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Field Summary Report - Contaminants Study for the 2008 Environmental Studies Program in the Chukchi Sea

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Prepared for

ConocoPhillips Alaska, Inc.
700 G Street
Anchorage, AK 99501

Shell Exploration & Production
3601 C Street, Suite 1000
Anchorage, AK 99503

Prepared by

Exponent
3 Clock Tower Place, Suite 205
Maynard, MA 01754

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Acronyms and Abbreviations

AOS	Aldrich Offshore Services
COC	Chain of Custody
Contaminants Program	Chukchi Sea Environmental Studies Program
CPAI	ConocoPhillips Alaska, Inc.
FIT	Florida Institute of Technology
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
IHA	Incidental Harassment Authorization
km	Kilometer
LOA	Letter of Authorization
MMS	Minerals Management Service
NEPA	National Environmental Policy Act
nm	Nautical Mile
NPDES	National Pollution Discharge and Elimination System
NPFVOA	North Pacific Fishing Vessel Owners' Association
OSHA	Occupational Safety and Health Administration
Shell E&P	Shell Exploration and Production
SOP	Standard Operating Procedure
PAHs	Polycyclic Aromatic Hydrocarbons
TBD	To Be Determined
TOC	Total Organic Carbon

Executive Summary

This report presents a summary of the field investigation and sample collection portion of the summer 2008 Chukchi Sea Environmental Studies Program Contaminants Study conducted by Exponent and Battelle on behalf of ConocoPhillips Alaska, Inc., (CPAI) and Shell Exploration and Production (Shell E&P) from August 19 to September 22, 2008 in the Chukchi Sea, Alaska. The summer 2008 field investigations were conducted in two prospect areas previously drilled for exploratory purposes in 1989 and 1990. These two prospect areas, located in the Chukchi Sea, are called the Klondike and Burger study areas. The purpose of the Contaminants Study field program is to collect samples for laboratory analyses to provide baseline data on the distribution and concentrations of chemical constituents associated with offshore oil and gas operations in sediments and biota from the Chukchi Sea. These constituents of concern include metals and hydrocarbons. In conjunction with the Contaminants portion of this field investigation, additional interdisciplinary scientific teams conducted baseline research on seabird and marine mammal observations, zooplankton distribution, benthic taxonomy, passive acoustic monitoring data collection of vocalizing marine mammals and ambient sound, and water column profiles and velocities.

This field report includes a summary of the logistics and schedules, site locations, and specific details on the types, numbers, and locations of sample collections for the Contaminants portion of the summer 2008 field investigations. Included in the appendices are copies of station logs, field notes, sample summary tables, fully executed chain of custody forms, and photo documentation for the month long investigation.

1 Introduction

1.1 Study Background

In February 2008, ConocoPhillips Alaska, Inc. (CPAI) and Shell Exploration & Production (Shell E&P) purchased lease blocks around two prospect areas, Klondike and Burger, in the Outer Continental Shelf (OCS) of the Chukchi Sea, Alaska (Figure 1). To progress a successful permit application to drill on these prospects, CPAI and Shell E&P are collecting baseline scientific information on the marine environment. The baseline scientific information includes data on seabird and marine mammals, plankton (phytoplankton and zooplankton), benthic taxonomy, recordings of ambient noise and vocalizing marine mammals, water column profiles and velocities, and the distribution and concentrations of chemicals of concern. These data will be used as part of an analysis of the potential effects of offshore oil and gas activities on the Chukchi Sea marine environment and its resources. Ultimately, the data and subsequent analyses will be used in the preparation of multiple regulatory documents such as National Pollution Discharge and Elimination System (NPDES) permits, National Environmental Protection Act (NEPA) documents, and Incidental Harassment Authorization (IHA) and Letter of Authorization (LOA) for incidental, unintentional take of marine mammals and protected marine birds. Samples collected from the CPAI and Shell E&P Chukchi Sea Environmental Studies Contaminants Program include sediment and biota samples for chemical analysis. Understanding the distribution of various chemical constituents in the sediment and various lower trophic level species (e.g., pelagic zooplankton, benthic clams, and amphipods) provides an indication of the baseline chemical concentrations at the lower tiers of the food web and provides input into food web models for predicting the risk of potential exposure of organic and metal contaminants to higher trophic level organisms such as fish, whales, seals, walrus, and birds. This field report summarizes the contaminants portion of the summer 2008 Chukchi field efforts.

1.2 Scientific Purpose

The objective of the Contaminants Program is to collect and synthesize baseline scientific information about the marine environment in the two lease areas (Klondike and Burger) in the Chukchi Sea.

The purpose of the 2008 Contaminants Program was to generate the first year of baseline (pre-drilling) data for metals and hydrocarbons in sediments, zooplankton, amphipods, and benthic invertebrates in the Klondike and Burger prospect areas. These baseline data are important to characterize the marine environment prior to the commencement of exploratory drilling activities to document pre-existing metal and hydrocarbon concentrations from natural or anthropogenic sources. The specific objectives of the field portion of the contaminants program were to:

1) Collect sediment samples for metals and hydrocarbon analyses at fixed, random, and historic drill sites within the Klondike and Burger prospect areas (Figures 2 and 3).

2) Collect biota samples for metals and hydrocarbon analyses wherever biota were most abundant at the fixed, random, and historic drill sites (zooplankton samples were collected only at the odd numbered fixed stations; clams, amphipods, and other biota were collected wherever they could be obtained in sufficient sample volume/mass for chemical analyses).

1.3 Study Area

The OCS of the Chukchi Sea is the least-developed continental shelf area of the United States. The northeastern Chukchi Sea lies north of latitude 70°N and is covered with sea ice for much of the year. However, it is a biologically rich area with high biological productivity, supported by nutrient inputs from the Bering Sea, upwelling from the Arctic continental slope, and the western Russian Chukchi Sea. Between 1988 and 1991, five exploratory wells were drilled, plugged, and abandoned in the U.S. portion of the Chukchi Sea. Two wells, drilled by Shell Oil Co., which showed promising formation geology and potential indications for hydrocarbons (primarily gas and condensate) are located in the current Klondike and Burger prospect areas. The two prospect areas are approximately 75 miles offshore of Wainwright, Alaska, in roughly 40 to 50 meters of water (Figure 1).

2 Cruise Operation Plan and Schedule

The multipurpose vessel M/V Bluefin served as the research vessel for the 2008 summer field investigations. The sampling teams were mobilized from Wainwright, AK in a transport vessel to meet the M/V Bluefin offshore. On August 19, 2008, the Contaminants Program field sampling team boarded the M/V Bluefin for the approximately 30-day field duration. The Contaminants Program field sampling team was demobilized on September 5, 2008 for 5 days due to ice in the study area, and then remobilized on September 11, 2008, and returned to the M/V Bluefin through the end of the contaminants portion of the cruise, which occurred on September 22, 2008. The first half of the cruise focused primarily on sample collections in the Klondike survey area, while the second half of the cruise focused on sample collections in the Burger survey area.

The M/V/ Bluefin was equipped with an A-frame and a hydraulic winch mounted on the starboard side of the ship working through a Baltic Door. The system was used to deploy the double Van Veen grab, zooplankton nets (bongo net for the zooplankton sampling), clam dredge, and for retrieving deployed amphipod traps.

3 2008 Contaminants Field Sampling Team

Joe Jermane – Vessel Captain (C Port)

John Hardin – Field Biologist (Battelle)

Waverly Thorsen – Field Chemist (Exponent)

Jeff LaDage – Marine Technician/Winch Operator (Aldrich Offshore Services [AOS])

Joshua Mumm – Marine Technician/Winch Operator (AOS)

Art Flippin – HSE/Medic (St. Jernholm Consulting)

4 Field Methods

4.1 Overview

The principal goals of this survey were to collect samples in sufficient volume/mass for chemical analysis of sediment, benthic infauna, amphipods, and zooplankton at fixed, random, and historic drill sites in the two prospect areas (Klondike and Burger). The required volumes/mass of each matrix for metals, grain size, total organic carbon, and hydrocarbon analyses was pre-determined with each respective analytical laboratory to ensure that, wherever possible, enough of each sample was obtained.

Throughout the survey, field notes and station logs were maintained by the Exponent and Battelle scientists, along with proper sample identification and chain of custody forms. Official standard operating procedures (SOPs), as outlined in the Field Survey Plan (Exponent 2008) were followed, and any deviations or comments relating to the procedures were reported in the field notes and station logs. Photocopies of the station logs and field notes are presented in Appendices A and B, attached to this report.

Photo documentation was also conducted during the entire contaminants survey and included photographs of each individual sediment grab from which a sample was collected for chemical analysis, and photographs of biota (amphipods, clams, worms and zooplankton). The photographs were labeled with time and date stamps, according to required CPAI photo documentation procedures, and are presented in Appendix E. At the time of this report, final taxonomic identifications have not been completed on the biota, so no genus or species names are provided in this report. Species identifications will be provided in the analytical report(s).

