NMY																X		
	NMZ																X		
	NMAA																X		
	NMGZ																X		
	NM-REF-1																X		
	NM-REF-2																X		
	NM-REF-3																X		

[a] Grid set; no small mammals collected.

[b] Single microplot for vegetation community.

[c] No small mammal grid set; not correct habitat (too open).

[d] Five washed and five unwashed samples were collected at each site.

[e] Samples archived.

[f] Aquatic invertebrate tissue sample collected from area encompassed by both Stations CL-REF-2 and CL-REF-3.

Table 4-2. Phase II data collection matrix

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Terrestrial							
Small Mammals (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry; whole body; each individual mammal equals one sample	List 1[a]	
TT5	-- Port transect	4	3				
	20 m north of road			5; 2 brown lemmings and 3 tundra voles			
	100 m north of road			None			Grid set; no small mammals were collected
	1,000 m north of road			3 northern red backed voles			
	2,000 m north of road			1 masked shrew			
TT2	-- DMTS road transect	3	2				
	20 m north of road			None			Grid set; no small mammals were collected
	100 m north of road			3 northern red backed voles			
	1,000 m north of road			1 northern red backed vole			
TT8	-- DMTS road transect	0	0				Stations were added in the field.
	20 m north of road			None			Grid set; no small mammals were collected
	100 m north of road			None			Grid set; no small mammals were collected
TT3	-- DMTS road transect	3	3				
	20 m north of road			1 masked shrew			
	100 m north of road			2; 1 masked shrew and 1 tundra shrew			
	1,000 m north of road			3; 2 northern red backed voles and 1 masked shrew			
TT6	-- DMTS road transect	3	0				
	20 m north of road			None			No grid set; not correct habitat (too open)
	100 m north of road			None			Grid set; no small mammals were collected
	1,000 m north of road			None			Grid set; no small mammals were collected
TT7	-- Solid waste permit boundary transect	2	0				
	10 m downwind of boundary			None			No grid set; not correct habitat (rock face)
	1,000 m downwind of mine			None			No grid set; not correct habitat (rock face)
TS-REF-5	-- Terrestrial reference area	1	1	4; 3 masked shrews and 1 northern red backed vole			
Ptarmigan	Near the DMTS road	NA	NA	5 individual birds	Tissue chemistry; breast muscle tissue (skin on), liver, and kidneys from each bird analyzed separately	List 2: Antimony, barium, cadmium, lead, thallium, and zinc	
	Terrestrial reference area	NA	NA	3 individual birds			
Soil Invertebrate Tissue (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry; whole body; composite tissue sample of all soil invertebrates collected at a given station	List 1[a]	
TT5	-- Port transect	4	4				
	10 m north of road			1 spiders-only composite and 1 multi-species composite			
	100 m north of road			1 crane flies-only composite and 1 multi-species composite			
	1,000 m north of road			2 spiders-only composites and 1 multi-species composite			
	2,000 m north of road			1 multi-species composite			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
TT2	-- DMTS road transect	3	3				
	10 m north of road			1 multi-species composite			
	100 m north of road			1 multi-species composite			
	1,000 m north of road			1 multi-species composite			
TT3	-- DMTS road transect	0	3				Stations were added in the field.
	10 m north of road			1 multi-species composite			
	100 m north of road			1 multi-species composite			
	1,000 m north of road			1 multi-species composite			
TT6	-- DMTS road transect	0	3				Stations were added in the field.
	10 m north of road			1 multi-species composite			
	100 m north of road			1 multi-species composite			
	1,000 m north of road			1 multi-species composite			
TS-REF-5	-- Terrestrial reference area	1	1	1 multi-species composite			
Vegetation Tissue (presented in ascending order from port facility to mine along the DMTS)							
TT5	-- Port transect	4	4		Tissue chemistry; unwashed willow or birch leaves (debris removed in field), unwashed sedge blades (minimum 3 plants per station), unwashed lichen (debris removed in field with minimum 3 plants per station)	List 1[a]	
	10 m north of road			3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
	100 m north of road			3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
	1,000 m north of road			4; willow, birch, sedge, and lichen (Peltigera) (1 composite sample per species)			Willow and birch leaves were collected at this station.
	2,000 m north of road			3; birch, sedge, and lichen (Cladina) (1 composite sample per species)			No willow leaves were collected at this station. Birch leaves were collected at this station.
TT2	-- DMTS road transect	3	3				
	10 m north of road			3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
	1,000 m north of road			3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
	1 km north of road			3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
TT8	-- DMTS road transect	3	3				
	10 m north of road			3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
	100 m north of road			3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
	1,000 m north of road			4; willow, sedge, and lichen (both Peltigera and Cladina) (1 composite sample per species)			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
TT3	-- DMTS road transect	3	3				
	10 m north of road			3; willow, sedge, and lichen (Peltigera) (1 composite sample per species)			
	100 m north of road			4; willow, birch, sedge, and lichen (Peltigera) (1 composite sample per species)			Willow and birch leaves were collected at this station.
	1,000 m north of road			4; birch, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			No willow leaves were collected at this station. Birch leaves were collected at this station.
TT6	-- Port transect	4	4				
	10 m north of road			4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			
	100 m north of road			4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			
	1,000 m north of road			4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			
	2,000 m north of road			4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			
TT7	-- Solid waste permit boundary transect	3	3				
	10 m downwind of boundary			3; willow, sedge, and lichen (Cladina) (1 composite sample per species)			
	1,000 m downwind of mine			3; willow, sedge, and lichen (Cladina) (1 composite sample per species)			
	2,000 m downwind of mine			3; willow, sedge, and lichen (Cladina) (1 composite sample per species)			
TS-REF-5	-- Terrestrial reference area	1	1	4; willow, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			
TS-REF-7	-- Terrestrial reference area	1	1	5; willow, birch, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			Willow and birch leaves were collected at this station.
TS-REF-11	-- Terrestrial reference area	1	1	5; willow, birch, sedge, and lichen (Peltigera and Cladina) (1 composite sample per species)			Willow and birch leaves were collected at this station.
Berries							
Site A	-- just north of the port ambient air boundary at Ipiavik Lagoon	1	1	10; 5 washed and 5 unwashed salmonberry samples	Tissue chemistry; for all washed samples any debris was removed in field	Antimony, barium, cadmium, lead, thallium, and zinc	
Site B	-- north of the port facility but closer to Kivalina	1	1	10; 5 washed and 5 unwashed salmonberry samples			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Site C	-- reference area north of Kivalina	1	1	10; 5 washed and 5 unwashed salmonberry samples			
Site D	-- south of Site A on Ipiavik Lagoon but closer to the port facility	0	1	10; 5 washed and 5 unwashed salmonberry samples			
Sourdock					Tissue chemistry; for all washed samples any debris was removed in field; minimum 3 sourdock plants per station	Antimony, barium, cadmium, lead, thallium, and zinc	
Site A	-- just north of the port ambient air boundary at Ipiavik Lagoon	1	1	10; 5 washed and 5 unwashed sourdock samples			
Site B	-- north of the port facility but closer to Kivalina	1	1	10; 5 washed and 5 unwashed sourdock samples			
Site C	-- reference area north of Kivalina	1	1	10; 5 washed and 5 unwashed sourdock samples			
Site D	-- south of Site A on Ipiavik Lagoon but closer to the port facility	0	1	10; 5 washed and 5 unwashed sourdock samples			
Vegetation Plots (presented in ascending order from port facility to mine along the DMTS)					Community analysis	--	
TT5	-- Port transect	4	4				
	10 m north of road			--			
	100 m north of road			--			
	1,000 m north of road			--			
	2,000 m north of road			--			
TT8	-- DMTS road transect	3	19				
	10 m north of road			--			Station was added in the field.
	50 m north of road			--			Single microplot; station was added in the field.
	100 m north of road			--			
	150 m north of road			--			Single microplot; station was added in the field.
	200 m north of road			--			Single microplot; station was added in the field.
	250 m north of road			--			Single microplot; station was added in the field.
	300 m north of road			--			Single microplot; station was added in the field.
	350 m north of road			--			Single microplot; station was added in the field.
	400 m north of road			--			Single microplot; station was added in the field.
	450 m north of road			--			Single microplot; station was added in the field.
	500 m north of road			--			Single microplot; station was added in the field.
	550 m north of road			--			Single microplot; station was added in the field.
	600 m north of road			--			Single microplot; station was added in the field.
	650 m north of road			--			Single microplot; station was added in the field.
	700 m north of road			--			Single microplot; station was added in the field.
	750 m north of road			--			Single microplot; station was added in the field.
	800 m north of road			--			Single microplot; station was added in the field.
	900 m north of road			--			Single microplot; station was added in the field.
	1,000 m north of road			--			
TT3	-- DMTS road transect	3	3				
	10 m north of road			--			
	100 m north of road			--			
	1,000 m north of road			--			
TT6	-- Port transect	3	3				
	10 m north of road			--			
	100 m north of road			--			
	1,000 m north of road			--			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
TS-REF-5	-- Terrestrial reference area	1	1	--			
TS-REF-7	-- Terrestrial reference area	1	1	--			
TS-REF-11	-- Terrestrial reference area	1	1	--			Reference area station location was modified to better match vegetation community at site stations.
TS-REF-12	-- Terrestrial reference area	0	1	--			Station was added in the field.
Tundra Soil (presented in ascending order from port facility to mine along the DMTS)					Chemistry; 0–2 cm	List 3[b] and pH	
TT5	-- Port transect	5	5				
	10 m north of road			1			
	20 m north of road			1			
	100 m north of road			1			
	1,000 m north of road			1			
	2,000 m north of road			1			
TT2	-- DMTS road transect	4	4				
	10 m north of road			1			
	20 m north of road			1			
	100 m north of road			1			
	1,000 m north of road			1			
TT8	-- DMTS road transect	3	19				
	10 m north of road			1			
	50 m north of road			1			Station was added in the field.
	100 m north of road			1			
	150 m north of road			1			Station was added in the field.
	200 m north of road			1			Station was added in the field.
	250 m north of road			1			Station was added in the field.
	300 m north of road			1			Station was added in the field.
	350 m north of road			1			Station was added in the field.
	400 m north of road			1			Station was added in the field.
	450 m north of road			1			Station was added in the field.
	500 m north of road			1			Station was added in the field.
	550 m north of road			1			Station was added in the field.
	600 m north of road			1			Station was added in the field.
	650 m north of road			1			Station was added in the field.
	700 m north of road			1			Station was added in the field.
	750 m north of road			1			Station was added in the field.
	800 m north of road			1			Station was added in the field.
	900 m north of road			1			Station was added in the field.
	1,000 m north of road			1			
TT3	-- DMTS road transect	6	4				Vegetation transition points at 50 m and 250 m were moved from TT3 to TT8.
	10 m north of road			1			
	20 m north of road			1			
	100 m north of road			1			
	1,000 m north of road			1			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
TT6	-- Port transect	5	4				
	10 m north of road			1			
	20 m north of road			0			No tundra soil sample was collected at 20 m.
	100 m north of road			1			
	1,000 m north of road			1			
	2,000 m north of road			1			
TT7	-- Solid waste permit boundary transect	3	3				
	10 m downwind of boundary			1			
	1,000 m downwind of mine			1			
	2,000 m downwind of mine			1			
TS-REF-5	-- Terrestrial reference area	1	1	1			
TS-REF-7	-- Terrestrial reference area	1	1	1			
TS-REF-11	-- Terrestrial reference area	1	1	1			Reference area station location was modified to better match vegetation community at site stations.
TS-REF-12	-- Terrestrial reference area	0	1	1			Station was added in the field.
Streams							
Aquatic Invertebrate Tissue (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry	Cadmium, lead, mercury, and zinc	Stations were added in the field.
AC-R	Aufeis Creek	0	1	1 multi-species composite			
OR-R	Omikviorok River	0	1	1 multi-species composite			
ARC-R	Anxiety Ridge Creek	0	1	1 multi-species composite			
ST-REF-3	-- Freshwater aquatic reference area	0	1	1 multi-species composite			
ST-REF-6	-- Freshwater aquatic reference area	0	1	1 multi-species composite			
Aquatic Invertebrate Community (presented in ascending order from port facility to mine along the DMTS)					Community analysis	--	
AC-R	Aufeis Creek	1	1	5 replicates per station			
OR-R	Omikviorok River	1	1	5 replicates per station			
ARC-R	Anxiety Ridge Creek	1	1	5 replicates per station			
ST-REF-3	-- Freshwater aquatic reference area	1	1	5 replicates per station			
ST-REF-5	-- Freshwater aquatic reference area	0	1	5 replicates per station			
ST-REF-6	-- Freshwater aquatic reference area	0	1	5 replicates per station			
Vegetation Tissue (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry; unwashed willow leaves (debris removed in field), sedge plant (rinsed roots [no sediment] and unwashed blades with minimum 3 plants per station)	List 1[a]	
AC-R	Aufeis Creek	1	1	1; willow (1 composite sample)			Sedge was not collected at this station.
OR-R	Omikviorok River	1	1	2; willow and sedge (1 composite sample per species)			
ARC-R	Anxiety Ridge Creek	1	1	2; willow and sedge (1 composite sample per species)			
ST-REF-3	-- Freshwater aquatic reference area	1	1	2; willow and sedge (1 composite sample per species)			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
ST-REF-5	-- Freshwater aquatic reference area	1	1	2; willow and sedge (1 composite sample per species)			
ST-REF-6	-- Freshwater aquatic reference area	1	1	2; willow and sedge (1 composite sample per species)			
Tundra Soil (presented in ascending order from port facility to mine along the DMTS)					Chemistry; 0–2 cm	List 3[b] and pH	
AC-R	Aufeis Creek	1	1	1			
OR-R	Omikviorok River	1	1	1			
ARC-R	Anxiety Ridge Creek	1	1	1			
ST-REF-3	-- Freshwater aquatic reference area	1	1	1			
ST-REF-5	-- Freshwater aquatic reference area	1	1	1			
ST-REF-6	-- Freshwater aquatic reference area	1	1	1			
Stream Sediment (presented in ascending order from port facility to mine along the DMTS)					Chemistry; 0–2 cm	List 3[b] and pH	Stations were added in the field (associated with the stream aquatic invertebrate tissue samples).
AC-R	Aufeis Creek	0	1	1			
OR-R	Omikviorok River	0	1	1			
ARC-R	Anxiety Ridge Creek	0	1	1			
ST-REF-3	-- Freshwater aquatic reference area	0	1	1			
ST-REF-6	-- Freshwater aquatic reference area	0	1	1			
Stream Water (presented in ascending order from port facility to mine along the DMTS)					Field measurements	Water quality parameters[c]	
AC-R	Aufeis Creek	1	1	1			
OR-R	Omikviorok River	1	1	1			
ARC-R	Anxiety Ridge Creek	1	1	1			
ST-REF-3	-- Freshwater aquatic reference area	1	1	1			
ST-REF-5	-- Freshwater aquatic reference area	1	1	1			
ST-REF-6	-- Freshwater aquatic reference area	1	1	1			
Tundra Ponds							
Vegetation Tissue (presented in ascending order from port facility to mine along the DMTS)					Tissue chemistry; sedge plant (rinsed roots [no sediment] and unwashed blades with minimum 3 plants per station); entire plant will be sampled	List 1[a]	
TP1	-- Port transect						
	100 m north of road	1	1	1			
	1 km north of road	1	1	1			
	--DMTS road						
	TP3	1	1	1			2 ponds at 100-500 m north of road - near mine and middle of road; a suitable third pond was not identified
	TP4	1	1	1			
TP-REF-2	-- Freshwater aquatic reference area	1	1	1			
TP-REF-3	-- Freshwater aquatic reference area	1	1	1			
TP-REF-5	-- Freshwater aquatic reference area	1	1	1			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Tundra Soil (presented in ascending order from port facility to mine along the DMTS)					Chemistry; 0–2 cm	List 3[b]	
TP1	-- Port transect						
	100 m north of road	1	1	1			
	1 km north of road	1	1	1			
	--DMTS road						
	TP3	1	1	1			
	TP4	1	1	1			
TP-REF-2	-- Freshwater aquatic reference area	1	1	1			
TP-REF-3	-- Freshwater aquatic reference area	1	1	1			
TP-REF-5	-- Freshwater aquatic reference area	1	1	1			
Tundra Pond Water (presented in ascending order from port facility to mine along the DMTS)					Field measurements	Water quality parameters[c]	
TP1	-- Port transect						
	100 m north of road	1	1	1			
	1 km north of road	1	1	1			
	--DMTS road						2 ponds at 100-500 m north of road - near mine and middle of road; a suitable third pond was not identified
	TP3	1	1	1			
	TP4	1	1	1			
TP-REF-2	-- Freshwater aquatic reference area	1	1	1			
TP-REF-3	-- Freshwater aquatic reference area	1	1	1			
TP-REF-5	-- Freshwater aquatic reference area	1	1	1			
Coastal Lagoons							
Aquatic Invertebrate Tissue (presented in ascending order from port facility to the north)					Tissue chemistry; composite sample of all invertebrates collected at a station	List 4: Cadmium, lead, and zinc	
PLNL	Port Lagoon North (inland shore)	1	1	1 multi-species composite			
NLK	North Lagoon (inland shore)	1	1	1 multi-species composite			
NLF	North Lagoon (seaward shore)	1	1	1 multi-species composite			
CL-REF-1	-- Reference lagoon	1	1	1 multi-species composite			
CL-REF-2/3	-- Control lagoon	0	1	1 multi-species composite			Station was added in the field.
Aquatic Invertebrate Community (presented in ascending order from port facility to the north)					Community analysis	--	
PLNL	Port Lagoon North (inland shore)	1	1	5 replicates per station			
NLK	North Lagoon (inland shore)	1	1	5 replicates per station			
NLF	North Lagoon (seaward shore)	1	1	5 replicates per station			
CL-REF-1	-- Reference lagoon	1	1	5 replicates per station			
CL-REF-2	-- Control lagoon (inland shore)	1	1	5 replicates per station			
CL-REF-3	-- Control lagoon (seaward shore)	1	1	5 replicates per station			
Fish							
	2 site lagoons	2	0	0			All 3 coastal lagoons were seined and trapped; no fish were collected.
	Reference lagoon TBD	1	0	0			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Vegetation Tissue (presented in ascending order from port facility to the north)					Tissue chemistry; sedge plant (rinsed roots [no sediment] and unwashed blades with minimum 3 plants per station); entire plant will be sampled	List 1[a]	
PLNL	Port Lagoon North (inland shore)	1	1	1			
NLK	North Lagoon (inland shore)	1	1	1			
NLF	North Lagoon (seaward shore)	1	0	0			No sedge was present at Station NLF.
CL-REF-1	-- Reference lagoon	1	1				
CL-REF-2	-- Control lagoon (inland shore)	1	1	1			
CL-REF-3	-- Control lagoon (northern shore)	1	0	0			
Vegetation Plots (presented in ascending order from port facility to the north)					Community analysis	--	
PLNL	Port Lagoon North (inland shore)	1	1	--			
NLK	North Lagoon (inland shore)	1	1	--			
NLF	North Lagoon (seaward shore)	1	0	--			No vegetation plots were surveyed at Station NLF; sand dune environment
CL-REF-1	-- Reference lagoon	1	1	--			
CL-REF-2	-- Control lagoon (inland shore)	1	1	--			
CL-REF-3	-- Control lagoon (northern shore)	1	0	--			No vegetation plots were surveyed at Station CL-REF-3
Tundra Soil (presented in ascending order from port facility to the north)					Chemistry; 0–2 cm	List 3[b] and pH	
PLNL	Port Lagoon North (inland shore)	1	1	1			
NLK	North Lagoon (inland shore)	1	1	1			
NLF	North Lagoon (seaward shore)	1	1	1			
CL-REF-1	-- Reference lagoon	1	1	1			
CL-REF-2	-- Control lagoon (inland shore)	1	1	1			
CL-REF-3	-- Control lagoon (northern shore)	1	1	1			
Lagoon Sediment (presented in ascending order from port facility to mine along the DMTS)					Chemistry and toxicity test; 0–2 cm	List 5: Arsenic, cadmium, lead, zinc; List 6: Grain size and total solids; *Hyalella* survival and growth	
PLNL	Port Lagoon North (inland shore)	1	1	1			
NLK	North Lagoon (inland shore)	1	1	1			
NLF	North Lagoon (seaward shore)	1	1	1			
CL-REF-1	-- Reference lagoon	1	1	1			
CL-REF-2	-- Control lagoon (inland shore)	1	1	1			
CL-REF-3	-- Control lagoon (seaward shore)	1	1	1			
Lagoon Water (presented in ascending order from port facility to the north)					Field measurements	Water quality parameters[c]	
PLNL	Port Lagoon North (inland shore)	1	1	1			
NLK	North Lagoon (inland shore)	1	1	1			
NLF	North Lagoon (seaward shore)	1	1	1			
CL-REF-1	-- Reference lagoon	1	1	1			
CL-REF-2	-- Control lagoon (inland shore)	1	1	1			
CL-REF-3	-- Control lagoon (seaward shore)	1	1	1			

Table 4-2. (cont.)

Sample Type	Description	No. of Proposed Stations	No. of Stations Sampled	No. of Field Samples	Kind of Sample	Analytes	Comments
Marine							
Surface sediment	19 stations around the port	19	19	38 (two events)[d]	Chemistry and toxicity test; 0–2 cm	List 4: Cadmium, lead, zinc	
Surface sediment	7 port stations - NMD, NMGZ, NML, NMM, NMN, NMO, NMAA	7	7	14 (two events)[d]		List 7: Cadmium, copper, lead, mercury, silver, zinc; List 6: Grain size, total solids; *Hyalella* survival and growth[e]	
Surface sediment	3 reference stations to the southeast	3	3	6 (two events)[d]			

Note: DMTS - DeLong Mountain Regional Transportation System
NA - not applicable
TBD - to be determined

[a] List 1: Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, lead, mercury, molybdenum, selenium, thallium, vanadium, and zinc.

[b] List 3: Antimony, arsenic, barium, cadmium, cobalt, copper, lead, manganese, mercury, molybdenum, selenium, silver, thallium, vanadium, and zinc.

[c] Water quality measurements were taken in the field (i.e., pH, dissolved oxygen, temperature, conductivity, and salinity).

[d] Marine sediment sampling events conducted in June and September 2004.

[e] The criteria described in the sampling and analysis plan (Exponent 2004b) were not met, so no sediment toxicity testing was conducted on marine sediments.

Table 5-1. Summary of exposure point concentrations for environmental media

	N	#ND	%ND	Min.	Max.	Mean	Std.Dev.	Distribution Tests			UCL Method	UCL	EPC	
								normal	gamma	lognormal				
Stream Surface water (μg/L)														
Lead	229	145	63%	0.018	7.3	0.33	0.75	--	--	--	--	--	0.33	Mean
Thallium	28	24	86%	0.016	0.55	0.055	0.11	No	No	No	Chebyshev NP	0.14	0.14	UCL
Soil Subareas (mg/kg)														
Port Soil (mg/kg)														
Antimony	23	18	78%	0.93	26.0	9.6	8.8	No	No	No	Chebyshev NP	17.5	17.5	UCL
Barium	23	0	0%	357	2,110	1,304	383	Yes	Yes	No	Student's-t	1,441	1,441	UCL
Cadmium	428	41	10%	0.40	388	27.6	39.2	No	No	No	Chebyshev NP[a]	39.4	39.4	UCL
Lead	433	12	3%	8.5	48,300	1,255	2,921	--	--	--	--	--	1,255	Mean
Thallium	4	0	0%	0.29	0.78	0.53	0.21		n <10		--	--	0.78	Max
Zinc	433	0	0%	37.4	64,300	4,494	6,415	No	No	No	Chebyshev NP[a]	6,419	6,419	UCL
Road Soil (mg/kg)														
Antimony	12	6	50%	0.38	5.5	2.9	2.4	No	No	No	Chebyshev NP[b]	9.8	5.5	Max
Barium	12	0	0%	650	6,290	2,216	1,870	No	Yes	Yes	Approx. gamma	3,373	3,373	UCL
Cadmium	32	2	6%	0.50	29.3	4.0	5.5	No	No	No	Chebyshev NP	8.3	8.3	UCL
Lead	32	0	0%	13.5	2,440	198	423	--	--	--	--	--	198	Mean
Thallium	6	0	0%	0.11	0.46	0.22	0.13		n<10		--	--	0.46	Max
Zinc	32	0	0%	102	4,840	731	952	No	No	Yes	H-statistic	962	962	UCL
DMTS Area-weighted Soil (mg/kg)[c]														
Antimony	--	--	--	--	--	--	--	--	--	--			6.5	UCL/Max
Barium	--	--	--	--	--	--	--	--	--	--			3,219	UCL
Cadmium	--	--	--	--	--	--	--	--	--	--			10.8	UCL
Lead	--	--	--	--	--	--	--	--	--	--			282	Mean
Thallium	--	--	--	--	--	--	--	--	--	--			0.49	Max
Zinc	--	--	--	--	--	--	--	--	--	--			1,399	UCL
DMTS Area-averaged Soil (mg/kg)[d]														
Antimony	--	--	--	--	--	--	--	--	--	--			11.5	UCL/Max
Barium	--	--	--	--	--	--	--	--	--	--			2,407	UCL
Cadmium	--	--	--	--	--	--	--	--	--	--			23.8	UCL
Lead	--	--	--	--	--	--	--	--	--	--			726	Mean
Thallium	--	--	--	--	--	--	--	--	--	--			0.62	Max
Zinc	--	--	--	--	--	--	--	--	--	--			3,691	UCL

Note: All UCL calculations were done using ProUCL 3.0. UCL methods are recommendations per EPA guidance (U.S. EPA 2002b).
Undetected sample results included based on one-half of the detection limit.

-- - not applicable
DMTS - DeLong Mountain Regional Transportation System
EPC - exposure point concentration
Min. - minimum result

Table 5-1. (cont.)

Max. - maximum result
N - number of results
ND - not detected
NP - nonparametric
Std.Dev. - standard deviation
UCL - upper confidence limit

[a] 97.5% UCL was used to obtain 95% coverage level, per ProUCL recommendation.

[b] 99% UCL was used to obtain 95% coverage level, per ProUCL recommendation.

[c] A DMTS area-weighted soil concentration was derived for each metal assuming that the port area soil samples represent an area of 26 hectares and that the road area soil samples represent an area of 312 hectares (see Figure 5-2). The total assumed DMTS site area is (26 + 312) 338 hectares; therefore, the port soil mean was adjusted by 0.08 (26/338) and the road soil mean was adjusted by 0.92 (312/338): DMTS Area-weighted Soil = (Port Area EPC x 0.08) + (Road Area EPC x 0.92).

[d] A DMTS area-averaged soil concentration was derived for each metal by averaging the EPC for port soil and the EPC for road soil:
DMTS Area-averaged Soil = (Port Area EPC + Road Area EPC) / 2.

Table 5-2. Summary of exposure point concentrations for subsistence foods

	N	#ND	%ND	Min.	Max.	Mean	Std.Dev.	Distribution Tests			UCL Method	UCL	EPC	
								normal	gamma	lognormal				
Caribou (mg/kg wet)[a]														
Caribou Tissue-Specific Data														
Kidney														
Barium	--	--	--	--	--	--	--	--	--	--	--	--	3.2	[b]
Cadmium	11	0	0%	1.3	9.9	4.7	2.9	yes	yes	yes	Student's-t	6.3	6.3	UCL
Lead	11	0	0%	0.35	5.8	2.0	1.8	--	--	--	--	--	2.0	Mean
Zinc	11	0	0%	10.0	53.8	22.1	11.8	no	yes	yes	Approx. Gamma	29.1	29.1	UCL
Liver														
Barium	--	--	--	--	--	--	--	--	--	--	--	--	2.7	[b]
Cadmium	11	0	0%	0.36	3.3	1.4	0.96	yes	yes	yes	Student's-t	1.9	1.9	UCL
Lead	11	0	0%	0.72	5.6	2.6	1.7	--	--	--	--	--	2.6	Mean
Zinc	11	0	0%	20.3	120	39.1	28.0	no	yes	no	Approx. Gamma	54.1	54.1	UCL
Muscle														
Barium	--	--	--	--	--	--	--	--	--	--	--	--	1.2	[b]
Cadmium	11	3	27%	0.0050	0.080	0.041	0.025	yes	yes	no	Student's-t	0.055	0.055	UCL
Lead	11	0	0%	0.020	0.26	0.11	0.086	--	--	--	--	--	0.11	Mean
Zinc	11	0	0%	20.1	69.0	29.1	13.8	no	no	no	Modified-t NP	36.6	36.6	UCL
Edible Tissue Weighted Average[c]														
Barium	--	--	--	--	--	--	--	--	--	--	--	--	1.3	[b]
Cadmium	33	--	--	--	--	--	--	--	--	--	--	--	0.22	UCL
Lead	33	--	--	--	--	--	--	--	--	--	--	--	0.19	Mean
Zinc	33	--	--	--	--	--	--	--	--	--	--	--	36.8	UCL
Fish (mg/kg wet)														
Lead	151	83	55%	0.0015	0.091	0.010	0.016	--	--	--	--	--	0.010	Mean
Thallium	--	--	--	--	--	--	--	--	--	--	--	--	0.0026	[d]
Ptarmigan (mg/kg wet)														
Ptarmigan Tissue-Specific Data														
Breast														
Barium	5	0	0%	0.040	0.48	0.19	0.17		n<10		--	--	0.48	Max
Cadmium	5	0	0%	0.16	0.48	0.31	0.12		n<10		--	--	0.48	Max
Lead	5	0	0%	0.011	0.045	0.025	0.013		n<10		--	--	0.025	Mean
Zinc	5	0	0%	6.3	10.2	8.6	1.5		n<10		--	--	10.2	Max
Kidney														
Barium	5	0	0%	0.38	3.8	1.2	1.5		n<10		--	--	3.8	Max
Cadmium	5	0	0%	52.6	108.1	80.9	26.2		n<10		--	--	108	Max
Lead	5	0	0%	0.44	2.7	1.3	0.9		n<10		--	--	1.3	Mean
Zinc	5	0	0%	41.0	67.1	54.5	9.7		n<10		--	--	67.1	Max

Table 5-2. (cont.)

	N	#ND	%ND	Min.	Max.	Mean	Std.Dev.	Distribution Tests			UCL Method	UCL	EPC	
								normal	gamma	lognormal				
Liver														
Barium	5	0	0%	0.12	0.53	0.29	0.16		n<10		--	--	0.53	Max
Cadmium	5	0	0%	7.8	22.5	15.2	6.8		n<10		--	--	22.5	Max
Lead	5	0	0%	0.11	0.97	0.38	0.34		n<10		--	--	0.38	Mean
Zinc	5	0	0%	28.2	64.8	41.8	14.1		n<10		--	--	64.8	Max
Edible tissue weighted average[e]														
Barium	15	--	--	--	--	--	--	--	--	--	--	--	0.52	Max
Cadmium	15	--	--	--	--	--	--	--	--	--	--	--	3.5	Max
Lead	15	--	--	--	--	--	--	--	--	--	--	--	0.07	Mean
Zinc	15	--	--	--	--	--	--	--	--	--	--	--	15.7	Max
Salmonberry (mg/kg wet)														
Barium	6	0	0%	0.022	0.078	0.052	0.019		n<10		--	--	0.078	Max
Cadmium	27	0	0%	0.0069	0.21	0.041	0.038	no	yes	yes	Approx. Gamma	0.052	0.052	UCL
Lead	27	1	4%	0.0011	1.8	0.15	0.34	--	--	--	--	--	0.15	Mean
Zinc	27	0	0%	1.9	9.2	4.2	1.7	no	yes	yes	Approx. Gamma	4.7	4.7	UCL
Sourdock (mg/kg wet)														
Antimony	6	0	0%	0.0037	0.012	0.0084	0.0034		n<10		--	--	0.012	Max
Barium	6	0	0%	0.76	10.6	3.4	3.7		n<10		--	--	10.6	Max
Cadmium	12	0	0%	0.0032	0.021	0.010	0.0053	yes	yes	yes	Student's-t	0.013	0.013	UCL
Lead	12	0	0%	0.047	0.42	0.21	0.11	--	--	--	--	--	0.21	Mean
Thallium	6	4	67%	0.00012	0.00049	0.00020	0.00015		n<10		--	--	0.00049	Max
Zinc	12	0	0%	0.00012	7.4	4.6	1.5	yes	yes	yes	Student's-t	5.4	5.4	UCL

Note: All UCL calculations were done using ProUCL 3.0. UCL methods are recommendations per EPA guidance (U.S. EPA 2002b).
Undetected sample results included based on one-half of the detection limit.

-- - not applicable
CoPC - chemical of potential concern
EPC - exposure point concentration
Min. - minimum result
Max. - maximum result
N - number of results
ND - not detected
NP - non parametric
Std.Dev. - standard deviation
UCL - upper confidence limit
EPA - U.S. Environmental Protection Agency

[a] Caribou tissue samples were not analyzed for antimony, barium, and thallium. Ptarmigan tissue EPCs were used to predict the caribou barium concentration. Antimony was never detected in ptarmigan, and thallium was only rarely detected and at concentrations near or below reference concentrations. Therefore, antimony and thallium were not included as caribou or ptarmigan CoPCs (see Section 5.2.1.2.6).

