Exponent®

Road Sampling and Analysis Plan

Haul Road Fugitive Dust Study

Red Dog Mine, Alaska

Prepared for

Teck Cominco Alaska Inc.
Anchorage, Alaska

Exponent®

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Haul Road Fugitive Dust Study

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Acronyms and Abbreviations

CSB	concentrate storage buildings
DMTS	Delong Mountain Transportation System
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
the haul road	DMTS road
IDW	investigation-derived waste
the port	DMTS Port facility
QAPP	quality assurance project plan
SAP	sampling and analysis plan
SOP	standard operating procedure

Road Sampling and Analysis Plan

Haul Road Fugitive Dust Study

Introduction

The Red Dog Mine is located approximately 50 miles east of the Chuckchi Sea, in the western end of the Brooks Range of northern Alaska (see Figure 1). Ore containing lead and zinc is milled at the Red Dog Mine to produce lead and zinc concentrates in a powder form. These concentrates are hauled year-round from Red Dog Mine via the Delong Mountain Transportation System (DMTS) Road (the haul road) to concentrate storage buildings (CSBs) at the DMTS Port facility (the port), where they are stored for later loading onto ships during the summer months.

The haul road is a 52-mile long, 30-ft wide all-weather gravel-surface overland haul road connecting the Red Dog Mine with the port (see Figure 2). The road was constructed in 1987–1988 using a 6-ft-thick gravel bed laid over a geotextile mat placed directly on the original ground surface. The haul road includes nine bridges spanning drainages along the way between the port and Red Dog Mine. The DMTS is owned by Alaska Industrial Development and Export Authority, which has contracted with Cominco for its use, operation, and maintenance (NPS 2001).

Although fugitive dust control has been a high priority at Red Dog Mine, port, and along the haul road over the years, a moss study done in the year 2000 by the National Park Service (Ford and Hasselbach 2001) indicates that there may be some impacts from fugitive dust along the haul road and near the port.

Teck Cominco is in the process of implementing additional dust control measures, including truck washing, new trucks, stilling curtains in the truck dumping bin, and potentially a new road surface (Hi-Float).

The purpose of this sampling and analysis plan (SAP) is to provide a better understanding of the causes of fugitive dust releases from the haul road corridor, and to provide a baseline from which to monitor performance of the new equipment and dust management practices. A companion SAP for vegetation (Exponent 2001b) is designed to provide data for evaluation of ecological impacts of fugitive dust releases.

This SAP describes sampling work for the following materials: dustfall along the haul road, the road surface itself, materials used for resurfacing the road, and water used for dust control on the road. Sampling of vegetation along the haul road (including near former spill areas) will also be performed, as described in the vegetation SAP (Exponent 2001b). Laboratory testing and analysis will be performed for physical parameters (e.g., particle size and density) and inorganic chemical parameters (e.g., metals). All sampling activities and laboratory work will be conducted in general accordance with the U.S. Environmental Protection Agency's (EPA's)

Environmental Investigations, Standard Operating Procedure and Quality Assurance Manual (U.S. EPA 1997). Specific methods for performing field tasks are described in the following sections.

The SAP is organized into the following sections:

- Introduction
- Dustfall Sampling
- Road Surface Sampling
- Road Material and Road Water Source Sampling
- Equipment Decontamination
- Sample Identification System
- Field Data Reporting
- Analytical Methods
- Disposal of Investigation-derived Waste
- Field Schedule
- References.

Sample locations are shown in Table 1, and numbers of samples and analyses are summarized in Table 2. In addition, a health and safety plan is provided in Appendix A, and a standard operating procedure (SOP) is provided in Appendix B. The quality assurance project plan (QAPP) is provided separately (Exponent 2001a).

Dustfall Sampling

Dustfall collectors will be installed along the length of the haul road to provide a way to assess the performance of dust control measures implemented by Cominco. The first set of monthly dustfall data collected this year would provide a baseline for comparison of future data, allowing an assessment of whether metals concentrations in the dustfall decline over time in response to dust control measures. At least part of the first 1-month dustfall collection would occur before the existing haul trucks are replaced by new trucks, which have a hydraulic cover and fewer surfaces to collect dust. Dustfall collection methods will be implemented using equipment similar to that which has been used for dustfall collection around Red Dog Mine and the port. The collection equipment and methods are based on ASTM D1739; however, aerodynamic collars have not been used. Instead, water has been used in the jars to prevent carryout of the dust.

Four dustfall collectors will be placed at each sampling location along the haul road (two on each side of the road). These will allow for rejected samples and to provide for statistical comparison between stations and between time periods.