4.2 Station Selection

A total of three different sampling location types were addressed in this field survey: 1) fixed, 2) random, and 3) historical drill sampling sites. Stations were not sampled unless the estimated percent of fine material ('fines') was > 20% silt/clay, indicating depositional sediment (Note: Only one sampling station [KS003] was not sampled for sediment due to limited presence of

fines). The sampling fixed and random stations were based on a stratified-random paradigm, where each of the two prospect areas was gridded for sample collection locations (Figures 2 and 3). Locations of the historic drill sites were provided by CPAI prior to the cruise.

4.2.1 Fixed Stations

The study design included 13 fixed stations from each prospect area. A 7.5 nautical mile (nm) grid was placed on the 30 x 30 nm prospect block and stations were established on the grid corners and every other grid block intersection (Figures 2 and 3). Grid points were labeled by row from left to right and from south to north (i.e. the southwest corner was 001). Only the odd fixed station locations were sampled for chemical analysis.

4.2.2 Random Stations – Primary and Secondary

Thirteen random ('primary random') stations were determined by establishing a 3 nm grid throughout each of the two 30 nm square study blocks. Stations were sequentially numbered by row from left to right and from north to south (i.e. the northwest corner was numbered 001). From these 100 fixed locations, 13 stations were randomly selected. In the event that a primary random station could not be sampled (e.g., due to ice in the Burger study area in early September), 13 alternate random ('secondary random') stations were established using the same method described above for primary random stations. During the 2008 summer field investigation ice in the Burger study area prevented the M/V Bluefin from reaching specific primary random stations on the 2nd and 3rd of September. Subsequently, secondary random stations were established, and samples were collected. However, after movement of the ice floe, all primary random stations in the Burger study area were sampled. The secondary random samples are not planned for analyses and will be archived. Tables 1 through 8 list the sample stations, locations, water depth, time, and date for the Klondike and Burger study areas for sediment, clam dredge, zooplankton, and amphipods sample collection activities. Actual samples collected at each station location are presented in Appendix C.

4.2.3 Historic Drill Stations

At both the Klondike and Burger study areas, historic drill stations were comprised of five individual sampling locations representing the center latitude and longitude location of the original historic drill site (i.e., KD005 and BD005, respectively), and four additional stations established as radials around each of the exploratory drill sites. The radial stations were located approximately 0.5-km to the north, south, east, and west of the center of the historic drill site and along the axis of and perpendicular to the prevailing currents in each study area (Figures 2 and 3).

4.2.4 Station Locations for Biota Sampling

Attempts were made to collect biota samples at most stations where sediment samples were collected. As expected, due to patchiness of the biota (e.g., especially clams and amphipods) in the study areas, biota were collected at a subset of the fixed and random sediment stations, and at some of the historic drill stations. Zooplankton samples for chemical analysis were collected at all fixed stations except for KF011.

The sediment and biota sampling were conducted in conjunction with the benthic infaunal sample collections (i.e., for taxonomy) performed by the University of Alaska, Fairbanks such that the samples for chemistry and infauna are statistically linkable. This was accomplished through the use of a double Van Veen grab, which provided two linked grab samples per station location: one grab for chemical sampling and one grab for benthic infauna sampling.

Continuing field sampling for the program would ideally be consistent with the fixed, random, and historic drill site locations over a multi-year program, with additional sampling possible at sites of interest such as whale feeding areas or known locations of upwelling.

4.3 Sample Identification Scheme

Each sediment and biota sample collected was assigned a unique sample tracking number. The sample identification scheme provides basic information about the sample and allows the

sample to be uniquely identified throughout the program. The basic index for the sample identification is as follows:

Year – Survey Number – Site Code – Replicate – Sample Type

For example, 08-03-KF021-01-SC, representing the 2008 contaminants survey, cruise number 3, the Klondike ('K'), fixed ('F') station number 021, replicate number 01, sediment sample collected for sediment chemistry ('SC') analysis. A description of the data fields in the sample identification is provided in Table 10.

4.4 Station Plan and Field Sampling Procedures

4.4.1 Station Plan

In conjunction with the 2008 Contaminants Program, zooplankton collection and water quality sampling occurred during the night shift operations on the amidships area of the vessel. The sequence of events at each sampling station followed specific procedures, described in detail below and in general was conducted in this order:

- Identify station (latitude and longitude)
- Navigate to station position within 0.2 nm radius of location
- Deploy/Retrieve amphipod traps (if applicable at station)
- Deploy and retrieve 18-minute bongo nets (at all fixed stations)
- Deploy and retrieve 10-minute bongo nets (at odd-fixed stations)
- Deploy and retrieve 10-minute vertical nets (at all fixed stations)
- Perform CTD water column profile (at all fixed stations)
- Collect 3 benthic sediment grabs (at each odd-fixed, random, and drill stations) and sieve sediments for bivalves and other benthic biota
- Deploy and retrieve 10-minute clam dredge (at most stations) and collect appropriate biota
- Deploy/Retrieve amphipod traps (if applicable at station)

- Navigate to next station

4.4.2 Field Sampling Procedures

4.4.2.1 Equipment Decontamination

Equipment decontamination procedures were followed at all times during sampling activities. The double Van Veen Grab, used to collect the sediment samples, was decontaminated in between each sampling station, and always prior to the first sampling of each shift period. The Kynar-coated 2-cm scoop used to collect the sediment samples for contaminants analysis, plastic spoons used to homogenize and aliquot the sediment samples, and a Teflon siphon used to remove overlying water from the grab surface, were all decontaminated prior to any sampling activities and in between sampling stations. The decontamination procedure included a site-water rinse and physical removal of visible sediment debris, followed by a Liquinox™-water rinse and cleaning with scrub brushes, an additional site-water rinse, a distilled water rinse, and a wipe-down with acetone wipes. Plastic spoons were rinsed with reagent-grade ethanol, rather than wiped with acetone wipes. After decontamination, plastic spoons, the Kynar-coated 2-cm scoop, and the Teflon syringe were stored in clean plastic bags to avoid contamination prior to use. To assess potential sample contamination, customary QA/QC samples were collected from cleaned equipment and vessel sources, (e.g. water system, air, and lubricants). A summary of the QA/QC samples collected in this study are presented in Section 5 and Table 10.

4.4.3 Navigation

Station positions (latitude and longitude) are provided in Tables 1 though 8 and Appendix C (separated by sediment, clam dredge, zooplankton, and amphipod sample collections). Data presented in the tables include the station ID, the as-sampled vessel position coordinates (Latitude/Longitude, WGS84, decimal Degrees), and water depth (as sampled, not tide corrected) for the particular sample collection, and time and date of collection. Data presented in the database summary (Appendix C) include both the target station positions (latitude and longitude) and the actual station positions. Amphipod sample collection tables include the time

of trap deployment and retrieval in addition to the other information. Each "station" was defined as a 0.2 nm radius around the target station position. The actual latitude and longitude of the station were recorded from satellite transmissions using the global positioning system (GPS) when the station was successfully sampled. The coordinates presented in the summary tables represent the as-sampled latitude and longitude values for the location where the sample was collected. The latitude and longitude are those for the 1st benthic grab collected (out of a total of three collected) for ease of presentation and consistency.

4.4.4 Sediment Sampling

Surface sediment samples were collected using a modified double Van Veen grab sampler (Exponent SOP SD-04, referenced in the 2008 Field Survey Plan [Exponent 2008]). During the collection and handling of sediment samples from the grab sampler extreme care was taken throughout the subsampling process to avoid contact with metals and hydrocarbon sources. Samples were taken from the center of the grab and away from the sides of the grab. No metal spatulas were used for the collection of the trace metal (or hydrocarbon) samples. Rather, plastic or Kynar-coated scoops were used for sediment sampling. Clean gloves were worn during all sampling activities and the grab was protected during sampling and storage as much as possible from stack smoke, grease drips from winches and wires, and other potential airborne contamination.

