FINAL CRUISE INSTRUCTIONS
FOCI

R/V *THOMAS G. THOMPSON*
April 24 – June 3, 2005
Chief Scientist, Leg 1 – Dr. Nancy B. Kachel, PMEL/NOAA
Chief Scientist, Leg 2 – Russell Hopcroft, University of Alaska, Fairbanks
Chief Scientist, Leg 3 – Sigrid A. Salo, PMEL/NOAA

1.0 FINAL CRUISE INSTRUCTIONS

1.1 Cruise Title – Fisheries-Oceanography Coordinated Investigations (FOCI).

1.2 Cruise Numbers

1.2.1 Cruise Number – TN-179

1.2.2 FOCI Numbers

1.2.2.1 Cruise TN-179 Leg 1 – 1TT05

1.2.2.2 Cruise TN-179 Leg 2 – University of Alaska, Fairbanks.

1.2.2.3 Cruise TN-179 Leg 3 – 2TT05

1.3 Cruise Dates

1.3.1 Cruise TN-179 Leg 1

1.3.1.1 Departure – Depart Seattle, Washington, at 0900 PST on Tuesday, April 26, 2005.

1.3.1.2 Touch-and-Go –Disembark all Leg 1 scientists, and embark UAF scientists in Seward, Alaska, at ~0900 on Sunday, May 8, 2005, for Leg 2. It is planned for a fishing boat to bring personnel and equipment to the ship for the exchange.

1.3.2 Cruise TN-179 Leg 3

1.3.2.1 Touch-n-Go – Seward, Alaska, to disembark UAF scientists from Leg 2 and embark PMEL scientists at ~1100 AST on Thursday, May 12, 2005. It is planned for a fishing boat to bring personnel and equipment to the ship for the exchange.

1.3.2.2 Touch-and-Go – Dutch Harbor, Alaska, to disembark all scientists at 1400 AST on Saturday, May 28, 2005.

1.3.3 **Arrival** – Arrive in Seattle, Washington, University of Washington, at 2000 PST on Friday, June 3, 2005.

1.3.4 **Demobilize** – Seattle, Washington, University of Washington, at 0800 PST on Saturday, June 4, 2005.

1.4 **Operating Areas**

1.4.1 **Cruise TN-179 Leg 1** – Gulf of Alaska.

1.4.2 **Cruise TN-179 Leg 2** – Gulf of Alaska.

1.4.3 **Cruise TN-179 Leg 3** – Eastern Bering Sea shelf.

2.0 **CRUISE OVERVIEW –** These instructions pertain to Leg 1 and Leg 3 of Cruise TN-179. Leg 2 is the responsibility of the University of Alaska, Fairbanks.

2.1 **Cruise Objectives** – Fisheries-Oceanography Coordinated Investigations (FOCI) is an effort by National Oceanic and Atmospheric Administration (NOAA) and associated academic scientists. FOCI's goal is to understand the effects of abiotic and biotic variability on ecosystems of the North Pacific Ocean and Bering Sea in order to discern the physical and biological processes that determine recruitment variability of commercially valuable finfish and shellfish stocks in Alaskan waters. Leg 1 and Leg 2 of the cruise are in support of research sponsored by North Pacific Research Board, Alaskan Ocean Observatory System, Steller Sea Lion Research Programs, and PMEL/FOCI base.

Leg 1 of the cruise will be in the Gulf of Alaska with the objective of sampling (CTD, Bongos, nutrients, heavy metals) in two deep mesoscale eddies that formed off the continental shelves of British Columbia, Canada, and Southeast Alaska during the winter of 2005, and then move westward across the Gulf of Alaska during the next two to three years.

Leg 3 of this cruise will be in the Bering Sea, where we plan to occupy three major transects involving Conductivity, Temperature, and Depth (CTD) profiler casts and Marine Assessment, Monitoring, and Prediction (MARMAP) Bongo tows. If ice has prevented operations during an earlier FOCI cruise, we will recover one mooring and deploy two moorings near St. Lawrence Island. We then plan a CTD and Bongo survey southward along the 70m isobath, and will finish the cruise by sampling as many stations of a Bristol Bay line as time allows.

2.1.1 **Cruise TN-179 Leg 1 –** This leg's goal will focus our hydrographic efforts on the physical, chemical, and biological processes occurring in the mesoscale eddies that form during the winter, that impact this region's productivity through processes that contribute to onshore, offshore, and vertical fluxes of nutrients, which in turn alters the conditions for phytoplankton growth, larval fish and zooplankton.

We plan to occupy hydrographic transects across two eddies that are located off the shelves of British Columbia, Canada, and southeast Alaska. The two eddies of interest form in deep water west of Queen Charlotte Sound and Sitka, Alaska, respectively. The positions of these eddies are shown in Section 8.2.1 Altimetry Figure as of March

31, 2005. The centers are defined by the 5-day tracks of satellite-tracked drifters. Therefore, the positions shown in the Section 8.2.1 Altimetry Figure and in the Section 8.4.1 Cruise TN-179 Leg 1 Itinerary are for planning purposes only. The eddies move westward at rates of one to three kilometers per day, so we shall be following their positions closely, both before and during the cruise using satellite altimetry and the drifter tracks to help us to ascertain the centers of each of the eddies at the time of the cruise. Our goal is to make the hydrographic transects cross as close as possible to the actual eddy center.

The primary activity on Leg 1 will involve casts with a CTD 911*plus* profiler casts equipped with a fluorometer and Photosynthetically Available Radiation (PAR) sensor, and a rosette with 10-liter (or 5-liter) Niskin bottles, from which FOCI will take samples for salinity calibrations, chlorophyll, and High Performance Liquid Chromatography (HPLC) and nutrient analyses. At the end of each station, GO-FLO bottles will be lowered on a Kevlar line to a depth of 40 meters to sample for heavy metals. At a selected subset of stations, GO-FLO casts using a Kevlar line attached to one of the ship's winches will be used to take samples to a depth of 2,000 meters for iron analyses, as well as non-ferrous heavy metal analyses.

At approximately 20 of the CTD stations in the eddy FOCI will make Marine Assessment Monitoring and Prediction (MARMAP) Bongo tows, so that we can sample for zooplankton and larval fish.

FOCI also plans to deploy five satellite-tracked (ARGOS) drifters as close to the eddy centers as possible. These are to track the movement of the eddies over the next six to ten months.

Small boat operations at sea will be conducted on three to four occasions. At those times the small boat will be taken away from the ship in order to collect surface iron samples. These operations will depend heavily on appropriate weather and sea state.

We plan to install a NAS nitrate meter in the flow-through system to add nitrate measurements to the suite of variables already available – Temperature, Salinity, and Fluorescence.

2.1.2 **Cruise TN-179 Leg 3** –FOCI plans to transit from Seward, Alaska, down Shelikof Strait, and through either Unimak Pass or Akutan Pass, at the Master's discretion, enroute to the Bering Sea shelf. Once in the Bering Sea, FOCI plans to occupy four long lines of CTD/MARMAP Bongo stations.

At the northern end of these transects FOCI tentatively plans to pick up one mooring at Site M8. These mooring operations may have been conducted onboard **NOAA Ship *MILLER FREEMAN*** cruise earlier in the year; however, preparations to conduct mooring operations onboard **R/V *THOMAS G. THOMPSON*** is being made in case ice conditions preclude this work onboard **NOAA Ship *MILLER FREEMAN***. The mooring to be picked up is a subsurface mooring has an approximately water depth of 70 meters.

We will then resume CTD/MARMAP operations on a transect down the 70m isobath of the eastern Bering Sea shelf to a location beyond Site M2 – near 57° N, 164° W.

At the end of this activity, FOCI plans to return to Dutch Harbor, Alaska, to disembark all but one the science party via a small boat operation. Peter Proctor will stay aboard to sample surface nitrate across the Gulf of Alaska as the ship returns to Seattle, Washington.

2.2 Participating Organizations

NOAA – Pacific Marine Environmental Laboratory (PMEL)
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University of British Columbia (UBC)
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Cetacean Research Lab
Vancouver Aquarium Marine Science Centre
845 Avison Way
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2.3 Personnel

2.3.1 Chief Scientist

2.3.1.1 Cruise TN-179 Leg 1

Name	Gender	Nationality	Affiliation	E-mail Address
Dr. Nancy B. Kachel (206) 526-6746	Female	USA	PMEL	Nancy.Kachel@noaa.gov

2.3.1.2 Cruise TN-179 Leg 3

Name	Gender	Nationality	Affiliation	E-mail Address
Sigrid A. Salo (206) 526-6802	Female	USA	PMEL	Sigrid.A.Salo@noaa.gov

2.3.2 Participating Scientists

2.3.2.1 Cruise TN-179 Leg 1

Name	Gender	Nationality	Affiliation	E-mail Address
Dr. Nancy B. Kachel	Female	USA	PMEL	Nancy.Kachel@noaa.gov
Dr. Carol Ladd	Female	USA	PMEL	Carol Ladd@noaa.gov
David G. Kachel	Male	USA	PMEL	Dave.Kachel@noaa.gov
Peter Proctor	Male	USA	PMEL	Peter.Proctor@noaa.gov
Dylan Righi	Male	USA	PMEL	Dylan.Righi@noaa.gov
Elizabeth Dobbins	Female	USA	PMEL	Elizabeth.Dobbins@noaa.gov
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Nadine Pinnell	Female	Canada	IOS	nadine.pinnell@vanaqua.org
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Agnes Sutherland	Female	Canada	IOS	sutherlandn@pac.dfo-mpo.gc.ca
Doug Anderson	Male	Canada	IOS	AndersonDo@pac.dfo-mpo.gc.ca
Keith Johnson	Male	Canada	IOS	JohnsonK@pac.dfo-mpo.gc.ca

2.3.2.2 Cruise TN-179 Leg 3

Name	Gender	Nationality	Affiliation	E-mail Address
Sigrid A. Salo	Female	USA	PMEL	Sigrid.A.Salo@noaa.gov
David G. Kachel	Male	USA	PMEL	Dave.Kachel@noaa.gov
Peter Proctor	Male	USA	PMEL	Peter.Proctor@noaa.gov
Antonio Jenkins	Male	USA	PMEL	Antonio.Jenkins@noaa.gov
Jay Clark	Female	USA	AFSC	Jay.Clark@noaa.gov
Kathy Mier	Female	USA	AFSC	Kathy.Mier@noaa.gov
Rachael Cartwright	Female	USA	AFSC	Rachael.Cartwright@noaa.gov
William J. Floering	Male	USA	PMEL	William.Floering@noaa.gov

2.4 Administrative

2.4.1 Ship Operations

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Mr. William H. Martin
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2.4.2 Scientific Operations

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3.0 OPERATIONS

3.1 Responsibilities

3.1.1 Master – The ship's Master shall be in sole command of the vessel and shall be responsible for the welfare of all personnel on board. The Master shall be the final authority in matters relating to the safety, proper navigation, stability, and sailing condition of the vessel and shall execute each voyage with the utmost dispatch.

The Master shall inform the Chief Scientist as soon as possible of any changes in the program necessitated by events. In the case of emergency, nothing in these instructions shall be construed as preventing the Master from taking the most effective action, which in the Master's judgment, will rectify the situation causing the emergency, and; thereby, safeguard life, property, and the ship.

The Master will have the authority to abort operations temporarily on the basis of clear and present danger to life and property at sea, and will inform the Chief Scientist as soon as safe conditions permit. Full details of the action taken, rationale, and recommendations will be provided at the earliest opportunity. Under normal operating conditions, the Master shall not take any mission-aborting action without consultation with the Chief Scientist.

