FINAL CRUISE INSTRUCTIONS
NOAA Ship *Ronald H. Brown*
26 April 2001

Cruise No:	RB-01-03 Leg 3
FOCI No:	3RB01
Operating Area:	SE Bering Sea

Dates:	25 May 2001 depart Kodiak, AK
	08 June 2001 arrive Dutch Harbor, AK
Sea Days:	15

Chief Scientist:

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1.0 Cruise Overview

1.1 Program Description: The Fisheries Oceanography Coordinated Investigations (FOCI) are an effort by NOAA and academic scientists to understand the physical and biological processes that determine recruitment variability of commercially valuable fish and shellfish stocks in Alaskan waters. FOCI consists of several projects including the present ones supported by the North Pacific Marine Research (NPMR) Program and the International Arctic Research Center (IARC).

1.2 Cruise Objectives: The purpose of the NPMR project is to understand the influence of mesoscale eddies on continental slope-shelf exchange in the Southeastern Bering Sea. The objectives are to

(1) Detect movements of nutrient-rich slope water onto the shelf and relate them to temporal and spatial variations in chlorophyll,
(2) Identify physical mechanisms that create slope-water fluxes onto the continental shelf,
(3) Detect ocean-color variability in relation to physical processes,
(4) Use shipboard measurements of near-surface optical and biological parameters to validate and extend bio-optical algorithms for use in autonomous sampling and remote sensing, and
(5) Investigate the effects of on-shelf flow on phytoplankton biology.

The IARC project (Tanaka) has the complementary objective of measuring the isotopic fractionation of nitrate and carbon to show biological features due to the interaction of basin water with the shelf.

1.3 Applicability: These instructions in conjunction with the "FOCI Standard Operating Instructions for NOAA Ship *Ronald H. Brown*, 2001" provide complete information for this cruise. The Chief Scientist is authorized to alter the scientific portion of this cruise plan with the concurrence of the Commanding Officer, provided that the proposed changes will not

(1) Jeopardize the safety of personnel or the ship,
(2) Exceed the time allotted for the cruise,
(3) Result in undue additional expense, or
(4) Change the general intent of the cruise.

1.4 Operating Area: Southeastern Bering Sea (see Fig. 1).

1.5 Participating Organizations

A. NOAA/Pacific Marine Environmental Laboratory (PMEL)
7600 Sand Point Way NE
Seattle, WA 98115-6439

B. University of Alaska-Fairbanks (UAF)
School of Fisheries & Ocean Sciences
P.O. Box 757220
Fairbanks, AK 99775-7220

C. Dalhousie University (Dal)
Department of Oceanography
Halifax, NS B3H 4J1
Canada

D Frontier Research System for Global Change
International Arctic Research Center (IARC)
Univ. Alaska Fairbanks
930 Koyukuk Dr.
P.O.Box 757335
Fairbanks, Alaska 99775-7335

D US Naval Academy (USN)

1.6 Personnel

	Name	Title	Affil.	Sex	Nation
1.	Edward (Ned) Cokelet, Ph D	Chief Scientist	PMEL	M	USA
2.	Carol DeWitt	Field Ops. Spec.	PMEL	F	USA
3.	William Floering	Field Ops. Spec.	PMEL	M	USA
4.	John Cullen, Ph D	Professor	Dal	M	USA
5.	Richard Davis	Research Assistant	Dal	M	USA
6.	Yannick Huot	Graduate Student	Dal	M	Canada
7.	Stephane Kirchhoff	Research Assistant	Dal	M	France
8.	Moritz Lehmann	Graduate Student	Dal	M	Germany
9.	Christina Schallenberg	Graduate Student	Dal	F	Germany
10.	Tomoyuki Tanaka	Graduate Student	IARC	M	Japan
11.	Taekeun Rho	Graduate Student	UAF	M	Korea
12.	Stephanie Moreland	Research Assistant	UAF	F	USA
13.	Amy Childers	Research Assistant	UAF	F	USA
14.	Sarah Heidt	Midshipman	USN	F	USA
15.	Andrew Winberry	Midshipman	USN	M	USA
16.	Timothy Ray	Midshipman	USN	M	USA
17.	Ken Neptun	Midshipman	USN	M	USA

1.7 Administrative

A. Ship Operations:

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B. Scientific Operations:

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2.0 Operations

2.1 Data to be collected: Measurements will be collected with shipboard sensors including the ADCP and Sea Beam, a CTD profiler with water bottles, and user-supplied mast-mounted radiometers, tethered spectral radiometer buoy (TSRB) and spectral radiometer profiler. A few satellite-tracked drifting buoys and temperature-salinity profiling floats will also be launched.

2.1.1: SCS will be configured to record the following:

Navigation - GPS P-code (even if not encrypted, if available) and differential position, time, COG, SOG and data-quality parameters; Ring-Laser-Gyro heading; "iron gyro" heading; Seapath 200 position, time, COG, SOG, heading, pitch, roll and data-quality parameters; bottom depth

Flow-through sampler - Thermosalinograph temperature, conductivity and salinity, and fluorometer temperature and fluorescence

Meteorological -	Solar radiation, relative and absolute wind speed and direction, barometric pressure, air temperature and humidity, precipitation

2.1.2: The ADCP will be configured according to the Chief Scientist’s specifications. It should receive position input from a DGPS, heading from the Ring-Laser Gyro and auxiliary heading from the Seapath 200. Data will be stored on 3.5” floppy disks or 100 MB Zip disks.

2.1.3: Sea Beam data may be collected on site-specific surveys as required and stored for transport back to PMEL.

2.1.4: CTD cast data will be collected on PMEL's Sea Bird 911+ system with the ship's system as a back-up. There will be approximately 120 CTD casts. 12 10-liter water samples will be taken on most casts.

2.1.5: AutoSal runs will be done to compare salinities with CTD values. Usually 2 samples will be taken per cast - one at depth and one in the surface mixed layer. This could be relaxed to one sample per cast - alternating between deep and mixed-layer samples.

2.1.6: AVHRR and SeaWiFS satellite observations of SST and ocean color will be downloaded using TeraScan and full-resolution, geo-referenced images made available in a timely manner to facilitate cruise planning. In clear weather these should prove invaluable for locating nutrient-rich slope water that moves onto the shelf and promotes phytoplankton blooms.

2.1.7: The ship will maintain a Marine Operations Abstract (MOA) on paper giving the date, time and location of significant events such as CTD casts, buoy deployments, etc.

2.2 Staging plan: Gear will be shipped to Kodiak and loaded on 23-24 May 2001. Access to the ship as soon as possible after its arrival in Kodiak is needed because the chemical analysis equipment requires extensive set-up. The scientific party will arrange for the use of a van and pick-up truck to move gear from the airport and/or the docks to the ship in Kodiak.

2.3 Cruise plan: The cruise's primary goal is to study slope-shelf interaction. Work will be divided into 5 stages as follows (see Itinerary in Table 1):

- The ship will depart Kodiak and transit through Unimak Pass enroute to SEBSCC (Southeast Bering Sea Carrying Capacity) Mooring 2.
- We will sample the SEBSCC Line from Mooring 2 to the Mooring 3 site. (No mooring is presently deployed at site 3.)
- The ship will transit to the slope-shelf interaction area inside the box of Figure 1.
- We will spend 10-11 days studying slope-shelf interaction.
- The ship will transit to Dutch Harbor for debarkation.