Sediment samples were collected from the top 2 cm of the grab to represent recent accumulation. Upon retrieval of the grab back onto the vessel, the grabs were opened and the samples were checked for acceptability. If the grabs were over or underfilled and/or there was sign of sediment loss from the grab, and/or a thin layer of overlying water was not present, the grab was deemed unacceptable and was discarded. When this occurred, the site was resampled until an acceptable grab was obtained. In most cases, grabs were consistently acceptable, and the overlying water was gently siphoned off using a decontaminated Teflon syringe. The sediment sample was collected following removal of the overlying water. Unconsolidated sediment 2-cm deep was removed from the grab with a Kynar-coated scoop. The scoop was 2-cm deep to facilitate accurate depth collection of the sediment. The top 2 cm of sediment was collected by a series of several scoops from the portions of the sediment grab but not touching the sides of

the grab. The number of scoops collected was appropriate to fill a 500-mL pre-cleaned glass sample jar with a Teflon lined plastic lid. The sediment was then homogenized to consistent texture and color in the 500-mL sample jar, and approximately 250 mL was removed using a decontaminated plastic spoon and aliquoted into two 125-mL pre-cleaned glass sample jars with Teflon lined plastic lids. The sediment collection resulted in three sample containers for each station: one 500-mL jar containing approximately 200 to 250 mL of sediment for organics analysis, one 125-mL jar containing approximately 100 mL of sediment for metals and total organic carbon (TOC) analysis, and one 125-mL jar containing approximately 100 mL of sediment for grain size analysis. The sediment samples were stored either frozen (i.e., samples for organics, metals, and TOC analysis) or refrigerated (i.e., samples for grain size analysis), as indicated in the 2008 Field Survey Plan (Exponent 2008).

All sediment samples were surface sample collections, with the exception of the historic drill sites, where four to six 2-cm deep layers were collected to include both the unconsolidated upper 2-cm surface layer and the >2 cm, deeper, consolidated sediment layers.

The goal was to collect sediment samples with at least 20% fine materials (e.g., silt and clay). In all cases but one (i.e., KS003), the grab samples consisted primarily of fine grained sediments. At KS003, the grab sample contained primarily gravel and sand material with nominal fines present. Multiple grabs were attempted at this location to "search" for fine material; however, gravel-sized material was obtained for all attempts. All observations, notes, and details were documented in a field log book and in individual station logs for each site. Photographs of each grab from which a sediment sample was collected for chemical analysis were obtained and documented.

4.4.5 Biota Collections

Amphipod, bivalve, worm, crab, snail, sea cucumber, and zooplankton samples were collected for chemical analysis.

4.4.5.1 Amphipod Sampling

Amphipod traps were deployed at multiple stations. Amphipod collections were notably more successful in the Burger study area than in the Klondike study area (see Tables 4 through 8). Amphipods (*Anonyx* sp.) were collected by using Nytex mesh-lined plastic minnow traps baited with sardines. The traps were deployed for different durations of time, anywhere from approximately 2 hours to 32 hours, depending on the schedule of the vessel and the demands for transport from the other scientific groups on board. The amphipod traps were deployed with a long line anchor and a float with a flashing beacon. The sardine bait was placed in an enclosed Nytex mesh pouch to reduce the possibility of amphipods ingesting sardine tissue and to ensure that sardine particles do not become entrained with the amphipods. Upon trap retrieval, amphipods were removed from the traps, washed with site-seawater, and placed in a clean sieve for sorting. Representative photographs were taken of a few amphipod samples. Any non-*Anonyx* sp. amphipods and/or isopods were removed with clean forceps or by hand with clean gloves prior to transfer into the appropriate sample container. Effort was made to minimize any sediment particles entering the sample container with the amphipods.

4.4.5.2 Benthic Biota Sampling

Bivalve, worm, crab, snail, and sea cucumber samples were collected at multiple stations where they were found in large enough amounts to support chemical analysis. They were collected by both Van Veen grab and clam dredge. Sediment grabs were collected into large plastic buckets and sieved through a 2-cm stainless steel sieve using site-seawater pumped through a stainless steel pump. Biota collected in the 10-minute clam dredge drag were placed into a large plastic bucket, cleaned using site-seawater, and sorted into sample containers. The clam dredge consisted of a four-foot wide rake with approximately 2-inch long stainless steel prongs at two inch centers. A stiff polyethylene mesh net (~1 in. diameter holes) was attached to the rake to collect the dredge materials. Clams[1] (*Astarte* sp., and additional spp. to be determined [TBD]) were present in limited amounts in Klondike with greater success at Burger. Where found, clams were collected, rinsed with site-seawater, photographed, and placed in sample jars. Worms[1] (spp. TBD) were collected, removed by hand from any tubes and/or sediment, rinsed,

photographed, and placed in sample jars. Crabs[1] (spp. TBD) were collected solely from the clam dredges, photographed, rinsed, counted, and placed in sample jars.

4.4.5.3 Zooplankton Sampling

Zooplankton samples for contaminants analysis were collected at all odd numbered fixed station locations (except KF011, due to miscommunication at the first chemistry zooplankton site of the survey) using a bongo net for a 10-minute deployment. The Bongo net was deployed using oblique tow methods, moving down and then up vertically through the water column while being towed horizontally. Approximately 250 mL of zooplankton/seawater slurry was collected for each sample. Effort was made to remove large jellyfish from the zooplankton samples aliquoted for chemical analysis.

4.5 Handling of Samples

All sediment, biota, and quality control samples for chemical analysis were inventoried (in a field log book maintained by the Contaminants Program field personnel and on chain of custody [COC] forms) and stored in secure areas on the vessel immediately after collection. Inventory included counting all of the samples to ensure that all samples were collected and safely returned to the custody area on board, documenting all samples, and preparing a COC form. Sample ID's were cross-checked against the COC logs prior to packaging samples in coolers for shipment to the analytical laboratories. Sediment and biota samples for organics, metals, and TOC (sediment only) analysis were frozen immediately in on-board scientific freezers after collection to ensure their integrity and temperature. Sediment samples for grain size analysis were refrigerated in scientific incubators immediately after collection. The sediment samples remained either frozen or refrigerated (depending on the particular analysis) prior to and during transportation to the respective analytical laboratories. Sample integrity and custody was maintained at all times (Exponent SOP GEN-02 and GEN-03). Storage requirements for the different analytical samples types are presented in the 2008 Field Survey Plan (Exponent 2008).

[1] Specific species collected are in the process of being determined by University of Alaska – Fairbanks benthic taxonomists

Every effort was made to deliver the samples to the analytical laboratories in a timely manner that maintained sample temperatures below 4 to 6° C (i.e., Coolers containing samples were custody sealed and samples were shipped on blue ice by priority overnight shipment). Sediment samples for organics analysis were shipped to Battelle (Duxbury, MA). Sediment samples for metals, TOC, and grain size analysis were shipped to Florida Institute of Technology ([FIT] Melbourne, FL). All biota samples were shipped to Battelle for homogenizing and aliquoting. Aliquots will be sent to FIT for metals analysis by Battelle.

4.6 Shipping of Samples

At the end of the sampling efforts in each study area, the Contaminants Program samples were packed in coolers for priority overnight shipment to the two analytical laboratories. The samples remained on-board the M/V Bluefin until the completion of the entire field survey and until the vessel returned to port in Seward, AK. Samples were removed in the packaged coolers from the boat, palletized and shrink-wrapped, and stored in a secured freezer and refrigerator (depending on the particular chemical analysis) in Seward for approximately one month. The palletized coolers were then transported by truck from Seward to Anchorage, AK. Samples were then shipped from Anchorage, AK to the respective laboratories (i.e., Battelle and Florida Institute of Technology). All COC and custody procedures were followed and maintained throughout the collection, packaging, and shipping process. Fully executed COCs with receipt conditions reported by the laboratories are presented in Appendix D. The shipping carrier was Federal Express. Samples were shipped frozen (organics, metals, and TOC), or refrigerated (grain size) with frozen gel ice with two custody seals on the outside of each cooler and COC forms inside each cooler (as per Exponent SOP GEN-02 and -03). No hazardous materials were included in the shipping.

4.7 Summary of Samples Collected

A comprehensive summary of the type and number of samples collected at each station is presented in Appendix C. Station logs for sediment and biota sampling were completed for each station and are included in Appendix A, with field notes presented in Appendix B. A daily

logbook was maintained by the Contaminants field personnel, and by the Chief Scientist on the vessel to summarize the sampling activities completed and any health and safety issues.

4.7.1 Target Analytes of Interest

The analytes of interest for analysis in sediments, biota, and QA/QC samples are presented in Table 11. Organics include polycyclic aromatic hydrocarbons (PAHs) and petroleum biomarkers (sterane and triterpane), and saturated hydrocarbons. Twelve or thirteen individual metals are included, depending on whether sediment or biota are analyzed. Conventional parameters include TOC and grain size.

5 Quality Assurance/Quality Control (QA/QC)

Quality assurance/quality control (QA/QC) samples were collected as part of the sampling program to assess data quality. All field personnel (including boat crew members) were briefed on the potential for contamination and cross-contamination of samples and were given guidance on techniques to avoid such problems (e.g., cigarette smoking). This included the use of pre-cleaned sample containers; the use of clean sampling equipment; the use of the decontamination protocol described above; and good laboratory practices in general. It also included following specified sampling procedures and protocols in accordance with Exponent SOPs.