An outline of the work follows:

- Samplers will be set up at a total of 7 stations along the haul road.
- Dustfall collection station locations will begin just east of the CSBs at the port, and end at the airport at Red Dog Mine end of the haul road. The stations are more closely spaced at either end of the road, and farther apart through the middle section of the road. Station locations are listed in Table 1, along with the mileage numbers measured from the port and global positioning system (GPS) coordinate locations. Station locations are also illustrated along the length of the road on Figure 2.
- Station locations may be modified slightly to make use of road turnouts to get the sampling crew's vehicle out of the way of the ore trucks.
- At each station, dustfall collectors will be placed approximately 10 m from the shoulder of the haul road, with a spacing of 10 m between them, oriented parallel to the road.
- Each station will have four dustfall collectors, two on each side of the road. This placement will allow for rejected samples and provide for statistical comparison between stations and between time periods. Jars are placed on both sides of the road so that results can be summed. Summed results can then be compared from one monitoring period to the next, despite variability in wind direction between periods.
- The dustfall collectors will all be installed within one week of one another.
- Prior to installation, the dustfall collectors and lids will be decontaminated (see section titled *Equipment Decontamination)*, sealed with their lids, and labeled with identification numbers (see *Sample Identification System)*.
- The collectors will be filled with 200 mL of deionized water. During the warm-weather months, 1/2 mL of copper sulfate may be added to prevent algal growth. The fluid addition will help trap collected dust particles and minimize resuspension (i.e., prevent them being blown out of the collector). This method will be used in place of using aerodynamic collars around the collectors.
- After approximately 1 month, the collectors will be removed from the stands, sealed, and shipped to the analytical laboratory for analysis. New collectors will be added to the stands for collection of the next monthly dustfall sample.
- Each sample will be properly labeled with a unique sample identification number and submitted to the laboratory for analysis. Chain-of-custody forms

will be completed and signed by the field representative and shipped with the samples to the analytical laboratory. Sample packaging and chain-of-custody procedures are provided in SOP 2 (Appendix B). Field documentation is discussed in the section titled *Field Data Reporting*.

- All dustfall samples will be analyzed for arsenic, cadmium, lead, zinc, calcium, aluminum, iron, and magnesium. This set of analytes matches the analyte list for the samples of the road surface, road core, and road shoulder fines at the corresponding stations. This will facilitate fingerprinting (i.e., matching constituents in dustfall samples with roadside moss samples and with road surface samples). Particle size analysis will be performed on a composite sample made from the four samples collected at each station. The composite will be prepared by the analytical laboratory and provided to the particle measurement laboratory. Some of the samples may not have sufficient mass to do a particle size distribution analysis. The laboratory will determine which samples have sufficient mass for particle size analysis prior to conducting the analysis, so as to avoid unnecessary costs.

Road Surface Sampling

Road surface samples will be collected to better understand the source of fugitive dust. The variables that likely affect metals concentration in the road surface are distance from Red Dog Mine and the port (i.e., tracking of dust by haul trucks) and how recently the road surface has been graded and/or has had fresh material placed. The sampling approach will be designed to account for these sources of variability.

The work involves collecting road surface composite samples, core samples, and fine material samples from the edge of the road shoulder. A description of each of the elements of the sampling follows.

Road Surface Composite Samples

- Samples will be collected at a total of 34 stations along the haul road. Field duplicate samples will also be collected at 10 percent of these stations.
- Station locations will begin at the port and end at the airport at Red Dog Mine end of the haul road. The stations are more closely spaced at either end of the road (with more frequent spacing beginning just east of the CSBs at the port) and farther apart through the middle section of the road. These stations are listed in Table 1, along with the mileage numbers measured from the port and GPS coordinate locations. Station locations are also illustrated on Figure 2.
- Station locations may be modified slightly to make use of road turnouts to get the sampling crew's vehicle out of the way of the ore trucks.

- Each station will be a composite sample collected from three points on the roadway surface: most likely left side, middle, and right side.
- Sample depth will be approximately 0 to 1 in.
- Samples will be collected using a precleaned stainless-steel spoon and bowl, homogenized, and placed in a precleaned sample jar for submittal to the analytical laboratory for analysis.
- Each sample will be properly labeled with a unique sample identification number and submitted to the laboratory for analysis. Chain-of-custody forms will be completed and signed by the field representative and shipped with the samples to the analytical laboratory. Sample packaging and chain-of-custody procedures are provided in SOP 2 (Appendix B). Field documentation is discussed in the section titled *Field Data Reporting*.
- All road surface samples will be analyzed for arsenic, cadmium, lead, and zinc. At the seven stations that correspond to the dustfall collector, road core, and road fines sample stations, additional inorganic constituents will be analyzed (aluminum, iron, magnesium, and calcium). Particle size distribution analysis will also be performed on samples from these seven stations.
- Information on the condition of the road, how recently it has been graded, and the presence of fresh road material, rutting, etc., will be recorded in the field logbook.