[b] This calculated EPC value used for barium is based on the relationship between barium and lead in the corresponding ptarmigan tissue (see Section 5.2.1.2.6).

[c] The EPC concentration for the edible caribou tissue weighted average was calculated using a mass-weighted calculation. Kidney and liver tissue each contributed 2 percent and muscle tissue contributed 96 percent of the concentration (ADPH 2001).

[d] This calculated EPC value used for thallium is based on the relationship between thallium and lead in stream surface water.

[e] The EPC concentration for the edible ptarmigan tissue weighted average was calculated using a mass-weighted calculation. Muscle tissue contributed 90 percent, kidney tissue contributed 1 percent, and liver tissue contributed 9 percent of the concentration (Kalas et al. 1995; Remington and Braun 1988) (Section 5.2.1.2.7).

Table 5-3. Calculation of predicted fish thallium exposure point concentration

	Max.	Mean	UCL	EPC	Ratio of Thallium Mean to Lead Mean in Surface Water	
Stream Surface Water (μg/L)						
Lead	7.3	0.33	0.55	0.33 Mean		
Thallium	0.55	0.055	0.14	0.14 UCL	0.17	(0.055/0.33)

	Max.	Mean	UCL	EPC	Calculation of Thallium EPC from Lead UCL in Fish	
Fish (mg/kg wet)						
Lead	0.091	0.010	0.016	0.010 Mean		
Thallium	--	--		0.0026 [a]	0.0026	(0.016*0.17)

Note: EPC - exposure point concentration
UCL - upper confidence limit

[a] The fish thallium EPC is calculated by multiplying the 95%UCL for lead in fish by the ratio of the mean thallium to mean lead concentrations in surface water.

Table 5-4. Calculation of predicted caribou barium exposure point concentrations for kidney, liver, and muscle tissue

					Ratios of Ptarmigan Mean Barium Value to Means for:		
	Max.	Mean	UCL	EPC	Cadmium	Lead	Zinc
Kidney Tissue							
Ptarmigan (mg/kg wet)							
Barium	3.8	1.2			0.015	0.96	0.023
Cadmium	108	80.9			(1.2/80.9)	(1.2/1.3)	(1.2/54.5)
Lead	2.7	1.3					
Zinc	67.1	54.5					
					Calculation of Barium EPC from Caribou EPCs through Application of Ratios for Other Metals		
	Max.	Mean	UCL	EPC	Cadmium	Lead	Zinc
Caribou (mg/kg wet)							
Barium	--	--		3.2 [a]	0.10	3.2	0.66
Cadmium	9.9	4.7	6.3	6.3 UCL	(6.3*0.015)	(3.4*0.96)	(29.1*0.023)
Lead	5.82	1.97	3.4	2.0 Mean			
Zinc	53.8	22.1	29.1	29.1 UCL			
					Ratios of Ptarmigan Mean Barium Value to Means for:		
	Max.	Mean	UCL	EPC	Cadmium	Lead	Zinc
Liver Tissue							
Ptarmigan (mg/kg wet)							
Barium	0.53	0.29			0.019	0.77	0.007
Cadmium	22.5	15.2			(0.29/15.2)	(0.29/0.38)	(0.29/41.8)
Lead	0.97	0.38					
Zinc	64.8	41.8					
					Calculation of Barium EPC from Caribou EPCs through Application of Ratios for Other Metals		
	Max.	Mean	UCL	EPC	Cadmium	Lead	Zinc
Caribou (mg/kg wet)							
Barium	--	--		2.7 [a]	0.038	2.7	0.38
Cadmium	3.32	1.42	1.9	1.9 UCL	(1.9*0.019)	(3.5*0.77)	(54.1*0.007)
Lead	5.6	2.6	3.5	2.6 Mean			
Zinc	120	39.1	54.1	54.1 UCL			
					Ratios of Ptarmigan Mean Barium Value to Means for:		
	Max.	Mean	UCL	EPC	Cadmium	Lead	Zinc
Muscle Tissue							
Ptarmigan (mg/kg wet)							
Barium	0.48	0.19			0.62	7.67	0.022
Cadmium	0.48	0.31			(0.19/0.31)	(0.19/0.025)	(0.19/8.6)
Lead	0.045	0.025					
Zinc	10.2	8.6					
					Calculation of Barium EPC from Caribou EPCs through Application of Ratios for Other Metals		
	Max.	Mean	UCL	EPC	Cadmium	Lead	Zinc
Caribou (mg/kg wet)							
Barium	--	--		1.2 [a]	0.034	1.2	0.80
Cadmium	0.080	0.041	0.055	0.055 UCL	(0.055*0.62)	(0.16*7.67)	(36.6*0.022)
Lead	0.26	0.11	0.16	0.11 Mean			
Zinc	69.0	29.1	36.6	36.6 UCL			

Note: EPC - exposure point concentration
UCL - upper confidence limit

[a] The predicted caribou barium EPCs were calculated by:
1) Calculating ratios of mean barium to mean cadmium, lead, and zinc in each of the ptarmigan tissues (i.e., kidney, liver, and muscle). For all tissues the ratio of barium to lead gave the highest ratio.
2) Multiplying the barium to lead ratio for each tissue by the 95%UCL for lead in the corresponding caribou tissue.

Table 5-5. Ptarmigan tissue weight calculations

Tissue	Weight (g-wet weight)	Fraction of Total	Basis	Source
Kidney	3	0.01	Twice the highest value for one kidney reported for willow ptarmigan (range was 1.2–1.5 g).	Kalas et al. (1995)
Liver	26.5	0.09	Average liver weight for adult male and female sage grouse.	Remington and Braun (1988)
Muscle	257	0.90	Average weight for adult male and female sage grouse pectoralis and supracorocoideus muscles.	Remington and Braun (1988)
Total	286.5			

Table 5-6. EPA IEUBK lead model exposure parameters and input values

Parameter	Input Value(s)	Source
Air		
Outdoor air lead concentration (μg/m^3)	0.100	EPA default
Indoor air lead concentration (percent of outdoor air)	30%	EPA default
Time spent outdoors (hours/day)	1, 2, 3, 4, 4, 4,4	EPA default[a]
Ventilation rates (m^3/day)	2, 3, 5, 5, 5, 7 ,7	EPA default[a]
Lung absorption (percentage)	32	EPA default
Diet		
Diet intake (μg/day)	3.16, 2.60, 2.87, 2.74, 2.61, 2.74, 2.99	Update to EPA default[a,b]
Alternative diet values	Not used	EPA default
Alternate source, subsistence food (μg/day)	1.6	Site data, see Table 5-8
Bioavailability of lead in food (percent)	50	EPA default
Drinking Water		
Lead concentration in drinking water (μg/L)	0.33	Site data
Drinking water intake (L/day)	0.20, 0.50, 0.52, 0.53, 0.55, 0.58, 0.59	EPA default[a]
Alternative water values	Not used	EPA default
Bioavailability of lead in drinking water (percent)	50	EPA default
Soil/Dust		
Soil lead levels (ppm; μg/g)	25, 65	Site data[c]
Indoor dust lead levels (percent of soil levels)	70%	EPA default
Ingestion weighting factor (percent soil/percent dust)	45/55	EPA default
Amount of soil/dust ingested daily (g/day)	0.085, 0.135, 0.135, 0.135, 0.100, 0.090, 0.085	EPA default[a]
Bioavailability of lead in soil and dust (percent)	30, 9.7	EPA default and site-specific[d]
Other		
Alternate source, subsistence food (μg/day)	1.6, 3.4	Site data[e], see Table 5-8
Bioavailability of lead from subsistence foods (percent)	50	EPA default
Maternal contribution method	Infant model	EPA default
Maternal blood lead at birth of child (μg/dL)	2.5	EPA default
Geometric standard deviation	1.6	EPA default

Note: EPA - U.S. Environmental Protection Agency
IEUBK - integrated exposure uptake/biokinetic

[a] Value varies by age group. Values listed are for the following ages, respectively: 0–1, 1–2, 2–3, 3–4, 4–5, 5–6, 6–7.

[b] EPA recommends use of updated dietary intake values (citation).

[c] IEUBK model results were derived based on both the area-weighted soil concentration (282 μg/g) and the area-averaged soil concentration (726 μg/g). Each value was multiplied by the site fractional intake of 0.09 to derive the soil lead level inputs for the model (i.e., 282 x 0.09 = 25; 726 x 0.09 = 65).

[d] The EPA default for the IEUBK lead model is 30 percent. The site-specific value is 9.7 percent (see Table 5-7), based on data from the lead bioavailability study conducted by the National Toxicology Program and reported by the Alaska Division of Public Health (ADPH 2001; Arnold and Middaugh 2001; Arnold et al. 2003).

[e] IEUBK model results were derived using both the site-specific fractional intake of 0.09 and the alternative caribou fractional intake of 0.2 to calculate lead intake from subsistence foods.

Table 5-7. Bioavailability of lead in Red Dog ore concentrate

Lead Concentration in Amended Food (mg/kg)[a]	Blood Lead (μg/dL)		Relative Bioavailability	Child Absolute Bioavailability[b]	Adult Absolute Bioavailability[b]
	Lead Acetate	Red Dog Concentrate			
0		5.05	--	--	--
10	16	4.32	27.0%	13.5%	5.4%
30	31.8	5.65	17.8%	8.9%	3.6%
100	84.8	11.5	13.6%	6.8%	2.7%
Average	--	--	19.4%	9.7%	3.9%

Source: ADPH (2001); Arnold and Middaugh (2001); Arnold et al. (2003)

Note: -- - not applicable

[a] Animals were fed a diet amended with either Red Dog ore concentrate or soluble lead acetate so that the animals' food had the specific lead concentrations listed.

[b] Absolute bioavailability is calculated by multiplying the relative bioavailability of Red Dog concentrate by the absolute bioavailability of lead acetate. The absolute bioavailability of lead acetate was assumed to be 50 percent for children and 20 percent for adults, per U.S. EPA (1994, 1996c) guidance. For the adult lead model, absolute bioavailability is referred to as absorption fraction.

Table 5-8. Calculation of subsistence food lead intake for EPA IEUBK child lead model

Scenario Timeframe: Current/Future
Exposure Medium: Food
Exposure Point: Subsistence Food
Receptor Population: Subsistence User
Receptor Age: Young child

Exposure Route	Food		EPC Value	EPC Units	Daily Food Intake[a]	Daily Food Intake Units	Chronic Daily Intake	Chronic Daily Intake Units
Based on Caribou FI=0.09								
	Caribou	Lead	195	µg/kg	7.6E-3	kg/day	1.5	µg/day
	Fish	Lead	10.2	µg/kg	5.6E-3	kg/day	0.06	µg/day
	Ptarmigan	Lead	69.3	µg/kg	9.0E-5	kg/day	0.006	µg/day
	Salmonberry	Lead	147	µg/kg	3.8E-4	kg/day	0.06	µg/day
	Sourdock	Lead	211	µg/kg	6.3E-5	kg/day	0.01	µg/day
						Total	1.6	µg/day
Based on Alternative Caribou FI=0.2								
	Caribou	Lead	195	µg/kg	1.7E-2	kg/day	3.3	µg/day
	Fish	Lead	10.2	µg/kg	5.6E-3	kg/day	0.06	µg/day
	Ptarmigan	Lead	69.3	µg/kg	9.0E-5	kg/day	0.006	µg/day
	Salmonberry	Lead	147	µg/kg	3.8E-4	kg/day	0.06	µg/day
	Sourdock	Lead	211	µg/kg	6.3E-5	kg/day	0.01	µg/day
						Total	3.4	µg/day

Note: -- - not applicable
AT - averaging time
BW - body weight
Cf - concentration in food
CR_f - consumption rate for food
ED - exposure duration
EF - exposure frequency
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
FI - fractional intake
IEUBK - integrated exposure uptake biokinetic

[a] Daily Food Intake = $CR_f \times 10^{-3} \times FI \times EF \times ED / (BW \times AT)$

Chronic Daily Intake (CDI) (mg/kg-day) = C_f x Daily Food Intake

Derivation of consumption rates presented in Table 5-11. All variables defined in Section 5.2.2.2.3. The daily food intake incorporates the site FI of 0.09 or the alternative caribou FI of 0.2.

Table 5-9. Exposure assumptions used to calculate risk for non-lead metals for adults in the subsistence use scenario

Scenario Timeframe: Current/Future
Receptor Population: Subsistence Use
Receptor Age: Adult

Exposure Medium and Route	Parameter Code	Parameter Definition	Units	Value	Rationale/ Reference	Intake Equation/ Model Name
Soil Ingestion						
	C_S	Chemical concentration in soil	mg/kg	see Table 5-1	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	kg/mg	0.000001	--	C_S x CF x IR_S x FI x EF x ED / (BW x AT)
	IR_S	Ingestion rate - soil	mg soil/day	100	DEC (2002)	
	FI	Fractional intake from site	unitless	0.09	Area calculated[a]	
	EF	Exposure frequency	days/year	200	DEC (2002)	
	ED	Exposure duration	years	30	DEC (2002)	
	BW	Body weight	kg	70	DEC (2002)	
	AT	Averaging time	days	10,950	DEC (2002)	
Water Ingestion						
	C_W	Chemical concentration in surface water	μg/L	see Table 5-1	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	mg/μg	0.001	--	C_W x CF x IR_W x FI x EF x ED / (BW x AT)
	IR_W	Ingestion rate for surface water	L/day	2	DEC (2002)	
	FI	Fractional intake from site	unitless	0.09	Area calculated[a]	
	EF	Exposure frequency	days/year	365	DEC (2002)	
	ED	Exposure duration	years	30	DEC (2002)	
	BW	Body weight	kg	70	DEC (2002)	
	AT	Averaging time	days	10,950	DEC (2002)	
Food Ingestion						
	C_F	Chemical concentration in food[b]	mg/kg-wet wt.	see Table 5-2	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	kg/g	0.001	--	C_F x CR_F x CF x FI x EF x ED / (BW x AT)
	CR_F	Consumption rate for food[b]	g/day	see Table 5-11	DFG (2001)	
	FI	Fractional intake from site	unitless	0.09	Area calculated[a,c]	
	EF	Exposure frequency	days/year	365	DEC (2002)	
	ED	Exposure duration	years	30	DEC (2002)	
	BW	Body weight	kg	70	DEC (2002)	
	AT	Averaging time	days	10,950	DEC (2002)	

Note: -- - not applicable
RME - reasonable maximum exposure

[a] Based on a calculation of the fraction of the assumed subsistence use area on the site divided by the total subsistence use areas for Kivalina and Noatak (see Figures 5-2 and 5-3 and Section 5.2.2.2.3).

[b] A separate calculation is done for each food item.

[c] Risks are calculated using both the site-specific FI of 0.09 and the alternative caribou FI of 0.2.

Table 5-10. Exposure assumptions used to calculate risk for non-lead metals for children in the subsistence use scenario

Scenario Timeframe: Current/Future
Receptor Population: Subsistence Use
Receptor Age: Child

Exposure Medium and Route	Parameter Code	Parameter Definition	Units	Value	Rationale/ Reference	Intake Equation/ Model Name
Soil Ingestion						
	C_S	Chemical concentration in soil	mg/kg	see Table 5-1	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	kg/mg	0.000001	--	C_S x CF x IR_S x FI x EF x ED / (BW x AT)
	IR_S	Ingestion rate - soil	mg soil/day	200	DEC (2002)	
	FI	Fractional intake from site	unitless	0.09	Area calculated[a]	
	EF	Exposure frequency	days/year	200	DEC (2002)	
	ED	Exposure duration	years	6	DEC (2002)	
	BW	Body weight	kg	15	DEC (2002)	
	AT	Averaging time	days	2,190	DEC (2002)	
Water Ingestion						
	C_W	Chemical concentration in surface water	µg/L	see Table 5-1	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	mg/µg	0.001	--	C_W x CF x IR_W x FI x EF x ED / (BW x AT)
	IR_W	Ingestion rate for surface water	L/day	1	?	
	FI	Fractional intake from site	unitless	0.09	Area calculated[a]	
	EF	Exposure frequency	days/year	365	DEC (2002)	
	ED	Exposure duration	years	6	DEC (2002)	
	BW	Body weight	kg	15	DEC (2002)	
	AT	Averaging time	days	2,190	DEC (2002)	
Food Ingestion						
	C_F	Chemical concentration in food[b]	mg/kg-wet wt.	see Table 5-2	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	kg/g	0.001	--	C_F x CR_F x CF x FI x EF x ED / (BW x AT)
	CR_F	Consumption rate for food[b]	g/day	see Table 5-11	DFG (2001)	
	FI	Fractional intake from site	unitless	0.09	Area calculated[a,c]	
	EF	Exposure frequency	days/year	365	DEC (2002)	
	ED	Exposure duration	years	6	DEC (2002)	
	BW	Body weight	kg	15	DEC (2002)	
	AT	Averaging time	days	2,190	DEC (2002)	

Note: -- - not applicable
RME - reasonable maximum exposure

[a] Based on a calculation of the fraction of the assumed subsistence use area on the site divided by the total subsistence use areas for Kivalina and Noatak (see Figures 5-2 and 5-3 and Section 5.2.2.2.3).

[b] A separate calculation is done for each food item.

[c] Risks are calculated using both the site-specific FI of 0.09 and the alternative caribou FI of 0.2.

Table 5-11. Estimated subsistence food consumption rates

	Mean per Capita Consumption (g/day)			Caloric Intake Weighted Mean per Capita Consumption (g/day)	
	Kivalina	Noatak	Average of two villages	Adult	Child
Land Mammals	212.1	305.8	259.0	168	84
Caribou[a]	177.5	300.6	239.1	155	78
Moose	70.0	36.9	53.4	35	17
Migratory Birds	10.6	9.9	10.3	6.7	3.3
Game Birds	3.1	3.1	3.1	2.0	1.0
Ptarmigan[a]	3.1	3.1	3.1	2.0	1.0
All Fish	314.8	248.7	281.7	183	91
Salmon	29.2	216.1	122.6	80	40
Non-salmon fish[a]	296.4	85.0	190.7	124	62
Char	252.3	57.7	155.0	101	50
White fish	28.2	36.0	32.1	21	10
Cod	24.8	1.1	12.9	8.4	4.2
Marine Invertebrates	1.8	3.8	2.8	1.8	0.9
Clams	0.0	1.3	0.6	0.4	0.2
Crabs	0.8	6.4	3.6	2.3	1.2
Shrimp	1.6	0.0	0.8	0.5	0.3
Marine Mammals	415.1	106.0	260.6	169	85
Seal	251.8	101.6	176.7	115	57
Walrus	101.1	52.9	77.0	50	25
Whale	89.8	20.2	55.0	36	18
Vegetation	18.3	7.5	12.9	8.4	4.2
Berries[a]	17.5	8.2	12.9	8.4	4.2
Plants/greens/mushrooms[a]	1.5	2.5	2.0	1.3	0.7
Sum of Main Categories	976	685	830	539	270
Total kcal/day (@5.1 kcal/g)	4,977	3,492	4,234	2,750	1,375
Caloric Intake Weighting Factor	--	--	--	0.65	0.32

Note: Data from Community Profile Database (DFG 2001). Kivalina data are from 1992. Noatak data are from 1994.

The sum of consumption rates for individual food items, or for sub-categories within a category, does not equal the consumption rate for the entire category in the database. For example, the sum of salmon and non-salmon fish consumption does not equal all fish consumption. This could be an artifact of the statistical methods used to derive consumption rates for entire categories based on data for individual items.

Boxed values are the consumption rates used in the risk assessment.

-- - not applicable

EPC - exposure point concentration

[a]Consumption rates for ptarmigan and non-salmon fish were used to derive risk estimates using EPCs for those foods. Consumption of land mammals was evaluated using EPCs for caribou. Consumption of all berries was evaluated using EPCs for salmonberries. Consumption of all plants, greens, and mushrooms was evaluated based on EPCs for sourdock.

Table 5-12. Daily dietary intake of Alaska native adults

	Males		Females	
	grams	kcal	grams	kcal
Protein	127	508	90	360
Fat	117	1,053	81	729
Carbohydrates	282	1,128	214	856
Total Energy[a]	526	2,689	385	1,945
Average kcal/g		5.1		5.1

Source: Nobmann et al. (1992)

Note: kcal - kilocalories; commonly called calories. Caloric intake was calculated by multiplying the intake in grams from Nobmann et al. (1992) by the number of kcal/g in each energy source: protein, 4 kcal/g; fat, 9 kcal/g; carbohydrate, 4 kcal/g

[a] The total energy estimates differ slightly from the values reported by Nobmann et al. (1992) (i.e., 2,750 kcal for males and 1,950 kcal for females), likely because of the standard rounding used for the specific energy content of protein, fat, and carbohydrates. The values calculated here are used solely for the purpose of calculating the average caloric density of the diet.

Table 5-13. Adult lead model exposure parameters

Scenario Timeframe: Current/Future
Receptor Population: Worker/Subsistence User
Receptor Age: Adult

Parameter Code	Parameter Definition	Units	Input Parameters	Rationale
C_S	Soil lead concentration average	µg/g or ppm	282, 726	Site specific[a]
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	EPA default
BKSF	Biokinetic slope factor	µg/dL per µg/day	0.4	EPA default
GSD_i	Geometric standard deviation PbB	--	2.1	U.S. EPA (2002a)
PbB_0	Baseline PbB	µg/dL	1.53	U.S. EPA (2002a)
IR_{S_W}	Soil ingestion rate while at work (including soil and dust)	g/day	0.100	Exponent (2007)
IR_{S_S}	Soil ingestion rate during subsistence activities (including soil and dust)	g/day	0.100	DEC (2004a)
AF_S	Absorption fraction	--	0.039, 0.12	Site specific, EPA default[b]
EF_S	Exposure frequency	days/year	200	DEC (2002)
FI_{S_W}	Fractional intake for soil ingestion while at work	--	0.67	Site specific
FI_{S_S}	Fractional intake for soil ingestion during subsistence activities	--	0.03	Site specific
ADI	Average daily intake of lead from subsistence foods	µg/day	1.6, 3.4	Site specific[c]
AF_F	Absorption fraction for food	--	0.20	U.S. EPA (1994, 1996c)
EF_F	Exposure frequency for food	days/year	182.5	Site specific
AT	Averaging time	days/year	365	365

Note: -- - not applicable
EPA - U.S. Environmental Protection Agency
PbB - blood lead

[a] Adult lead model results were derived using both the area-weighted lead EPC of 282 µg/g and the area-averaged lead EPC of 726 µg/g. See Table 5-1.

[b] Adult lead model results were derived using both the site-specific soil lead absorption fraction of 0.039 and the EPA default of 0.12. See Table 5-7 for derivation of the site-specific absorption fraction, also referred to as absolute bioavailability.

[c] Adult lead model results were derived using both the site-specific FI of 0.09 and the alternative caribou FI of 0.2 to calculate subsistence food lead intake. See Table 5-14.

Table 5-14. Calculation of subsistence food lead intake for adult lead model

Scenario Timeframe: Current/Future
Exposure Medium: Food
Exposure Point: Subsistence Food
Receptor Population: Worker/Subsistence User
Receptor Age: Adult

Exposure Route	Food		EPC Value	EPC Units	Daily Food Intake[a]	Daily Food Intake Units	Chronic Daily Intake[b]	Chronic Daily Intake Units
Based on Caribou FI=0.09								
	Caribou	Lead	195	µg/kg	7.5E-3	kg/day	1.5	µg/day
	Fish	Lead	10.2	µg/kg	5.6E-3	kg/day	0.06	µg/day
	Ptarmigan	Lead	69.3	µg/kg	9.0E-5	kg/day	0.006	µg/day
	Salmonberry	Lead	147	µg/kg	3.8E-4	kg/day	0.06	µg/day
	Sourdock	Lead	211	µg/kg	5.8E-5	kg/day	0.01	µg/day
						Total	1.6	µg/day
Based on Alternative Caribou FI=0.2								
	Caribou	Lead	195	µg/kg	1.7E-2	kg/day	3.3	µg/day
	Fish	Lead	10.2	µg/kg	5.6E-3	kg/day	0.06	µg/day
	Ptarmigan	Lead	69.3	µg/kg	9.0E-5	kg/day	0.006	µg/day
	Salmonberry	Lead	147	µg/kg	3.8E-4	kg/day	0.06	µg/day
	Sourdock	Lead	211	µg/kg	5.8E-5	kg/day	0.01	µg/day
						Total	3.4	µg/day

Note: AT - averaging time
BW - body weight
Cf - concentration in food
CR_f - consumption rate for food
ED - exposure duration
EF - exposure frequency
EPC - exposure point concentration
FI - fractional intake
FI_{WF} - fractional intake of food from site for workers

[a] Daily Food Intake = $CR_f \times 10^{-3} \times FI_{WF} \times EF \times ED / (BW \times AT)$
Derivation of consumption rates presented in Table 5-11. All variables defined in Section 5.2.2.2.3. The daily food intake incorporates the site FI of 0.09, giving a worker/subistence user FI_{WF} of 0.045, or the alternative caribou FI of 0.2, giving a worker/subsistence user FI_{WF} of 0.1.

[b] Chronic Daily Intake (CDI) (mg/kg-day) = C_f x Daily Food Intake

Table 5-15. Exposure assumptions used to calculate risk for non-lead metals for adults in the combined worker/ subsistence user scenario

Scenario Timeframe: Current/Future
Receptor Population: Combined Worker/Subsistence Use
Receptor Age: Adult

Exposure Medium and Route	Parameter Code	Parameter Definition	Units	Value	Rationale/ Reference	Intake Equation/ Model Name
Soil Ingestion						
	C_S	Chemical concentration in soil	mg/kg	see Table 5-1	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	kg/mg	0.000001	--	C_S x CF x IR_S x (FI_{S_W} + FI_{S_S}) x EF x ED / (BW x AT)
	IR_S	Ingestion rate for soil	mg soil/day	100	DEC (2004a, pers. comm.)	
	FI_{S_W}	Fractional intake of site soil for workers	unitless	0.67	Area calculated[a]	
	FI_{S_S}	Fractional intake of site soil during subsistence activities	unitless	0.03	Area calculated[a]	
	EF	Exposure frequency	days/year	200	DEC (2002)	
	ED	Exposure duration	years	25	DEC (2002)	
	BW	Body weight	kg	70	DEC (2002)	
	AT	Averaging time	days	9,125	DEC (2002)	
Water Ingestion						
	C_W	Chemical concentration in surface water	μg/L	see Table 5-1	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	mg/μg	0.001	--	C_W x CF x IR_W x FI_{WW} x EF x ED / (BW x AT)
	IR_W	Ingestion rate for surface water	L/day	2	DEC (2002)	
	FI_{WW}	Fractional intake of water from site for workers	unitless	0.045	Area calculated[a]	
	EF	Exposure frequency	days/year	365	DEC (2002)	
	ED	Exposure duration	years	25	DEC (2002)	
	BW	Body weight	kg	70	DEC (2002)	
	AT	Averaging time	days	9,125	DEC (2002)	
Food Ingestion						
	C_F	Chemical concentration in food[b]	mg/kg-wet wt.	see Table 5-2	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	CF	Conversion factor	kg/g	0.001	--	C_F x CR_F x CF x FI_{wf} x EF x ED / (BW x AT)
	CR_F	Consumption rate for food[b]	g/day	see Table 5-11	DFG (2001)	
	FI_{WF}	Fractional intake of food from site for workers	unitless	0.045	Area calculated[a,c]	
	EF	Exposure frequency	days/year	365	DEC (2002)	
	ED	Exposure duration	years	25	DEC (2002)	
	BW	Body weight	kg	70	DEC (2002)	
	AT	Averaging time	days	9,125	DEC (2002)	

Note: -- - not applicable
RME - reasonable maximum exposure

[a] Based on a calculation of the fraction of the total subsistence use area comprised of the site, combined with the relative amount of time individuals spend at work vs. off work (see Section 5.2.3.2).

[b] A separate calculation is done for each food item.

[c] Risks are calculated using both the site-specific FI of 0.09, giving a worker/subistence user FI_{WF} of 0.045, and the alternative caribou FI of 0.20, giving a worker/subsistence user FI_{WF} of 0.10.

Table 5-16. Noncancer toxicity data—oral reference doses

Chemical of Concern	Oral Chronic RfD (mg/kg-day)	Primary Target Organ or System	Uncertainty Factor	Source	Date RfD Accessed
Inorganics					
Antimony	0.0004	Longevity; metabolic	1,000	IRIS	2/1/06
Barium	0.2	Kidney	300	IRIS	2/1/06
Cadmium (food and soil)	0.001	Kidney	10	IRIS	2/1/06
Cadmium (water)	0.0005	Kidney	10	IRIS	2/1/06
Lead	NA	NA	NA	NA	NA
Thallium	0.00008	Liver enzymes	3,000	IRIS	2/1/06
Zinc	0.3	Iron and copper status	3	IRIS	2/1/06

Note: IRIS - Integrated Risk Information System
NA - not applicable
RfD - reference dose

[a] No adverse effects were observed in the studies on which the RfD is based.

Table 5-17. Results for IEUBK child lead model

Scenario Timeframe: Current/Future
Exposure Medium: Surface soil, foods, water
Exposure Point: DMTS surface soil and subsistence foods
Receptor Population: Child subsistence
Receptor Age: Child

	Area-weighted Soil Lead				Area-averaged Soil Lead			
	Site-Specific Bioavailability		Default Bioavailability		Site-Specific Bioavailability		Default Bioavailability	
	Geometric Mean Blood Lead (μg/dL)	Percent Chance of Exceeding 10 μg/dL	Geometric Mean Blood Lead (μg/dL)	Percent Chance of Exceeding 10 μg/dL	Geometric Mean Blood Lead (μg/dL)	Percent Chance of Exceeding 10 μg/dL	Geometric Mean Blood Lead (μg/dL)	Percent Chance of Exceeding 10 μg/dL
Site fractional intake	1.0	< 0.0005	1.2	< 0.0005	1.1	< 0.0005	1.6	0.005
Alternative caribou fractional intake	1.3	0.001	1.5	0.004	1.5	0.002	1.9	0.023

Table 5-18. Results for adult lead model

Scenario Timeframe: Current/Future
Exposure Medium: Surface soil and foods
Exposure Point: DMTS surface soil and subsistence foods
Receptor Population: Combined worker/subsistence user
Receptor Age: Adult

Exposure Variable	Description of Exposure Variable	Units	Area-weighted Soil Lead		Area-averaged Soil Lead	
			Site-Specific Bioavailability	Default Bioavailability	Site-Specific Bioavailability	Default Bioavailability
C_S	Soil lead concentration average	µg/g or ppm	282	282	726	726
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	Biokinetic slope factor	µg/dL per µg/day	0.4	0.4	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	2.1	2.1	2.1	2.1
PbB_0	Baseline PbB	µg/dL	1.53	1.53	1.53	1.53
IR_S	Soil ingestion rate (including soil and dust)	g/day	0.100	0.100	0.100	0.100
AF_S	Absorption fraction	--	0.039	0.12	0.039	0.12
EF_S	Exposure frequency	days/year	200	200	200	200
FI_{S_W}	Fractional intake for soil ingestion while at work	--	0.67	0.67	0.67	0.67
FI_{S_S}	Fractional intake for soil ingestion during subsistence activities	--	0.03	0.03	0.03	0.03
CDI	Chronic daily intake of lead from subsistence foods (see Table 5-14)	µg/day	1.6	1.6	1.6	1.6
AF_f	Absorption fraction for food	--	0.20	0.20	0.20	0.20
EF_f	Exposure frequency for food	days/year	182.5	182.5	182.5	182.5
AT	Averaging time	days/year	365	365	365	365
PbB_{adult}	PbB of adult worker, geometric mean	µg/dL	1.8	2.1	2.0	2.9
PbB_{fetal}	PbB among fetuses of adult workers, geometric mean	µg/dL	1.6	1.9	1.8	2.6
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	5.4	6.5	6.2	9.0
PbB_t	Target PbB level of concern (e.g., 10 µg/dL)	µg/dL	10.0	10.0	10.0	10.0
$P(PbB_{fetal} > PbB_t)$	Probability that fetal PbB > PbB_t, assuming lognormal distribution	%	0.7%	1.3%	1.1%	3.7%

Note: $PbB_{adult} = PbB0 + (BKSF \times ((C_S \times IR_{S\_W} \times (FI_{S\_W} + FI_{S\_S}) \times EF_S \times AF_S) + (CDI \times EF_F \times AF_F))) / AT$

$PbB_{fetal, 0.95} = PbB_{adult} * (GSD_i^{1.645} * R)$

DMTS - DeLong Mountain Regional Transportation System
PbB - blood lead

Table 5-19. Results for adult lead model using alternative caribou fractional intake

Scenario Timeframe: Current/Future
Exposure Medium: Surface soil and foods
Exposure Point: DMTS surface soil and subsistence foods
Receptor Population: Combined worker/subsistence user
Receptor Age: Adult

Exposure Variable	Description of Exposure Variable	Units	Area-weighted Soil Lead		Area-averaged Soil Lead	
			Site-Specific Bioavailability	Default Bioavailability	Site-Specific Bioavailability	Default Bioavailability
C_S	Soil lead concentration average	µg/g or ppm	282	282	726	726
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	Biokinetic slope factor	µg/dL per µg/day	0.4	0.4	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	2.1	2.1	2.1	2.1
PbB_0	Baseline PbB	µg/dL	1.53	1.53	1.53	1.53
IR_S	Soil ingestion rate (including soil and dust)	g/day	0.100	0.100	0.100	0.100
AF_S	Absorption fraction	--	0.039	0.12	0.039	0.12
EF_S	Exposure frequency	days/year	200	200	200	200
FI_{S_W}	Fractional intake for soil ingestion while at work	--	0.67	0.67	0.67	0.67
FI_{S_S}	Fractional intake for soil ingestion during subsistence activities	--	0.03	0.03	0.03	0.03
CDI	Chronic daily intake of lead from subsistence foods (see Table 5-14)	µg/day	3.4	3.4	3.4	3.4
AF_f	Absorption fraction for food	--	0.20	0.20	0.20	0.20
EF_f	Exposure frequency for food	days/year	182.5	182.5	182.5	182.5
AT	Averaging time	days/year	365	365	365	365
PbB_{adult}	PbB of adult worker, geometric mean	µg/dL	1.8	2.2	2.1	3.0
PbB_{fetal}	PbB among fetuses of adult workers, geometric mean	µg/dL	1.7	2.0	1.9	2.7
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	5.6	6.7	6.4	9.2
PbB_t	Target PbB level of concern (e.g., 10 µg/dL)	µg/dL	10.0	10.0	10.0	10.0
$P(PbB_{fetal} > PbB_t)$	Probability that fetal PbB > PbB_t, assuming lognormal distribution	%	0.8%	1.5%	1.3%	4.0%

Note: $PbB_{adult} = PbB0 + (BKSF \times ((C_S \times IR_{S\_W} \times (FI_{S\_W} + FI_{S\_S}) \times EF_S \times AF_S) + (CDI \times EF_F \times AF_F))) / AT$

$PbB_{fetal, 0.95} = PbB_{adult} * (GSD_i^{1.645} * R)$

DMTS - DeLong Mountain Regional Transportation System
PbB - blood lead

Table 5-20. Summary of lead modeling results for IEUBK child lead model and adult lead model

	Area-weighted Soil Lead[a]				Area-averaged Soil Lead[b]			
	Site-specific Bioavailability		Default Bioavailability		Site-specific Bioavailability		Default Bioavailability	
	Geometric Mean Blood Lead (μg/dL)	Percent Chance of Exceeding 10 μg/dL	Geometric Mean Blood Lead (μg/dL)	Percent Chance of Exceeding 10 μg/dL	Geometric Mean Blood Lead (μg/dL)	Percent Chance of Exceeding 10 μg/dL	Geometric Mean Blood Lead (μg/dL)	Percent Chance of Exceeding 10 μg/dL
Site fractional intake[c]								
Child	1.0	< 0.0005	1.2	< 0.0005	1.1	< 0.0005	1.6	0.005
Adult Worker	1.6	0.7	1.9	1.3	1.8	1.1	2.6	3.7
Alternative caribou fractional intake[c]								
Child	1.3	0.001	1.5	0.004	1.5	0.002	1.9	0.023
Adult Worker	1.7	0.8	2.0	1.5	1.9	1.3	2.7	4.0

Note: Modeling based on the following exposure media concentrations

Surface soil, area-weighted	=	282 mg/kg
Surface soil, area-averaged	=	726 mg/kg
Water[d]	=	0.33 μg/L
Caribou	=	195 μg/kg
Fish	=	10.2 μg/kg
Ptarmigan	=	69.3 μg/kg
Berry	=	147 μg/kg
Sourdock	=	211 μg/kg

[a] A DMTS area-weighted soil concentration was derived for each metal assuming that the port area soil samples represent an area of 26 hectares and that the road area soil samples represent an area of 312 hectares (see Figure 5-2). The total assumed DMTS site area is (26 + 312) 338 hectares; therefore, the port soil mean was adjusted by 0.08 (26/338) and the road soil mean was adjusted by 0.92 (312/338): DMTS Area-weighted Soil = (Port Area EPC x 0.08) + (Road Area EPC x 0.92).