3.1.2 Chief Scientist – The Chief Scientist is responsible for executing the technical portion of the scientific mission specified by these instructions. Responsibilities also include:

1. Comportment of visiting scientists and technicians,
2. Disposition of data, feedback on data quality, and archiving of data and specimens collected,
3. Administration and physical handling of all scientific party hazardous materials,
4. Assignment of berthing for the scientific party,
5. Cleanliness of all berthing,, laboratory, and storage spaces used by the scientific party,
6. Delivery of medical and emergency contact forms for the scientific party, and
7. With the Master, safe, efficient, and economical use of shipboard resources to support the embarked mission.

The Chief Scientist has the authority to revise or alter the technical portion of the instructions as work progresses provided that after consultation with the Master, it is ascertained that the proposed changes will not:

1. Jeopardize the safety of personnel or the ship,
2. Exceed the overall time allotted for the project,
3. Result in undue additional expenses, or
4. Alter the general intent of these project instructions.

3.1.3 **Scheduling** – Scheduling of individual activities will depend upon weather conditions and progress of scientific work. Therefore, firm advance scheduling of events will not be possible, and a continual dialogue between scientific and ship's personnel will be important.

3.2 **Data To Be Collected** – The Chief Scientist is responsible for the disposition, feedback on data quality, and archiving of data and specimens collected on board the ship for the primary project. The Chief Scientist will be considered the representative of the Directors of PMEL and AFSC for purpose of data disposition. A single copy of all data gathered by the vessel shall be delivered to the Chief Scientist for forwarding to the Center and Laboratory Directors, who in turn will be responsible for distribution of data to other investigators desiring copies.

3.2.1 **Data Logging** – If the ship has a computer system that operates throughout the cruise acquiring and logging data from navigation, meteorological, and flow-through oceanographic sensors, it is requested that we receive a copy of the data at the end of the cruise. It is requested that Photosynthetically Available Radiation (PAR), air temperature and wind speed and direction be recorded in addition to the Sea Surface Temperature (SST), Salinity, and Fluorescence from the sea chest – underway system, if possible.

At regular intervals, not to exceed every five days, the ship's computer manager will archive data from disk files to recordable compact diskettes (CD) for delivery to the Chief Scientist at the end of the cruise. Additional recording of processed data may be requested of the ship's computer manager. The ship's computer manager will ensure data quality. During the cruise, the scientific party may require the assistance of the ship's computer manager to determine if all sensors are functioning properly and to monitor some of the collected data in real time to make sampling strategy decisions.

3.3 **Staging Plan** – Loading of scientific equipment is planned to occur in Seattle, Washington, on a date to be assign by the ship's personnel, but before April 25, 2005. All equipment from Institute of Ocean Sciences, University of British Columbia, will be shipped to PMEL and then brought to the ship on the day arranged by the ship operations personnel at the University of Washington. See Section 8.1 Cruise TN-179 Equipment Inventory – Not Final for an equipment list.

3.4 **De-staging Plan** – Equipment will be off-loaded in Seattle, Washington, on Saturday, June 4, 2005, when the ship returns to port, in coordination with the ships' operations officer. The scientific party will be responsible for arranging vehicles for moving their equipment.

3.5 Cruise Plan

3.5.1 Cruise TN-179 Leg 1

1. FOCI will begin CTD operations near the southern edge of the Haida eddy. The position of eddies can be tracked via satellite altimetry data as depicted in Section 8.2.1 Altimetry Figure. Altimetry results from Altimetry Research in Ocean Circulation (TOPEX POSEIDON) conducted jointly by the National Aeronautics and Space Administration (NASA) and the French agency Centre Nationale d'Études Spatiales (CNES) will be used to locate the position of this eddy.

   As of March 31, 2005, there is one satellite-tracked drifter circling the center of each eddies as depicted in Section 8.2.2 Drifter Figure. We expect to have two more deployed before the departure of Cruise TN-179. See Section 8.4.1 Cruise TN-179 Leg 1 Itinerary for station locations and tentative itinerary and Section 8.3.1 Cruise TN-179 Leg 1 Chartlet for a chart of the cruise trackline.

2. At each station, CTD casts will usually be taken to a depth of either 1,000 meters or 1,500 meters and water samples will be taken for salinity calibrations, nutrients, and chlorophyll. Two to three casts will be taken to 2,000 meters.

3. GO-FLO casts to 2,000 meters will be taken at six to eight stations to sample for heavy metal concentrations at depth. Samples will be taken for both iron non-ferrous metal analysis. At approximately 20 stations, MARMAP Bongo tows will be taken for zooplankton sampling. Samples will be taken at the surface for phytoplankton analyses.

4. FOCI will then sample the Sitka Eddy, located west of Sitka, Alaska, using a similar sampling scheme.

5. ARGOS drifters – approximately six – drogued at 40 meters will also be deployed.

6. FOCI plans to then come into Seward, Alaska, for a touch-and-go operation to disembark Leg 1 scientists and embark scientists for Cruise TN-179 Leg 2.

3.5.2 Cruise TN-179 Leg 3

1. Cruise TN-179 Leg 3 begins with a transit down Shelikof Strait, through Unimak Pass to Dutch Harbor, Alaska, for small boat operations to embark scientists, and then into the Bering Sea.

2. See Section 8.4.2 Cruise TN-179 Leg 3 Itinerary for station locations and tentative itinerary and Section 8.3.2 Cruise TN-179 Leg 3 Chartlet for a tentative chart of the cruise trackline. Final positions depend on the location of the eddies at the beginning of the cruise.

3. FOCI then plans to occupy a series of four transects of CTD and MARMAP Bongo tow stations across the Eastern Bering shelf; however, the positions listed are not final. As of April 5, 2005, there is still ice south of St Lawrence Island and if it persists, the CTD/MARMAP stations will be moved southward.

4. At the northern end of these transects FOCI tentatively plans to pick up one mooring and deploy two subsurface moorings at Site M8. These mooring operations may have been completed onboard **NOAA Ship *MILLER FREEMAN*** earlier in the year; however, preparations to conduct mooring operations onboard **R/V *THOMAS G. THOMPSON*** are being made in case ice conditions preclude this work onboard **NOAA Ship *MILLER FREEMAN***. The first of these is a subsurface mooring in water depth of approximately 70 meters. The second mooring to be deployed located nearby will be a short subsurface mooring containing an Acoustic Doppler Current Profiler (ADCP).

5. After the mooring operations, another transect of CTD/MARMAP tow stations will be occupied along the 70m isobath, south to the location of FOCI's Mooring Site M2.

6. All scientists, except Peter Proctor will then debark in Dutch Harbor, Alaska, before the ship transits back to Seattle, Washington. He will stay aboard to sample the Flow-Through nutrients and ensure quality data during the transit.

3.6 **Sampling Strategy** – On Leg 1 and Leg 3 of the cruise, CTD casts will be done throughout the cruise. The CTD will be equipped with dual temperature and conductivity sensors, as well as an SBE-43 oxygen sensor, a WetLabs Fluorometer and transmissometer, and a Photosynthetically Available Radiation (PAR) sensor. The Uncontaminated Scientific Seawater System (USSW) with thermosalinograph and with a fluorometer will be used throughout the entire cruise. A PMEL provided Nitrate meter will be attached to the underwater system.

Salinity and nutrient samples will be taken at up to 24 depths at most CTD stations. Chlorophyll will be sampled at five or six depths. Some nutrient samples may need to be frozen in a -20° Celsius chest freezer. It is planned to analyze all of the samples on board. In case it becomes necessary to freeze nutrient samples for analysis back in Seattle, Washington, FOCI requests the capability of freezing nutrient samples from both our legs of the cruise. If possible, it is best to flash freeze the nutrient samples in an -80° Celsius freezer, then move them to the -20° Celsius freezer. Approximately two cubic feet are necessary in the -80°C freezer and 16 cubic feet in the -20°C freezer.

On Leg 1 only, both iron and non-ferrous heavy metals will be sampled via GO-FLO bottles and Niskins, respectively. Analyses for iron will be done on board the ship. Analyses for non-ferrous metals will be done back at University of British Columbia.

Chlorophyll samples will be filtered immediately after sampling and the filters frozen at -20° Celsius for analysis back in Seattle, Washington.

Advanced Research and Global Observation Satellite (ARGOS) satellite-tracked drifter buoys during both Leg 1 and Leg 2 of the cruise.

Approximately 15-20 MARMAP bongo tows will be taken to collect zooplankton. Samples will be put in jars and preserved with formalin.

The last portion of Leg 3 will involve sampling water properties and zooplankton using

Throughout the cruise, samples will be drawn from the underway system, to ground-truth measurements.

3.7 Station Locations – See Section 8.4 Cruise TN-179 Cruise Itineraries for station locations and tentative itinerary and Section 8.3 Cruise TN-179 Chartlets for cruise tracklines.

3.8 Station Operation Procedures – The following are the standard operation procedures at PMEL for the conduct of proposed operations on this cruise:

3.8.1 CTD/Water Sample Operations – A Sea-Bird Electronics' SBE 911*plus* Conductivity, Temperature, and Depth (CTD) profiler with dual temperature and conductivity sensors will be the primary system. It is requested that the vessel provide the primary 911*plus* CTD system. If the ship is unable to provide a Photosynthetically Available Radiation (PAR) sensor and fluorometer, then FOCI will provide the fluorometer and PAR light meter to be mounted on the CTD stand for all casts. However, these instruments cannot exceed the following depths:

- WETLabs' WETStar fluorometer cannot exceed 600 meters, and
- Biospherical Instruments' QSP-200L4S light meter cannot exceed 1,000 meters.

Samples will be collected using the 5-liter or 10-liter Niskin bottles.

Once the CTD has been deployed, it should be lowered to 10 meters, and then the deck unit should be turned on. After 45 seconds, the CTD can be returned to just below the surface. Then the data acquisition program should then be started. The CTD should descend at a rate of 30 meters per minute for the first 200 meters and 45-50 meters per minute below that. The ascent rate should be 50 meters per minute. An entry in the Marine Observation Abstract (MOA) should be made for each CTD cast at the maximum cast depth.

Scientists will keep the ***CTD Cast Information/Rosette Log***. Pressure, primary salinity, secondary salinity, primary temperature, secondary temperature, fluorescence, and light levels will be recorded on the ***CTD Cast Information/Rosette Log*** for all water bottle samples.

3.8.1.1 CTD Calibration – Salinity samples will be taken on every other cast, or as specified by the Chief Scientist. The CTD systems will be equipped with dual temperature and conductivity sensors. **It is requested that the ship bring an autosalinometer so that salinities may be analyzed aboard ship.**

3.8.2 MARMAP Bongo Tows – A 60-cm aluminum Bongo frame with 0.333-mm mesh and a 20-cm aluminum Bongo frame with 153-micron mesh, both with hard plastic cod-ends, and a 40-kg lead weight for a depressor will be used in standard Marine Assessment Monitoring and Prediction (MARMAP) Bongo tows. The nets will be deployed at a constant wire speed of 40-45 meters per minute to a maximum depth of 200 meters, or 5-10 meters off bottom in shallower waters. A Sea-Bird Electronics SBE 19 SEACAT Profiler will be attached to the wire above the bongo frame to provide real-time tow data.