Road Surface Core and Shoulder Samples

- Core samples and fine material samples from the toe of the road shoulder will be collected at seven of the stations where road surface composite samples are to be collected. These seven stations correspond to the stations where dustfall samplers will be installed. Four field duplicate samples will also be collected: three for the core samples and one for the shoulder fine material samples.
- These seven stations are listed in Table 1, along with the mileage numbers measured from the port and GPS coordinate locations. Station locations are also illustrated in Figure 2.
- Core samples will be collected from the center of the road using a split-spoon sampler driven by a hand-operated power hammer. The split spoon will be driven to a depth of 12 in. and samples will be collected from three depth intervals: 0–4, 4–8, and 8–12 in.
- Shoulder samples will be collected as a three-point composite from the edge of the roadway where fine material accumulates. These samples will be collected with a decontaminated stainless-steel spoon with an emphasis on

fine material that was carried by runoff into the transition where the edge of the shoulder meets the tundra.

- Each sample will be properly labeled with a unique sample identification number and submitted to the laboratory for analysis. Chain-of-custody forms will be completed and signed by the field representative and shipped with the samples to the analytical laboratory. Sample packaging and chain-of-custody procedures are provided in SOP 2 (Appendix B). Field documentation is discussed in the section titled *Field Data Reporting*.

- The core samples will be analyzed for arsenic, cadmium, lead, and zinc.

- The shoulder fine-material samples will be analyzed for arsenic, cadmium, lead, zinc, calcium, aluminum, iron, and magnesium. This set of analytes matches the analyte list for the dustfall samples at the corresponding stations. This will facilitate fingerprinting (i.e., matching constituents in dustfall samples with road surface samples and with roadside moss samples). Particle size analysis will also be performed on the shoulder fine-material samples from these stations.

Road Material and Road Water Source Sampling

This work includes collecting samples (from various source sites) of materials used for road surfacing and water applied to the road for dust control. The planned sampling is described in the following sections.

Road Surfacing Material Source Sampling

The surfacing materials source-site samples will be collected from the primary source sites (MS-2 and MS-9) and from the sites sampled by the National Park Service in 2000 (MS-3, MS-5, and MS-6).

- A total of 6 samples will be collected, one each from the five sites, and one field duplicate.

- The samples will be collected as multi-point composites from each source site. Representative subsamples may be collected using a stainless-steel spoon, or if necessary, by using a split-spoon sampler driven by a hand-held power hammer.

- Subsamples will be composited in a stainless-steel bowl, and placed in pre-cleaned sample containers.

- Each sample will be properly labeled with a unique sample identification number and submitted to the laboratory for analysis. Chain-of-custody forms will be completed and signed by the field representative and shipped with the

samples to the analytical laboratory. Sample packaging and chain-of-custody procedures are provided in SOP 2 (Appendix B). Field documentation is discussed in the section titled *Field Data Reporting*.

- The road material source samples will be analyzed for the following constituents: arsenic, lead, zinc, cadmium, calcium, aluminum, iron, and magnesium.

Road Water Source Sampling

Samples of the water used for dust control on the road will be collected from the primary source sites MS-3 and MS-10, and also from secondary source sites MS-2 and MS-6.

- A total of 5 samples will be collected, one each from the four sites, and one field duplicate.
- The samples may be collected as multi-point composites from each source site, if there appears to be any variability in the water source.
- Samples will be collected by dipping a pre-cleaned sample jar into the water source and using that to fill the pre-cleaned and preserved sample bottles.
- Each sample will be properly labeled with a unique sample identification number and submitted to the laboratory for analysis. Chain-of-custody forms will be completed and signed by the field representative and shipped with the samples to the analytical laboratory. Sample packaging and chain-of-custody procedures are provided in SOP 2 (Appendix B). Field documentation is discussed in the section titled *Field Data Reporting*.
- The road water source samples will be analyzed for the following constituents: arsenic, lead, zinc, cadmium, calcium, aluminum, iron, and magnesium.

Equipment Decontamination

All reusable sampling equipment will be decontaminated prior to collection of each sample. Procedures for management and disposal of waste generated during equipment decontamination are described in the section titled *Disposal of Investigation-derived Waste*.

Sampling equipment (such as dustfall collectors, stainless-steel bowls, spoons, and split-spoon samplers) will be washed using a scrub brush in a solution of Alconox and water. Following the wash, equipment will be rinsed in tap water, and then rinsed with deionized water from a spray bottle.

Sample Identification System

Each sample will be assigned a unique sample number. Samples will be numbered using the following nomenclature:

DN-01, -02, etc. = North side dust collector samples (a suffix of A, B, or C will be added for each of the three samplers on the northerly side of the road at a given station)

DS-01, -02, etc. = South side dust collector samples (a suffix of A, B, or C will be added for each of the three samplers on the southerly side of the road at a given station)

RS-01, -02, etc. = Haul road composite surface samples

RC-01, -02, etc. = Haul road core samples (a suffix of A, B, or C will be added for the depth samples at 0–4, 4–8, and 8–12 in., respectively)

RF-01, -02, etc. = Haul road composite shoulder fine material sample

RM-01, -02, etc. = Road material source samples

RW-01, -02, etc. = Road water source samples

Station numbers are shown in Table 1. To ensure that station numbers correspond for the dustfall, core, and shoulder fine material samples, the first set of cores and fine material samples has the suffix "–PORT" because no dustfall samplers are placed at that location. The remaining stations use consecutive numbering.