Several types of field quality control samples were collected during the survey, including equipment blanks, field blanks, and replicate (triplicate) samples. For both equipment blank and field blank samples, two subsets were collected, to be analyzed for both organics and metals, respectively. Field quality control procedures included the collection of equipment blanks. Equipment blanks were collected wherever sampling involved the use of collection equipment that came into direct contact with the sample (e.g., sampling spoons, scoops, modified Van Veen grab) during or following the collection of sediment chemistry samples. The equipment blank is representative of potential contamination associated with the equipment. To collect equipment blanks, the grab apparatus was first decontaminated according to the procedure outlined above. Then the inside of the bucket was rinsed with high-purity distilled water and the rinsate was collected directly into a clean, pre-labeled water sample container. The rinsate equipment blanks were stored frozen. For each set of equipment blank samples, two sets were collected, one for each set of analyses (i.e., organics and metals).

5.1 Replicate Samples

Triplicate sediment samples were collected at two sampling locations in each study area (i.e., two stations in Burger [BF005, BR032] and two stations in Klondike [KR019, KR045]) to assess the heterogeneity of the environment and sample collection reproducibility.

5.2 Equipment Blank Samples

Five equipment blank samples were collected throughout the cruise to assess any possible contamination that might have resulted from equipment contact with the sample. A distilled water rinse of a decontaminated plastic spoon and decontaminated 2-cm scoop were collected during sampling at each study area (KS002, BF013 and KF013, BF023, respectively), and a distilled water rinse of the decontaminated Van Veen grab was collected at KR008 mid-way through the field investigation.

5.3 Field Blank and Field Source Samples

A total of three field blank samples and three field source samples were collected during the field investigation to isolate any contamination from sample jars, site-seawater rinse (i.e., water pumps), and from potential source materials that might contain analytes of interest. The field blanks consisted of blank sample jars, a sample of site-seawater pumped through the hose system prior to installation of a stainless steel pump, and a sample of site-seawater pumped through the hose system following installation of the stainless steel pump. Field source samples were collected using pre-baked GFB Whatman filters and were collected from two different source possibilities including a sheave used for the winch-operation of the Van Veen grab and two 55-gallon oil drums containing Chevron Rykon oil and Chevron Clarity Hydraulic Oil AW. A third field source wipe was collected by placing two GFB filters (one in each side of the double Van Veen grab) inside the Van Veen for approximately 10 hours. The field source samples and station locations for where they were each collected are presented in Table 10.

6 Safety Considerations

All field personnel associated with the Contaminants Program sample collection (i.e., Exponent and Battelle staff) were 40-hr HAZWOPER (Hazardous Waste Operations) certified, which conforms to federal (Occupational Safety and Health Administration [OSHA]) regulations. Additionally, all field staff completed the training required by CPAI, which included a Cold Water Survival Training Course conducted by the North Pacific Fishing Vessel Owners' Association (NPFVOA), and a physical compliant with Merchant Marine Medical requirements.

All personnel adhered to health and safety precautions promulgated onboard the vessel, which included the following specific safety requirements:

- Learning the location of all fire equipment, life rings, life preservers, survival suits, and life boats and knowing the proper use of all safety equipment.
- Participation in daily safety meetings and in weekly drills while on-board the M/V Bluefin.
- In the event of an emergency, knowing each specific individual's duties.
- Not smoking in bunks.
- No open-toed shoes or sandals when working on the operations deck; Steel-toed Xtra-Tuff boots were worn at all times on the back deck.
- No equipment was deployed over the side of the vessel without permission from the captain. All gear was aboard and secured before moving between stations.
- The buddy-system was used when working on deck. During rough weather, individuals did not enter the back deck area, unless absolutely necessary, and always let others know their whereabouts.

Field procedures required the use of several hazardous chemicals, which included ethanol and acetone wipes. Field personnel avoided direct contact with all chemicals and avoided breathing any fumes by working in open areas or fume hoods, wherever possible, and wearing gloves when using solvents. Material Safety Data Sheets (MSDSs) were available on the vessel for each hazardous material on board. In general, the following guidelines were followed whenever chemicals were handled:

- Protective clothing and gloves were worn (e.g., nitrile gloves).
- Safety glasses were worn, where applicable.
- Work was performed in a well-ventilated area (typically on the open amidship deck of the vessel).
- Chemicals were stored securely in fume hoods or appropriate chemical storage cabinets on-board, away from living quarters and heat and ignition sources.

Waste solvents were collected in appropriate containers and were either combusted on-board the vessel in approved burn barrels, or were removed at the completion of the cruise and disposed of appropriately.

6.1 Personal Protection

Each member associated with the research used appropriate personal protection equipment at all times during the field collection portions of the survey (i.e., while working on the back-deck of the vessel). Full Mustang suits, steel-toed boots, and hard hats were worn during all field operation activities on the back-deck, which included launching or retrieving traps, dredges, and the Van Veen grab. Life lines were attached to staff deploying and retrieving equipment when the Baltic door was open. Survival suits were available on the vessel for all personnel.

6.2 Shipboard Policies

Prior to sailing, the ship's captain met with all scientific personnel to discuss safety procedures and the scientific work to be performed. Information on chemicals to be used during the cruise, equipment to be deployed, and other daily activities associated with the research were presented to the captain and project managers to provide as much information as possible prior to the commencement of the cruise, and the ensure the safety of all members on-board the vessel. Daily safety meetings were held prior to the commencement of any work on the back-deck of the vessel, and guidelines for safety were established and reviewed on a daily basis.

7 References

Exponent. 2008. Field Survey Plan: Contaminants Study for the ConocoPhillips Alaska, Inc., 2008 Environmental Studies Program in the Chukchi Sea. Prepared for ConocoPhillips Alaska, Inc., Anchorage, AK by Exponent, Inc. 3 Clock Tower Place, Maynard, MA.

Figures

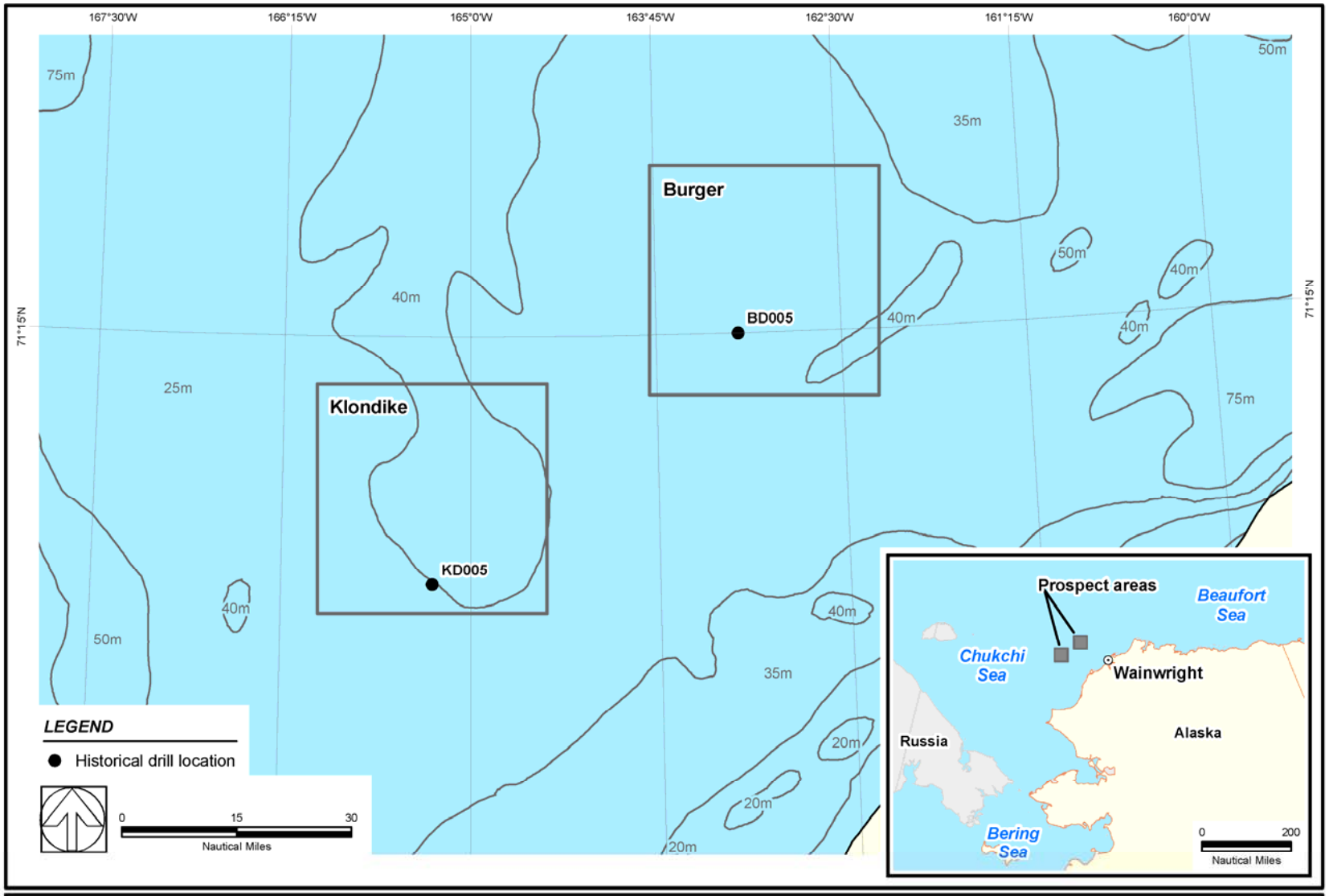

Figure 1. Locations of the two prospect areas (Burger and Klondike) relative to the Chukchi Sea