2.3.1: The purpose of the NPMR observations is to locate one or more eddies interacting with the Southeastern Bering Sea shelf break and sample the evolving flux of nutrient-rich slope water onto the continental shelf and associated primary production changes. Before and during the cruise, eddies will be located in three ways:

- from sea-surface height anomalies observed by the TOPEX/Poseidon satellite (images downloaded directly from the World Wide Web if feasible, or faxed from PMEL),
- from SeaWiFS ocean color images downloaded and processed via TeraScan (or downloaded from the World Wide Web, if available), and
- from the trajectories of satellite-tracked drifting buoys launched prior to and during this cruise.

The water structure of temperature, salinity, nutrients, fluorescence, irradiance and pigments will be surveyed with CTD sections. Currents will be observed from ADCP transects and drifting-buoy trajectories.

2.3.1.1: Nutrient samples will be taken and analyzed aboard ship. Optical properties will be measured using spectral profiling and floating radiometers. Biological, bio-optical and physiological measurements, such as chlorophyll-a concentration, particulate absorption, and *in vivo* fluorescence, will be collected.

2.3.1.2: The speed and direction of the drifters within the onshore flow will not tell us its width, but previous work indicates that the breadth of an episodic onshore flow event is approximately 10-20 km. Estimates of jet size from remote sensing and onboard analysis of data will allow for real-time modification of the sampling scheme to accommodate the actual size of the jet encountered, within the available ship time. The ship will follow a zig zag pattern, crossing the onshelf flow approximately 5 times until the 100 m isobath is reached. Stations will be occupied every 5 to 10 km along any one diagonal.

2.3.1.3 Alternative NPMR Plan: Drifters deployed on an earlier cruise along with altimeter data will be used to identify possible sites of episodic onshelf flow. There is, however, the chance that no onshelf flow events will be identified. If an episodic event is not located using either method, then the presence and effects of the relatively persistent onshelf flow, as evident in drifter trajectories and hydrographic surveys from past years, at either Bering Canyon or Pribilof Canyon will be examined. The sampling schedule will be as described, proceeding from the head of the canyon towards the shelf.

2.4 Waypoints: CTD station locations between mooring sites 2 and 3 are listed in Table 1. If possible, the Chief Scientist will e-mail the approximate location of the NPMR study area to the ship a few days in advance of the cruise, once we have determined it from satellite-tracked drifting buoy trajectories and satellite images. Owing to the dynamic nature of the interaction of Bering Slope Current eddies with the shelf break, it will not be possible to provide sampling points until the day of departure. The sampling area will evolve with the eddy interaction.

2.5 Station operations: CTD operations will proceed 24 hours per day for ~120 casts. There will be ~120 AutoSal salinity determinations. Care must be taken at the SEBSCC mooring site 2 (M2 of Table 2) to avoid fouling the CTD on the mooring gear.

2.5.1: A CTD station will consist of the following:

- CTD profile to 1500 m or to ~10 m above the sea floor with a fluorometer on the package to measure *in vivo* fluorescence and an altimeter to measure height above the bottom.

- Discrete 10-L samples will be obtained at selected depths with Niskin bottles on the rosette. Nutrient analysis will require 50 ml, isotopic fractionation studies will require 2 L, and the remaining water sample will be available for carbon and nitrogen productivity studies.

2.5.2: A standard bio-optics station will consist of a CTD cast and the following:

- Tethered spectral radiometer buoy (TSRB), FRR fluorometer, ac-9, and HydroScat deployment. Each of these deployments will typically require 15 minutes of in-water time. A bucket sample will be taken concurrently to characterize near-surface pigments.

- Spectral radiometer profile to ~100 m or ~10 m above the sea floor using a Satlantic SPMR. The data stream from this instrument consists of 13 channels of downwelling irradiance, pressure, temperature, conductivity, and *in vivo* fluorescence.

Each standard bio-optics station should take no more than 1.5 hr to conduct. Discrete samples will be processed on board for fluorometric determination of chlorophyll concentration and for nutrient concentrations.

2.6 Underway operations: Several underway measurements are required. The Thermosalinograph, flow-through fluorometer, and ADCP will be used continuously. These and other SCS data should be logged throughout the cruise. Periodically, 2-L water samples will be taken from the flow-through water supply and analyzed for isotopic fractionation.

2.6.1: Dalhousie scientists wish to mount 2 radiometers on the ship - 10 and 25 cm in diameter - probably on the ship's mast. Solar shadowing needs to be minimized, but they need not be mounted at the highest point on the ship. Often the forward mast is an appropriate location. These should be logged by SCS.

2.6.2: Sea Beam - Bering Sea eddies may interact with the continental shelf in submarine canyons and at discontinuities in the shelf break. Since Bering Sea bathymetry is poorly known, we may wish to map the bottom using Sea Beam in areas of eddy impingement.

2.7 Applicable restrictions: None.

2.8 Small boat operations: None planned.

2.9 De-staging plan: Gear will be off-loaded in Dutch Harbor on 8 June 2001 and transported via NMFS van to the airport. GaxEx and ACE-Asia gas cylinders will be off-loaded in Victoria after the cruise.

3.0 Facilities

3.1 Equipment and capabilities provided by ship:

- Oceanographic winch with slip rings and 3-conductor cable terminated for CTD,
- Readout for oceanographic winch,
- Backup Sea Bird 911 plus CTD system including underwater CTD with twin temperature and conductivity sensors (plus spares), 12-bottle rosette, pinger, weights, deck unit, PC with SeaSoft software and tape recorder,
- 10-liter sampling bottles for use with rosette (12 plus spares),
- AUTOSAL salinometer for CTD salinity calibration,
- Thermosalinograph,
- Flow-through fluorometer,
- For meteorological observations: radiometer, 2 anemometers, barometer, air temperature sensor, relative humidity sensor and rainfall sensor,
- Freezer space for storage of biological and chemical samples (-20 F or colder, at least 10 cu. ft.),
- Bench space (at least 10 linear feet for productivity experiment filtering),
- Salt water outlets to cool productivity deck incubator(s) in an unshaded, but protected, deck area,
- Laboratory refrigerator (at least 6 cu. ft.),
- Distilled or reverse-osmosis water source,
- Laboratory space with exhaust hood, sink, lab tables and storage space,
- Echo sounders for deep and shallow water measurements,
- RDI 150-KHz ADCP with position input from DGPS receiver, heading input from Ring-Laser Gyro and Seapath 200 and output to Iomega Zip drive,
- SCS (Scientific Computer System),
- One or more networked PCs,
- Network connection for science-party-supplied Macintosh, NT and Unix computers,
- Networked black-and-white and color PostScript printers,
- Internet access for downloading TOPEX/Poseidon sea-surface height anomaly plots and SeaWiFs images,
- TeraScan oceanographic data satellite downlink and image analysis system,
- Sea Beam 2112 swath bathymetric sonar system,
- Adequate deck lighting for night-time operations,
- Safety harnesses for working on deck.

3.2 Equipment and capabilities provided by scientists:

PMEL:

- Primary Sea Bird 911 plus CTD system including underwater CTD with twin temperature and conductivity sensors (plus spares), fluorometer, Benthos altimeter, 12-bottle rosette and weights,
- Networked Macintosh computer with WordPerfect, Word, Excel and eXodus,
- Networked Unix computer with EPIC and Ferret,
- Networked Windows NT computer with SeaSoft,

- IAPSO water,
- Argos-tracked drifting buoys with optical sensors,
- Miscellaneous scientific sampling and processing equipment ,
- Discrete Sample Data Base software and forms,
- Float coats,
- Office supplies: paper, pens, pencils, data storage disks.