Field Data Reporting

Sampling activities will be documented in a field logbook. Detailed information to be recorded in the logbook will include:

- Date and time of sample collection
- Sample number
- Location of sample (e.g., mileage, GPS coordinate locations, material site number, spill site number)
- Sample type (i.e., discrete grab sample or composite sample, and number of subsamples if a composite sample is collected)
- Sample material description
- Description of the road surface, noting if the road had been recently graded or had fresh material or calcium chloride applied, presence of ruts, etc.

- Photograph(s) of the road conditions in the vicinity of the sample stations
- Weather conditions
- Description of any deviation from the SAP (as applicable)
- Personnel conducting the activity.

Additional details to be collected for dustfall samplers during installation and sample collection will include:

- Date and time of sampler installation
- Distance of sampler from road
- Orientation and relative location of A, B, and C samplers at each station.

Any other pertinent data or observations identified during sampling will also be recorded. Quality assurance and quality control documentation, including sample tags and chain-of-custody forms, will be completed. Samples will be delivered to the analytical laboratory using standard chain-of-custody procedures.

Analytical Methods

The samples will be tested for metals, particle size distribution, and specific gravity of the solids. The number of inorganic constituents to be analyzed depends on the sample (refer to the sampling discussions in the previous sections). Analytical methods and sample volume requirements are summarized in the QAPP (Exponent 2001a).

The following analytes will be analyzed using EPA Method 6010: aluminum, arsenic, calcium, cadmium, iron, magnesium, manganese, and zinc. Lead will be analyzed using EPA Method 7421 (graphite furnace atomic absorption spectrometry).

The sampling containers for soil will be 8-oz jars. Containers for water samples will be bottles provided by the laboratory with HNO_3.

Disposal of Investigation-derived Waste

Wastes generated during the sampling program are expected to be non-hazardous. Investigation-derived waste (IDW) generated during sampling is expected to include decontamination water containing residual solid materials and used personal protective equipment (e.g., gloves, paper towels). Liquid IDW generated from decontamination will be disposed of on the road surface. Solid IDW (e.g., used personal protective equipment) will be placed in plastic garbage bags and disposed of in Red Dog Mine or port solid waste collection facilities.

Field Schedule

Week of 8/11–8/17	One 2-person Online Exploration crew	Dust collector installation
		Road surface sampling
Week of 8/18–8/24	One 2-person Online Exploration crew	Road surface sampling
		Material/water source sampling
	Two 2-person vegetation crews	Vegetation sampling
		Haul road spill site sampling
Week of 8/25–8/31	Two 2-person vegetation crews	Vegetation sampling

References

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Ford, S., and L. Hasselbach. 2001. Heavy metals in mosses and soils on six transects along the Red Dog Mine haul road, Alaska. NPS/AR/NRTR-2001/38. National Park Service, Western Arctic National Parklands.

NPS. 2001. National Park Service Red Dog Mine Road. http://www.nps.gov/akso/gis/metadata/reddogrd.html# Identification_Information. Accessed on August 2, 2001. National Park Service.

U.S. EPA. 1997. Environmental investigations, standard operating procedure and quality assurance manual. U.S. Environmental Protection Agency, Washington, DC.