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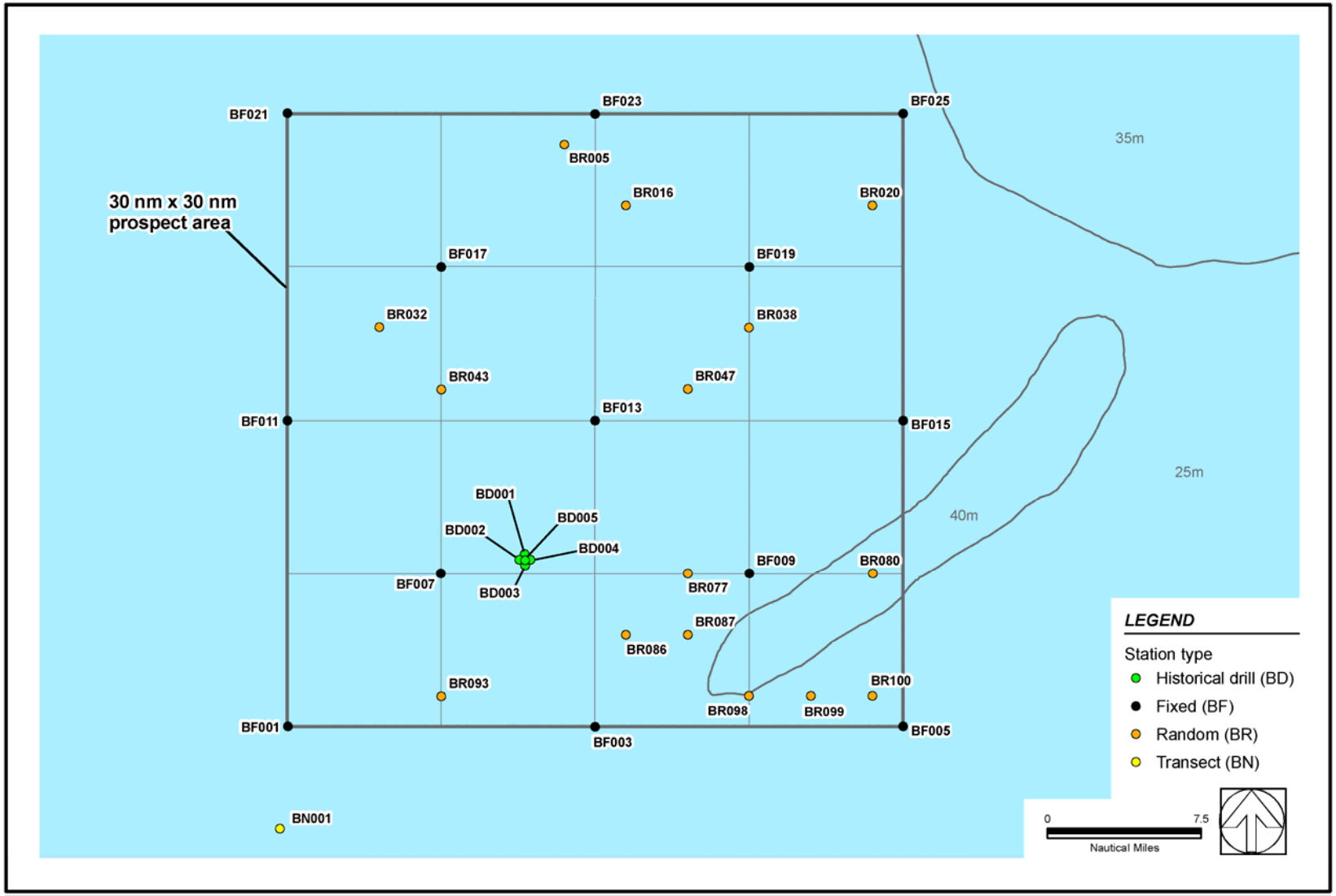

Figure 2. Contaminants program sampling station locations in Burger

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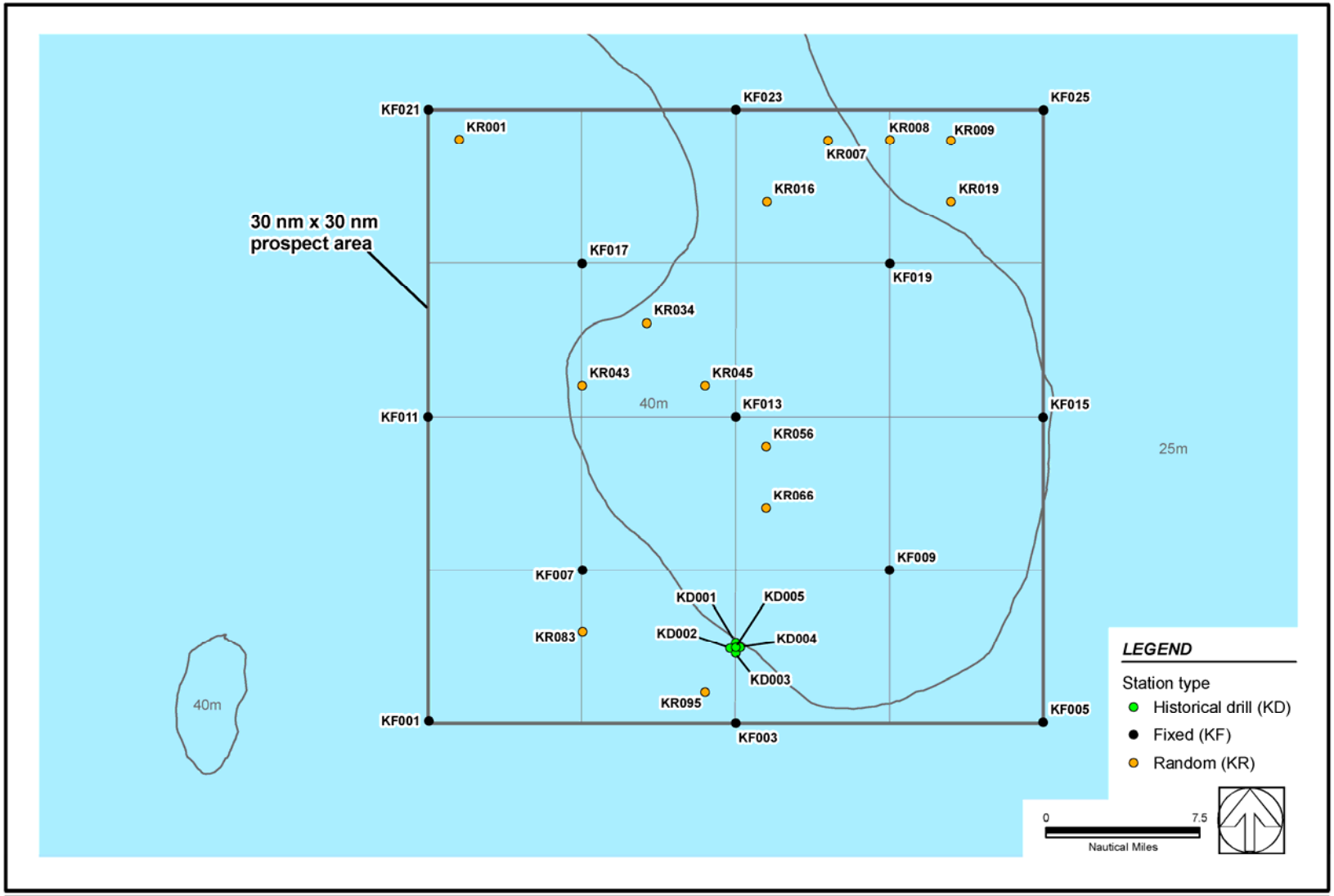

Figure 3. Contaminants program sampling station locations in Klondike

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Tables

Table 1. Klondike sediment and biota station locations, water depth, time, and date of sample collection.