UAF:

- Alpkem RFA 300 nutrient analyzer,
- Polyethylene water sampling bottles for nutrients,
- Productivity filtration equipment and sampling bottles,
- Productivity deck incubators or pool,
- PC computer for data logging,

Dal:

- Profiling spectroradiometer
- Floating spectroradiometer
- 2 mast-mounted spectroradiometers
- Profiling FRR fluorometer
- Profiling ac-9 absorption/attenuation meter
- Profiling HydroScat backscatter meter
- Benchtop fluorometer
- Filter rigs
- Various computers
- Beam transmissometer for CTD

4.0 Disposition of Data and Reports

4.1 Data responsibilities: The Chief Scientist will receive all original data gathered by the ship for the primary project, and this data transfer will be documented on NOAA Form 61-29 "Letter Transmitting Data". The Chief Scientist in turn will furnish the ship a complete inventory listing all data gathered by the scientific party detailing types and quantities of data. The Chief Scientist will be 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 also be responsible for the dissemination of copies of these data to participants in the cruise, to any other requesters, and to notify NODC of measurements and samples taken at sea via a Cruise Summary Report (IOC ROSCOP, Third Edition). The ship may assist in copying data and reports insofar as facilities allow. Metadata describing data collected during FOCI and NPMR cruises must be submitted to the Bering Sea Ecosystem Biophysical Metadatabase within one month of completion of the cruise. On-line guidance and submission forms are available through the World Wide Web at http://www.pmel.noaa.gov/bering/mdb/.   Alternatively, forms may be requested from the FOCI Coordinator.

4.1.1: The Chief Scientist will ensure that all stations, deployments, etc. are entered into the FOCI Discrete Sample DataBase.

4.1.2: Individuals in charge of supplementary ("piggyback") projects conducted during the cruise have the same responsibilities for their project's data as the Chief Scientist has for primary project data. All requests for data should be made through the Chief Scientist.

4.1.3: The Commanding Officer is responsible for all data collected for fleet ancillary projects until those data have been transferred to the project's principal investigators or their designees. Data transfers will be documented on NOAA Form 61-29. Copies of fleet ancillary project data will be provided to the Chief Scientist when requested. Reporting and sending copies of fleet ancillary project data to NESDIS (ROSCOP) is the responsibility of the program office sponsoring those projects.

4.2 Pre- and post-cruise meetings: All scientific personnel will meet with ship's representatives in a pre-cruise meeting the day of departure to discuss scientific objectives, operations, safety and Standing Orders. A post-cruise meeting will be scheduled between the Chief Scientist and Commanding Officer for a convenient time at the end of the cruise. Project accomplishments will be reviewed, as will general aspects of ship's performance and any administrative issues.

4.3 Ship operation evaluation report: Reporting requirements for the Shipboard Operations Evaluation Form, to be completed and submitted by the Chief Scientist to the Office of Marine and Aviation Operations (OMAO) within 30 days of cruise completion, will also be reviewed.

5.0 Additional Projects

Any additional work will be subordinate to the primary project and will be accomplished only with the concurrence of the Commanding Officer and the Chief Scientist(s).

5.1 Supplementary ("Piggyback") projects:

5.1.1 Underway Measurements in support of Global Carbon Cycle Research ,
(GCC)

5.1.1.1 Request: As part of the ongoing research to quantify the CO2 uptake by the world's oceans we have installed underway systems on BROWN. On many cruises we request bunk space for one scientist of our laboratories to maintain the many systems outlined below. If we cannot send a dedicated person we try to have a scientist of the specific scientific party look after the Underway pCO2 system (described in section A4 below). On some cruises we are unsuccessful in attracting a volunteer and would like to use the services of the survey technician for the Underway pCO2 system only . After initial start-up, which requires about one hour of monitoring, the system needs checking twice a day requiring a total of about 20-minutes. We would also request weekly data downloads and transmission such that we can perform on shore near-real-time quality control to assess if the instrument is operating satisfactorily. All costs of the email transmissions and survey technician overtime would be covered by AOML. The chief survey technician, J. Shannahoff, has operated the instrument before with good results. In the event of system malfunction that cannot be easily repaired, we will ask Mr. Shannahoff to shut the system down. The shoreside leader of the effort, Mr. Robert Castle has interacted closely with J. Shannahoff and feels that this arrangement would work well.

5.1.1.2 Introduction: The underway sensors on RHB will be used in support of the objectives of the Global Carbon Cycle Research (GCC) to quantify the uptake of carbon by the world's ocean and to understand the bio-geochemical mechanisms responsible for variations of partial pressure of CO2 in surface water (pCO2). This work is a collaborative effort between the CO2 groups at AOML and PMEL.

Principal investigators:

Dr Rik Wanninkhof 305-361-4379 wanninkhof@aoml.noaa.gov AOML
Dr. Richard Feely 206-526-6214 feely@pmel.noaa.gov PMEL

The semi-automated instruments are installed on a permanent basis in the hydrolab of RHB and are operated by personnel from AOML and PMEL. All work is performed on a not-to-interfere basis and does not introduce any added ship logistic requirements other than the continuous operation of the bow water pump and thermosalinograph. This effort requires one permanent berth for the operator of the systems. The instrumentation is comprised of an underway system to measure pCO2, a SOMMA (single operator multi-parameter metabolic analyzer)-coulometer system to measure total dissolved inorganic carbon, a Turner Designs fluorometer, and a YSI oxygen probe. An oxygen titrator and stand-alone fluorometer will be used to calibrate the underway oxygen and fluorometer, respectively. All the instruments are set up along the port side wall and aft bench in the hydrolab.

5.1.1.3 Rationale: Current estimates of anthropogenic CO2 uptake by the oceans range from 1 to 2.8 Gigatons per year. The CO2 fluxes between air and water are poorly constrained because of lack of seasonal and geographic coverage of delta pCO2 (the air-water disequilibrium) values and incomplete understanding of factors controlling the air-sea exchange of carbon dioxide. Seasonal and temporal coverage can be increased dramatically by deploying pCO2 analyzers on ships.

The effort on RHB is expanded beyond the historical scope of the underway programs by incorporating additional sensors to improve our understanding of the factors controlling pCO2 levels.

5.1.1.4 Sensor Suite and Maintenance:

A. Underway pCO2 system

This system consists of a large (40-liter) air-water equilibrator requiring an unobstructed drain at floor level for the 15 L/min outflow, an infrared analyzer with valves and flow meters, and a computer controlling the operating sequence and which also logs the data. The underway pCO2 system is an integrated package for measurement of pCO2 in air and water and support sensors necessary to reduce the data (such as equilibrator temperature, location, salinity, sea surface temperature and barometric pressure). This system is an upgrade from the initial systems and requires routine checks at 6-12 hour intervals, including logging of mercury thermometers in the equilibrator.

B. Oxygen sensor
This is a compact pulsed electrode unit which also contains a temperature sensor. This is a new sensor built by Dr. Langdon at LDEO. Water requirement is 2-Liter/minute with a bench top drain. One foot of bench space is required. During this cruise the data will be validated against samples taken four time a day and analyzed by potentiometric winkler titrations

C. Turner Designs Fluorometer
This instrument, which was jointly purchased by AOML and MOC-A for BALDRIGE, requires a water throughput of about 5 L/min. Periodic cleaning of the flow through cell (2-14 days) is required . The signal of the fluorometer is logged on the shipboard SCS system or on the computer logging the underway pCO2 data. Aliquots of seawater are extracted twice per day and analyzed for chlorophyll and phaopigments on a separate fluorometer following routine procedures to calibrate the fluorometer signal. This information will be particularly useful to extrapolate the observations from the NASA SeaWiFS satellite to in situ pigment concentrations.

5.1.1.5 Summary - Ship infrastructure support:

1. Continuous seawater supply: 20 lpm minimum, 40 lpm maximum for instruments, and 75 lpm throughput to assure short residence time of water in line and minimal heating.

2. Access to TSG and SCS data: Temperature at intake, salinity from TSG, fluorometer signal, wind speed (true and relative), wind direction (true and relative), time, latitude, longitude, and ship speed.