After the bridge gives permission, ship's personnel and one or two scientists will deploy the Bongo array. A scientist will monitor the depth of the Bongo nets using SeaCat software – or net-minding software – and inform the ship's winch operator when the desired gear depth is reached. Afterwards, the winch operator will be instructed by the scientist to retrieve the nets at a wire speed of 20 meters per minute. The ship's speed should be adjusted to maintain a wire angle of 45° during the entire tow, which is accomplished by relaying wire angles to the bridge by radio, so that the bridge personnel can speed up or slow down the vessel's speed to increase or reduce the towing angle.

When the nets reach the surface, the SeaCat, and nets will be recovered. After the nets are brought aboard, they are hosed down with saltwater to wash the sample into the cod-end. In some cases, larvae are sorted and preserved separately. Flow meters in the nets record the amount of water filtered, and the SBE 19 SEACAT records the depth history of the tow. The scientists on watch are responsible for recording times, maximum depth, wire-out, and flow meter counts on the Cruise Operations Database (COD) forms. Tows not meeting specifications may be repeated at the discretion of the scientific watch (i.e. hit bottom, poor wire angles, nets tangled, etc.) If the net minder is used, the scientists will then download the SeaCat data recorded during the cast.

3.8.3 **Chlorophyll/Nutrient Sampling Operations** – Chlorophyll samples will be collected simultaneously with Conductivity, Temperature, and Depth (CTD) profiler casts from the 10-liter Niskin bottles. The scientists will be responsible for collection, filtration, and preservation of samples. Sampling depths depend on the fluorescence profile. A typical strategy would be samples at 0, 10, 20, 30, 40, and 50 or 60 meters, depending upon which of the latter two depths is closest to the fluorescence maximum. If the maximum is deeper than 60 meters, sampling should be moved deeper with fewer samples in the mixed layer.

Nutrient samples will be collected from all Niskin bottles, both near-surface and from depth. It is desirable to flash-freeze nutrient samples in an -80° Celsius freezer, if available, if they are not to be analyzed with 24 hours. The -20° Celsius freezer is required for sample storage of the chlorophyll filters, and frozen nutrient samples.

3.8.4 **ARGOS Satellite-Tracked Drifter Buoy Deployments** – Two to three working days before deployment, the Chief Scientist, or designee, will secure the drifter on the back deck. The drifter buoy is then turned on, usually by removing the magnet, and an e-mail message will be sent by the Chief Scientist, or designee, to Dr. Phyllis Stabeno at Phyllis.Stabeno@noaa.gov, stating the serial number that is stamped on the drifter and the time that it was turned on. This lead-time is necessary to ensure that telemetry from the buoy is being received and transmitted by the Advanced Research and Global Observation Satellite (ARGOS). The method of deployment of the drifter is dependent upon the particular make of drifter and is to be directed by the Chief Scientist, or designee.

3.8.5 **GO-FLO Casts** – Casts will be done off the starboard side using Kevlar line attached to the second winch at the CTD station. They will be sampled for iron and other non-ferrous metals. GO-FLOs can be mounted in the wet lab on forward bulkhead. Location for clean hood could possibly be in the wet lab over the sink or in the staging area.

3.8.6 **Mooring Recoveries and Deployments** – The following is a brief overview for PMEL mooring recoveries and deployments. Depending on the type of mooring, the weather and the available vessel equipment techniques and practices may vary somewhat from what has been described here.

The standard PMEL subsurface mooring is a string of instruments connected to each other by wire or ½ inch long link chain. Shackles connecting the various parts of the mooring string are ½ inch to ¾ inch in diameter. Steel floats measuring either 30 or 41 inches are incorporated in the mooring string to provide floatation for the equipment. The mooring is held to the bottom by a railroad wheel anchor with an average weight of 1,600 to 2,000 pounds. An acoustic release is activated to drop the anchor for recovery.

For a recovery the vessel pulls up near the mooring location and holds station while a transducer is lowered by hand over the side. The acoustic release is enabled and a distance from the ship is determined. Once we are confident that we are close enough to see the mooring when it comes to the surface the command will be sent to release the mooring from the anchor.

Once the floats are on the surface the ship will come along side the string and prepare for recovery. Different vessels have developed their own techniques for recoveries but the tried and true method has been to snag the top float or wire just below the top float with a grapple line. Other techniques include having a small boat put in the water to make the attachment, tossed loops of line or wire over the floats, and developing a noose system deployed from a crane extended over the side of the ship.

When snagged, the grapple line is pulled around the ship and attached to a working winch line at the stern. Again, depending on the availability of equipment, recoveries and deployments have taken place alongside of a ship instead of at the stern. The winch line is pulled in until we reach a point on the mooring where we can chain it off and remove the grapple line. The recovery is a series of steps of attaching the winch wire, pulling in the mooring string, chaining off the mooring string, removing the winch wire and a section of the mooring string, re-attaching the winch wire, taking another section in until the entire mooring is aboard.

Pulling the 5/8 shackles, chain, and other hardware requires a large open block on the A-frame. We have those blocks available if you do not have one. The distance we can pull each pick will depend on the height of the A-frame, the block and the equipment on the mooring. We can also provide a piece to chain to chain off the mooring to move the winch recovery wire. We would have to know where you prefer to chain off so we can bring a long enough chain. In the past we have chained off directly overhead from the A-frame and also from the sides of the gallows.

Deployments are similar to recoveries except you have the added strain of the anchor on the wire as you build the mooring. Normally, we deploy anchor first and build the mooring from the bottom up. As with recoveries, the mooring is built in sections, breaking the string to insert instruments or floatation when required. Stabilizing the mooring with one, two, or no tag lines is dependent on the weather and stability of the vessel. Section by section the mooring is assembled while suspended off the stern or side of the ship. Depending on the available winches the entire mooring backbone – chain and/or wire – can be spooled on the winch drum. As it is lowered into the water it is chained off and opened to insert instruments or floats along the mooring backbone. If that style of winch is not available sections of the mooring backbone are laid out on the deck and shorter pieces are put into play one at a time. If no winches are available the recoveries and deployments have been accomplished using a capstan.

Obviously this is a slower and more cumbersome process but one that has been used on a limited basis when necessary. We have also conducted mooring operations alongside of a ship using a deck crane. Once the mooring is complete and hanging off the stern, or side, of the ship it is released on station and allowed to sink using a peck and hale release. We also use a gravity release for some mooring applications. That style release requires lowering the mooring string to the bottom, the release lets go once the anchor hits bottom and there is slack in the wire. For this type of release you need enough winch wire to put the anchor on the bottom. I do not believe we have a need to use a gravity release during this cruise.

3.9 **Underway Operations** – Underway operations that will be performed during this cruise include thermosalinograph, fluorometer, nitrate meter, bathymetry, and meteorological data.

3.10 **Data Logging** – The ship's data logger, shall operate throughout the cruise, acquiring, and logging data from navigation, meteorological, oceanographic, and bathymetric sensors. If a method for observing data acquisition is available, please provide project scientists with the capability of monitoring sensor acquisition via text and graphic displays. A data processing node should be made available to project scientists throughout the cruise for the above-mentioned purpose.

At regular intervals, not to exceed every five days, the ship's computer manager will archive data from disk files to recordable compact diskettes (CD-R) for delivery to the project representative at the end of the cruise. Additional recording of processed data may be requested of the ship's computer manager. The ship's computer manager will ensure data quality. During the cruise, the scientific party may require the assistance of the ship's computer manager to determine if all sensors are functioning properly and to monitor some of the collected data in real time to make sampling strategy decisions.

3.11 **Seachest and Uncontaminated Seawater** – Sea surface temperature, conductivity, and fluorometry will be continuously monitored. Uncontaminated seawater from the Uncontaminated Scientific Seawater System (USSS) will be continuously pumped through the thermosalinograph, fluorometer, and nitrate monitor – provided by PMEL. Data from these instruments should be sent to the data logger, if possible. Approximately two square feet of bench space will be required near a sink with uncontaminated seawater to install the underway nitrate monitor.

The ship's complement will be responsible for inspecting, and when required, cleaning the seachest and conductivity cells. The scientists will be responsible for regularly cleaning the cuvette, inside the fluorometer, and obtaining and processing the calibration samples for fluorescence and nitrate. Calibration samples will be taken twice per day, throughout the cruise

During the cruise, the ship's personnel will be responsible for ensuring that the data logger correctly logs data streams from the instruments, and checking the logger status display once per watch to determine that the instruments are functioning.

The scientists also request that the fluorometer be interfaced to the ship's data logger, if possible, and the data logger should be configured to log one-minute data throughout each FOCI cruise, including:

- GPS Time,
- GPS Latitude,
- GPS Longitude,
- Water Depth, in meters,
- PAR from the superstructure, if available,
- Seawater (seachest) Temperature,
- Seawater (seachest) Salinity,
- Laboratory Fluorometer voltage, and
- Flow-Through Nitrate voltage, if we are able to wire it in.

3.12 **Small Boat Operations** – The small boat will be needed for transferring scientific personnel in Dutch Harbor, Alaska. Additionally, FOCI plans on deploying the small boat a few times – weather permitting – to allow sampling of the surface water for dissolved iron away from the ship.

4.0 FACILITIES

4.1 Equipment and Capabilities Provided by Ship

- Oceanographic winch with 0.322" electro-mechanical cable with slip rings terminated for CTD operations and MARMAP bongo tows with an attached SeaBird 25 SEACAT
- Winch with minimum of 3,000 meters of 9/16" wire,
- Block for Kevlar line,
- A-Frame,
- Shipboard ADCP,
- Ability to connect a PAR and Fluorometer Oxygen and transmissometer, provided by the ship, or by PMEL, to the CTD,
- Provide termination kits and ship support personnel to do the terminations,
- A device to allow the signal from the sea cable to be split, so it can be fed into both the deck unit for the CTD and for the Bongo SEACAT,
- Wire speed indicators and readout for winches,
- Meter block for MARMAP plankton tows, 0.322" electro-mechanical cable is preferred for these tows, but is not essential. Ability to switch the cable between the CTD and MARMAP bongos,
- Electrical connection between winch and Deck computer system,
- Sea-Bird Electronics' SBE 911*plus* CTD system with dual sensors, 24 bottle rosette, stand, deck unit, and weights,
- Place to tie up GO-FLO bottles,

- Refrigerator and freezer space for storage of biological and chemical samples, +4° C (4-cu ft) for nutrients and -20°C (~12-16-cu ft) for chlorophyll samples and frozen nutrients, respectively, plus a –80°C freezer, if possible,
- For meteorological observations: Anemometers, calibrated air thermometer – wet-and dry-bulb – and a calibrated barometer and/or barograph, interfaced to the data logger, if possible,
- A salinometer for analysis of salinity samples,
- Bench space for PCs, monitor, and printer,
- Exhaust hoods,
- Laboratory space with exhaust hood, sink, lab tables, and storage space,
- Sea-water hoses and nozzles to wash nets and recovered mooring equipment and Bongo stations,
- Adequate deck lighting for night-time operations,
- Navigational equipment including GPS and radar,
- Depth sounder good to at least 3,000 meters,
- Safety harnesses for working on quarterdeck and fantail,
- Ship's crane(s) used for loading and/or deploying,
- (2) Hand-held radios for scientific/winch/bridge communications,
- VHF radio with external antenna at CTD computer station,
- Thermosalinograph and fluorometer interfaced with the data logger,
- Continuous uncontaminated seawater sampling system with debubbler piped from bow into labs,
- MilliQ de-ionized water source – projected use of 50-L/day for Leg 1, and
- Capability to transfer ship's data to Iomega Zip disks or CD-ROM or DVD.