Station	Latitude (N)	Longitude (W)	Water Depth	Time	Date
Fixed (13)					
KF001	70.6480643	166.0016638	39.9	7:30:46	8/21/2008
KF003	70.6489090	165.2512844	39.7	5:01:06	8/29/2008
KF005	70.6489148	164.5013230	44.5	7:38:47	8/31/2008
KF007	70.7723082	165.6298009	38.6	4:02:04	8/22/2008
KF009	70.7732335	164.8752738	36.9	0:45:17	8/24/2008
KF011	70.8950757	166.0157329	39.2	0:40:23	8/21/2008
KF013	70.8977667	165.2551004	38.9	3:14:58	8/23/2008
KF015	70.8967595	164.4948166	35.6	3:31:04	8/31/2008
KF017	71.0212530	165.6388596	40.6	1:26:24	8/30/2008
KF019	71.0224134	164.8729733	32.8	6:28:44	8/28/2008
KF021	71.1442261	166.0274483	40.7	3:41:32	8/27/2008
KF023	71.1467926	165.2578500	41.7	10:11:33	8/27/2008
KF025	71.1461652	164.4873400	40.0	23:39:39	8/27/2008
Primary Random (13)					
KR001	71.1195652	165.9496602	40.4	23:30:18	8/26/2008
KR007	71.1218525	165.0276195	41.7	6:46:28	8/30/2008
KR008	71.1220683	164.8724261	38.6	8:14:36	8/30/2008
KR009	71.1215329	164.7194506	38.6	21:22:48	8/30/2008
KR016	71.0722775	165.1794203	40.0	5:07:14	8/30/2008
KR019	71.0721415	164.7198491	40.9	23:03:46	8/30/2008
KR034	70.9730045	165.4769906	39.4	6:01:27	8/23/2008
KR043	70.9216952	165.6362323	39.7	7:57:55	8/22/2008
KR045	70.9223692	165.3312461	38.9	4:31:25	8/23/2008
KR056	70.8732133	165.1797062	38.6	0:04:37	8/23/2008
KR066	70.8234089	165.1788367	39.3	22:32:14	8/22/2008
KR083	70.7224160	165.6285269	39.4	0:19:40	8/22/2008
KR095	70.6738255	165.3274395	40.6	1:50:59	8/29/2008
Historic Drill (5)					
KD001	70.7145128	165.2530791	39.9	0:14:26	9/1/2008
KD002	70.7098289	165.2666621	40.2	1:29:41	9/1/2008
KD003	70.7057730	165.2520409	39.7	6:14:38	9/1/2008
KD004	70.7103043	165.2412624	39.8	4:23:44	9/1/2008
KD005	70.7105223	165.2529609	40.0	3:00:02	9/1/2008

Table 2. Klondike clam dredge station locations, water depth, time, and date of sample collection.

Station		Latitude (N)	Longitude (W)	Water Depth	Time	Date
Fixed						
	KF003	70.6483781	165.2497149	39.9	5:59:35	8/29/2008
	KF005	70.6485725	164.4980015	43.8	8:24:31	8/31/2008
	KF017	71.0202319	165.6379108	40.4	2:11:20	8/30/2008
	KF019	71.0220248	164.8738236	32.8	7:13:21	8/28/2008
	KF021	71.1454656	166.0258849	40.4	5:15:32	8/27/2008
	KF023	71.1460283	165.2578150	41.6	11:06:25	8/27/2008
	KF025	71.1459552	164.4894219	40.0	0:35:16	8/28/2008
Primary Random						
	KR001	71.1201890	165.9487082	40.5	1:05:20	8/27/2008
	KR007	71.1220654	165.0283755	41.7	7:26:29	8/30/2008
	KR008	71.1221009	164.8721640	38.6	9:02:15	8/30/2008
	KR009	71.1218612	164.7184470	38.9	22:14:23	8/30/2008
	KR016	71.0731920	165.1779978	40.0	5:49:13	8/30/2008
	KR019	71.0724036	164.7217358	41.0	0:02:01	8/31/2008
	KR095	70.6746917	165.3265815	40.3	3:01:10	8/29/2008
Historic Drill						
	KD001	70.7146711	165.2526017	40.0	0:59:02	9/1/2008
	KD002	70.7096030	165.2722630	40.0	2:27:04	9/1/2008
	KD003	70.7059143	165.2557399	39.8	7:02:53	9/1/2008
	KD004	70.7099915	165.2411146	39.8	5:15:37	9/1/2008
	KD005	70.7103655	165.2556322	40.0	3:56:20	9/1/2008

Note: Locations and time represent when dredge was deployed (approximately 10 minute dredge)

Table 3. Klondike zooplankton station locations, water depth, time, and date of sample collection.

Station		Latitude (N)	Longitude (W)	Water Depth	Time	Date
Fixed						
	KF001	70.6478289	166.0027359	40.0	6:49:09	8/21/2008
	KF003	70.6518565	165.2534553	40.1	3:56:45	8/29/2008
	KF005	70.6497914	164.5215867	43.9	6:31:13	8/31/2008
	KF007	70.7756799	165.6368753	38.1	6:15:50	8/22/2008
	KF009	70.7756337	164.8947224	37.4	23:13:57	8/23/2008
	KF013	70.9036055	165.2470138	38.8	1:47:35	8/23/2008
	KF015	70.8945401	164.5003194	36.0	2:27:17	8/31/2008
	KF017	71.0267963	165.6490731	40.4	0:25:44	8/30/2008
	KF019	71.0223765	164.8567631	32.5	5:28:24	8/28/2008
	KF021	71.1444398	166.0368693	40.7	2:28:40	8/27/2008
	KF023	71.1417524	165.2685276	41.4	9:22:13	8/27/2008
	KF025	71.1396540	164.4940481	40.0	22:38:20	8/27/2008

Note: Approximately 10 minute bongos; locations and times represent beginning of collection

Table 4. Klondike amphipod station locations, water depth, trap deployment and retrieval time, and date of sample collection.

Station		Latitude (N)	Longitude (W)	Water Depth	Time (Deployed)	Time (Retrieved)	Date[a]
Fixed							
	KF001[b,c]	70.6480643	166.0016638	39.9	11:27:00	6:00:00	8/21/2008
	KF007[d]	70.7718119	165.6303441	38.4	17:47:00	Unrecovered	8/21/2008
	KF011[b]	70.8950757	166.0157329	39.2	14:06:00	23:30:00	8/20/2008
	KF021[b]	71.1442261	166.0274483	40.7	18:47:00	3:40:00	8/27/2008
Primary Random							
	KR001[b]	71.1195652	165.9496602	40.4	14:16:00	23:11:00	8/27/2008
	KR043	70.9220445	165.6353262	39.4	19:18:00	8:45:00	8/22/2008
	KR083	70.7213430	165.6299419	39.7	16:55:00	23:50:00	8/22/2008

[a] Date represents retrieval date (not deployment date).

[b] Actual coordinates not available; lat/long listed are for actual grab station locations .

[c] Only deployed trap that contained enough amphipod sample for collection and analysis.

[d] Amphipod trap not recovered (lost in fog).

Table 5. Burger sediment and biota station locations, water depth, time, and date of sample collection.

Station		Latitude (N)	Longitude (W)	Water Depth	Time	Date
Fixed						
	BF001	71.1201942	163.8027983	39.8	8:20:40	9/16/2008
	BF003	71.1131997	163.0356872	42.5	2:56:39	9/2/2008
	BF005	71.1037243	162.2668396	44.2	2:16:30	9/20/2008
	BF007	71.2417196	163.4105993	42.4	2:18:47	9/16/2008
	BF009	71.2335010	162.6355409	43.6	7:53:54	9/20/2008
	BF011	71.3688929	163.7882039	42.5	23:28:42	9/13/2008
	BF013	71.3624968	163.0096744	43.5	23:14:37	9/16/2008
	BF015	71.3525543	162.2319418	42.8	8:12:11	9/19/2008
	BF017	71.4904363	163.3887800	39.9	23:16:46	9/12/2008
	BF019	71.4821244	162.6045131	41.4	1:15:27	9/19/2008
	BF021	71.6183140	163.7719583	38.8	4:46:09	9/13/2008
	BF023	71.6111934	162.9834605	39.9	23:48:00	9/17/2008
	BF025	71.6013829	162.1950585	42.1	6:47:59	9/18/2008
Primary Random						
	BR005	71.5871730	163.0650440	39.3	1:31:45	9/21/2008
	BR016	71.5358307	162.9134282	39.3	2:11:20	9/18/2008
	BR020	71.5281210	162.2853232	41.8	3:32:22	9/19/2008
	BR032	71.4426865	163.5498556	40.0	5:07:25	9/14/2008
	BR038	71.4326950	162.6113303	42.2	21:51:20	9/18/2008
	BR043	71.3910771	163.3969895	41.8	1:45:51	9/14/2008
	BR047	71.3849179	162.7728695	44.7	2:47:54	9/17/2008
	BR077	71.2353055	162.7901573	42.8	9:33:26	9/20/2008
	BR080	71.2292733	162.3257234	43.3	21:12:09	9/19/2008
	BR086	71.1872831	162.9505039	42.6	23:18:24	9/1/2008
	BR093	71.1416705	163.4172921	42.1	5:08:08	9/2/2008
	BR098	71.1339572	162.6480368	42.2	23:48:30	9/2/2008
	BR099	71.1320500	162.4937076	42.6	4:46:07	9/3/2008
Secondary Random						
	BR087	71.1854894	162.7957737	43.1	21:44:09	9/2/2008
	BR100	71.1299244	162.3393385	42.5	2:51:39	9/3/2008
Historic Drill						
	BD001	71.2554425	163.1977782	43.3	5:19:40	9/21/2008
	BD002	71.2510693	163.2119512	43.4	22:54:21	9/15/2008
	BD003	71.2462715	163.1981950	42.7	6:38:52	9/21/2008
	BD004	71.2506038	163.1841944	42.3	8:15:04	9/21/2008
	BD005	71.2506231	163.1976270	42.3	21:49:45	9/15/2008
New Stations						
	BN001	71.0374535	163.8270314	40.7	4:45:44	9/4/2008