3. Bench space, hydrolab space, access to bow water line and drains.

Specific questions should be directed to:
Robert Castle, phone 305-361-4418, castle@aoml.noaa.gov

5.2 NOAA Fleet ancillary projects:
Ancillary tasks will be accomplished in accordance with the NOAA Fleet Standing Ancillary Instructions.

6.0 Hazardous Materials

6.1 Policy/Compliance: *Ronald H. Brown* will operate in full compliance with all NOAA hazardous materials (HAZMAT) requirements. All hazardous materials and substances needed to carry out the objectives of the embarked science mission, including ancillary tasks, are the direct responsibility of the embarked designated Chief Scientist, whether or not that Chief Scientist is using them directly. The ship's Environmental Compliance Officer will work with the Chief Scientist to ensure that this management policy is properly executed.

6.1.1: All hazardous materials require a Material Safety Data Sheet (MSDS). Copies of all MSDSs shall be forwarded to the ship 60-90 days prior to sailing. The Chief Scientist shall have copies of each MSDS available when the hazardous materials are loaded aboard. HAZMAT for which the MSDS is not provided will not be loaded aboard.

6.1.2: At least 60 days before the cruise, the Chief Scientist will provide the Commanding Officer with an inventory indicating the amount of each hazardous material brought onboard, and for which the Chief Scientist is responsible. This inventory shall be updated at the beginning of the cruise prior to departure of the ship. A final inventory will be conducted at the completion of the cruise accounting for the amount of material being removed, as well as the amount consumed in science operations and the amount being removed in the form of waste.

6.1.3: The ship's dedicated HAZMAT Locker contains two 45-gallon capacity flame cabinets and one 22-gallon capacity flame cabinet. All HAZMAT, except small amounts for ready use, must be stored in the HAZMAT Locker. If science party requirements exceed ship's storage capacity, excess HAZMAT must be stored in dedicated lockers meeting OSHA/NFPA standards to be provided by the science party.

6.1.4: The scientific party, under supervision of the Chief Scientist, shall be prepared to respond fully to emergencies involving spills of any mission HAZMAT. This includes providing properly trained personnel for response, as well as the necessary neutralizing chemicals and clean-up materials. Ship's personnel are not first responders and will only act in a support role in the event of a spill. At least 60 days prior to the cruise, the Chief Scientist shall provide an inventory of necessary neutralizing agents and clean-up materials as well as a list of science party members that are properly trained to respond in the event of HAZMAT spills. The clean-up materials and number of trained responders shall be appropriate for the total amount of scientific HAZMAT brought aboard.

6.1.5: The Chief Scientist is directly responsible for the handling, both administrative and physical, of all scientific party hazardous wastes. No liquid wastes shall be introduced into the ship's drainage system. No solid waste material shall be placed in the ship's garbage.

6.1.6: The embarking Chief Scientist will work with the departing Chief Scientist and the ship's Environmental Compliance Officer to ensure proper tracking of all scientific hazardous materials. No hazardous materials will be left aboard and transferred to the embarking Chief Scientist without prior arrangements and the express consent of the Commanding Officer.

6.2 Inventory:

Previous Projects:	See Section 9.4.1
PMEL:	None
UAF:	See Section 9.4.2
Dalhousie:	See Section 9.4.3

6.3 Material Safety Data Sheets (MSDS)

UAF: Hard copies of all MSDS have been forwarded with the Draft Cruise Instructions. Additionally, MSDS Forms are packed with the chemicals and will transferred when the chemicals are loaded.

Dalhousie: Hard copies of all MSDS, except 3,4-dichlorophenyl-1,1-dimethylurea (DCMU)**,** have been forwarded with the Draft Cruise Instructions. MSDS for 3,4-dichlorophenyl-1,1-dimethylurea (DCMU) will be forwarded under separate cover.

7.0 Radioactive Material

7.1 Radioactive material policy: Radioactive material must be handled according to the policies and procedures of ENV 07, Radioactive Material (RAM) Aboard NOAA Ships.

7.2 Inventory:

PMEL:	None
Dalhousie:	None
UAF:	None

8.0 Miscellaneous

8.1 Scientific Berthing: The Chief Scientist is responsible for assigning berthing for the scientific party within the spaces approved as dedicated scientific berthing. The Ops Officer will send stateroom diagrams to the Chief Scientist showing authorized berthing spaces. The Chief Scientist is responsible for returning the scientific berthing spaces in the condition in which they were received; for stripping bedding and for linen return; and for the return of any room keys which were issued. Only one set of linens/towels are provided to embarked personnel; the scientific complement is responsible for laundering their own linen and towels during the cruise.

8.1.1: The Chief Scientist is responsible for the cleanliness of the berthing and laboratory spaces and storage areas used by the science party, both during the cruise and at its conclusion prior to departing the ship.

8.1.2: In accordance with NC Instruction 5355.0, dated 16 August 1985, and other guidance regarding controlled substances aboard NOAA vessels, all persons boarding NOAA vessels give implied consent to conform with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time.

8.2 Medical Forms: The *NOAA Health Services Questionnaire* must be completed in advance by each participating scientist. The questionnaire will be sent out by the Chief Scientist and should be returned to him in a separate, sealed envelope marked with the participant's name, cruise number and cruise dates. It should reach the ship no later than 4 weeks prior to the cruise to allow time to medically clear the individual, to request more information if needed, and to prepare for special circumstances. In order to ensure that all NHSQs are reviewed in a timely manner, medical forms which have not reached the ship prior to the 4 week deadline (e.g. scientist added late) should either be faxed to the ship via INMARSAT or a copy of the NHSQ should be submitted to MOA Health Services (LCDR Dan Aronson, PHS) for review and clearance well before the cruise. All personnel are required to meet the NOAA Physical/Health Standard as specified in the NOAA Fleet Medical Policy Manual. If there are any questions about eligibility, individuals can directly contact *Ronald H. Brown*'s medical officer (e-mail: Medical.Ronald.Brown@noaa.gov) or MOC Health Services. All personnel must bring with them prescription and routine, over-the-counter medication (e.g. an aspirin a day). Supplies on board are limited, and chances to restock are few.

8.2.1 Emergency Contacts: Prior to departure, the Chief Scientist must provide a listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: scientist's name, emergency contact's name, address, relationship to scientist, telephone number and e-mail address (if available).

8.3 Shipboard Safety: Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. Steel-toed shoes are required to participate in any work with suspended loads, including CTD deployment and recovery. These are not provided by the ship. Hard hats are also required when working with suspended loads and will be provided by the ship when required. All members of the scientific party are expected to be aware of these regulations and to comply with them.

8.4 Communications: The Chief Scientist or designated representative will have access to ship's telecommunications systems on a cost-reimbursable basis. Direct payment (e.g. by credit card) to the communications provider (e.g. the telephone company) shall be used as opposed to after-the-fact reimbursement. Specific information on how to contact *Ronald H. Brown* and all other fleet vessels can be found at http://www.moc.noaa.gov/phone.htm.

8.4.1 E-mail Policy: Standing Order 9.21-1: In recent years the proliferation of electronic mail (e-mail) and the reduction of INMARSAT costs have permitted the sending of nominal amounts of personal e-mail when transmitted with official ship's business. A complimentary amount of personal use will be permitted for all personnel aboard. Shipboard e-mail accounts will be provided. Downloads and uploads are made twice daily.

8.4.1.1: Each person will be allowed $45 per month for e-mail transmission costs. There is no provision for payment to a person who does not utilize the complimentary amount.