4.2 Equipment and Capabilities Provided by Scientists – See Section 8.1 Cruise TN-179 Equipment Inventory – Not Final for weights:

- Sea-Bird Electronics' SBE 911*plus* CTD system with dual sensors, 12 bottle rosette, stand, deck unit, and weights – to be available as backup for the ship's system,
- Photosynthetically Active Radiation (PAR) and Fluorometer to be mounted on CTD,
- CTD carousel sampler,
- (12) 5-liter sample bottles,
- Lanyard material and nicropress sleeves,
- 144 salinity sample bottles,
- Fluorometer (spare) to be mounted to the Uncontaminated Scientific Seawater System (USSS),
- Debubbler for the fluorometer,
- (2) Sea-Bird Electronics' SBE-19 SEACAT systems,
- 60-cm MARMAP Bongo sampling arrays,
- 20-cm MARMAP Bongo arrays,
- Spare wire angle indicator,
- Filtration rig for chlorophyll samples,
- (2) Subsurface moorings,
- (2) 600-lbs anchors for subsurface moorings,
- Chain, wire rope, rope, and assorted hardware for moorings,
- Benthos acoustic release deck-set and transducer,
- EdgeTech 8011-A acoustic release deck-set and transducer,

- (8) ARGOS satellite tracked drifter buoys,
- (2) Hand held grapple hooks,
- Iridium phone,
- (2) Hand-held radios for scientific/winch/bridge communications,
- Miscellaneous scientific sampling and processing equipment,
- Cruise Operations Database (COD) and forms,
- Marine Observation Abstract (MOA) log,
- PMEL CTD Weather Observation Logs,
- CTD Cast Information/Rosette Log,
- GO-FLO bottles,
- Kevlar line,
- Miscellaneous laboratory and sampling equipment (IOS), and
- Miscellaneous laboratory and sampling equipment (UBC).

5.0 DISPOSITION OF DATA AND REPORTS

5.1 **Ship Provided Data Products** – The following data products will be provided by the ship and included in the data package at the end of the cruise:

- Calibration Sheets for all ship's instruments used,
- Files from data logger,
- Marine Operations Abstracts (MOA), and
- PMEL CTD Weather Observation Logs.

5.2 **Scientific Party Provided Data Products** – The following data products will be completed by the scientific party:

- CTD Cast Information/Rosette Log,
- Cruise Operations Database (COD) log sheets, and
- Mooring logs.

5.3 **Pre-cruise Meeting** – A pre-cruise meeting between the ship's representative and the Chief Scientist will be held before the start of the cruise. Its purpose is to identify the day-to-day requirements of the project in order to best utilize shipboard personnel resources and to identify overtime requirements. A brief meeting of all scientific personnel, the ship's officers, deck and marine tech departments, and other relevant ship's personnel should be held before the vessel reaches the operations area for the purposes of:

1. Introducing scientific personnel to ship's procedures, proper channels, etc.,
2. Discuss operating procedures for deploying various pieces of sampling equipment, and
3. Coordinating scientific watch assignments.

6.0 HAZARDOUS MATERIALS

6.1 Definition – Hazardous scientific materials are any substance, which because of its chemical properties can cause the deterioration of the materials or injury to living organisms. Rules for the stowage, labeling, and protection of flammables and other hazardous scientific stores on inspected vessels are given in ***Subchapter U, Title 46 CFR, Part 194***.

6.2 Standards

6.2.1 Storage Containers – Storage containers should be marked, labeled, and stored in a ventilated and protected area under the supervision of the Chief Scientist with the knowledge and approval of the Master. Consideration should be given to transporting and storing hazardous materials, normally shipped in glass containers, in special, non-breakable containers.

6.2.2 Working Quantities – Working quantities only should be stored in the laboratory. A reasonable working quantity would be a one-day supply, considering the hazard posed by the material. Containers should be marked with the material's chemical and common names, type, and classification.

6.2.3 Storerooms – Storerooms for chemicals and flammables, where practicable, should be protected by fixed CO_2 or Halon systems, and used for no other purpose. Where it is not practical to provide such a storeroom, consideration should be given to a hazardous material locker appropriate for the type and quantity of material being stored.

6.2.4 Incompatible Materials – Because of the limited shipboard storage for hazardous materials, particular attention must be made to avoid storing incompatible materials together. A close review of the Material Safety Data Sheets (MSDS) will show if two chemicals are incompatible.

6.3 Transportation and Disposal – The Chief Scientist is responsible for the proper transportation, shipping, and disposal of hazardous materials, including empty containers, associated with their project. Transportation and disposal must be carried out in accordance with Federal, State, and Local regulations. In no case will this responsibility be passed to the ship's crew or operating institution unless specifically arranged in advance.

6.4 Chemical Spill Response – The scientific party is responsible for supplying neutralizing agents, buffers, and/or absorbents in the amounts adequate to address spills of a size equal to the amount of any chemicals brought aboard. This spill response material must accompany the chemicals when they come aboard.

6.5 HAZMAT Inventory – See Section 8.5 Cruise TN-179 HAZMAT Inventory.

6.6 Material Data Safety Sheets (MSDS) – All hazardous materials brought onboard will have accompanying MSDSs.

7.0 MISCELLANEOUS

7.1 Communications – For scientific projects, the Chief Scientist, or their designated representative, may have access to the ship's communications systems on a cost reimbursable basis.

7.2 Satellite Communications – INMARSAT (voice and facsimile) communications are available aboard ship and may be used for personal or business related calls. Arrangements to pay for the calls must be made before calling. Credit card calls are the preferred method of payment. INMARSAT calls can be extremely expensive and the exact cost may not be known until you receive your bill.

7.3 Electronic Mail (E-mail) – FOCI requests that **R/V *THOMAS G. THOMPSON*** transmit e-mail at least twice a day. Each embarked personnel will have an e-mail account and address established in their name by the ship.

7.4 Internet - The scientists will have use of the internet access at times during the cruise for the purpose of accessing near real-time data to assists us in locating the oceanographic features of interest.

7.5 Use of Radio Transceivers – Because it is sometimes necessary for the scientific staff to communicate with other research vessels, commercial vessels, and shore based NOAA facilities, the Chief Scientist or designee may request the use of radio transceivers aboard the vessel.

7.6 Important Telephone and Facsimile Numbers and E-mail Addresses

7.6.1 Pacific Marine Environmental Laboratory (PMEL)

FOCI – Ocean Environmental Research Division (OERD2):
- (206) 526-4700 (voice)
- (206) 526-6485 (fax)

Administration:
- (206) 526-6810 (voice)
- (206) 526-6815 (fax)

7.6.2 Alaska Fisheries Science Center (AFSC)

FOCI – Resource Assessment and Conservation Engineering (RACE):
- (206) 526-4171 (voice)
- (206) 526-6723 (fax)

7.6.3 Institute of Ocean Sciences, Fisheries and Oceans Canada

Institute of Ocean Sciences
Fisheries and Oceans Canada
Telephone: (250) 363-6816
Facsimile: (250) 363-6476

7.6.4 Department of Earth and Ocean Sciences, University of British Columbia

Earth and Ocean Sciences
University of British Columbia
Vancouver, British Columbia, Canada
Telephone: (604) 822-6571

7.6.5 R/V *THOMAS G. THOMPSON*

Cellular

- (206) 799-6547

INMARSAT B

- 011-872-33-663-4510 (Voice)
- 011-872-33-663-4511 (Facsimile – on the bridge)
- 011-872-33-663-4512 (Facsimile – in the main lab)