Figures

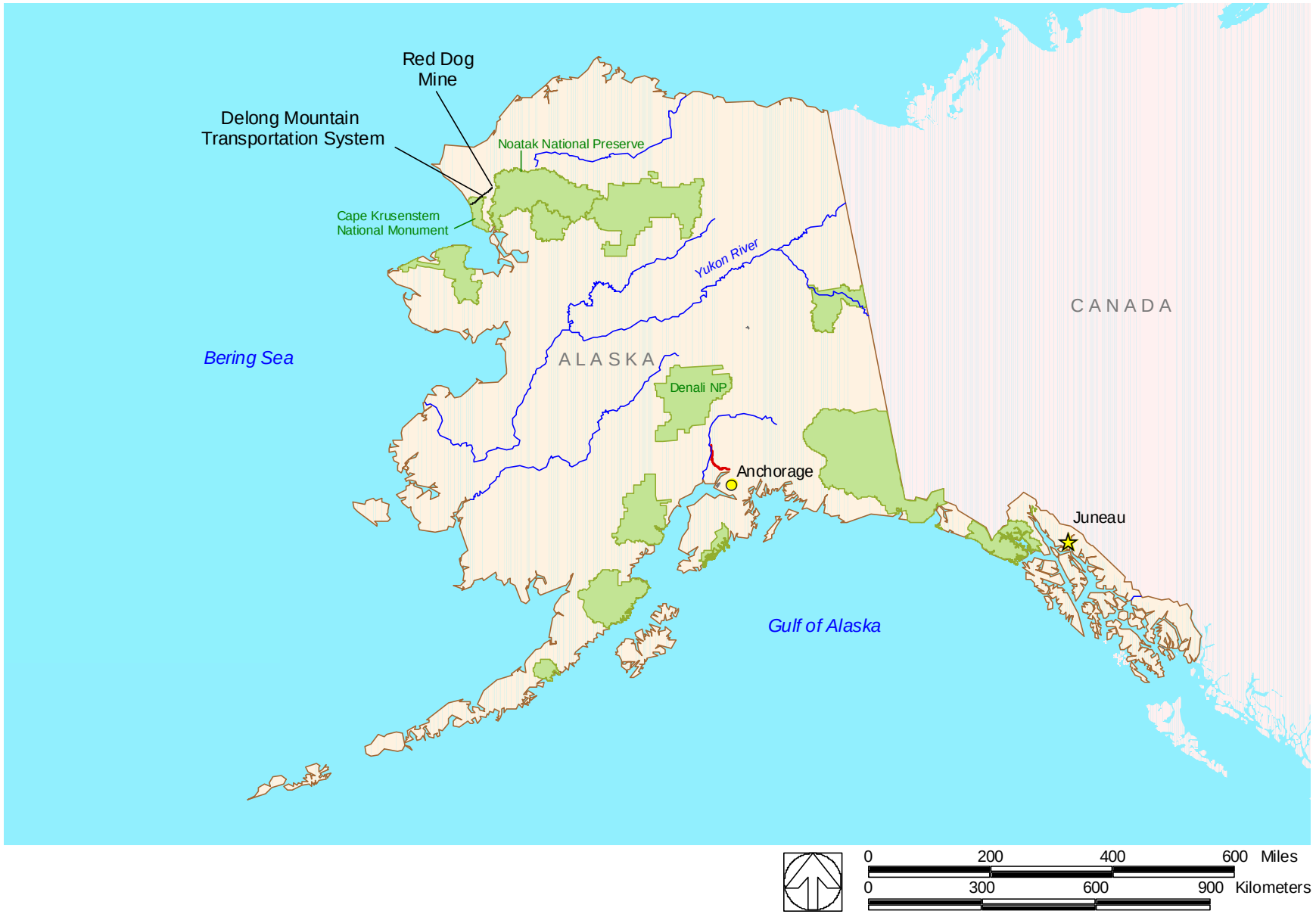

Figure 1. Location map

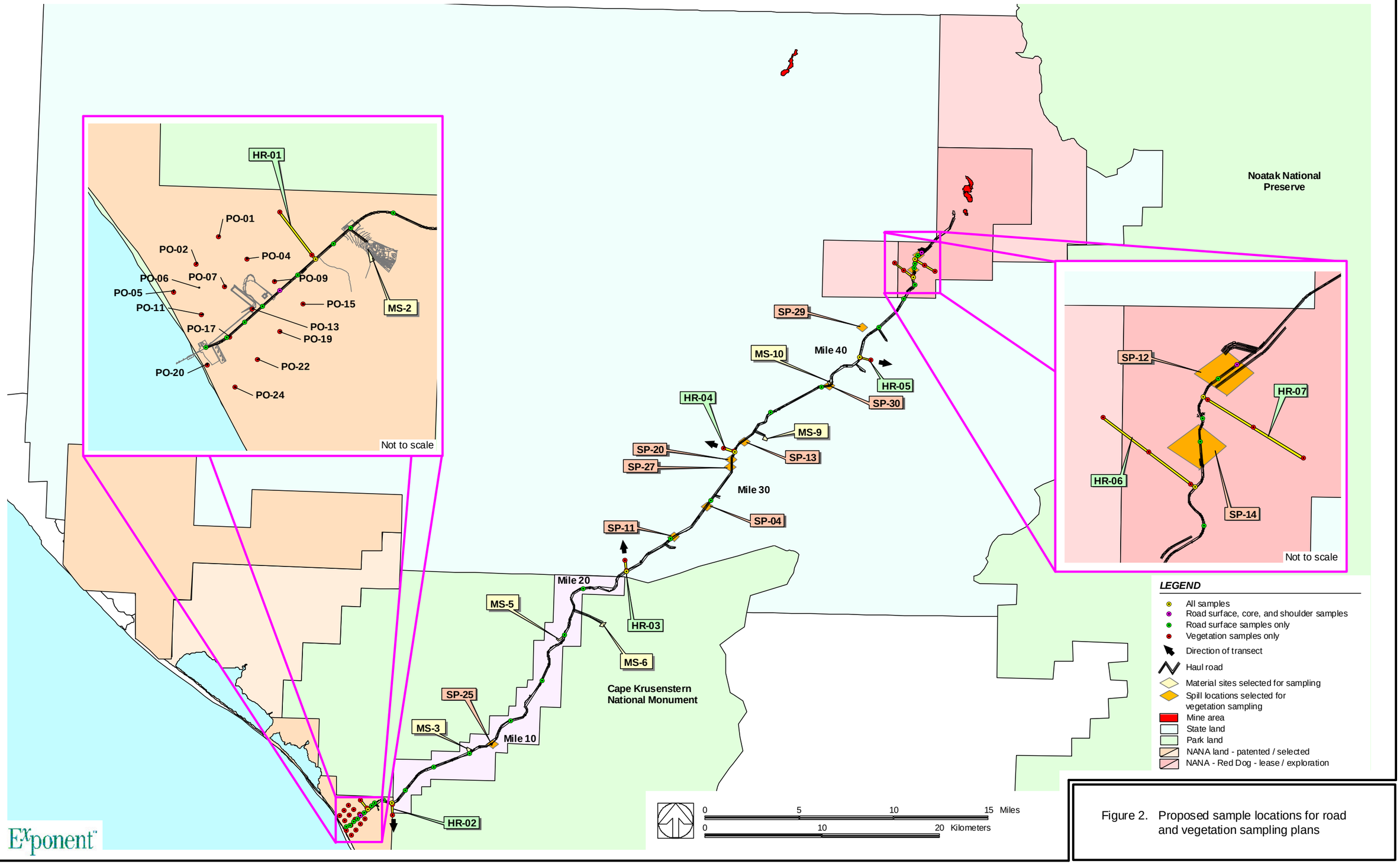

Figure 2. Proposed sample locations for road and vegetation sampling plans

Tables

Table 1. Planned dustfall collector and haul road sample stations and locations

	Sample Station Names				Longitude (NAD 27)		Latitude (NAD 27)		Alaska SP, Zone 7, NAD 27	
Approximate Mileage from Port	Road Surface	Dustfall	Road Cores	Road Shoulder Fines	X Deg	X Min	Y Deg	Y Min	X (Easting)	Y (Northing)
0	RS-01				–164	3.1655	67	34.6995	413284	4968048
0.25	RS-02				–164	2.6710	67	34.7962	414454	4968599
0.50	RS-03				–164	2.2589	67	34.9448	415443	4969474
0.75	RS-04				–164	1.8470	67	35.0935	416431	4970349
1	RS-05		RC-PORT	RF-PORT	–164	1.4349	67	35.2423	417420	4971224
1.25	RS-06				–164	1.0228	67	35.3909	418408	4972099
1.50	RS-07	DN-01, DS-01	RC-01	RF-01	–164	0.6106	67	35.5396	419396	4972974
1.75	RS-08				–164	0.1983	67	35.6883	420384	4973849
2	RS-09				–163	59.7859	67	35.8369	421372	4974724
2.5	RS-10				–163	58.7852	67	35.9837	423728	4975544
3	RS-11	DN-02, DS-02	RC-02	RF-02	–163	57.7146	67	35.8567	426193	4974691
4	RS-12				–163	56.1873	67	36.4657	429861	4978291
5										
6	RS-13				–163	52.8776	67	37.5810	437760	4984853
7										
8	RS-14				–163	48.6544	67	38.2150	447682	4988425
9										
10										
11	RS-15				–163	43.8269	67	39.8036	459161	4997790
12										
13										
14	RS-16				–163	40.1953	67	41.6541	467887	5008840
15										
16										
17	RS-17				–163	37.6150	67	43.7897	474206	5021700
18										
19										
20	RS-18				–163	35.5271	67	45.9257	479369	5034597
21										
22										
23	RS-19	DN-03, DS-03	RC-03	RF-03	–163	30.3053	67	46.7420	491549	5039272
24										

Table 1. (cont.)