8.4.1.2: It should be understood that the cost of personal e-mail being transmitted from shore to an individual aboard ship will be charged against that individual's complimentary amount. A detailed billing statement will be issued periodically to any individual or Chief Scientist whose costs have exceeded his or his group's monthly entitlement. All costs in excess of an individual's or group's complimentary amount must be reimbursed. When personal use cannot be easily distinguished from official business, the amount of reimbursement will equal the total cost minus the complimentary amount. Each embarked person will have an e-mail account/address established in his/her name by the Lead Electronic Technician (LET) at the time of arrival. The general format is:

Firstname_Lastname%BROWN@ccmail.rdc.noaa.gov

8.4.2 Satellite Communications: Standing Order 9.21-2: INMARSAT-A (voice and fax) and INMARSAT-M (voice) communications are available aboard ship and may be used for personal or business-related calls so long as the caller makes arrangements to pay for the calls via credit card. INMARSAT calls can be extremely expensive and the exact cost may not be known until you receive your bill. Brevity is encouraged. See the Lead Electronic Technician (LET) for any questions regarding the use of these phones.

8.4.2.1 Ship Phone Services: Standing Order 9.21-3: Routine incoming non-emergency phone calls are discouraged. Use e-mail communications for this purpose. In an emergency, embarked personnel can be contacted by phone. Phone numbers for the Ronald H. Brown can be found at

http://www.moc.noaa.gov/phone.htm#RB.

8.4.2.2 INMARSAT-A: For high speed data transmission, including FTP, and high quality voice telephone communications. Costs range from $5-$11 per minute for use of the service, and may be charged to credit card or called collect.

8.4.2.3 INMARSAT MINI-M: For voice telephone communications and 2400 baud data transfer. Cost is about $3 per minute to the US and may be charged to credit card, collect or otherwise reimbursed. Mini-M coverage is by spot beam and may not be available in all the areas the ship may be working in.

8.4.2.3.1 Messages: can also be left with the Marine Operations Center-Atlantic, Norfolk, Virginia, at (757)441-6206 or the Marine Operations Center-Pacific, Seattle, Washington at (206) 553-4548. After hours and on weekends and holidays, an answering service will relay a message to the appropriate duty officer.

8.4.3 Ship's Mail: Standing Order 9.22: Incoming letters and packages can be sent to embarked members of the ship's operating crew and scientific complement by addressing them to:

Name
NOAA Ship RONALD H. BROWN
Marine Operations Center - Pacific
1801 Fairview Ave. E.
Seattle, WA 98102

Mail received at the Marine Operations Center will be periodically forwarded to the ship's next port of call. When the ship is on a foreign deployment, senders are encouraged to mail letters and packages earlier to ensure delivery. Be advised that some foreign customs authorities routinely open and inspect incoming mail. Arrangements for ship's outgoing mail will be made on the morning of departure. In foreign ports, mail must have US postage affixed as it will be boxed and overnight-expressed to the Marine Operations Center-Atlantic where it will enter the US postal system. US postage stamps are not routinely available aboard ship.

8.5 Port Agent Services/Billing: Contractual agreements exist between the port agents and the commanding officer for services provided to NOAA Ship *Ronald H. Brown*. The costs or required reimbursements for any services arranged through the ship's agents by the scientific program, which are considered to be outside the scope of the agent/ship support agreement, will be the responsibility of that program. Direct payment be arranged between the science party and port agent, as opposed to after-the-fact reimbursement to the ship's accounts.

8.6 Wage Marine Dayworker Working Hours and Rest: Chief Scientist shall be cognizant of the reduced capability of *Ronald H. Brown*'s operating crew to support 24-hour mission activities with a high tempo of deck and survey department operations at all hours. Wage marine employees are subject to negotiated work rules contained in the applicable collective bargaining agreement. Dayworkers' hours of duty are a continuous eight-hour period, beginning no earlier than 0600 and ending no later than 1800. It is not permissible to separate such an employee's workday into several short work periods with interspersed non-work periods. Dayworkers called out to work between the hours of 0000 and 0600 are entitled to a rest period of one hour for each such hour worked. Such rest periods begin at 0800 and will result in no dayworkers being available to support science operations until the rest period has been observed. All wage marine employees are supervised and assigned work only by the Commanding Officer or designee. The Chief Scientist and the Commanding Officer shall consult regularly to ensure that the shipboard resources available to support the embarked mission are utilized safely, efficiently and with due economy.

9.0 Appendices

9.1. Equipment Inventory
9.2. Figures
9.3. Tables
9.4. Hazardous Materials
  9.4.1. Hazardous Material Inventory - Previous Projects
  9.4.2. Hazardous Material Summary - UAF
  9.4.3. Hazardous Materials Summary - Dalhousie University
  9.4.4. Spill Clean-up and Personal Protective Equipment - PMEL

9.1 Equipment Inventory

PMEL

1 Sea Bird 911plus CTD system including CTD fish with twin temperature and conductivity sensors (plus spares), pylon, 12-bottle rosette, 20 Niskin bottles and weights,
1 Benthos CTD altimeter
1 Wetstar fluorometer
1 Biospherical PAR sensor
3 MetOcean color satellite drifters
1-2 MetOcean satellite drifters
2 Temperature/salinity profiling floats
10 bottles IAPSO Standard Seawater
1 Macintosh computer
1 Windows NT computer
1 Sun Unix computer
Networking boxes
1 Zip drive
Miscellaneous manuals
4 Mustang Float coats (2-L, 2-XL)
4 pair XtraTuf steel-toed boots (1-6, 2-7, 1-11)
Office supplies: paper, pens, pencils, data storage disks