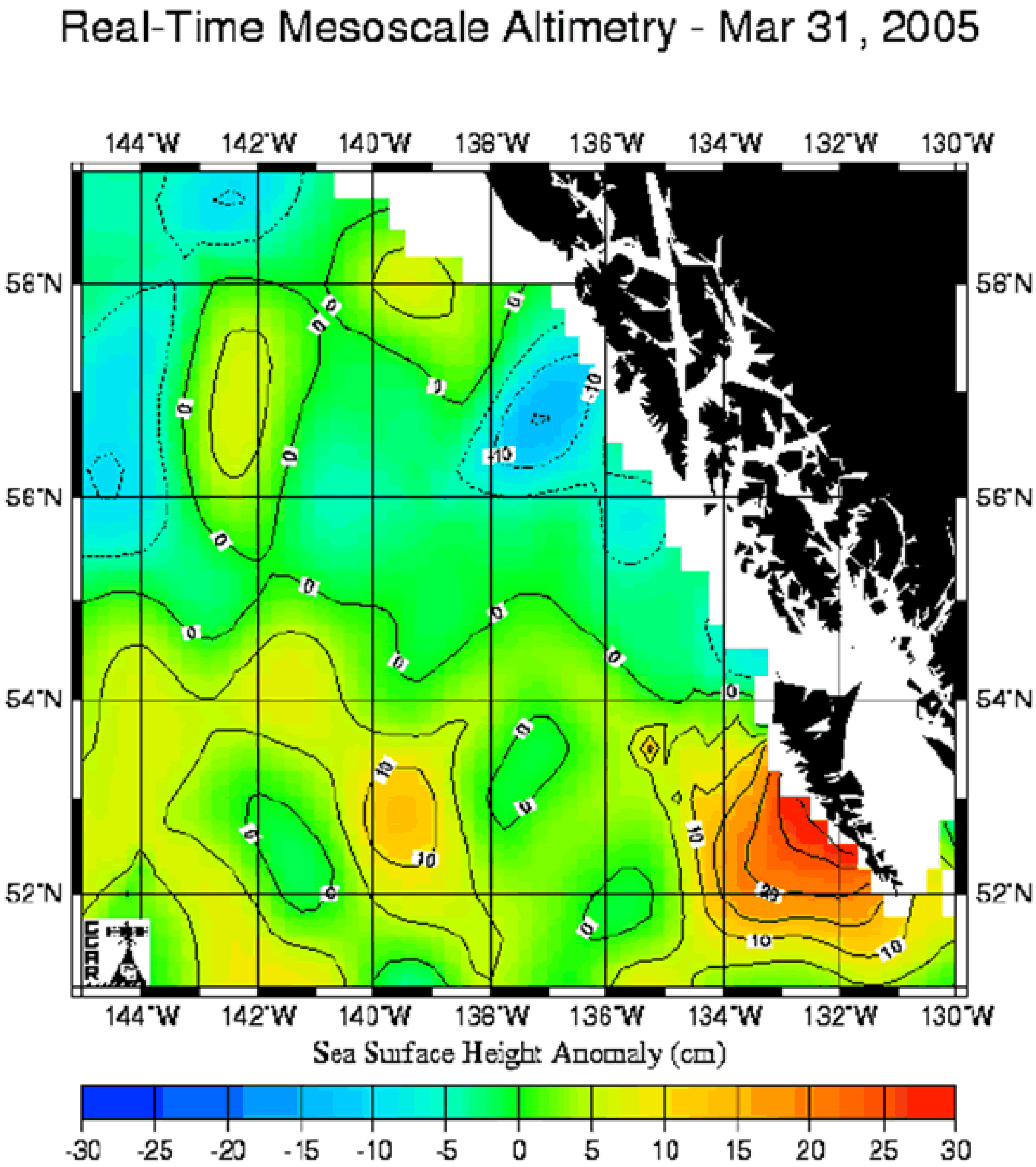
8.0 Appendices

8.1 Cruise TN-179 Equipment Inventory – Not Final

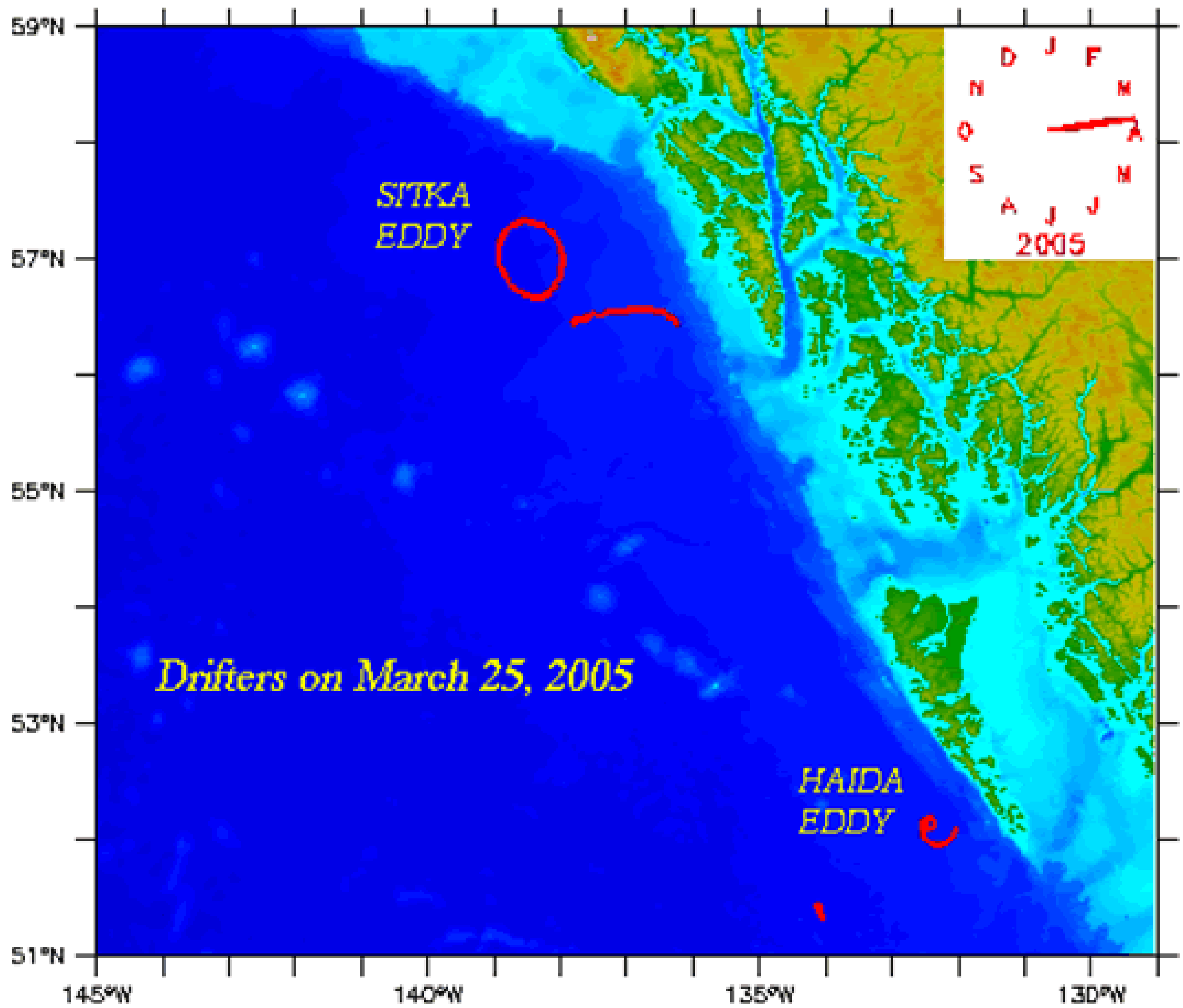
ITEM	QTY	WEIGHT	TOTAL WEIGHT
CTD Equipment			
CTD Rosette	1		
CTD Cage	1		
SBE 911*plus*			
Bottles, Niskin, 5-l	12		
Mooring Supplies			
Box, Release	1	110 lbs	110 lbs
Stand, Reel	1	25 lbs	25 lbs
NMFS-FOCI			
Supplies, Miscellaneous, G1	1	25 lbs	25 lbs
Coats, Float and Gloves, B2	1	20 lbs	20 lbs
Kit, Response, Spill	1	15 lbs	15 lbs
Box, Clear Plastic, Large	1	35 lbs	35 lbs
Deck Unit, SeaCat	1	30 lbs	30 lbs
Buckets		5 lbs	5 lbs
SBE-39	1	10 lbs	10 lbs
Frame, Bongo, 60-cm	1	40 lbs	40 lbs
Frame, Bongo, 20-cm	1	15 lbs	15 lbs
Weight, Depressor, Bongo	1	50 lbs	50 lbs
Filtering rig w/supplies		70 lbs	70 lbs
Bottles, Sample, Nutrient			
Box, SeaCat	1	40 lbs	40 lbs
Box, SeaCat	1	40 lbs	40 lbs
MISCELLANEOUS			
Box, Drifter, ARGOS	2	69 lbs	138 lbs
Cages, MicroCAT	3	48 lbs	144 lbs
Box, Wooden, Large	1	795 lbs	795 lbs
CTD	1	900 lbs	900 lbs
Assorted laptop computers			
Nutrient Analysis-IOS			
Equipment and Supplies			350 lbs
Iron Analysis-IOS			
GO-FLO bottles and Miscellaneous Lab Equipment			200 lbs
		Total	**3,057 lbs**

8.2 Cruise TN-179 Figures

8.2.1 **Altimetry Figure** – Satellite altimetry defining the location of the Haida and Sitka Eddies we want to sample as of March 31, 2005.

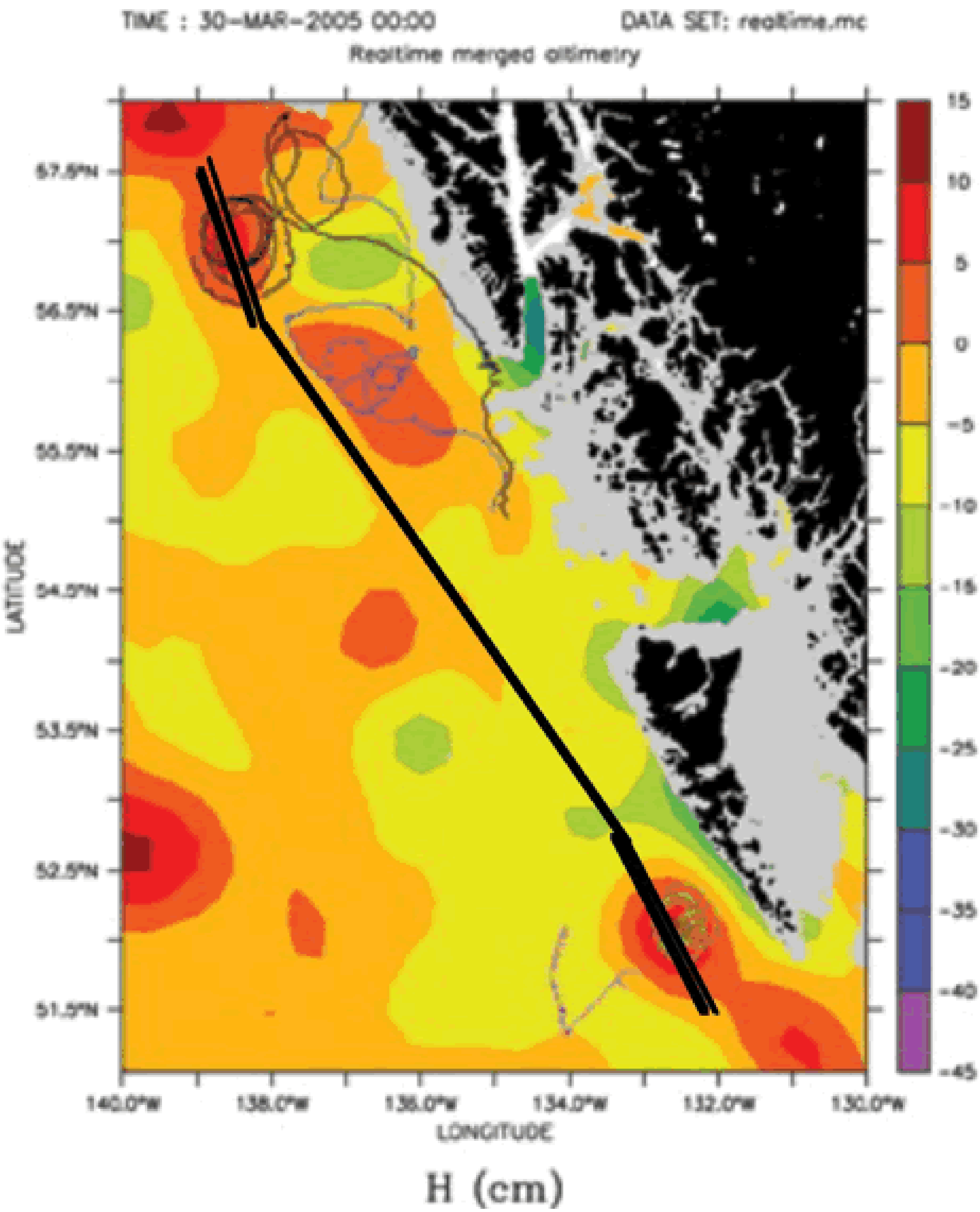


8.2.2 **Drifter Figure** – Satellite tracked drifter paths defining the centers of the Haida and Sitka eddies we want to sample on this cruise.