	Sample Station Names				Longitude (WGS 84)		Latitude (WGS 84)		Alaska SP, Zone 7, NAD27	
Approximate Mileage from Port	Road Surface	Dustfall	Road Cores	Road Shoulder Fines	X Deg	X Min	Y Deg	Y Min	X (Easting)	Y (Northing)
25										
26	RS-20				–163	25.0732	67	48.3036	503842	5048507
27										
28										
29	RS-21				–163	20.3108	67	50.0778	515056	5059080
30										
31										
32	RS-22	DN-04, DS-04	RC-04	RF-04	–163	17.5280	67	52.3479	521753	5072785
33										
34										
35	RS-23				–163	13.2562	67	54.1901	531795	5083818
36										
37										
38	RS-24				–163	7.1820	67	55.3950	545874	5090901
39										
40										
41	RS-25	DN-05, DS-05	RC-05	RF-05	–163	2.6122	67	56.7681	556498	5099090
42										
43	RS-26				–163	0.3007	67	58.1536	561933	5107451
44										
45	RS-27				–162	57.3626	67	59.4638	568783	5115334
46	RS-28				–162	55.9840	68	0.1187	571997	5119279
46.5	RS-29	DN-06, DS-06	RC-06	RF-06	–162	56.1938	68	0.4661	571549	5121404
47	RS-30				–162	56.1047	68	0.8884	571792	5123977
47.25	RS-31				–162	56.0549	68	1.1031	571925	5125284
47.50	RS-32	DN-07, DS-07	RC-08	RF-08	–162	56.0471	68	1.2988	571961	5126477
47.75	RS-33				–162	55.6941	68	1.4648	572783	5127477
48 (Airport)	RS-34		RC-09	RF-09	–162	55.2341	68	1.5963	573845	5128263
Total No. Stations:	34	14	9	9						
No. Samples/Station:	1	2	3	1						
Total No. Samples:	**34**	**28**	**27**	**9**						

Footnotes on following page.

Table 1. (cont.)

Note: DN - north side dustfall collector sample
DS - south side dustfall collector sample
RC - road core sample
RF - road shoulder fines sample
RS - road surface sample

Dustfall Collector Samples: Includes four collectors per station; two on either side of the road. Dustfall collector samples will be named by adding A, B, and C to the station name.

Roadway Surface Samples: Includes one 3-point composite surface sample per station.

Roadway Core Samples: Includes three depth samples from a core with normal analyte list. Core samples will be named by adding A, B, and C to the station name to correspond with depth.

Roadway Shoulder Samples: Includes one 3-point composite sample per station collected from fine materials from beyond the shoulder, with expanded analyte list.

Table 2. Summary of road sampling for the haul road fugitive dust study

Area	Number of Stations	Number of Samples per Station	Number of Samples	Analytes		
				As, Cd, Pb, Zn	Ca, Al, Fe, Mg	Particle Size & Density
Dustfall Collectors	7	2 upwind, 2 downwind	28[a]	X	X	Particle Size Only
Road Surface	27	1 three-point composite	27 + 2 field duplicates	X		
Road Surface–Selected	7	1 three-point composite	7 + 1 field duplicate	X	X	X
Road Cores	7	3	27 + 3 field duplicates	X		
Road Shoulder Fines	7	1 three-point composite	7 + 1 field duplicate	X	X	X
Road Material Source	5	1 three-point composite	5 + 1 field duplicate	X	X	
Road Water Source	4	1 three-point composite	4 + 1 field duplicate	X	X	
Total Number[a] (including duplicates)			86[a]			

[a] Dustfall samples to be collected by Teck Cominco Alaska personnel 1 month after jar installation. Dustfall samples not included in the sample total.

Appendix A

Health and Safety Plan

Health and Safety Plan

a.) **Site:** Cominco Red Dog Mine, near Kotzebue, Alaska

b.) **Client:** Cominco

c.) **Work Dates:** August 10–September 1, 2001

d.) **Staff:** Scott Shock, Liz Maier, subcontractor Chris Schadt

e.) **Summary of All Proposed Activities:** Collect data from mine files, collect soil and vegetation samples, train and provide guidance to Cominco subcontractors to do sampling on haul road.

f.) **Project Number:** 8601997.001

g.) **Project Manager:** Walt Shields

h.) **New Project or Project with an Existing Health and Safety Plan:** New project

i.) **Type of Facility or Site:** Haul road for zinc and lead mine

j.) **Proposed Site-Safety Officer:** Scott Shock, then Liz Maier following Scott's departure

k.) **List of Potential Hazardous Chemicals and Concentrations (if available):** Lead and other heavy metals in dust on the haul road and plant surfaces. Airborne dust is expected to be very minimal, as the sampling is occurring during the rainy season, and it has been raining every day.

l.) **List of Potential Physical Hazards:** Moving equipment, primarily trucks on the haul road; slip and trip hazards; cold weather, rain, and wind chill (i.e., hypothermia); bears.

m.) **Do Client Health and Safety Procedures Need to Be Followed?** Follow Cominco policies on haul road travel and activities, including the use of two-way radios for contact between vehicles, or to contact the emergency response team.

n.) **Proposed Level of Protection:** Modified Level D with steel-toed rubber boots and gloves. Two-person sampling teams (one person as lookout) and air horns will be used for bear protection.

o.) **List of Chemicals that Will Be Used (decontamination, preservatives, field tests):** Detergent will be used in decontamination. Sample bottles may contain acid as a preservative.