9.2 Figures

Fig. 1: RB-01-03 Leg 3, CTD Sites & Ops. Area

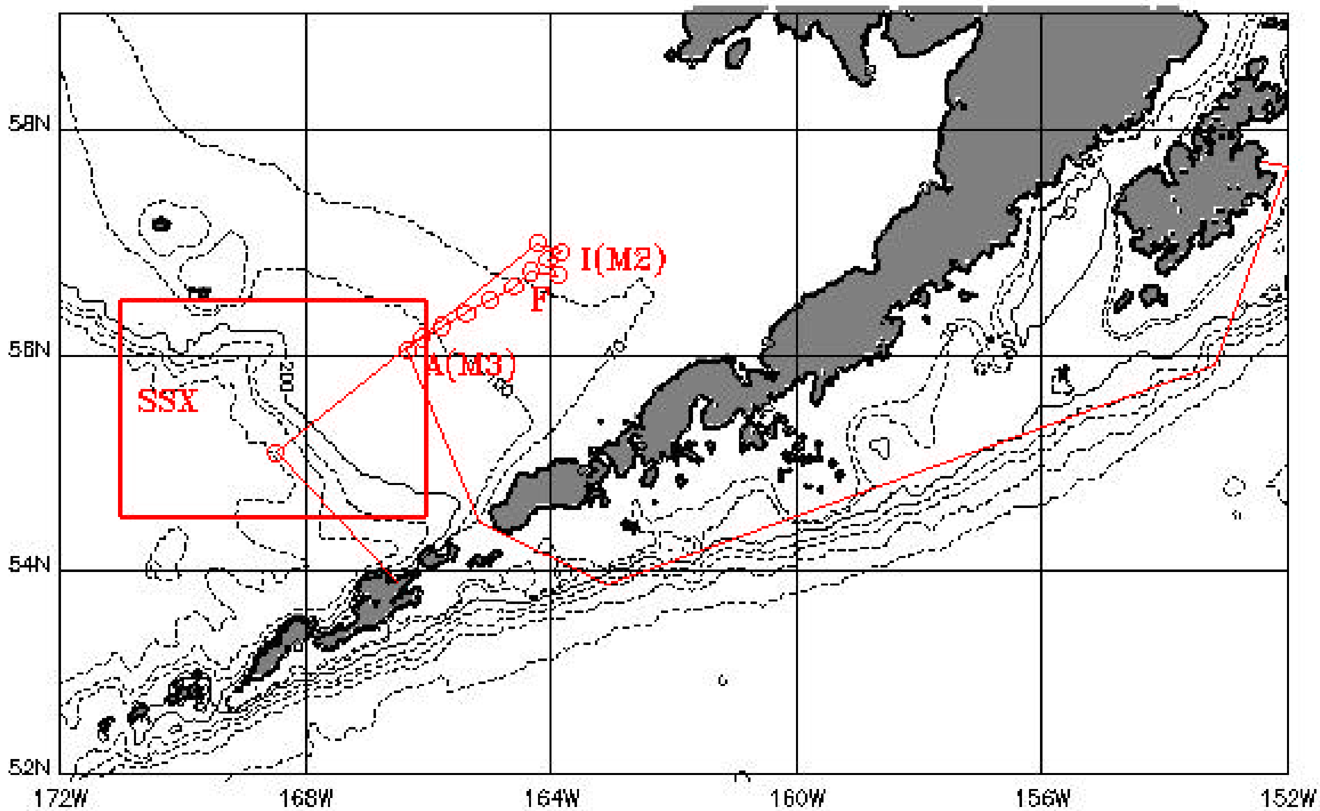

Table 1. Cruise RB-01-03 Leg 3 Itinerary 25 May-8 June 2001

Transect	Site	Stn. No.	Lat. Deg.	Min	Hem.	Lon. Deg.	Min.	Hem.	Dist. nm	Spd kt	Transit hr	Water Depth m	CTD Depth m	CTD Time min	Add. on stn. min	Arrive (ADT) Date / Time	Depart (ADT) Date / Time	Cum. Time (hr)	Cum. Time (d)
	Kodiak		57	44.22	N	152	25.13	W									25-May 10:00	0.00	0.00
	Waypoint		57	41.84	N	152	0.00	W	13.6	12	1.1			0	0	25-May 11:08	25-May 11:08	1.14	0.05
	Waypoint		55	55.46	N	153	10.52	W	113.2	12	9.4			0	0	25-May 20:33	25-May 20:33	10.57	0.44
	Waypoint		53	51.86	N	163	5.87	W	363.6	12	30.3			0	0	27-May 02:52	27-May 02:52	40.87	1.70
	Unimak Pass		54	27.74	N	165	10.59	W	81.4	12	6.8			0	0	27-May 09:38	27-May 09:38	47.65	1.99
I	A (M3)		56	3.60	N	166	20.10	W	103.7	12	8.6	110	100	21	60	27-May 18:17	27-May 19:38	57.64	2.40
I	B		56	10.00	N	166	6.00	W	10.1	12	0.8	110	100	21	60	27-May 20:29	27-May 21:50	59.84	2.49
I	C		56	16.30	N	165	46.40	W	12.6	12	1.0	100	90	21	0	27-May 22:53	27-May 23:13	61.23	2.55
I	D		56	23.40	N	165	23.50	W	14.5	12	1.2	100	90	21	0	28-May 00:26	28-May 00:46	62.78	2.62
I	E		56	30.50	N	164	59.90	W	14.9	12	1.2	90	80	20	0	28-May 02:01	28-May 02:21	64.35	2.68
I	F		56	37.70	N	164	36.30	W	14.9	12	1.2	80	70	19	0	28-May 03:35	28-May 03:54	65.91	2.75
I	G (X @ M2)		56	46.00	N	164	20.00	W	12.2	12	1.0	70	60	19	60	28-May 04:55	28-May 06:14	68.24	2.84
I	H (X @ M2)		56	43.90	N	163	53.00	W	15.0	12	1.2	70	60	19	60	28-May 07:29	28-May 08:47	70.80	2.95
I	I (M2)		56	52.40	N	164	3.20	W	10.2	12	0.8	70	60	19	180	28-May 09:38	28-May 12:57	74.96	3.12
I	J (X @ M2)		56	56.50	N	163	50.00	W	8.3	12	0.7	70	60	19	60	28-May 13:38	28-May 14:57	76.96	3.21
I	K (X @ M2)		57	1.00	N	164	13.00	W	13.3	12	1.1	70	60	19	60	28-May 16:04	28-May 17:22	79.38	3.31
SSX	Slp-shlf Xchng		55	7.00	N	168	29.00	W	182.7	12	15.2				13923	29-May 08:36	08-Jun 00:39	326.66	13.61
	Dutch Harbor		53	54.00	N	166	31.00	W	100.1	12	8.3					08-Jun 09:00		335.00	13.96

Sunrise and Sunset Times
At 56 N, 165 W on 31 May:
Sunrise at 6:23 ADT
Sunset at 23:33 ADT
Sunrise-to-Sunset = 17 hr 10 min

Table 2. SE Bering Sea Mooring Locations - March 2001

Mooring	Lat (deg.)	Lat (min.)	Hemisphere	Lon (deg.)	Lon (min.)	Hemisphere	Water Depth (m)	Mooring Type	Instrumentation
M2	56	52.76	N	164	3.88	W	72	Subsurface	ADCP
M2	56	52.86	N	164	3.55	W	71	Subsurface	MTRs, CHLAM, Current Meter
M2	56	53.04	N	164	3.84	W	71	Subsurface	Sediment Trap

9.4 Hazardous Materials

9.4.0 Hazardous Materials Responders - Richard Davis and William Floering

9.4.1 Hazardous Material Inventory - Previous Projects

ACE-Asia, Compressed Gases:

Currently on ship, to be off-loaded in Victoria

He (sondes)	40 tanks	PMEL
CO2 (Neph)	2 tanks	PMEL
Helium (IC)	6 tanks	PMEL
Breathing air (DMS)	1 tanks	PMEL
H2 (OC/EC)	2 tanks	PMEL
O2 10% balance He (OC/EC)	2 tanks	PMEL
CH4 10% balance He (OC/EC)	2 tanks	PMEL
He (OC/EC)	2 tanks	PMEL
Breathing air (OC/EC)	2 tanks	PMEL
He (CO)	2 tanks	PMEL
H2 (OC/EC)	2 tanks	RU
O2 10% balance He (OC/EC)	2 tanks	RU
CH4 10% balance He (OC/EC)	2 tanks	RU
He (OC/EC)	3 tanks	RU
Breathing air (OC/EC)	8 tanks	RU
N2	2 tanks	AS
H2	2 tanks	AS
He	2 tanks	AS
N2	3 tanks	UCR
Zero Air	3 tanks	UCR
N2	5 tanks	uw pCO2
Standard air tanks	10 tanks	uw pCO2

Underway CO_2 System:

1.5 kg Magnesium perchlorate
3 jars of glass wool
2 mercury thermometers

MSDS's are on file with the HAZMAT officer.