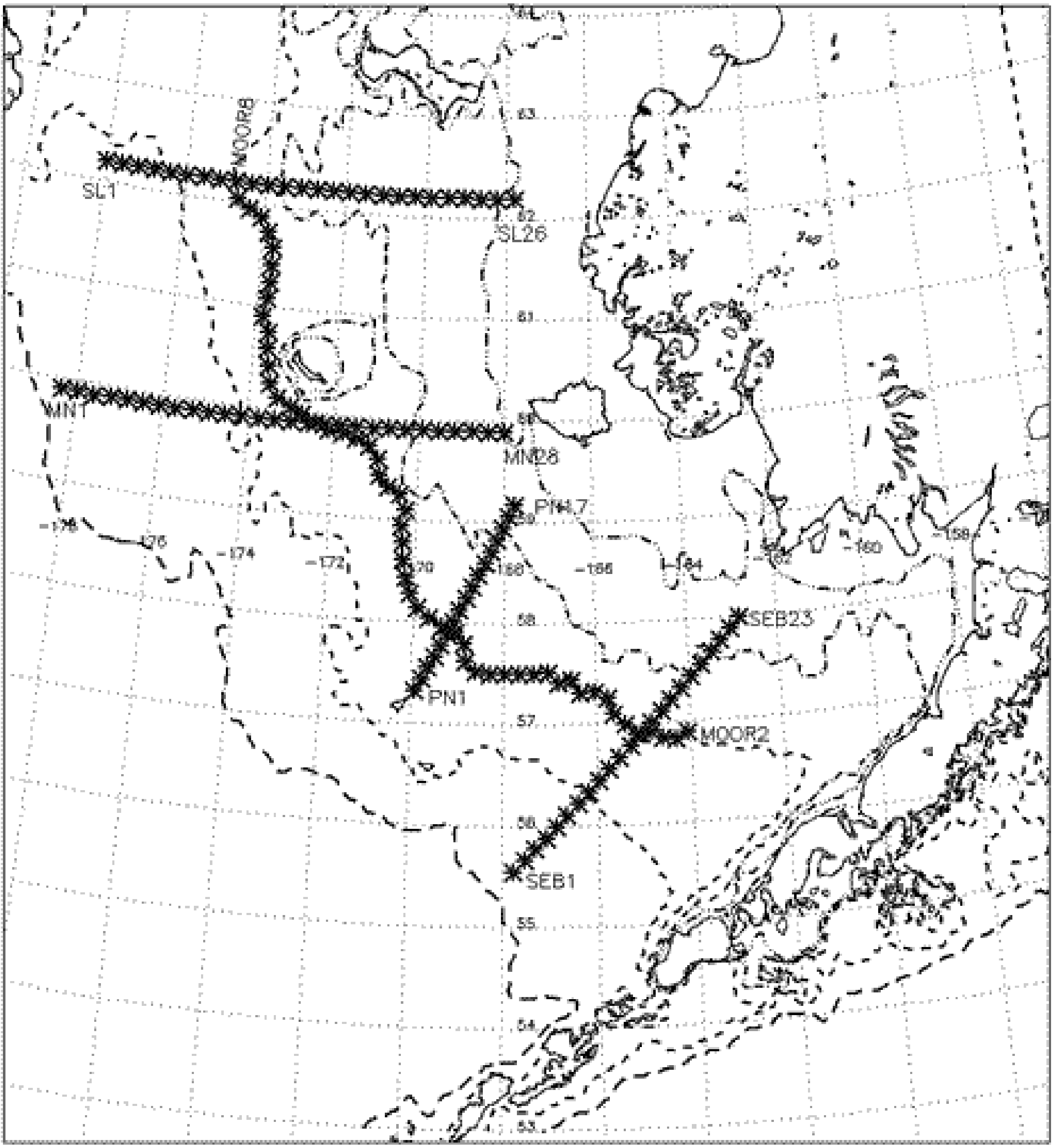


8.3 Cruise TN-179 Chartlets

8.3.1 Cruise TN-179 Leg 1 Chartlet



8.3.2 Cruise TN-179 Leg 3 Chartlet



8.4 <u>Cruise TN-179 Cruise Itineraries</u> – Station locations for Leg 1 and Leg 3 included in these instructions may change. The Chief Scientists will work closing with the command to ensure that the latest locations are provided.

8.4.1 Cruise TN-179 Leg 1 Itinerary

Station ID	Activity	Latitude	Longitude	Dist. (nm)	Spd (kts)	Transit (hrs)	CTD Depth (m)	CTD Time (min)	Net Time (min)	Other Time (min)	Arrive Local Date/Time	Depart Local Date/Time
Depart Seattle, WA												26-Apr-2005 09:00
Strait of Juan de Fuca (+12hrs)		48° 25.000' N	124° 45.000' W			12.00					26-Apr-2005 21:00	26-Apr-2005 21:00
HAIDA01	ctd/ bongo	51° 10.000' N	132° 30.000' W	342.3	12	28.5	2,000	112	45	720	28-Apr-2005 01:31	28-Apr-2005 16:08
HE02	ctd/ bongo	51° 40.000' N	131° 54.000' W	37.5	12	3.1	1,000	69	45	30	28-Apr-2005 19:15	28-Apr-2005 21:39
HE03	ctd/ bongo	51° 44.091' N	131° 58.091' W	4.8	12	0.4	1,000	69		30	28-Apr-2005 22:04	28-Apr-2005 23:43
HE04	ctd	51° 48.182' N	131° 00.000' W	36.2	12	3.0	2,000	112		30	29-Apr-2005 02:44	29-Apr-2005 05:06
HE05	ctd	51° 52.273' N	131° 00.000' W	4.1	12	0.3	1,000	69		30	29-Apr-2005 05:26	29-Apr-2005 07:05
HE06	ctd/ bongo	51° 56.364' N	131° 00.000' W	4.1	12	0.3	1,000	69	45	30	29-Apr-2005 07:26	29-Apr-2005 09:50
HE07	ctd/ bongo	51° 00.000' N	131° 00.000' W	56.4	12	4.7	2,000	112	45	720	29-Apr-2005 14:32	30-Apr-2005 05:09
HE08	ctd/ bongo	51° 00.000' N	131° 00.000' W	0.0	12	0.0	1,000	69	45	30	30-Apr-2005 05:09	30-Apr-2005 07:33
HE09	ctd	51° 00.000' N	131° 00.000' W	0.0	12	0.0	1,000	69		30	30-Apr-2005 07:33	30-Apr-2005 09:13
HE10	ctd	51° 00.000' N	131° 00.000' W	0.0	12	0.0	1,500	91		30	30-Apr-2005 09:13	30-Apr-2005 11:58
HE11	ctd	51° 00.000' N	131° 00.000' W	0.0	12	0.0	1,000	69		30	30-Apr-2005 11:58	30-Apr-2005 13:38
HE12	ctd/ bongo	51° 00.000' N	131° 00.000' W	0.0	12	0.0	1,000	69		30	30-Apr-2005 13:38	30-Apr-2005 15:17
HE13	ctd/ bongo	51° 00.000' N	131° 00.000' W	0.0	12	0.0	1,500	91	45	30	30-Apr-2005 15:17	30-Apr-2005 18:03
REF 2	ctd/ bongo	53° 30.000' N	134° 30.000' W	197.5	12	16.5	2,000	112	45	720	01-May-2005 10:30	02-May-2005 01:07
SSN01	ctd/ bongo	56° 30.000' N	137° 15.000' W	397.2	12	33.1	2,000	112	45	720	03-May-2005 10:13	04-May-2005 00:50
SSN02	ctd	56° 24.000' N	138° 00.000' W	25.6	12	2.1	1,000	69		30	04-May-2005 02:58	04-May-2005 04:37
SSN03	ctd	56° 00.000' N	138° 04.000' W	24.1	12	2.0	1,000	69		30	04-May-2005 06:38	04-May-2005 08:17
SSN04	ctd	56° 00.000' N	138° 08.000' W	2.2	12	0.2	1,500	91		30	04-May-2005 08:28	04-May-2005 10:29
SSN05	ctd	56° 00.000' N	138° 12.000' W	2.2	12	0.2	1,000	69		30	04-May-2005 10:40	04-May-2005 12:19
SSN06	ctd	56° 00.000' N	138° 16.000' W	2.2	12	0.2	1,000	69		30	04-May-2005 12:31	04-May-2005 14:10
SSN07	ctd	56° 00.000' N	138° 20.000' W	2.2	12	0.2	1,500	91		30	04-May-2005 14:21	04-May-2005 16:22
SSN08	ctd/ bongo	56° 00.000' N	138° 24.000' W	2.2	12	0.2	1,000	69	45	30	04-May-2005 16:33	04-May-2005 18:57
SSN09	ctd/ bongo	56° 00.000' N	138° 28.000' W	2.2	12	0.2	2,000	112	45	720	04-May-2005 19:09	05-May-2005 09:45
SSN10	ctd/ bongo	56° 00.000' N	138° 32.000' W	2.2	12	0.2	1,000	69	45	30	05-May-2005 09:56	05-May-2005 12:21
SSN11	ctd	56° 00.000' N	138° 36.000' W	2.2	12	0.2	1,500	91		30	05-May-2005 12:32	05-May-2005 14:33
SSN12	ctd	56° 00.000' N	138° 40.000' W	2.2	12	0.2	1,000	69		30	05-May-2005 14:44	05-May-2005 16:23

Station ID	Activity	Latitude	Longitude	Dist. (nm)	Spd (kts)	Transit (hrs)	CTD Depth (m)	CTD Time (min)	Net Time (min)	Other Time (min)	Arrive Local Date/Time	Depart Local Date/Time
SSN13	ctd/ bongo	56° 00.000' N	138° 44.000' W	2.2	12	0.2	1,000	69		30	05-May-2005 16:34	05-May-2005 18:14
SSN14	ctd	56° 00.000' N	138° 48.000' W	2.2	12	0.2	1,500	91		30	05-May-2005 18:25	05-May-2005 20:26
SSN15	ctd	56° 00.000' N	138° 52.000' W	2.2	12	0.2	1,000	69	45	30	05-May-2005 20:37	05-May-2005 23:01
SSN16	ctd	56° 00.000' N	138° 56.000' W	2.2	12	0.2	1,000	69		30	05-May-2005 23:12	06-May-2005 00:52
SSN17	ctd	57° 24.000' N	139° 00.000' W	84.0	12	7.0	1,500	91	45	720	06-May-2005 07:52	06-May-2005 22:08
Zodiak launches (4) * 1hr		57° 24.000' N	139° 00.000' W	0.0	12	0.0				240	06-May-2005 22:08	07-May-2005 02:08
Other work		57° 24.000' N	139° 00.000' W	0.0	13	0.0				1,960	07-May-2005 02:08	08-May-2005 10:48
Arrive Seward, AK		60° 06.301' N	149° 25.268' W	362.2	14	25.9					09-May-2005 12:40	

8.4.2 Cruise TN-179 Leg 3 Itinerary

Station ID	Activity	Latitude	Longitude	Dist. (nm)	Spd (kts)	Transit (hrs)	CTD Depth (m)	CTD Time (min)	Net Time (min)	Arrive Local Date/Time	Depart Local Date/Time
Depart Seward, AK		60° 06.301' N	149° 25.268' W			37.0					12-May-2005 17:00
SEB1	ctd	55° 33.000' N	167° 46.000' W	643.9	12.0	53.7	68	25		14-May-2005 22:39	14-May-2005 23:03
SEB2	ctd	55° 39.682' N	167° 32.455' W	10.2	12.0	0.8	68	25	45	14-May-2005 23:54	15-May-2005 01:04
SEB3	ctd	55° 46.364' N	167° 18.909' W	10.1	12.0	0.8	68	25		15-May-2005 01:54	15-May-2005 02:19
SEB4	ctd	55° 53.045' N	167° 05.364' W	10.1	12.0	0.8	68	25	45	15-May-2005 03:10	15-May-2005 04:19
SEB5	ctd	55° 59.727' N	166° 51.818' W	10.1	12.0	0.8	68	25		15-May-2005 05:10	15-May-2005 05:34
SEB6	ctd	56° 06.409' N	166° 38.273' W	10.1	12.0	0.8	68	25	45	15-May-2005 06:25	15-May-2005 07:34
SEB7	ctd	56° 13.091' N	166° 24.727' W	10.1	12.0	0.8	68	25		15-May-2005 08:25	15-May-2005 08:49
SEB8	ctd	56° 19.773' N	166° 11.182' W	10.1	12.0	0.8	68	25	45	15-May-2005 09:39	15-May-2005 10:49
SEB9	ctd/ bongo	56° 26.455' N	165° 57.636' W	10.0	12.0	0.8	68	25	45	15-May-2005 11:39	15-May-2005 12:49
SEB10	ctd	56° 33.136' N	165° 44.091' W	10.0	12.0	0.8	68	25		15-May-2005 13:39	15-May-2005 14:03
SEB11	ctd/ bongo	56° 39.818' N	165° 30.545' W	10.0	12.0	0.8	68	25	45	15-May-2005 14:53	15-May-2005 16:03
SEB12	ctd/ bongo	56° 46.500' N	165° 17.000' W	10.0	12.0	0.8	68	25		15-May-2005 16:53	15-May-2005 17:17
SEB13	ctd	56° 53.182' N	165° 03.455' W	10.0	12.0	0.8	68	25	45	15-May-2005 18:07	15-May-2005 19:17
SEB14	ctd	56° 59.864' N	164° 49.909' W	10.0	12.0	0.8	68	25		15-May-2005 20:07	15-May-2005 20:31
SEB15	ctd	57° 06.545' N	164° 36.364' W	9.9	12.0	0.8	68	25	45	15-May-2005 21:21	15-May-2005 22:30
SEB16	ctd	57° 13.227' N	164° 22.818' W	9.9	12.0	0.8	68	25		15-May-2005 23:20	15-May-2005 23:45
SEB17	ctd	57° 19.909' N	164° 09.273' W	9.9	12.0	0.8	68	25	45	16-May-2005 00:34	16-May-2005 01:44