[b] A DMTS area-averaged soil concentration was derived for each metal by averaging the EPC for port soil and the EPC for road soil:
DMTS Area-averaged Soil = (Port Area EPC + Road Area EPC) / 2

[c] As described in Section 5.2.2.2.3, the site fractional intake of 0.09 was derived by estimating the area of the site within the subsistence use area relative to the total subsistence use area. For the alternative caribou fractional intake of 0.2, the area reported to have cadmium levels elevated above background by Hasselbach et. al. (2005) was used as the site subsistence use area.

[d] The site specific water concentration was used in the IEUBK model. In the adult lead model, exposure to lead in water is included in the baseline blood lead.

Table 5-21. Noncancer hazards for adult subsistence soil ingestion based on area-weighted soil concentrations

Scenario Timeframe: Current/Future
Exposure Medium: Surface Soil
Exposure Point: DMTS Area Weighted Surface Soil
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	6.5	mg/kg	4.6E-7	mg/kg-day	4.0E-4	mg/kg-day	0.001
	Barium	3,219	mg/kg	2.3E-4	mg/kg-day	2.0E-1	mg/kg-day	0.001
	Cadmium	10.8	mg/kg	7.6E-7	mg/kg-day	1.0E-3	mg/kg-day	0.0008
	Thallium	0.49	mg/kg	3.4E-8	mg/kg-day	8.0E-5	mg/kg-day	0.0004
	Zinc	1,399	mg/kg	9.9E-5	mg/kg-day	3.0E-1	mg/kg-day	0.0003
						Total Hazard Index for All CoPCs		0.004

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-22. Noncancer hazards for adult subsistence soil ingestion based on area-averaged soil concentrations

Scenario Timeframe: Current/Future
Exposure Medium: Surface Soil
Exposure Point: DMTS Area Averaged Surface Soil
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	11.5	mg/kg	8.1E-7	mg/kg-day	4.0E-4	mg/kg-day	0.002
	Barium	2,407	mg/kg	1.7E-4	mg/kg-day	2.0E-1	mg/kg-day	0.0008
	Cadmium	23.8	mg/kg	1.7E-6	mg/kg-day	1.0E-3	mg/kg-day	0.002
	Thallium	0.62	mg/kg	4.4E-8	mg/kg-day	8.0E-5	mg/kg-day	0.0005
	Zinc	3,691	mg/kg	2.6E-4	mg/kg-day	3.0E-1	mg/kg-day	0.0009
						Total Hazard Index for All CoPCs		0.006

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-23. Noncancer hazards for child subsistence soil ingestion based on area-weighted soil concentrations

Scenario Timeframe: Current/Future
Exposure Medium: Surface Soil
Exposure Point: DMTS Area Weighted Surface Soil
Receptor Population: Subsistence User
Receptor Age: Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	6.5	mg/kg	4.2E-6	mg/kg-day	4.0E-4	mg/kg-day	0.01
	Barium	3,219	mg/kg	2.1E-3	mg/kg-day	2.0E-1	mg/kg-day	0.01
	Cadmium	10.8	mg/kg	7.1E-6	mg/kg-day	1.0E-3	mg/kg-day	0.007
	Thallium	0.49	mg/kg	3.2E-7	mg/kg-day	8.0E-5	mg/kg-day	0.004
	Zinc	1,399	mg/kg	9.2E-4	mg/kg-day	3.0E-1	mg/kg-day	0.003
						Total Hazard Index for All CoPCs		0.04

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-24. Noncancer hazards for child subsistence soil ingestion based on area-averaged soil concentrations

Scenario Timeframe: Current/Future
Exposure Medium: Surface Soil
Exposure Point: DMTS Area Averaged Surface Soil
Receptor Population: Subsistence User
Receptor Age: Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	11.5	mg/kg	7.6E-6	mg/kg-day	4.0E-4	mg/kg-day	0.02
	Barium	2,407	mg/kg	1.6E-3	mg/kg-day	2.0E-1	mg/kg-day	0.008
	Cadmium	23.8	mg/kg	1.6E-5	mg/kg-day	1.0E-3	mg/kg-day	0.02
	Thallium	0.62	mg/kg	4.1E-7	mg/kg-day	8.0E-5	mg/kg-day	0.005
	Zinc	3,691	mg/kg	2.4E-3	mg/kg-day	3.0E-1	mg/kg-day	0.008
						Total Hazard Index for All CoPCs		0.06

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-25. Noncancer hazards for adult subsistence surface water ingestion

Scenario Timeframe: Current/Future
Exposure Medium: Surface Water
Exposure Point: Site Stream Surface Water
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Thallium	0.14	µg/L	3.6E-7	mg/kg-day	8.0E-5	mg/kg-day	0.005
						Total Hazard Index for All CoPCs		0.005

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-26. Noncancer hazards for child subsistence surface water ingestion

Scenario Timeframe: Current/Future
Exposure Medium: Surface Water
Exposure Point: Site Stream Surface Water
Receptor Population: Subsistence User
Receptor Age: Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Thallium	0.14	µg/L	8.5E-7	mg/kg-day	8.0E-5	mg/kg-day	0.01
						Total Hazard Index for All CoPCs		0.01

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-27. Noncancer hazards for adult subsistence caribou consumption based on site fractional intake

Scenario Timeframe: Current/Future
Exposure Medium: Caribou
Exposure Point: Site Caribou
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	--	mg/kg	--	mg/kg-day	4.0E-4	mg/kg-day	--
	Barium	1.3	mg/kg	2.7E-4	mg/kg-day	2.0E-1	mg/kg-day	0.001
	Cadmium	0.22	mg/kg	4.7E-5	mg/kg-day	1.0E-3	mg/kg-day	0.05
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	36.8	mg/kg	8.0E-3	mg/kg-day	3.0E-1	mg/kg-day	0.03
						Total Hazard Index for All CoPCs		0.07

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-28. Noncancer hazards for adult subsistence caribou consumption based on alternative caribou fractional intake

Scenario Timeframe: Current/Future
Exposure Medium: Caribou
Exposure Point: Site Caribou
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	--	mg/kg	--	mg/kg-day	4.0E-4	mg/kg-day	--
	Barium	1.3	mg/kg	6.1E-4	mg/kg-day	2.0E-1	mg/kg-day	0.003
	Cadmium	0.22	mg/kg	1.0E-4	mg/kg-day	1.0E-3	mg/kg-day	0.1
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	36.8	mg/kg	1.8E-2	mg/kg-day	3.0E-1	mg/kg-day	0.06
						Total Hazard Index for All CoPCs		0.2

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-29. Noncancer hazards for child subsistence caribou consumption based on site fractional intake

Scenario Timeframe: Current/Future
Exposure Medium: Caribou
Exposure Point: Site Caribou
Receptor Population: Subsistence User
Receptor Age: Young Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	--	mg/kg	--	mg/kg-day	4.0E-4	mg/kg-day	--
	Barium	1.3	mg/kg	6.4E-4	mg/kg-day	2.0E-1	mg/kg-day	0.003
	Cadmium	0.22	mg/kg	1.1E-4	mg/kg-day	1.0E-3	mg/kg-day	0.1
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	36.8	mg/kg	1.9E-2	mg/kg-day	3.0E-1	mg/kg-day	0.06
						Total Hazard Index for All CoPCs		0.2

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-30. Noncancer hazards for child subsistence caribou consumption based on alternative caribou fractional intake

Scenario Timeframe: Current/Future
Exposure Medium: Caribou
Exposure Point: Site Caribou
Receptor Population: Subsistence User
Receptor Age: Young Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	--	mg/kg	--	mg/kg-day	4.0E-4	mg/kg-day	--
	Barium	1.3	mg/kg	1.4E-3	mg/kg-day	2.0E-1	mg/kg-day	0.007
	Cadmium	0.22	mg/kg	2.4E-4	mg/kg-day	1.0E-3	mg/kg-day	0.2
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	36.8	mg/kg	4.1E-2	mg/kg-day	3.0E-1	mg/kg-day	0.1
						Total Hazard Index for All CoPCs		0.4

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-31. Noncancer hazards for adult subsistence fish consumption

Scenario Timeframe: Current/Future
Exposure Medium: Fish
Exposure Point: Site Fish
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Thallium	0.0026	mg/kg	4.2E-7	mg/kg-day	8.0E-5	mg/kg-day	0.005
						Total Hazard Index for All CoPCs		0.005

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-32. Noncancer hazards for child subsistence fish consumption

Scenario Timeframe: Current/Future
Exposure Medium: Fish
Exposure Point: Site Fish
Receptor Population: Subsistence User
Receptor Age: Young Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Thallium	0.0026	mg/kg	9.7E-7	mg/kg-day	8.0E-5	mg/kg-day	0.01
						Total Hazard Index for All CoPCs		0.01

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-33. Noncancer hazards for adult subsistence ptarmigan consumption

Scenario Timeframe: Current/Future
Exposure Medium: Ptarmigan
Exposure Point: Site Ptarmigan
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Barium	0.52	mg/kg	1.3E-6	mg/kg-day	2.0E-1	mg/kg-day	0.000007
	Cadmium	3.5	mg/kg	9.1E-6	mg/kg-day	1.0E-3	mg/kg-day	0.009
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	15.7	mg/kg	4.0E-5	mg/kg-day	3.0E-1	mg/kg-day	0.0001
						Total Hazard Index for All CoPCs		0.009

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-34. Noncancer hazards for child subsistence ptarmigan consumption

Scenario Timeframe: Current/Future
Exposure Medium: Ptarmigan
Exposure Point: Site Ptarmigan
Receptor Population: Subsistence User
Receptor Age: Young Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Barium	0.52	mg/kg	3.1E-6	mg/kg-day	2.0E-1	mg/kg-day	0.00002
	Cadmium	3.5	mg/kg	2.1E-5	mg/kg-day	1.0E-3	mg/kg-day	0.02
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	15.7	mg/kg	9.4E-5	mg/kg-day	3.0E-1	mg/kg-day	0.0003
						Total Hazard Index for All CoPCs		0.02

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-35. Noncancer hazards for adult subsistence berry consumption

Scenario Timeframe: Current/Future
Exposure Medium: Berries
Exposure Point: Site Salmonberries
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Barium	0.078	mg/kg	8.4E-7	mg/kg-day	2.0E-1	mg/kg-day	0.000004
	Cadmium	0.052	mg/kg	5.6E-7	mg/kg-day	1.0E-3	mg/kg-day	0.0006
	Zinc	4.7	mg/kg	5.1E-5	mg/kg-day	3.0E-1	mg/kg-day	0.0002
						Total Hazard Index for All CoPCs		0.0007

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-36. Noncancer hazards for child subsistence berry consumption

Scenario Timeframe: Current/Future
Exposure Medium: Berries
Exposure Point: Site Salmonberries
Receptor Population: Subsistence User
Receptor Age: Young Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Barium	0.078	mg/kg	2.0E-6	mg/kg-day	2.0E-1	mg/kg-day	0.00001
	Cadmium	0.052	mg/kg	1.3E-6	mg/kg-day	1.0E-3	mg/kg-day	0.001
	Zinc	4.7	mg/kg	1.2E-4	mg/kg-day	3.0E-1	mg/kg-day	0.0004
						Total Hazard Index for All CoPCs		0.002

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-37. Noncancer hazards for adult subsistence sourdock consumption

Scenario Timeframe: Current/Future
Exposure Medium: Sourdock
Exposure Point: Site Sourdock
Receptor Population: Subsistence User
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	0.012	mg/kg	2.1E-8	mg/kg-day	4.0E-4	mg/kg-day	0.00005
	Barium	10.6	mg/kg	1.8E-5	mg/kg-day	2.0E-1	mg/kg-day	0.00009
	Cadmium	0.013	mg/kg	2.2E-8	mg/kg-day	1.0E-3	mg/kg-day	0.00002
	Thallium	0.00049	mg/kg	8.2E-10	mg/kg-day	8.0E-5	mg/kg-day	0.00001
	Zinc	5.4	mg/kg	9.0E-6	mg/kg-day	3.0E-1	mg/kg-day	0.00003
						Total Hazard Index for All CoPCs		0.0002

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-38. Noncancer hazards for child subsistence sourdock consumption

Scenario Timeframe: Current/Future
Exposure Medium: Sourdock
Exposure Point: Site Sourdock
Receptor Population: Subsistence User
Receptor Age: Young Child

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	0.012	mg/kg	5.2E-8	mg/kg-day	4.0E-4	mg/kg-day	0.0001
	Barium	10.6	mg/kg	4.5E-5	mg/kg-day	2.0E-1	mg/kg-day	0.0002
	Cadmium	0.013	mg/kg	5.5E-8	mg/kg-day	1.0E-3	mg/kg-day	0.00005
	Thallium	0.00049	mg/kg	2.1E-9	mg/kg-day	8.0E-5	mg/kg-day	0.00003
	Zinc	5.4	mg/kg	2.3E-5	mg/kg-day	3.0E-1	mg/kg-day	0.00008
						Total Hazard Index for All CoPCs		0.0005

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-39. Noncancer hazards for adult DMTS worker/subsistence user soil ingestion based on area-weighted soil concentrations

Scenario Timeframe: Current/Future
Exposure Medium: Surface Soil
Exposure Point: DMTS Area Weighted Surface Soil
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	6.5	mg/kg	3.5E-6	mg/kg-day	4.0E-4	mg/kg-day	0.009
	Barium	3,219	mg/kg	1.8E-3	mg/kg-day	2.0E-1	mg/kg-day	0.009
	Cadmium	10.8	mg/kg	5.9E-6	mg/kg-day	1.0E-3	mg/kg-day	0.006
	Thallium	0.49	mg/kg	2.6E-7	mg/kg-day	8.0E-5	mg/kg-day	0.003
	Zinc	1,399	mg/kg	7.6E-4	mg/kg-day	3.0E-1	mg/kg-day	0.003
						Total Hazard Index for All CoPCs		0.03

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-40. Noncancer hazards for adult DMTS worker/subsistence user soil ingestion based on area-averaged soil concentrations

Scenario Timeframe: Current/Future
Exposure Medium: Surface Soil
Exposure Point: DMTS Area Averaged Surface Soil
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	11.5	mg/kg	6.3E-6	mg/kg-day	4.0E-4	mg/kg-day	0.02
	Barium	2,407	mg/kg	1.3E-3	mg/kg-day	2.0E-1	mg/kg-day	0.007
	Cadmium	23.8	mg/kg	1.3E-5	mg/kg-day	1.0E-3	mg/kg-day	0.01
	Thallium	0.62	mg/kg	3.4E-7	mg/kg-day	8.0E-5	mg/kg-day	0.004
	Zinc	3,691	mg/kg	2.0E-3	mg/kg-day	3.0E-1	mg/kg-day	0.007
						Total Hazard Index for All CoPCs		0.05

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-41. Noncancer hazards for adult DMTS worker/subsistence user surface water ingestion

Scenario Timeframe: Current/Future
Exposure Medium: Stream Surface Water
Exposure Point: Site Stream Surface Water
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Thallium	0.14	µg/L	1.8E-7	mg/kg-day	8.0E-5	mg/kg-day	0.002
						Total Hazard Index for All CoPCs		0.002

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-42. Noncancer hazards for adult DMTS worker/subsistence user caribou consumption based on site fractional intake

Scenario Timeframe: Current/Future
Exposure Medium: Caribou
Exposure Point: Site Caribou
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	--	mg/kg	--	mg/kg-day	4.0E-4	mg/kg-day	--
	Barium	1.3	mg/kg	1.4E-4	mg/kg-day	2.0E-1	mg/kg-day	0.0007
	Cadmium	0.22	mg/kg	2.3E-5	mg/kg-day	1.0E-3	mg/kg-day	0.02
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	36.8	mg/kg	4.0E-3	mg/kg-day	3.0E-1	mg/kg-day	0.01
						Total Hazard Index for All CoPCs		0.04

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-43. Noncancer hazards for adult DMTS worker/subsistence user caribou consumption based on alternative caribou fractional intake

Scenario Timeframe: Current/Future
Exposure Medium: Caribou
Exposure Point: Site Caribou
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	--	mg/kg	--	mg/kg-day	4.0E-4	mg/kg-day	--
	Barium	1.3	mg/kg	3.0E-4	mg/kg-day	2.0E-1	mg/kg-day	0.002
	Cadmium	0.22	mg/kg	5.2E-5	mg/kg-day	1.0E-3	mg/kg-day	0.05
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	36.8	mg/kg	8.8E-3	mg/kg-day	3.0E-1	mg/kg-day	0.03
						Total Hazard Index for All CoPCs		0.08

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-44. Noncancer hazards for adult DMTS worker/subsistence user fish consumption

Scenario Timeframe: Current/Future
Exposure Medium: Fish
Exposure Point: Site Fish
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Thallium	0.0026	mg/kg	2.1E-7	mg/kg-day	8.0E-5	mg/kg-day	0.003
						Total Hazard Index for All CoPCs		0.003

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-45. Noncancer hazards for adult DMTS worker/subsistence user ptarmigan consumption

Scenario Timeframe: Current/Future
Exposure Medium: Ptarmigan
Exposure Point: Site Ptarmigan
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Barium	0.52	mg/kg	6.6E-7	mg/kg-day	2.0E-1	mg/kg-day	0.000003
	Cadmium	3.5	mg/kg	4.5E-6	mg/kg-day	1.0E-3	mg/kg-day	0.005
	Thallium	--	mg/kg	--	mg/kg-day	8.0E-5	mg/kg-day	--
	Zinc	15.7	mg/kg	2.0E-5	mg/kg-day	3.0E-1	mg/kg-day	0.00007
						Total Hazard Index for All CoPCs		0.005

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-46. Noncancer hazards for adult DMTS worker/subsistence user berry consumption

Scenario Timeframe: Current/Future
Exposure Medium: Berries
Exposure Point: Site Salmonberries
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Barium	0.078	mg/kg	4.2E-7	mg/kg-day	2.0E-1	mg/kg-day	0.000002
	Cadmium	0.052	mg/kg	2.8E-7	mg/kg-day	1.0E-3	mg/kg-day	0.0003
	Zinc	4.7	mg/kg	2.5E-5	mg/kg-day	3.0E-1	mg/kg-day	0.00008
						Total Hazard Index for All CoPCs		0.0004

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-47. Noncancer hazards for adult DMTS worker/subsistence user sourdock consumption

Scenario Timeframe: Current/Future
Exposure Medium: Sourdock
Exposure Point: Site Sourdock
Receptor Population: Worker/Subsistence
Receptor Age: Adult

Exposure Route	CoPC	EPC Value[a]	EPC Units	Intake	Intake Units	Reference Dose[b]	Reference Dose Units	Hazard Quotient
Ingestion								
	Antimony	0.012	mg/kg	1.0E-8	mg/kg-day	4.0E-4	mg/kg-day	0.00003
	Barium	10.6	mg/kg	8.8E-6	mg/kg-day	2.0E-1	mg/kg-day	0.00004
	Cadmium	0.013	mg/kg	1.1E-8	mg/kg-day	1.0E-3	mg/kg-day	0.00001
	Thallium	0.00049	mg/kg	4.1E-10	mg/kg-day	8.0E-5	mg/kg-day	0.000005
	Zinc	5.4	mg/kg	4.5E-6	mg/kg-day	3.0E-1	mg/kg-day	0.00001
						Total Hazard Index for All CoPCs		0.0001

Note: CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
EPA - U.S. Environmental Protection Agency
EPC - exposure point concentration
UCL - upper confidence limit

[a] Values for all chemicals reflect the lower of either the 95th percentile UCL on the mean or the maximum concentration.

[b] Toxicity values obtained from the EPA Integrated Risk Information System (IRIS) (U.S. EPA 2005).

Table 5-48. Summary of hazard indices for all CoPCs and pathways for reasonable maximum exposure scenarios

		Subsistence		Worker
		Adult	Child	Adult
	EPC	Hazard Quotient	Hazard Quotient	Hazard Quotient
Surface soil ingestion, area-weighted[a]				
Antimony	6.5 mg/kg	0.001	0.01	0.009
Barium	3,219 mg/kg	0.001	0.01	0.009
Cadmium	10.8 mg/kg	0.0008	0.007	0.006
Thallium	0.49 mg/kg	0.0004	0.004	0.003
Zinc	1,399 mg/kg	0.0003	0.003	0.003
Total Hazard Index for Pathway		0.004	0.04	0.03
Surface soil ingestion, area-averaged[b]				
Antimony	11.5 mg/kg	0.002	0.02	0.02
Barium	2,407 mg/kg	0.0008	0.008	0.007
Cadmium	23.8 mg/kg	0.002	0.02	0.01
Thallium	0.62 mg/kg	0.0005	0.005	0.004
Zinc	3,691 mg/kg	0.0009	0.008	0.007
Total Hazard Index for Pathway		0.006	0.06	0.05
Water ingestion				
Thallium	0.14 μg/L	0.005	0.01	0.002
Total Hazard Index for Pathway		0.005	0.01	0.002
Caribou consumption				
Barium	1.3 mg/kg	0.001	0.003	0.0007
Cadmium	0.22 mg/kg	0.05	0.1	0.02
Zinc	36.8 mg/kg	0.03	0.06	0.01
Total Hazard Index for Pathway		0.07	0.2	0.04
Fish consumption				
Thallium	0.0026 mg/kg	0.005	0.01	0.003
Total Hazard Index for Pathway		0.005	0.01	0.003
Ptarmigan consumption				
Barium	0.52 mg/kg	0.000007	0.00002	0.000003
Cadmium	3.5 mg/kg	0.009	0.02	0.005
Zinc	15.7 mg/kg	0.0001	0.0003	0.00007
Total Hazard Index for Pathway		0.009	0.02	0.005
Berry consumption				
Barium	0.078 mg/kg	0.000004	0.00001	0.000002
Cadmium	0.052 mg/kg	0.0006	0.001	0.0003
Zinc	4.7 mg/kg	0.0002	0.0004	0.00008
Total Hazard Index for Pathway		0.0007	0.002	0.0004

Table 5-48. (cont.)

	EPC	Subsistence Adult Hazard Quotient	Subsistence Child Hazard Quotient	Worker Adult Hazard Quotient
Sourdock consumption				
Antimony	0.012 mg/kg	0.00005	0.0001	0.00003
Barium	10.6 mg/kg	0.00009	0.0002	0.00004
Cadmium	0.013 mg/kg	0.00002	0.00005	0.00001
Thallium	0.00049 mg/kg	0.00001	0.00003	0.000005
Zinc	5.4 mg/kg	0.00003	0.00008	0.00001
Total Hazard Index for Pathway		0.0002	0.0005	0.0001
Total for All Pathways based on area-weighted soil[a]		**0.1**	**0.3**	**0.08**
Total for All Pathways based on area-averaged soil[b]		**0.1**	**0.3**	**0.09**

Note: DMTS - DeLong Mountain Regional Transportation System

Lead risks are evaluated using separate models that do not predict hazard indices, so they cannot be directly compared to risks from othermetals. Thus, the contribution of lead to pathway risks is summarized elsewhere.

[a] A DMTS area-weighted soil concentration was derived for each metal assuming that the port area soil samples represent an area of 26 hectares and that the road area soil samples represent an area of 312 hectares (see Figure 5-2). The total assumed DMTS site area is (26 + 312) 338 hectares; therefore, the port soil mean was adjusted by 0.08 (26/338) and the road soil mean was adjusted by 0.92 (312/338): DMTS Area-weighted Soil = (Port Area EPC x 0.08) + (Road Area EPC x 0.92).

[b] A DMTS area-averaged soil concentration was derived for each metal by averaging the EPC for port soil and the EPC for road soil: DMTS Area-averaged Soil = (Port Area EPC + Road Area EPC) / 2.

Table 5-49. Summary of total hazard indices for reasonable maximum exposure scenarios

	Adult		Young Child		
Receptor/Exposure Pathway	Hazard Index	% Contribution by Pathway	Hazard Index	% Contribution by Pathway	Chemicals Accounting for 90 percent of Hazard Indices for each Pathway
Subsistence User—Current/Future					
Surface soil ingestion, area-weighted	0.004	4%	0.04	14%	Antimony, barium, cadmium, thallium
Surface soil ingestion, area-averaged	0.006	6%	0.06	22%	Antimony, cadmium, zinc, barium
Water ingestion	0.005	5%	0.01	4%	Thallium
Caribou consumption	0.07	76%	0.2	68%	Cadmium, zinc
Fish consumption	0.005	5%	0.01	5%	Thallium
Ptarmigan consumption	0.009	9.3%	0.02	8.4%	Cadmium
Berry consumption	0.0007	0.7%	0.002	0.7%	Cadmium, zinc
Sourdock consumption	0.0002	0.2%	0.0005	0.2%	Barium, antimony, zinc
Total for Subsistence User based on area-weighted soil	**0.1**	100%	**0.3**	100%	
Total for Subsistence User based on area-averaged soil	**0.1**	100%	**0.3**	100%	
Worker—Current/Future					
Surface soil ingestion, area-weighted	0.03	38%			Antimony, barium, cadmium, thallium
Surface soil ingestion, area-averaged	0.05	60%			Antimony, cadmium, thallium, barium
Water ingestion	0.002	3%			Thallium
Caribou consumption	0.04	49%			Cadmium, zinc
Fish consumption	0.003	3%			Thallium
Ptarmigan consumption	0.005	6.0%			Cadmium
Berry consumption	0.0004	0.5%			Cadmium, zinc
Sourdock consumption	0.0001	0.1%			Barium, antimony, zinc
Total for DMTS Worker based on area-weighted soil	**0.08**	100%			
Total for Subsistence User based on area-averaged soil	**0.09**	100%			

Note: DMTS - DeLong Mountain Regional Transportation System

Lead risks are evaluated using separate models that do not predict hazard indices, so they cannot be directly compared to risks from other metals. Thus, the contribution of lead to pathway risks is summarized elsewhere.

Table 5-50. Summary of hazard indices for all CoPCs and pathways for reasonable maximum exposure scenarios with alternative caribou fractional intake[a]

		Subsistence		Worker
		Adult	Child	Adult
	EPC	Hazard Quotient	Hazard Quotient	Hazard Quotient
Surface soil ingestion, area-weighted[b]				
Antimony	6.5 mg/kg	0.001	0.01	0.009
Barium	3,219 mg/kg	0.001	0.01	0.009
Cadmium	10.8 mg/kg	0.0008	0.007	0.006
Thallium	0.49 mg/kg	0.0004	0.004	0.003
Zinc	1,399 mg/kg	0.0003	0.003	0.003
Total Hazard Index for Pathway		0.004	0.04	0.03
Surface soil ingestion, area-averaged[c]				
Antimony	11.5 mg/kg	0.002	0.02	0.02
Barium	2,407 mg/kg	0.0008	0.008	0.007
Cadmium	23.8 mg/kg	0.002	0.02	0.01
Thallium	0.62 mg/kg	0.0005	0.005	0.004
Zinc	3,691 mg/kg	0.0009	0.008	0.007
Total Hazard Index for Pathway		0.006	0.06	0.05
Water ingestion				
Thallium	0.14 µg/L	0.005	0.01	0.002
Total Hazard Index for Pathway		0.005	0.01	0.002
Caribou consumption				
Barium	1.3 mg/kg	0.003	0.007	0.002
Cadmium	0.22 mg/kg	0.1	0.2	0.05
Zinc	36.8 mg/kg	0.06	0.1	0.03
Total Hazard Index for Pathway		0.2	0.4	0.08
Fish consumption				
Thallium	0.0026 mg/kg	0.005	0.01	0.003
Total Hazard Index for Pathway		0.005	0.01	0.003
Ptarmigan consumption				
Barium	0.52 mg/kg	0.000007	0.00002	0.000003
Cadmium	3.5 mg/kg	0.009	0.02	0.005
Zinc	15.7 mg/kg	0.0001	0.0003	0.00007
Total Hazard Index for Pathway		0.009	0.02	0.005
Berry consumption				
Barium	0.078 mg/kg	0.000004	0.00001	0.000002
Cadmium	0.052 mg/kg	0.0006	0.001	0.0003
Zinc	4.7 mg/kg	0.0002	0.0004	0.00008
Total Hazard Index for Pathway		0.0007	0.002	0.0004

Table 5-50. (cont.)

	EPC	Subsistence Adult Hazard Quotient	Subsistence Child Hazard Quotient	Worker Adult Hazard Quotient
Sourdock consumption				
Antimony	0.012 mg/kg	0.00005	0.0001	0.00003
Barium	10.6 mg/kg	0.00009	0.0002	0.00004
Cadmium	0.013 mg/kg	0.00002	0.00005	0.00001
Thallium	0.00049 mg/kg	0.00001	0.00003	0.000005
Zinc	5.4 mg/kg	0.00003	0.00008	0.00001
Total Hazard Index for Pathway		0.0002	0.0005	0.0001
Total for All Pathways based on area-weighted soil[b]		**0.2**	**0.5**	**0.1**
Total for All Pathways based on area-averaged soil[c]		**0.2**	**0.5**	**0.1**

Note: DMTS - DeLong Mountain Regional Transportation System

Lead risks are evaluated using separate models that do not predict hazard indices, so they cannot be directly compared to risks from othermetals. Thus, the contribution of lead to pathway risks is summarized elsewhere.