9.4.2 Hazardous Material Summary - UAF

9.4.2.1 Chemical Inventory - UAF

ALPKEM Nutrient Analyzer Chemical Inventory
R/V Ron Brown - May 2001
SOLIDS

	g/pack	#packs	Total
Orthophosphate			
Ammonium Molybdate	6.0 g	4	24 g
Potassium Antimony Tartrate	3.0 g	4	12 g
Sodium Lauryl Sulfate	15 g	4	60g
Ascorbic Acid	6 g	4	24 g
Potassium Phosphate standard	0.34 g	4	1.36 g
Dissolved Silicon (Silicate)			
Ammonium Molybdate	10.8g	12	130 g
Tartaric Acid	100 g	8	800 g
Stannous Chloride	40 g	4	160 g
Sodium Silicofluoride standard	1.88 g	4	7.52 g
Nitrate plus Nitrite; Nitrite			
Imidazole	6.8 g	8	54.4 g
Copper sulfate	2.5 g	4	10g
Copper sulfate	20 g	4	80 g
sulfanilamide	10 g	8	80 g
N-(1-Naphthyl)ethylenediamine-Dihydrochloride	1 g	8	8 g
Cadmium metal tubing	20 g	3	60 g
Potassium nitrate standard	1.01 g	4	4.04 g
Sodium nitrite standard	0.17 g	4	.68 g
Compressed nitrogen gas	5 ml/min		30 ft3
Ammonium			
Phenol	35 g	6	210 g
Sodium Nitroprusside Dihydrate	0.4 g	6	2.4 g
Sodium Citrate	140 g	12	1680 g
Sodium Hydroxide	2.5 g	12	30 g
Ammonium Chloride standard	0.14 g	4	0.56 g

****

LIQUIDS	Vol/each	Total Vol
Sulfuric Acid (concentrated)	500 ml	1 liter
Acetone	500 ml	1 liter
Hydrochloric Acid (concentrated)	500 ml	2 liters
Brij-35	50 ml	100 ml
Chlorox (~5% solution)	250 ml	250 ml

Chemical Inventory for Shipping
(All Solids, No liquids)

CAS No.		g/pack	#packs	Total
********				
13106-76-8	Ammonium Molybdate	6.0 g	4	24 g
28300-74-5	Potassium Antimony Tartrate	3.0 g	4	12 g
151-21-3	Sodium Lauryl Sulfate	15 g	4	60g
50-81-7	Ascorbic Acid	6 g	4	24 g
7778-77-0	Potassium Phosphate	0.34 g	4	1.36g
13106-76-8	Ammonium Molybdate	10.8g	12	130 g
00087-69-4	Tartaric Acid	100 g	8	800 g
10025-69-1	Stannous Chloride	40 g	4	160 g
16893-85-9	Sodium Silicofluoride	1.88 g	4	7.52g
288-32-4	Imidazole	6.8 g	8	55 g
7758-98-7	Cupric sulfate	2.5 g	4	10g
7758-98-7	Cupric sulfate	20 g	1	20 g
63-74-1	Sulfanilamide	10 g	8	80 g
1465-25-4	N-(1-Naphthyl)ethylenediamine Dihydrochloride	1 g	8	8 g
7440-43-9	Cadmium metal tubing	3 each		
7757-79-1	Potassium nitrate	1.01 g	4	4.04g
7632-00-0	Sodium nitrite	.17 g	4	.68 g
108-95-2	Phenol	35 g	6	210 g
13755-38-9	Sodium Nitroprusside	0.4 g	6	2.4 g
6132-04-3	Sodium Citrate	140 g	12	1680g
1310-73-2	Sodium Hydroxide	2.5 g	12	30 g
12125-0209	Ammonium Chloride	.14g	4	.56g

9.4.2.2 Neutralizing Agents - UAF

Acids: hydrochloric acid, sulfuric acid
*** baking soda (sodium bicarbonate) is provided for neutralization.
*** vermiculite and kitty litter are provided for absorbency material.

Bases: sodium hydroxide
*** dilute hydrochloric acid (10%) is provided for neutralization.
*** vermiculite and kitty litter are provided for absorbency material.

9.4.2.3 All chemicals will be packed for air shipment to Kodiak under DOT rules and loaded on 23 May. Chemicals will depart ship upon arrival at Dutch Harbor on 8 June. The principal investigator or a student will be present for both loading and offloading of chemicals.

9.4.2.4 Unused and waste chemicals will be offloaded in Dutch Harbor. No chemicals will remain onboard after the cruise.

9.4.2.5 All field party members will be briefed at a pre-cruise meeting on the location and quantity of hazardous chemicals. In addition, cleanup of chemical spills and use of neutralizing agents will be explained. A set of written instructions of cleanup procedures will be posted by the chemical analysis work area.

9.4.2.6 Material Safety Data Sheets (MSDS) - UAF

MSDS Forms are packed with chemicals and will transferred when the chemicals are loaded. A spare copy of the MSDS forms will be forwarded with the Cruise Instructions.

9.4.2.7 Assessment of Chemical Wastes from ALPKEN Model 300 Chemical Analyzers -UAF

The Marine Nutrient Chemistry Laboratory (MNCL) analyzes the quantity of biogenic nutrients (orthophosphate, dissolved silicon, nitrate plus nitrite, nitrite, and ammonium) that are utilized by marine plants during growth and are excreted by microorganisms and marine animals. The quantity of nutrients, along with available light, determines the growth rate of marine plants such as phytoplankton and seagrasses. The principal nutrients measured are dissolved in marine, estuarine and fresh waters and are present in concentrations ranging from nanomoles to millimoles per liter. Clean seawater will contain a few micromoles of nutrients per liter so high purity distilled water and analytical grade chemicals are necessary to obtain the required accuracy and precision of the measurements.

The Alpkem model 300 chemical analyzers have separate chemical analysis manifolds so the chemicals from each analysis could be collected individually. This has not been done in the past since it was much more convenient to combine all of the waste streams into a single waste line. In the past this waste stream was directed to a normal laboratory drain which also received tap water wastes.

The table shows each individual chemical and the quantities of chemical solutions that are prepared. The second column has a value for grams of chemical/liter in the chemical reagent. The third column lists the pumping rate of each chemical reagent, water washes and samples. The last column shows the grams of each chemical in the waste of a typical 8 hour day.

At the bottom of the table, the total hourly volume of chemical reagents, washes and samples are shown. The daily volume was calculated for an 8 hour day.

ALPKEM Nutrient Analyzer Waste Discharges

(assume an 8 hr day)	g/l	ml/hr		g/day

****

Orthophosphate				
Molydate Solution				
Ammonium Molybdate	17.0 g	8.5	2.2	0.15
Sulfuric Acid	200 ml	100	2.2	1.76ml
Potassium Antimony Tartrate	0.37 g	.185	2.2	0.003
Sodium Lauryl Sulfate	0.3	.15	2.2	0.002
dilute to 2000 ml with distilled water				
Ascorbic Solution				
Ascorbic Acid	6 g	15	2.2	0.26
Acetone	200 ml	500	2.2	8.8ml
dilute to 400 ml with distilled water				
Dilution Water				
distilled water	-	-	30	
Sample (seawater or freshwater)	-		-	12

****

Dissolved Silicon (Silicate)				
Molybdate Solution				
Ammonium Molybdate	10.8g	10	17.2	1.38
Sulfuric Acid	2.8 ml	2.8	17.2	.39ml
dilute to 1000 ml with distilled water				
Tartaric Solution				
Tartaric Acid	100 g	100	7.1	5.68
dilute to 1000 ml with distilled water				
Stannous Solution				
Stannous Chloride	40 g	400	4.4	14.1
Hydrochloric Acid	50 ml	500	4.4	17.6ml
dilute to 100 ml with distilled water				
Sample (seawater or freshwater)	-		-	12

****

Nitrate plus Nitrite				
Ammonium Solution				
Ammonium Chloride	10 g	5	17.2	.69
dilute to 2000 ml with distilled water				
Sulfanilamide Solution				
sulfanilamide	10 g	10	4.4	.35
Hydrochloric Acid	100 ml	100	4.4	3.5ml
Brij-35	0.5 ml	.5	4.4	.02mldilute
to 1000 ml with distilled water				
Naphthyl Solution				
N-(1-Naphthyl)ethylenediamine-Dihydrochloride	1 g	1	4.4	.04
Brij-35	0.5 ml	.5	4.4	.02ml
dilute to 1000 ml with distilled water				
Sample (seawater or freshwater)		-	-	8