Station ID	Activity	Latitude			Longitude			Dist. (nm)	Spd (kts)	Transit (hrs)	CTD Depth (m)	CTD Time (min)	Net Time (min)	Arrive Local Date/Time	Depart Local Date/Time
SEB18	ctd/ bongo	57°	26.591'	N	163°	55.727'	W	9.9	12.0	0.8	68	25		16-May-2005 02:33	16-May-2005 02:58
SEB19	ctd	57°	33.273'	N	163°	42.182'	W	9.9	12.0	0.8	68	25	45	16-May-2005 03:47	16-May-2005 04:57
SEB20	ctd/ bongo	57°	39.955'	N	163°	28.636'	W	9.9	12.0	0.8	68	25		16-May-2005 05:46	16-May-2005 06:11
SEB21	ctd/ bongo	57°	46.636'	N	163°	15.091'	W	9.8	12.0	0.8	68	25	45	16-May-2005 07:00	16-May-2005 08:09
SEB22	ctd	57°	53.318'	N	163°	01.545'	W	9.8	12.0	0.8	68	25	45	16-May-2005 08:58	16-May-2005 10:08
SEB23	ctd	58°	00.000'	N	162°	48.000'	W	9.8	12.0	0.8	68	25		16-May-2005 10:57	16-May-2005 11:22
NP1	ctd	57°	19.400'	N	169°	55.300'	W	232.0	12.0	19.3	68	25	45	17-May-2005 06:42	17-May-2005 07:51
NP2	ctd/ bongo	57°	26.331'	N	169°	47.156'	W	8.2	12.0	0.7	68	25		17-May-2005 08:32	17-May-2005 08:57
NP3	ctd	57°	33.263'	N	169°	39.013'	W	8.2	12.0	0.7	68	25	45	17-May-2005 09:38	17-May-2005 10:47
NP4	ctd/ bongo	57°	40.194'	N	169°	30.869'	W	8.2	12.0	0.7	68	25		17-May-2005 11:28	17-May-2005 11:53
NP5	ctd	57°	47.125'	N	169°	22.725'	W	8.2	12.0	0.7	68	25	45	17-May-2005 12:34	17-May-2005 13:43
NP6	ctd	57°	54.056'	N	169°	14.581'	W	8.2	12.0	0.7	68	25		17-May-2005 14:24	17-May-2005 14:49
NP7	ctd	58°	00.987'	N	169°	06.438'	W	8.2	12.0	0.7	68	25	45	17-May-2005 15:30	17-May-2005 16:39
NP8	ctd	58°	07.919'	N	168°	58.294'	W	8.2	12.0	0.7	68	25		17-May-2005 17:20	17-May-2005 17:44
NP9	ctd	58°	14.850'	N	168°	50.150'	W	8.2	12.0	0.7	68	25	45	17-May-2005 18:25	17-May-2005 19:35
NP10	ctd	58°	21.781'	N	168°	42.006'	W	8.1	12.0	0.7	68	25		17-May-2005 20:15	17-May-2005 20:40
NP11	ctd	58°	28.713'	N	168°	33.863'	W	8.1	12.0	0.7	68	25	45	17-May-2005 21:21	17-May-2005 22:30
NP12	ctd	58°	35.644'	N	168°	25.719'	W	8.1	12.0	0.7	68	25	45	17-May-2005 23:11	18-May-2005 00:20
NP13	ctd	58°	42.575'	N	168°	17.575'	W	8.1	12.0	0.7	68	25		18-May-2005 01:01	18-May-2005 01:26
NP14	ctd	58°	49.506'	N	168°	09.431'	W	8.1	12.0	0.7	68	25	45	18-May-2005 02:06	18-May-2005 03:16
NP15	ctd	58°	56.438'	N	168°	01.288'	W	8.1	12.0	0.7	68	25		18-May-2005 03:56	18-May-2005 04:21
NP16	ctd	59°	03.369'	N	167°	53.144'	W	8.1	12.0	0.7	68	25	45	18-May-2005 05:01	18-May-2005 06:11
NP17	ctd	59°	10.300'	N	167°	45.000'	W	8.1	12.0	0.7	68	25	45	18-May-2005 06:51	18-May-2005 08:01
NSM1	ctd	59°	54.000'	N	168°	00.000'	W	44.4	12.0	3.7	68	25	45	18-May-2005 11:43	
NSM2	ctd	59°	54.000'	N	168°	23.000'	W	11.5	12.0	1.0	68	25		18-May-2005 13:50	18-May-2005 14:14
NSM3	ctd	59°	54.000'	N	168°	46.000'	W	11.5	12.0	1.0	68	25	45	18-May-2005 15:12	18-May-2005 16:22
NSM4	ctd	59°	54.000'	N	169°	09.000'	W	11.5	12.0	1.0	68			18-May-2005 17:19	18-May-2005 17:19
NSM5	ctd	59°	54.000'	N	169°	32.000'	W	11.5	12.0	1.0	68	25	45	18-May-2005 18:17	18-May-2005 19:26
NSM6	ctd	59°	54.000'	N	169°	55.000'	W	11.5	12.0	1.0	68	25		18-May-2005 20:24	18-May-2005 20:49
NSM7	ctd	59°	54.000'	N	170°	18.000'	W	11.5	12.0	1.0	68	25	45	18-May-2005 21:46	18-May-2005 22:56
NSM8	ctd	59°	54.000'	N	170°	41.000'	W	11.5	12.0	1.0	68	25		18-May-2005 23:54	19-May-2005 00:18
NSM9	ctd	59°	54.000'	N	171°	04.000'	W	11.5	12.0	1.0	68	25	45	19-May-2005 01:16	19-May-2005 02:25
NSM10	ctd	59°	54.000'	N	171°	27.000'	W	11.5	12.0	1.0	68	25		19-May-2005 03:23	19-May-2005 03:47
NSM11	ctd	59°	54.000'	N	171°	50.000'	W	11.5	12.0	1.0	68	25	45	19-May-2005 04:45	19-May-2005 05:55

Station ID	Activity	Latitude			Longitude			Dist. (nm)	Spd (kts)	Transit (hrs)	CTD Depth (m)	CTD Time (min)	Net Time (min)	Arrive Local Date/Time	Depart Local Date/Time
NSM12	ctd	59°	54.000'	N	172°	13.000'	W	11.5	12.0	1.0	68	25		19-May-2005 06:52	19-May-2005 07:17
NSM13	ctd	59°	54.000'	N	172°	36.000'	W	11.5	12.0	1.0	68	25	45	19-May-2005 08:15	19-May-2005 09:24
NSM14	ctd	59°	54.000'	N	172°	59.000'	W	11.5	12.0	1.0	68	25		19-May-2005 10:22	19-May-2005 10:46
NSM15	ctd	59°	54.000'	N	173°	22.000'	W	11.5	12.0	1.0	68	25	45	19-May-2005 11:44	19-May-2005 12:53
NSM16	ctd/bongo	59°	54.000'	N	173°	45.000'	W	11.5	12.0	1.0	68	25		19-May-2005 13:51	19-May-2005 14:16
NSM17	ctd	59°	54.000'	N	174°	08.000'	W	11.5	12.0	1.0	68	25	45	19-May-2005 15:13	19-May-2005 16:23
NSM18	ctd	59°	54.000'	N	174°	31.000'	W	11.5	12.0	1.0	68	25		19-May-2005 17:21	19-May-2005 17:45
NSM19	ctd	59°	54.000'	N	174°	54.000'	W	11.5	12.0	1.0	68	25	45	19-May-2005 18:43	19-May-2005 19:52
NSM20	ctd	59°	54.000'	N	175°	17.000'	W	11.5	12.0	1.0	68	25		19-May-2005 20:50	19-May-2005 21:15
NSM21	ctd	59°	54.000'	N	175°	40.000'	W	11.5	12.0	1.0	68	25	45	19-May-2005 22:12	19-May-2005 23:22
NSM22	ctd	59°	54.000'	N	176°	03.000'	W	11.5	12.0	1.0	68	25		20-May-2005 00:19	20-May-2005 00:44
NSM23	ctd	59°	54.000'	N	176°	26.000'	W	11.5	12.0	1.0	68	25	45	20-May-2005 01:42	20-May-2005 02:51
NSM24	ctd/bongo	59°	54.000'	N	176°	49.000'	W	11.5	12.0	1.0	68	25		20-May-2005 03:49	20-May-2005 04:13
NSM25	ctd/bongo	59°	54.000'	N	177°	12.000'	W	11.5	12.0	1.0	68	25	45	20-May-2005 05:11	20-May-2005 06:21
NSM26	ctd	59°	54.000'	N	177°	35.000'	W	11.5	12.0	1.0	68	25		20-May-2005 07:19	20-May-2005 07:43
NSM27	ctd	59°	54.000'	N	177°	58.000'	W	11.5	12.0	1.0	68	25	45	20-May-2005 08:41	20-May-2005 09:50
NSM28	ctd	59°	54.000'	N	178°	21.000'	W	11.5	12.0	1.0	68	25		20-May-2005 10:48	20-May-2005 11:13
SL1	ctd/ bongo	62°	17.000'	N	175°	25.000'	W	166.4	12.0	13.9	68	25	45	21-May-2005 01:04	21-May-2005 02:14
SL2	ctd	62°	14.500'	N	175°	05.000'	W	9.6	12.0	0.8	68	25		21-May-2005 03:02	21-May-2005 03:27
M8	ctd	62°	12.000'	N	174°	45.000'	W	9.7	12.0	0.8	68	25	45	21-May-2005 04:15	21-May-2005 05:24
SL3	ctd	62°	09.143'	N	174°	27.857'	W	8.5	12.0	0.7	68	25		21-May-2005 11:22	21-May-2005 11:46
SL4	ctd	62°	06.286'	N	174°	10.714'	W	8.5	12.0	0.7	68	25	45	21-May-2005 12:29	21-May-2005 13:39
SL5	ctd	62°	03.429'	N	173°	53.571'	W	8.5	12.0	0.7	68	25		21-May-2005 14:21	21-May-2005 14:46
SL6	ctd/ bongo	62°	00.571'	N	173°	36.429'	W	8.5	12.0	0.7	68	25	45	21-May-2005 15:28	21-May-2005 16:38
SL7	ctd	62°	57.714'	N	172°	19.286'	W	67.3	12.0	5.6	68	25		21-May-2005 22:15	21-May-2005 22:39
SL8	ctd/ bongo	62°	54.857'	N	172°	02.143'	W	8.3	12.0	0.7	68	25	45	21-May-2005 23:21	22-May-2005 00:30
SL9	ctd	62°	52.000'	N	171°	45.000'	W	8.3	12.0	0.7	68	25		22-May-2005 01:12	22-May-2005 01:36
SL10	ctd/ bongo	62°	49.143'	N	171°	27.857'	W	8.3	12.0	0.7	68	25	45	22-May-2005 02:18	22-May-2005 03:28
SL11	ctd	61°	46.286'	N	170°	10.714'	W	72.4	12.0	6.0	68	25		22-May-2005 09:29	22-May-2005 09:54
SL12	ctd	61°	43.429'	N	170°	53.571'	W	20.5	12.0	1.7	68	25	45	22-May-2005 11:36	22-May-2005 12:46
SL13	ctd/ bongo	61°	40.571'	N	169°	36.429'	W	36.7	12.0	3.1	68	25		22-May-2005 15:49	22-May-2005 16:14
SL14	ctd	61°	37.714'	N	169°	19.286'	W	8.6	12.0	0.7	68	25		22-May-2005 01:13	22-May-2005 01:38
SL15	ctd/ bongo	61°	34.857'	N	168°	02.143'	W	36.8	12.0	3.1	68	25	45	22-May-2005 04:40	22-May-2005 05:50
SL16	ctd	61°	32.000'	N	168°	45.000'	W	20.6	12.0	1.7	68	25		22-May-2005 05:11	22-May-2005 05:35