Table 6. Burger clam dredge station locations, water depth, time, and date of sample collection.

Station	Latitude (N)	Longitude (W)	Water Depth	Time	Date
Fixed					
BF001	71.1200092	163.8022200	40.2	9:14:22	9/16/2008
BF003	71.1137442	163.0342009	42.6	3:43:52	9/2/2008
BF005	71.1039880	162.2659735	45.0	3:07:39	9/20/2008
BF007	71.2417670	163.4097535	42.6	3:00:12	9/16/2008
BF009	71.2333221	162.6333665	43.4	8:32:00	9/20/2008
BF011	71.3684882	163.7859121	42.7	0:24:41	9/14/2008
BF013	71.3628950	163.0065701	43.4	0:03:25	9/17/2008
BF015	71.3534330	162.2309720	42.2	8:51:31	9/19/2008
BF017	71.4910509	163.3849320	40.0	0:12:00	9/13/2008
BF019	71.4830962	162.6037786	41.1	2:04:08	9/19/2008
BF021	71.6181505	163.7715511	38.9	5:44:02	9/13/2008
BF023	71.6099362	162.9886123	40.1	0:43:46	9/18/2008
BF025	71.6006213	162.1978559	42.1	7:37:11	9/18/2008
Primary Random					
BR005	71.5874785	163.0627847	39.3	2:12:33	9/21/2008
BR016	71.5358813	162.9111934	39.4	3:02:07	9/18/2008
BR032	71.4422792	163.5540856	40.3	6:06:18	9/14/2008
BR038	71.4338478	162.6104517	43.2	22:55:09	9/18/2008
BR043	71.3913961	163.3968173	41.5	2:31:32	9/14/2008
BR047	71.3851173	162.7715846	44.1	3:30:54	9/17/2008
BR077	71.2354323	162.7876354	43.9	10:09:50	9/20/2008
BR080	71.2291985	162.3211967	43.3	22:03:13	9/19/2008
BR086	71.1867002	162.9500761	43.0	0:20:43	9/2/2008
BR093	71.1407463	163.4199248	42.1	5:53:42	9/2/2008
BR098	71.1348445	162.6466320	41.9	0:55:55	9/3/2008
BR099	71.1309400	162.4943747	42.5	5:31:27	9/3/2008
Secondary Random					
BR087	71.1856018	162.7952645	43.1	22:46:36	9/2/2008
BR100	71.1307020	162.3455655	42.8	3:40:10	9/3/2008
Historic Drill					
BD001	71.2554155	163.2003747	42.8	6:04:06	9/21/2008
BD002	71.2511540	163.2124228	43.3	9:49:44	9/21/2008
BD003	71.2466215	163.2037477	43.1	7:30:17	9/21/2008
BD004	71.2510587	163.1835488	43.0	9:09:16	9/21/2008
New Stations					
BN001	71.0375702	163.8282812	40.7	5:43:12	9/4/2008

Table 7. Burger zooplankton station locations, water depth, time, and date of sample collection.

Station		Latitude (N)	Longitude (W)	Water Depth	Time	Date
Fixed						
	BF001	71.1208672	163.8086556	39.8	7:23:10	9/16/2008
	BF003	71.1143801	163.0227403	42.6	1:50:49	9/2/2008
	BF005	71.0979628	162.2816968	45.2	1:15:50	9/20/2008
	BF007	71.2430670	163.4208910	42.5	0:58:38	9/16/2008
	BF009	71.2340947	162.6178023	42.9	7:18:10	9/20/2008
	BF011	71.3680467	163.8055062	43.2	22:26:34	9/13/2008
	BF013	71.3542658	163.0209826	43.5	22:12:50	9/16/2008
	BF015	71.3529167	162.2171514	42.4	7:34:38	9/19/2008
	BF017	71.4835841	163.3848891	40.0	22:06:00	9/12/2008
	BF019	71.4802845	162.6057375	41.3	0:04:48	9/19/2008
	BF021	71.6254386	163.7662797	38.3	4:13:20	9/13/2008
	BF023	71.6067658	162.9919102	39.9	22:34:49	9/17/2008
	BF025	71.5980157	162.2100113	40.2	5:36:27	9/18/2008
New Stations						
	BN001	71.0356095	163.8389675	40.2	3:27:11	9/4/2008

Table 8. Burger amphipod station locations, water depth, trap deployment and retrieval time, and date of sample collection.

Station	Latitude (N)	Longitude (W)	Water Depth	Time (Deployed)	Time (Retrieved)	Date[a]
Fixed						
BF011	71.36900063 N	163.7876709 W	42.5	0:19:00	7:25:00	9/14/2008
BF013	71.36266783 N	163.00928653 W	43.4	23:59:00	9:15:00	9/17/2008
BF017	71.49051768 N	163.38582213 W	40	0:05:00	8:50:00	9/13/2008
BF021	71.61898503 N	163.78275203 W	38.9	5:36:00	19:08:00	9/13/2008
BF023	71.61221572 N	162.97355435 W	39.7	21:44:08	1:00:00	9/18/2008
Primary Random						
BR038	71.432393 N	162.61089471 W	43.2	22:48:00	10:15:00	9/18/2008
BR080	71.22975848 N	162.32632616 W	43.5	22:00:00	11:40:00	9/20/2008
BR099	71.13158112 N	162.49406838 W	42.5	2:17:00	4:30:00	9/3/2008
Secondary Random						
BS002	71.22863853 N	163.12123122 W	43.6	23:04:00	10:00:00	9/15/2008
Historic Drill						
BD002	71.25073583 N	163.21264783 W	42.9	5:04:17		9/21/2008
BD004	71.25067133 N	163.1833495 W	43.2	5:04:00	9:47:00	9/21/2008
BD005	71.2512765 N	163.19911023 W	43	0:20:00	10:40:00	9/15/2008

[a] Date represents retrieval date (not deployment date).

Table 9. Sample Identification Nomenclature

Field	Possible Input Options
Year	08 (study year 2008)
Survey	03 (Contaminants Program Cruise)
Site Code	KF_ _ _ ; KR_ _ _; KS_ _ _; KD_ _ _
	BF_ _ _; BR_ _ _; BS_ _ _; BD_ _ _
	K=Klondike, B=Burger, F=Fixed, R=Random, D=Drill (e.g., KF021, BD001)
Replicate	01, 03 (03 = triplicate)
Sample Type	SC=sediment chemistry, AC=amphipod chemistry, BC=bivalve chemistry, ZC=zooplankton chemistry, WC=worm chemistry, CC=crab chemistry, HC=holuthroid chemistry, SnC=snail chemistry, FB=field blank, FS=field source, EB=equipment blank

Table 10. QA/QC samples collected during 2008 field investigations.