[a] As described in Section 5.2.2.2.3, the site fractional intake of 0.09 was derived by estimating the area of the site within the subsistence use area relative to the total subsistence use area. For the alternative caribou fractional intake of 0.2, the area reported to have cadmium levels elevated above background by Hasselbach et. al. (2005) was used as the site subsistence use area.

[b] A DMTS area-weighted soil concentration was derived for each metal assuming that the port area soil samples represent an area of 26 hectares and that the road area soil samples represent an area of 312hectares (see Figure 5-2). The total assumed DMTS site area is (26 + 312) 338 hectares; therefore, the port soil mean was adjusted by 0.08 (26/338) and the road soil mean was adjusted by 0.92 (312/338): DMTS Area-weighted Soil = (Port Area EPC x 0.08) + (Road Area EPC x 0.92).

[c] A DMTS area-averaged soil concentration was derived for each metal by averaging the EPC for port soil and the EPC for road soil: DMTS Area-averaged Soil = (Port Area EPC + Road Area EPC) / 2.

Table 5-51. Summary of total hazard indices based on reasonable maximum exposure scenarios with alternative caribou fractional intake

Receptor/Exposure Pathway	Adult Hazard Index	Adult % Contribution by Pathway	Young Child Hazard Index	Young Child % Contribution by Pathway	Chemicals Accounting for 90 percent of Hazard Indices for each Pathway
Subsistence User—Current/Future					
Surface soil ingestion, area-weighted	0.004	2%	0.04	8%	Antimony, barium, cadmium, thallium
Surface soil ingestion, area-averaged	0.006	3%	0.06	12%	Antimony, cadmium, zinc, barium
Water ingestion	0.005	2%	0.01	2%	Thallium
Caribou consumption	0.2	88%	0.4	83%	Cadmium, zinc
Fish consumption	0.005	3%	0.01	3%	Thallium
Ptarmigan consumption	0.009	4.8%	0.02	4.6%	Cadmium
Berry consumption	0.0007	0.4%	0.002	0.4%	Cadmium, zinc
Sourdock consumption	0.0002	0.1%	0.0005	0.1%	Barium, antimony, zinc
Total for Subsistence User based on area-weighted soil	**0.2**	100%	**0.5**	100%	
Total for Subsistence User based on area-averaged soil	**0.2**	100%	**0.5**	100%	
Worker—Current/Future					
Surface soil ingestion, area-weighted	0.03	24%			Antimony, barium, cadmium, thallium
Surface soil ingestion, area-averaged	0.05	38%			Antimony, cadmium, thallium, barium
Water ingestion	0.002	2%			Thallium
Caribou consumption	0.08	68%			Cadmium, zinc
Fish consumption	0.003	2%			Thallium
Ptarmigan consumption	0.005	3.8%			Cadmium
Berry consumption	0.0004	0.3%			Cadmium, zinc
Sourdock consumption	0.0001	0.1%			Barium, antimony, zinc
Total for DMTS Worker based on area-weighted soil	**0.1**	100%			
Total for Subsistence User based on area-averaged soil	**0.1**	100%			

Note: DMTS - DeLong Mountain Regional Transportation System

Lead risks are evaluated using separate models that do not predict hazard indices, so they cannot be directly compared to risks from other metals. Thus, the contribution of lead to pathway risks is summarized elsewhere.

Table 6-1. Refined assessment endpoints, representative receptors, and measurement endpoints

Environment	Assessment Endpoint	Representative Receptor[a]	Measurement Endpoint
Tundra	Structure and function of terrestrial plant communities	Terrestrial plant communities	Plant abundance, diversity, biomass, percent cover
Tundra	Structure and function of tundra soil fauna communities	Tundra soil fauna communities	Not directly assessed, evaluated through terrestrial plant community analysis
Tundra	Survival, growth, and reproduction of terrestrial avian herbivore populations	Willow ptarmigan	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, soil, and surface water) relative to avian TRVs
Tundra	Survival, growth, and reproduction of terrestrial mammalian herbivore populations	Tundra vole; caribou; moose	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, soil, and surface water) relative to mammalian TRVs
Tundra	Survival, growth, and reproduction of terrestrial avian invertivore populations	Lapland longspur	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, soil, and surface water) relative to avian TRVs
Tundra	Survival, growth, and reproduction of terrestrial mammalian invertivore populations	Tundra shrew	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, soil, and surface water) relative to mammalian TRVs
Tundra	Survival, growth, and reproduction of terrestrial avian carnivore populations	Snowy owl	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, soil, and surface water) relative to avian TRVs
Tundra	Survival, growth, and reproduction of terrestrial mammalian carnivore populations	Arctic fox	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, soil, and surface water) relative to mammalian TRVs
Streams	Structure and function of stream aquatic and wetland plant communities	Stream aquatic and wetland plant communities	Plant abundance, diversity, biomass, percent cover
Streams	Structure and function of stream aquatic invertebrate communities	Stream aquatic invertebrate communities	Abundance and diversity of stream aquatic invertebrates
Streams	Survival, growth, and reproduction of stream avian herbivore populations	Green-winged teal	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, sediment, and surface water) relative to avian TRVs
Streams	Survival, growth, and reproduction of stream mammalian herbivore populations	Muskrat; moose	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, sediment, and surface water) relative to mammalian TRVs

Table 6-1. (cont.)

Environment	Assessment Endpoint	Representative Receptor[a]	Measurement Endpoint
Streams	Survival, growth, and reproduction of stream avian invertivore populations	Common snipe	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, sediment, and surface water) relative to avian TRVs
Tundra ponds	Structure and function of tundra pond aquatic and wetland plant communities	Tundra pond aquatic and wetland plant communities	Plant abundance, diversity, biomass, percent cover
Tundra ponds	Structure and function of tundra pond aquatic invertebrate communities	Tundra pond aquatic invertebrate communities	Abundance and diversity of tundra pond aquatic invertebrates
Tundra ponds	Survival, growth, and reproduction of tundra pond avian herbivore populations	Green-winged teal	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, sediment, and surface water) relative to avian TRVs
Tundra ponds	Survival, growth, and reproduction of tundra pond mammalian herbivore populations	Muskrat	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, sediment, and surface water) relative to mammalian TRVs
Tundra ponds	Survival, growth, and reproduction of tundra pond avian invertivore populations	Common snipe[b]	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, sediment, and surface water) relative to avian TRVs
Coastal lagoons	Structure and function of coastal lagoon aquatic and wetland plant communities	Coastal lagoon aquatic and wetland plant communities	Plant abundance, diversity, biomass, percent cover
Coastal lagoons	Structure and function of coastal lagoon aquatic invertebrate communities	Coastal lagoon aquatic invertebrate communities	Abundance and diversity of coastal lagoon aquatic invertebrates
Coastal lagoons	Survival, growth, and reproduction of coastal lagoon avian invertivore populations	Black-bellied plover	Range of modeled total dietary exposures (based on measured CoPC concentrations in food and sediment) relative to avian TRVs
Coastal lagoons	Survival, growth, and reproduction of coastal lagoon mammalian herbivore populations	Muskrat; moose	Range of modeled total dietary exposures (based on measured CoPC concentrations in food, sediment, and surface water) relative to mammalian TRVs

Note: CoPC - chemical of potential concern
TRV - toxicity reference value

[a] Receptors to be evaluated in the risk assessment.

[b] Evaluated as a terrestrial receptor

Table 6-2. Cover classes for quantifying percent cover of plant species

Cover Class	Range (percent)	Midpoint (percent)
+	Trace	0
1	<5	2.5
2	5–25	15
3	25–50	37.5
4	50–75	62.5
5	75–95	85
6	95–100	97.5

Source: Modified from Daubenmire (1959).

Table 6-3. Summary of *p*-values for site to reference comparison by vegetation community type

	Coastal		Tundra and Coastal					
	Plain	Tundra	All	10 m[a]	100 m	1,000 m[b]	Hillslope	Lagoon
Forb cover	0.429	0.371	0.930	0.108	0.543	0.237	0.655	0.439
Graminoid cover	0.157	0.505	1.000	0.480	0.248	1.000	0.655	0.439
Deciduous shrub cover	0.157	**0.096**	0.499	0.724	0.564	0.480	0.180	--
Evergreen shrub cover	0.157	0.739	0.271	**0.034**	1.000	0.858	0.180	--
Moss cover	0.480	**0.096**	**0.091**	0.289	**0.083**	0.157	0.180	0.439
Moss frequency	0.617	0.564	0.419	0.387	0.221	--	--	0.317
Lichen cover	0.157	**0.044**	**0.011**	**0.028**	**0.083**	**0.034**	0.180	--
Lichen frequency	0.277	0.153	**0.060**	**0.022**	**0.053**	0.387	0.157	--
Vegetative litter	1.000	1.000	0.735	0.724	0.564	0.480	0.655	0.439
Unvegetated cover	0.429	0.182	0.607	0.285	**0.076**	0.266	0.346	1.000
Diversity	0.480	0.739	0.866	0.480	1.000	0.724	0.655	0.439
Evenness	1.000	0.505	0.499	**0.077**	**0.083**	**0.034**	0.655	0.121
Richness	1.000	0.211	0.300	0.472	0.197	**0.028**	0.655	1.000
Antimony	**0.079**	**0.023**	**0.006**	**0.017**	**0.042**	**0.017**	**0.090**	**0.061**
Arsenic	**0.079**	0.251	**0.064**	**0.016**	0.282	0.238	0.327	**0.061**
Barium	0.234	0.159	0.118	**0.016**	**0.042**	0.760	**0.090**	**0.061**
Cadmium	**0.079**	**0.023**	**0.006**	**0.017**	**0.042**	**0.017**	**0.090**	**0.061**
Cobalt	**0.079**	0.909	0.433	0.144	0.718	0.638	0.673	0.500
Copper	**0.079**	0.369	0.118	**0.017**	0.124	0.638	**0.090**	**0.061**
Lead	**0.079**	**0.091**	**0.032**	**0.017**	**0.042**	0.240	**0.090**	**0.061**
Manganese	0.240	0.631	0.306	**0.039**	0.282	0.856	0.910	0.500
Mercury	**0.079**	**0.048**	**0.046**	**0.039**	0.124	0.144	**0.090**	**0.061**
Molybdenum	**0.079**	0.748	0.400	0.240	0.718	0.429	**0.090**	0.500
Selenium	**0.079**	0.120	**0.026**	**0.017**	0.124	0.106	**0.090**	**0.061**
Silver	**0.079**	**0.091**	**0.017**	**0.017**	**0.042**	0.106	**0.090**	**0.061**
Thallium	0.500	0.253	0.306	**0.017**	**0.042**	0.240	0.327	0.781
Vanadium	**0.079**	0.253	0.155	**0.079**	0.282	0.362	0.327	0.500
Zinc	0.240	**0.023**	**0.021**	**0.017**	**0.042**	0.144	**0.090**	**0.061**
pH	0.147	0.129	**0.032**	**0.032**	**0.083**	0.172	0.180	0.121
Total solids	1.000	0.505	0.612	**0.077**	1.000	0.480	0.655	0.439

Note: Metals compared using one-sided test for higher concentrations at site.
Bold values indicate a significant difference from reference, $p < 0.10$.
Wilcoxon test was used for comparisons between site and reference groups.

-- - comparison was not possible because there was no variability or no relevant species were observed

[a] Also includes Station TT5-0100, located approximately 85 m from the nearest dust source.

[b] Also includes Stations TT5-1000 and TT5-2000, located approximately 450 m and 1,430 m from the nearest dust source, respectively.

Table 6-4. Summary of parameter relationships with distance from DMTS road

	All Transects				Coastal and Tundra Transects only			
	Correlation		Linear Regression		Correlation		Linear Regression	
	Estimate	*P*-value	*P*-value	R-square	Estimate	*P*-value	*P*-value	R-square
Forb cover	**-0.494**	**0.085**	0.503	4.2%	**-0.710**	**0.032**	0.163	22.8%
Graminoid cover	0.186	0.526	0.427	5.8%	0.241	0.481	0.545	4.7%
Deciduous shrub cover	-0.211	0.458	0.343	8.2%	-0.321	0.326	0.206	19.2%
Evergreen shrub cover	**0.589**	**0.042**	**0.040**	**33.1%**	**0.741**	**0.027**	**0.010**	**58.6%**
Moss cover	0.285	0.329	0.354	7.9%	**0.593**	**0.078**	**0.051**	**39.7%**
Moss frequency	0.263	0.367	0.337	8.4%	0.310	0.361	0.321	12.3%
Lichen cover	**0.595**	**0.040**	0.144	18.3%	**0.994**	**0.003**	**0.001**	**77.0%**
Lichen frequency	**0.717**	**0.013**	**0.003**	**57.9%**	**0.911**	**0.007**	**<0.001**	**95.5%**
Vegetative litter	-0.183	0.520	0.967	0.0%	-0.414	0.208	0.511	5.6%
Unvegetated cover	**-0.522**	**0.069**	0.230	12.8%	**-0.602**	**0.068**	0.189	20.5%
Diversity	0.307	0.292	0.140	18.7%	0.358	0.291	0.179	21.4%
Evenness	**0.631**	**0.029**	**0.013**	**44.3%**	**0.908**	**0.007**	**<0.001**	**84.8%**
Richness	**-0.551**	**0.055**	0.667	1.7%	**-0.892**	**0.007**	**0.052**	**39.3%**
Antimony	**-0.654**	**0.023**	**0.017**	**41.9%**	**-0.809**	**0.015**	**0.021**	**50.8%**
Arsenic	**-0.897**	**0.002**	**<0.001**	**72.9%**	**-0.950**	**0.004**	**<0.001**	**84.9%**
Barium	**-0.684**	**0.017**	**0.013**	**44.7%**	**-0.836**	**0.012**	**0.008**	**60.5%**
Cadmium	**-0.673**	**0.019**	**0.018**	**41.1%**	**-0.833**	**0.012**	**0.013**	**55.7%**
Cobalt	**-0.823**	**0.004**	**0.003**	**57.9%**	**-0.803**	**0.015**	**0.017**	**52.7%**
Copper	**-0.769**	**0.007**	**0.002**	**58.4%**	**-0.914**	**0.006**	**0.001**	**78.2%**
Lead	**-0.817**	**0.005**	**0.004**	**53.9%**	**-0.840**	**0.011**	**0.006**	**63.4%**
Manganese	**-0.707**	**0.014**	**0.017**	**41.6%**	**-0.698**	**0.035**	**0.037**	**44.0%**
Mercury	-0.256	0.371	0.205	14.2%	-0.278	0.394	0.241	16.7%
Molybdenum	-0.042	0.876	0.880	0.22%	-0.084	0.788	0.750	1.3%
Selenium	**-0.504**	**0.079**	**0.054**	**29.6%**	**-0.678**	**0.040**	**0.034**	**44.9%**
Silver	**-0.685**	**0.017**	**0.010**	**46.4%**	**-0.895**	**0.007**	**0.006**	**64.0%**
Thallium	**-0.662**	**0.021**	**0.007**	**49.4%**	**-0.914**	**0.006**	**0.001**	**78.5%**
Vanadium	**-0.696**	**0.015**	**0.006**	**51.1%**	**-0.945**	**0.004**	**0.001**	**75.7%**
Zinc	**-0.817**	**0.005**	**0.008**	**49.1%**	**-0.796**	**0.016**	**0.011**	**57.9%**
pH	**-0.808**	**0.005**	**0.001**	**63.2%**	**-0.878**	**0.008**	**<0.001**	**84.2%**
Total Solids	**-0.919**	**0.001**	**<0.001**	**83.0%**	**-0.945**	**0.004**	**<0.001**	**81.7%**

Note: Spearman rank non-parametric correlation was used.
Linear regression models related $\log_{10}$ distance to each variable. Log_{10} transform of metals concentrations and total solids was used to better meet method assumptions of equal variability and normality.
Bold indicates significant relationship with distance (p <0.10).

Table 6-5. Summary of correlations among vegetation variables and soil parameters

	Antimony	Arsenic	Barium	Cadmium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Selenium	Silver	Thallium	Vanadium	Zinc	pH	Total Solids
Distance	-0.654	-0.897	-0.684	-0.673	-0.823	-0.769	-0.817	-0.707			-0.504	-0.685	-0.662	-0.696	-0.817	-0.808	-0.919
Forb cover		0.598	0.386	0.428		0.665	0.512				0.661	0.536	0.533	0.596	0.401	0.511	
Graminoid cover	-0.436		-0.414	-0.410				-0.391	-0.398			-0.478	-0.523				
Deciduous shrub cover			0.512					0.642									
Evergreen shrub cover		-0.854		-0.468	-0.469	-0.724	-0.572			-0.375	-0.567	-0.526	-0.516	-0.730	-0.413	-0.431	
Moss cover																	
Moss frequency	-0.459			-0.367			-0.410					-0.456			-0.410		
Lichen cover		-0.579				-0.368	-0.451				-0.490			-0.493	-0.407	-0.488	
Lichen frequency		-0.747		-0.396	-0.469	-0.555	-0.586				-0.606	-0.456	-0.385	-0.728	-0.516	-0.667	
Vegetative litter										-0.436							
Unvegetated cover		0.442												0.531		0.383	
Diversity		-0.616			-0.374									-0.573			
Evenness		-0.749	-0.492	-0.388	-0.534	-0.778	-0.542			-0.461	-0.452	-0.515	-0.636	-0.709	-0.458	-0.427	-0.425
Richness			0.542					0.669				0.421	0.554				0.478
Antimony	1		0.700	0.918		0.677	0.831	0.386	0.789		0.702	0.909	0.794		0.856	0.691	
Arsenic		1	0.422	0.450	0.694	0.837	0.634			0.436	0.689	0.557	0.587	0.892	0.486	0.549	0.421
Barium	0.700	0.422	1	0.662		0.730	0.744	0.703			0.585	0.741	0.847	0.397	0.766	0.817	0.582
Cadmium	0.918	0.450	0.662	1		0.773	0.892	0.413	0.760		0.747	0.937	0.868		0.860	0.746	0.412
Cobalt		0.694			1	0.635	0.444				0.446	0.434	0.432	0.579			0.493
Copper	0.677	0.837	0.730	0.773	0.635	1	0.838	0.451	0.465	0.464	0.807	0.851	0.897	0.704	0.734	0.752	0.488
Lead	0.831	0.634	0.744	0.892	0.444	0.838	1	0.527	0.577		0.745	0.897	0.874	0.452	0.931	0.801	0.531
Manganese	0.386		0.703	0.413		0.451	0.527	1				0.472	0.621		0.494	0.565	0.485
Mercury	0.789			0.760		0.465	0.577		1		0.468	0.667	0.530		0.585	0.410	
Molybdenum		0.436				0.464				1	0.413			0.509			
Selenium	0.702	0.689	0.585	0.747	0.446	0.807	0.745		0.468	0.413	1	0.794	0.713	0.674	0.709	0.770	
Silver	0.909	0.557	0.741	0.937	0.434	0.851	0.897	0.472	0.667		0.794	1	0.921	0.431	0.833	0.793	0.473
Thallium	0.794	0.587	0.847	0.868	0.432	0.897	0.874	0.621	0.530		0.713	0.921	1	0.481	0.786	0.801	0.601
Vanadium		0.892	0.397		0.579	0.704	0.452			0.509	0.674	0.431	0.481	1		0.548	
Zinc	0.856	0.486	0.766	0.860		0.734	0.931	0.494	0.585		0.709	0.833	0.786		1	0.788	0.494
pH	0.691	0.549	0.817	0.746		0.752	0.801	0.565	0.410		0.770	0.793	0.801	0.548	0.788	1	0.464
Total solids		0.421	0.582	0.412	0.493	0.488	0.531	0.485				0.473	0.601		0.494	0.464	1

Note: Only significant (p <0.10) correlation estimates are reported.
Spearman rank non-parametric method was used.

Table 6-6. Summary of correlations among vegetation variables

	Distance	Forb cover	Graminoid cover	Deciduous shrub cover	Evergreen shrub cover	Moss cover	Moss frequency	Lichen cover	Lichen frequency	Vegetative litter	Unvegetated cover	Diversity	Evenness	Richness
Distance	1	-0.494			0.589			0.595	0.717		-0.522		0.631	-0.551
Forb cover	-0.494	1			-0.664				-0.520				-0.599	
Graminoid cover			1	-0.687				-0.524			0.481			-0.629
Deciduous shrub cover			-0.687	1				0.604				0.371		0.654
Evergreen shrub cover	0.589	-0.664			1			0.595	0.706			0.459	0.646	
Moss cover						1	0.566	0.649	0.494		-0.560	0.472		0.460
Moss frequency						0.566	1				-0.550			
Lichen cover	0.595		-0.524	0.604	0.595	0.649		1	0.824		-0.617	0.529		0.470
Lichen frequency	0.717	-0.520			0.706	0.494		0.824	1		-0.671	0.525	0.469	
Vegetative litter										1				
Unvegetated cover	-0.522		0.481			-0.560	-0.550	-0.617	-0.671		1	-0.434		
Diversity				0.371	0.459	0.472		0.529	0.525		-0.434	1	0.45195	0.580
Evenness	0.631	-0.599			0.646				0.469			0.45195	1	
Richness	-0.551		-0.629	0.654		0.460		0.470				0.580		1
Antimony	-0.654		-0.436				-0.459							
Arsenic	-0.897	0.598			-0.854			-0.579	-0.747		0.442	-0.616	-0.749	
Barium	-0.684	0.386	-0.414	0.512									-0.492	0.542
Cadmium	-0.673	0.428	-0.410		-0.468		-0.367		-0.396				-0.388	
Cobalt	-0.823				-0.469				-0.469			-0.374	-0.534	
Copper	-0.769	0.665			-0.724			-0.368	-0.555				-0.778	
Lead	-0.817	0.512			-0.572		-0.410	-0.451	-0.586				-0.542	
Manganese	-0.707		-0.391	0.642										0.669
Mercury			-0.398											
Molybdenum					-0.375					-0.436			-0.461	
Selenium	-0.504	0.661			-0.567			-0.490	-0.606				-0.452	
Silver	-0.685	0.536	-0.478		-0.526		-0.456		-0.456				-0.515	0.421
Thallium	-0.662	0.533	-0.523		-0.516				-0.385				-0.636	0.554
Vanadium	-0.696	0.596			-0.730			-0.493	-0.728		0.531	-0.573	-0.709	
Zinc	-0.817	0.401			-0.413		-0.410	-0.407	-0.516				-0.458	
pH	-0.808	0.511			-0.431			-0.488	-0.667		0.383		-0.427	
Total solids	-0.919												-0.425	0.478

Note: Only significant (p <0.10) correlation estimates are reported.
Spearman rank non-parametric method was used.

Table 6-7. Summary of correlations among vegetation variables and soil parameters at coastal plain and tundra communities

	Antimony	Arsenic	Barium	Cadmium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Selenium	Silver	Thallium	Vanadium	Zinc	pH	Total Solids
Distance	-0.809	-0.950	-0.836	-0.833	-0.803	-0.914	-0.840	-0.698			-0.678	-0.895	-0.914	-0.945	-0.796	-0.878	-0.945
Forb cover		0.618	0.617	0.502	0.576	0.714	0.634	0.694			0.548	0.541	0.634	0.551	0.528	0.497	
Graminoid cover					-0.484												
Deciduous shrub cover									-0.500								
Evergreen shrub cover	-0.580	-0.764		-0.759	-0.649	-0.724	-0.732				-0.487	-0.748	-0.790	-0.547	-0.558	-0.475	-0.707
Moss cover				-0.478			-0.500					-0.531	-0.500			-0.491	-0.555
Moss frequency																	
Lichen cover	-0.895	-0.778	-0.741	-0.912		-0.773	-0.834	-0.575	-0.503		-0.753	-0.877	-0.873	-0.657	-0.807	-0.912	-0.602
Lichen frequency	-0.866	-0.790	-0.836	-0.832		-0.768	-0.922	-0.733	-0.486		-0.717	-0.892	-0.861	-0.692	-0.910	-0.905	-0.750
Vegetative litter										-0.537							0.626
Unvegetated cover			0.658											0.550		0.578	
Diversity														-0.571			-0.544
Evenness		-0.664	-0.699		-0.604	-0.676	-0.588	-0.643				-0.534	-0.577	-0.681	-0.549		-0.808
Richness						0.575		0.533									0.525
Antimony	1	0.821	0.680	0.934	0.484	0.802	0.874	0.588	0.632		0.893	0.955	0.901	0.621	0.852	0.826	0.615
Arsenic	0.821	1	0.796	0.840	0.810	0.953	0.848	0.664			0.852	0.919	0.942	0.887	0.741	0.711	0.807
Barium	0.680	0.796	1	0.613	0.525	0.784	0.746	0.845			0.695	0.719	0.751	0.869	0.790	0.846	0.669
Cadmium	0.934	0.840	0.613	1	0.582	0.830	0.874	0.522	0.654		0.854	0.944	0.929	0.610	0.780	0.803	0.604
Cobalt	0.484	0.810	0.525	0.582	1	0.868	0.527	0.549			0.672	0.624	0.703	0.736			0.599
Copper	0.802	0.953	0.784	0.830	0.868	1	0.808	0.742			0.876	0.880	0.934	0.841	0.676	0.756	0.725
Lead	0.874	0.848	0.746	0.874	0.527	0.808	1	0.742			0.736	0.930	0.940	0.648	0.874	0.776	0.720
Manganese	0.588	0.664	0.845	0.522	0.549	0.742	0.742	1			0.620	0.605	0.698	0.632	0.676	0.731	
Mercury	0.632			0.654					1		0.554	0.580	0.489				
Molybdenum										1							
Selenium	0.893	0.852	0.695	0.854	0.672	0.876	0.736	0.620	0.554		1	0.872	0.843	0.733	0.705	0.750	0.567
Silver	0.955	0.919	0.719	0.944	0.624	0.880	0.930	0.605	0.580		0.872	1	0.968	0.740	0.825	0.795	0.787
Thallium	0.901	0.942	0.751	0.929	0.703	0.934	0.940	0.698	0.489		0.843	0.968	1	0.764	0.775	0.795	0.747
Vanadium	0.621	0.887	0.869	0.610	0.736	0.841	0.648	0.632			0.733	0.740	0.764	1	0.571	0.700	0.786
Zinc	0.852	0.741	0.790	0.780		0.676	0.874	0.676			0.705	0.825	0.775	0.571	1	0.773	0.621
pH	0.826	0.711	0.846	0.803		0.756	0.776	0.731			0.750	0.795	0.795	0.700	0.773	1	0.536
Total solids	0.615	0.807	0.669	0.604	0.599	0.725	0.720				0.567	0.787	0.747	0.786	0.621	0.536	1

Note: Only significant (p <0.10) correlation estimates are reported.
Spearman rank non-parametric method was used.

Table 6-8. Summary of correlations among vegetation variables at coastal plain and tundra communities

	Distance	Forb cover	Graminoid cover	Deciduous shrub cover	Evergreen shrub cover	Moss cover	Moss frequency	Lichen cover	Lichen frequency	Vegetative litter	Unvegetated cover	Diversity	Evenness	Richness
Distance	1	-0.710			0.741	0.593		0.994	0.911		-0.602		0.908	-0.892
Forb cover	-0.710	1			-0.551			-0.502	-0.549				-0.726	0.699
Graminoid cover			1		0.586							0.544		
Deciduous shrub cover				1										
Evergreen shrub cover	0.741	-0.551	0.586		1			0.645	0.630				0.553	-0.489
Moss cover	0.593					1	0.513	0.624	0.561		-0.497			
Moss frequency						0.513	1				-0.579			
Lichen cover	0.994	-0.502			0.645	0.624		1	0.889		-0.477			
Lichen frequency	0.911	-0.549			0.630	0.561		0.889	1		-0.528		0.631	
Vegetative litter										1			-0.505	
Unvegetated cover	-0.602					-0.497	-0.579	-0.477	-0.528		1		-0.480	
Diversity			0.544									1		
Evenness	0.908	-0.726			0.553				0.631	-0.505	-0.480		1	-0.769
Richness	-0.892	0.699			-0.489								-0.769	1
Antimony	-0.809				-0.580			-0.895	-0.866					
Arsenic	-0.950	0.618			-0.764			-0.778	-0.790				-0.664	
Barium	-0.836	0.617						-0.741	-0.836		0.658		-0.699	
Cadmium	-0.833	0.502			-0.759	-0.478		-0.912	-0.832					
Cobalt	-0.803	0.576	-0.484		-0.649								-0.604	
Copper	-0.914	0.714			-0.724			-0.773	-0.768				-0.676	0.575
Lead	-0.840	0.634			-0.732	-0.500		-0.834	-0.922				-0.588	
Manganese	-0.698	0.694						-0.575	-0.733				-0.643	0.533
Mercury				-0.500				-0.503	-0.486					
Molybdenum										-0.537				
Selenium	-0.678	0.548			-0.487			-0.753	-0.717					
Silver	-0.895	0.541			-0.748	-0.531		-0.877	-0.892				-0.534	
Thallium	-0.914	0.634			-0.790	-0.500		-0.873	-0.861				-0.577	
Vanadium	-0.945	0.551			-0.547			-0.657	-0.692		0.550	-0.571	-0.681	
Zinc	-0.796	0.528			-0.558			-0.807	-0.910				-0.549	
pH	-0.878	0.497			-0.475	-0.491		-0.912	-0.905		0.578			
Total solids	-0.945				-0.707	-0.555		-0.602	-0.750	0.626		-0.544	-0.808	0.525

Note: Only significant ($p < 0.10$) correlation estimates are reported.
Spearman rank non-parametric method was used.

Table 6-9. Summary of correlations between PCA factors and distance and soil parameters

	All Vegetation Communities				Coastal and Tundra Communities Only			
	Factor 1		Factor 2		Factor 1		Factor 2	
	correlation	*p*-value	correlation	*p*-value	correlation	*p*-value	correlation	*p*-value
Distance	-0.18	0.5323	**0.52**	**0.0724**	-0.30	0.3546	**0.88**	**0.0085**
Antimony	0.16	0.4876	-0.31	0.1660	-0.41	0.1507	**-0.48**	**0.0921**
Arsenic	-0.31	0.1666	**-0.76**	**0.0007**	-0.04	0.8787	**-0.76**	**0.0082**
Barium	**0.38**	**0.0865**	**-0.50**	**0.0244**	-0.04	0.8939	**-0.72**	**0.0122**
Cadmium	0.10	0.6526	**-0.42**	**0.0572**	-0.35	0.2268	**-0.54**	**0.0608**
Cobalt	-0.08	0.7340	**-0.45**	**0.0436**	0.20	0.4872	**-0.62**	**0.0323**
Copper	0.08	0.7123	**-0.80**	**0.0003**	-0.02	0.9469	**-0.75**	**0.0094**
Lead	0.04	0.8548	**-0.54**	**0.0158**	-0.09	0.7535	**-0.71**	**0.0137**
Manganese	**0.52**	**0.0197**	-0.28	0.2044	0.19	0.5237	**-0.63**	**0.0279**
Mercury	0.14	0.5320	-0.09	0.6969	-0.26	0.3659	-0.06	0.8267
Molybdenum	-0.23	0.3091	**-0.45**	**0.0462**	-0.25	0.3904	0.13	0.6469
Selenium	-0.19	0.4047	**-0.48**	**0.0330**	-0.34	0.2292	-0.41	0.1523
Silver	0.15	0.4912	**-0.57**	**0.0102**	-0.26	0.3553	**-0.64**	**0.0270**
Thallium	0.30	0.1864	**-0.66**	**0.0031**	-0.14	0.6274	**-0.73**	**0.0117**
Vanadium	-0.30	0.1750	**-0.73**	**0.0010**	-0.10	0.7247	**-0.67**	**0.0197**
Zinc	0.06	0.7916	**-0.43**	**0.0542**	-0.13	0.6547	**-0.64**	**0.0253**
pH	0.00	0.9930	**-0.47**	**0.0345**	-0.38	0.1856	**-0.52**	**0.0693**
Total solids	0.22	0.3205	-0.31	0.1667	0.07	0.8267	**-0.75**	**0.0094**

Note: Spearman rank non-parametric method was used.

Bold indicates significant relationship with distance or soil parameter without multiple comparison correction, p<0.10.

Table 6-10. Correlation of NMDS axes with environmental variables

	All Vegetation Communities				Coastal and Tundra Only			
	Axis 1		Axis 2		Axis 1		Axis 2	
	Correlation	*p*-Value	Correlation	*p*-Value	Correlation	*p*-Value	Correlation	*p*-Value
Distance	**-0.50**	**0.0812**	**-0.51**	**0.0794**	**-0.61**	**0.0665**	**-0.84**	**0.0045**
Antimony	0.19	0.3973	0.35	0.1146	0.12	0.7028	**0.81**	**0.0013**
Arsenic	-0.19	0.3957	0.04	0.8767	0.37	0.2059	**0.69**	**0.0103**
Barium	**0.54**	**0.0125**	0.05	0.8192	**0.54**	**0.0611**	**0.63**	**0.0237**
Cadmium	0.14	0.5484	0.30	0.1811	0.08	0.7855	**0.75**	**0.0046**
Cobalt	0.07	0.7561	0.13	0.5637	0.45	0.1272	0.36	0.2277
Copper	0.14	0.5447	0.04	0.8745	0.41	0.1604	**0.64**	**0.0202**
Lead	0.12	0.5870	0.35	0.1174	0.30	0.3200	**0.77**	**0.0028**
Manganese	**0.66**	**0.0015**	0.03	0.8923	**0.53**	**0.0657**	0.47	0.1035
Mercury	0.04	0.8745	**0.37**	**0.0962**	-0.25	0.4150	**0.61**	**0.0294**
Molybdenum	-0.18	0.4352	**-0.45**	**0.0441**	0.28	0.3534	-0.19	0.5292
Selenium	-0.05	0.8456	0.24	0.2941	0.15	0.6298	**0.62**	**0.0261**
Silver	0.23	0.3119	0.25	0.2668	0.22	0.4647	**0.82**	**0.0011**
Thallium	**0.40**	**0.0730**	-0.02	0.9348	0.31	0.2929	**0.73**	**0.0061**
Vanadium	-0.10	0.6737	-0.13	0.5695	**0.59**	**0.0350**	**0.50**	**0.0831**
Zinc	0.11	0.6430	**0.43**	**0.0535**	0.14	0.6494	**0.88**	**0.0000**
pH	0.31	0.1697	0.27	0.2285	0.40	0.1695	**0.67**	**0.0139**
Total Solids	**0.39**	**0.0829**	0.08	0.7347	0.37	0.2130	**0.76**	**0.0034**

Note: Spearman rank non-parametric method was used.