Station ID	Activity	Latitude	Longitude	Dist. (nm)	Spd (kts)	Transit (hrs)	CTD Depth (m)	CTD Time (min)	Net Time (min)	Arrive Local Date/Time	Depart Local Date/Time
SL17	ctd/ bongo	61° 29.143' N	168° 27.857' W	8.7	12.0	0.7	68	25	45	22-May-2005 10:37	22-May-2005 11:47
SL18	ctd	61° 26.286' N	168° 10.714' W	34.6	12.0	2.9	68	25		22-May-2005 04:29	22-May-2005 04:54
SL19	ctd/ bongo	61° 23.429' N	168° 53.571' W	27.1	12.0	2.3	68	25	45	22-May-2005 05:43	22-May-2005 06:52
SL20	ctd	61° 20.571' N	168° 36.429' W	12.1	12.0	1.0	68	25		22-May-2005 10:55	22-May-2005 11:19
SL21	ctd	61° 17.714' N	168° 19.286' W	12.1	12.0	1.0	68	25		22-May-2005 13:47	22-May-2005 14:11
SL22	ctd/ bongo	61° 14.857' N	168° 02.143' W	8.7	12.0	0.7	68	25	45	22-May-2005 14:55	22-May-2005 16:04
M8	Recover mooring	62° 12.000' N	174° 45.000' W	0.0	12.0	0.0	68		120	21-May-2005 05:24	21-May-2005 07:24
M8	Deploy mooring	62° 12.000' N	174° 45.000' W	0.0	12.0	0.0	68		120	21-May-2005 07:24	21-May-2005 09:24
M8	Deploy mooring	62° 12.000' N	174° 45.000' W	0.0	12.0	0.0	68		75	21-May-2005 09:24	21-May-2005 10:39
M8	ctd 70m isobath	62° 12.000' N	174° 45.000' W	199.1	12.0	16.6	68	25		23-May-2005 08:40	23-May-2005 09:04
M2	ctd 70m isobath	57° 00.000' N	164° 00.000' W	450.5	6.0	75.1	68	25	900	26-May-2005 12:09	27-May-2005 03:34
Dutch Harbor, AK, touch-n-go		54° 54.000' N	166° 30.000' W	151.4	12.0	12.6			240	27-May-2005 16:11	27-May-2005 20:11
Arrive Seattle, WA				1717	12.0	143.1				02-Jun-2005 19:16	

8.5 Cruise TN-179 HAZMAT Inventory

Chemical	CAS Number	Quantity	H	F	R	Storage Color Code	Hazard Class	Packing Group Number	UN	Reportable Quantity	Response Indices
Acetone	67-64-1	4-l	1	4	2	Flammable	3	II	1090	350 LBS	1
Ammonium Chloride	12125-02-9	428-g	1	0	0	General	Not regulated		9085	5,000 LBS	2
Ammonium Hydroxide	1336-21-6	1-l	3	1	0	Store Separately	8	III	2672	385 LBS	3
Ammonium Molybdate, Anhydrous	12027-67-7	150-g	2	0	1	General	Not regulated				2
Antimony Potassium Tartrate	11071-15-1	4.2-g	3	0	1	Corrosive	6.1	III	1551	2.5 KG	4
Ascorbic Acid	50-81-7	157-g	1	1	0	General	Not regulated				4
Battery, Alkaline	mixture	7-cells				General	Not regulated				
Battery, Lithium, Bromine Chloride	mixture	92-cells	1	1	2	General	9	II	3090	35 KG	
Battery, Lithium, Tadiran	mixture	140-cells				General	9	II	3090	35 KG	
Brij	9002-92-0	250-ml	0	1	0	General	Not regulated				5
Cadmium	7440-43-9	82-g				Toxic	4.1	III	3178		6
Ethyl Alcohol	mixture	1-l	1	3	0	Flammable	3	II	1987	5,000 LBS	1
Formaldehyde, 37%	50-00-0	7-gal	3	2	2	Flammable	3 & 8	III	1198	100 LBS	1

Chemical	CAS Number	Quantity	H	F	R	Storage Color Code	Hazard Class	Packing Group Number	UN	Reportable Quantity	Response Indices
Formalin, Hex Buffered	50-00-0	250-ml	3	2	2	Flammable	3 & 8	III	1198	100 LBS	1
Formic Acid	64-18-6	0.5-l	3	2	0	Store Separately	8	II	1779	127 LBS	7
Hydrazine Sulfate	10034-93-2	25-g	3	1	0	Corrosive	8	III	3260	200 LBS	8
Hydrochloric Acid	7647-01-0	2.5-l	3	0	2	Corrosive	8	II	1789	5,000 LBS	9
Hydrochloric Acid, 6M	7647-01-0	500-ml	3	0	0	Corrosive	8	II	1789	5,000 LBS	9
Hydrochloric Acid, 10% Solution	7647-01-0	3-l	3	0	0	Corrosive	8	II	1789	5,000 LBS	9
Hydrogen Peroxide	7722-84-1	2-l	3	0	1	Corrosive	5.1 & 8	II	2014	470 LBS	
Imidazole	288-32-4	27-g	3	1	0	Corrosive	8	III	3263	5 KG	8
Iodine Lugols, Solution	mixture	2.25-l	1	0	0	General	Not regulated				
Luminol	521-31-3	< 5-g	2	1	0	General	Not regulated				10
Magnesium Sulfate Heptahydrate	10034-99-8	213-g	1	0	0	General	Not regulated				2
Mercuric Chloride	7487-94-7	0.04-l	3	0	0	Corrosive	6.1	II	1624	12 KG	6
N-1-Napthylethylenediamine Dihydrochloride	1465-25-4	1-g	2	1	0	General	Not regulated				4
Nitric Acid	7697-37-2	150-ml	3	0	0	Corrosive	8	II	2031	150 LBS	9
Oxalic Acid	144-62-7	490-g	3	1	0	Corrosive	8	III	3261	12 KG	11
Phosphoric Acid	7664-38-2	1-l	3	0	2	Corrosive	8	III	1805	350 LBS	9
Potassium Carbonate	584-08-7	< 10-g	2	0	0	General	Not regulated				12
Potassium Nitrate	7757-79-1	112-mg	1	0	0	Reactive	5.1	III	1486	100 KG	8
Potassium Phosphate	11/4/7758	3-g	1	0	0	General	Not regulated				2
Sodium Bicarbonate	144-55-8	54-g	1	0	0	General	Not regulated				13
Sodium Borate	1330-43-4	500-g	1	0	0	General	Not regulated				4
Sodium Borate, Solution	1330-43-4	20-l	1	0	0	General	Not regulated				4
Sodium Chloride	7647-14-5	963-g	1	0	0	General	Not regulated				13
Sodium Fluorosilicate	16893-85-9	2.4-g	3	0	0	Toxic	6.1	III	2674		14
Sodium Hydroxide, 10N	1310-73-2	500-ml	4	0	2	Store Separately	8	II	1823	1,000 LBS	15
Sodium Nitrite	7632-00-0	0.5-g	2	0	1	Reactive	5.1	III	1500	100 LBS	16
Stannous Chloride	7772-99-8	100-g	1	0	0	General	Not regulated				2
Sulfanilamide	63-74-1	150-g	1	1	0	General	Not regulated				2
Sulfuric Acid	7664-93-9	1-l	4	0	2	Corrosive	8	II	1830	440 LBS	9
Triethylenetetramine Dihydrochloride	38260-01-4	3-g				General	Not regulated				

Spill Response 1: Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e.g., vermiculite, dry sand, or earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. U.S. Regulations (CERCLA) requires reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.
Spill Response 2: Ventilate area of leak or spill. Wear appropriate personal protective equipment. Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. Place material in closed container.
Spill Response 3: Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment. Contain and recover liquid when possible. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric, or sulfuric. Absorb neutralized caustic residue on clay, vermiculite, or other inert substance and package in a suitable container for disposal. U.S. Regulations (CERCLA) require reporting spills and releases to soil, water, and air in excess of reportable quantities. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.
Spill Response 4: Ventilate area of leak or spill. Wear appropriate personal protective equipment. Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust.
Spill Response 5: Ventilate area of leak or spill. Wear appropriate personal protective equipment. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!
Spill Response 6: Evacuate area. Wear Self-Contained Breathing Apparatus (SCBA), rubber boots, and heavy rubber gloves. Wear disposable coveralls and discard them after use. Sweep up, place in bag, and hold for waste disposal. Ventilate area and wash spill site after material pickup is complete. Avoid raising dust.
Spill Response 7: Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e.g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. U.S. Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.
Spill Response 8: Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment. Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container.
Spill Response 9: Ventilate area of leak or spill. Wear appropriate personal protective equipment. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e.g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! U.S. Regulations (CERCLA) requires reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.
Spill Response 10: Eliminate Ignition Sources. Neutralize with soda lime, soda ash. Absorb with vermiculite or other inert material. Place in container.
Spill Response 11: Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment. Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container. Do not flush to the sewer! Dry lime or soda ash may be used on spill for neutralization. U.S. Regulations (CERCLA) requires reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.
Spill Response 12: Ventilate area of leak or spill. Wear appropriate personal protective equipment. Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust.
Spill Response 13: Ventilate area of leak or spill. Wear appropriate personal protective equipment. Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. Small amounts of residue may be flushed to sewer with plenty of water.

Spill Response 14: Keep unnecessary people away. Stay upwind, keep out of low areas. Isolate hazard area and deny entry. Ventilate closed spaces before entering them. Employees should be trained in safety procedures for storage and handling this product. Any personnel in area should wear a National Institute for Occupational Safety and Health (NIOSH) approved breathing apparatus and protective clothing. Isolate product spill area. Carefully shovel material and place in clean, dry container and cover. Remove container from spill site and dispose of in accordance with federal, state, and local regulations.
Spill Response 15: Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment. Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush caustic residues to the sewer! Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric, or sulfuric. Absorb neutralized caustic residue on clay, vermiculite, or other inert substance and package in a suitable container for disposal. U.S. Regulations (CERCLA) requires reporting spills and releases to soil, water, and air in excess of reportable quantities. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.
Spill Response 16: Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment. Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container. U.S. Regulations (CERCLA) requires reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the U.S. Coast Guard National Response Center is (800) 424-8802.