Appendix B

Standard Operating Procedure

Exponent®

SOP 2
SAMPLE PACKAGING AND SHIPPING

Specific requirements for sample packaging and shipping must be followed to ensure the proper transfer and documentation of environmental samples collected during field operations. Procedures for the careful and consistent transfer of samples from the field to the laboratory are outlined herein.

EQUIPMENT REQUIRED

Specific equipment or supplies necessary to properly pack and ship environmental samples include the following:

- Sealable airtight bags
- Plastic garbage bags
- Coolers
- Bubble wrap
- Fiber reinforced packing tape
- Scissors
- Chain-of-custody seals
- Airbills for overnight shipment
- Chain-of-custody record/sample analysis request forms.

PROCEDURE

The following steps should be followed to ensure the proper transfer of samples from the field to the laboratories:

1. Appropriately document all samples using proper logbooks and chain-of-custody record/sample analysis request forms (example provided in Attachment 2-1).

2. Make sure all applicable laboratory quality control sample designations have been made on the chain-of-custody record/sample analysis request forms. Samples that will be archived for future possible analysis should be clearly identified on the chain-of-custody record/sample analysis request form. Such samples should also be labeled on the chain-of-custody record/sample analysis request form as "Do Not Analyze: Hold and archive for possible future analysis" as some laboratories interpret "archive" to mean continue holding the residual sample after analysis.

3. Notify the laboratory contact and the project QA/QC coordinator that samples will be shipped and the estimated arrival time. Send copies of all chain-of-custody record/sample analysis request forms to the QA/QC coordinator.

4. Samples will be placed in secure onsite storage or remain in the possession of the sampling personnel before shipment. Any temporary sample storage areas will be locked and secured to maintain sample integrity and chain-of-custody requirements.

5. Clean the outside of all dirty sample containers to remove any residual material that may lead to cross-contamination.

6. Check sample containers against the chain-of-custody record/sample analysis request form to ensure all samples intended for shipment are accounted for.

7. Choose the appropriate size cooler (or coolers) and line with bubble wrap.

8. Fill the cooler with the samples, separating glass containers with bubble wrap. After all samples have been added to the cooler, use bubble wrap to fill any empty space to keep the samples from shifting during transport.

9. After the cooler is sufficiently packed to prevent shifting of the containers, close the lid and seal it shut with fiber-reinforced packing tape. If the cooler has a drain at the bottom, it should be taped shut in the same manner.

10. Fill out the chain-of-custody/sample analysis request form and retain the back copy of the form for the project records before sealing the cooler. Store the signed chain-of-custody record/sample analysis request forms in a sealable bag and tape them to the inside of the cooler lid. For a shipment containing multiple coolers, indicate on the outside of this cooler "Chain-of-Custody Inside."

11. As security against unauthorized handling of the samples, apply one or two chain-of-custody seals across the opening of the cooler lid (example provided in Attachment 2-1). Be sure the seals are properly affixed to the cooler so they are not removed during shipment.

12. Label the cooler with destination and return addresses, and add other appropriate stickers, such as “This End Up,” “Fragile,” and “Handle With Care.”

13. If an overnight courier is used, fill out the airbill as required and fasten it to the top of the cooler. The identification number sticker should be taped to the lid, because tracking problems can occur if a sticker is removed during shipment.

ATTACHMENT 2-1

Example Chain-of-Custody Record/Sample Analysis Request Form, and Label and Custody Seal

CHAIN OF CUSTODY RECORD/SAMPLE ANALYSIS REQUEST FORM

Project:
(Name and Number)

Exponent Contact: _____ Office: _____

Ship to: _____

_____

_____

Lab Contact/Phone: _____

Samplers:

Exponent®
Environmental Group
Bellevue, WA (425) 643-9803
Boulder, CO (303) 444-7270
Lake Oswego, OR (503) 636-4338
Los Angeles, CA (310) 823-2035
Natick, MA (508) 652-8500

Sample No.	Tag No.	Date	Time	Matrix	Analyses Requested						Extra Container	Archive	Remarks

Matrix Code: GW - Groundwater SL - Soil SD - Sediment SW - Surface water

OTHER - Please identify codes _____

Priority:
☐ Normal ☐ Rush Rush time period _____

Shipped via: ☐ FedEx/UPS ☐ Courier Other _____

Condition of Samples Upon Receipt: _____

Custody Seal Intact: ☐ Yes ☐ No ☐ None

Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
(Signature) *(Signature)*

Relinquished by: _____ Date/Time: _____ Received by: _____ Date/Time: _____
(Signature) *(Signature)*

Distribution: White and Yellow Copies - Accompany Shipment; Pink Copy - Project File

Exponent®

OFFICIAL SAMPLE SEAL

SAMPLE NO.	DATE
SIGNATURE	
PRINT NAME AND TITLE	

Exponent®

SAMPLE NO.

SITE NAME

DATE TIME

SAMPLER PRESERVATIVE

TAG NO. 25101