Bold entries indicate significant correlation ($p < 0.10$).

Table 6-11. Average percent cover and frequency results at coastal plain[a] stations

			Site								Reference	
			TT50010		TT50100		TT51000		TT52000		TS-REF-12	
Species	Species Code	Common Name	C	F	C	F	C	F	C	F	C	F
Forbs												
Anemone narcissiflora	ANNA	Anemone	0.25	10	--	--	--	--	--	--	--	--
Androsace sp.	ANsp	Primrose	--	10	--	--	--	--	--	--	--	--
Pedicularis capitata	PECA	Lousewort	--	10	--	--	--	--	--	--	--	--
Petasites frigidus or hyperboreus	PEFR/PEHY	Sweet coltsfoot	4.75	100	7.25	100	--	--	--	--	--	--
Polemonium acutiflorum	POAC	Jacob's ladder	0.25	50	1.25	90	--	--	--	--	--	--
Polygonum viviparum	POVI	Alpine meadow bistort	--	20	--	--	--	--	--	--	--	--
Saussurea angustifolia	SAAN	Saussurea	--	10	--	--	--	--	--	--	--	--
Stellaria laeta	STLA	Chickweed	--	30	0.75	60	--	--	--	--	--	--
Valeriana capitata	VACA	Valerian	--	20	1.75	20	--	--	--	--	--	--
Forbs Total			5.25		11.0		--		--		--	
Graminoids												
Arctagrostis latifolia var. arundinaceae	ARLA	Polar grass	0.25	20	0.50	60	--	--	--	--	--	--
Carex aquatilis	CAAQ	Carex	0.25	10	1.75	30	--	--	1.25	70	1.00	50
Caryx bigelowii	CABI	Bigelow's sedge	0.25	10	0.25	20	1.00	40	--	20	0.75	30
Calamagrostis holmii	CAHO	Bluejoint grass	--	--	--	--	--	--	--	--	0.25	10
Calamagrostis sp.	CAsp	Bluejoint grass	--	--	0.25	10	--	10	--	--	--	--
Eriophorum angustifolium subarcticum	ERAN	Cottongrass	3.25	40	5.25	60	3.50	40	0.25	10	2.50	60
Eriophorum vaginatum	ERVA	Cottongrass	8.25	80	8.00	90	13.5	100	20.5	100	18.3	100
Hierchloe alpina	HIAL	Holy grass	--	10	--	10	--	--	--	--	--	--
Luzula multiflora multiflora	LUMU	Wood rush	0.25	10	--	--	--	--	--	--	--	--
Luzula wahlenbergii	LUWA	Wood rush	--	--	--	--	--	--	--	--	1.00	40
Poa lanata	POLA	Bluegrass	5.25	70	3.75	100	--	--	--	--	--	10
Graminoids Total			17.8		19.8		18.0		22.0		23.8	
Deciduous Shrubs												
Betula nana exilis	BENA	Dwarf birch	9.25	40	23.0	60	14.3	90	12.3	60	3.00	20
Rubus chamaemorus	RUCH	Salmonberry	0.75	60	7.5	100	1.50	80	6.00	100	13.5	100
Salix arctica	SAAR	Arctic willow	--	10	--	--	--	--	--	--	--	--
Salix planifolia pulchra	SAPL	Diamondleaf willow	21.5	70	0.25	10	--	10	--	--	--	--
Salix polaris	SAPO	Polar willow	0.25	10	--	--	--	--	--	--	--	--
Vaccinium uliginosum alpinum	VAUL	Alpine blueberry	--	--	--	--	8.25	90	14.75	100	3.75	50
Deciduous Shrubs Total			31.8		30.8		24.0		33.0		20.3	

Table 6-11. (cont.)

Species		Common Name	Site								Reference	
			TT50010		TT50100		TT51000		TT52000		TS-REF-12	
			C	F	C	F	C	F	C	F	C	F
Evergreen Shrubs												
Empitrum nigrum hermaphroditum	EMNI	Crowberry	--	10	--	--	2.50	60	4.75	50	1.50	10
Ledum palustre decumbens	LEPA	Labrador tea	1.00	40	--	--	12.3	100	14.8	100	21.8	100
Vaccinium vitis-idaea minus	VAVI	Lingonberry	0.25	20	--	--	13.3	100	12.3	100	13.8	100
Evergreen Shrubs Total			1.25		--		28.0		31.8		37.0	
Vegetative Litter												
Broadleaf litter	Broadleaf litter	Broadleaf litter	18.3	90	13.5	100	2.25	100	10.0	100	17.0	100
Dry blades	Dry blades	Dry blades	37.3	100	46.5	100	45.3	100	38.3	100	38.0	100
Vegetative Litter Total			55.5		60.0		47.5		48.3		55.0	
Other												
Lichen	Lichen	Lichen	--	--	0.25	40	2.75	100	8.25	90	15.8	100
Moss	Moss	Moss	4.25	90	62.0	100	34.5	100	39.8	100	45.0	100
Other Total			4.25		62.3		37.3		48.0		60.8	
Unvegetated												
Bare ground	Bare ground	Bare ground	2.25	90	--	--	--	10	--	--	0.50	20
Road gravel	Road gravel	Road gravel	4.00	70	--	--	--	--	--	--	--	--
Water	Water	Water	0.50	20	--	--	--	--	--	--	--	--
Unvegetated Total			6.75		--		--		--		0.50	

Note: -- - not identified in any 1-m^2 microplot

C - average 1-m^2 microplot cover percentage

F - percent frequency in ten 1-m^2 microplots

[a] Coastal plain mesic tussock tundra community.

Table 6-12. Average percent cover and frequency results at tundra[a] stations

			Site												Reference			
			TT30010		TT80010		TT30100		TT80100		TT31000		TT81000		TS-REF-5		TS-REF-7	
Species	Species Code	Common Name	C	F	C	F	C	F	C	F	C	F	C	F	C	F	C	F
Forbs																		
Arnica lessingii lessingii	ARLE	Arnica	0.25	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Equisetum arvense	EQAR	Horsetail	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Petasites frigidus or hyperboreus	PEFR/PEHY	Sweet coltsfoot	--	--	6.50	100	--	--	--	10	--	--	--	--	--	--	1.50	20
Pedicularis labradorica	PELA2	Lousewort	--	--	0.25	10	--	--	0.25	10	0.25	10	--	--	0.25	10	0.50	30
Stellaria laeta	STLA	Chickweed	--	--	--	10	--	--	--	--	--	--	--	--	--	--	--	--
Forbs Total			0.25		6.75		--		0.25		0.25		--		0.25		2.00	
Graminoids																		
Arctagrostis latifolia var. latifolia	ARLA2	Polar grass	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.25	20
Carex aquatilis	CAAQ	Carex	2.50	50	--	--	2.50	60	0.25	10	--	--	2.25	40	--	--	--	--
Caryx bigelowii	CABI	Bigelow's sedge	--	--	15.5	90	--	--	14.3	90	--	50	3.75	50	--	10	1.75	70
Carex rotundata	CARO	Sedge	--	--	--	--	0.25	10	--	--	--	--	--	--	--	--	--	--
Eriophorum angustifolium subarcticum	ERAN	Cottongrass	0.25	10	--	--	2.00	30	--	--	0.25	10	0.25	10	0.25	10	0.25	10
Eriophorum vaginatum	ERVA	Cottongrass	15.8	100	5.25	70	20.5	100	12.8	80	14.8	100	24.3	100	12.3	100	24.5	100
Luzula multiflora multiflora	LUMU	Wood rush	--	--	0.25	10	--	--	--	--	--	--	--	--	--	--	--	--
Graminoids Total			18.5		21.0		25.3		27.3		15.0		30.5		12.5		26.8	
Deciduous Shrubs																		
Betula nana exilis	BENA	Dwarf birch	14.5	100	35.5	100	16.8	100	31.0	100	11.0	100	8.75	100	5.25	70	16.8	100
Rubus chamaemorus	RUCH	Salmonberry	22.8	100	1.00	50	11.8	80	3.75	50	4.75	100	2.75	80	28.5	100	15.3	100
Salix ovalifolia	SAOV	Ovaleaf willow	--	--	--	--	3.75	10	--	--	--	--	--	--	--	--	--	--
Salix planifolia pulchra	SAPL	Diamondleaf willow	--	--	8.00	30	--	--	0.25	10	--	--	--	--	0.25	10	1.75	20
Vaccinium uliginosum alpinum	VAUL	Alpine blueberry	28.8	100	1.00	40	26.3	100	3.00	20	28.8	100	20.0	90	37.8	100	26.5	70
Deciduous Shrubs Total			66.0		45.5		58.5		38.0		44.5		31.5		71.8		60.3	
Evergreen Shrubs																		
Andromeda polifolia	ANPO	Bog rosemary	0.75	70	--	--	2.00	70	--	--	--	--	--	--	0.50	50	0.25	30
Empitrum nigrum hermaphroditum	EMNI	Crowberry	4.25	90	0.75	50	2.50	80	5.25	20	3.75	70	5.00	50	8.50	100	8.50	90
Ledum palustre decumbens	LEPA	Labrador tea	1.75	100	8.75	100	13.5	100	24.0	100	11.3	100	15.8	100	15.5	100	16.0	100
Vaccinium vitis-idaea minus	VAVI	Lingonberry	0.75	90	1.75	100	2.00	40	10.0	100	15.8	100	18.0	100	4.25	100	7.00	100
Evergreen Shurbs Total			7.50		11.3		20.0		39.3		30.8		38.8		28.8		31.8	
Vegetative Litter																		
Broadleaf litter	Broadleaf litter	Broadleaf litter	13.3	100	8.50	100	21.0	80	10.0	100	14.5	90	3.50	100	45.3	100	12.3	100
Dry blades	Dry blades	Dry blades	21.8	100	55.0	100	32.3	100	40.0	100	35.8	100	40.3	100	17.0	100	31.3	100
Vegetative Litter Total			35.0		63.5		53.3		50.0		50.3		43.8		62.3		43.5	
Other																		
Lichen	Lichen	Lichen	--	--	--	--	2.25	60	0.50	50	4.75	100	5.00	100	21.8	100	9.75	100
Moss	Moss	Moss	26.3	100	14.3	100	34.3	90	40.5	100	37.5	100	48.8	100	45.5	100	52.3	100
Other Total			26.3		14.3		36.5		41.0		42.3		53.8		67.3		62.0	

Table 6-12. (cont.)

Species	Species Code	Common Name	Site										Reference			
			TT30010		TT80010		TT30100		TT80100		TT31000		TT81000		TS-REF-5		TS-REF-7	
			C	F	C	F	C	F	C	F	C	F	C	F	C	F	C	F
Unvegetated																		
Bare ground	Bare ground	Bare ground	4.00	20	2.00	30	--	--	0.50	20	--	--	--	--	--	--	--	--
Road gravel	Road gravel	Road gravel	2.25	70	3.75	70	--	--	--	--	--	--	--	--	--	--	--	--
Rock	Rock	Rock	0.50	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Water	Water	Water	1.50	10	0.25	10	18.0	50	3.50	40	--	--	4.75	40	0.50	30	0.75	40
Unvegetated Total			8.25		6.00		--		4.00		--		--		--		--	

Note: -- - not identified in any 1-m^2 microplot

C - average 1-m^2 microplot cover percentage

F - percent frequency in ten 1-m^2 microplots

[a] Foothills mesic tussock tundra community.

Table 6-13. Average percent cover and frequency results at hillslope[a] stations

Species	Species Code	Common Name	Site						Reference	
			TT60010		TT60100		TT61000		TS-REF-11	
			C	F	C	F	C	F	C	F
Forbs										
Anemone sp.	ANsp2	Anemone	--	20	--	--	--	20	--	--
Artemisia arctica arctica	ARAR	Wormwood	--	--	--	--	0.25	10	0.25	30
Arnica lessingii lessingii	ARLE	Arnica	--	--	--	--	--	--	0.25	20
Equisetum arvense	EQAR	Horsetail	--	--	0.25	30	3.50	40	2.75	80
Equisetum sp.	EQsp2	Horsetail	--	--	--	10	--	--	--	--
Unknown forb	FOTT60010	Unknown forb	--	10	--	--	--	--	--	10
Unknown forb	FOTT60010	Unknown forb	--	--	--	10	--	--	--	--
Unknown forb	FOTT60010	Unknown forb	0.25	10	--	30	--	--	--	--
Unknown forb	FOTT60010	Unknown forb	--	--	--	--	0.25	20	--	--
Unknown forb	FOTT60010	Unknown forb	--	--	--	--	--	40	--	--
Unknown forb, LEG Family	FOTT61000-3	Unknown forb	--	--	--	--	0.25	20	--	--
Lupinus arcticus	LUAR	Lupine	--	--	--	--	0.25	10	--	--
Lycopodium clavatum monostachyon	LYCL	Club moss	--	--	--	--	--	--	0.25	10
Minuartia arctica	MIAR	Sandwort	0.25	10	--	--	0.50	20	--	--
Papaver macounni	PAMA	Alaska poppy	--	--	--	--	0.25	10	--	--
Petasites frigidus or hyperboreus	PEFR/PEHY	Sweet coltsfoot	1.75	80	0.75	80	--	10	2.00	50
Pedicularis labradorica	PELA2	Lousewort	0.75	40	--	--	0.75	30	--	--
Polemonium acutiflorum	POAC	Jacob's ladder	--	--	--	20	--	--	--	--
Polygonum bistorta plumosum	POBI	Bistort	--	20	--	--	0.75	50	--	10
Potentilla fruiticosa	POFR	Shrubby cinquefoil	--	--	--	--	--	10	--	--
Polygonum viviparum	POVI	Alpine meadow bistort	--	--	--	--	0.75	30	--	--
Pyrola grandiflora	PYGR	Wintergreen	0.50	20	--	10	0.25	20	--	--
Ranunculus lapponicus	RALA	Buttercup	--	--	--	--	--	--	--	10
Ranunculus sp.	RAsp	Buttercup	--	--	--	--	--	20	--	--
Saussurea angustifolia	SAAN	Saussurea	0.25	10	--	--	2.00	30	--	--
Saxifraga punctata	SAPU	Brook saxifrage	--	10	--	--	0.25	40	--	--
Senecio sp.	SEsp	Senecio	--	--	--	--	0.25	40	--	--
Stellaria laeta	STLA	Chickweed	--	20	--	--	--	20	--	10
Valeriana capitata	VACA	Valerian	--	--	0.25	20	--	--	--	10
Forbs Total			3.75		1.25		10.3		5.50	

Table 6-13. (cont.)

Species		Common Name	Site						Reference	
			TT60010		TT60100		TT61000		TS-REF-11	
			C	F	C	F	C	F	C	F
Graminoids										
Arctagrostis latifolia var. latifolia	ARLA2	Polar grass	0.25	40	0.25	20	--	10	0.75	60
Caryx bigelowii	CABI	Bigelow's sedge	--	--	10.8	100	7.00	70	3.50	80
Carex microchaeta	CAMI	Sedge	1.25	50	--	--	--	--	0.25	30
Carex podocarpa	CAPO	Sedge	0.25	10	--	--	--	--	--	--
Carex saxatilis laxa	CASA	Sedge	--	--	--	--	1.50	20	--	--
Eriophorum vaginatum	ERVA	Cottongrass	--	--	0.25	10	--	--	--	--
Festuca altaica	FEAL	Fescue grass	0.75	30	--	--	0.25	10	0.25	10
Unknown grass	GRTT61000	Unknown grass	--	--	--	--	1.75	20	--	--
Poa glauca	POGL	Tundra bluegrass	--	--	--	--	--	20	--	--
Poa sp.	POsp	Bluegrass	0.50	50	0.25	30	--	--	--	10
Unknown sedge, CYP Family	SETT61000	Unknown sedge	--	--	--	--	0.25	10	--	--
Graminoids Total			3.00		11.5		10.8		4.75	
Deciduous Shrubs										
Betula nana exilis	BENA	Dwarf birch	26.5	100	16.8	60	30.8	60	10.5	40
Rubus chamaemorus	RUCH	Salmonberry	--	--	1.50	70	--	--	0.75	60
Salix glauca	SAGL	Grayleaf willow	--	--	32.3	60	--	--	--	--
Salix lanata richardsonii	SALA	Richardson willow	1.75	20	3.50	40	10.8	40	--	--
Salix planifolia pulchra	SAPL	Diamondleaf willow	6.00	60	--	--	1.50	10	23.0	70
Salix reticulata	SARE	Netleaf willow	--	--	1.50	10	15.8	60	--	--
Salix sp.	SAsp3	Dwarf willow	--	--	--	--	--	--	0.25	10
Vaccinium uliginosum alpinum	VAUL	Alpine blueberry	30.8	90	7.00	40	9.25	40	40.5	100
Deciduous Shrubs Total			65.0		62.5		68.0		75.0	
Evergreen Shrubs										
Andromeda polifolia	ANPO	Bog rosemary	--	--	--	10	--	--	--	--
Arctostaphylos alpina [b]	ARAL	Bearberry	4.00	20	--	--	--	--	--	--
Cassiope tetragona	CATE	Heather	--	--	--	--	1.50	10	--	10
Dryas integrifolia integrifolia	DRIN	Dryas	--	--	1.75	20	7.00	40	--	--
Empitrum nigrum hermaphroditum	EMNI	Crowberry	4.75	40	0.25	20	--	20	10.3	100
Ledum palustre decumbens	LEPA	Labrador tea	3.50	100	0.75	50	0.25	10	9.25	70
Linnaea borealis borealis	LIBO	Twin flower	0.50	20	--	--	--	--	--	--
Rhododendron lapponicum	RHLA	Lapland rosebay	--	--	--	--	1.50	10	--	--
Vaccinium vitis-idaea minus	VAVI	Lingonberry	6.00	100	0.75	60	0.25	30	1.75	90
Evergreen Shrubs Total			18.8		3.50		10.5		21.3	

Table 6-13. (cont.)

Species		Common Name	Site						Reference	
			TT60010		TT60100		TT61000		TS-REF-11	
			C	F	C	F	C	F	C	F
Vegetative Litter										
Broadleaf litter	Broadleaf litter	Broadleaf litter	13.5	100	8.75	100	19.5	100	17.0	100
Dry blades	Dry blades	Dry blades	4.50	100	11.8	100	10.5	100	11.0	100
Vegetative Litter Total			18.0		20.5		30.0		28.0	
Other										
Lichen	Lichen	Lichen	10.8	90	10.0	100	14.3	90	18.0	80
Moss	Moss	Moss	79.3	100	71.5	100	70.0	100	50.3	100
Other Total										
Unvegetated										
Road gravel	Road gravel	Road gravel	0.25	10	--	--	--	--	--	--
Rock	Rock	Rock	0.25	20	--	--	0.25	10	0.25	10
Water	Water	Water	--	--	--	--	--	--	0.25	10
Unvegetated Total			0.50		--	--	0.25		0.50	

Note: -- - not identified in any 1-m^2 microplot

C - average 1-m^2 microplot cover percentage

F - percent frequency in ten 1-m^2 microplots

[a] Hillslope mesic open shrubland community.

[b] Nondeciduous shrub per Walker (2000).

Table 6-14. Average percent cover and frequency results at coastal lagoon[a] stations

			Site				Reference			
			PLNL		NLK		CL-REF-1		CL-REF-2	
Species	Species Code	Common Name	C	F	C	F	C	F	C	F
Forbs										
Hippuris vulgaris	HIVU	Mare's tail	65.3	100	--	--	6.75	100	--	--
Polygonum bistorta plumosum	POBI	Bistort	--	--	--	--	--	--	--	--
Potentilla egedii egedii	POEG	Beach cinquefoil	--	--	--	--	--	--	0.25	30
Ranunculus confervoides	RACO	Buttercup	--	--	1.75	40	--	--	--	--
Ranunculus hyperborealis hyperborealis	RAHY	Buttercup	0.50	50	--	--	--	--	--	--
Rumex arcticus	RUAR	Sourdock	--	--	0.25	10	--	--	--	--
Stellaria crassifolia	STCR	Chickweed	0.25	40	1.75	90	0.25	30	--	20
Unknown forb, CRU Family	FONLK2	Unknown mustard	--	--	0.75	50	--	--	--	--
Unknown forb, RAN Family	FONLK3	Unknown buttercup	--	--	0.50	40	--	--	--	--
Forbs Total			66.0		5.00		7.00		0.25	
Graminoids										
Arctophila fulva	ARFU	Pendent grass	3.75	50	--	--	26.5	100	1.75	60
Calamagrostis deschampsioides	CADE	Bluejoint grass	--	--	2.50	50	--	--	3.25	30
Carex aquatilis	CAAQ	Carex	--	--	37.8	100	--	--	49.8	100
Carex canescens	CACA2	Sedge	--	--	--	--	8.00	80	2.00	30
Deschampsia caespitosa	DECA	Tufted hairgrass	0.25	10	0.75	40	0.50	30	0.75	30
Dupontia fischeri psilosantha	DUFI	Tundra grass	10.5	50	37.8	100	19.8	80	22.8	60
Eriophorum angustifolium subarcticum	ERAN	Cottongrass	4.5	40	--	--	15.0	90	--	--
Poa alpigena	POAL	Bluegrass	--	--	--	20	--	--	--	--
Graminoids Total			19.0		78.8		69.8		80.3	
Deciduous Shrubs										
Salix ovalifolia	SAOV	Ovaleaf willow	--	--	--	--	--	10	--	--
Vegetative Litter										
Broadleaf litter	Broadleaf litter	Broadleaf litter	--	--	--	--	17.0	100	--	--
Detritus/fines	Detritus/fines	Detritus/fines	4.25	70	2.50	100	7.5	100	12.3	100
Dry blades	Dry blades	Dry blades	16.5	50	66.5	100	11.0	100	15.5	100
Littoral matter	Littoral matter	Littoral matter	--	--	2.25	50	--	--	0.25	10
Vegetative Litter Total			20.8		71.3		35.5		28.0	
Other										
Lichen	Lichen	Lichen								
Moss	Moss	Moss	3.25	40	38.0	100	50.3	100	34.5	100
Other Total			--	--	--	--	--	--	--	--

Table 6-14. (cont.)

Species	Species Code	Common Name	Site				Reference			
			PLNL		NLK		CL-REF-1		CL-REF-2	
			C	F	C	F	C	F	C	F
Unvegetated										
Rock	Rock	Rock	--	--	--	--	0.25	10	1.50	10
Sand/gravel	Sand/gravel	Sand/gravel	--	--	1.50	10	--	--	3.75	10
Water	Water	Water	68.3	80	--	--	0.25	10	--	--
Unvegetated Total			--		1.50		0.50		5.25	

Note: -- - not identified in any 1-m^2 microplot

C - average 1-m^2 microplot cover percentage

F - percent frequency in ten 1-m^2 microplots

[a] Coastal lagoon fringe emergent community.

Table 6-15. Vascular plant species diversity, evenness, and richness at terrestrial and coastal lagoon plant community survey stations

Station	Diversity	Evenness	Richness	Area Richness
Coastal Lagoon Fringe Emergent				
Site				
PLNL	1.2	0.42	7	12
NLK	1.6	0.51	10	11
Reference				
CL-REF-1	2.2	0.79	8	8
CL-REF-2	1.5	0.52	8	11
Coastal Plain Mesic Tussock Tundra				
Site				
TT50010	2.7	0.67	25	33
TT50100	2.8	0.74	15	22
TT51000	2.8	0.88	11	13
TT52000	2.8	0.87	10	10
Reference				
TS-REF-12	2.7	0.77	13	13
Foothills Mesic Tussock Tundra				
Site				
TT30010	2.5	0.72	12	16
TT80010	2.5	0.71	13	19
TT30100	2.9	0.81	12	15
TT80100	2.7	0.78	12	14
TT31000	2.6	0.82	10	10
TT81000	2.8	0.84	10	11
Reference				
TS-REF-5	2.5	0.73	12	13
TS-REF-7	3.0	0.78	14	14
Hillslope Mesic Open Shrubland				
Site				
TT60010	2.8	0.66	25	29
TT60100	2.6	0.63	23	29
TT61000	3.4	0.69	38	53
Reference				
TS-REF-11	2.7	0.66	24	35

Note: Shannon-Weiner diversity index and evenness index calculated using average percent covers for vascular plant species.

Species richness represents the number of vascular plant species observed in ten 1-m^2 microplots.

Area richness represents the number of vascular plant species observed in the near vicinity of the survey line.

Table 6-16. CoPC concentrations, pH, and total solids in tundra soil at terrestrial and coastal lagoon plant community survey stations

Station	pH (wet)	Total Solids (% wet)	Antimony	Arsenic	Barium	Cadmium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Selenium	Silver	Thallium	Vanadium	Zinc
Coastal Lagoon[a]																	
Site																	
PLNL	6.5	13.5	2.8 *J*	13	429	17.7	8.84	37.1	532	160	0.424	1.96 *J*	2.2	1.87	0.239	30.4	3,010
NLK	5.6	31	0.31 *J*	16.6	264	2.47	7.54	16.1	156	249	0.141	2.58 *J*	1.3	0.151	0.109	31.3	446
Reference																	
CL-REF-1	5.4	15.3	0.17 *J*	8.57	123	0.204	3.7	9.55	11.5	78.4	0.069	1.13 *J*	1.1	0.069	0.021	25.7	42.4
CL-REF-2	4.7	34.2	0.2 *J*	11.4	206	0.524	9.7	15.4	36	331	0.06	3.08 *J*	0.9	0.129	0.093	32.8	158
Coastal Plain[b]																	
Site																	
TT5_0010	6.7	42.9	2.75	8	1,200	20.6	18.6	20.6	1,210	1,860 *J*	1.75	0.89	1.5	1.91	0.455	11.6	4,330 *J*
TT5_0100	6.4	34.7	2.46	5.3	1,200	24	8.18	19.8	1,060	1,560 *J*	0.25	0.84	1.9	1.25	0.368	8.25	5,120 *J*
TT5_1000	4.5	19	0.83	1.8	15.3	4.08	6.82	7.93	8.62	32.5 *J*	0.33	1.16	0.9	0.264	0.072	4.64	38.9 *J*
TT5_2000	4.5	18.9	0.55	0.5	96	1.31	1.97	4.82	54.1	290 *J*	0.27	0.8	0.5	0.12	0.036	0.98	286 *J*
Reference																	
TS-REF12	3.6	22	0.21 *J*	0.28	24.5	0.215	0.49	3.09	5.83	137	0.176	0.506 *J*	0.2	0.03	0.012	0.85	58.6
Tundra[c]																	
Site																	
TT3-0010	7.1	42.8	0.93 *J*	5.3 *J*	2,280	7.07 *J*	8.3 *J*	19.0 *J*	385	2,110 *J*	0.3 *J*	1.08	1.0 *J*	0.45	0.30 *J*	14.2 *J*	1,350 *J*
TT8_0010	7.1	66.5	1.07	4.1	1,900	4.72	6.5	15.3	226	494 *J*	0.13	0.93	1.4	0.453	0.245	15.9	976 *J*
TT3-0100	6.3	25	0.91 *J*	2.2 *J*	690 *J*	2.1 *J*	2.69 *J*	7.5 *J*	119	348 *J*	0.12 *J*	0.48 *J*	0.5 *J*	0.32	0.088 *J*	5.0 *J*	465
TT8_0100	6.9	19.2	1.25	3	1,470	3.83	5.48	14.9	189	2,380 *J*	0.2	1.16	1.8	0.375	0.214	11.2	908 *J*
TT3-1000	4	18.8	0.4 *J*	0.8 *J*	131 *J*	0.55 *J*	0.6 *J*	5.87 *J*	16.1 *J*	250 *J*	0.1	0.79 *J*	0.4 *J*	0.07	0.049 *J*	1.5 *J*	78.4
TT8_1000	4.5	15.3	0.42	0.8	275	0.408	3.57	6.15	4.23 *U*	139 *J*	0.15	1.68	0.6	0.062	0.02	4.8	89.3 *J*
Reference																	
TS-REF-5	3.9	38	0.22 *J*	3.5 *J*	383 *J*	0.29 *J*	15.3 *J*	9.5 *J*	13.4	365 *J*	0.11 *J*	0.80 *J*	0.6	0.12	0.057 *J*	12.7 *J*	57.4
TS-REF-7	4.5	14.4	0.18 *J*	0.4 *J*	195 *J*	0.27 *J*	6.02 *J*	6.2 *J*	6.9 *J*	541 *J*	0.09 *J*	2.01 *J*	0.3 *J*	0.02	0.027 *J*	1.1 *J*	50.3
Hillslope[d]																	
Site																	
TT6_0010	6.9	54.1	1.92	9.1	6950 *J*	5.47	9.11 *J*	45.6	349	1,020 *J*	0.25	1.95 *J*	1.5	0.726	1.29	19.7 *J*	1,020
TT6_0100	5.6	26.3	2.03	4.9	6360 *J*	5.06	3.3 *J*	20.1	281	534 *J*	0.27	2.47 *J*	0.9	0.486	0.755	7.51 *J*	764
TT6_1000	6.6	20.8	1.22	2.9	1290 *J*	6.11	1.87 *J*	15.8	145	429 *J*	0.22	2.09 *J*	1.6	0.697	0.38	16.0 *J*	592
Reference																	
TS-REF11	5.3	21	0.3	3.2	293 *J*	0.414	7.81 *J*	12.2	12.7	3,490 *J*	0.12	0.348 *J*	0.5	0.204	0.105	11.0 *J*	56.4

Note: Metals reported as mg/kg, dry weight basis.

Results averaged across sampling events (2003 and 2004).

Field replicates averaged.

CoPC - chemical of potential concern

J - estimated value

U - undetected; value reported is one-half the detection limit

[a] Coastal lagoon fringe emergent community.

[b] Coastal plain mesic tussock tundra community.

[c] Foothills tussock tundra community.

[d] Hillslope mesic open shrubland community.