QA/QC Parameter	Station	Details
Equipment Blanks	KS002	DI rinse of decontaminated plastic sampling spoon
	KR008	DI rinse of decontaminated Van Veen grab
	KF013	DI rinse of decontaminated 2-cm sampling scoop
	BF013	DI rinse of decontaminated plastic sampling spoon
	BF023	DI rinse of decontaminated 2-cm sampling scoop
Field Blanks	KF003	water from seawater hose pumped by stainless pump
	KF021	water from seawater hose prior to installation of stainless pump
	KF023	blank sample jars (opened during sample collection)
Field Triplicates	KR019	sediment and biota triplicate samples
	KR045	sediment triplicate samples
	BF005	sediment triplicate samples
	BR032	sediment triplicate samples
Field Source Samples	KF003	Pre-baked GFB wipe of sheave used for Van Veen grab
	KF019	Pre-baked GFB wipe of 2x 55-gal oil drums stored on back deck
	KR008	Pre-baked GFB wipes stored for 10-hr inside Van Veen grab

Table 11. List of target analytes for analysis in sediment and biota samples (PAHs)

Compound	Reporting Code	SIS/RIS	Compound	Reporting Code	SIS/RIS
Naphthalene	C0N	A/1	Continued		
C1-Naphthalenes	C1N	A/2	Benzo[a]anthracene	BAA	B/3
C_2-Naphthalenes	C2N	A/2	Chrysene	C0C	B/3
C_3-Naphthalenes	C3N	A/2	C_1-Chrysenes	C1C	B/3
C_4-Naphthalenes	C4N	A/2	C_2-Chrysenes	C2C	B/3
Acenaphthylene	ACEY	A/2	C_3-Chrysenes	C3C	B/3
Acenaphthene	ACE	A/2	C_4-Chrysenes	C4C	B/3
Biphenyl	BIP	A/2	Benzo[b]fluoranthene	BBF	B/4
Dibenzofuran	DBF	A/2	Benzo[k]fluoranthene	BKF	B/4
Fluorene	C0F	A/2	Benzo[e]pyrene	BEP	B/4
C_1-Fluorenes	C1F	A/2	Benzo[a]pyrene	BAP	B/4
C_2-Fluorenes	C2F	A/2	Perylene	PER	B/4
C_3-Fluorenes	C3F	A/2	Indeno[1,2,3-c,d]pyrene	IND	B/4
Anthracene	C0A	A/3	Dibenzo[a,h]anthracene	DAH	B/4
Phenanthrene	C0P	A/3	Benzo[g,h,i]perylene	BGP	B/4
C_1-Phenanthrenes/Anthracenes	C1P/A	A/3			
C_2-Phenanthrenes/Anthracenes	C2P/A	A/3			
C_3-Phenanthrenes/Anthracenes	C3P/A	A/3			
C_4-Phenanthrenes/Anthracenes	C4P/A	A/3			
Retene	RET	A/3			
Dibenzothiophene	C0D	A/3			
C_1-Dibenzothiophenes	C1D	A/3	<u>Surrogate Compounds</u>		
C_2-Dibenzothiophenes	C2D	A/3	Naphthalene-d_8	D8N	A/1
C_3-Dibenzothiophenes	C3D	A/3	Acenaphthene-d_{10}	D10ACE	A/2
C_4-Dibenzothiophenes	C4D	A/3	Phenanthrene-d_{10}	D10PH	A/3
Fluoranthene	FLANT	A/3	Benzo(a)pyrene-d_{12}	D12BAP	B/4
Pyrene	PYR	A/3			
C_1-Fluoranthenes/Pyrenes	C1F/P	A/3	<u>Recovery Internal Standard</u>		
C_2-Fluoranthenes/Pyrenes	C2F/P	A/3	Acenapthylene-d_8	D8ACEY	A
C_3-Fluoranthenes/Pyrenes	C3F/P	A/3	Chrysene-d_{12}	D12C	B

Table 11 Cont'd. List of target analytes for analysis in sediment and biota samples (Steranes and triterpanes)

Compound	Reporting Code	SIS/RIS
C_{23} Diterpane	T4	A/1
13β,17α-diacholestane(20S)	S4	A/1
13β,17α-diacholestane(20R)	S5	A/1
C_{29} Tricyclictriterpane	T9	A/1
C_{29} Tricyclictriterpane	T10	A/1
5α,14α,17α-cholestane(20R) [a]	S17	A/1
18α(H)-22,29,30-trisnorhopane(TS)	T11	A/1
17α(H)-22,29,30-trisnorhopane(TM)	T12	A/1
5α,14α,17α,24-methylcholestane(20R)	S24	A/1
5α,14α,17α,24-ethylcholestane(20S)	S25	A/1
5α,14α,17α,24-ethylcholestane(20R)	S28	A/1
17α(H),21β(H)-30-norhopane	T15	A/1
18α(H)-oleanane	T18	A/1
17α(H),21β(H)-hopane	T19	A/1
22S-17α(H),21β(H)-30-homohopane	T21	A/1
22R-17α(H),21β(H)-30-homohopane	T22	A/1
17β(H),21β(H)-hopane [a]	T23	A/1
Surrogate Compounds		
5β(H)-cholane	5B	2
Recovery Internal Standards		
Chrysene-d_{12}	D12C	A

Table 11 Cont'd. List of target analytes for analysis in sediment and biota samples (Saturated hydrocarbons)

Compound	Reporting Code	SIS/RIS	Compound	Reporting Code	SIS/RIS
n-Octane (optional)	C8	A/1	Continued		
n-Nonane	C9	A/1	n-Heptacosane	C27	A/1
n-Decane	C10	A/1	n-Octacosane	C28	A/1
n-Undecane	C11	A/1	n-Nonacosane	C29	A/1
n-Dodecane	C12	A/1	n-Triacontane	C30	A/1
n-Tridecane	C13	A/1	n-Hentriacontane	C31	A/1
Isoprenoid RRT 1380	1380	A/1	n-Dotriacontane	C32	A/1
n-Tetradecane	C14	A/1	n-Tritriacontane	C33	A/1
Isoprenoid RRT 1470	1470	A/1	n-Tetratriacontane	C34	A/1
n-Pentadecane	C15	A/1	n-Pentatriacontane	C35	A/1
Isoprenoid RRT 1650	1650	A/1	n-Hexatriacontane	C36	A/1
n-Hexadecane	C16	A/1	n-Heptatriacontane	C37	A/1
n-Heptadecane	C17	A/1	n-Octatriacontane	C38	A/1
Pristane	PRIS	A/1	n-Nonatriacontane	C39	A/1
n-Octadecane	C18	A/1	n-Tetracontane	C40	A/1
Phytane	PHYT	A/1	Total Saturated HCs	TSHC	A/1
n-Nonadecane	C19	A/1			
n-Eicosane	C20	A/1			
n-Heneicosane	C21	A/1	<u>Surrogate Compounds</u>		
n-Docosane	C22	A/1	Tetracosane-d_{50}	D50T	A/1
n-Tricosane	C23	A/1	5a-Androstane	5AA	B/1
n-Tetracosane	C24	A/1			
n-Pentacosane	C25	A/1	<u>Recovery Internal Standard</u>		
n-Hexacosane	C26	A/1	Eicosane-d_{42}	D42E	1

Table 11 Cont'd. List of target analytes for analysis in sediment samples (Metals)

Metal	Method	MDLs (µg metal/g dry sediment)
Ag – silver	ZGFAAS	0.01
Al – aluminum	FAAS	10
As – arsenic	ZGFAAS	0.2
Ba – barium	ICP-MS	1
Cd – cadmium	ICP-MS	0.02
Cr – chromium	FAAS	1
Cu – copper	FAAS	2
Fe – iron	FAAS	10
Hg – mercury	CVAAS	0.001
Mn – manganese	FAAS	3
Pb – lead	ICP-MS	0.2
Se – selenium	ICP-MS	0.04
Zn – zinc	FAAS	2
Other Parameters		
Grain Size	Sieve and Pipet	---
TOC	Shimadzu Carbon System	0.1%
TOM and carbonate	Muffle Furnace	0.1%

CVAAS = Cold Vapor Atomic Absorption Spectrometry
FAAS = Flame Atomic Absorption Spectrometry
GFAAS = Graphite Furnace Atomic Absorption Spectrometry
ZGFAAS = Zeeman Graphite Furnace Atomic Absorption Spectrometry
ICP/MS = Inductively Coupled Plasma/Mass Spectrometry
MDL = Method Detection Limit

Table 11 Cont'd. List of target analytes for analysis in biota samples (Metals)

	Biological Tissue	
Metal	Method	MDLs (µg metal/g tissue dry weight)
Ag – silver	ZGFAAS	0.004
As – arsenic	ZGFAAS	0.03
Ba – barium	ICP-MS	0.01
Cd – cadmium	ICP-MS	0.001
Cr – chromium	FAAS	0.01
Cu – copper	FAAS	0.7
Fe – iron	FAAS	2.5
Hg – mercury	CVAAS	0.001
Mn – manganese	FAAS	1.1
Pb – lead	ICP-MS	0.003
Se – selenium	ICP-MS	0.03
Zn – zinc	FAAS	0.4

Appendix A

Field Station Logs for Klondike and Burger Sampling
(Included on attached CD)

Appendix B

Field Notes
(Included on attached CD)

Appendix C

Field Database and Contaminants Sample Summaries

(Included on attached CD)

Appendix D

Fully Executed Chain of Custody (COC) Forms
(Included on attached CD)

Appendix E

Photo Documentation of Sediment Grabs, Clam Dredges, and Biota

(Included on attached CD)