****

Nitrite				
Sulfanilamide Solution				
sulfanilamide	10 g	10	4.4	.35
Hydrochloric Acid	100 ml	100	4.4	3.5ml
Brij-35	0.5 ml	.5	4.4	.02ml
dilute to 1000 ml with distilled water				
Naphthyl Solution				
N-(1-Naphthyl)ethylenediamine-Dihydrochloride	1 g	1	4.4	.04
Brij-35	0.5 ml	.5	4.4	.02ml
dilute to 1000 ml with distilled water				
Dilution Water				
distilled water	-	-	8	
Sample (seawater or freshwater)		-	-	30

****

Ammonium				
Reagent A - Phenol Solution				
Phenol	35 g	35	4.4	1.23
Sodium Nitroprusside Dihydrate	0.4 g	.4	4.4	.01
dilute to 1000 ml with distilled water				
Reagent B - Chlorox Solution				
Chlorox (~5%)	50 ml	2.5	4.4	.09
Sodium Hydroxide	5 g	5	4.4	.18
dilute to 1000 ml with distilled water				
Dilution Complex - Citrate Buffer				
Sodium Citrate	140 g	140	13.6	15.2
Sodium Hydroxide	5 g	5	13.6	.54
dilute to 1000 ml with distilled water				
Sample (seawater or freshwater)	-	-	30	

****

Sampler Wash Water				
Baseline Solution				
Distilled Water	-	-	200	-

****

Total Solution Volume (ml/hour)	-	-	499.5
Total Solution Volume (ml/day)	-	-	3996

So there are 500 ml of waste solution/hour which translates to 3996 ml of waste solution per day.

9.4.3 Hazardous Materials Summary - Dalhousie University

9.4.3.1 Chemical Inventory Estimate - Dalhousie University

Investigator Name: Cullen Date: Feb 2001

Cruise ID: RB-O1-03, Leg 3 Cruise Dates: 25 May-08 June 2001 Chief Scientist: E. D. Cokelet

Chemical Name: **acetone**	Concentration: 99.9%	Owner: John Cullen	Sample Owner: John Cullen	Used for: pigment extraction	Quantity: 24L
	Hazard: highly flammable; irritant to respiratory system, skin and eyes	MSDS Provided? yes	Neutralizer: activated carbon adsorber	Protection equipment: fume hood; gloves; lab coat	Loaded: 24L
	Storage: flammable locker	Disposal Plan: waste will be removed in Dutch Harbor	Off-loading: to be off loaded in Dutch Harbor	Over-packing:	Used: 18L
					Unloaded: 6L

Chemical Name: **chlorophyll**	Concentration: 100%	Owner: John Cullen	Sample Owner: John Cullen	Used for: fluorometer calibration	Quantity: 2 mg
	Hazard: none	MSDS Provided? yes	Neutralizer: n/a	Protection equipment: n/a	Loaded: 2 mg
	Storage: freezer	Disposal Plan: n/a	Off-loading: n/a	Over-packing:	Used: 2 mg
					Unloaded: n/a

Chemical Name: **dimethyl sulfoxide**	Concentration: 100%	Owner: John Cullen	Sample Owner: John Cullen	Used for: pigment extraction	Quantity: 3.8 L
	Hazard: combustible; irritant to respiratory system, skin and eyes	MSDS Provided? yes	Neutralizer: sand or vermiculite	Protection equipment: fume hood; respirator; rubber gloves and boots	Loaded: 3.8 L
	Storage: flammable locker	Disposal Plan: Waste will be removed in Dutch Harbor	Off-loading: to be off loaded in Dutch Harbor	Over-packing:	Used: 1.8 L
					Unloaded: 2 L

Chemical Name: **glutaraldehyde**	Concentration: 50%	Owner: John Cullen	Sample Owner: John Cullen	Used for: sea-water sample preservation	Quantity: 100 ml
	Hazard: highly toxic; harmful in contact with skin	MSDS Provided? yes	Neutralizer: dry lime or soda ash	Protection equipment: fume hood; respirator; rubber gloves and boots	Loaded: 100 ml
	Storage: cool dry place	Disposal Plan: waste will be removed in Dutch Harbor	Off-loading: to be off-loaded in Dutch Harbor	Over-packing:	Used: 30 ml
					Unloaded: 70 ml

Chemical Name: **3,4-dichlorophenyl-1,1-dimethylurea (DCMU)**	Concentration: $1x10^{-3}$ M	Owner: John Cullen	Sample Owner: John Cullen	Used for: photosynthetic inhibitor	Quantity: 0.2 L
	Hazard: harmful by inhalation, skin contact, ingestion	MSDS Provided? yes	Neutralizer: sweep and place in bag.	Protection equipment: gloves, safety goggles, lab coat	Loaded: 0.2 L
	Storage: fume hood	Disposal Plan: waste will be removed in Dutch Harbor	Off-loading: to be off-loaded in Dutch Harbor	Over-packing:	Used: 0.2 L
					Unloaded:

Chemical Name: **hydrochloric acid**	Concentration: 36%	Owner: John Cullen	Sample Owner: John Cullen	Used for: acidification of chlorophyll samples	Quantity: 1 L
	Hazard: corrosive; toxic by inhalation or swallowed; reacts violently with water	MSDS Provided? yes	Neutralizer: dry lime, sand or soda ash	Protection equipment: fume hood; respirator; rubber gloves and boots	Loaded: l L
	Storage: corrosive locker	Disposal Plan: waste will be removed in Dutch Harbor	Off-loading: to be off loaded in Dutch Harbor	Over-packing:	Used: 0.2 L
					Unloaded: 0.8 L

Chemical Name: **methanol**	Concentration: 100%	Owner: John Cullen	Sample Owner: John Cullen	Used for: instrument cleaning	Quantity: 2 L
	Hazard: highly flammable; toxic if inhaled or swallowed; irritant to eyes and skin	MSDS Provided? yes	Neutralizer: dry lime, sand or soda ash	Protection equipment: fume hood; respirator; rubber gloves and boots	Loaded: 2 L
	Storage: flammable locker	Disposal Plan: waste will be removed in Dutch Harbor	Off-loading: to be off loaded in Dutch Harbor	Over-packing:	Used: 0.5 L
					Unloaded: 1.5 L

9.4.4 Spill Clean-up and Personal Protective Equipment - PMEL

9.4.4.1 Spill Clean-up Equipment

- 4: 40lb bag of dri-zorb: This product is for use in absorbing all hazardous liquids except: hot or concentrated nitric acid and perchloric acids, fuming sulfuric acid at 60ºC (140ºF) or above and liquid chlorine. An all-natural corncob product that is particularly useful as an alternative to clay when disposal methods dictate your absorbent medium. Dri-Zorb® has 98.4% less residual ash than clay and adds BTU value. Absorbs 10-15 gallons liquid per 40 lb. bag. We have 4 bags so this should be sufficient for 40-60 gallons of liquid.
- 1: 30 gal. drum. - blue, poly
- 1: 20 gal. drum - blue, poly
- 6: 5 gal pails - white, plastic + covers
- 6: 2 gal pails - white, plastic + covers
- 6: 1 gal pails - white, plastic + covers
- 1 small pail lid opener
- 3: Anti static Scoop - 1 quart

9.4.4.2 Personal Protective Equipment

- 4: R95 respirator (dust masks) for nuisance level acid gas relief
- 4: R95 respirator (dust masks) for nuisance level organic vapor
- 3: XL Tyvek Body coverall
- 2: Medium Tyvek body coverall
- 10: Large Silvershield Gloves
- 100: Large "Touch n Tuff" Nitrile Gloves
- 3: Stealth Teal Frame Uvex Goggles