Table 6-17. Comparison of CoPC concentrations in unwashed willow and birch leaves against phytotoxicity thresholds reported in the literature

Station	Sample ID	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
Phytotoxicity Reference Value															
[a]		50–200	150	5–20	500	5–30	5–30	15–50	30–300	1–3	10–50	5–30	20	5–10	100–400
[b]		--	--	3–10	--	5–700	20	25–100	--	--	100	100	--	10	500–1,500
[c]		--	--	11–26	400–800	14–16	5–20	3–9	20–35	2–5	130–140	7–90	11–45	--	160–320
Site															
TT2-0010	WI0006	93.6	0.15	0.13	77.2	16.5	0.2 *U*	0.456	5.76	0.05	0.174	0.2	0.013	0.2 *U*	548
TT2-0100	WI0005	10.8	0.14	0.04 *U*	14.1	1.72	0.2 *U*	0.738	0.89	0.04	0.149	0.1 *U*	0.002 *U*	0.2 *U*	234
TT2-1000	WI0004	7.5	0.03 *U*	0.04 *U*	9.1 *J*	0.26	0.2 *U*	0.41	0.35	0.04	0.078	0.1 *U*	0.002	0.3 *U*	244
TT3-0010	WI0007	154	0.18	0.19	154	4.43	0.55 *U*	0.426	7.74	0.06	0.342	0.1 *U*	0.025	0.2 *U*	345
TT3-0100	BR0004	28.4 *J*	0.03 *UJ*	0.04 *U*	123	0.136	0.2 *U*	0.306	1.91	0.03	0.369	0.1 *U*	0.002 *U*	0.2 *U*	138
TT3-0100	WI0011	9.1 *J*	0.02 *UJ*	0.04 *U*	54.4	4.71	0.2 *U*	3.11	0.48	0.03	0.48	0.1 *U*	0.0010 *U*	0.3 *U*	246
TT3-1000	BR0003	6.6 *J*	0.02 *UJ*	0.04 *U*	77.9	0.155	0.2 *U*	0.313	0.58	0.04	0.08	0.1 *U*	0.0010 *U*	0.3 *U*	275
TT5-0010	WI0001	66.7	0.17	0.1	57.5 *J*	10.3	0.2 *U*	0.604	6.64	0.05	0.122	0.1 *U*	0.006	0.2 *U*	592
TT5-0100	WI0003	43.0	0.04 *U*	0.04 *U*	35.3	2.14	0.4 *U*	0.965	4.85	0.04	0.075	0.1 *U*	0.005	0.2 *U*	267
TT5-1000	BR0001	8.4	0.12	0.04 *U*	42.3 *J*	0.728	0.4 *U*	0.437	3.77	0.04	0.084	0.1 *U*	0.0010 *U*	0.3 *U*	284
TT5-1000	WI0002	11.3	0.04 *U*	0.04 *U*	17.1 *J*	0.817	0.2 *U*	2.91	1.07	0.03	0.062	0.1 *U*	0.0010 *U*	0.3 *U*	163
TT5-2000	BR0002	5.7	0.03 *U*	0.04 *U*	28.0	0.323	0.2 *U*	0.76	0.42	0.03	0.222	0.1 *U*	0.0010 *U*	0.2 *U*	225
TT6-0010	WI0024	21.9	0.055 *U*	0.03 *U*	40.2	2.69	0.3 *UJ*	1.17	1.12	0.057	0.16	0.05 *U*	0.004	0.3 *U*	127 *J*
TT6-0100	WI0013-D	10.8 *J*	0.03 *U*	0.03 *U*	31.2 *J*	1.78	0.2 *UJ*	0.22	1.07	0.047	0.316	0.05 *U*	0.005	0.2 *U*	223 *J*
TT6-1000	WI0012	6.5 *J*	0.03 *U*	0.03 *U*	14.8 *J*	4.65	0.2 *UJ*	0.2	0.41	0.047	0.373	0.05 *U*	0.003	0.3 *U*	79.8 *J*
TT6-2000	WI0017	10.5 *J*	0.085 *U*	0.03 *U*	40.9 *J*	1.91	0.2 *UJ*	0.76	0.37	0.047	0.19	0.05 *U*	0.0010 *U*	0.2 *U*	103 *J*
TT7-0010	WI0016	41.5 *J*	0.11 *U*	0.03 *U*	144 *J*	2.66	0.2 *UJ*	1.86	6.89	0.048	0.089	0.05 *U*	0.006	0.2 *U*	145 *J*
TT7-1000	WI0015	2.5 *UJ*	0.03 *U*	0.03 *U*	17.1 *J*	4.88	0.2 *UJ*	0.13	0.52	0.034	0.883	0.05 *U*	0.011	0.2 *U*	227 *J*
TT7-2000	WI0029	6.5	0.026 *U*	0.03 *U*	54.0	4.48	0.4	0.25	1.4	0.042	0.284	0.05 *U*	0.007	0.2 *U*	330
TT7-2000	WI0030	5.5	0.01 *U*	0.03 *U*	15.5	3.68	0.4	0.22	1.09	0.056	0.992	0.05 *U*	0.004	0.2 *U*	225
TT8-0010	WI0010	108	0.12	0.11	57.2	6.73	0.5 *U*	1.6	2.91	0.05	0.312	0.2	0.007	0.5	239
TT8-0100	WI0009	20.4	0.05 *U*	0.04 *U*	54.6	1.77	0.2 *U*	3.23	0.79	0.04	0.316	0.1 *U*	0.0010 *U*	0.2 *U*	143
TT8-1000	WI0008	18.0	0.51	0.04 *U*	39.2	0.714	0.3 *U*	4.96	1.47	0.04	0.207	0.1 *U*	0.0010 *U*	0.3 *U*	126
Reference															
TS-REF-5	WI0019	14.8	0.03 *U*	0.03 *U*	76.1	0.673	0.2 *U*	8.03	0.4	0.044	0.166	0.1	0.0010 *U*	0.3 *U*	78.8
TS-REF-7	BR0005	2.5 *U*	0.02 *U*	0.03 *U*	69.9	0.16	0.4 *U*	0.54	0.13	0.047	0.15	0.05 *U*	0.003	0.2 *U*	107
TS-REF-7	WI0020	9.0	0.03 *U*	0.03 *U*	26.7	0.389	0.3 *U*	2.47	0.11	0.042	0.312	0.05 *U*	0.0010 *U*	0.2 *U*	62.1
TS-REF11	BR0006	2.5 *U*	0.02 *U*	0.03 *U*	74.4	0.108	0.4 *UJ*	0.1	0.08	0.049	0.005 *U*	0.05 *U*	0.0010 *U*	0.3 *U*	145 *J*
TS-REF11	WI0023	22.6	0.04 *U*	0.03 *U*	51.1	0.376	0.4 *UJ*	0.84	0.77	0.055	0.013 *U*	0.05 *U*	0.003	0.3 *U*	47.2 *J*

Note: Phytotoxicity reference values and tissue concentrations are in mg/kg dry weight.
"WI" samples are willow leaves (*Salix* spp.); "BR" samples are dwarf birch leaves (*Betula nana*).
Boxed concentrations exceed the minimum phytotoxicity reference value.
Plant tissue data were not available for the following CoPCs in tundra soil: copper, manganese, and silver.

-- - not reported
CoPC - chemical of potential concern
U - undetected; value reported is one-half the detection limit
J - estimated value

[a] Leaf tissue concentration at which toxicity was observed in plants that are neither sensitive nor tolerant (McBride 1994).

[b] Phytotoxic concentrations in plant foliage (Langmuir et al. 2004).

[c] Upper critical level in leaves and shoots of spring barley (*Hordeum vulgare*) associated with reduced yield (Davis et al. 1978).

Table 6-18. Comparison of CoPC concentrations in unwashed sedge blades against phytotoxicity thresholds reported in the literature

Station	Sample ID	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
Phytotoxicity Reference Value															
[a]		50–200	150	5–20	500	5–30	5–30	15–50	30–300	1–3	10–50	5–30	20	5–10	100–400
[b]		--	--	3–10	--	5–700	20	25–100	--	--	100	100	--	10	500–1,500
[c]		--	--	11–26	400–800	14–16	5–20	3–9	20–35	2–5	130–140	7–90	11–45	--	160–320
Site															
TT2-0010	SE0010	69.2	0.19	0.08	85.0	0.256	0.70 *U*	0.133	5.63	0.05	0.322	0.1 *U*	0.007	0.2 *U*	89.4
TT2-0100	SE0006	17.4	0.21	0.04 *U*	30.7	0.05	0.4 *U*	0.028	1.01	0.03	0.345	0.1 *U*	0.0010 *U*	0.2 *U*	78.4
TT2-1000	SE0005	7	0.13	0.12	20	0.021	0.2 *U*	0.033	0.16	0.03	0.379	0.1 *U*	0.0010 *U*	0.2 *U*	52.5
TT3-0010	SE0013	72	0.13	0.09	84.3	0.138	3.3	0.162	4.06	0.03	0.177	0.1 *U*	0.032	0.2 *U*	40.4
TT3-0100	SE0022	17.9 *J*	0.02 *UJ*	0.04 *U*	44.5	0.052	0.2 *U*	0.048	0.91	0.04	0.551	0.1 *U*	0.0010 *U*	0.2 *U*	41.3
TT3-1000	SE0021	5.4 *J*	0.02 *UJ*	0.04 *U*	34.0	0.02	0.2 *U*	0.076	0.18	0.03	0.403	0.1 *U*	0.0010 *U*	0.3 *U*	51.3
TT5-0010	SE0001	93.8	0.22	0.13	85.8 *J*	0.567	0.65 *U*	0.159	10.8	0.05	0.239	0.1 *U*	0.01	0.2 *U*	209
TT5-0100	SE0004	26.1	0.17	0.04 *U*	39.7	0.104	0.3 *U*	0.046	2.33	0.03	0.172	0.1 *U*	0.0010 *U*	0.2 *U*	67.7
TT5-1000	SE0002-D	8.8	0.19	0.04 *U*	26.6	0.09	0.3	0.04	2.10	0.04	0.490	0.1 *U*	0.005	0.3 *U*	74.9
TT5-1000	SE0002-D	8.0	0.05 *U*	0.04 *U*	22.3	0.076	0.2 *U*	0.038	1.57	0.04	0.391	0.1 *U*	0.0010 *U*	0.2 *U*	64
TT5-2000	SE0003	2.5 *U*	0.04 *U*	0.04 *U*	18.6 *J*	0.036	0.2 *U*	0.016	0.33	0.04	0.618	0.1 *U*	0.009	0.3 *U*	72.8
TT6-0010	SE0042	13.1	0.03 *U*	0.03 *U*	128	0.121	0.2 *UJ*	0.09	0.71	0.04	0.463	0.3	0.004	0.3 *U*	58.9 *J*
TT6-0100	SE0024	13.8 *J*	0.03 *U*	0.03 *U*	47.4 *J*	0.053	0.2 *UJ*	0.005 *U*	0.33	0.017	1.15	0.05 *U*	0.002	0.3 *U*	47.4 *J*
TT6-0100	SE0025	8.6 *J*	0.03 *U*	0.03 *U*	87.7 *J*	0.122	0.2 *UJ*	0.04	1.32	0.026	1.72	0.1	0.007	0.2 *U*	53 *J*
TT6-1000	SE0023	2.8 *UJ*	0.03 *U*	0.03 *U*	33.6 *J*	0.038	0.3 *UJ*	0.03	0.3 *U*	0.025	0.454	0.4	0.002	0.3 *U*	33 *J*
TT6-2000	SE0028	8.6 *J*	0.070 *U*	0.03 *U*	66.7 *J*	0.398	0.2 *UJ*	0.09	1.10	0.03	0.134	0.05 *U*	0.007	0.2 *U*	71.4 *J*
TT7-0010	SE0027	12.5 *J*	0.05 *U*	0.08	77.0 *J*	0.403	0.2 *UJ*	0.11	2.24	0.022	0.556	0.05 *U*	0.035	0.3 *U*	166 *J*
TT7-1000	SE0026	12.2 *J*	0.04 *U*	0.03 *U*	78.4 *J*	0.172	0.3 *UJ*	0.04	5.67	0.036	0.888	0.05 *U*	0.006	0.3 *U*	43.4 *J*
TT7-2000	SE0061	7.2	0.02 *U*	0.03 *U*	62.3	0.197	0.3	0.05	1.95	0.045	1.26	0.2	0.009	0.2 *U*	49.7
TT7-2000	SE0062	14.9	0.031 *U*	0.04 *U*	93.6	0.378	0.2 *UJ*	0.07	7.96	0.035	0.669	0.05 *U*	0.007	0.2 *U*	65.2
TT8-0010	SE0017	104	0.16	0.11	109	0.164	4.5	0.209	4.89	0.04	0.816	0.3	0.007	0.2 *U*	51
TT8-0100	SE0015-D	23.5	0.04 *U*	0.04 *U*	70.8	0.071	0.4 *U*	0.061	1.3	0.04	0.767	0.1 *U*	0.001 *U*	0.2 *U*	35.7
TT8-1000	SE0014	6.9	0.04 *U*	0.04 *U*	32.3	0.034	0.2 *U*	0.019	0.34	0.01 *U*	0.44	0.1 *U*	0.01	0.2 *U*	48.4
Reference															
TS-REF-5	SE0031	8.3	0.02 *U*	0.03 *U*	34.7	0.071	0.2 *U*	0.04	0.52	0.023	0.422	0.05 *U*	0.004	0.3 *U*	35.9
TS-REF-5	SE0056	8.2	0.037 *U*	0.03 *U*	25.6	0.035	0.6	0.05	0.46	0.04	0.549	0.05 *U*	0.0010 *U*	0.2 *U*	30.6
TS-REF-7	SE0032	6.8	0.02 *U*	0.03 *U*	28.3	0.032	0.4 *U*	0.06	0.28	0.029	0.651	0.05 *U*	0.0010 *U*	0.3 *U*	37.9
TS-REF11	SE0041	6.8	0.02 *U*	0.05	16.7	0.025	0.3 *UJ*	0.08	0.39	0.036	0.236	0.3	0.0010 *U*	0.3 *U*	25.6 *J*

Note: Phytotoxicity reference values and tissue concentrations are in mg/kg dry weight.
Sedge samples include *Eriophorum vaginatum* and *Carex* species.
Boxed concentrations exceed the minimum phytotoxicity reference value.
Plant tissue data were not available for the following CoPCs in tundra soil: copper, manganese, and silver.

-- - not reported
CoPC - chemical of potential concern
U - undetected; value reported is one-half the detection limit
J - estimated value

[a] Leaf tissue concentration at which toxicity was observed in plants that are neither sensitive nor tolerant (McBride 1994).

[b] Phytotoxic concentrations in plant foliage (Langmuir et al. 2004).

[c] Upper critical level in leaves and shoots of spring barley (*Hordeum vulgare*) associated with reduced yield (Davis et al. 1978).

Table 6-19. Comparison of tissue threshold concentrations in moss samples (*Hylocomium splendens*)

Station	Zone	Sample ID	Event	Copper	Tissue Threshold Concentrations[a]	Zinc	Tissue Threshold Concentrations[a]
				mg/kg dry	A = 25 - 60 B = 35 - 90 C = 70 - 110	µg/g dry	A = 150 - 290 B = 190 - 350 C = 300 - 400
Site							
001P-M01	ECO-R	001P-M-01	2001			1,530	C
002P-M01	ECO-R	002P-M-01	2001			1,970	C
003P-M01	ECO-R	003P-M-01	2001			2,060	C
004P-M01	ECO-R	004P-M-01	2001			1,420	C
005P-M01	ECO-R	005P-M-01	2001			2,090	C
006P-M01	ECO-R	006P-M-01	2001			1,970	C
007P-M01	ECO-R	007P-M-01	2001			1,280	C
008P-M01	ECO-R	008P-M-01	2001			1,330	C
009D-M01	ECO-R	009D-M-01	2001			3,440	C
009P-M01	ECO-R	009P-M-01	2001			3,210	C
010P-M01	ECO-R	010P-M-01	2001			2,490	C
011P-M01	ECO-R	011P-M-01	2001			1,110	C
013P-M01	ECO-R	013P-M-01	2001			1,450	C
015P-M01	ECO-R	015P-M-01	2001			424	C
016P-M01	ECO-R	016P-M-01	2001			1,160	C
017P-M01	ECO-R	017P-M-01	2001			191	B
018D-M01	ECO-R	018D-M-01	2001			261	B
018P-M01	ECO-R	018P-M-01	2001			264	B
019P-M01	ECO-R	019P-M-01	2001			518	C
020P-M01	ECO-R	020P-M-01	2001			901	C
021P-M01	ECO-R	021P-M-01	2001			1,250	C
022P-M01	ECO-R	022P-M-01	2001			602	C
023P-M01	ECO-R	023P-M-01	2001			981	C
024P-M01	ECO-R	024P-M-01	2001			1,140	C
025P-M01	ECO-R	025P-M-01	2001			862	C
026D-M01	ECO-R	026D-M-01	2001			420	C
026P-M01	ECO-R	026P-M-01	2001			290	B
028P-M01	ECO-R	028P-M-01	2001			922	C
029P-M01	ECO-R	029P-M-01	2001			119	
030P-M01	ECO-R	030P-M-01	2001			209	B
030R-M01	ECO-R	030R-M-01	2001			124	
031P-M01	ECO-R	031P-M-01	2001			301	C
031R-M01	ECO-R	031R-M-01	2001			348	C
032P-M01	ECO-R	032P-M-01	2001			207	B
032R-M01	ECO-R	032R-M-01	2001			169	A
033P-M01	ECO-R	033P-M-01	2001			117	
034D-M01	ECO-R	034D-M-01	2001			93.6	
034P-M01	ECO-R	034P-M-01	2001			109	
034R-M01	ECO-R	034R-M-01	2001			97.3	
035P-M01	ECO-R	035P-M-01	2001			92.5	
036P-M01	ECO-R	036P-M-01	2001			559	C
036R-M01	ECO-R	036R-M-01	2001			436	C
037P-M01	ECO-R	037P-M-01	2001			179	A
038P-M01	ECO-R	038P-M-01	2001			116	
038R-M01	ECO-R	038R-M-01	2001			153	A
039P-M01	ECO-R	039P-M-01	2001			187	A
040P-M01	ECO-R	040P-M-01	2001			72.3	
040R-M01	ECO-R	040R-M-01	2001			71.9	
041P-M01	ECO-R	041P-M-01	2001			309	C
042D-M01	ECO-R	042D-M-01	2001			84.2	
042P-M01	ECO-R	042P-M-01	2001			83	
042R-M01	ECO-R	042R-M-01	2001			82.9	
044P-M01	ECO-R	044P-M-01	2001			230	B

Table 6-19. (cont.)

Station	Zone	Sample ID	Event	Copper	Tissue Threshold Concentrations[a]	Zinc	Tissue Threshold Concentrations[a]
				mg/kg dry	A = 25 - 60 B = 35 - 90 C = 70 - 110	µg/g dry	A = 150 - 290 B = 190 - 350 C = 300 - 400
044R-M01	ECO-R	044R-M-01	2001			184	A
045P-M01	ECO-R	045P-M-01	2001			74.4	
046P-M01	ECO-R	046P-M-01	2001			223	B
048P-M01	ECO-R	048P-M-01	2001			129	
048R-M01	ECO-R	048R-M-01	2001			148	
050P-M01	ECO-P	050P-M-01	2001			377	C
051A-M01	ECO-P	051A-M-01	2001			358	C
052P-M01	ECO-P	052P-M-01	2001			637	C
053D-M01	ECO-P	053D-M-01	2001			197	B
053P-M01	ECO-P	053P-M-01	2001			193	B
059D-M01	ECO-P	059D-M-01	2001			300	B
059P-M01	ECO-P	059P-M-01	2001			384	C
060P-M01	ECO-P	060P-M-01	2001			340	C
102P-M01	ECO-R	102P-M-01	2001			141	
103P-M01	ECO-R	103P-M-01	2001			85.6	
116P-M01	ECO-R	116P-M-01	2001			87.8	
117P-M01	ECO-R	117P-M-01	2001			101	
117R-M01	ECO-R	117R-M-01	2001			119	
161P-M01	ECO-P	161P-M-01	2001			128	
161R-M01	ECO-P	161R-M-01	2001			156	A
201P-M01	ECO-R	201P-M-01	2001			132	
HR01-01A	ECO-P	HR-01-01-M	2001			4,180	C
HR01-02M	ECO-P	HR-01-02-M	2001			2,040	C
HR01-03M	ECO-P	HR-01-03-M	2001			273	B
HR02-01M	ECO-P	HR-02-01-M	2001			3,140	C
HR02-02M	ECO-P	HR-02-02-M	2001			949	C
HR02-03M	ECO-P	HR-02-03-M	2001			59.2	
HR03-01M	ECO-R	HR-03-01-M	2001			1,160	C
HR03-02M	ECO-R	HR-03-02-M	2001			435	C
HR03-03M	ECO-R	HR-03-03-M	2001			164	A
HR04-01B	ECO-R	HR-04-01-M	2001			1,240	C
HR04-02M	ECO-R	HR-04-02-M	2001			889	C
HR04-03M	ECO-R	HR-04-03-M	2001			167	A
HR05-01M	ECO-R	HR-05-01-M	2001			1,360	C
HR05-02M	ECO-R	HR-05-02-M	2001			460	C
HR05-03M	ECO-R	HR-05-03-M	2001			118	
HR06-01M	ECO-M	HR-06-01-M	2001			1,440	C
HR06-02M	ECO-M	HR-06-02-M	2001			1,200	C
HR06-03M	ECO-M	HR-06-03-M	2001			1,450	C
HR06-04M	ECO-M	HR-06-04-M	2001			433	C
HS1N0003	ECO-R	HS-1N-0003-M	2000			1,570	C
HS1N0050	ECO-R	HS-1N-0050-M	2000			1,020	C
HS1N0100	ECO-R	HS-1N-0100-M	2000			554	C
HS1N0250	ECO-R	HS-1N-0250-M	2000			281	B
HS1N1000	ECO-R	HS-1N-1000-M	2000			153	
HS1S0003	ECO-R	HS-1S-0003-M	2000			1,500	C
HS1S0050	ECO-R	HS-1S-0050-M	2000			352	C
HS1S0100	ECO-R	HS-1S-0100-M	2000			207	B
HS1S0250	ECO-R	HS-1S-0250-M	2000			148	
HS1S1000	ECO-R	HS-1S-1000-M	2000			111	
HS1S1600	ECO-R	HS-1S-1600-M	2000			96.1	
HS2N0003	ECO-R	HS-2N-0003-M	2000			2,750	C
HS2N0050	ECO-R	HS-2N-0050-M	2000			1,880	C
HS2N0100	ECO-R	HS-2N-0100-M	2000			1,040	C

Table 6-19. (cont.)

Station	Zone	Sample ID	Event	Copper	Tissue Threshold Concentrations[a]	Zinc	Tissue Threshold Concentrations[a]
				mg/kg dry	A = 25 - 60 B = 35 - 90 C = 70 - 110	µg/g dry	A = 150 - 290 B = 190 - 350 C = 300 - 400
HS2N0250	ECO-R	HS-2N-0250-M	2000			516	C
HS2N1000	ECO-R	HS-2N-1000-M	2000			237	B
HS2S0003	ECO-R	HS-2S-0003-M	2000			1,200	C
HS2S0050	ECO-R	HS-2S-0050-M	2000			321	C
HS2S0100	ECO-R	HS-2S-0100-M	2000			255	B
HS2S0250	ECO-R	HS-2S-0250-M	2000			138	
HS2S1000	ECO-R	HS-2S-1000-M	2000			118	
HS3N0003	ECO-R	HS-3N-0003-M	2000			1,180	C
HS3N0050	ECO-R	HS-3N-0050-M	2000			856	C
HS3N0100	ECO-R	HS-3N-0100-M	2000			695	C
HS3N0250	ECO-R	HS-3N-0250-M	2000			259	B
HS3N1000	ECO-R	HS-3N-1000-M	2000			158	A
HS3N1600	ECO-R	HS-3N-1600-M	2000			169	A
HS3S0003	ECO-R	HS-3S-0003-M	2000			2,860	C
HS3S0050	ECO-R	HS-3S-0050-M	2000			751	C
HS3S0100	ECO-R	HS-3S-0100-M	2000			453	C
HS3S0250	ECO-R	HS-3S-0250-M	2000			222	B
HS3S1000	ECO-R	HS-3S-1000-M	2000			112	
MI-02M	ECO-M	MI-02-M	2001			589	C
MI-104	ECO-R	MS0024	2003			74.5	
MI-107	ECO-R	MS0020	2003			137	
MI-108	ECO-R	MS0023	2003			386	C
MI-25-M	ECO-R	MI-25-M	2002			440	C
MI-26-M	ECO-R	MI-26-M	2002			166	A
MI-42-M	ECO-M	MI-42-M	2002			611	C
MI-45-M	ECO-M	MI-45-M	2002			748	C
PO-01M	ECO-P	PO-01-M	2001			1,370 *J*	C
PO-02M	ECO-P	PO-02-M	2001			2,540 *J*	C
PO-04M	ECO-P	PO-04-M	2001			2,090 *J*	C
PO-05M	ECO-P	PO-05-M	2001			6,480 *J*	C
PO-06M	ECO-P	PO-06-M	2001			3,950 *J*	C
PO-07M	ECO-P	PO-07-M	2001			1,580 *J*	C
PO-09M	ECO-P	PO-09-M	2001			1,560 *J*	C
PO-10M	ECO-P	PO-10-M	2001			1,930 *J*	C
PO-11M	ECO-P	PO-11-M	2001			1,260 *J*	C
PO-13M	ECO-P	PO-13-M	2001			1,580 *J*	C
PO-15M	ECO-P	PO-15-M	2001			1,500 *J*	C
PO-16M	ECO-P	PO-16-M	2001			1,520 *J*	C
PO-17M	ECO-P	PO-17-M	2001			1,550 *J*	C
PO-18M	ECO-P	PO-18-M	2001			1,480 *J*	C
TT1-0100	ECO-P	MS0005	2003	24.2		8,120	C
TT1-1000	ECO-P	MS0008	2003	4.56		869	C
TT2-0010	ECO-P	MS0004	2003	21.6		2,910	C
TT2-0100	ECO-P	MS0003	2003	13.1		1,340	C
TT2-1000	ECO-P	MS0006	2003	3.85		251	B
TT3-0010	ECO-R	MS0002	2003	16.8		1,110	C
TT3-0100	ECO-R	MS0001	2003	9.73		595	C
TT3-1000	ECO-R	MS0015	2003	3.49		135	
Reference							
TS-REF-7	ECOREF	MS0011	2003	3.73		47.9	
TS-REF-8	ECOREF	MS0010	2003	4.35		64	
TS-REF10	ECOREF	MS0009	2003	3.29		55	

Table 6-19. (cont.)

Note: Both site and literature reference samples were unwashed.

J - estimated value

Data Sources: Exponent (2002a)
Ford and Hasselbach (2001)
Exponent (2003c) and Appendix A of this document
Further detail is provided in Appendix Table C-21

[a] Tissue threshold concentration ranges defined as follows based on effects thresholds reported for multiple species in Folkeson and Andersson-Bringmark (1988).

A - exceeds minimum threshold for first signs of reduction in cover
B - exceeds minimum threshold for obvious reductions in cover
C - exceeds minimum apparent survival thresholds (some dead individuals observed)

Table 6-20. Comparison of tissue threshold concentrations in lichen samples

	Station	Sample ID	Event	Taxon	Zinc	Tissue Threshold Concentrations[a]
					µg/g dry	A = 480 - 1,300 B = 550 - 1,800 C = 600 - 2,200
Site						
	HR01-02L	HR-01-02-L	2001	*Peltigera*	1,610	C
	HR02-02L	HR-02-02-L	2001	*Peltigera*	545 *J*	A
	HR02-03L	HR-02-03-L	2001	*Peltigera*	82.2 *J*	
	HR03-03L	HR-03-03-L	2001	*Peltigera*	115 *J*	
	HR05-03L	HR-05-03-L	2001	*Peltigera*	85.2 *J*	
	HR07-01B	HR-07-01-L	2001	*Peltigera*	1,720 *J*	C
	HR07-02L	HR-07-02-L	2001	*Peltigera*	1,040 *J*	C
	HR07-03L	HR-07-03-L	2001	*Peltigera*	185 *J*	
	HR07-04L	HR-07-04-L	2001	*Peltigera*	121 *J*	
	PO-04L	PO-04-L	2001	*Peltigera*	1,010 *J*	C
	PO-11L	PO-11-L	2001	*Peltigera*	1,020 *J*	C
	PO-17L	PO-17-L	2001	*Peltigera*	1,050 *J*	C
	TT2-0010	LI0018	2004	*Peltigera*	780	C
	TT2-0100	LI0008	2004	*Peltigera*	292	
	TT2-1000	LI0007	2004	*Peltigera*	137	
	TT3-0010	LI0010	2004	*Peltigera*	209	
	TT3-0100	LI0037	2004	*Peltigera*	119 *J*	
	TT3-1000	LI0016	2004	*Cladina*	81.9	
	TT3-1000	LI0017	2004	*Peltigera*	94.4	
	TT5-0010	LI0038	2004	*Peltigera*	594	B
	TT5-0100	LI0006	2004	*Peltigera*	572	B
	TT5-1000	LI0002	2004	*Peltigera*	531	A
	TT5-2000	LI0019	2004	*Cladina*	278	
	TT6-0010	LI0034-D	2004	*Peltigera*	351 *J*	
	TT6-0010	LI0036	2004	*Cladina*	317 *J*	
	TT6-0100	LI0022	2004	*Cladina*	420 *J*	
	TT6-0100	LI0023	2004	*Peltigera*	392 *J*	
	TT6-1000	LI0020	2004	*Peltigera*	335 *J*	
	TT6-1000	LI0021	2004	*Cladina*	386 *J*	
	TT6-2000	LI0026	2004	*Peltigera*	163 *J*	
	TT6-2000	LI0027	2004	*Cladina*	141 *J*	
	TT7-0010	LI0025	2004	*Cladina*	2,740 *J*	C
	TT7-1000	LI0024	2004	*Cladina*	996 *J*	C
	TT7-2000	LI0039	2004	*Cladina*	1,260	C
	TT8-0010	LI0015	2004	*Peltigera*	627	C
	TT8-0100	LI0014	2004	*Peltigera*	397	
	TT8-1000	LI0011	2004	*Cladina*	70	
	TT8-1000	LI0012-D	2004	*Peltigera*	149	
Reference						
	TS-REF-5	LI0028	2004	*Cladina*	45.2	
	TS-REF-5	LI0029	2004	*Peltigera*	48.5	
	TS-REF-7	LI0030	2004	*Cladina*	26.9	
	TS-REF-7	LI0031	2004	*Peltigera*	39.2	
	TS-REF11	LI0032	2004	*Cladina*	19.4 *J*	
	TS-REF11	LI0033	2004	*Peltigera*	29.7 *J*	

Notes on following page

Table 6-20. (cont.)

Note: Both site and literature reference samples were unwashed.
J - estimated value

Data Sources: Exponent (2004a) and Appendix E of this document.
Data are presented in Appendix Table G-19.

[a] Tissue threshold concentration ranges defined as follows based on effects thresholds reported for multiple species in Folkeson and Andersson-Bringmark (1988).

A - exceeds minimum threshold for first signs of reduction in cover
B - exceeds minimum threshold for obvious reductions in cover
C - exceeds minimum apparent survival thresholds (some dead individuals observed)

Table 6-21. Summary of sampling characteristics for site and reference stream stations

Station	Replicate	Water Temperature (°C)	Water Depth (cm)	Sampling Area (m^2)	Mean Water Velocity (m/sec)	Sampling Period (min.)	Volume Sampled (m^3)
Site Stations							
AC-R	A	10.5	28	0.13	0.56	60	266
AC-R	B	10.5	28	0.13	2.69	62	1,315
AC-R	C	10.4	27	0.13	2.26	69	1,201
AC-R	D	10.4	28	0.13	1.54	74	895
AC-R	E	10.4	28	0.13	1.71	76	1,023
ARC-R	A	8.9	25	0.12	1.46	55	560
ARC-R	B	--	27	0.13	2.53	60	1,140
ARC-R	C	9.0	28	0.13	1.92	65	985
ARC-R	D	8.9	28	0.13	1.71	67	900
ARC-R	E	--	28	0.13	0.66	70	364
OR-R	A	8.8	28	0.13	1.55	58	707
OR-R	B	8.8	28	0.13	1.50	60	709
OR-R	C	8.8	28	0.13	2.44	63	1,209
OR-R	D	8.8	28	0.13	1.64	68	876
OR-R	E	8.8	28	0.13	0.64	71	356
Reference Stations							
ST-REF-3	A	7.7	28	0.13	0.55	60	259
ST-REF-3	B	7.7	28	0.13	1.36	61	652
ST-REF-3	C	7.7	28	0.13	1.05	65	538
ST-REF-3	D	7.7	28	0.13	0.68	70	376
ST-REF-3	E	7.7	28	0.13	0.77	78	476
ST-REF-5	A	7.7	28	0.13	0.58	58	267
ST-REF-5	B	7.7	28	0.13	0.88	67	465
ST-REF-5	C	7.7	28	0.13	1.03	74	600
ST-REF-5	D	7.7	28	0.13	0.42	80	266
ST-REF-5	E	7.5	28	0.13	1.07	83	698
ST-REF-6	A	7.6	25	0.12	0.84	58	341
ST-REF-6	B	--	28	0.13	1.86	64	940
ST-REF-6	C	--	28	0.13	1.71	70	942
ST-REF-6	D	--	28	0.13	1.87	79	1,166
ST-REF-6	E	--	28	0.13	1.69	80	1,067

Note: -- - data not collected

Table 6-22. Summary of abundances of macroinvertebrates (per m^3) in drift samples from site and reference stations

					Site Stations			Reference Stations		
Phylum	Class	Order	Family	Genus	ARC-R	OR-R	AC-R	ST-REF-3	ST-REF-5	ST-REF-6
Platyhelminthes	Turbellaria						0.0017	0.0027		
Nematoda	Nematoda					0.0028	0.0017		0.0014	
Annelida	Oligochaeta					0.054	0.081		0.012	0.13
Arthropoda	Arachnida	Acarina			0.33	0.66	0.18	0.12		0.34
	Crustacea	Ostracoda				0.020				
	Insecta	Coleoptera	Dytiscidae				0.00083			
		(Beetles)		*Agabinus*			0.027			
				Dytiscus	0.0035	0.012				
				Hydaticus						0.0042
				Oreodytes		0.017				
			Hydrophilidae		0.0027			0.0039		
				Ametor			0.023			
				Hydrophilus						0.0037
		Collembola	Sminthuridae		0.0041		0.0039	0.0082		0.015
		(Springtails)		*Sminthuris*	0.0044					
			Isotomidae		0.023	0.0090		0.041		0.19
			Onychiuridae		0.015		0.030	0.014		0.0069
			Poduridae			0.043	0.010	0.012		0.046
		Diptera	Chironomidae		3.8	7.1	3.6	1.1	0.15	15
		(True flies)	Culicidae		0.034	0.012		0.010	0.0045	0.021
			Dolicopodidae				0.018	0.010	0.0017	0.0037
			Ephydridae	*Scatella*		0.0046	0.0045			
			Empididae				0.0045			
				Chelifera	0.0035	0.017				
				Oreogeton	0.071					0.019
			Dixidae	*Dixella*					0.0038	
			Simulidae	*Simulium*	1.0	1.7	1.1	0.63		1.7
			Tipulidae		0.0035			0.0074		0.012
				Dicranota	0.0071					0.0077
				Tipula	0.0035	0.0057	0.025	0.0074		0.020
		Ephemeroptera	Ameletidae	*Ameletus*				0.0039		0.0037
		(Mayflies)	Baetidae							0.0075
				Baetis	0.75	0.97	16.5	3.3	0.0014	3.7
			Heptageniidae	*Cinygmula*	1.5		0.33	0.62		0.69
				Epeorus				0.0053		0.093

Table 6-22. (cont.)

					Site Stations			Reference Stations		
Phylum	Class	Order	Family	Genus	ARC-R	OR-R	AC-R	ST-REF-3	ST-REF-5	ST-REF-6
		Plecoptera	Capniidae	*Capnia*	2.6	0.23	5.3	0.33		0.31
		(Stoneflies)	Chloroperlidae		0.0035	0.034		0.015		0.11
				Neaviperla	0.0027	0.071		0.11	0.0022	0.087
				Utaperla						0.0043
			Nemouridae		0.023	0.024	0.072	0.022		
				Nemoura	0.087	0.0028	0.11	0.052		0.0080
				Zapada			0.050	0.0021		0.080
		Trichoptera	Brachycentridae					0.0074		
		(Caddis flies)		*Amiocentris*		0.0089	0.0025			0.0075
				Brachycentrus		0.0056	0.0039	0.0039		0.0043
			Limnephilidae				0.0039			
				Grensia	0.0085		0.00083	0.020		0.020
				Hydatophylax	0.023	0.37		0.16		1.8
Grand Total					**10**	**11**	**28**	**6.6**	**0.18**	**24**

Table 6-23. Summary of benthic metrics at site and reference stations

Station	Total Abundance (per m^2)	Percent Dominance	Taxa Richness		Relative Abundance (percent)	
			Total	EPT	EPT	Chironomids
Site Stations						
ARC-R	10	37	24	9	49	37
OR-R	11	63	23	9	15	63
AC-R	28	60	26	10	82	13
Reference Stations						
ST-REF-3	6.6	50	27	14	71	17
ST-REF-6	24	61	31	15	29	62

Table 6-24. Comparison of CoPC concentrations in stream sedge and willow samples against phytotoxicity thresholds reported in the literature

Station	Sample ID	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
Phytotoxicity Reference Value															
[a]		50–200	150	5–20	500	5–30	5–30	15–50	30–300	1–3	10–50	5–30	20	5–10	100–400
[b]		--	--	3–10	--	5–700	20	25–100	--	--	100	100	--	10	500–1,500
[c]		--	--	11–26	400–800	14–16	5–20	3–9	20–35	2–5	130–140	7–90	11–45	--	160–320
Site															
AC-R	WI0018	156	0.070 *U*	0.21	81.0	1.99	0.8	0.65	10.9	0.051	0.21	0.2	0.015	0.55 *U*	185
ARC-R	SE0055	307	0.040 *U*	1.13	250	0.638	3.1	0.92	14.3	0.06	0.309	0.3	0.027	0.7	87.4
ARC-R	WI0028	142	0.0775 *U*	0.24	308	3.9	1.8	1.04	11.8	0.05	0.411	0.3	0.022	0.7	198
OR-R	SE0051	1,900	0.0515 *U*	1.87	208	0.492	16.2	2.96	8.27	0.042	0.238	0.3	0.033	4.8	59.4
OR-R	WI0026-D	134	0.0615 *U*	0.2	65.2	0.528	1.0	1.3	4.86	0.050	0.36	0.1	0.006	0.3	61.7
Reference															
ST-REF-3	SE0043	261	0.05 *U*	2.93	50.6	0.18	3.7 *J*	2.17	1.28	0.032	0.231	0.5	0.023	0.65 *U*	47.7 *J*
ST-REF-3	WI0025	11.0	0.035 *U*	0.04	26.4	0.356	0.2 *UJ*	2.40	0.14	0.068	0.112	0.1	0.003	0.2 *U*	97.6 *J*
ST-REF-5	SE0035	290	0.060 *U*	0.32	73.3	0.132	2.6	1.13	0.47	0.034	0.378	0.05 *U*	0.05	0.65 *U*	29.6
ST-REF-5	WI0021	15.5	0.04 *U*	0.03 *U*	57.2	0.401	0.3 *U*	2.43	0.62	0.037	0.435	0.05 *U*	0.003	0.3 *U*	79.2
ST-REF-6	SE0039	396	0.05 *U*	1.08	64.0	0.057	4.1	1.62	0.74	0.025	0.147	0.2	0.009	0.85 *U*	30
ST-REF-6	WI0022	2.5 *U*	0.04 *U*	0.03 *U*	24.1	0.558	0.2 *UJ*	2.06	0.09	0.065	0.09	0.05 *U*	0.002	0.2 *U*	92.2

Note: Phytotoxicity reference values and tissue concentrations are in mg/kg dry weight.
"WI" samples are willow leaves (*Salix planifolia*); "SE" samples are whole sedge plants (*Carex aquatilis*).
Sedge shoots were unwashed, and roots were rinsed in site water.
Boxed concentrations exceed the minimum phytotoxicity reference value.

-- - not reported
CoPC - chemical of potential concern
U - undetected; value reported is one-half the detection limit
J - estimated value

[a] Leaf tissue concentration at which toxicity was observed in plants that are neither sensitive nor tolerant (McBride 1994).

[b] Phytotoxic concentrations in plant foliage (Langmuir et al. 2004).

[c] Upper critical level in leaves and shoots of spring barley (*Hordeum vulgare*) associated with reduced yield (Davis et al. 1978).

Table 6-25. Comparison of CoPC concentrations in tundra pond sedge samples against phytotoxicity thresholds reported in the literature

Station	Sample ID	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
Phytotoxicity Reference Value															
[a]		50–200	150	5–20	500	5–30	5–30	15–50	30–300	1–3	10–50	5–30	20	5–10	100–400
[b]		--	--	3–10	--	5–700	20	25–100	--	--	100	100	--	10	500–1,500
[c]		--	--	11–26	400–800	14–16	5–20	3–9	20–35	2–5	130–140	7–90	11–45	--	160–320
Site															
TP1-0100	SE0009	68.1	0.740	0.43	21.4	1.71	6.8	2.23	48.1	0.06	0.261	0.3	0.085	0.2 *U*	351
TP1-1000	SE0008	69.8	0.37	0.31	48.2	0.74	3.1	22.5	16.1	0.05	0.108	0.1 *U*	0.02	0.2 *U*	87.6
TP3	SE0018-D	225 *J*	0.17 *J*	0.28	70.0	0.219	2.3	1.1	3.49	0.07	1.31	0.1 *U*	0.017	1.0 *J*	74.8
TP4	SE0011	190	0.510	0.88	289	0.559	18.4	1.38	21.1	0.05	0.321	0.1 *U*	0.283	0.5	104
Reference															
TP-REF-2	SE0037	48.2	0.030 *U*	0.50	60.8	0.026	1.5	1.63	0.4	0.041	0.211	0.05 *U*	0.01	0.3 *U*	25.4
TP-REF-3	SE0029	1,300	0.095 *U*	1.96	74.9	0.081	55.0	1.72	2.3	0.03	0.9	0.1	0.13	7.6	36.6
TP-REF-5	SE0033	714	0.08 *U*	9.4	117	0.179	6.2	4.56	1.1	0.03	0.38	0.2	0.049	3.9	32.0

Note: Phytotoxicity reference values and tissue concentrations are in mg/kg dry weight.
Samples are whole sedge plants (*Carex aquatilis*).
Plant shoots were unwashed, and roots were rinsed in site water.
Boxed concentrations exceed the minimum phytotoxicity reference value.

-- - not reported
CoPC - chemical of potential concern
U - undetected; value reported is one-half the detection limit
J - estimated value

[a] Leaf tissue concentration at which toxicity was observed in plants that are neither sensitive nor tolerant (McBride 1994).

[b] Phytotoxic concentrations in plant foliage (Langmuir et al. 2004).

[c] Upper critical level in leaves and shoots of spring barley (*Hordeum vulgare*) associated with reduced yield (Davis et al. 1978).

Table 6-26. Metals concentrations in site and reference stream sediments and invertebrates

	Stream Sediment					Stream Invertebrates				
	Site			Reference		Site[a]			Reference[b]	
Analyte	AC-R	ARC-R	OR-R	ST-REF-3	ST-REF-6	AC-R	ARC-R	OR-R	ST-REF-3	ST-REF-6
Cadmium	0.49	1.06	0.44 *J*	0.25	0.19	0.228	0.803	0.365	0.696	0.347
Lead	29.2	117	22	9.5	5.71	4.43 *J*	10.9 *J*	5.16 *J*	8.14 *J*	2.73 *J*
Zinc	125	148	107	66.9	33.1	87.8 *J*	96.2 *J*	79 *J*	137 *J*	91.3 *J*

Note: Concentrations in mg/kg dry weight
Field replicates averaged

J - estimated value

[a] Predominantly crane fly larvae, with small proportions of stone fly larvae, caddis fly larvae, and/or amphipods.

[b] Composite of crane fly larvae, caddis fly larvae, and stone fly larvae.

Table 6-27. Comparison of juvenile Dolly Varden tissue concentrations with effects thresholds

	Source[a]	Date Collected	N	Total Cadmium Min.	Total Cadmium Max.	Total Lead Min.	Total Lead Max.	Total Selenium Min.	Total Selenium Max.	Total Zinc Min.	Total Zinc Max.
Anxiety Ridge Creek (all)	DFG	1993–2002	61	0.017	0.308	0.001	0.612	0.010	2.01	11.48	36.12
ARC at Haul Road	DFG	1993–2000	31	0.022	0.090	0.041	0.612	0.529	1.37	--	--
ARC Upstream	DFG	2002	15	0.017	0.224	0.001	0.101	0.010	2.01	11.48	36.12
ARC Downstream	DFG	2002	15	0.039	0.308	0.031	0.138	0.895	2.01	21.97	32.56
Literature values[b] for tissue residue and effect (ppm)											
No effects (range)[c]				0.036–5.0		0.34–5.1		0.12–19		4.5–480	
No effects (range)[d]				0.04–2		0.34–5.1		0.2–0.8		4.5–60	
Effects (range)[c]				0.12–8.0		0.4–4.0		0.66–4.6		40–60	
Effects (range)[d]				0.12–4.0		0.4–4.0		0.66–2.08		--	

Note: Concentrations are reported in ppm wet wt (converted from dry wt).

Based on studies with ecologically relevant endpoints (survival, growth, or reproduction).

If multiple effects thresholds were provided in a single study, the highest no effects threshold value was used.

If multiple effects thresholds were provided in a single study, the lowest effects threshold value was used.

DFG - Alaska Department of Fish and Game
ARC - Anxiety Ridge Creek
-- - not available

[a] Ott and Morris (2004).

[b] Jarvinen and Ankley (1999).

[c] Ranges of whole body tissue concentrations for all freshwater fish species (Atlantic salmon, bluegill, brook trout, chinook salmon, dace, fathead minnow, flagfish, guppy, largemouth bass, perch, rainbow trout, and stickleback) exposed to chemicals in water or their diet for at least 30 days.

[d] Ranges of whole body tissue concentrations for only freshwater salmonids (Altantic salmon, brook trout, Chinook salmon, rainbow trout) exposed to chemicals in water or their diet for at least 30 days.

Table 6-28. Summary of water quality parameters for surface waters

Station	Date	Time	Dissolved Oxygen (mg/L)	Temperature (°C)	pH	Conductivity (μS/cm)	Salinity (ppt)
Site Stream Surface Water							
AC	06/27/04	15:10	9.21	11.4	7.6	122.9	0.1
ARC	06/27/04	11:55	10.06	8.5	7.0	--	--
OR	06/27/04	13:50	10.22	10.5	7.4	99.2	0.1
Reference Stream Surface Water							
ST-REF-3	07/01/04	13:09	5.22	15.4	8.1	158.2	0.1
ST-REF-5	07/01/04	14:30	2.19	17.0	7.6	38.3	0.0
ST-REF-6	07/01/04	16:08	4.08	14.5	7.2	60.6	0.0
Site Tundra Pond Surface Water							
TP1_100m	06/17/04	12:15	--	9.1		--	--
TP1_100m	07/01/04	14:20	2.51	23.53	7.13	715	--
TP1_1000m	06/17/04	10:45	--	11.5		--	--
TP1_1000m	07/01/04	13:25	3.36	23.25	6.2	42	--
TP3	07/01/04	--	3.03	21.55	6.38	329	--
TP4	06/17/04	17:03	--	11.2		--	--
TP4	07/01/04	18:16	2.96	21.93	6.8	119	--
Reference Tundra Pond Surface Water							
TP-REF-2	07/01/04	12:40	5.44	19.5	7.9	111.6	0.1
TP-REF-3	07/01/04	11:50	5.4	22.1	7.7	23.4	0.0
TP-REF-5	07/01/04	12:45	3.5	14.5	7.2	63.2	0.0
Site Lagoon Surface Water							
PLNL	06/29/04	10:30	3.88	17.9	7.2	2,724	1.7
NLK	06/30/04	16:09	8.19	23.6	8.5	958	0.5
NLF	07/02/04	14:35	4.07	20.9	8.6	866	0.5
Reference Lagoon Surface Water							
CL-REF-1	07/03/04	12:05	2.81	18.4	8.5	210.3	0.0
CL-REF-2	07/04/04	12:00	8.45	15.7	8.0	357.8	0.2
CL-REF-3	07/04/04	15:31	8.56	15.5	8.3	361.5	0.2

Table 6-29. Comparison of CoPC concentrations in coastal lagoon sedge and grass samples against phytotoxicity thresholds reported in the literature

Station	Sample ID	Species	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
Phytotoxicity Reference Value																
[a]			50–200	150	5–20	500	5–30	5–30	15–50	30–300	1–3	10–50	5–30	20	5–10	100–400
[b]			--	--	3–10	--	5–700	20	25–100	--	--	100	100	--	10	500–1,500
[c]			--	--	11–26	400–800	14–16	5–20	3–9	20–35	2–5	130–140	7–90	11–45	--	160–320
Site																
NLK	SE0049-D	*Carex aquatilis*	26.2	0.02 *U*	0.38	22.0	0.114	0.4 *J*	0.47	3.3	0.031	0.143	0.3	0.008	0.2 *U*	44.8
PLNL	SE0045	*Carex aquatilis*	17.4	0.05	0.13	19.5	0.078	0.1 *U*	0.15	1.81	0.026	0.231	0.2	0.004	0.2 *U*	40.5
PLNL	SE0046	*Eriophorum angustifolium*	2.0 *U*	0.027 *U*	0.03 *U*	14.5	0.034	0.4	0.03	0.76	0.045	0.077	0.05 *U*	0.004	0.2 *U*	49.7
Reference																
CL-REF-1	SE0057	*Eriophorum angustifolium*	8.0	0.025 *U*	0.03 *U*	16.4	0.034	0.3	0.1	0.82	0.052	0.104	0.05 *U*	0.004	0.2 *U*	35.2
CL-REF-1	SE0058	*Carex aquatilis*	13.2	0.020 *U*	0.03 *U*	18.7	0.072	0.4	0.31	0.69	0.055	0.072	0.05 *U*	0.0010 *U*	0.2 *U*	35.6
CL-REF-2	SE0060	*Carex aquatilis*	23.5	0.03 *U*	0.2	32.4	0.197	0.4	0.44	3.28	0.029	0.45	0.2	0.007	0.2 *U*	49.3

Note: Phytotoxicity reference values and tissue concentrations are in mg/kg dry weight.
Samples consisted primarily of above-ground tissue with some root material.
Plant shoots were unwashed, and roots were rinsed in site water.
Boxed concentrations exceed the minimum phytotoxicity reference value.

-- - not reported
CoPC - chemical of potential concern
U - undetected; value reported is one-half the detection limi
J - estimated value

[a] Leaf tissue concentration at which toxicity was observed in plants that are neither sensitive nor tolerant (McBride 1994).

[b] Phytotoxic concentrations in plant foliage (Langmuir et al. 2004).

[c] Upper critical level in leaves and shoots of spring barley (*Hordeum vulgare*) associated with reduced yield (Davis et al. 1978).

Table 6-30. Food-web exposure model parameters

Representative Receptor	Community	Body Weight (kg)	Food Ingestion Rate (kg/day dry wt)	Soil/Sediment Ingestion Rate (kg/day dry wt)	Water Ingestion Rate (L/day)[a]	Diet Composition (percent)	Time Use (days)	Home Range (ha)
Terrestrial								
Willow ptarmigan	Terrestrial avian herbivores	0.53 [b]	0.060 [c]	0.0056 [d]	0.038	90% shrubs, 10% herbaceous plants [e]	365 [f]	3.93 [g]
Tundra vole	Terrestrial mammalian herbivores	0.047 [h]	0.0085 [i]	0.00020 [j]	0.0063	90% herbaceous plants, 5% moss, 5% lichen [k]	365 [f]	0.1087 [l]
Caribou	Terrestrial mammalian herbivores	107 [m]	5.0 [n]	0.34 [o]	6.6	70% lichen, 10% shrubs, 10% herbaceous plants, 10% moss [p]	150 [q]	NA
Moose	Terrestrial mammalian herbivores	339 [r]	6.4 [s]	0.13 [t]	19	90% shrubs, 10% herbaceous plants [u]	365 [f]	2,849–29,008 [v]
Lapland longspur	Terrestrial avian invertevores	0.0254 [w]	0.0053 [x]	0.000074 [y]	0.0050	90% invertebrates, 10% herbaceous plants [z]	150 [aa]	1.76 [bb]
Tundra shrew	Terrestrial mammalian invertevores	0.0064 [cc]	0.0021 [dd]	0.00011 [ee]	0.0011	100% invertebrates [ff]	365 [f]	0.22 [gg]
Snowy owl	Terrestrial avian carnivores	2.28 [hh]	0.10 [ii]	0.0020 [t]	0.10	100% small mammals [jj]	365 [f]	777 [kk]
Arctic fox	Terrestrial mammalian carnivores	3.2 [ll]	0.11 [mm]	0.0031 [nn]	0.28	100% small mammals [oo]	365 [f]	407 [pp]
Freshwater Aquatic								
Green-winged teal	Freshwater aquatic avian herbivores	0.32 [qq]	0.053 [rr]	0.0010 [ss]	0.027	85% herbaceous plants, 15% invertebrates [tt]	123 [uu]	243 [vv]
Muskrat	Freshwater aquatic mammalian herbivores	0.932 [ww]	0.070 [xx]	0.0014 [t]	0.093	100% herbaceous plants [yy]	365 [f]	0.17 [zz]
Common snipe	Freshwater aquatic avian invertevores	0.116 [qq]	0.015 [aaa]	0.0016 [bbb]	0.014	90% invertebrates, 10% herbaceous plants [ccc]	109 [ddd]	0.0908–47.7 [eee]
Coastal Lagoon								
Brant	Marine avian herbivores	1.23 [qq]	0.13 [rr]	0.011 [fff]	0.068	95% herbaceous plants, 5% moss [ggg]	126 [hhh]	201.06 [iii]
Black-bellied plover	Marine avian invertevores	0.214 [jjj]	0.028 [kkk]	0.0082 [lll]	0.021	100% invertebrates [mmm]	124 [nnn]	53 [ooo]

[a] Based on U.S. EPA (1993) drinking water ingestion equations for all birds or all mammals.

[b] Mean female body weight from West et al. (1970).

[c] Estimated from Andreev (1991).

[d] Based on 9.3 percent soil in wild turkey diet from Beyer et al. (1994).

[e] Estimated from diets reported for Alaska in Hannon et al. (1998).

[f] Assumes receptor is present year-round at the site.

[g] Mean territory size for monogamous males (Hannon and Dobush 1997).

[h] Mean female body weight from Bee and Hall (1956).

[i] Based on Nagy et al. (1999) allometric equation for Rodentia.

[j] Based on 2.4 percent soil in meadow vole diet from Beyer et al. (1994).

[k] Estimated from summer and winter diets at Pearce Point, NWT (Bergman and Krebs 1993).

[l] Mean home range for reproductive females at Pearce Point, NWT (Lambin et al. 1992).

Table 6-30. (cont.)

[m] Mean female in Alaska from Silva and Downing (1995).

[n] Based on mean value from Hanson et al. (1975).

[o] Based on 6.8 percent soil in bison diet from Beyer et al. (1994).

[p] Based on diets reported in Miller (1976), Boertje (1990), and Scotter (1967).

[q] Best professional judgment based on Lent (1966), Hemming (1987, 1988, 1989, 1991), and Pollard (1994a,b).

[r] Mean body weight for female Alaskan moose measured at the Kenai Moose Research Center, Soldotna, AK (Franzmann et al. 1978).

[s] Average daily ingestion rate for all female moose; 1.9% of body weight per day on a dry weight basis (Schwartz et al. 1984).

[t] Based on minimum soil ingestion rate from Beyer et al. (1994).

[u] Estimated from diets reported for Alaska in Franzmann and Schwartz (1997).

[v] Mean home ranges of nonmigratory individuals in Alaska (Franzmann and Schwartz 1997).

[w] Mean female body weight from Irving (1960).

[x] Calculated using an average female daily energy budget of 118 kJ/day and average prey caloric value of 22.16 kJ/g from Custer et al. (1986).

[y] Based on 1.4 percent soil in Lapland longspur diet reported by URS Team (1996).

[z] Estimated from summer diets near Barrow, AK (Custer and Pitelka 1978).

[aa] Based on 150 days from first to last sighting in Cape Thompson area reported by Williamson et al. (1966).

[bb] Mean male breeding territory near Barrow, AK (Seastedt and MacLean 1979).

[cc] Mean body weight from Bee and Hall (1956) and Martell and Pearson (1978).

[dd] Based on measured food consumption from Buckner (1964), assuming a mid-range moisture content of 75 percent in invertebrates from U.S. EPA (1993).

[ee] Best professional judgment based on Beyer et al. (1994).

[ff] Based on Yudin (1962, as cited in Aitchison 1987 and Buckner 1964).

[gg] Mean home range for breeding females (*Sorex vagrans* and *Sorex obscurus*) in British Columbia, Canada (Hawes 1977).

[hh] Mean female body weight from Kerlinger and Lein (1988).

[ii] Estimated from Gessaman (1972) and Pitelka et al. (1955), assuming a moisture content of 68 percent in diet from U.S. EPA (1993).

[jj] Simplified from Parmelee (1992).

[kk] Mean nesting territory near Barrow, AK (Pitelka et al. 1955).

[ll] Mean female body weight from Anthony (1997).

[mm] Based on Nagy et al. (1999) allometric equation for Carnivora.

[nn] Based on 2.8 percent soil in red fox diet from Beyer et al. (1994).

[oo] Simplified from Anthony et al. (2000).

[pp] Mean female home range in western Alaska (Anthony 1997).

[qq] Mean female body weight from Dunning (1993).

[rr] Based on Nagy et al. (1999) allometric equation for all birds.

Table 6-30. (cont.)

[ss] Based on 1.9 percent sediment in green-winged teal diet from Beyer et al. (1999).

[tt] Estimated from autumn diet in southeastern Alaska (Hughes and Young 1982).

[uu] Based on 123 days from first to last sighting in Cape Thompson area reported by Williamson et al. (1966).

[vv] Home range for one pair in South Dakota (Drewien 1967, as cited in Granholm 2003).

[ww] Mean body weight from Fuller (1951).

[xx] Estimated from Campbell et al. (1998).

[yy] Based on diets reported in U.S. EPA (1993).

[zz] Mean female home range in Iowa (Neal 1968, as cited in U.S. EPA 1993).

[aaa] Based on Nagy et al. (1999) allometric equation for Insectivores.

[bbb] Based on 10.4 percent soil in American woodcock diet from Beyer et al. (1994).

[ccc] Based on diets reported in Mueller (1999).

[ddd] Based on 109 days from first to last sighting in Cape Thompson area reported by Williamson et al. (1966).

[eee] Estimated area based on a 17–390 m mean distance (radius) females traveled from nest to feeding sites during incubation period (Green et al. 1990).

[fff] Based on 8.2 percent soil in Canada goose diet from Beyer et al. (1994).

[ggg] Based on breeding season diets reported in Reed et al. (1998).

[hhh] Based on 126 days from first to last sighting in Cape Thompson area reported by Williamson et al. (1966).

[iii] Estimated assuming a maximum foraging distance (radius) of 800 m from nest (Reed et al. 1998).

[jjj] Mean female body weight for Alaska from Paulson (1995).

[kkk] Based on Nagy et al. (1999) allometric equation for Charadriiformes.

[lll] Based on 29% sediment in black-bellied plover diet from Hui and Beyer (1998).

[mmm] Based on breeding season diets reported in Paulson (1995).

[nnn] Based on 124 days from first to last sighting of American golden plover in Cape Thompson area reported by Williamson et al. (1966).

[ooo] Estimated based on average radius of breeding territory in northern Alaska (412 m) (Moitoret pers. comm., as cited in Paulson 1995).

Table 6-31. Toxicity reference values for risk evaluation for wildlife receptors

	TRVs (mg/kg-day)					
	Avian			Mammalian		
CoPC	NOAEL	LOAEL	Citation	NOAEL	LOAEL	Citation
Aluminum	120	NA	Carriere et al. (1986)	1.9	19	Ondreicka et al. (1966)
Antimony	NA	NA	NA	0.66	NA	Schroeder et al. (1970)
Arsenic (arsenate)	10	40	Stanley et al. (1994)	0.40	1.6	Nemec et al. (1998)
Arsenic (arsenite)	20	50	USFWS (1964)	0.13	1.3	Schroeder and Mitchener (1971)
Barium	21	42	Johnson et al. (1960)	5.1	--	Perry et al. (1983)
	--	--	--	--	20	Borzelleca et al. (1988)
Cadmium	1.5	20	White and Finley (1978)	1.0	10	Sutou et al. (1980)
Chromium	0.86	4.3	Haseltine et al. (1985), as cited in Sample et al. (1996)	3.3	--	Mackenzie et al. (1958)
	--	--	--	--	69	Gross and Heller (1946)
Cobalt	NA	NA	NA	0.5	2.0	Nation et al. (1983)
Lead	3.9	--	Pattee (1984)	11	90	Azar et al. (1973)
	--	11	Edens et al. (1976)	--	--	--
Mercury[a]	0.032	0.064	Heinz (1974, 1976a,b, 1979)	0.032	0.16	Verschuuren et al. (1976)
Molybdenum	3.5	35	Lepore and Miller (1965)	0.26	2.6	Schroeder and Mitchener (1971)
Selenium	0.40	0.80	Heinz et al. (1989)	0.20	0.33	Rosenfeld and Beath (1954)
Thallium	0.24	24	Hudson et al. (1984)	0.074	0.74	Formigli et al. (1986)
Vanadium	11	NA	White and Dieter (1978)	0.21	2.1	Domingo et al. (1986)
Zinc (TRV1)	130	NA	Stahl et al. (1990)	160	320	Schlicker and Cox (1968)
Zinc (TRV2)	70	120	Jackson et al. (1986)	--	--	--

Note: -- - not applicable
CoPC - chemical of potential concern
LOAEL - lowest-observed-adverse-effect level
NA - not available; no suitable TRV was derived
NOAEL - no-observed-adverse-effect level
TRV - toxicity reference value

[a] Mercury TRVs were based on exposure to methylmercury.

Table 6-32. Food-web exposure modeling results for willow ptarmigan

		NOAEL Hazard Quotient		LOAEL Hazard Quotient	
Assessment Unit	Chemical	Mean	95%UCL	Mean	95%UCL
Port	Lead	2.4	6.2	0.84	2.2
Port	Mercury	0.40	1.2	0.20	0.62
Port	Zinc (TRV2)	0.82	1.3	0.48	0.74
Road	Barium	1.2	1.7	0.59	0.87
Mine	Barium	1.9	4.0	0.94	2.0
Mine	Lead	1.6	3.5	0.55	1.2
Mine	Zinc (TRV2)	0.51	1.4	0.29	0.81

Note: Results shown only for chemicals with NOAEL-based hazard quotients >1.0.

For 10 CoPCs (aluminum, antimony, arsenic, cadmium, chromium, cobalt, molybdenum, selenium, thallium, and vanadium) all hazard quotients were less than 1.0.

No hazard quotients were exceeded for the reference area; all values were < 1.0.

95%UCL - 95 percent upper confidence limit on the mean
CoPC - chemical of potential concern
LOAEL - lowest-observed-adverse-effect level
NOAEL - no-observed-adverse-effect level

Table 6-33. Food-web exposure modeling results for caribou

		NOAEL Hazard Quotient		LOAEL Hazard Quotient	
Assessment Unit	Chemical	Mean	95% UCL	Mean	95% UCL
Reference area	Aluminum	8.9	16	0.89	1.6
Port	Aluminum	22	44	2.2	4.4
Port	Barium	1.6	2.6	0.41	0.66
Road	Aluminum	23	43	2.3	4.3
Road	Barium	2.4	4.1	0.62	1.0
Mine	Aluminum	24	67	2.4	6.7
Mine	Barium	5.1	7.9	1.3	2.0
Mine	Lead	0.52	1.1	0.064	0.13
Whole site	Aluminum	25	40	2.5	4.0
Whole site	Barium	3.1	4.7	0.80	1.2

Note: Results shown only for chemicals with NOAEL-based hazard quotients >1.0.

For 11 CoPCs (antimony, arsenic, cadmium, chromium, cobalt, mercury, molybdenum, selenium, thallium, vanadium, and zinc) all hazard quotients were less than 1.0.

95% UCL - 95 percent upper confidence limit on the mean
LOAEL - lowest-observed-adverse-effect level
NOAEL - no-observed-adverse-effect level

Table 6-34. Food-web exposure modeling results for arctic fox

		NOAEL Hazard Quotient		LOAEL Hazard Quotient	
Assessment Unit	Chemical	Mean	95% UCL	Mean	95% UCL
Reference area	Aluminum	2.3	4.4	0.23	0.44
Port	Aluminum	11	21	1.1	2.1
Road	Aluminum	2.8	5.0	0.28	0.50
Road	Mercury	2.6	11	0.51	2.2

Note: Results shown only for chemicals with NOAEL-based hazard quotients >1.0.

For 12 CoPCs (antimony, arsenic, barium, cadmium, chromium, cobalt, lead, molybdenum, selenium, thallium, vanadium, and zinc) all hazard quotients were less than 1.0.

95% UCL - 95 percent upper confidence limit on the mean
LOAEL - lowest-observed-adverse-effect level
NOAEL - no-observed-adverse-effect level

Table 6-35. Allometric scaling of mammalian TRVs

	TRVs (mg/kg-day)			Test	Body weight		Scaled TRVs (mg/kg-day)											
							Tundra vole		Caribou		Moose		Tundra shrew		Arctic fox		Muskrat	
CoPC	NOAEL	LOAEL	Citation	Species	(kg)	Reference	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Aluminum	1.9	19	Ondreicka et al. (1966)	mice	0.03	U.S. EPA (1988)	1.8	18	1.2	12	1.1	11	2.1	21	1.4	14	1.5	15
Antimony	0.66	NA	Schroeder et al. (1970)	rats	0.35	U.S. EPA (1995)	0.74	NA	0.47	NA	0.43	NA	0.84	NA	0.58	NA	0.62	NA
Arsenic (Arsenate)	0.4	1.6	Nemec et al. (1998)	rabbits	4.4	Nemec et al. (1998)	0.53	2.1	0.33	1.3	0.31	1.2	0.59	2.4	0.41	1.6	0.44	1.8
Arsenic (Arsenite)	0.13	1.3	Schroeder and Mitchener (1971)	mice	0.03	U.S. EPA (1988)	0.12	1.2	0.077	0.77	0.072	0.72	0.14	1.4	0.095	0.95	0.10	1.0
Barium	5.1	--	Perry et al. (1983)	rats	0.435	Perry et al. (1983)	5.8	--	3.7	--	3.4	--	6.6	--	4.5	--	4.9	--
	--	20	Borzelleca et al. (1988)	rats	0.35	U.S. EPA (1988)	--	22	--	14	--	13	--	25	--	17	--	19
Cadmium	1.0	10	Sutou et al. (1980)	rats	0.303	Sutou et al. (1980)	1.1	11	0.70	7.0	0.66	6.6	1.3	13	0.87	8.7	0.93	9.3
Chromium	3.3	--	Mackenzie et al. (1958)	rats	0.35	U.S. EPA (1988)	3.7	--	2.3	--	2.2	--	4.2	--	2.9	--	3.1	--
	--	69	Gross and Heller (1946)	rats	0.168	Gross and Heller (1946)	--	74	--	47	--	44	--	84	--	58	--	62
Cobalt	0.5	2.0	Nation et al. (1983)	rats	0.35	U.S. EPA (1988)	0.56	2.3	0.35	1.4	0.33	1.3	0.64	2.5	0.44	1.8	0.47	1.9
Lead	11	90	Azar et al. (1973)	rats	0.35	U.S. EPA (1988)	13	100	8.0	64	7.5	60	14	120	9.9	79	11	85
Mercury[a]	0.032	0.16	Verschuuren et al. (1976)	rats	0.35	U.S. EPA (1988)	0.036	0.18	0.023	0.11	0.021	0.11	0.041	0.20	0.028	0.14	0.030	0.15
Molybdenum	0.26	2.6	Schroeder and Mitchener (1971)	mice	0.03	U.S. EPA (1988)	0.25	2.5	0.16	1.6	0.15	1.5	0.29	2.9	0.20	2.0	0.21	2.1
Selenium	0.20	0.33	Rosenfeld and Beath (1954)	rats	0.35	U.S. EPA (1988)	0.23	0.37	0.14	0.23	0.13	0.22	0.25	0.42	0.18	0.29	0.19	0.31
Thallium	0.074	0.74	Formigli et al. (1986)	rats	0.365	Formigli et al. (1986)	0.084	0.84	0.053	0.53	0.049	0.49	0.094	0.94	0.065	0.65	0.070	0.70
Vanadium	0.21	2.1	Domingo et al. (1986)	rats	0.26	Domingo et al. (1986)	0.23	2.3	0.15	1.5	0.14	1.4	0.26	2.6	0.18	1.8	0.19	1.9
Zinc	160	320	Schlicker and Cox (1968)	rats	0.35	U.S. EPA (1988)	180	360	110	230	110	210	200	410	140	280	150	300

Note: Mammalian TRVs were extrapolated from laboratory studies using the following general equation from Sample and Arenal (1999):

$A_w = A_t(BW_t/BW_w)^{1-b}$

A_w - TRV for ecological receptor

A_t - TRV for test species

BW_t - Body weight of laboratory test species

BW_w - Body weight of ecological receptor (see Table 6-26)

b - Allometric scaling factor

Based on recommendations in Sample and Arenal (1999), an allometric scaling factor of 0.94 was used to extrapolate mammalian TRVs.

-- - not applicable
CoPC - chemical of potential concern
LOAEL - lowest-observed-adverse-effect level
NA - not available; no suitable TRV was derived
NOAEL - no-observed-adverse-effect level
TRV - toxicity reference value

[a] Mercury TRVs were based on exposure to methylmercury.

Table 6-36. Allometric scaling of avian TRVs

	TRVs (mg/kg-day)				Body Weight		Scaled TRVs (mg/kg-day)													
							Willow ptarmigan		Lapland longspur		Snowy owl		Green-winged teal		Common snipe		Brant		Black-bellied plover	
CoPC	NOAEL	LOAEL	Citation	Test species	(kg)	Reference	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Aluminum	120	NA	Carriere et al. (1986)	ringed doves	0.155	Terres (1980)	150	NA	84	NA	210	NA	140	NA	110	NA	180	NA	130	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic (Arsenate)	10	40	Stanley et al. (1994)	mallards	1	Heinz et al. (1989)	8.8	35	4.8	19	12	47	8.0	32	6.5	26	10	42	7.3	29
Arsenic (Arsenite)	20	50	USFWS (1964)	mallards	1	Heinz et al. (1989)	18	44	9.6	24	24	59	16	40	13	32	21	52	15	37
Barium	21	42	Johnson et al. (1960)	chicks	0.121	US EPA (1988)	28	56	15	31	37	75	25	51	21	41	33	66	23	47
Cadmium	1.5	20	White and Finley (1978)	mallards	1.153	White and Finley (1978)	1.2	17	0.68	9.3	1.7	23	1.1	15	0.92	13	1.5	20	1.0	14
Chromium	0.86	4.3	Haseltine et al. (1985) as cited in Sample et al. (1996)	black duck	1.25	Dunning (1984)	0.72	3.6	0.39	2.0	0.97	4.8	0.65	3.3	0.53	2.7	0.86	4.3	0.60	3.0
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	3.9	NA	Pattee (1984)	American kestrels	0.13	Sample et al. (1996)	5.1	NA	2.8	NA	6.8	NA	4.6	NA	3.8	NA	6.0	NA	4.3	NA
	--	11	Edens et al. (1976)	Japanese quail	0.15	Vos et al. (1971)	--	14	--	7.7	--	19	--	13	--	10	--	17	--	12
Mercury[a]	0.032	0.064	Heinz (1974, 1976a,b, 1979)	mallards	1	Heinz et al. (1989)	0.028	0.056	0.015	0.031	0.038	0.075	0.025	0.051	0.021	0.042	0.033	0.067	0.024	0.047
Molybdenum	3.5	35	Lepore and Miller (1965)	chicken	1.5	US EPA (1988)	2.8	28	1.5	15	3.8	38	2.6	26	2.1	21	3.4	34	2.4	24
Selenium	0.40	0.80	Heinz et al. (1989)	mallards	1	Heinz et al. (1989)	0.35	0.70	0.19	0.38	0.47	0.94	0.32	0.64	0.26	0.52	0.42	0.83	0.29	0.59
Thallium	0.24	24	Hudson et al. (1984)	ring-necked pheasants	1	U.S. EPA (1993)	0.21	21	0.11	11	0.28	28	0.19	19	0.15	15	0.25	25	0.17	17
Vanadium	11	NA	White and Dieter (1978)	mallards	1.17	White and Dieter (1978)	9.4	NA	5.1	NA	13	NA	8.5	NA	6.9	NA	11	NA	7.8	NA
Zinc (TRV1)	130	NA	Stahl et al. (1990)	white leghorn hens	1.935	Stahl et al. (1990)	100	NA	55	NA	130	NA	91	NA	74	NA	120	NA	84	NA
Zinc (TRV2)	70	120	Jackson et al. (1986)	Hisex laying hens	1.87	Jackson et al. (1986)	54	93	30	51	73	130	49	84	40	69	64	110	45	78

Note: Avian TRVs were extrapolated from laboratory studies using the following general equation from Sample and Arenal (1999):

$A_w = A_t(BW_t/BW_w)^{1-b}$

A_w - TRV for ecological receptor

A_t - TRV for test species

BW_t - Body weight of laboratory test species

BW_w - Body weight of ecological receptor (see Table 6-26)

b - Allometric scaling factor

Based on recommendations in Sample and Arenal (1999), an allometric scaling factor of 1.2 was used to extrapolate avian TRVs.

-- - not applicable
CoPC - chemical of potential concern
LOAEL - lowest-observed-adverse-effect level
NA - not available; no suitable TRV was derived
NOAEL - no-observed-adverse-effect level
TRV - toxicity reference value

[a] Mercury TRVs were based on exposure to methylmercury.

Table 6-37. Summary of comparison of vegetation survey parameters at site and reference areas

Parameter	Coastal Plain	Tundra	Tundra and Coastal Plain Combined[a] All	10 m[b]	100 m[b]	1,000 m[b]	Hillslope	Lagoon
Forb cover	--	--	--	--	--	--	--	--
Graminoid cover	--	--	--	--	--	--	--	--
Deciduous shrub cover	--	Sig. Different	--	--	--	--	--	--
Evergreen shrub cover	--	--	--	Sig. Different	--	--	--	--
Moss cover	--	Sig. Different	Sig. Different	--	Sig. Different	--	--	--
Moss frequency	--		--	--	--	--	--	--
Lichen cover	--	Sig. Different	Sig. Different	Sig. Different	Sig. Different	Sig. Different	--	--
Lichen frequency	--	--	Sig. Different	Sig. Different	Sig. Different	--	--	--
Vegetative litter	--	--	--	--	--	--	--	--
Unvegetated cover	--	--	--	--	Sig. Different	--	--	--
Diversity	--	--	--	--	--	--	--	--
Evenness	--	--	--	Sig. Different	Sig. Different	Sig. Different	--	--
Richness	--	--	--	--	--	Sig. Different	--	--

Source: Table 6-3.

Note: Significance level for the statistical comparison is $p < 0.10$.

-- - indicates site vegetation parameters not significantly different from reference site

Sig. Different - indicates site vegetation parameters significantly different from reference site

[a] Coastal plain and tundra communities were similar and thus were combined and tested against their corresponding combined reference samples to increase the sample size and thus increase the power of the test to detect differences between site stations and reference stations.

[b] The coastal plain and tundra communities showed similar changes with distance from the road, so samples were combined according to their respective distance.

Table 6-38. Summary of vegetation parameter correlations with distance from DMTS road

	Hillslope, Coast Plain, Tundra Transects	Coastal Plain and Tundra Transects Only
Forb cover	Negative correlation	Negative correlation
Graminoid cover	--	--
Deciduous shrub cover	--	--
Evergreen shrub cover	Positive correlation	Positive correlation
Moss cover	--	Positive correlation
Moss frequency	--	--
Lichen cover	Positive correlation	Positive correlation
Lichen frequency	Positive correlation	Positive correlation
Vegetative litter	--	--
Unvegetated cover	Negative correlation	Negative correlation
Diversity	--	--
Evenness	Positive correlation	Positive correlation
Richness	Negative correlation	Negative correlation

Source: Table 6-4.

Note: Spearman rank non-parametric correlation was used.

Positive and negative correlations were significant with distance ($p < 0.10$).

-- - no correlation
Negative correlation - indicates that as one variable increases, the other decreases
Positive correlation - indicates that as one variable increases, so does the other

Table 6-39. Locations where phytotoxicity benchmarks were exceeded for vascular plants

CoPC	Number of Site Stations Exceeding Benchmarks	Number of Reference Stations Exceeding Benchmarks	Station Locations with Exceedances
Aluminum	11/29	5/11	TT2-0010, TT3-0100, TT5-0010, TT8-0010, TP-0100, TP-1000, TP-3, TP-4, AC-R, ARC-R, OR-R, ST-REF-3, ST-REF-5, ST-REF-6, TP-REF-3, TP-REF-5
Antimony	0/29	0/11	
Arsenic	0/29	1/11	TP-REF-5
Barium	0/29	0/11	
Cadmium	3/29	0/11	TT2-0010, TT5-0010, TT8-0010
Chromium	3/29	2/11	OR-R, TP1-0100, TP-4, TP-REF-3, TP-REF-5
Cobalt	4/29	2/11	TT3-0100, TT8-0100, TT8-1000, TP1-1000, TP-REF-5, TS-REF-5
Lead	2/29	0/11	TP1-0100, TP-4
Mercury	0/29	0/11	
Molybdenum	0/29	0/11	
Selenium	0/29	0/11	
Thallium	0/29	0/11	
Vanadium	0/29	1/11	TP-REF-3
Zinc	23/29	2/11	TT2-0010, TT2-0100, TT2-1000, TT3-0010, TT3-0100, T3-1000, TT5-0010, TT5-0100, TT5-1000, TT5-2000, TT6-0010, TT6-0100, TT6-2000, TT7-0010, TT7-1000, TT7-2000, TT8-0010, TT8-0100, TT8-1000, TP1-0100, TP-4, AC-R, ARC-R, TS-REF-7, TS-REF-11

Source: Tables 6-17, 6-18, 6-24, 6-25, 6-29.

Note:
-0010, -0100, -1000 - approximate distance of station from DMTS Road or facilities in meters
AC-R - Aufeis Creek station, just downstream of the DMTS road crossing
ARC-R - Anxiety Ridge Creek station, just downstream of the DMTS road crossing
OR-R - Omikviorok River station, just downstream of the DMTS road crossing
REF - reference stations
ST - stream station
TP - tundra pond station
TS - tundra soil station
TT - terrestrial transect station

Table 6-40. Locations where phytotoxicity benchmarks were exceeded for mosses and lichens

CoPC	Number of Site Stations Where Moss Samples Exceeded Benchmarks	Number of Site Stations Where Lichen Samples Exceeded Benchmarks	Number of Reference Stations Where Moss or Lichen Samples Exceeded Benchmarks	Moss Station Locations With Exceedances	Lichen Station Locations With Exceedances
Copper	0/155	--	0/9	None	None
Zinc	120/155	15/32	0/9	001P-M01, 002P-M01, 003P-M01, 004P-M01, 005P-M01, 006-M01, 007P-M01, 008P-M01, 009D-M01, 009-M01, 010P-M01, 011P-M01, 013P-M01, 015-M01, 016P-M01, 017P-M01, 018D-M01, 018P-M01, 019P-M01, 020P-M01, 021P-M01, 022P-M01, 023P-M01, 024P-M01, 025P-M01, 026D-M01, 026D-M01, 028P-M01, 030P-M01, 031P-M01, 031R-M01, 032P-M01, 032R-M01, 036-M01, 036R-M01, 037P-M01, 038R-M01, 039P-M01, 041P-M01, 044P-M01, 044R-M01, 046P-M01, 050P-M01, 051A-M01, 052P-M01, 053D-M01, 053P-M01, 059D-M01, 059P-M01, 060P-M01, 161R-M01, HR01-01A, HR01-02M, HR01-03M, HR02-01M, HR02-02M, HR03-01M, HR03-02M, HR03-03M, HR04-01B, HR04-02M, HR04-03M, HR05-01M, HR05-02M, HR06-01M, HR06-02M, HR06-03M, HR06-04M, HS1N0003, HS1N0050, HS1N0100, HS1N0250, HS1S0003, HS1S0050, HS10100, HS2N0003, HS2N0050, HS2N0100, HSN0250, HSN1000, HS2S0003, HS2S0050, HS2S0100, HS3N0003, HS3N0050, HS3N0100, HS3N0250, HSN3N1000, HS3N1600, HS3S0003, HS3S0050, HS3S0100, HS3S0250, MI-02M, MI-108, MI-25-M, MI26-M, MI-42M, MI-45M, PO-01M, PO-02M, PO-04M, PO-05M, PO-06M, PO-07M, PO-09M, PO-10M, PO-11M, PO-13M, PO-15M, PO-16M, PO-17M, PO-18M, TT1-0100, TT1-1000, TT2-0010, TT2-0100, TT2-1000, TT3-0010, TT3-0100	HR01-02L, HR02-02L, HR01-01B, HR07-02L, PO-04L, PO-11L, PO-17L, TT2-0010, TT5-0010, TT5-0100, TT5-1000, TT7-0010, TT7-1000, TT7-2000, TT8-0010

Source: Tables 6-19 and 6-20.

Note: Copper data not available for lichens along DMTS road.

CoPC - chemical of potential concern
DMTS - DeLong Mountain Regional Transportation System
HR - DMTS road transect samples
HS - National Park Service samples collected along transects at Cape Krusenstern National Monument
MO - National Park Service samples collected in outlying areas at Cape Krusenstern National Monument
PO - Port site samples
TT - terrestrial transect station samples

Table 6-41. Locations and receptors for which mean NOAEL or LOAEL hazard quotients exceed 1.0

Assessment Unit Location	Aluminum	Antimony	Arsenic (arsenate)	Arsenic (arsenite)	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
DMTS Road and Port Operations															
Site Stations															
Whole Site	Moose, caribou				Caribou										
Port Site	Moose, fox, caribou				Caribou				Ptarmigan	Ptarmigan					Ptarmigan
Near Mine	Moose, caribou				Ptarmigan, caribou				Ptarmigan, caribou						Ptarmigan
Road Site	Moose, fox, caribou				Ptarmigan, caribou					Owl, fox					
Reference Stations															
Reference Site	Moose, fox, caribou														
Lagoon Environment															
Site Stations															
Control Lagoon	Moose, muskrat														
North Lagoon	Moose, muskrat														
Port Lagoon North	Moose, muskrat								Plover						
Reference Stations															
Reference Lagoon	Moose, muskrat														
Tundra Pond Environment															
Site Stations															
TP1-0100	Muskrat														
TP1-1000	Muskrat							Muskrat							
TP3	Muskrat				Muskrat										
TP4	Muskrat				Muskrat										
Reference Stations															
TP-REF-2	Muskrat														
TP-REF-3	Muskrat			Muskrat	Muskrat		Muskrat							Muskrat	
TP-REF-5	Teal, muskrat		Muskrat	Muskrat	Muskrat		Teal							Muskrat	
Stream Environment															
Site Stations															
ARC-R	Moose, muskrat				Moose, muskrat										
OR-R	Moose, muskrat			Muskrat	Muskrat									Muskrat	
AC-R	Moose														
Reference Stations															
ST-REF-3	Moose, muskrat			Muskrat											
ST-REF-5	Moose, muskrat				Muskrat										
ST-REF-6	Moose, muskrat				Muskrat										
Terrestrial Environment															
Site Stations															
TT2-0010	Vole, shrew, snipe			Shrew	Vole, shrew	Shrew			Shrew	Shrew				Vole, shrew	Shrew
TT2-0100	Vole, shrew				Vole, shrew	Shrew				Shrew		Shrew		Shrew	
TT2-1000	Vole, shrew									Shrew		Shrew			
TT3-0010	Vole, shrew, snipe			Shrew	Vole, shrew	Shrew				Shrew				Vole, shrew	
TT3-0100	Vole, shrew				Vole, shrew	Shrew				Shrew					
TT3-1000	Vole, shrew				Vole										
TT5-0010	Snipe, vole, shrew			Shrew	Vole, shrew	Shrew			Snipe, vole, shrew	Shrew		Shrew		Shrew	Shrew

Table 6-41. (cont.)

Assessment Unit Location	Aluminum	Antimony	Arsenic (arsenate)	Arsenic (arsenite)	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
Terrestrial Environment (cont.)															
Site Stations (cont.)															
TT5-0100	Vole, shrew			Shrew	Vole, shrew	Shrew			Snipe, vole, shrew	Shrew				Shrew	Shrew
TT5-1000	Vole, shrew				Vole					Shrew		Shrew			
TT5-2000	Vole, shrew					Shrew				Shrew		Shrew			Shrew
TT6-0010	Vole, shrew			Vole, shrew	Vole, shrew, snipe	Shrew								Vole, shrew	
TT6-0100	Vole, shrew				Vole, shrew, snipe	Shrew				Shrew					
TT6-1000	Vole, shrew				Vole, shrew	Shrew					Shrew			Shrew	
TT6-2000	Vole				Vole										
TT7-0010	Vole			Vole	Vole				Vole					Vole	
TT7-1000	Vole				Vole				Vole		Vole				
TT7-2000	Vole				Vole										
TT8-0010	Vole				Vole									Vole	
TT8-0100	Vole				Vole										
TT8-1000	Vole				Vole										
Reference Stations															
TS-REF-5	Vole, shrew, snipe				Vole, shrew							Shrew		Shrew	
TS-REF-7	Vole				Vole										
TS-REF-11	Vole														

Source: Appendix K tables of this report. This summary is based on the most conservative scenarios presented in Appendix K (i.e., 95% UCL scenario values were used if available, otherwise, mean scenario values were used).

Note:
-0010, -0100, -1000 - approximate distance of station from DMTS Road or facilities in meters
AC-R - Aufeis Creek station, just downstream of the DMTS road crossing
ARC-R - Anxiety Ridge Creek station, just downstream of the DMTS road crossing
DMTS - DeLong Mountain Regional Transportation System
LOAEL - lowest-observed-adverse-effect level
NOAEL - no-observed-adverse-effect level
OR-R - Omikviorok River station, just downstream of the DMTS road crossing
REF - reference stations
ST - stream station
TP - tundra pond station
TS - tundra soil station
TT - terrestrial transect station

Table 6-42. Locations and receptors for which only LOAEL hazard quotients exceed 1.0

Assessment Unit Location	Aluminum	Antimony	Arsenic (arsenate)	Arsenic (arsenite)	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
DMTS Road and Port Operations															
Site Stations															
Whole Site	Caribou				Caribou										
Port Site	Caribou, fox								Ptarmigan						
Near Mine	Caribou				Ptarmigan, caribou				Ptarmigan						
Road Site	Caribou									Fox, owl					
Reference Stations															
Reference Site	Caribou														
Lagoon Environment															
Site Stations															
Control Lagoon															
North Lagoon															
Port Lagoon North															
Reference Stations															
Reference Lagoon															
Tundra Pond Environment															
Site Stations															
TP1-0100															
TP1-1000															
TP3															
TP4					Muskrat										
Reference Stations															
TP-REF-2															
TP-REF-3	Muskrat														
TP-REF-5	Muskrat														
Stream Environment															
Site Stations															
ARC-R	Muskrat														
OR-R	Muskrat														
AC-R															
Reference Stations															
ST-REF-3	Muskrat														
ST-REF-5	Muskrat														
ST-REF-6	Muskrat														

Table 6-42. (cont.)

Assessment Unit Location	Aluminum	Antimony	Arsenic (arsenate)	Arsenic (arsenite)	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
Terrestrial Environment															
Site Stations															
TT2-0010	Vole, shrew				Vole, shrew										
TT2-0100	Vole, shrew														
TT2-1000															
TT3-0010	Vole, shrew				Vole, shrew										
TT3-0100	Vole, shrew				Vole, shrew										
TT3-1000															
TT5-0010	Vole, shrew				Vole, shrew										
TT5-0100	Vole, shrew				Vole, shrew										
TT5-1000															
TT5-2000															
TT6-0010	Vole, shrew				Vole, shrew										
TT6-0100	Vole, shrew				Vole, shrew										
TT6-1000	Vole				Shrew										
TT6-2000															
TT7-0010	Vole				Vole										
TT7-1000	Vole				Vole										
TT7-2000					Vole										
TT8-0010	Vole				Vole										
TT8-0100	Vole				Vole										
TT8-1000					Vole										
Reference Stations															
TS-REF-5 Site	Vole, shrew														
TS-REF-7 Site															
TS-REF-11 Site															

Source: Appendix K tables of this report. This summary is based on the most conservative scenarios presented in Appendix K (i.e., 95% UCL scenario values were used if available, otherwise, mean scenario values were used).

Note:
-0010, -0100, -1000 - approximate distance of station from DMTS Road or facilities in meters
AC-R - Aufeis Creek station, just downstream of the DMTS road crossing
ARC-R - Anxiety Ridge Creek station, just downstream of the DMTS road crossing
DMTS - DeLong Mountain Regional Transportation System
LOAEL - lowest-observed-adverse-effect level
OR-R - Omikviorok River station, just downstream of the DMTS road crossing
REF - reference stations
ST - stream station
TP - tundra pond station
TS - tundra soil station
TT - terrestrial transect station

Table 6-43. Summary of LOAEL hazard quotient exceedances

	Aluminum	Antimony	Arsenic (arsenate)	Arsenic (arsenite)	Barium	Cadmium	Chromium	Cobalt	Lead	Mercury	Molybdenum	Selenium	Thallium	Vanadium	Zinc
Tundra vole															
Site stations	13/20	--	0/20	0/20	12/20	0/20	0/20	0/20	0/20	0/20	0/20	0/20	0/20	0/20	0/20
Reference stations	1/3	--	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3
Common snipe															
Site stations	--	--	0/13	0/13	0/13	0/16	0/13	--	0/16	0/16	0/13	0/13	0/13	--	0/16
Reference stations	--	--	0/1	0/1	0/1	0/3	0/1	--	0/3	0/3	0/1	0/1	0/1	--	0/3
Lapland longspur															
Site stations	--	--	0/13	0/13	0/13	0/13	0/13	--	0/13	0/13	0/13	0/13	0/13	--	0/13
Reference stations	--	--	0/1	0/1	0/1	0/1	0/1	--	0/1	0/1	0/1	0/1	0/1	--	0/1
Black-bellied plover															
Site stations	--	--	--	--	--	0/3	--	--	0/3	--	--	--	--	--	0/3
Reference stations	--	--	--	--	--	0/1	--	--	0/1	--	--	--	--	--	0/1
Green-winged teal															
Site stations	--	--	0/6	0/6	0/6	0/6	0/6	--	0/6	0/6	0/6	0/6	0/6	--	0/6
Reference stations	--	--	0/6	0/6	0/6	0/6	0/6	--	0/6	0/6	0/6	0/6	0/6	--	0/6
Snowy owl															
Site stations	--	--	0/2	0/2	0/2	0/2	0/2	--	0/2	1/2	0/2	0/2	0/2	--	0/2
Reference stations	--	--	0/1	0/1	0/1	0/1	0/1	--	0/1	0/1	0/1	0/1	0/1	--	0/1
Willow ptarmigan															
Site stations	--	--	0/3	0/3	1/3	0/3	0/3	--	2/3	0/3	0/3	0/3	0/3	--	0/3
Reference stations	--	--	0/1	0/1	0/1	0/1	0/1	--	0/1	0/1	0/1	0/1	0/1	--	0/1
Brant															
Site stations	--	--	0/3	0/3	0/3	0/3	0/3	--	0/3	0/3	0/3	0/3	0/3	--	0/3
Reference stations	--	--	0/1	0/1	0/1	0/1	0/1	--	0/1	0/1	0/1	0/1	0/1	--	0/1
Arctic fox															
Site stations	1/2	--	0/2	0/2	0/2	0/2	0/2	0/2	0/2	1/2	0/2	0/2	0/2	0/2	0/2
Reference stations	0/1	--	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Caribou															
Site stations	4/4	--	0/4	0/4	2/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4
Reference stations	1/1	--	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Moose															
Site stations	0/10	--	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10	0/10
Reference stations	0/5	--	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5	0/5
Tundra shrew															
Site stations	8/13	--	0/13	0/13	8/13	0/13	0/13	0/13	0/13	0/13	0/13	0/13	0/13	0/13	0/13
Reference stations	1/1	--	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Muskrat															
Site stations	2/9	--	0/9	0/9	1/9	0/9	0/9	0/9	0/9	0/9	0/9	0/9	0/9	0/9	0/9
Reference stations	5/7	--	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7	0/7

Source: Appendix K tables of this report.

Note: Ratios represent number of LOAEL exceedances/number of sites evaluated.

Shaded cells are those with one or more exceedances.

This summary is based on the most conservative scenarios presented in Appendix K (i.e., 95% UCL scenario values were used if available, otherwise, mean scenario values were used).

-- - analyte not analyzed
LOAEL - lowest-observed-adverse-effect level

Table 6-44. Summary of observed and predicted ecological effects[a]

Terrestrial Habitats	Observed or Predicted Effects		
Receptor	Near Port	Near Mine[b]	DMTS Road
Caribou	--	--	--
Moose	--	--	--
Lapland longspur	--	--	--
Snowy owl	--	--	--
Arctic fox	--	--	--
Ptarmigan	yes[c]	yes[c]	--
Tundra vole	--	--	--
Tundra shrew	--	--	--
Vegetation	yes[d]	yes[b,e]	yes[d]

Freshwater Habitats	Observed or Predicted Effects			
Receptor	Aufeis Creek	Omikviorok Creek	Anxiety Ridge Creek	Tundra Ponds
Benthic macroinvertebrates	--	--	--	--[f]
Fish	--	--	--[g]	--[h]
Green-winged teal	--	--	--	--
Muskrat	--	--	--	--
Moose	--	--	--	--
Common snipe	--	--	--	--
Vegetation	[f]	[f]	[f]	--[i]

Coastal Lagoon Habitats	Observed or Predicted Effects
Receptor	Lagoons[j]
Benthic macroinvertebrates	--
Fish	--[k]
Brant	--
Muskrat	--
Moose	--
Black-bellied plover	--
Vegetation	--

Source: Summary based on Tables 6-42 and 6-43, and the interpretation of ecological significance (Section 6.7).

Note: -- - indicates very low or no likelihood of adverse effects

[a] Observed or predicted effects indicated as "yes" are to be addressed in a risk management plan, as discussed in Section 8.

[b] The areas evaluated near the mine were outside the mine boundary. The area within the mine boundary was beyond the scope of this assessment.

[c] Potential for adverse effects from lead.

[d] Vegetation survey parameters were statistically compared to reference area data (Tables 6-3 and 6-37), and several differences were observed, as summarized in Table 6-37. No individual metals were isolated as primary causative factors. Multiple causative factors are likely.

[e] The hillslope community vegetation did not show significant difference from the reference site (Tables 6-3 and 6-37). However, at one transect station just west of the mine's ambient air/solid waste permit boundary, some shrubs appeared to be in poor condition.

[f] Effects could not be ruled out in small, shallow ponds close to facilities within the port site (Section 6.3.2).

[g] Cadmium and lead levels in some juvenile Dolly Varden exceeded conservative screening levels for fish tissue, but were also within the range of no-effects levels (Table 6-27).

[i] Exception: Effects possible from lead and zinc in ephemeral tundra ponds located within 100 m of port facility structures, based on exceedances of literature-derived effects thresholds. However, tundra pond vegetation appeared healthy during field sampling.

[j] Lagoons located within the port site boundary.

[k] No fish were present in port site lagoons, as they have no open water connections to the Chukchi Sea.

Table 8-1. Baseline CoPC concentrations in vegetation at port, road, and near-mine sites

	Moss Concentration in mg/kg[a]				Lichen Concentration in mg/kg[b]			
	10 m	100 m	1,000 m	2,000 m	10 m	100 m	1,000 m	2,000 m
Port								
Aluminum	6,630	3,720	452	--	1600	573	260	190
Antimony	1.37	2.91	0.6	--	1.2	1.52	0.43	0.3
Arsenic	6	3.6	0.5	--	1.6	1	0.49	0.3
Barium	1,890	829	100	--	660	330	66.6	31
Cadmium	15	21.7	2.81	--	4.5	2.9	1.78	1.51
Chromium	25	13.8	3.09	--	8.2	2.1	1.1	0.8
Cobalt	7.69	6.45	0.765	--	1.88	0.89	0.417	0.268
Lead	506	1,020	107	--	166	118	58.8	52.6
Mercury	0.455	0.63	0.12	--	0.14	0.09	0.1	0.05
Molybdenum	1	0.79	0.24	--	0.389	0.28	0.414	0.075
Selenium	0.6	0.5	0.2	--	0.4	0.3	0.3	0.2
Thallium	0.333	0.377	0.071	--	0.09	0.04	0.03	0.024
Vanadium	12	6.63	1.06	--	4.4	1.4	0.6	0.5
Zinc	2,910	4,730	560	--	690	432	334	278
Road								
Aluminum	3,210	1,440	275	--	1,600	980	200	--
Antimony	0.99	0.72	0.25	--	1.14	0.58	0.27	--
Arsenic	2.7	1.5	0.4	--	1.61	0.8	0.7	--
Barium	2,530	1,150	193	--	1150	509	90	--
Cadmium	7.41	3.24	0.81	--	3.03	1.63	0.524	--
Chromium	19.5	10.5	4.71	--	9.9	3.7	0.8	--
Cobalt	5.61	2.88	0.469	--	2.72	1.5	0.88	--
Lead	241	148	29.5	--	110	73	17.3	--
Mercury	0.18	0.107	0.082	--	0.1	0.08	0.06	--
Molybdenum	0.88	0.61	0.5	--	0.724	0.524	0.37	--
Selenium	0.6	0.3	0.2	--	0.5	0.3	0.2	--
Thallium	0.265	0.149	0.053	--	0.09	0.065	0.044	--
Vanadium	12.3	7.25	1.3	--	6.7	4.3	0.7	--
Zinc	1,110	595	135	--	418	258	100	--
Near-Mine								
Aluminum	8,340	8,500	1,520	650	1,700	1,110	325	351
Antimony	2.98	2.44	3.52	--	5.5	1.04	2.4	2.1
Arsenic	15	4.6	2.7	1.18	4.37	1.39	1.9	1.83
Barium	8,800	4,900	1,690	--	2,540	1,830	700	650
Cadmium	15.3	9.5	13.8	4.61	10.9	3.5	6.26	5.8
Chromium	32.9	19.9	7.7	--	8	3.1	1.3	1.4
Cobalt	7.24	2.84	1.46	--	1.87	1.1	0.45	0.55
Lead	632	443	586	182	820	143	355	277
Mercury	0.439	0.268	0.338	--	0.409	0.108	0.176	0.185
Molybdenum	2.4	1.02	0.66	--	1.13	0.39	0.71	0.94
Selenium	1.5	0.6	0.4	--	0.6	0.3	0.4	0.5
Thallium	1.84	0.759	0.612	--	0.85	0.186	0.415	0.335
Vanadium	14.7	7.25	1.8	--	6.4	3.2	1.7	1.8
Zinc	2,400	1,150	1,370	433	1,540	410	678	710

Note: CoPC - chemical of potential concern

This table summarizes mean CoPC concentration data in unwashed vegetation samples.

All CoPCs are listed for all areas, because no single CoPC could be identified as a primary causative factor.

[a] Moss data from the following transects: Port: TT1, TT2; Road: TT3; Near-Mine: TT4, HR06.

[b] Lichen data from the following transects: Port: TT2, TT5; Road: TT3, TT8; Near-Mine: TT6, TT7.

Table 8-2. Baseline ptarmigan exposure point concentrations and hazard quotients

Exposure Scenarios	Exposure Point Concentrations				LOAEL
	Water (μg/L)	Soil/Sediment (mg/kg)	Herb. Plant (mg/kg)	Shrub (mg/kg)	Hazard Quotient
Port					
Mean					
Lead	0.462	792	6.85	7.59	0.84
95%UCL					
Lead	1.63	2,100	14.5	14.9	2.2
Road					
Mean					
Lead	0.455	121	5.88	4.95	0.17
95%UCL					
Lead	1.10	173	13.8	9.21	0.27
Near-Mine					
Mean					
Lead	0.369	552	2.40	1.61	0.55
95%UCL					
Lead	0.65	1,220	5.10	4.97	1.2

Note: Lead is the CoPC for which ptarmigan are considered potentially at risk of adverse effects (Table 6-44).

CoPC - chemical of potential concern
LOAEL - lowest-observed-adverse-effect level